
australian
wildlife
conservancy
wildlife matters
Issue 38
Back from the brink of extinction

Contents

Cover image:
Bridled Nailtail Wallaby *Joey Clarke/AWC*

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australian wildlife conservancy

The AWC mission

The mission of Australian Wildlife Conservancy (AWC) is the effective conservation of all Australian animal species and the habitats in which they live.

To achieve this mission our actions are focused on:

- Establishing a network of sanctuaries which protect threatened wildlife and ecosystems. AWC now manages 29 sanctuaries covering more than 6.5 million hectares (16.1 million acres).
- Implementing practical, on-ground conservation programs to protect the wildlife at our sanctuaries. These programs include feral animal control, fire management, weed eradication and the translocation of threatened species.
- Conducting (either alone or in collaboration with other organisations) scientific research that will help address the key threats to our native wildlife.
- Hosting visitor programs at our sanctuaries for the purposes of education and promoting awareness of the plight of Australia's wildlife.

About AWC

AWC is an independent, not-for-profit organisation based in Perth, Western Australia. Donations to AWC are tax deductible.

Over the last 10 years, around 87 per cent of AWC's total expenditure was incurred on conservation programs, including land acquisition, while only 13 per cent was allocated to development (fundraising) and administration.

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AWC taking action to combat extinction crisis

In the previous edition of *Wildlife Matters*, I wrote about the United Nations Global Assessment report – how the report spoke to the dire situation facing more than one million species globally, and that Australia is leading the world in extinctions. Australia is a 'mega-diverse' country, one of very few countries to hold that description. Simply put, it means that much of Australia's wildlife cannot be found anywhere else. Therefore, if we don't act now to protect what we have – what makes Australia unique – it will be lost forever, consigned to the history books.

It is in our power to prevent this, and I am very proud that the AWC team is leading the way in securing the future of many of Australia's threatened species through:

- Completion of the Newhaven Stage 1 fence, triggering the reintroduction of the Rufous Hare Wallaby (Mala);
- Completion of the Mallee Cliffs National Park fence, and release of the Greater Bilby into a specially designed breeding area;
- Scaling up of Australia's largest ever reintroduction program; translocating threatened species to Mt Gibson, Newhaven, Pilliga, Mallee Cliffs and North Head;
- Developing innovative technological solutions that enhance our ability to monitor species; and
- Leading more than 30 scientific research projects, and collaborating on a further 100 research projects.

With the commencement of our new partnerships, we have substantially increased our land management programs of fire management, feral predator and feral herbivore control, and weed management, and progressed planning for new fenced area projects.

Our mission is precise: the effective conservation of all native Australian wildlife and their habitats.

Our strategy to deliver this mission is clear:

- Deliver science-informed land management;
- Construct a network of large-scale fenced areas to secure the future of threatened species;
- Invest in strategic research; and
- Pursue long-term solutions to control key threats to wildlife, such as gene drive technology (in partnership with CSIRO).

This work is delivered by our dedicated and skilled team of ecologists and land managers. If you have had an opportunity to visit an AWC Sanctuary, I'm sure you would have been inspired by the passion of a team that understands the criticality of the AWC mission.

Similarly, we cannot fulfil our mission without your support. Whether you are a determined volunteer, or sharing the story of AWC with your friends and networks, or investing in AWC, you are an essential part of the AWC family.

Your support also enabled us to meet the fundraising challenge set by the generosity of the JAAM Foundation and the Martin Copley Will Trust, raising a total of $2,000,031. This is a fantastic result, and I thank you on behalf of the whole team at AWC.

In my last message I wrote that we can make a difference.

It is with your support that we are making a difference, securing the future for many of our unique and iconic species.

Thank you and have a safe and Merry Christmas.

Tim Allard

Chief Executive

The 44 kilometre conservation fence at Newhaven Wildlife Sanctuary now protects a vast 9,400 hectare feral-free area. *Brad Leue/AWC*

Restoring Australia's lost biodiversity to the central deserts

By Dr Rachael Collett, Wildlife Ecologist, and James Stevens, Land Management Officer

At Newhaven Wildlife Sanctuary, AWC is undertaking a nationally significant reintroduction program, restoring at least 10 threatened native mammal species to central Australia.

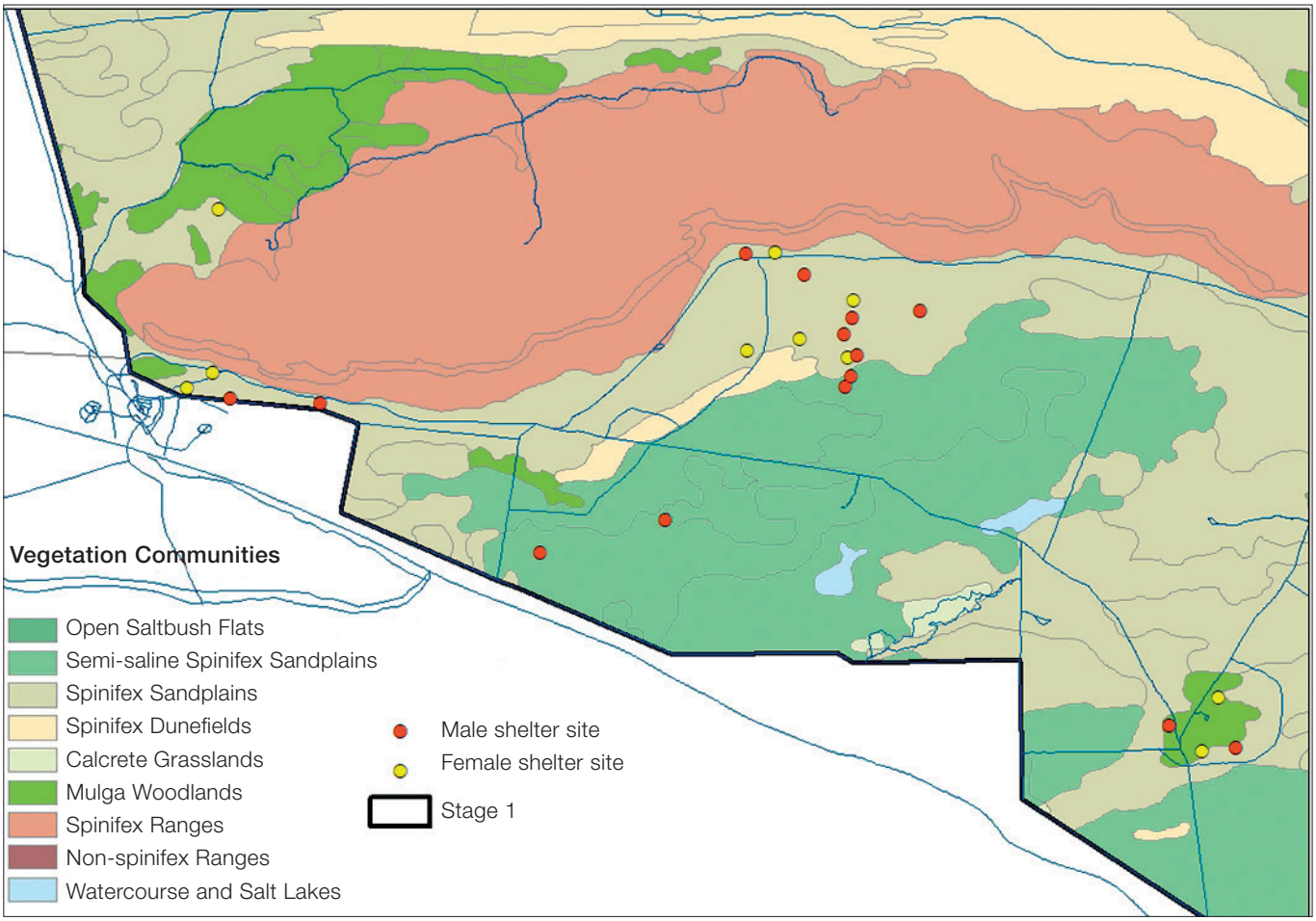
In July 2019, the first reintroductions into Stage 1 were conducted, with the release of 30 Mala (*Lagorchestes hirsutus*) into the 9,400 hectare, feral predator-free area. Weighing just 800 to 1,600 grams, the Mala is a small, arid-adapted wallaby with long, soft, sandy-coloured fur. Although once widespread in the central and western deserts, predation by feral cats and foxes, and destructive wildfires, caused the last wild population on mainland Australia to go extinct in the early 1990s. Fortunately, a few Mala had been collected for a captive-breeding program, and it is the descendants of these animals, managed in insurance populations for several decades, that we are returning to establish the Newhaven population.

Included in the first release were the last remaining Mala from Watarrka National Park, which were moved to Newhaven in an emergency translocation in late 2017. The Watarrka population had been decimated after a massive wildfire left the animals exposed to birds of prey. AWC built a special purpose, 150 hectare, feral predator-free haven for the Mala while the larger, 9,400 hectare fenced area was completed. In 2018, we also translocated Mala from the insurance population at AWC's Scotia Wildlife Sanctuary to the 150 hectare area at Newhaven. Cross-breeding between the Watarrka and Scotia Mala is expected to enhance the genetic diversity of the Newhaven population.

