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(Founded 1909)

EASTERN QUOLL - PHOTO BY BRONWYN FANCOURT



The spots on an eastern quoll are as individually unique as fingerprints on humans. For more information see page 10

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Suzanne Medway AM
Editor, Australian Wildlife

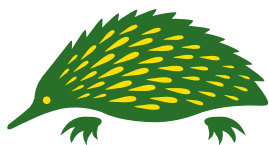


Sabine Borgis
Sub-Editor, Australian Wildlife



Front cover:

Eastern quoll. Photo by Australian Ecosystems Foundation Inc. The eastern quoll, also known as the eastern native cat, is a medium-sized carnivorous dasyurid marsupial native to Australia. They are widespread and even locally common in Tasmania. See page 10 for more details



Australian Wildlife Society

Conserving Australia's Wildlife
since 1909

Australian Wildlife

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of our unique Australian wildlife in all its forms.

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Notice to our members

The Australian Wildlife Society (Wildlife Preservation Society of Australia Limited) is managed and controlled by an elected board of ten volunteer directors. The Society is a registered company limited by guarantee with ASIC and is responsible for complying with all its regulations.

Any member who might like to consider serving as a director of the Society is invited to contact the national office for more details. The most important qualification to serving as a director is 'a commitment to and love of Australian wildlife'.

The Society holds regular monthly meetings on the first Wednesday of each month in Sydney.

The Editor would like to feature a member's profile in the fortnightly email newsletter and occasionally in our quarterly magazine. Members are invited to consider submitting a short article with a photograph for possible publication.

Our Mission

The Australian Wildlife Society (Wildlife Preservation Society of Australia Limited) is an independent, voluntary, non-profit conservation organisation, formed in 1909, and is committed to the preservation of Australia's precious flora and fauna. We act as a watchdog and provide advice to government agencies and institutions regarding environmental and conservation issues concerning all aspects of wildlife preservation. Our mission is to conserve Australia's fauna and flora through education and involvement of the community. We are dedicated to the conservation of our unique Australian wildlife in all its forms through national environmental education programs, political lobbying, advocacy and hands on conservation work.

Our Society has always known that a conservation battle is never really won until the victory is enshrined in legislation. We have always tried to convince politicians of the necessity to include the preservation of Australia's precious wildlife and its vital conservation habitat in all their planning and environmental issues and discussions.

Articles and comments expressed in this magazine do not necessarily reflect the opinions of the Editor, Society or members. Articles contributed from outside sources are included for the reading enjoyment of members and to encourage discussion on different points of view.

Articles may be copied or quoted with appropriate attribution.

From the President's desk

Suzanne Medway AM - President

Wildlife rehabilitators play a vital role in conservation of Australian wildlife and the Australian Wildlife Society would like to see these special carers recognised and rewarded



Many people find the experience of rehabilitating native wildlife rewarding, however it is time consuming and can be very expensive. Caring for native wildlife takes a lot of experience. It is not like looking after a cat or a dog; native animals have special dietary requirements, need frequent veterinary care and wildlife carers need to have a strong commitment to their rehabilitation. Some native animals need highly specialised care; koalas, echidnas, platypuses, raptors and reptiles are some examples of animals that require high levels of expertise and a degree of specialisation. Many of these species are also threatened and their survival is highly significant.

Wildlife rehabilitators play a vital role in conservation of Australian wildlife and the Australian Wildlife Society would like to see these special carers recognised and rewarded.

The Australian Wildlife Society has decided to create a new award to compliment the Serventy Award and the Community Wildlife Conservation Award – the **Australian Wildlife Society Wildlife Rehabilitation Award**.

The aim of introducing this new award is to benefit the preservation of Australian wildlife by supporting volunteer wildlife rescuers and rehabilitators and to further the Society's commitment to preserving native wildlife by supporting volunteers who rescue and rehabilitate injured native wildlife.

We would like to increase awareness of the dedication of wildlife rescuers and rehabilitators by rewarding these smaller organisations and/or individuals who do not reach the criteria for judging of the Community

Wildlife Conservation Award and the Serventy Conservation Award.

The Australian Wildlife Society will provide an annual award of \$1,000 to an individual or small organisation who contributes to the conservation of Australian wildlife through rescue and rehabilitation. A trophy and certificate will accompany the cash award, which will be announced at the Annual General Meeting luncheon each year along with the Serventy Award and the Community Award. Winners will be notified by mail, and full results published in the Society's magazine.

Application process

The application process will be advertised online through our website and social media and through our fortnightly newsletter. Applications are to be received annually by 31 December.

An online application form on the Society's website is available or an application form can be downloaded and posted to the national office.

The applications will be judged by the President of the Australian Wildlife Society.



Tasmanian devil at Devil Ark, photographed by Callum Meney. "This particular devil took quite a bit of interest in my camera and was trying to inspect me as I approached it for a photograph." For more information about Devil Ark see page 16



REINTRODUCING LOCALLY EXTINCT MAMMALS

Australia is home to more than 500,000 animal and plant species, many of which are found nowhere else in the world. Over the last 200 years, more than 100 animal and plant species have become extinct. In New South Wales, almost 1,000 animal and plant species are at risk of extinction.

The NSW Government has announced it will be negotiating a project, led by the University of New South Wales, to deliver an innovative plan to

reintroduce locally extinct mammal species into New South Wales national parks.

This initiative could see the return of mammal species not seen in their natural habitat in New South Wales for over 90 years.

Over 200,000 hectares of New South Wales national parks will be dedicated to the project. Within these areas, the partner organisations will establish

and manage large predator-free exclusion areas of several thousand hectares. They will also deliver complementary park management activities in collaboration with the NSW National Parks and Wildlife Service.

Parks in which fences are proposed to be constructed – in accordance with environmental approvals – are Sturt National Park, Mallee Cliffs National Park and Pilliga Nature Reserve.



SUZANNE MEDWAY

More than ten species have been identified for reintroduction including the iconic bilby, numbat, and brush-tailed bettong.

It is known through scientific research that these mammals play a significant role in maintaining the health of ecosystems. Reintroducing them to enclosures in parks where feral predators have been removed will not only reduce their risk of extinction, but is expected to deliver significant

benefits to many other threatened species as well.

Reintroduction of mammals is a significant component of the Saving our Species program, which aims to maximise the number of threatened species that can be secured in the wild in New South Wales over the next 100 years.

Potential species for reintroduction are:

Numbat

The numbat (*Myrmecobius fasciatus*), also known as the banded anteater or walpurti, is a marsupial found in Western Australia. Its conservation status in New South Wales is **Presumed Extinct**. Its Commonwealth status is **Vulnerable**.

The numbat is a small, colourful creature between 35 and 45 cm long, including the tail, with a finely pointed muzzle and a prominent, bushy tail about the same length as its body. Its diet consists almost exclusively of termites. Colour varies considerably, from soft grey to reddish-brown, often with an area of brick red on the upper back, and always with a conspicuous black stripe running from the tip of the muzzle, through the eyes, to the bases of the small, round-tipped ears. There are between four and eleven white stripes across the animal's hindquarters, which gradually become fainter towards the mid-back. The underside is cream or light grey, while the tail is covered with long grey hair flecked with white. Weight varies between 280 and 700 grams.

Bilby

The bilby (*Macrotis lagotis*) is an important part of traditional indigenous culture in the deserts of Central Australia. Its conservation status in New South Wales is **Presumed Extinct**. Its Commonwealth Status is **Vulnerable**.

The large rabbit-like ears of the greater bilby (referred to as bilby) have also made it a popular Australian icon at Easter. Through habitat loss and competition with introduced animals, the number of these small mammals has dramatically reduced over the last 100 years.

Bilbies have an excellent sense of smell and sharp hearing. Their fur is blue-grey with patches of tan and is very soft. The tail is black and white with a distinct

crest. Bilbies have strong forelimbs and thick claws, which they use to dig for food and make burrows. They are about 29–55 cm in length. Compared to bandicoots, they have a longer tail, bigger ears, and softer, silky fur. At 1 to 2.4 kg, the male bilby is about the same size as a rabbit; although male bilbies in exceptional health have been known to grow up to 3.7 kg in captivity. The female bilby is smaller and weighs around 0.8 to 1.1 kilograms.

Brush-tailed bettong (or woylie)

The brush-tailed bettong (*Bettongia penicillata penicillata*) is a small potoroid marsupial which once occupied most of the Australian mainland. Its conservation status in New South Wales is **Presumed Extinct**. Its Commonwealth status is **Extinct**.

Two subspecies have been described, *Bettongia penicillata ogilbyi* (often referred to as woylie) and the now extinct *Bettongia penicillata penicillata* (brush-tailed bettong).

