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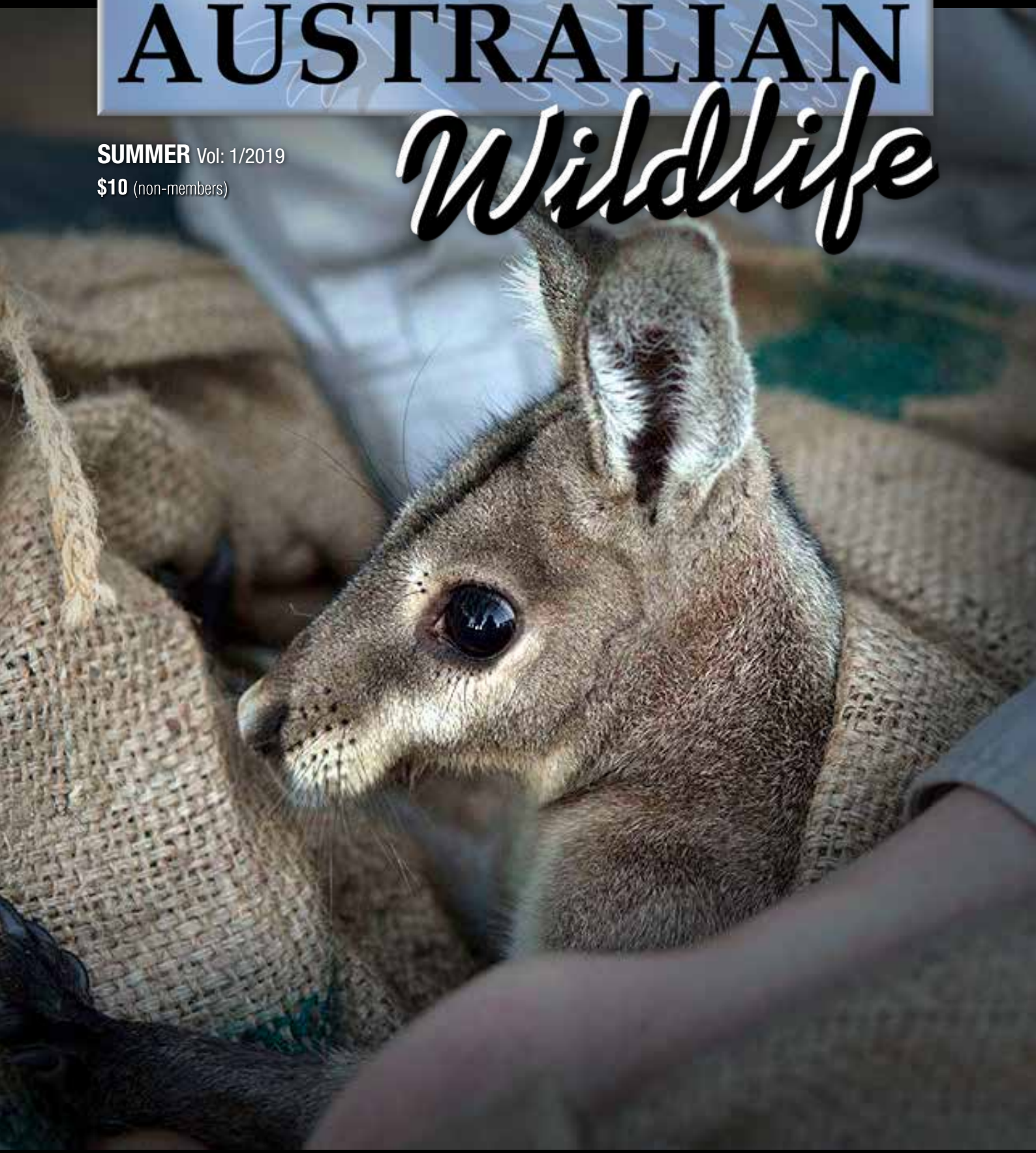

Celebrating a new century of wildlife preservation in Australia

Journal of the Wildlife Preservation Society of Australia Limited
(Founded 1909)

PHOTOS BY JESSIE PANAZZOLO

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Eastern yellow robin

Sulphur-crested cockatoo

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Suzanne Medway AM
Editor, Australian Wildlife

Sabine Borgis
Sub-Editor, Australian Wildlife

On the cover:

Front and Back Cover:
The bridled nailtail wallaby, Australia's cutest, and one of our rarest, wallabies. See page 7 for more information.

Australian Wildlife Society
Conserving Australia's Wildlife since 1909

Australian Wildlife

is the official journal of the Australian Wildlife Society (Wildlife Preservation Society of Australia Limited).

Founded in 1909, the Society is dedicated to the conservation of our unique Australian wildlife in all its forms.

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Directors 2018/2019

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.

From the President's desk

Suzanne Medway AM - President

Today, it is becoming increasingly more common for like-minded groups such as our Society and the National Parks Association to work together to achieve our common goals.

A gathering of friends at the NPA dinner. L to R: Ken Mason, NPA CEO Alix Goodwin, Sue Emmett and Suzanne Medway.

The executive of the Australian Wildlife Society recently attended the annual dinner of the New South Wales National Parks Association (NPA).

National parks and other protected areas are the nation's primary means of ensuring our core natural places are safeguarded for generations to come. Yet, with only nine percent of the state of New South Wales conserved, many significant areas remain unprotected, leaving our natural heritage and its biodiversity facing a range of growing threats. These threats include habitat destruction, climate change, invasive species, mining and gas extraction, pollution, residential, industrial and agricultural development, and population growth.

NPA plays a crucial role in ensuring that the national parks in New South Wales are protected in perpetuity.

From the formation of the Wild Life Preservation Society of Australia Inc. in 1909 (later to become known as the Australian Wildlife Society), the executive and members have always placed the highest emphasis on the preservation of native fauna and flora through national parks.

In the published Chapter 1 of the history of the Society – *Conserving Australia's Wildlife: The History of the Wild Life Preservation Society of Australia, Inc.* – Dr Joan Webb writes:

In Australia, nature conservation has involved three main streams of interest: scientific (dating from the formation of the first Royal Societies in the 1840s and 1850s); wildlife and field naturalism (the Wild Life Preservation Society of Australia, 1909); and bushwalking (the National Parks and Primitive Areas Council formed in 1933). These groups sometimes worked together on campaigns for conservation reserves and legislation. The National Parks Associations (the first formed in Queensland in 1930) gained their membership from all three groups above. The most important conservation groups today are the State Conservation Councils.

Today, it is becoming increasingly more common for like-minded groups such as our Society and the National Parks Association to work together to achieve our common goals. The Society recently gave a grant of $5,000 to the Illawarra–Shoalhaven Great Eastern Ranges Regional Partnership to deliver two pest control workshops and purchase 10 feral fox and cat cage traps designed to reduce predation on native fauna in the local, national parks.

NOTICE

The Wildlife Preservation Society of Australia Limited (trading as Australian Wildlife Society) will be holding its 110th Annual General Meeting on

Wednesday 6 March 2019

Any notices of motions and/or applications to serve on the Board of Directors must be received in writing and in the hands of the Secretary by 31 January 2019.