As well as being important for Mala conservation, this translocation provides an important opportunity to learn about the behaviour and habitat preferences of Mala in the central deserts. The Mala released into the 9,400 hectare feral predator-free area in July 2019 were fitted with radio-collars so AWC's ecologists could continue to monitor their survival, behaviour and distribution.

Since their release, radio-tracking has shown the Mala have successfully dispersed across much of the area around their release sites. As Mala prefer spinifex sandplain habitat, these animals have built burrows under large spinifex hummocks, sheltered by *Acacia* and *Melaleuca* shrubs. The burrows are tunnel-like structures with a spinifex roof. This provides a cool refuge during the heat of the day. In summer, they are likely to dig deeper burrows to withstand searing desert temperatures.

Ten of the released Mala were females and, as of the most recent survey in mid-September, five of the females were carrying pouch young. Additional Mala from Alice Springs Desert Park and from AWC's Scotia Wildlife Sanctuary will be released into the feral predator-free area in 2019-20. We expect the population to eventually exceed 2,000 individuals. As a result of this reintroduction, Newhaven is now home to the only free-ranging population of Mala on mainland Australia.



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AWC will commence reintroductions of Numbats (*Myrmecobius fasciatus*) and Red-tailed Phascogales (*Phascogale calura*) to Newhaven later in 2019-20. Both these species are extinct in the Northern Territory, and this project will enable their return to the central deserts.

Conservation management beyond the fence

Exciting as the reintroduction program is at Newhaven, it is important to remember that a number of threatened species still occur outside the fence, along with feral predators.

AWC has established a strategic feral animal control program outside the feral predator-proof fence to protect populations of threatened species, with a focus on the Great Desert Skink (*Liopholi skintorei)* and Black-footed Rock Wallaby (*Petrogale lateralis*). The Great Desert Skink is a large burrowing reptile that establishes complex communal burrow systems in semi-saline spinifex habitat on Newhaven.

2.

Images

1. Mala have established shelter sites across much of the area around their release site.

2. Mala are important to the Warlpiri Traditional Owners. Witnessing the release are Geofrey Pollard, AWC Ranger Christine Ellis and Janesha Michaels. *Brad Leue/AWC*


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4.

This project at Newhaven Wildlife Sanctuary in central Australia represents one of the country's most ambitious wildlife restoration projects.

$1,000 will fund the translocation of one Numbat to Newhaven.

$300 will purchase a radio collar to monitor one reintroduced mammal.

$150 will purchase a cage trap for catching feral cats and foxes in unfenced landscapes.

Images

1. Threatened Great Desert Skinks are being systematically hunted by feral cats outside the feral-free area. *Joe Schofield/AWC*

2. An extant population of threatened Black-footed Rock-wallabies are now protected from feral predators at Newhaven. *Wayne Lawler/AWC*

3. Numbats are the next species slated for reintroduction at Newhaven. *Wayne Lawler/AWC*

4. Mala are the first of a suite of threatened mammals to be released into the 9,400 hectare haven. *Wayne Lawler/AWC*

Feral cats are a serious predator of the Great Desert Skink. Field observations have determined that individual cats systematically hunt skinks from burrow system to burrow system. AWC's feral predator program aims to reduce the density of cats and disrupt hunting behaviour within and around key Great Desert Skink populations, with the aim of increasing the breeding success and population size of the species.

At the time of going to print, a total of 73 cats had been removed from Newhaven this year, with 55 of these taken near skink populations. The majority (54 cats) were trapped in 'cat-a-vaults', an enclosed box trap buried in the ground that provides a dark and cool environment. AWC has deployed 24 cat-a-vault traps across Newhaven to protect three populations of Great Desert Skinks and one population of Black-footed Rock Wallabies.

The exceptionally dry conditions throughout 2019 have resulted in cats moving great distances in search of prey, and in some cases, encountering the feral predator-proof fence on Newhaven. This has provided a unique opportunity to use the fence for a second purpose – not only keeping the cats out and providing a feral predator-free sanctuary for wildlife, but also in successfully funnelling travelling cats into waiting traps. For example, 51 cats were caught in June and July 2019, most near the southern boundary of the predator-free area.

As a national leader in threatened species translocations and in feral predator ecology, AWC plans to expand the feral-free area on Newhaven to 100,000 hectares. This will be the largest fenced, feral-free area on the planet, and will deliver huge conservation benefits, including the doubling in the population size of at least six threatened Australian mammal species.

AWC ecologists Rhiannon Khoury and Grace Hornstra release a Bilby into Mallee Cliffs National Park. *Wayne Lawler/AWC*

Greater Bilby returns to Mallee Cliffs National Park

By Dr Laurence Berry, Wildlife Ecologist, and Bruce Summerfield, Operations Manager

For the first time in a century, the Greater Bilby (*Macrotis lagotis*) has been returned to the woodland habitats of Mallee Cliffs National Park, in far-western New South Wales. Fifty Bilbies were reintroduced in October, marking another important milestone in Australian Wildlife Conservancy's partnership with the NSW National Parks and Wildlife Service.

At a time when populations of this nationally threatened species are under stress from drought and feral predators, the establishment of this new population is a critical step in Bilby conservation. The project is ultimately predicted to result in a 10 per cent increase in the global population of the species.

Construction of the 9,570 hectare fenced area at Mallee Cliffs National Park represents one of the most significant pieces of conservation infrastructure in Australia. Over 42 kilometres of conservation fencing and 54 kilometres of new tracks were installed in just six months, with the fence itself completed in a record 12 weeks. The team overcame intense heat, dust and very hard Mallee stumps to get the job done. The finished fence consists of 378 kilometres of plain wire, 504,000 fence clips, 8,400 star posts, and eight heavy-duty gates. AWC staff inspected over 440 trees to ensure valuable ecological features, such as hollows, were retained. This approach has paid off, with one of the released Bilbies tracked to a den site under a fallen tree retained as habitat.

The feral animal eradication process commenced in 2017, prior to fence construction, when AWC's skilled and experienced land management team undertook intensive fox control across the park. The breeding area was declared feral-free in June 2019, with the larger area on track for feral eradication by March 2020. The outcomes of the eradication effort, undertaken by five full-time feral animal control officers, is monitored using 89 camera traps deployed within the fence. Since 2017, the operations team has deployed more than 2,500 fresh baits, conducted 100,000 Canid Pest Ejector nights and dragged over 1,500 kilometres of tracks.

AWC ecologists undertook three separate translocations to source the founding population of Bilbies for Mallee Cliffs National Park. The first translocation involved over a dozen AWC staff across three locations. At the start of October, a team of eight AWC ecologists flew to Thistle Island in South Australia, which supports a wild, reintroduced population of Bilbies. In total, 68 individuals were caught over two nights. Of these, 30 Bilbies (15 males and 15 females, some with pouch young) were selected for translocation based on strict criteria including condition, age and health. They were then transferred by charter flight to AWC's Yookamurra Wildlife Sanctuary where local AWC staff, accompanied by a veterinarian, conducted health checks, fitted radio-transmitters and took physical measurements from the animals. The following morning the animals were airlifted to Mallee Cliffs National Park and released after dark into the fenced area.

The 30 founding animals from Thistle Island have been joined by 10 additional Bilbies from AWC's Scotia Wildlife Sanctuary, and 10 captive-bred animals from various zoos. The Bilbies have been sourced according to genetic advice provided by researchers at Sydney University, in collaboration with AWC. Sourcing founders from different populations will promote the genetic