The brush-tailed bettong (south-east mainland) was grey-brown in colour with pale yellowish-grey undersides. The sides of the face and the bases of the ears had a reddish tinge. The base of the long tail was also grey-brown and the last two-thirds were dark brown to black above. The tail had a crested tip. Males and females were similar in appearance and no geographic variation has been reported.

Measurements of the brush-tailed bettong (south-east mainland) are unavailable, however, the similar woylie has a head and body length of 300–380 mm, tail length of 290–360 mm and weight between 1.1 and 1.6 kg.

Bridled nail-tail wallaby

The bridled nail-tail wallaby (*Onychogalea fraenata*) is a medium-sized macropod. Its conservation status in New South Wales is **Presumed Extinct**. Its Commonwealth status is **Endangered**.

The bridled nail-tail wallaby can grow to one metre in length, half of which

Above left: Numbat



Numbat



Bilby



Bridled nail-tail wallaby

is tail, and weighs 4–8 kg. Females are somewhat smaller than the males. They have distinctive markings of a white 'bridle' line running from the centre of the neck, along the shoulder to behind the forearm on each side of the body. A black stripe runs the length of the body, and white cheek stripes are present on both sides of the head. A 'nail' at the tip of the tail is between 3 and 6 mm and is partly concealed by hair.

Mitchell's hopping mouse

Mitchell's hopping-mouse (*Notomys mitchellii*) is a bipedal rodent with large back legs, similar to a jerboa or kangaroo rat. Its conservation status in New South Wales is **Presumed Extinct**. Its Commonwealth status is **Not Listed**.

Individuals are a sandy grey colour, with white chest hairs and a paler underbelly. The tail of the species is long and has the characteristic hopping-mouse brush at the tip. This tail morphology is thought to aid balance when travelling at speed. It is the largest member of the genus *Notomys*, weighing between 40 and 60 g. Neither male nor female *N. mitchellii* have the gular pouch that is present in the other *Notomys*.

The species is not currently considered to be threatened with extinction nationally, but its range has been reduced through habitat disturbance and destruction associated with European settlement in Australia.

Greater stick-nest rat

The greater stick-nest rat (*Leporillus conditor*), or 'wopilkara' as it was also known, is a fluffy yellow-brown to grey rodent with a creamy underbelly, blunt snout, a large head with large eyes and rounded ears. Its conservation status in New South Wales is **Presumed Extinct**. Its Commonwealth status is **Vulnerable**.

The wopilkara reaches a head–body length of 17–26 cm and a body weight of 180–450 g. The tail is usually shorter than the head and body (average 17 cm) and has a slight terminal brush of hairs. The rat rests in a hunched posture, similar to a rabbit.

They inhabited much of the semi-arid and southern arid zone of Australia and

were named after the conspicuous stick-nests they built and lived in.

Since European settlement this species was severely affected by the overgrazing of their preferred habitat. A single population of greater stick-nest rats survived on the Franklin Islands, off the coast of Ceduna, South Australia. The lesser stick-nest rat is now presumed extinct.

Boodie – burrowing bettong

The boodie (*Bettongia lesueur*), also known as the burrowing bettong, is a small marsupial. Its conservation status in New South Wales is **Presumed Extinct**. Its Commonwealth status is **Extinct**.

The largest of the bettongs, it is yellow-grey on its back and light grey on the belly with a lightly haired, fattened tail. In some regions the tail had a white tip. A pale, indistinct hip stripe was usually present. The ears were shorter and more rounded than in other bettong species. The head-body length was 28–40 cm, with the tail adding an additional 22–30 cm. The species generally weighed about 1.3 kg but could be as heavy as 2 kg.

The boodie is very vocal and makes a variety of squeals, hisses and grunts and they move in a bipedal fashion, not making use of their tail or fore-limbs for support, except when stationary.

Golden bandicoot

The golden bandicoot (*Isodon auratus*) (mainland) is a small golden-brown marsupial with a rather long, pointed head and compact body. Its conservation status in New South Wales is **Presumed Extinct**. Its Commonwealth status is **Vulnerable**.

The golden bandicoot has stiff golden hairs which lie over the head and body, completely hiding the softer, greyish underfur. It is by far the smallest of its genus, being a little over half the size of its relatives the northern brown bandicoot (*I. macrourus*) and the southern brown bandicoot (*I. obesulus*).

This species grows to an average length of 24.5 cm with an average tail length of 10.5 cm. It weighs between 300 and 670 g when mature.



Golden bandicoot



Boodie - burrowing bettong



Brush-tailed bettong



THE EASTERN QUOLL

BRONWYN FANCOURT

The eastern quoll (*Dasyurus viverrinus*) is an endangered medium-sized carnivorous marsupial that was once widespread throughout south-eastern Australia, but now survives only in Tasmania. Populations on the Australian mainland declined rapidly around the late 1800s and early 1900s, apparently due to a disease epidemic that reportedly affected a number of native species at that time. To add insult to injury, quolls were regularly poisoned and persecuted for killing domestic poultry, further contributing to their decline. The introduction of the European red fox as a novel predator was likely the final straw in their mainland demise, with the eastern quoll now considered extinct on the mainland.

In contrast to its mainland extinction, the eastern quoll continued to thrive in Tasmania where it was, until recently, considered stable and secure. However, the species has recently undergone rapid and severe population decline across the Tasmanian mainland, although North Bruny Island still supports an isolated stable, high-density population. A

combination of trapping and spotlight surveys indicated statewide declines of more than 50 percent in the 10 years to 2009 with no sign of recovery.

Between 2010 and 2014, I investigated the possible causes of the eastern quoll's decline in Tasmania. In-depth weather modelling revealed that fluctuations in quoll abundance were related to changes in short-term weather across the species' range, including a sharp decline between 2001 and 2003. It seems eastern quolls prefer it cold and dry, and don't do so well when it's warm and wet! But while weather conditions improved after 2004, quoll numbers did not recover. So while unfavourable weather conditions pushed the quoll numbers down, something else is now keeping them down and preventing them from recovering. But what?

An investigation into *Toxoplasma gondii*, the cat-borne parasite that causes the disease toxoplasmosis, found a high prevalence of the parasite in populations where quolls had declined, but a low prevalence in quoll

populations that were stable. At first glance, this suggested that the parasite might have been contributing to the low quoll numbers, or preventing them from recovering. But further investigations revealed that the parasite did not affect either quoll survival or reproduction. As the parasite is primarily spread by cats, the high prevalence at declined quoll sites actually signalled a higher cat density at these sites, suggesting that feral cats may be suppressing quoll recovery through predation of quolls, or competition for key resources.

So I cast the net a bit wider across Tasmania to better understand the relationship between cats and quolls. I performed camera surveys at 16 sites across Tasmania, and analysed how quolls responded to different abundance and activity of cats. I predicted that areas with low quoll numbers would have more feral cats than areas with

Above: Black and tan eastern quolls were once thought to be two different species, but they are just like the blondes and the brunettes of the quoll world.

high quoll numbers. But to my surprise, there was actually no relationship between cat and quoll abundance.

However, the species activity profiles revealed more interesting results. Quolls were strictly nocturnal, with activity peaking in the first couple of hours after sunset each night, regardless of season. But cats changed their activity times quite dramatically between seasons. In winter, cats were mostly active during the afternoon, concentrating their activity in the hours just before sunset. But in summer, cats were more active at night, increasing the chance that a quoll will run into a cat. Unfortunately, summer is the time of year when juvenile quolls first emerge from their natal dens as independent little fluff balls. With cats being most active at this time, the predation risk is much higher for these small, naïve juvenile quolls. Indeed, trapping results revealed that very few juveniles entered the population in areas where quolls had declined, whereas sites with stable populations had a surge in juveniles over summer.



Reproduction success still appears high, with nearly all quolls carrying a full compliment of six pouch young.



Quolls were trapped using PVC devil traps.



The spots on an eastern quoll are as individually unique as fingerprints on humans.

While cat predation of juvenile quolls has likely been occurring for hundreds of years, quoll populations have historically been high enough to withstand the loss of a few juveniles, without any negative effects at the population level. However, with quoll populations currently at much lower densities, the loss of only a few juveniles is now enough to prevent populations from recovering.

So it seems that a period of unsuitable weather reduced quoll populations to an unprecedented low abundance, and that populations are now too small to withstand threats, such as cat predation, to which they were robust when at higher densities. The inability of eastern quoll populations to recover does not appear to have resulted from any new threat, or even an increase in threat intensity, but rather an inability to reproduce fast enough to overcome existing levels of threat and achieve a positive population growth from their current low densities. Eastern quolls are now trapped in a 'predator pit', and recovery is unlikely without management intervention.

Bronwyn Fancourt was awarded grants from the Australian Wildlife Society in 2010 and 2011 for her honours and PhD research investigating the cause of decline of the eastern quoll in Tasmania. More recently, Bronwyn worked at the Mulligans Flat Woodland Sanctuary in the ACT, and is currently working in Queensland researching ways to improve feral cat management in eastern Australia.