Patrick W Medway AM
HON. SECRETARY

Suzanne Medway and Dick Mason at the NPA dinner.

Do you think it's possible to live life without plastic? Or to at least live with less of it?

I have written previously about our campaigns to reduce plastic in the environment and in this edition of the magazine one of our university grant winners has written a very poignant article on his personal experience of plastic in the environment on page 44. I ask that all our members show this article to family and friends and urge them to reduce their reliance on all forms of plastics.

In saying that, our modern purchasing methods in supermarkets make in almost impossible to entirely eradicate plastic containers from our lives. Most fresh fruits come in plastic containers, also biscuits and cherry tomatoes – so I have been puzzling how to purchase those fresh strawberries and blueberries I buy nearly every day.

One suggestion put to me is to buy them at a farmers' market in a green plastic basket and then return it to the farmer each week for a refill, but I don't have a farmers' market nearby. It was then suggested that I ask my local grocer to take them back – I have yet to try this out with the local Woolies or Coles. I have also considered emptying the berries into my own container before leaving the store and leaving the plastic container behind. Perhaps if enough of us do this, the major supermarkets will take note and give us some alternatives to purchasing fresh produce in plastic containers. I have noted that the supermarkets have even started putting apples and pears in plastic containers, as well as a vast range of pre-prepared salads and vegetables.

But getting rid of plastic would require more than a packaging-free aisle at the supermarket and soggy cardboard drinking straws. Plastic is everywhere, not because it was always better than the natural materials it replaced, but because it was lighter and cheaper – so much cheaper, in fact, that it was easier to justify throwing away. Customers found this convenient, and businesses were happy to sell them a new plastic container for every bottle of water or sandwich they bought. In the same way as steel enabled new frontiers in building, plastic made possible the cheap and disposable consumer culture that we have come to take for granted. To take on plastic is in some way to take on consumerism itself. It requires us to recognise just how radically our way of life has reshaped the planet in the span of a single lifetime and to ask whether it is too much.

I suppose reducing our own reliance on plastic becomes one step at a time. Tackle the easy ones first and then work on those that will prove more difficult.

11 easy ways to reduce your plastic waste today

- Bring your own shopping bag.
- Stop buying bottled water.
- Bring your own thermos or mug to the coffee shop.
- Choose cardboard over plastic bottles and bags.
- Say no to straws.
- Get the plastic off your face – skip the disposable razor.
- Switch from disposable nappies to cloth.

I would love to hear from our members their tips for reducing the more difficult areas where we rely on plastic.

Kookaburras

On a recent trip to Port Stephens, I was delighted to see a kookaburra perched on the railing of our veranda. It appeared to be a very young bird and didn't mind us going out onto the veranda to photograph it. The young bird was a magnificent specimen with lovely fluffy feathers that fluttered in the breeze. A little later we observed a different bird that was apparently a mature specimen, and then later again another bird – so we surmised they were a family of a mother, father and chick.

The laughing kookaburra is one of the most well-loved birds of our suburbs, often seen on fences, trees and rooftops. Kookaburras mate for life and usually build their nests in a tree hollow. Both parents incubate the eggs and care for the chicks.

Just opposite our motel room in a large gum tree was a huge wasps' nest, which was a bit of a concern until we observed the kookaburras flying in and out of the wasps' nest and realised that it was now a nest for the kookaburras. It is not uncommon for kookaburras to use wasp nests and termite mounds to make nests in.

Wasps' nest in the busy at Port Stephens.

The next morning we were woken at 5 a.m. by the call of the kookaburras and a banging on our window. It was distressing to observe the birds flying at the window and hitting it.

Why do birds repeatedly fly into windows?

I consulted a PhD student studying birds in the urban environment and was told that such behaviour is called avian shadow-boxing. He suggested that the breeding male saw his reflection as an adversary and flew into the window and pecked at the image to ward off a competing male. Most birds apparently do not recognise themselves in reflected images.

At one stage the male became stuck in the flyscreen, and I had to gently free his beak and claws. Consequently, the flyscreen door was torn to shreds.

A friendly little kookaburra visiting on our motel balcony.

Australia's cutest, and one of our rarest, wallabies

The endangered bridled nailtail wallaby was thought to be extinct until 1973. Despite the hard work of many over the past 30 years, it's still teetering on the edge of extinction. It is hoped that the recently secured approval by Wild Mob to pioneer a new approach to threatened species management might just save them once and for all.

It's 3 a.m. and a group of 12 volunteers and two Wild Mob team leaders huddle around the fire munching on muesli bars, crunching apples and sipping cups of tea or milo sweetened coffee to wake themselves up for the second round of trapping and monitoring.

The group has been camped out amongst the slender brigalows of the Avocet Nature Refuge for the past week. Avocet is a commercial cattle property located just north of the magnificent Carnarvon Ranges in central Queensland, owned by local grazier Hugo Spooner. Just under 5,000 hectares in size, an astounding 1,200 hectares of this property, along with all its precious inhabitants, has been designated a nature refuge by the landholder and officially recognised by the state government.

Every night at around 11 p.m., and then again in the early morning hours, the volunteers head out in the dusted but reliable white troopy to check the wire-cage traps. Their night-time mission is to bump along stretches of dirt road, stopping at all 120 traps that have been set for the nailtails. The entire round takes 2-3 hours and has to be done at night because the nailtail is nocturnal.

The team is performing what's known as a capture mark re-capture to monitor the population numbers and health of the Avocet nailtails. The hope is that they'll find one that they haven't tagged previously, particularly juveniles as this will give hope that the population is growing.

Even more importantly, they're constantly on the look out for juveniles tagged in previous years.

Above: Bridled nailtail wallabies.

Wallaby in the bush.

The almost independent and incredibly cute *Orange 31 (031).*

Finding such a juvenile would give hope that the baiting program against feral animals is having some effect and that the juveniles are making it to adulthood. The reality is that the researchers commonly see females with pouch young but rarely do they subsequently see those joeys make it to adulthood.

This morning there were three nailtails found in the traps – all of them previously tagged and released on this survey. It is not uncommon for the nailtails to regularly hop back into the traps for an easy feed on the delicious green lucerne set out to lure them in. Their fairly easy-going nature makes them the perfect species for volunteers to work with but it is also something that is potentially abetting their extinction. Regardless, the nailtail often sits much more docilely than other wallabies as they are measured, weighed and generally cooed over.

An adult female known by her ear tag as *Green 6* (G6) has been monitored on the refuge for several years and this year she is being tailed by her son – the almost independent and incredibly cute *Orange 31 (O31)*.

O31 has been trapped three times over the course of the week's survey: twice on his own and once with G6. This trapping pattern indicates that *G6* is his mother and also that he is nearly independent – already spending time foraging on his own. *O31* weighs slightly over 0.5 kilograms and while being such a lightweight makes him adorable it also makes him highly vulnerable.

The researchers and volunteers are concerned that they won't see *O31* again next year. Almost half of juvenile wallabies fail to make it to adulthood. The reason? Predation by feral cats. These feral cats have bred wild in the bush over multiple generations and often weigh in excess of five kilograms. They are a far cry from our domestic pets and are prolific predators.