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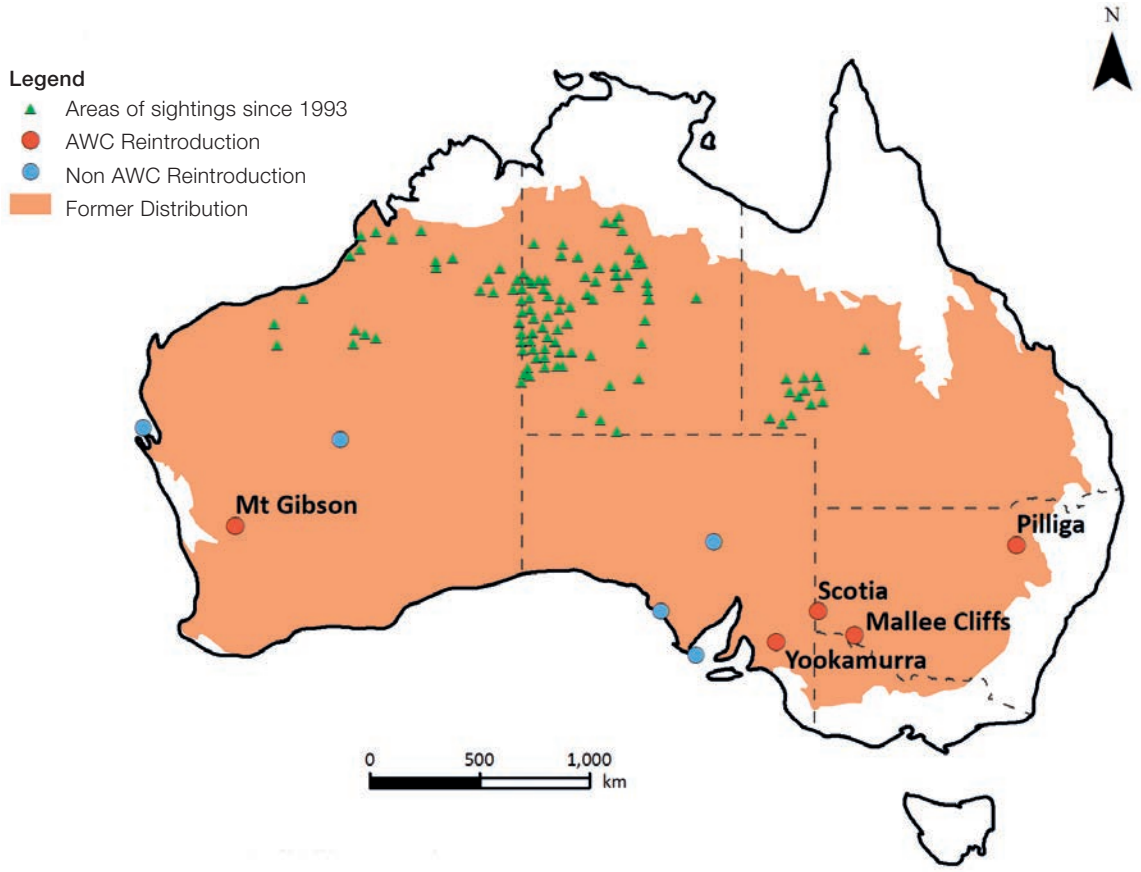

Image

1. Fifty Bilbies are now settling in at Mallee Cliffs National Park. *Wayne Lawler/AWC*
2. Bilbies were once abundant across the continent but are now only found in isolated or protected areas. *AWC*
3. (Opposite page) Wildlife ecologist Dr Laurence Berry monitors the Bilbies via transmitters attached to their tails. *Wayne Lawler/AWC*

2.

diversity of the population and hence, adaptive capacity, such as resilience to environmental change. To encourage interbreeding, the Bilbies have been released into a specially designed, 480 hectare breeding area. The Bilbies will be released into the 9,500 hectare area once it has been declared feral free.

AWC ecologists are closely monitoring the survival of the released animals using a custom made coded VHF telemetry system that has been specifically designed for this project. Ten Bilbies from each source population have been fitted with small, 10 gram radio transmitters attached to their tails. These transmitters emit a unique code enabling the survival of each individual to be tracked. The data are captured in the field using a receiver attached to a tower that can detect animals within a one kilometre radius.

One month after their release, the Bilbies are settling in well. Survival monitoring indicates a 97 per cent survival rate of radio-tracked individuals, which demonstrates the extraordinary short-term success of the reintroduction. There are clear signs that the Bilbies are adapting to their new home with diggings clearly visible throughout the fenced area. Many of the Bilbies have dug their own burrows. Several individuals have excavated old rabbit warrens and some have constructed homes under fallen trees. Follow-up trapping early next year will provide further insights into the establishment of the population and the success of the reintroduction.

The Bilby is the first of 10 regionally-extinct mammals to be restored to Mallee Cliffs National Park as part of an innovative and ambitious partnership between AWC and National Parks and Wildlife Service. The other nine species to be reintroduced are the Western Quoll (*Dasyurus geoffroii*), Red-tailed Phascogale (*Phascogale calura*), Numbat (*Myrmecobius fasciatus*), Western Barred Bandicoot (*Perameles bougainville*), Bridled Nailtail Wallaby (*Onychogalea fraenata*), Burrowing Bettong (*Bettongia lesueur*), Brush-tailed Bettong (*Bettongia penicillata*), Greater Stick-nest Rat (*Leporillus conditor*) and Mitchell's Hopping-mouse (*Notomys mitchellii*).

Few projects have ever made such a significant contribution to the conservation of Australia's threatened mammal species. Funding for the construction of the fence, feral eradication, land management and species reintroduction has been provided by the NSW State Government as part of its $41.3 million Reintroduction of Locally Extinct Mammals Project (implemented across three NSW parks) and part of the *Saving our Species* program. As part of our contribution to the partnership, AWC will construct a dedicated field operations base for our staff working on site.

NSW GOVERNMENT

SAVING OUR SPECIES

Please support the construction of a field-operations base for AWC staff at Mallee Cliffs National Park. Your tax-deductible donation will help save endangered wildlife and roll out an innovative new model for conservation.

Back from the brink of extinction: a Bridled Nailtail Wallaby is released into the Pilliga. *Wayne Lawler/AWC*

Locally-extinct Bridled Nailtail Wallabies return to the Pilliga

By Dr Greg Holland, Senior Wildlife Ecologist

Australian Wildlife Conservancy, in partnership with the New South Wales Government, has achieved yet another remarkable outcome for the conservation of Australia's threatened wildlife – the return of the Bridled Nailtail Wallaby (*Onychogalea fraenata*) to a conservation reserve on public land in NSW. The wallabies were reintroduced to the Pilliga State Conservation Area in September 2019. This is a major milestone in the historic partnership between AWC and the NSW Government, with two of six reintroductions earmarked for the Pilliga now complete. The first was the Greater Bilby (*Macrotis lagotis*) in late 2018. The Bridled Nailtail Wallaby was last recorded in the wild in NSW in the 1920s, and was thought to be completely extinct until rediscovered at a site in central Queensland in 1973.

At the Pilliga project area, Bridled Nailtail Wallabies were released into a secure, 680 hectare, feral predator-free area specially created by AWC for the reintroductions of threatened mammals. The wallabies will be released into the larger, 5,800 hectare fenced area once it has been declared feral predator-free. Predation by introduced cats and foxes is the primary cause of the extinction of small to medium-sized mammals in the Pilliga forest (and elsewhere across Australia), with reintroductions only possible to areas where feral predators are excluded.

AWC ecologists translocated 42 adult wallabies (22 males, 20 females) to the Pilliga. Eleven of the females were carrying pouch young. The animals came from two sources: the last remaining remnant population at Taunton National Park in Queensland (25 adults and eight pouch young) and AWC's Scotia Wildlife Sanctuary, in south-west NSW (17 adults and three pouch young). Securing animals from Taunton National Park involved a collaboration between the NSW and Queensland governments, the Bridled Nailtail Recovery Group and AWC. The availability of animals from Scotia highlights the importance of AWC's secure, fenced populations of threatened species in providing animals for reintroductions to NSW National Parks and elsewhere.

A detailed genetic management plan for the Bridled Nailtail Wallaby informed the Pilliga reintroduction, including the optimal source of animals, and ratio of males to females. This will enhance the rate of growth of the new Pilliga population and maximise its genetic diversity and adaptive potential. In time, this population is expected to grow to more than 2,000 individuals, and will in turn provide an important source of animals for future reintroductions of this species.

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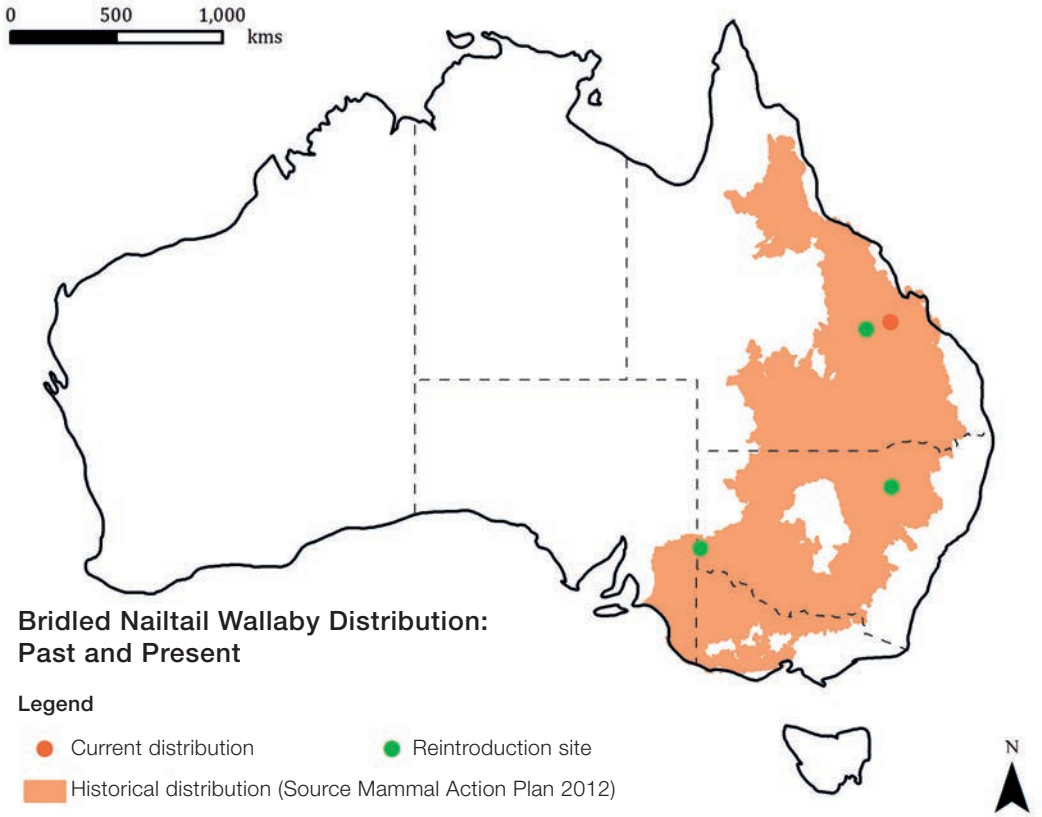