Eastern quolls are bold around people and can often be seen scavenging on food scraps around car parks and camp grounds.



It's standing room only in Mum's pouch as the young reach 60 days of age.

WILDLIFE ANIMAL OF THE YEAR

EASTERN QUOLL

The eastern quoll, also known as the eastern native cat, is a medium-sized carnivorous dasyurid marsupial native to Australia. It is currently found only in Tasmania, where populations have recently declined.

The Australian Wildlife Society has decided that the eastern quoll will take centre stage in 2016 as our wildlife animal of the year.

Our focus will be on raising awareness of the plight of the eastern quoll.

Since European settlement, all Australian quoll species have declined due to a combination of factors including persecution, poisoning, disease, habitat loss, cane toads, predation by introduced foxes, dogs and cats, pastoralism, changed fire regimes and collisions with motor vehicles.

Historically, the eastern quoll was widespread across south-eastern Australia, from south-east Queensland, through New South

Wales and Victoria across to the Adelaide Hills in the west. The species experienced a dramatic decline around the early 1900s and is now considered extinct on the Australian mainland. Eastern quolls continued to thrive in Tasmania, however this residual population has recently undergone rapid decline, with no sign of recovery. The eastern quoll is now listed as an endangered species.

EASTERN QUOLL MAINLAND RECOVERY TEAM

Despite not being listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), eastern quolls (*Dasyurus viverrinus*) are now thought to be extinct on the mainland of Australia and are listed as Regionally Extinct under the Advisory List of Threatened Vertebrate Fauna in Victoria (2013).

The last sighting was in Vaucluse, Sydney in 1963. As populations are now only found in the state of Tasmania, this presents the only option for a reintroduction of eastern quolls to the mainland of Australia.

The Eastern Quoll Mainland Working Group was formed in 2008 by a number of individuals representing institutions who had extensive experience with importing, breeding and releasing eastern quolls into free-range, predator-free fenced sites. Government and private institutions across various states are now working towards the common goal of establishing eastern quolls on the mainland. Creating a formal Eastern Quoll Mainland Recovery Team is a required transition to assist in completing the objectives.

The team have detailed a list of objectives which include the following:

Short-term

- To increase genetic diversity.
- To maintain and increase community and institutional awareness and support.

Mid-term

- To establish a minimum population size of 500 eastern quolls in semi-wild, feral-animal free sites.

Long-term

- To re-establish eastern quolls in the wild on the mainland of Australia.

Current research indicates that there are four distinct genetic clusters of wild eastern quoll populations in Tasmania. Isolation of these populations has been documented by Dr Maria Cardosa et al. (2014). Each cluster has unique variation that is likely to be important from an adaptive perspective. Dr Andrew Weeks (2014) recommended that the mainland population should seek to have representation

of the genetics from each cluster, thereby providing maximum genetic diversity and adaptive capacity. It is essential and expected for the key interest groups and responsible institutions to co-ordinate their work towards this common goal.

The Eastern Quoll Mainland Recovery Team plays an integral role in ensuring the community, government and research activities are (i) undertaken in support of eastern quoll conservation through the implementation of the action statement, (ii) are aligned and coordinated, and (iii) that the knowledge is shared as a basis for informed action.

An underlying principle of the working group is that all the members will play a significant role relevant to the overall objectives in turn benefiting through the knowledge gained and achieving efficiencies in plan implementation.

Current trades and agreements with supporting Tasmanian institutions (Tasmanian Quoll Conservation Program) have assisted in supplying new bloodlines when available to contribute towards our objectives. This is on the basis all stock is contained within the group's possession and surplus or security populations may be harvested in the future. They effectively manage their populations with recommendations made in accordance with the only formal studbook used in Tasmania that is co-institutionally managed.

Functions of the Eastern Quoll Mainland Recovery Team

The primary function of The Eastern Quoll Mainland Recovery Team is to coordinate implementation of the action statement. To achieve this, the Eastern Quoll Mainland Recovery Team (EQMRT) holds regular meetings which will have the primary purpose of sharing information, coordinating implementation activities and reporting to partners on progress and implementation issues, as a means of ensuring effective implementation of the action statement.

The team provides information and advice to all relevant institutions and authorities within the team as appropriate on eastern quoll conservation issues.



EASTERN QUOLL BREEDING AND SPECIES RECOVERY PROGRAM

The eastern quoll (*Dasyurus viverrinus*), also known as the eastern native cat, is a medium-sized carnivorous dasyure marsupial native to Australia.

Eastern quolls are generally about the size of a small domestic cat, with adult males measuring 53 to 66 cm in total length, including the 20 to 28 cm tail, and having an average weight of 1.1 kg. Females are significantly smaller, measuring 48 to 58 cm, including a 17 to 24 cm tail, and weighing around 0.7 kg. They have a tapering snout, short legs, and erect ears. They can be distinguished from all other species of quoll by the presence of only four toes, rather than five, on the hind feet, lacking the hallux.

They have a thick coat covered by white spots, that can be either light fawn or near black, with off-white underparts stretching from the chin to the underside of the tail. Both fawn

and black individuals can be born in the same litter, although in surviving populations the former represent about three times more common than the latter. The spots are 5 to 20 mm in diameter, and are found across the upper body and flanks, from the top of the head to the rump, but, unlike some other species of quoll, do not extend onto the tail.

Females possess a relatively shallow fur-lined pouch formed by lateral folds of skin. The pouch becomes enlarged during the breeding season and includes six to eight teats, which only become elongated and functional if one of the young attaches to them, regressing again after they leave the pouch. As with all quolls, the penis of the male bears an unusual fleshy appendage. The large intestine of eastern quolls is relatively simple, having no caecum, and not being divided into a colon and rectum. An unusual feature of eastern quolls is the

presence of an opening connecting the ventricles of the heart in newborn young, in addition to that connecting the atria found in all marsupials. Both openings close after a few days.

The Australian Wildlife Society as part of its Wildlife Animal of the Year initiative is supporting Australian Ecosystems Foundation in the recovery of this rare, near-extinct Australian marsupial predator. Trevor Evans, a founding member of AEFI and Australian Geographic 2010 Conservationist of the Year, has been breeding eastern quolls at Secret Creek Sanctuary since 2003 and now holds the largest captive breeding population on mainland Australia. This population is becoming increasingly important as the species continues to disappear throughout its remaining range. Eastern quolls are extinct on mainland Australia, and Tasmania has been the last stronghold for this quoll for many years. However, there is now evidence

of a 10-year decline in population numbers in Tasmania and a submission has just been made to list the species as Threatened in this last island refuge.

AEFI is part of the Mainland Eastern Quoll Recovery Team, a group dedicated to conserving the species on mainland Australia. The quolls are exchanged with other private sanctuaries in New South Wales and Victoria, and each year new quolls are brought up from Tasmania to ensure good levels of genetic diversity in the captive population.

The aim of the breeding program is to return the eastern quoll to the wild on mainland Australia. AEFI is working through a seven-step reintroduction process, which includes genetic testing of the captive population to make sure they are fit enough for release, and disease testing to make sure the quolls don't introduce anything to wildlife at the reintroduction site and also to make sure they are not susceptible to any diseases already out there in the wild.

Eastern quolls are beautiful animals, with light to chocolate brown coats covered in white spots, providing them with perfect camouflage as they move through the bush with great speed and agility. These quolls are a medium-sized marsupial predators, growing



up to the size of a small domestic cat, and are capable of hunting animals the size of a rabbit. However, they are predominantly insectivorous eating a variety of small prey as well as vegetation and fruit. They were once widely found from northern New South Wales down to Victoria and South Australia, but the last confirmed sighting on the mainland was in the Sydney suburb of Vacluse in 1963. Quolls are part of the Dasyurid

family and related to the Tasmanian devil, the now extinct Tasmanian tiger and the smaller Dasyurids such as antechinuses.

If you would like to support this project to secure the future of this endearing spotted marsupial carnivore, please make a donation. All donations of \$2 or over are tax deductible. To donate to this program go to our website at www.australianwildlife.net.au under 'Projects'.



Back from the brink

The last efforts to save the Tasmanian devil from the threat of extinction
Callum Meney



The Tasmanian devil has made its name around the world as being one of the toughest, fiercest little animals on the planet, so it was no surprise when scientists were shocked to see that the species was being crippled from within by a new and unknown disease. The disease is devil facial tumour disease (DFTD). There is no cure, no solution and no stopping the fatal course it will take when it is spread from devil to devil.