There are now less than 300 nailtails left in the wild of central Queensland. Various groups, including Wild Mob, have been monitoring the nailtail population for many years. The population continues to teeter on the edge of extinction because feral cats dominate in the environment and baiting programs are largely ineffective when it comes to them. While the monitoring and baiting programs are important, a new approach is needed to secure a future for the nailtail that doesn't involve ongoing management and intervention.

So, after two years of planning, research and design, Wild Mob, in partnership with landholder Hugo Spooner, have sought and received approval from the Queensland government to build a new state-of-the-art nursery on the Avocet Nature Refuge.

The approach to the nursery is based on an understanding of predator behaviour and the Critical Weight Range (CWR). The CWR was determined by Burbidge and McKenzie (1986) who sought patterns to explain Australia's appalling record for mammal decline: 15 percent of our terrestrial mainland mammals are extinct and a further 20 percent suffer population reductions of over 50 percent.

Burbidge and McKenzie found that almost all of the mammals that were extinct or endangered fell within the CWR. That is, they have a mean adult body weight of between 35 grams to 5.5 kilograms. This CWR puts them in the perfect-meal-size category for feral predators such as the feral cat.

Closer inspection of the endangered species identified in the CWR reveals that 90 percent of the CWR mammals weigh 3 kilograms or less. This finding is important for the nailtail program because it indicates that it is the juvenile nailtail that is most at risk as adult male and females weigh between 4 and 8 kilograms.

The nursery will be purpose built to protect juvenile nailtails from predation. Predator exclusion fencing is not a new concept. Exclusion fences have enabled the northern hairy-nosed wombat (*Lasiorhinus krefftii*) recover from the brink of extinction as well as seeing strong increases in the population of bilbies (*Macrotis lagotis*).

The difference with the Nailtail Nursery is that Wild Mob won't be fencing the entire Avocet Refuge. Instead, it will be a 9-hectare enclosure within the Avocet Nature reserve and it will house only females and juveniles. This will mean that juveniles will be protected when they're small and most at risk. Importantly, they will be released back into the wild when they weigh 3 kilograms or more. In this way, Wild Mob hopes to increase the chances of nailtail survival by 50 percent and in turn give the wild Avocet breeding population a significant boost.

The nursery will have a 'hands-off' management approach. Custom-designed and remote monitoring technology will weigh and identify the wallabies as they make their way to a water source within the nursery. Images and data will then be sent to an off-site database as they pass over the weigh stations. These new technologies will help understand how the population is faring while reducing long hours of night time surveys and the handling of wallabies.

It is this type of collaborative and forward-thinking approach to our endangered flora and fauna that sets Wild Mob apart from many other organisations of its kind. Their conservation initiatives are based on sound science and are not risk averse. Importantly, they collaborate with local communities, government and other organisations so that conservation efforts can be most efficiently delivered.

Wild Mob also actively engages volunteers from all over Australia, of all ages, and from all walks of life, to join them on their trips. In this way they increasingly involve the broader Australian community in hands-on conservation and are able to deliver more with less money spent.

With approval from the Queensland government, construction is now underway. Wild Mob needs to raise $250,000 to build and run the nursery for three years. If successful, it will build up a strong, wild population of nailtails that won't require ongoing intensive management. This means that Wild Mob, their volunteers and other organisations can move their time, attention and resources to help another critically endangered species.

For More Information go to: wildmob.org/nailtail-nursery/

FERAL HORSES IN KOSCIUSZKO NATIONAL PARK

The NSW Government's decision to ignore scientific evidence and years of public consultation and instead protect feral horses in Kosciuszko National Park under a 'Brumbies Bill' sets a dangerous precedent for Australia's threatened species and our protected areas.

The Australian Wildlife Society supports the Reclaim Kosci campaign that has been created to overturn the NSW Government's decision to protect destructive feral horses at the expense of Kosciuszko National Park's incredible natural values.

Background

In June 2018, a bill was passed in the NSW parliament to protect feral horses in Kosciuszko National Park. The Kosciuszko Wild Horse Heritage Act 2018 prioritises a harmful invasive species over the fragile ecosystems of a national park and world biosphere reserve.

Please support the campaign to repeal this law, and to implement humane and effective control of feral horses in Kosciuszko National Park. Go to **ReclaimKosci.org.au** to sign the petition.

Habitat destruction by feral horses could impact on listed threatened species, including:

Southern corroboree frog Critically Endangered
Northern corroboree frog Critically Endangered
Smoky mouse - Critically Endangered
Clover glycine - Critically Endangered
Broad-toothed rat - Vulnerable
Shining cudweed - Vulnerable
Mauve burr-daisy - Vulnerable
Max Mueller's burr-daisy - Vulnerable
Anemone buttercup - Vulnerable
Monaro golden daisy - Vulnerable

On 30 November 2018 the NSW Scientific Committee's Determination Advice was released. It advised that "... feral horses are officially recognised in New South Wales as a key threat to native wildlife". The case to address the growing feral horse threat to Kosciuszko National Park is now overwhelming.

Myths vs Facts

Myth: Kosciuszko's horses are part of a unique heritage and have always been protected by high-country cattlemen.

Many of the native species in Kosciuszko National Park are unique, but the feral horses there are just like any other horse. Australia has more than 300,000 feral horses, and there are no genetic traits to distinguish the Kosciuszko horses from them or domestic horses. Just because horses have been in Kosciuszko for 150 years does not give them heritage value. By that same skewed logic, foxes, pigs, rabbits and other invasive animals would also have heritage value. In the 1860s and 1870s, wild horses in New South Wales were regarded as a nuisance and a pest and were regularly killed to control numbers.

Above: Kosciuszko National Park is home to a mix of mountains and alpine wilderness areas. Photo: Mike Bremers

Myth: Kosciuszko's horses are descended from horses that went to war with Australian soldiers.

Kosciuszko's horses are not descendants of horses used in World War I (these horses were not returned to Australia). The Kosciuszko population has descended from horses that escaped from local farms or were deliberately released. Nor is there clear evidence that horses were even taken from the Kosciuszko population for the war effort. Such horses came from many places in Australia.

Myth: There aren't many horses in Kosciuszko.

The latest detailed aerial survey in 2016 found 6,000 feral horses in Kosciuszko National Park. This is far too many horses for sensitive alpine ecosystems, and experts say the number will continue to grow by 6 to 17 percent a year. There is overwhelming scientific evidence that current numbers are causing severe damage. A recent study of horses on the Bogong Plains found that "with even a small number of animals, the rate of damage is greater than the rate of natural repair". The NSW Government's 2016 draft strategy for controlling feral horses in Kosciuszko said their population should be reduced by 90 percent over 20 years.

Myth: Horses in Kosciuszko don't cause much damage.

Australia's alpine plants and animals did not evolve with heavy, hard-hoofed animals and many rely on habitats that are now being severely damaged by horses. In both New South Wales and Victoria, the scientific committees advising the governments on threatened species have concluded that feral horses are a significant threat to alpine and subalpine habitats. The New South Wales committee found that "habitat damage in streams, wetlands and adjacent riparian systems occurs through selective grazing, trampling, track creation, pugging (soil compaction), wallowing, dust bathing leading to stream bank slumping and destruction, stream course disturbance and incision, and sphagnum bog and wetland destruction."