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Images

1. NPWS Ranger Bernadette Lai, AWC Senior Field Ecologist Jessica Skewes, and AWC Senior Ecologist Rod Kavanagh release one of the Taunton wallabies into the Pilliga. *Wayne Lawler/AWC*

2. Bridled Nailtail Wallabies were once continuously distributed throughout inland areas of eastern Australia. In NSW they are now only found in the Pilliga and at AWC's Scotia Wildlife Sanctuary. *AWC*

The translocation process

At Taunton, AWC ecologists worked with staff from Queensland's Department of Environment and Science, who provided local knowledge and experience. A team of AWC ecologists conducted all work at Scotia. Expert veterinary teams provided advice and conducted health examinations.

Young adults, weighing between 2.0 and 4.5 kilograms, were targeted for translocation to maximise both longevity and reproductive output once released at the Pilliga. A uniquely coded microchip was implanted into each wallaby to enable permanent individual identification. Each animal was also fitted with a numbered ear tag and a VHF radio transmitter attached via a collar. Ear tags allow individual identification from remote camera images, while radio collars permit the survival of animals to be determined in the months following release.

Wallabies selected for translocation were flown by charter flight to Narrabri, then loaded into transport vans and driven to the Pilliga. Shortly after nightfall and a final health check, the Bridled Nailtail Wallabies were released at pre-determined locations inside the feral predator-free area. Most animals took a cautious approach to exploring their new home, taking the time to sniff the air and scan their surroundings before hopping away.

The new Bridled Nailtail Wallaby population in the Pilliga will be carefully monitored. VHF radio collars will provide information on their survival for up to 12 months post-release. An automated data-logging system, similar to that being implemented by AWC at Newhaven Wildlife Sanctuary and at Mallee Cliffs National Park, is ensuring signals are recorded for each individual on most days. Remote cameras will provide information on animal activity and habitat preferences. Finally, trapping of the population will occur every three months in the first year post-release. This will provide valuable information on animal health and condition, and allow the size of the population to be estimated.

Securing the future of the Bridled Nailtail Wallaby

The Bridled Nailtail Wallaby was once continuously distributed throughout inland areas of eastern Australia (west of the Dividing Range). Prior to this reintroduction, the Bridled Nailtail Wallaby was found in just three locations:

1. The remnant population at Taunton National Park;
2. A small reintroduced population at Avocet Nature Refuge (near Taunton National Park); and
3. The reintroduced population at AWC's Scotia Wildlife Sanctuary.

Establishment of this new population in the Pilliga is, therefore, of critical importance to the conservation and long-term persistence of the species. The Pilliga population increases the number of secure populations of the Bridled Nailtail Wallaby, while also increasing total population size. It also restores the wallaby to part of its former range, ensuring the long-term adaptive potential of the species is maintained.

Restoring natural ecological processes

AWC is working in partnership with the NSW National Parks and Wildlife Service as part of its *Saving our Species* program to reintroduce a further four regionally extinct mammals to the Pilliga State Conservation Area: Brush-tailed Bettong (*Bettongia penicillata*), Plains Mouse (*Pseudomys australis*), Western Barred Bandicoot (*Perameles bougainville*) and Western Quoll (*Dasyurus geoffroii*). In addition to the significant conservation benefits for each individual species, restoration of much of the former small mammal assemblage will also reinstate important ecological processes including herbivory, predation, seed/spore dispersal and soil engineering (e.g., burrows, foraging pits). The reintroduction program is expected to have far-reaching ecological benefits.

Funding for the construction of the Pilliga fence, feral eradication, land management and species reintroduction has been provided by the NSW State Government as part of its $41.3 million Reintroduction of Locally Extinct Mammals Project (implemented across three NSW parks) and part of the *Saving our Species* program. In addition to the Pilliga, AWC is partnering with the NSW Government to reintroduce regionally-extinct mammals into a feral predator-free area at Mallee Cliffs National Park. Importantly, AWC is also responsible for measuring broader ecological health and delivering land management services at both locations. As the only non-government conservation organisation contracted to manage part of the public land estate, AWC is leading the way in this bold new approach to conservation in Australia.

NSW GOVERNMENT SAVING OUR SPECIES

Endangered Northern Quolls are particularly threatened by cane toads. *Wayne Lawler/AWC*

Innovative approach required as cane toads arrive in the Kimberley

By Dr Rohan Wilson, Wildlife Ecologist, Dr John Kanowski, Chief Science Officer, and Dr Alexandra James, former AWC Senior Wildlife Ecologist

As cane toads continue to invade northern Australia, AWC ecologists in the Kimberley have been testing innovative techniques to mitigate their impact on native predators, with a particular focus on protecting endangered Northern Quolls.

Once common across northern Australia, quolls have declined due to predation by feral cats, wildfire and other factors. Cane toads pose an additional serious threat to quolls, as they carry a toxin that is novel to most Australian animals. Many populations of quolls and other native predators have collapsed across northern Australia as toads have invaded.

Cane toads first arrived at AWC's Mornington Wildlife Sanctuary in the Kimberley in the 2016-17 wet season. Toads are expected to invade the Artesian Range in 2019-20.

Why do some quolls persist in the presence of cane toads?

Encouragingly, some quoll populations have managed to survive 'behind enemy lines' in Queensland despite toads being present for decades. Two theories have been proposed for the persistence of these quolls.

The first theory is conditioned taste aversion (CTA), whereby animals learn though experience that toads are poisonous by ingesting a sub-lethal amount of toad toxin. This could occur in the wild when predators eat a small toad before they encounter an adult, ingesting enough toxin to make them sick but not kill them, hence developing an aversion to toads. Juvenile quolls may also learn to avoid toads from their mothers.

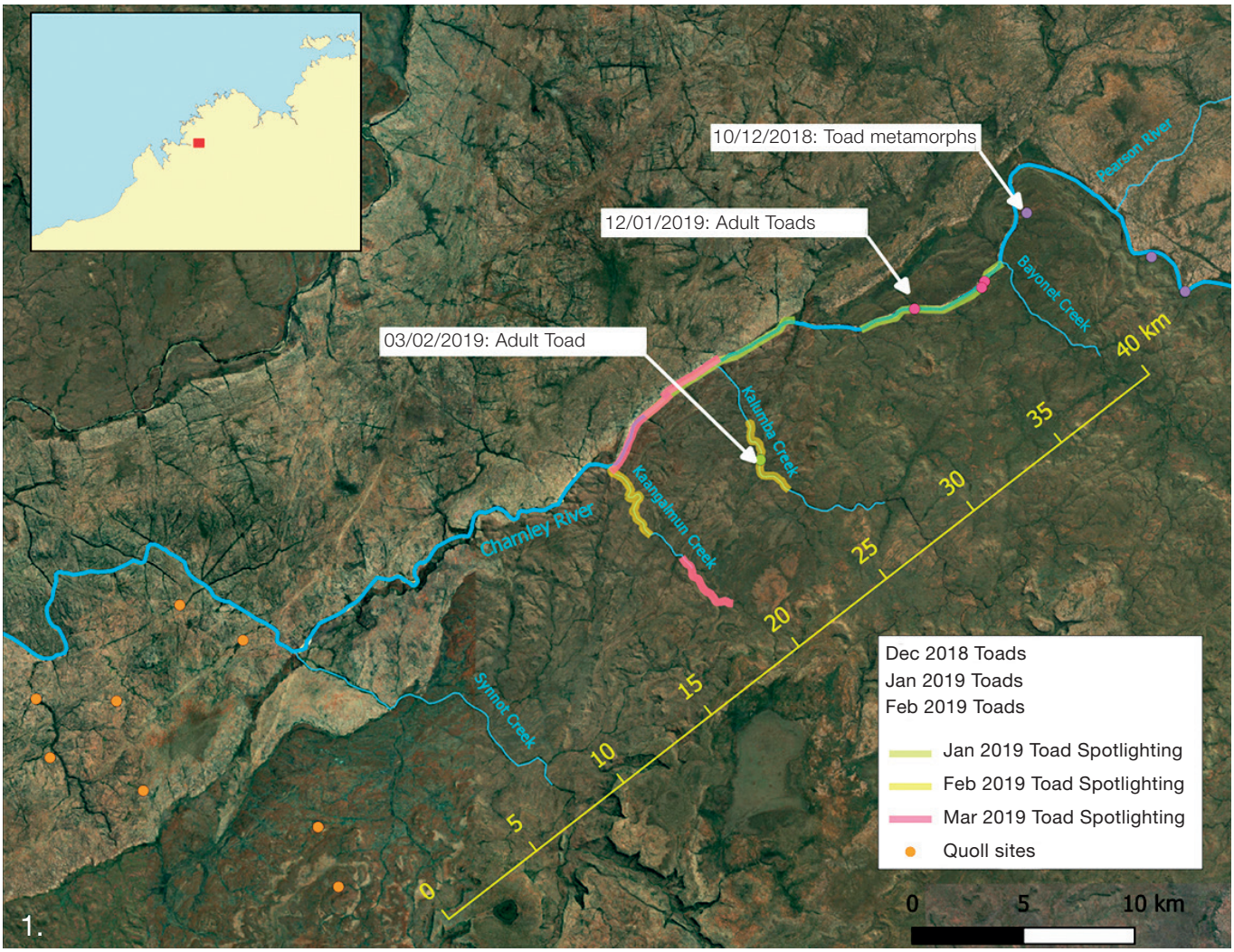
The second theory proposes a genetic basis for not eating toads in some individuals. Once toads arrive in an area, individuals with this trait are favoured to survive and reproduce, such that this trait becomes dominant in the population.