Scientists have been working around the clock since the appearance of the disease to find a cure, but so far these efforts have been in vain. With the population of devils infected in Tasmania increasing, there is only one definite way to ensure that our Tasmanian icon doesn't become extinct. That's where Devil Ark comes in. The facility located in the Barrington Tops, New South Wales,

is one of a kind with the sole purpose of breeding a healthy insurance population on the mainland.

I had the privilege of visiting Devil Ark to photograph the devils and chat with Dean and Abe, who look after the devils and the facility, about the work that Devil Ark does.

Upon arriving, it was clear to me that the team who started the 'ark' was adamant on creating/choosing an area as close to Tasmania as possible on the mainland. Everything from the trees to the climate was the nearest fit to the devils' natural habitat anywhere on the mainland.

We arrived in time to join the guys on their evening feeding rounds and final checks on the devils for the day. As we neared the area where the devils were kept, I was taken aback by the scale of the facility. I'm not sure exactly what

I expected but the 'yards' where the devils are kept are over 2.5 hectares and each houses only around 10 devils. This sort of space is required to keep the devils as wild as they possibly can be and I think that's what makes Devil Ark so unique compared to zoos and other breeding facilities.

The access I was given to photograph the devils in the natural enclosures was astounding as I was able to see a new perspective of the Tasmanian devil that I had never witnessed before. Unfortunately devils get pretty bad publicity for being fierce and aggressive but at Devil Ark I really saw another side of them. They were quite shy but very curious about my cameras and only became feisty when they were around food – which is very understandable. The staff does not think of the animals as numbers but



know each devil individually. Even by spending two days with them I really understood that each of the devils had their own personality.

In my opinion, the work that the team at Devil Ark does is an essential step in safeguarding the future of the Tasmanian devil. Breeding an insurance population of devils on the mainland is a necessary measure ensuring, if DFTD infects too large a population of devils in Tasmania to control, the Tasmanian devil will not become extinct due to the work of the Devil Ark team.

To find out more information about the work that Devil Ark does, visit: <http://www.devilark.org.au/>

Above: Every single devil at Devil Ark is completely free of DFTD and entirely healthy



Around 180 devils have been born at Devil Ark since the project was launched in 2011



Devils undergo frequent medical checkups to ensure they are healthy and not in threat of any illnesses



Although devils may look aggressive, they are quite shy and elusive. The Tasmanian devil featured in this photograph is actually just yawning



The enclosures or 'yards' at Devil Ark are extremely spacious so as to imitate natural environments



Team members truly know each devil personally and have personal relationships with each animal



KOSTER'S CURSE

LETTING LOOSE THE NEXT LANTANA

Andrew Cox, CEO, Invasive Species Council

The federal, state and territory governments in a joint decision have decided to let loose the next lantana and nobody thought to ask us if maybe that was a bad idea.

Ten months ago a decision was made to abandon the eradication of a highly invasive weed, Koster's curse, and the Invasive Species Council only just found out.

There was no advance notice, no consultation and not even a requirement to let anybody know the outcome.

The Council only knows because up until now Koster's curse has been targeted as part of the Four Tropical Weeds Eradication Program, which began in 2002 under national cost-sharing arrangements.

Initially few funds were allocated for the eradication, but this improved between 2011 and 2014 when \$4.6 million over three years was allocated for eradication of the four weeds. This information was known, but it's harder to find out what happened next.

Koster's curse (*Clidemia hirta*) is a densely branching, long-lived shrub that grows to between 0.5 and 5 metres. It is predicted to cover humid coastal sites in the Northern Territory and much of northeast Queensland.

Worryingly, Koster's curse is highly invasive, described as a 'nightmare weed'. It has already spread from its home in South America to dominate forests in many tropical countries including Hawaii, Malaysia and Fiji. According to the federal environment department it can form 'dense thickets that smother plantations, pastures and native vegetation, much like lantana'.

On the move

Koster's curse was first found in 2001 at Julatten, 50 km north of Cairns. Fortunately, the infestation was small – only a few hundred plants. But since the numerous berries can be spread by birds and wash downstream, an extensive search had to be mounted for new plants.

This all changed when a new infestation was found 150 km to the south in a

national park near Innisfail. It had been there some time. Eradication was to be a major undertaking and beyond the resources of the current eradication program. It was deemed not technically feasible to eradicate.

While the serious weed remains a declared pest in Queensland, a panel of state and federal public servants decided to halt the government-led eradication program. The weed will now be allowed to spread and expand its range, and could become the new lantana of the north.

Local fury

Ian Adcock, Chair of the Mitchell River Watershed Management Group, found out about the decision late last year and was distraught. He said, "It beggars belief that we're going to leave the doors open and walk away".

Ian noted that the eradication effort at Julatten that used expert field teams and local contractors was costly.

Above: Koster's curse growing densely under a young albizia plantation on Hawaii Island, Hawaii. Photo: JB Friday

"People would be right to think that's a lot of money to spend every year, but the teams were making great progress on getting rid of this plant. Once it gets away, we'll be spending ten times that amount just to protect some of our key assets from being over-run."

Ian said, "Our ecosystems and primary producers will be devastated by yet another invasive weed that takes expensive resources every year just to keep a paddock and a creek line cleared. In other countries graziers have had to simply walk off the land once Koster's takes hold. It's that bad."

The Mitchell River Watershed Management Group has not given up. It will keep going with Koster's curse eradication efforts near Julatten, calling on landowners, council and the rest of the community to make up for the loss of government funds. We don't know what will happen to the new outbreak.

Keeping us in the dark

Secretive decision-making is the norm when it comes to how Australia decides if it will begin or halt eradication of dangerous weeds, pests or feral animals.

In 2012 a decision by the Queensland Government to abandon Queensland's yellow crazy ant eradication program was done without consultation, without justification.

Decisions about whether to continue eradicating red imported fire ants, one of the worst invasive species ever found in Australia but one that we can still eradicate, are conducted in secret.

In 2011 the smooth newt was found in a creek to the southeast of Melbourne, the first time a newt or salamander type species had established in Australia.

Despite the potential impacts on our river systems, two years later it was decided to do nothing. Months later the Invasive Species Council found out about the decision by accident and then had to request documents via freedom of information legislation to establish what happened.

The secretive processes raise serious questions about government decision-making on whether to eradicate or not to eradicate a major new environmental pest in Australia.

Why is the public kept in the dark about the consequences of a decision before it is made?

Why can't the public have a say in the fate of our natural environment

threatened by invasive species before the government decides for them?

What chance does the community have to offer help before government abandons an eradication program?

If prevention is the stated goal of Australia's biosecurity system and confirmed as the most cost-effective approach, why are eradication programs so readily abandoned?

One rule for agriculture, another for nature!

If a pest impacts agriculture, affected industries are routinely consulted.

For a major development that affects the environment there is usually a public environmental assessment and the chance to provide submissions and participate in a public debate about its merits.

The impact of not eradicating a particular plant or animal pest will be experienced by generations of conservation land managers and volunteers. The pest may transform vast areas of Australia's environment and be the trigger to push some species to extinction decades later. Ants like the red imported fire ant may completely alter the way we interact with nature and the outdoors, making many people afraid to visit open spaces and parks for fear of being attacked.

Secretive biosecurity decision-making must change. Eradication decisions must be open to public scrutiny. This is the only way to give people a real say in their future and to put invasive species prevention into practice.



Map of Queensland showing where the outbreak of Koster's curse is occurring



What's a wambenger?

Simon Cherriman

At the end of a guided bird tour I took in the Perth Hills recently, I was chatting to some participants in the group over a hot cuppa when one of them pointed behind me and said, "Look, there's a possum on the roof!" I glanced around quickly and suddenly found myself leaping across the lawn towards the roof in one of the greatest moods of excitement I've ever experienced. The animal in my torch-beam was no possum - it was a WAMBENDER!!

Wambenger is an Aboriginal word for a small Australian marsupial known as a Phascogale (pronounced 'fas-koh-gale'). This name means 'pouched weasel', and was used by early European settlers because of the animal's similarity to the tenacious carnivore of the northern hemisphere. Phascogale is used both as a common name and a scientific genus name. There are two different species of wambenger: the brush-tailed (*Phascogale tapoatafa*) and the red-tailed (*P. calura*), both of which occur

in Western Australia. The brush-tailed variety, however, prefers forest and woodland, and is the only species to occur in the jarrah forest of the Perth Hills.

While I was totally thrilled to have (for the first time in more than 25 years of being a naturalist in the Mundaring area) seen a live, wild wambenger, and I thoroughly enjoyed sharing my excitement with all members of that evening's bird walk, I was in no position to take any decent photos. The blurry shot I managed to take with my iPhone 4s (which, incidentally, at ~150 – 200 grams, weighs about the same as the subject!), was enough to prove this sighting of what is quite a rare species, but that was about it. I immediately began planning a return nocturnal visit in the hope of better images, but my chances were quite slim. Several walks with a head torch over the past few weeks left me with no luck. But one night, after more than three

hours of waiting in some bushland not far from the original sighting, my patience paid off.