Myth: Horses do not go into the sensitive areas of Kosciuszko.

All of Kosciuszko is sensitive to damage by feral horses. The greatest horse impacts have been focused in

The mountain pygmy possum is a small, mouse-sized nocturnal marsupial of Australia found in dense alpine rock screes and boulder fields, mainly in southern Victoria and around Mount Kosciuszko in Kosciuszko National Park in New South Wales at elevations from 1,300 to 2,230 metres.

The smoky mouse is similar in size to a small rat, with a head and body length averaging about 90 mm and a tail averaging 140 mm.

Horse wallows in Kosciuszko National Park have spread, some knee deep, and erosion is spreading at river crossings.

The Monaro golden daisy is a low, tufted perennial with a woody root-stock. Its leaves are dark green, woolly underneath, to about 10 cm long.

the most sensitive areas, especially wetlands, waterways, alpine and subalpine areas. Horse herds move annually into Main Range during spring and summer, and they have also been seen on the alpine plateaus.

Myth: Horse grazing prevents fires in Kosciuszko.

The popular claim that "grazing prevents blazing" is not supported by science. Horses do not feed on the shrubs and unpalatable tussocky grasses that carry fire in extreme conditions, such as occurred in the catastrophic fires of 1939 and 2003. There is, however, some evidence of the converse – that grazing by feral horses and cattle can increase the intensity of bushfires by removing ground cover, resulting in denser scrub. The damage caused by severe fires is intensified by horses after fires due to the erosion and degradation they cause.

Myth: Pigs, deer and foxes are the real problems in Kosciuszko, not horses.

Introduced pigs, deer, goats, rabbits and foxes also threaten Kosciuszko's natural values and are controlled by park managers through trapping, baiting, and aerial and ground shooting. Feral horses are an even bigger threat and should be managed just like other harmful feral animals.

Myth: Kosciuszko horses are a major tourist attraction.

Several surveys show the main activities of visitors to Kosciuszko are snow sports, walking, car touring, sightseeing and nature appreciation. Many visitors, without knowing the full story, like

Clover glycine is a low-growing herb growing to only a few centimetres high. Leaves are split into three, like a classic clover leaf, 5–20 mm long and 4–12 mm wide. The species generally flowers in spring in the lower elevation parts of its range and in summer in higher elevation areas.

Max Mueller's burr-daisy is a perennial herb with thick and fleshy underground stems. Its leaves are very woolly when young. It has unbranched flowering stems that hold single mauve or white flower-heads in December. Photo: Mike Bremers

Shining cudweed is a low, mat-forming, perennial daisy. Its crowded stems are only a few centimetres tall.

seeing horses, but those who realise polluted and damaged streams and wetlands are caused by feral horses are appalled by their presence. Some visitors find the horses intimidating. Feral horses are undermining the major tourism assets of the park – the natural beauty and diverse wildlife.

Myth: Aerial shooting is inhumane.

The RSPCA supports professionally managed aerial culling of feral horses in Kosciuszko. An expert committee appointed by the NSW Government to advise on feral horse control concluded that aerial culling is the most humane and effective method of control in Kosciuszko. There are strict protocols to maximise welfare outcomes. Trapping and transporting horses for slaughter causes much more suffering than shooting.

Myth: Rehoming and fertility control are solutions.

Fertility control in an area the size of Kosciuszko is not feasible. Trapping, the current main control method, is also ineffective because it cannot keep up with the rate of increase. Where regular trapping has occurred horse numbers have increased. Over the past decade an average of less than 100 trapped horses a year have been rehomed, despite extensive advertising and liaison with brumby groups.

About Reclaim Kosci

In June 2018 the NSW Government turned Australia into a global laughing stock when it passed legislation protecting destructive feral horses in Kosciuszko National Park, locking in ongoing degradation of sensitive wetlands and alpine areas.

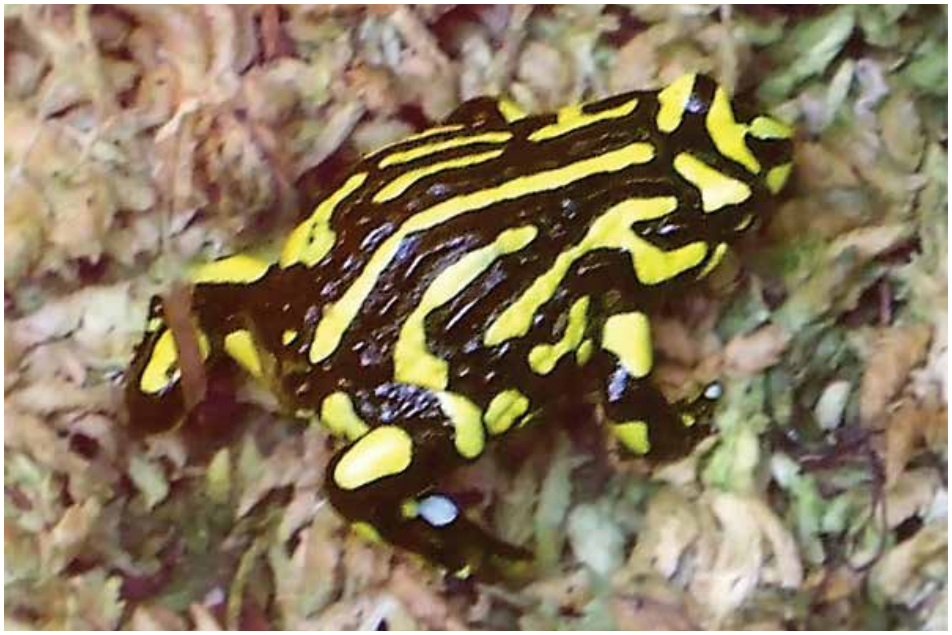
Overturning the Kosciuszko Wild Horse Heritage Act – which should be called the Kosciuszko Destruction Act – is essential for protecting our fragile alpine region.

Reclaim Kosci is aimed at achieving just that, as well as major reductions in horse numbers to ensure Kosciuszko National Park's restoration.

Reclaim Kosci is led by the Invasive Species Council and supported by the National Parks Association of the ACT, National Parks Association of NSW, Colong Foundation for Wilderness, and the Nature Conservation Council of NSW.