Conducting experimental research on a landscape scale

At present, we do not know which theory is correct. However, faced with the potential collapse of quoll populations in the Kimberley, AWC has been conducting innovative – and highly experimental – research aimed at protecting wild populations of quolls, in collaboration with academics from the University of Technology Sydney and University of Melbourne. The research, predicated on the CTA theory, involved deploying sausages made from toad meat laced with a nausea-inducing chemical to try to teach quolls to avoid eating toads. This was the first time CTA theory had been rigorously tested on a wild population of quolls.

PhD student Naomi Indigo, assisted by AWC ecologists, tested the efficacy of toad sausages in inducing CTA in quoll populations. The project required quantifying the size of each population, the number of individuals that attempted to eat toad sausages, and importantly, the proportion that came back for a 'second bite of the sausage'. The results showed, on average, 60 per cent of quolls in a population ate toad sausages. Of these, between 40 and 70 per cent did not attempt to consume baits a second time. Taken together, these data suggest toad sausages induced CTA in 24 to 42 per cent of quolls in a population.

Based on these results, we deployed toad sausages at Mornington in the 2016-17 wet season, as toads entered the sanctuary. Camera traps were used to quantify quoll population sizes at treatment sites, before and after toads invaded, as well as at control sites, where quolls were present but sausages were not deployed. This design (replicated Before-After-Treatment-Control) allowed us to robustly determine any effect of the treatment.



Image

1. The front line of cane toads spotted on AWC's Charnley River-Artesian Range Wildlife Sanctuary in the Kimberley region of Western Australia.

2. The Artesian Range is located in the only part of Australia to have suffered no wildlife extinctions since European settlement. *Wayne Lawler/AWC.*

3. (Opposite page) A toad metamorph found on AWC's Charnley River-Artesian Range Wlldlife Sanctuary is smaller that a thumb nail. *David Nelson/AWC*

3.

The result: toad sausages failed to protect quolls on Mornington. Regardless of treatment, quoll populations crashed soon after toads arrived. Nevertheless, a small number of quolls have persisted.

Identifying knowledge gaps

This project highlights the challenges involved in finding landscape-scale solutions to key threats to wildlife like cane toads. However, science progresses by testing hypotheses. The results have helped AWC's scientists identify important questions we need to address in any future toad sausage deployments, including:

1. Will quolls 'trained' on toad sausages avoid eating live, hopping toads?
2. Are toad sausages, as currently formulated, sufficiently attractive or 'educational' to quolls?
3. How frequently do we need to deploy baits ahead of toads invading an area?

Refining our forward strategy

These lessons are informing our forward strategy as we focus on protecting quolls in the Artesian Range. First, we plan to track multiple populations of quolls as toads invade the area. Some populations may survive without active intervention, either because sufficient numbers of quolls encounter small toads before adults, or because of inherent avoidance of toads among quolls in those populations.

Second, we will intensively monitor quoll populations around the David Attenborough Field Research Station in the Artesian Range. It is one of very few sites where we can follow the fate of a well-studied quoll population in detail and in real time as toads invade.

For a subset of quolls, we aim to test the efficacy of CTA, deploying toad legs (rather than sausages) at two to three-month intervals during the invasion phase. We will follow the fate of these animals using live trapping. We will also collect tissue samples to determine whether the survival of quolls has a genetic basis.

Preparing for the next assault

In preparation, teams of AWC ecologists have been surveying quoll populations in the Artesian Range and closely monitoring the cane toad front, currently on Charnley River, to inform the timing of the aversion training. The intensive study of quolls around the David Attenborough Field Research Centre will commence at the start of the 2019-20 wet season, with CTA trials to follow ahead of the toad invasion.

This project highlights the challenges involved in finding landscape-scale solutions to key threats to wildlife, like cane toads. The results of this important research will inform future strategies to protect quoll populations that are yet to be invaded by cane toads, like those on Yampi and elsewhere in the Kimberley.

Images

1. Dambimangari country extends along the north-west Kimberley coast. *David Nelson/AWC*
2. Dambimangari Ranger Azarnia Malay attaches a camera trap to a tree. *David Nelson/AWC*

Please help support AWC's innovative indigenous partnerships in the Kimberley.
It costs just $1/ha per year to implement this partnership and protect the Kimberley's unique wildlife.

Surveys confirm abundance of rare species on Dambimangari country

By David Nelson, Senior Field Ecologist

AWC ecologists and Dambimangari rangers have recently completed biodiversity surveys on Dambimangari country, which aim to extend our understanding of what animals are present, where they occur, and how populations are faring under the joint management of AWC and Dambimangari. This management includes fire, feral animal and weed control programs that have been carried out over the last two years.

Dambimangari country represents a large proportion of the north-west Kimberley, one of the few parts of mainland Australia with an intact mammal fauna. This land has been actively managed by the Dambimangari people over millennia, and we have their custodianship to thank for its intact natural values. Today, AWC and Dambimangari Aboriginal Corporation (DAC) have partnered to implement best-practice land management, guided by strong science, to deliver conservation outcomes.

Established in late 2017, this partnership is a novel model for conservation on Indigenous land. AWC provides expertise, experience and resources to protect the exceptional conservation values of this land. DAC can achieve its conservation goals while building capability in its ranger group and generating an income.

Establishing a species inventory

The task of producing a species inventory of Dambimangari country is no mean feat. The country covers 800,000 hectares, stretching for more than 200 kilometres end-to-end. The area encompasses 725 islands and 3,000 kilometres of coastline that winds past a seemingly endless landscape of rocky ranges, mangrove forests, tidal and freshwater rivers and dissected sandstone escarpments.

To date, we have focused on identifying threatened species – particularly mammals. There are seven nationally threatened, terrestrial mammal species that may be present on Dambimangari country, plus another 11 listed at state level as 'priority species', that are important to monitor and study. Some of these species, like the endangered Northern Quoll (*Dasyurus hallucatus)*, have already been detected. We are optimistic we will find others, like the Brush-tailed Rabbit-Rat (*Conilurus penicillatus*). Mapping the occurrence of Kimberley endemics, such as the Monjon (*Petrogale burbidgei*) and Wyulda (*Wyulda squamicaudata*), is also a priority.

From our work in places like AWC's Charnley River-Artesian Range Wildlife Sanctuary, we know many important species occur in the sandstone escarpments that are a prominent feature of Dambimangari country.

Accessing this remote country is like a military operation. We deployed 89 baited camera traps over a large area in the south/central part of Dambimangari country, accessing sites either by boat on the coast or by helicopter further afield. Camera traps are an effective tool for identifying the presence of most species, however, to distinguish some species – Golden Bandicoots (*Isoodon auratus*) from Northern Brown Bandicoots (*I. macrourus*), and Monjon from Nabarlek (*Petrogale concinna*) – we need to analyse DNA. For this, we must live-trap the bandicoots, while the rock-wallabies conveniently leave small, round, black DNA samples scattered over the rocks – scats, which we collect for analysis.