The individual I spotted, which was moving rapidly along the limb of a jarrah tree about 10 metres above me, was surprisingly unafraid of my torch beam, and I watched with delight as it behaved completely naturally, going about its nocturnal foraging business. As I observed the wambenger's behaviour, I thought about what I knew of their biology, and felt so totally filled with excitement to know that an animal so rare was right THERE!!

Wambengers live in very low densities, with individual females having a home range of about 50 hectares (~10% of the area of Perth's CBD), and males requiring more than twice this. Their cryptic behaviour, low numbers, and the fact that many are eaten by

Above: Adults have a head and body length of about 20 cm, a tail length of about 20 cm and weigh 110 - 235 grams



A wambenger's black 'bottlebrush' tail has hairs as long as a matchbox (50 mm)



A brush-tailed wambenger forages for invertebrates on the bark of a jarrah tree



You can see from this picture that a wambenger's teeth are very sharp and pointy, with two obvious canines near the front. This dentition points to a carnivorous diet, one that requires the right tools for lots of chopping up and slicing of food. Wambengers are known to eat mice, especially baby ones, so this (together with their insectivorous diet) can make them useful garden additions for keeping pest species down

cats, foxes, owls and goannas, means wambengers are very difficult to glimpse. Emerging from the safety of their tree-hollow home well after dark, they spend most of the night in the canopy, climbing expertly through the branches and catching insects with their sharp teeth. Prey consists mostly of spiders, crickets, centipedes and even bull-ants, but they will also feed on nectar and sometimes small birds. What struck me was how easily the animal could scurry up and down branches, cling to the underside and remain hidden, and I even saw it run up one limb and leap nearly 2 metres to the next tree!

My mind went back to a fauna survey I was assisting with several years ago, during which time we had caught wambengers in traps designed for possums and bandicoots, and this research had created an opportunity to observe some of their features close up. One fascinating insight was seeing underneath a wambenger's foot, and observing the tiny ridges or keels on the foot pads, a special adaptation which helps it grip to the bark while climbing.

I mentioned above that this was the first time I'd seen a wild live wambenger. In 2013 I found a dead (road-killed) male. While it might be sad to think about an animal getting killed by a car, this particular victim would have died very soon anyway – after each breeding season, all male wambengers in a population die off. While it may seem strange, this bizarre phenomenon is in fact common among many carnivorous Australian marsupials (a group known as Dasyurids). They do it because it helps boost survival of the next generation by reducing the amount of competition for resources, so newly dispersing young wambengers and their mothers have ample food and nest sites. Also, the fact that mating can be a physically exhausting event which goes on for hours and hours might have some impact on the males' lifespan – I'm surprised more male mammals don't keel over after aggressively mating for 6-8 hours straight!

I've since recorded another road-killed wambenger close to Mundaring, an indicator that this species is obviously still surviving in some suburban parts of the Perth Hills.

How Can You Help?

While many Australians have probably never heard of a wambenger, they are an important part of what makes our landscape unique. In Western Australia they are classified as Vulnerable, meaning they can be threatened with extinction if factors affecting their survival (habitat loss, altered fire regimes and, in particular, predation by cats (especially roaming pet ones), are unmanaged. They can also be a natural form of pest control, eating many of the spiders, ants and cockroaches we humans find annoying. The main thing these cute animals need to survive is habitat (that is, native vegetation with large, hollow-bearing trees), so you can help them by supporting the protection of bushland in your local area. In the Perth Hills, EVERY tree is vital, and the increasing number of jarrah and marri trees we are seeing felled in the Mundaring Shire of late is of great concern. This has direct impacts on the survival of all local animals, including wambengers. Nest boxes designed for wambengers can also help and be a useful way to determine the species' presence and abundance if boxes are monitored regularly. Wouldn't you love to share your space with this magnificent creature?



At 250 mm, a wambenger's tail can be longer than its body. Sharp claws and highly flexible ankle joints allow them to climb down tree limbs as though gravity doesn't exist



The underside of a wambenger's foot showing the finely keeled foot pads



Simon Cherriman is passionate about Australian wildlife. Simon grew up in the hills near Perth in Western Australia. When he was a child, the bushland surrounding home drew him out each weekend to explore, watch, climb and listen to the natural world. He collected birds' nests and swam in creeks, watched kangaroos graze and skinks scurry under rock crevices. He learnt first-hand how nature works and this shaped his being forever.

To help spread his passion, he established iNSiGHTOrnithology in 2008, a unique, one-man environmental business which aims to engage and inspire people about the environment, mainly through the science of birds (ornithology). He is based in Perth, Western Australia.

He is an environmental educator, specialising in wildlife filmmaking, but he also uses photography, writing, public presentations and guided walks, all with the aim of educating and inspiring others about the beauty of our natural world. He

believes this is a necessary cause because the human population is becoming progressively isolated from the natural world, and losing sight of the reality of our situation; we depend on a healthy Earth to survive. Reconnecting people with nature is vitally important if we are to understand that ecology is the law by which everything on Earth is governed, even people. It all starts with taking note of the plants and animals in our backyards. This interest can then spread to streets, local bush reserves, then regions, states and so on. The more we understand, the more we appreciate and the more likely our decisions will be made with consideration for preserving ecological relationships.

His website is available to provide environmental services to schools and environmental interest groups, individuals, consultants and government departments. http://simoncherriman.com/Simon_Cherriman/Home.html

Simon is fascinated by the link between humans and nature, how we separate ourselves from it. We depend on society for many things, but how ultimately we are just elements of a natural system. Mother Nature surrounds us and influences all that we do, directly or indirectly. She owns us and controls us.



Cane toad (*Rhinella marina*; formerly *Bufo marinus*)

Cane toad

Peter Hardiman

The cane toad (*Rhinella marina*; formerly *Bufo marinus*) is an invasive species in Australia. The cane toad is the largest species in the family Bufonidae.

The cane toad is tough and adaptable, as well as being poisonous throughout its life cycle, and has few predators in Australia.

It is commonly referred to as 'giant toad' or 'marine toad' and similar species are known as 'eastern pobblebonk frog' and 'giant burrowing frog'.

Cane toads are large, heavily built amphibians with dry warty skin and weigh an average of up to 1.8 kg. They have a bony head and over their eyes are bony ridges that meet above the nose. They sit upright and move in short rapid hops. Their hind feet have leathery webbing between the toes and their front feet are unwebbed. Adult cane toads have large swellings called the parotoid glands on each shoulder behind the eardrum.

Cane Toads can be grey, yellowish, olive-brown or reddish-brown in colour and their bellies are pale with dark

mottling. Average sized adults are 10–15 cm long. The largest female measured in Queensland was 24 cm and weighed 1.3 kg. Male cane toads are smaller and wartier than females. During the breeding season males develop dark nuptial pads on their first two fingers; these help them cling to a female while mating. Their mating call is a long, loud, purring trill. Their size may vary from 10 to 23 cm. The coloration on their back and sides may vary from olive-brown or reddish-brown to grey and yellow while their bellies are semi-yellow or semi-white with darker mottling. Their body is round and flat, has prominent corneal crests, and light middorsal stripes. Their front feet are unwebbed but their back feet have tough, leathery webbing. Cane toads have short legs and a ridged bony head that extends forward from their eyes to their nose. Behind their ears lies the parotoid gland, which usually causes their head to appear swollen. This gland is used for defence against predators. The parotoid gland produces a milky toxic secretion or poison that is dangerous to many species. This poison primarily affects the functioning of the heart. Intoxication is painful but is usually not fatal for humans. However, it does have

some effects, such as burning of the eyes and hands, and skin irritation.

Young cane toads have a smooth dark skin with darker blotches and bars and lack conspicuous parotoid glands. They can be distinguished from some native Australian frogs because they sit upright and are active in the daytime in dense clusters.

Cane toad tadpoles are shiny black on top and have a plain black belly and a short thin tail. They are smaller than most native tadpoles (less than 3.5 cm long). They often gather in huge numbers in shallow water. Cane toad spawn is unique in Australia as it is laid in long strings of transparent jelly enclosing double rows of black eggs. The spawn tangles in dense dark masses around water plants, and hangs in ropy strands if picked up.

Distribution

The natural range of cane toads extend from the southern United States to tropical South America. They were deliberately introduced from Hawaii to Australia in 1935, to control scarab beetles that were pests of sugar cane. By 2002, cane toads were throughout

the eastern and northern half of Queensland and have extended their range to the catchments surrounding Kakadu National Park in the Northern Territory. In New South Wales they occur on the coast as far south as Yamba, and there is an isolated colony near Port Macquarie. More recently they have been found at Brighton-Le-Sands, a suburb of Sydney.