The broad-toothed rat (*Mastacomys fuscus*) is a native, herbivorous rodent. Photo: Ken Green

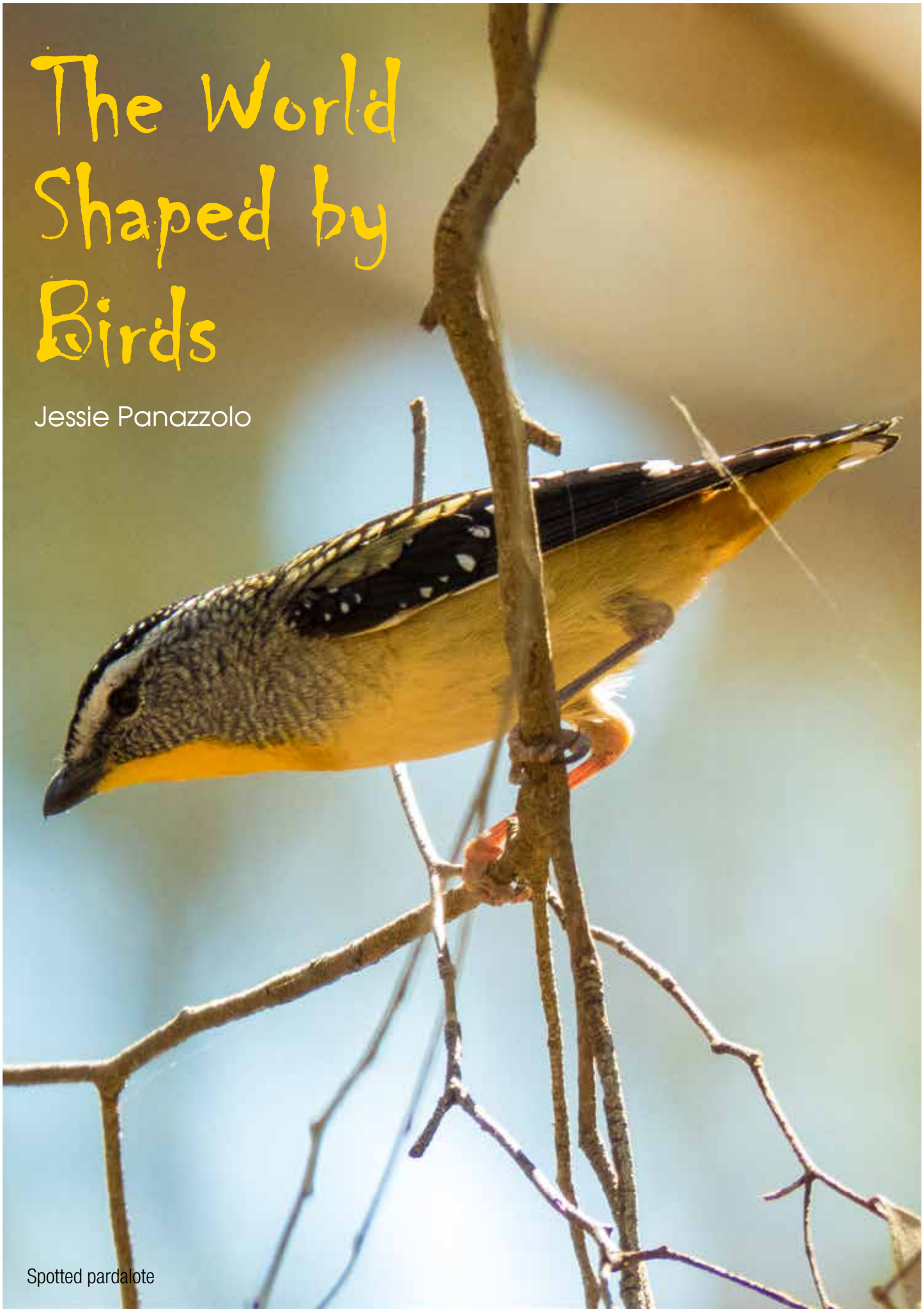
The anemone buttercup is a robust, perennial herb. Its basal leaves are large (to 8 cm wide), leathery and deeply cleft into multiple spreading lobes; the stem-clasping leaves are stalkless. The dramatic flowers are creamy-white and large (to 6 cm in diameter). The flowers appear almost as soon as the snow melts. Photo: Brian Slee



The corroboree frog is listed as critically endangered, one step away from extinct in the wild. Threats include the amphibian chytrid fungus, habitat degradation, feral animals and weeds. Feral horses, pigs and deer have been observed damaging corroboree frog habitat.

The World Shaped by Birds

Jessie Panazzolo



Spotted pardalote

In early days, the world was viewed as a smorgasbord of food and building resources. Everything man saw was his for the taking. Animals were food, trees were only steps away from becoming houses, and the ground was laden with precious metals. Collecting and naming new species of birds was arguably the first transition from eating nature to admiring and documenting it. Being a naturalist meant collecting new bird species from exotic faraway lands and bringing them back to European home towns for analysis and display in collections. I always think back to Alfred Russel Wallace, collecting birds around the Amazon and not once, but twice, experiencing his ship catching alight on his way home to London. Maybe if he hadn't had so many disasters, he could have beaten Darwin in the race to unveil the theory of evolution.

As technology evolved, shooting birds with guns transitioned into shooting birds with cameras. Collections of stuffed birds transitioned into photo albums full of stunning bird photos from around the world. To this day, people such as I carry on the naturalist tradition of capturing our own collections of photos of wild bird species and appreciating their different forms from behind our lenses. As a keen bird photographer, I often consider bird species to be collectors' items, with some species considered more prized than others. I understand the Pokémon mentality of "Gotta catch 'em all" as there are so many different shapes, sizes and colours to uncover.

Naturalists soon evolved into modern-day biologists and conservationists who uncover millions of more species than of avian varieties. However, unless you are one of these specialised individuals in elephant dung analysis, seahorse pregnancy behaviour or jewel beetle morphologies, it is unlikely that your time spent experiencing nature takes up a great proportion of your life – but here is where we come full circle. Birds are the most accessible aspect of nature for people living in dense city high-rises, rural towns or suburban housing estates. Birds

Grey fantail

Superb fairy wren

White naped honeyeater

Laughing kookaburra

Black-faced cuckoo-shrike

Spotted dove

come to our houses, sit on our fences and chirp from our trees to an extent whereby birds are cutting through our technologically saturated lives and are perking human interest in nature once again. In some instances, birds are people's only connection to nature. Watching rainbow lorikeets feeding outside the kitchen window or hearing the kookaburra's iconic laugh is now re-engaging the world with our environment. Birds began the naturalist trend, and when we lost our way, birds are once again re-engaging us with natural connections.

This year I have tried to uncover as much as possible about birds, from their social and natural history to their behaviour, intelligence, anatomy and how humans interact with and consider them. I initially wanted to know why I was so fascinated by birds, but the more I learned, the more I realised that there are probably more people fascinated with birds than people who have never considered them. Modern-day quails have told palaeontologists how flight evolved; geese, swans and cuckoos told linguists how the English language has evolved, and cockatoos taught Alfred Russel Wallace how the continents were once connected. Discovering the same bird species in Australia and Asia, Wallace finally received some credit for the aptly named 'Wallace Line' which separates the two continents in a way that groups similar species found across both regions. After so many flaming ship disasters, birds came through for Wallace even though it was not in the initial way he intended.

To conclude, if you secretly feed birds in your backyard, find yourself lost in thought looking at a pigeon pecking at the ground or stop to admire the bright pink breast of a galah, you are not alone. For centuries, millions of humans all over the world have used birds as a gateway drug to uncover the rest of what the natural world has to offer. From understanding human speech from birdsong to canaries in coal mines, I dare you to find a subset of human culture where birds have not had an influence. How special must a creature be to have shaped our lives so intensely, even if most of us have never realised this until now?