Survey results

Working with DAC rangers, we identified 55 species caught on camera on the recent biodiversity survey, highlighting the exceptional conservation values of this country. In total, 19 mammal, 25 bird and 11 reptile species were identified from more than 1,500 animal detections. The most common species was the endangered Northern Quoll, present at every mainland site surveyed. We also found bandicoots and small rock wallabies at about half the mainland sites surveyed. We are now eagerly awaiting the results of DNA testing.

The picture we are building through these surveys is of a landscape that is bustling with threatened and endemic mammals.

As well as identifying native wildlife, remote cameras give us an idea of the distribution and density of feral animals. The good news is that not a single feral pig, horse, donkey or cow was detected. Only two feral cats were observed, supporting our theory that cats are in low densities here due to the rocky habitat which provides critical refuge for wildlife, and to the history of good fire management, and the absence of feral herbivores.

Searching for species most at risk

The next task is to redouble our efforts to find species most at risk of decline. We are strategically selecting novel habitat types to maximise our chances of discovering new populations of priority species. We are also incorporating factors such as fire history into our site selection, which will help us learn more about how we can best protect the species present here.

AWC and DAC are continuing to work together to co-design an effective model for delivering conservation. Data from the surveys conducted in this initial phase of the project will help us create an EcoHealth monitoring program that will allow us to measure ecological outcomes. Ultimately, the ongoing health of this beautiful and ecologically rich region depends on it.

Sharman's Rock-wallaby were trapped and released as part of a four-year study on this rare mammal. *Catherine Hayes/AWC*

Securing the future of one of Australia's rarest rock wallabies

Dr Catherine Hayes, Wildlife Ecologist

A four-year research project on the elusive Sharman's Rock-wallaby (*Petrogale sharmani*) has just wrapped up at Australian Wildlife Conservancy's Mount Zero-Taravale Wildlife Sanctuary, in northern Queensland. This project was a collaboration between AWC, the University of Queensland and the Queensland Department of Environment and Science.

The project was the first detailed ecological study of the threatened species, which has a highly restricted range between Townsville and Ingham in north Queensland. Most of the known colonies of the species occur on Mount Zero-Taravale. Sharman's Rock-wallaby is nocturnal, spending the daylight hours hidden in rocky caves and crevices and coming out to forage at night. Its nocturnal habits and love of steep, rocky terrain makes it a very challenging species to study, but gathering baseline ecological information is critical for its future conservation management.

Population dynamics

Three sites on Mount Zero-Taravale were trapped repeatedly during the study to establish baseline data on the species' population dynamics and reproductive ecology. Colony sizes were small (less than 15 animals), however, nearly all of the female rock-wallabies trapped carried pouch young, with most breeding to their full potential. These results suggest that although small, these populations are not at immediate risk of decline and have healthy reproductive rates. Nevertheless, with estimates of fewer than 700 animals in the entire global population, it is important to track the status of this species and ensure management of its habitat is appropriate.

The role of fire for conservation

The study highlighted the importance of AWC's prescribed burning program in promoting food resources for Sharman's Rock-wallaby, and in protecting its habitat from large wildfires. GPS collars were fitted to 15 rock-wallabies to track their movements around their rocky shelter sites. Their response to fire was also studied, as the GPS collars recorded the location of the rock-wallabies both before and after fire.

Like other herbivores, Sharman's Rock-wallaby quickly made use of 'green pick' which flourished after fires. The rock-wallabies showed a strong preference for foraging in the recently burnt areas on the new grasses and forbs. At one site, they completely abandoned a slighter older burn scar (two months older) to forage on the newer burn.

The tracking allowed us, for the first time, to determine the home range of Sharman's Rock-wallaby. The average home range was less than 10 hectares. They moved an average of 200 metres from their rocky shelter sites while foraging at night. The smallest collared female had a home range of under four hectares. These results highlight how closely tied these rock-wallabies are to their rocky shelter sites. In addition to promoting the rock-wallabies' food plants, AWC's prescribed burning program will also reduce the chance of intense and extensive late dry season fire destroying the entirety of the food resources at one or more colonies.

Predator monitoring

Over 17,000 camera trap nights were undertaken to better define the distribution of Sharman's Rock-wallaby and to investigate how often feral cats and Dingoes were present at rock-wallaby sites. Dingoes were detected six times more frequently than feral cats over the course of the study. Cats and Dingoes were active at different times: cats showed a midnight activity peak, whereas Dingoes were more active at dawn and dusk. Both predators were detected more often on roads and in open habitat than in the rocky areas.

These results suggest that a healthy population of Dingoes is working to suppress feral cat activity, and possibly abundance. Dingoes are also likely to regulate the abundance of potential competitors of Sharman's Rock-wallaby, such as Common Wallaroos (*Macropus robustus*).

Mapping rock-wallaby distribution

The study confirmed Mount Zero-Taravale provides vital habitat for Sharman's Rock-wallaby. Six new colonies of Sharman's Rock-wallaby were discovered during the study, meaning AWC protects 70 per cent of all the known populations of this species. Habitat modelling suggests there may still be undiscovered colonies on Mount Zero-Taravale. These steep, rocky sites will be targeted by AWC in future surveys of the species.

Modelling based on Sharman's Rock-wallaby's current range showed a huge reduction in potentially suitable habitat under climate change, with only several small pockets of suitable habitat predicted to remain by 2070. Importantly, Mount Zero-Taravale is predicted to play a crucial role in ensuring the survival of Sharman's Rock-wallaby into the future.

AWC plans to return the Western Quoll to Mt Gibson Wildlife Sanctuary. *Lochman Transparencies*

Plan to return Western Quolls to Mt Gibson Wildlife Sanctuary

By Dr Michael Smith, South-west Regional Ecologist, and Dr John Kanowski, Chief Science Officer

In 2015, Australian Wildlife Conservancy began an ambitious reintroduction project at Mt Gibson Wildlife Sanctuary, in south-west Western Australia. The sanctuary is located in the northern Wheatbelt, an area once rich in small and medium-sized native mammals. Based on sub-fossil evidence collected from the property, we believe more than 30 species historically inhabited the area, three of which are now globally extinct and another 13 are extinct from the region. AWC's nationally significant reintroduction project aims to return at least 10 of the 13 regionally-extinct mammals back to Mt Gibson.

To date, eight mammal species have been reintroduced to a 7,800 hectare, fenced, feral predator-free area on the property: Numbats (*Myrmecobius fasciatus*), Red-tailed Phascogales (*Phascogale calura*), Western Barred Bandicoots (*Perameles bougainville*, also known in WA as Shark Bay Bandicoot), Greater Bilbies (*Macrotis lagotis*), Woylies (*Bettongia penicillata*), Banded Hare-wallabies (*Lagostrophus fasciatus*), Greater Stick-nest Rats (*Leporillus conditor*) and Shark Bay Mice (*Pseudomys fieldi)*.This project has already set a new benchmark for rewilding projects in Australia; no other project has involved the return of so many regionally extinct species to one site.

The results are encouraging:

- Seven of the eight reintroduced species have fully established;
- Individuals are spreading across the fenced area; and
- There is evidence of breeding for some species. For example, Woylies – the first species to be reintroduced – have increased to more than 800 individuals (Figure 1, page 26) over half the projected carrying capacity of the fenced area, after just four years.

Other threatened species, including Numbats and Bilbies, have expanded their range across most of the fenced area (Figure 2, page 27).

AWC plans to return the two remaining species – Western Quolls (*Dasyurus geoffroii*) and Brushtail Possums (*Trichosurus vulpecula*) – in the next few years. Of these, the Western Quoll (known as 'Chuditch' in Western Australia) is a top predator with a large home range. Quolls are expected to prey upon some reintroduced species, like bandicoots and rodents. While this is part of the natural process, populations of the potential prey species need to fully establish within the fenced area before being exposed to Quoll predation. For these reasons, Quolls may be better suited to release outside the fenced area than within it. Quolls are potentially capable of surviving outside the fenced area, in conjunction with feral animal control. Refugial populations of Western Quolls are known to persist in parts of south-western Australia subject to fox control, like at AWC's Paruna Wildlife Sanctuary. Western Quolls have also been successfully reintroduced to other locations in WA and, more recently, to the Flinders Ranges in South Australia, where foxes and feral cats are suppressed.

To facilitate the Quoll reintroduction, AWC ecologists have been developing an 'outside the fence' strategy for Mt Gibson. The strategy draws on survey and statistical methods developed as part of research conducted by AWC at Scotia Wildlife Sanctuary and in the Pilliga State Conservation Area and Pilliga National Park in New South Wales. In 2019, AWC ecologists implemented the first stage of the strategy, deploying an array of 90 camera traps over 20,000 hectares of the broader landscape of Mt Gibson. Data from these cameras will be used to estimate the density of cats and foxes in the landscape.