Habitat

Cane toads are found in habitats ranging from sand dunes and coastal heath to margins of rainforest and mangroves. They are most abundant in open clearings in urban areas, and in grassland and woodland. Their vegetation habitat is closed scrub, grassland, low open forest, low shrubland, open forest and woodland.

Feeding and diet

Cane toads eat almost anything they can swallow, including pet food, carrion and household scraps, but most of their food is living insects. Beetles, honey bees, ants, winged termites, marine snails, smaller toads, native frogs, small snakes, small mammals, crickets and bugs are all part of the diet of this opportunist pest. The tadpoles of cane toads eat algae and other aquatic plants which they rasp off with their five rows of ting peg-like teeth. They also filter organic matter from the water. Large tadpoles sometimes eat cane toad eggs.

Other behaviour and adaptations

Adult cane toads are active at night during the warm months of the year. During the day and in cold dry weather they shelter in moist crevices and hollows, sometimes excavating depressions beneath logs, rocks, and debris. They can survive the loss of up to 50 percent of their body water, and can survive temperatures ranging from 5 to 40° centigrade.

Life cycle

Predators of cane toad tadpoles in Australia include dragonfly nymphs, water beetles, saw-shelled turtles and keelback snakes. Keelbacks also eat young toads; laboratory tests have shown that they can tolerate low levels of toad toxins. Young or adult cane toads are eaten by wolf spiders, freshwater crayfish, estuarine crocodiles, crows, white faced herons, kites, bush stone-curlews, tawny frogmouths, water rats and giant white-tailed rats. Some predators eat only the toad's tongue, or attack its belly and eat only the mildly poisonous organs.

Management

Cane toads are considered a chronic pest in Australia because they:

- poison pets and injure humans with their toxins;
- poison many native animals whose diet includes frogs, tadpoles and frog's eggs;
- eat large numbers of honey bees, creating a management problem for bee keepers;
- prey on native fauna;
- compete for food with vertebrate insectivores such as small skinks; and
- may carry disease that can be transmitted to native frogs and fishes.

Scientists at the CSIRO Animal Health Laboratory in Victoria have been searching for biological control of cane toads for some time. In 2001 they began investigating gene technology as a mechanism of control. Scientists at the University of Adelaide have isolated a sex pheromone in a native frog; they hope that a similar pheromone will be found in cane toads and that it could be used to disrupt their breeding cycle.

The main control on the spread of cane toads in southern Australia are quarantine checks and public awareness and response. One publicity campaign on the north coast of New South Wales resulted in 100 people collecting more than 900 cane toads.

If you think you have seen a cane toad, with care, catch it or report your sighting to a National Parks office or your local council. It is important to confirm and identify before disposing of a suspected cane toad because two-thirds turn out to be harmless native frogs that need our protection.

Danger to humans and first aid

All stages of the cane toad's life cycle are poisonous. The poison produced by the parotoid glands acts principally upon the heart. No humans have died in Australia from cane toad poison but overseas people have died after eating toads and even soup made from boiled toad eggs. Cane toads are also poisonous to pets and in Hawaii up to 50 dogs a year have died after mouthing cane toads. Signs of poisoning through ingestion include profuse salivation, twitching, vomiting, shallow breathing and collapse of the hind limbs. Death may occur by cardiac arrest within 15 minutes.

Australian native fauna that have been killed by eating or mouthing cane toads include goannas, freshwater crocodile,

tiger snake, red-bellied black snake, death adder, dingo and western quoll.

A cane toad responds to threat by turning side-on so its parotoid glands are directed towards the attacker. The poison oozes out of the glands but toads can squirt a fine spray for a short distance if they are handled roughly. The poison is absorbed through mucous membranes such as eyes, mouth and nose, and in humans may cause intense pain, temporary blindness and inflammation.

General

Cane toads can breed in most still or slow-flowing water and tolerate salinity levels up to 15 percent. Male cane toads start calling for mates after the first summer storms (in Australia that is about September) or when water temperatures reach 25° centigrade. The choruses peak in January and finish by March. The males congregate after dark around shallow water and mount females as they arrive at the water's edge. The male grips the female in the armpits (this is called axillary amplexus) and she releases her eggs, which are fertilised by the male sperm.

The female lays 8,000 to 35,000 eggs at a time and may produce two clutches a year. The eggs hatch within 24 to 72 hours and the tadpole stage may last from three to twenty weeks, depending upon food supply and water temperature. The tadpoles gradually change (metamorphose) into toadlets 1–15 cm in length then leave the water and congregate in large numbers.

Toads in the tropics grow very quickly and may reach sexual maturity within one year, but in temperate southern Queensland they mature in 18 months to two years. An adult lifespan of at least five years has been recorded in wild cane toads; captive individuals have lived for up to 15 years. Only about 0.5 percent of cane toad individuals that hatch from eggs survive to reach sexual maturity and reproduce.

Mating and reproduction

Cane toads are prolific breeders, requiring only a small pool of water of almost any nature.

Predators, parasites and diseases

The cane toad is tough and adaptable as well as being poisonous throughout its life cycle. It has few predators in Australia, which is bad news for competing native amphibians, and it may be responsible for the population decline of snakes and other species that do prey on it.

Economic/social impacts

Cane toads were introduced to Australia to eat French's cane beetle and the greyback cane beetle. The 'whitegrub' larvae of these beetles eat the roots of the sugar cane and kill or stunt the growth of the plants. The Australian Bureau of Sugar Experimental Stations imported about 100 toads from Hawaii to the Meringa Experimental Station near Cairns. The toads quickly spread and more than 3,000 were released into the sugar cane plantations of north Queensland in July 1935.

The protesters included the President of the Wild Life Preservation Society of Australia in 1912 (now known as the Australian Wildlife Society), who was a former New South Wales entomologist, W. Froggatt.

Current methods to control cane toads

Despite decades of concerted efforts, the best minds and the most committed communities have been unable to stop the cane toads from hopping across northern Australia. However, research efforts are improving. These efforts culminated in a workshop being held in Darwin in mid-June convened by the federal Department of the Environment as it updates the cane toad threat abatement plan.

Some of the promising research includes sequencing the cane toad genome to identify genetic vulnerabilities, taste aversion trials to train quolls and goannas to avoid eating the toad, a pheromone-based cane toad tadpole trap and an adult female toad trap. Special toad-only fences have also been designed to restrict toad access to water sources and these have proven to keep arid environments free from toads.

To date, the most popular way to reduce toad numbers is just to go out and pick the adult animals up, but the fundamental principle to reduce the numbers of cane toads in an area is that you have to be able to remove animals faster than they can replace the numbers you are removing.

There are three major features of cane toad biology that make this really difficult to achieve:

1. A single female toad can produce around 30,000 eggs in a single clutch – so the few toads that you miss can rapidly replace all the ones you removed.

2. Toads are each other's worst enemies (they eat each other, compete with each other and so on), so the more toads you remove the better things are for the ones you leave behind.
3. Toads at the invasion front don't actually live in any particular area – they just keep moving through, spending their whole life as nomads heading towards the far horizon.

So even if you removed all the toads from your yard one night, by the next night you're likely to have a new bunch of toads there to replace the ones you got rid of yesterday. This isn't such a problem in the dry-season or in older populations of toads but the wet-season invasion front is just a moving walkway of migrating animals.

How effective is physical removal of toads?

Unfortunately, this all adds up to real problems in toad control – especially at the invasion front, which is where a lot of effort has gone into the attempt to control toads. Physical removal by hand-collecting, or attempting to keep toads out of areas by building fences, requires a huge amount of work. Some of the community groups have done a fantastic job of mobilising that effort, but it's difficult to see how it can be sustained in the long term. Traps for adult toads usually don't work very well, and risk catching and killing native animals like bandicoots and lizards. The nature of the climate and the landscape in northern Australia make things tough also – wet-season flooding not only makes many areas inaccessible but creates absolutely enormous numbers of shallow pools well suited to toad breeding. Dry-season fires threaten any permanent structures like fences.

Although direct removal of toads is not a major solution, it does have a role to play – especially in the dry season and especially in areas a few years after toads have arrived (rather than right at the front). There may also be especially high-priority areas where it's feasible to expend a lot of effort to keep toad numbers down like this. In places like small islands with only one or two freshwater ponds, or in the extremely dry areas at the fringe of the toads' invasion, it might be possible to keep the toads away from water by suitable fencing.

There is one circumstance where collecting and removing adult toads can make a big difference though – and that is if you have a way to stop toads

from breeding. Scientists think that this can now be done, with pheromone-baited traps and suppression chemicals. This could mean that with every toad removed there is now one less toad out there – with no way for the remaining animals to replace him (or her). If community 'toad-busting' efforts are integrated with community tadpole-trapping efforts, it might be possible to achieve a big reduction in toad numbers.