CAN YOU SPOT A QUOLL?

Julie M. Old and Hayley J. Stannard

Quolls (*Dasyurus* spp.) are carnivorous marsupials with white spots and are only found in the Australasian region. They live in a wide range of habitats and are the largest marsupial carnivores on mainland Australia and New Guinea alive today. As predators, they help to maintain biodiversity; however, they remain cryptic and largely elusive to most biologists, because of their large home range and solitary nature.

How can you tell one quoll species from another?

Each quoll species can be identified by differences in its anatomical features and distribution. The eastern quoll is the only species of quoll lacking the first digit on the hind foot, while the spotted-tailed quoll is unique in that it is the only quoll species to have spots on its tail. The remaining four species of quoll can be distinguished from one another by distribution, either New Guinea or Australia, and whether they have stripes on their footpads. The northern quoll and New Guinean quoll both have stripes on their footpads and can be further differentiated by their teeth. New Guinea quolls are also restricted to New Guinea, whereas the northern quoll is only found in northern Australia. The chuditch or western quoll, and the bronze quoll, both lack stripes on their footpads. The chuditch is found in Western Australia (WA), while the bronze quoll is only found in New Guinea.

Eastern quolls

As mentioned earlier, four quoll species are only found in Australia, while the other two quoll species are only found in New Guinea. The eastern quoll was formerly found throughout south-eastern Australia including New South Wales (NSW), Victoria, and South Australia (SA), but it was last recorded on mainland Australia in 1963, in what is now an exclusive Sydney suburb, Vaucluse. However, a road-killed eastern quoll collected in 1989 from Barrington Tops, NSW, was recently confirmed genetically to be from mainland Australia, suggesting that eastern quolls remained in remote areas longer than previously thought. Today the eastern quoll is believed to only occur in Tasmania, where it is prevalent in the east of the state in open forests, woodlands, grasslands and alpine heathlands with low to moderate rainfall.

Above: Spotted-tailed quoll. Note the spots visible on the tail. Photo: Rewilding Australia

Spotted-tailed quolls

The spotted-tailed quoll has declined in numbers from much of its former range, including the east coast and in the semi-arid zone of eastern Australia, and Tasmania, and is now extinct on the islands in Bass Strait and SA. The spotted-tailed quoll is common only in the New England Tablelands of NSW, far-north Queensland, and Tasmania. It formerly occurred along the Great Dividing Range, south-western Victoria and south-eastern SA, suggesting it can occur in a wide range of habitats. In Tasmania, the spotted-tailed quoll is now restricted mainly to the north-east and the west of the state in wet forests or scrub.

There are two distinct subspecies of spotted-tailed quolls. The subspecies formerly found in south-east Queensland, eastern NSW, Victoria, SA, Tasmania and some Bass Strait islands, *D. maculatus maculatus*, is now rare in Queensland; however, larger numbers occur in NSW on the mid-north coast from the Hunter Valley to Coffs Harbour, and the New England Tablelands. The other subspecies, *D. m. gracilis*, can now only be found in notophyll vine forests in the south of Queensland but was also formerly found throughout the wet tropics of Queensland, where it is now believed to be extinct.

Northern quolls

While the northern quoll is currently limited in its distribution to northern Australia, it did occur from the Pilbara to south-eastern Queensland, and inland as far south as Alexandria in the Northern Territory (NT). Recent declines have been observed in lowrainfall areas in the NT, the south-east and south-west Kimberley, eastern and southern Queensland, the Cape York Peninsula and the Pilbara. A significant population decline has occurred in Kakadu National Park (NP) due to the onslaught and expansion of cane toads (*Rhinella marina*). The northern quoll has also been translocated to Astell and Pobassoo islands and has been recorded on Groote Eylandt, Marchinbar Island, Inglis Island and Vanderlin Island. While population numbers tend to fluctuate less in rocky environments, they are most often found in open and monsoon forests, and savannah woodlands.

Chuditch

Chuditch are found in areas with sclerophyll forest or drier woodland, and mallee and heath shrubland, but given its former range across Australia (except in the NT and Tasmania), are likely capable of occupying a more diverse range of habitats and thus may be more widely distributed. The eastern subspecies, *D. geoffroii geoffroii*, was recorded in eastern Queensland at Peak Downs (Thomas 1888), and on the Liverpool Plains and Mildura, in NSW (Gould 1840; Kreft 1857). Additional reports have been noted in NSW, north of Broken Hill (1996), between Broken Hill and Menindee (1988), and north-west of Tilpa (1990). One *D. geoffroii* was also confiscated from a chicken pen (presumed to be a pet) in central western NSW in 1983. While many of these are unconfirmed reports, the species is suspected to occur in central west NSW; however, formal mammal surveys have not been undertaken to locate chuditch in western NSW.

The western subspecies (*D. geoffroii fortis*) is currently restricted to the central and southern wheatbelt in WA. At present, it is estimated that there are less than 10,000 individuals of the subspecies *fortis*. It was listed as 'Vulnerable' in 1996, however, due to translocations and fox control, most populations have stopped declining. Usually, the translocated populations remain small, the translocated Julimar population, for example, is estimated at less than 100 individuals.

Threats to quolls

Quolls are threatened by a range of factors including loss of habitat through land clearing and modification, disease (such as toxoplasmosis), human persecution, vehicle collisions and poisoning, either targeted or secondary, as well as competition from European red foxes (*Vulpes vulpes*), feral cats (*Felis catus*) and, potentially, wild dogs (*Canis lupus*). In Tasmania, fragmentation of forests due to agriculture appears to have enhanced habitat for the eastern quoll, by increasing the populations of pasture grubs and insects. Despite this, a large reduction in numbers of eastern quolls over the 10 years to 2009 (from spotlighting surveys), and reduced trapping success over 12 years has been observed in Tasmania. Vehicle collisions have likely contributed to a reduction in spotted-tailed quoll numbers as they eat carrion on roadsides. In Queensland, quoll numbers have also likely incurred major impacts by cane toads .

Cane toads have also impacted the northern quoll, which was once widespread across northern Australia, particularly in forest habitats and woodlands. Other significant threats to northern quolls include loss of habitat and direct and indirect effects of mining. Interestingly, strychnine poisoning in the early 20th Century has also reduced spotted-tailed quoll numbers.

Changes to fire regimes, particularly extensive hot wildfires, and clearing and grazing pose major threats to chuditch. Predation by and competition for food with cats and foxes (particularly after fires), and hunting and poisoning have also led to their decline. Other threats to chuditch include collisions with vehicles, shooting, predation by raptors, and disease. During radio-tracking studies, scientists have also observed deaths by drowning, and injuries around poultry sheds associated with trapping.

Despite chuditch being found across much of Australia, live trapping surveys in the 1980s suggested less than 6,000 chuditch remained in the wild and a recovery plan (1991) was implemented. In the south-west of WA, populations have since increased as a result of fox baiting.

Quoll conservation

Quoll conservation status ranges from Near Threatened to Endangered. The northern quoll is listed as Endangered due to a decreasing population, estimated to have declined by more than 50 percent in the last 10 years. The population is expected to continue to decline due to habitat degradation or destruction, introduced predators and cane toads. However, some northern quolls have since been taught taste aversion to cane toads, with the use of 'cane toad sausages', and there are hopes for the species to be reintroduced into areas where cane toads are now prevalent.