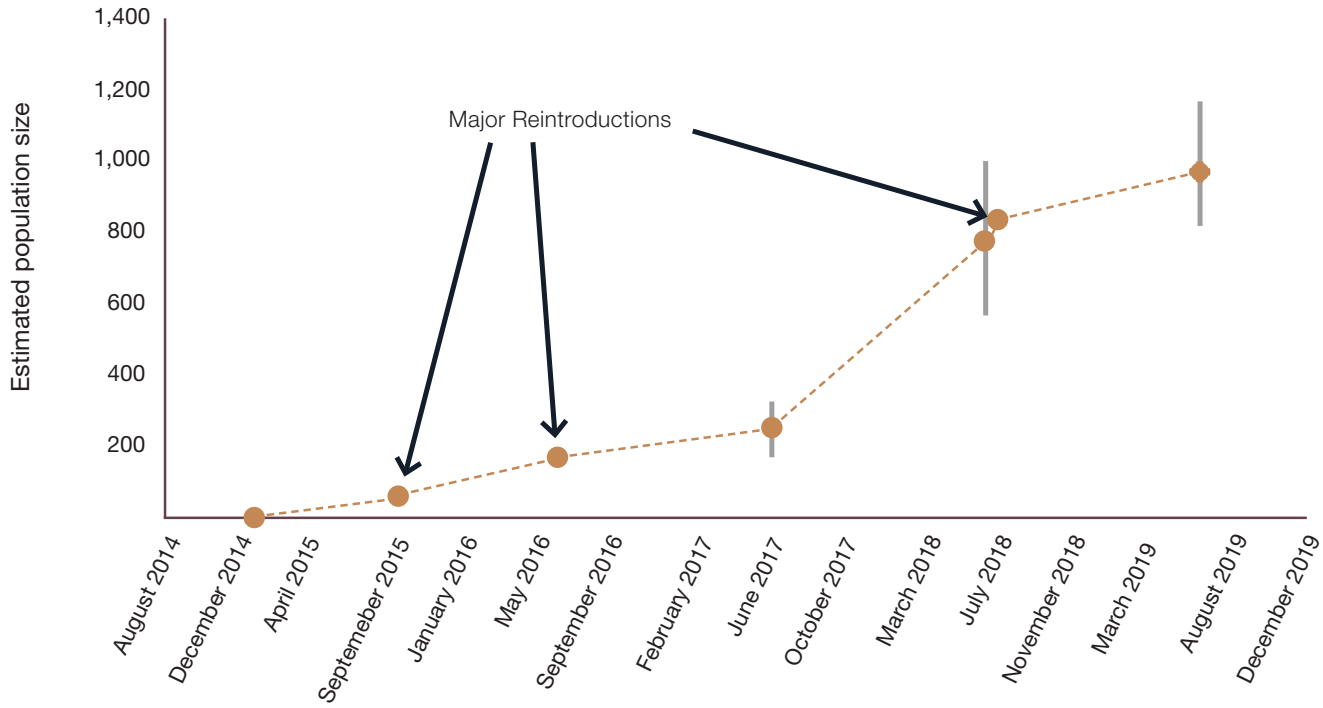


Fig. 1

Images

1.The Shark Bay Mouse is one of the eight mammal species reintroduced to Mt Gibson Wildlife Sanctuary. *Wayne Lawler/AWC*

2. Field Ecologist Noel Riessen releases a Red-tailed Phascogale into a tree hollow at Mt Gibson. *Brad Leue/AWC*

Fig 1. Woylie population size, Mt Gibson Wildlife Sanctuary. The population size is estimated from capture-mark-release data collected from live-trapping surveys. The graph shows population estimate modelling (and 95% Credible Intervals) for 2017 and 2018 and plus major reintroductions.

Fig.2. Map showing the distribution of Numbats within the fenced, feral predator-free area at Mt Gibson Willdlife Sanctuary in WA.

Thank you to all AWC supporters for your generous support of this project, with special thanks to our major Mt Gibson partners:

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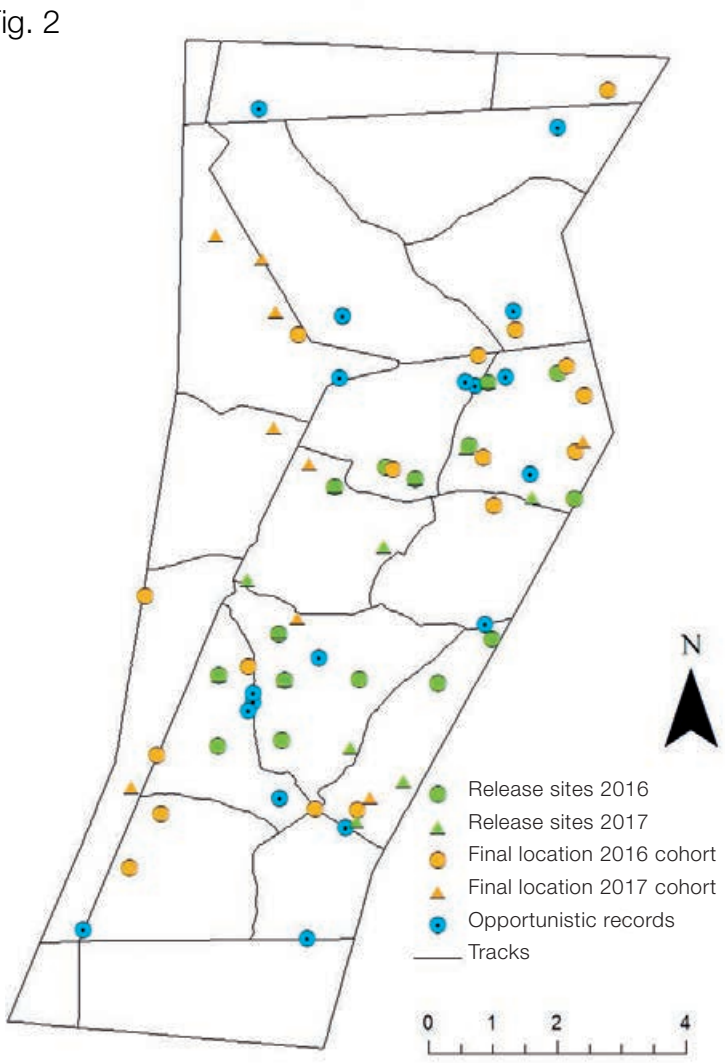
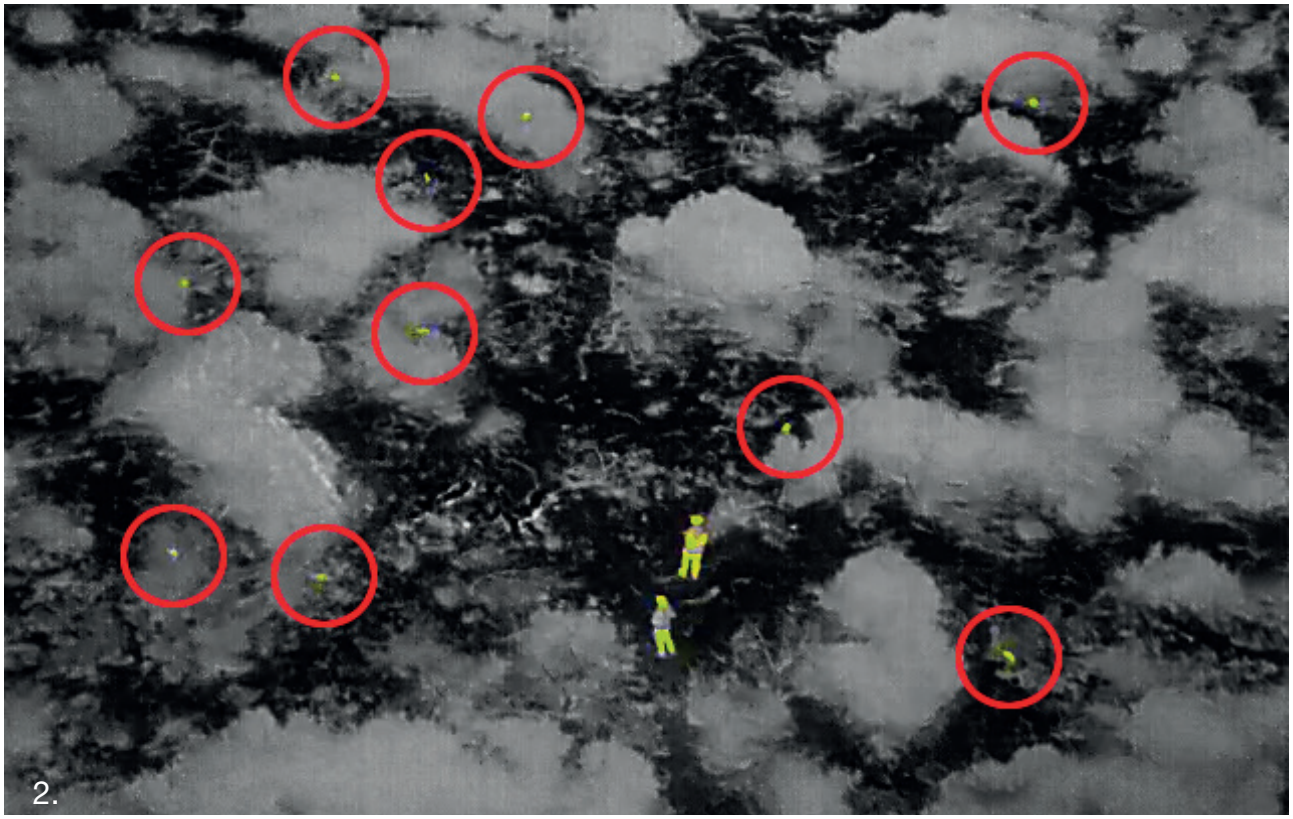
Fig. 2



Stage two of this strategy, to be undertaken in 2020, involves an aerial baiting program to drive down cat and fox densities. Data collected from camera trap arrays on the treated site, and from a matched control site, will be used to quantify the impacts of baiting. Provided baiting sufficiently suppresses fox and cat densities, AWC will progress to stage three – the reintroduction of quolls. Released animals will be monitored closely using satellite telemetry to assess their survival and movement. If successful, a larger release program will be enacted.