Ideally, the answer to toad control on a landscape scale will involve methods that don't require constant input of effort.

New hope in the face of toad invasion

A University of Sydney research study has been used to develop a new strategy to help animals adapt ahead of the main cane toad invasion front.

Wild goannas have been successfully trained by researchers to avoid eating potentially deadly cane toads as the invasive species makes its way south from Western Australia's top end. Research in the Kimberley has shown that training monitors and goannas to avoid eating cane toads has vastly improved survival rates.

Large predators like yellow-spotted monitors and sand goannas are highly vulnerable to the toxins produced by cane toads.

The Sydney University study involved feeding baby cane toads to the reptiles to discourage them from eating the dangerous, more toxic adults. It was hoped that the goannas would have a negative experience from eating baby cane toads but not die from it, then remember the bad experience so that when larger cane toads migrated into their natural habitat they would avoid them.

The research lasted two years and involved scientists and Aboriginal rangers using radio beacons to track the goannas while they were foraging. The researchers approached the reptiles in the field with a small cane toad with a small cotton belt around it. A fishing pole was then extended out to the goanna as it foraged and the small cane toad was placed in front of the goanna.

Eighteen months after the study started, many of the trained lizards are still alive despite the presence of toads.

The goannas that had been trained were surviving in much large numbers than the goannas who had not been trained, who died almost immediately.

Ideally, the way this research would be used is for a targeted release of small teacher reptiles ahead of the invasion of cane toads.

The Western Australia Department of Parks and Wildlife (DPAW) has ruled out releasing baby toads *en masse*, but the State Cane Toad Program said there are applications for the research.

'Genetic backburning'

Scientists at the University of Melbourne have suggested a new and potentially powerful tool for stopping the spread of invasive species such as the infamous cane toads.

The idea, called 'genetic backburning', involves taking a subset of the invasive species that is fitter but less effective at dispersing, and transporting them to the invasion front to out-compete the main population for food and habitat.

According to the researchers, genetic backburning could make it easier to stop the spread of invasive species.

In the right circumstances, 'genetic backburning' could potentially be a

powerful tool for halting invasions at natural choke points and natural landscape barriers. One of the ways that could make invasion fronts easier to stop is to take some of those individuals from back in the main population, the low-dispersing individuals, and put them in front of the invasion front.

It could be used as part of a two-step approach where scientists could first slow the spread of the species before actually dealing with eradication.

'Toad sausages'

Across northern Australia, cane toads have had a significant impact on the endangered northern quoll as well as goannas, some large snake species and freshwater crocodiles.

Australian Wildlife Conservancy scientists are taking steps to protect the northern quolls at Mornington in the Northern Territory by conducting toad-aversion training in advance of the arrival of toads. By offering quolls 'toad sausages', made of minced cane toad meat and a small dose of the nausea-inducing chemical thiabendazole,

ecologists aim to train quolls to associate the smell and taste of cane toads with the feeling of sickness. The work at Mornington builds on studies that have determined that quolls can be trained to avoid cane toads so that they and their young have a greater chance of survival. Deployment of toad sausages at Mornington will be the first time a wild population of quolls have been trained ahead of the arrival of cane toads.

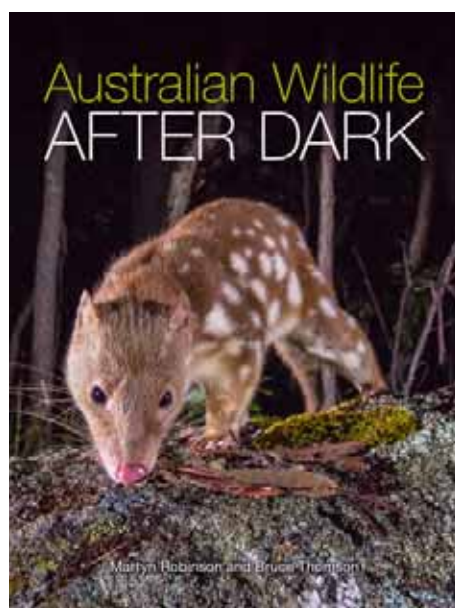
Camera traps will be used to monitor the populations of northern quolls before and after the arrival of the cane toad.

The next step is to develop a method of preserving the toad sausages to allow them to be distributed from a helicopter and left out over longer periods for quoll consumption. A more intensive study will then be conducted at Sir John Gorge to monitor the fate of trained and untrained quolls via radio-telemetry before and after the toad invasion.



A sign at Kununurra, a town in far northern Western Australia located at the eastern extremity of the Kimberley region approximately 37 kilometres from the border with the Northern Territory.

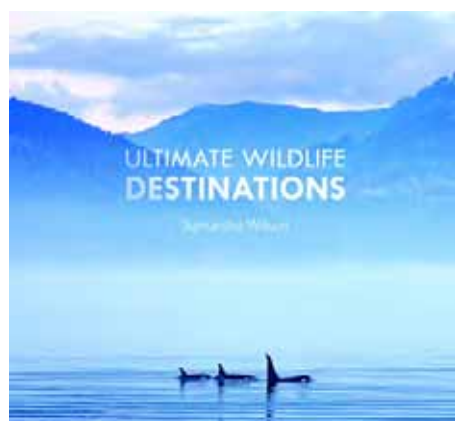
Book Reviews



Australian Wildlife After Dark by Martin Robinson and Bruce Thomson

Australian Wildlife After Dark brings the hidden fauna of Australia into the light. This book will encourage a better understanding of and interest in the largest proportion of Australia's fauna – those that are more active after dark. These are the after-dark animals so widespread yet so little noticed by humans, whether in our backyards, the arid desert, woodlands or rainforest.

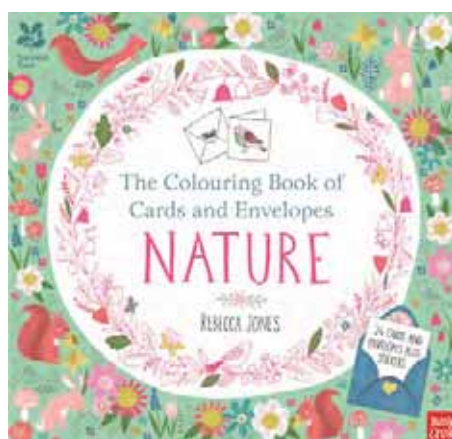
Publisher: CSIRO Publishing
RRP: \$35



Ultimate Wildlife Destinations by Samantha Wilson

In a world where bucket list activities and once-in-a-lifetime experiences are more possible than ever before, it is the wilds of the natural kingdom and its majestic and often eccentric inhabitants that fuel the wanderlust. *Ultimate Wildlife Destinations* will take readers on a journey across oceans and polar ice caps, rainforests and mountain peaks in search of the most astounding creatures on the planet.

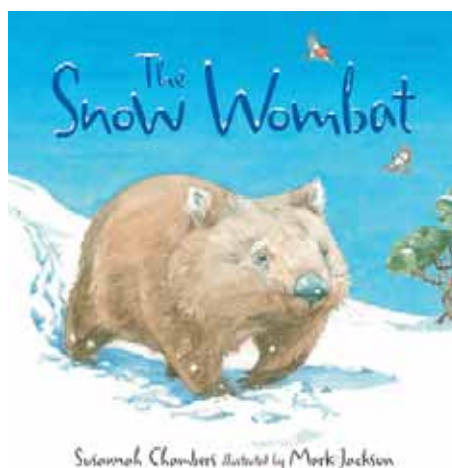
Publisher: New Holland Publishers
RRP: \$29.99



The Colouring Book of Cards and Envelopes: Nature by Rebecca Jones

Get creative with this amazingly innovative colouring book, full of beautifully designed cards and envelopes to tear out and colour. The twenty-four gorgeous designs include woodland animals, flowers, butterflies and birds and are perfect for all ages to decorate and send to family and friends. Take inspiration from nature, or get experimental – try unusual colours and different materials to make each card truly unique! With enough blank space inside for a message, envelopes to customise and cute stickers to seal your card, this is the complete creative package!

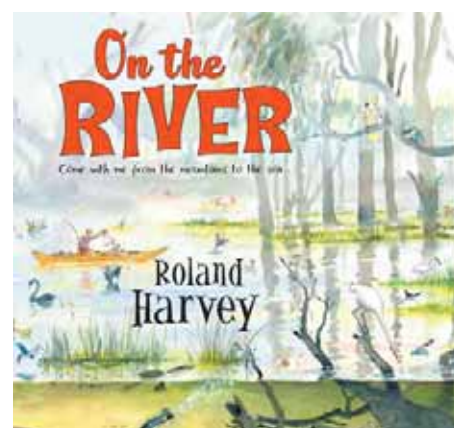
Publisher: Allen & Unwin
RRP: \$14.99



The Snow Wombat by Susannah Chambers, Illustrated by Mark Jackson

This beautifully illustrated book is a heart-warming story set in the Australian High Country. An adventurous young wombat finds his way around a winter landscape before snuggling back into his own cosy burrow. It's a big journey through the snow for a little wombat, meeting animals, birds and people along the way... but there's no place like home!