To date, several northern quoll translocations have occurred. In 2003, 64 northern quolls were translocated to Astell (11 males and 34 females) and Pobassoo (8 males and 11 females) islands, NT. Juvenile

animals were sourced from the Darwin rural fringe and Kakadu NP, NT, for the translocation. Subsequent surveys (April to July 2003–2005, October to December 2006–2009 and October 2014), confirmed successful translocations had occurred.

To aid conservation, further efforts are being planned to reintroduce and translocate two of the other four quoll species in Australia into current and former habitats. While largely dependent on fox control, reintroduction of eastern quolls on mainland Australia has been suggested by several groups. In April this year, 20 eastern quolls were translocated into Booderee NP, NSW, the first reintroduction of the species onto mainland Australia, with the aim, of a further 40 per year in 2019 and 2020.

Chuditch have been successfully bred at Perth Zoo, and their subsequent relocations have led to the species being reclassified from Endangered to Vulnerable under the IUCN criteria and *Environment Protection and Biodiversity Conservation Act 1999*. A great news story for quolls! To date, 315 chuditch have been released by Perth Zoo into Julimar State Forest, Lake Magenta Nature Reserve, Cape Arid NP, Mount Lindsay NP and Kalbarri NP. Baiting with fluoroacetate (1080) has been particularly effective at reducing fox numbers and aiding successful chuditch translocations and hence chuditch population recovery. Native animals, including quolls, are unaffected by fluoroacetate as they evolved alongside the plant it is sourced from, *Gastrolobium*.

Relocations of chuditch have also occurred in WA's Rangeland Restoration project and Dirk Hartog NP. In total, 93 chuditch have been translocated to the Flinders Ranges, SA, starting with 38 in 2014. Cat control is allowing the population to persist, despite some cat predation being observed. A further ten chuditch were planned to be introduced into an Arid Recovery Reserve (fenced area) in SA in 2018. Eastern quolls have also been reintroduced into fenced areas at Mt Rothwell, VIC (http://mtrothwell.com.au/) and Mulligans Flat near Canberra, ACT (https://mulligansflat.org.au/).

Where to from here?

Major knowledge gaps remain regarding quoll biology. Recovery programs for some quolls in Australia have been successful with increases in populations when released into areas of their former range. With additional success of these programs, we are likely to see the conservation statuses of these species downgraded, as has occurred for the chuditch. However, translocations are not a quick and easy fix, as they often require ongoing control of predators, possible implementation of other threat mitigation strategies, rigorous monitoring and actions to prevent loss of individuals post-release. They are also heavily reliant on funding from and cooperation with a range of

Eastern quolls exhibiting the two colour morphs. Photo: Rewilding Australia

agencies including non-government organisations, zoological parks and NPs. Recovery programs for species such as the spotted-tailed quoll will likely require similar resources. It may also require cane toad aversion training prior to individuals being released in Queensland and northern NSW, similar to that conducted on captive northern quolls. Reintroductions onto islands where quoll species were formerly distributed may also be beneficial in creating insurance populations.

The overall success of reintroduction and translocation programs is heavily reliant on gaining a good understanding of the biology and ecology of the species involved, and often includes successfully breeding and maintaining captive populations of the species pre-release. To maintain and breed quolls in captivity requires an excellent understanding of their biology and specifically, aspects of their genetics, nutrition, reproduction, immunology, ecology and behaviour, as well as the development of appropriate husbandry techniques. While our knowledge is growing in many areas, it is clear there is still much to learn and gain from further research on quolls both in captivity and in wild populations.

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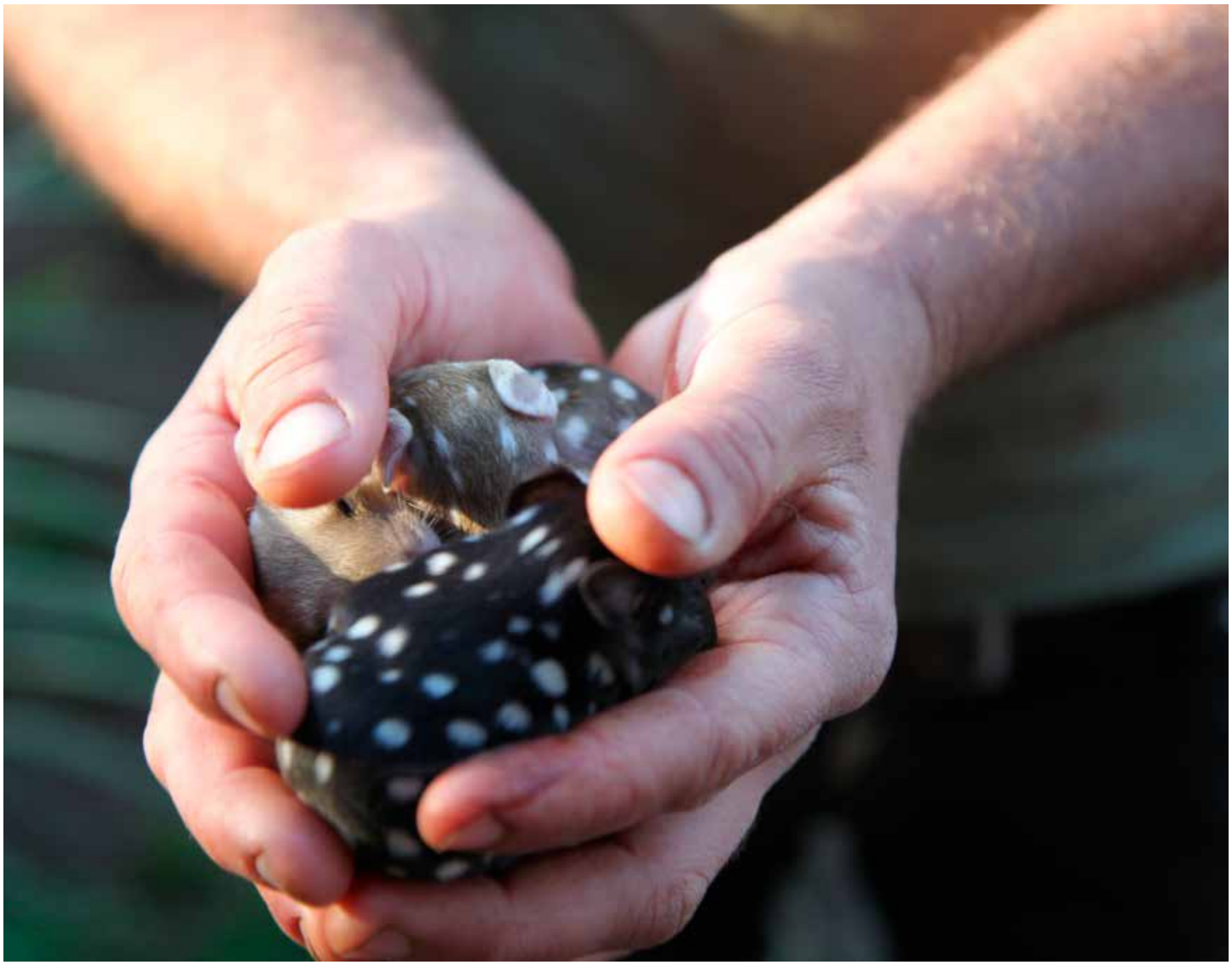
Dr Hayley Stannard is a biologist whose research area focuses on conservation biology and physiology of vertebrates, including nutritional ecology, comparative physiology, and animal welfare. Her research has discovered new knowledge on the nutrition and welfare of iconic Australian wildlife (e.g. Tasmanian devils). Dr Stannard strives for active engagement with industry and management agencies to ensure her research is integrated to its full potential and benefits wildlife conservation in Australia.