The planned reintroduction of Western Quolls to Mt Gibson is a major step towards re-establishing wildlife in WA's Wheatbelt outside of fenced areas. A reduction in cat and fox densities will also benefit extant mammal fauna in the management area. AWC's EcoHealth monitoring program at Mt Gibson will provide crucial data that will enable us to measure the ecological return for our investment on this exciting project.



Images

1. Travis Marshall sets up the drone fitted with thermal cameras to monitor the introduced native mammals on Faure Island. *Brad Leue/AWC*
2. A thermal image taken from the drone shows two AWC ecologists surrounded by native mammals hidden in dense vegetation. *AWC*

Please support the development and deployment of conservation technology to help protect threatened wildlife.
$1,000 will purchase a Songmeter to monitor birds, frogs and microbats.
$300 will pay for one hour of drone time and image analysis to monitor and protect elusive wildlife.

Deploying conservation technology to monitor and protect threatened wildlife

By Dr Michael Smith, South-west Regional Ecologist

American inventor, Dean Kamen, once said, "Every once in a while, a new technology, an old problem and a big idea turn into an innovation". In many ways, Australian Wildlife Conservancy has adopted this philosophy when it comes to improving our approach for monitoring wildlife. At AWC we are trialling and deploying a suite of exciting new technologies in our science program. Three new technologies being investigated in Western Australia include the use of:

1. Drones fitted with thermal cameras to monitor reintroduced mammals;
2. DNA extracted from animal scats to estimate population sizes of cryptic species; and
3. Deploying acoustic recorders to monitor birds, frogs and bats.

Counting animals using drones

In June 2019, AWC staff and Travis Marshall, from technology firm C4D Intel, travelled to AWC's Faure Island Wildlife Sanctuary, in Shark Bay, WA, to trial the use of a drone to monitor reintroduced mammals. AWC has reintroduced four threatened mammal species to Faure: the Burrowing Bettong (*Bettongia lesueur*), Banded Hare-wallaby (*Lagostrophus fasciatus*), Western Barred Bandicoot (also known as the Shark Bay Bandicoot, *Perameles bougainville*) and Shark Bay Mouse (*Pseudomys fieldi*). AWC currently monitors these species through spotlighting, trapping and track surveys. However, spotlight surveys are challenging because of the dense vegetation, and the last three species are cryptic and difficult to trap.

On Faure Island, AWC trialled the use of a drone, the DJI M210 Aircraft, fitted with a FLIR XT2 dual thermal/RGB sensor to determine whether:

1. Different species could be detected and differentiated using thermal imagery; and
2. The behaviour of reintroduced species introduced a bias to population estimates.

We found the thermal camera was excellent at detecting mammals and may be an effective tool for monitoring bandicoots, but the limited resolution made it difficult to distinguish between Burrowing Bettongs and Banded Hare-wallabies, which are both small macropods. Footage showed that Burrowing Bettongs tended to 'investigate' people as they walked through the bush, potentially biasing population estimates through double counting. Even so, estimates of population size derived from the drone footage were comparable to those generated by spotlight surveys, probably because some individuals are hidden by dense scrub during spotlighting.

Counting animals via their scats

At AWC's Mt Gibson Wildlife Sanctuary, eight threatened mammal species have been reintroduced, including Banded Hare-wallabies and Greater Bilbies (*Macrotis lagotis*). Both species are difficult to survey; they generally will not enter traps, cannot be individually recognised from photos or in thick vegetation, and are challenging to monitor via spotlight searches.

A novel approach for monitoring these species involves extracting DNA from scats and using this information to estimate population size. AWC has trialled this method on Bilbies at Mt Gibson, in collaboration with Martin Dziminski from the West Australian Department of Biodiversity, Conservation and Attractions (DBCA). We conducted an initial trial shortly after Bilbies were reintroduced, when we knew exactly how many animals were in the population. Trial results provided a very good estimate of the population size.

A larger trial has now been undertaken by sampling scats across the 7,800 hectare fenced area at Mt Gibson, with results pending. We intend to use a similar method for Banded Hare-wallabies, in collaboration with DBCA. If successful, it will provide a new methodology for monitoring population sizes of elusive species.

Detecting animals through sound

Detecting birds and frogs by their calls is a skill developed by many ecologists, but comprehensive surveys are expensive and time consuming. For species that call only after certain environmental triggers (such as frogs after rain), planning surveys in advance can be challenging.

Deploying acoustic monitors in the field, rather than people, is an exciting alternative. The recent development of low cost, programmable and robust acoustic monitors has facilitated their use in routine ecological monitoring. AWC's science team has successfully trialled 'Audiomoth' devices for monitoring birds on Faure Island, and frogs on Karakamia and Paruna Wildlife Sanctuaries. In other regions, AWC ecologists have deployed 'Songmeter' devices for monitoring frogs, birds and microbats. Combined with developments in artificial intelligence, these technologies have the potential to provide new and more efficient methods for monitoring Australia's threatened wildlife.

Dr Andrew Carter with the EONEF helium balloon in the Pilliga. *Brad Leue/AWC*

Please support AWC's ground-breaking research for monitoring wildlife

$1,000 will help purchase a base station for downloading animal tracking data

$500 will fund a scientist delivering research in the field for one day (including vehicle and equipment)

Up, up and away: helium balloon assists with wildlife tracking

By Dr Andrew Carter, Wildlife Ecologist

Fitting wildlife with tracking devices is an important part of the work AWC does across the country. Tracking is undertaken to monitor the survival of native mammals reintroduced inside fenced, feral predator-free areas or to better understand the effects of management activities on the spatial ecology of wildlife in open (unfenced) landscapes.

Satellite-based transmitters can send location data remotely without the need to relocate the tagged animal, but the size of this technology means that, at present, it can only be fitted to species that weigh more than three kilograms. To obtain location data from telemetry tags fitted to smaller species, it is necessary to maintain contact with the tagged animals. This can be done actively from the ground via vehicle or foot-based searches, but such an approach is very time consuming as detection distances are usually short (up to two kilometres).

Another option is to use base stations that download location data automatically when a tagged animal is nearby. These can either be fitted to fixed towers and left unattended at strategic locations, or mounted to unmanned aerial vehicles ('drones') for active searching. Fixed towers are difficult to build in remote locations and once erected cannot easily be moved elsewhere, while drones can only be flown for short periods at a time.

In a search for a more efficient and effective solution for downloading wildlife telemetry data, AWC recently trialled an alternative approach—a tethered helium balloon.

The week-long trial, which took place in September in the Pilliga State Conservation Area and Pilliga National Park, in northern New South Wales, was the first of its kind in the southern hemisphere to use this type of balloon for wildlife research.

Developed by French company, EONEF (eonef.com), the balloon is made with a gas-proof, multilayer, plastic membrane, and is filled with 10 cubic metres of helium. Tethered to the ground with a nylon cable, it can be flown at heights of up to 120 metres, and returned to the ground using a winch. Measuring approximately 4.3 metres long by two metres wide and two metres high, the balloon can be set up by one person and is capable of flying unattended for weeks at a time. It can be fitted with solar panels to maintain power to the telemetry base station that is attached to its undercarriage.

In the forested landscape of the Pilliga, the balloon was able to download data from telemetry tags located nine kilometres away. That equates to an effective detection area exceeding 25,000 hectares, which suggests that a single tethered helium balloon could provide download coverage across any of AWC's current fenced reserves — greatly improving the efficiency of obtaining location data from tagged animals.

The next stage of development for the balloon is to automate its operation so it can be raised and lowered to the ground remotely to safeguard against adverse weather conditions. This approach would open up endless possibilities for monitoring wildlife in even the most remote locations.

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