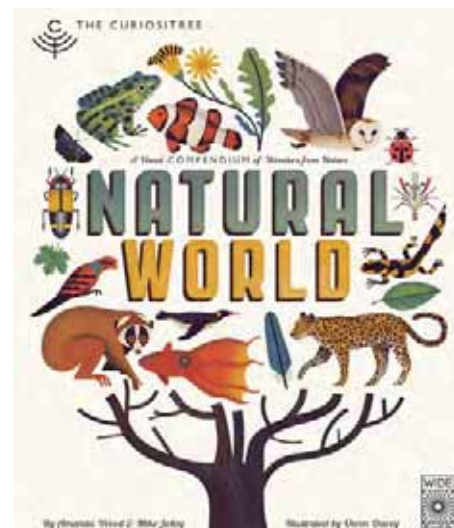
Publisher: Allen & Unwin
RRP: \$24.99



On the River - Come With Me From the Mountains to the Sea... by Roland Harvey

Follow the mighty Murray River from the mountains to the sea on an epic journey with Roland Harvey and his pelican friend, in this glorious picture book full of humorous, intricate illustrations and fascinating information. Roland Harvey and his new pelican friend are off on an adventure to walk, fish, canoe, raft, windsurf, sail, paddle-steam, houseboat and even fly their way along the Murray River, from its smallest beginnings in the High Country to where it meets the sea. Together they discover the story of the river: its secrets, history, ecology, people and animals. And you're invited, too!

Publisher: Allen & Unwin
RRP: \$24.99



Natural World by Amanda Wood and Mike Jolley

See how nature is connected with this beautifully illustrated children's book. *Natural World* explores and explains why living things look and behave the way they do in a series of visually compelling information charts. This book is a fascinating first introduction to the natural world that looks at the myriad ways in which plants and animals have adapted to give themselves the best chance of survival.

Publisher: Allen & Unwin
RRP: \$35.00



Bequest Program for wildlife conservation work

The Society has a Bequest Program to assist with their wildlife conservation work across Australia. Interested members are invited to complete the bequest form on page 46 in this issue of "Australian Wildlife" and send it to the National Office for processing.

In recent times much of the Bequest Program has been dedicated to our Society's environmental education programs, which are designed to educate the next generation of young Australians about our precious native wildlife in all its forms. There is an urgent need for further wildlife conservation work in this field.

Many families have already included a bequest in their personal last will and testament dedicating funds to the ongoing wildlife conservation work of the Society. You might like to consider including a bequest to the Society in your own will.

Friends of Australian Wildlife Society

The Society has been dramatically expanding its conservation and environmental work program and has embarked on an exciting new chapter in its history of wildlife conservation in Australia.

You can be a part of the Australian Wildlife Society's conservation future by becoming a 'Friend'. Application form is available from our national office.

University Grants Scheme

The Society already offers Wildlife University Research Grants of \$1,000 each for honours/postgraduate students currently studying at any university in Australia, but the new award is aimed at a more significant level and for potentially a larger sum of funding to study wildlife conservation at the University of Technology Sydney.

The aims of this scholarship are: 1) to benefit the preservation of Australian wildlife by supporting applied scientific research with a wildlife conservation focus; 2) to further the Society's commitment to environmental education by supporting science students with a research interest in conservation; and 3) to increase awareness of, and attract new members to, the Wildlife Preservation Society of Australia and its wildlife conservation work.

We can also name a University Wildlife Education Scholarship after any person who is prepared to make a significant donation to this innovative program. We currently have ten national scholarships and a major university scholarship scheme at the University of Technology Sydney. We would be pleased to provide further information to members at any time.

Please contact the National Office at any time for further details of the Bequest Program, the Friends of Australian Wildlife Society and the University Grants Scheme.



A vertical collage of five images. From top to bottom: 1. A rabbit with large, upright ears sitting on a wooden surface. 2. A bird with brown and white wings in flight against a blue sky. 3. A bat with a mouse-like face peeking out from under a dark wing. 4. A butterfly with green and brown wings resting on a rock. 5. A deer lying down on a sandy surface.

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Tel: (02) 9556 1537
Fax: (02) 9599 0000
Email: accounts@aws.org.au

All donations of \$2 or more are tax deductible.



Name: Dr / Mr / Ms / Mrs / Miss

Address:

State:

Postcode:

Phone: Home

Work

Email:

☐ I want to join the Friends of WPSA and give by automatic deduction each month to help protect our unique native wildlife and its important habitat

I will give via: Credit Card (please complete authority form below)

**Regular Payment
can be made by EFT**

BSB: 062 000

Account No: 1043 2583

Account Name: Wildlife

Preservation Society of Australia

I am paying by: ☐ Visa ☐ MasterCard Card Security Code (CSC) _____

[illegible]

Name on card

Signature

I will give:

☐ \$10 per month ☐ \$15 per month ☐ \$25 per month ☐ \$50 per month

☐ My choice of \$ per month

Signature

Date _____

This authorisation is to remain in force until cancelled by the donor and in accordance with the terms described in the Agreement below.

Deduction will be made on 15th of each month.

CREDIT CARD AUTHORITY

1. The Donor will be advised 14 days in advance of any changes to the Credit Card Authority arrangements. 2. For all arrangements relating to the Credit Card Authority arrangements, the Donor will need to call AWS on (02) 9556 1537 or write to PO Box 42, Brighton Le Sands NSW 2216 or email info@wpsa.org.au. 3. Account details should be checked against a recent statement from your Financial Institution. 4. It is the donor's responsibility to ensure sufficient funds are available when the payments are due to be drawn. 5. If the due date for payment falls on a non-working day or public holiday, the payment will be processed on the next working day. 6. For returned unpaid transactions, the following procedure will apply: AWS will advise the Donor of the unpaid transaction and request alternative arrangements to be made for payment if possible. 7. All Donor records and account details will be kept private and confidential to be disclosed only at the request of the donor or Financial Institution in connection with a claim made to an alleged incorrect or wrongful debit. 8. This authorisation is to remain in force until cancelled by the Donor.

Membership Form



WILDLIFE PRESERVATION SOCIETY OF AUSTRALIA LIMITED

PO Box 42 Brighton Le Sands NSW 2216

Membership

Become a member of the Wildlife Preservation Society Limited

Simply fill out this form.

Name:.....

Address:.....

City/Suburb:..... Postcode:

Telephone:..... Fax:

Email:

Membership category (please tick)

- ☐ Individual: \$55
- ☐ Family: \$70
- ☐ Concession (pensioner/student/child): \$50
- ☐ E-mag (emailed as PDF, no hardcopy will be sent): \$30
- ☐ Associate (library, school, conservation groups): \$85
- ☐ Corporate: \$125
- ☐ Life: \$2,000

(Includes postage within Australia. Add \$40 for overseas postage)

Three year membership (please tick)

- ☐ Individual: \$150
- ☐ Family: \$190
- ☐ Concession (pensioner/student/child): \$135
- ☐ E-mag (emailed as PDF, no hardcopy will be sent): \$81
- ☐ Associate (library, school, conservation groups): \$230
- ☐ Corporate: \$340

(Includes postage within Australia. Add \$60 for overseas postage)

Payment details (please tick)

☐ Direct Debit ☐ Cheque ☐ Money Order ☐ Mastercard ☐ Visa

Card Security Code (CSC) _ _ _ _

Card Number: Amount \$.....

Name on Card: Expiry: Donation \$.....

Signature: **Total** \$.....

Mail to the: Wildlife Preservation Society Limited
PO Box 42, Brighton Le Sands NSW 2216.
Email: accounts@aws.org.au Website: www.wpsa.org.au

Direct debit: BSB: 062 000
Account No: 1043 2583
Account Name: Wildlife Preservation Society of Australia

Note: All cheques to be made out to the Wildlife Preservation Society of Australia

Consider - A Bequest

Another way which you can support the work of the Wildlife Preservation Society of Australia (Australian Wildlife Society) is to remember us in your will.

If you would like to make a bequest, add the following codicil to your Will:

I bequeath the sum of \$..... to the Wildlife Preservation Society of Australia for its general purposes and declare that the receipt of the Treasurer for the time being of the Society shall be complete discharge to my Executors in respect of any sum paid to the Wildlife Preservation Society of Australia Limited.

"The challenge to the present adult generation is to reduce the increasing pressures on the Earth and its resources - and to provide youth with an education that will prepare them emotionally and intellectually for the task ahead.



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