Juvenile eastern quoll. Photo: Rewilding Australia

Eight-legged Freaks

Brendon Carrick

You're in your bathroom, brushing your teeth getting ready for bed. Just as you're finishing up, something catches your eye. A big, dark, hairy, ferocious-looking creature scuttles at a metre per second across the wall next to you. Is your first reaction to scream, freeze or grab that little guy and get him out to the safety of the back yard? Maybe for you it's a healthy combination of all those reactions, for which I commend you! Or maybe you're someone who would douse him at close range with enough fly spray to kill 1,000 men? Either way, I encourage you to open up your hearts and your homes to these wrongfully perceived eight-legged ancient beasts. See their beauty and elegance over the traditional belief that these creatures have a personal vendetta against us. In fact, spiders are less likely to take your life than bees, which will kill an average of 10 people per year in Australia. Not so much the cute and fuzzy little honey makers we perceive them to be when compared to the spiders, which haven't killed anyone in Australia since 1979. This is the result of successful introductions of antivenins for all poisonous native species. Of the 45,700 spider species estimated worldwide, Australia hosts around 10,000 species, all of which exist in vastly diverse ecosystems throughout the country. The spiders featured here were photographed during my hikes through the South Australian bushland.

This lovely orange lady was photographed just outside of her den in Frank Smith Park of Coromandel Valley in the city of Onkaparinga. After searching tirelessly to identify her I came to the conclusion, judging by her appearance, that she is most likely to be a trapdoor spider. Unfortunately, the trapdoor spider populations in South Australia are rapidly declining, an issue that is being examined by researchers at the University of Adelaide. As Professor Andrew Austin, from the University of Adelaide's Centre for Evolutionary Biology and Biodiversity says, "It's a little bit concerning and we don't quite know what is going on." A survey first conducted in the 1950s shows over 100 individuals of a particular species sampled from one geographical range have declined to just over 10 individuals in the same range by 2014. Austin says "the populations in some places have disappeared completely [...] in other places they are down by 90 percent or so". Habitat destruction may be the reason for the decline, but Professor Austin says other losses have left biologists clueless. One explanation could be that trapdoor spiders have quite a unique lifecycle, which could make them more susceptible to human encroachment. The females live between 25 and 30 years at the bottom of their burrow. Their offspring vaccate shortly after hatching to make a burrow of their own. However, adults whose burrows get damaged are not capable of rebuilding it. Because of their roles as major predators of other invertebrates, their complete disappearance could have negative impacts on the ecosystem. Although venomous, trapdoor spiders are not to be feared and their bite is known to cause only mild discomfort to humans.

This handsome hairy beast belongs to the huntsman family – one of Australia's most well-known families of spider. Their threat to humans is not their bite but their erratic movements. They are known to scare drivers of the cars they're crawled into, which can sometimes result in crashes. Despite their horrifying size, huntsman spiders are a great companion to have around, helping to rid your house of flies and other pesky vermin. This one here was just crawling across my frontyard minding her own business when I found her on the hunt for some breakfast. Each huntsman species has differing characteristics. Note the striking blue colour at the top of the chelicerae on this specimen. This is something I haven't seen before.

This remarkably coloured huntsman species is known as a badge huntsman. I found this one in my backyard near Belair National Park. To get the shot of her colourful badge on the underside of her abdomen, I placed her on a pane of glass. Little is known about the purpose of this marking, but some suggest it has to do with mating and sexual selection processes. This species is known as *Neosparassus diana* and is notoriously the most aggressive member of the huntsman family, with more bite reports than any other species. The badge huntsman is widespread across Australia and is found in both dry and moist eucalyptus forests. Being nocturnal, they are often seen hunting for prey on tree trunks and leaves at night. During the day they spend most of their time in makeshift leaf huts they construct, or beneath the bark of eucalyptus trees.

This menacing-looking arachnid (top right) is the infamous red-back spider, a female red-back to be exact. You can tell, as the males are brown and a lot smaller. I found this individual while I was doing garden renovation work in Seaford Meadows. Sadly, her web was destroyed, but I made an effort to find her a safe spot in another garden. Unlike most of the spiders seen here, this one is seriously dangerous – or at least the females are; the males aren't big enough to pierce human skin. With a very potent venom in its arsenal, given a chance, this spider is capable of killing an adult human. However, since 1956, when an antivenin was synthesised, there have been no human fatalities. Relatives of the red-back include the black widow of the United States and the katipo of New Zealand, all of which belong to the genus *Latrodectus* and sport the red colouration on their abdomen. To hunt, the red-back will assemble its multi-layered, messy-looking but highly elaborate and specialised webs across the travel paths used by its prey. When one of these unlucky critters interferes with the trip-lines, it gets

stuck to them. When the critter begins to struggle, the vibration alerts the spider and also releases the web from the ground, lifting it up and sometimes catapulting it upward into a network of sticky silk lines above.

These two Yin and Yang love birds are known as *Ocrisiona leucocomis*. Seen here is their webbed safety retreat, underneath a piece of bark. These spiders inhabit most of the eucalypt forests of Australia, as well as the native forests of New Zealand. To impress the female, the male will show his interest by moving his abdomen back and forwards , vibrating his legs, as well as moving around her, in a way that looks almost like dancing. If the female doesn't think his skills are good enough, well perhaps he'll taste better than he can boogie. Female jumping spiders don't think twice about eating males that don't take the cake. This species is primarily bark-dwelling and will rarely be seen on foliage. The female (seen here on the right) will lay her eggs under the bark and raise the young for a number of months before they mature and leave the nest. The young offspring will often inhabit the same tree as the generation before them. This shot was taken in Montacute Conservation Park. It is a protected area located in South Australia, about 17 kilometres north-east of the Adelaide city centre.

This cute collection of baby huntsmen and their big protective mother were seen at the World Environment Fair in Adelaide. Unlike some other species of spider, the males are not often attacked by the females after mating. When she is impregnated, the female builds a silken sac in which she lays around 200 eggs. The sac is placed under bark or a rock and she will guard her offspring for a few weeks. Huntsman spiders prefer to mate when the weather is warm and humid, to reduce the chance of her eggs drying out over the summer months. During this period the mother will become quite hostile and aggressive in a defensive display if provoked or agitated. When she is ready she opens the egg sac and releases her spiderlings into the world. The babies start off in a pale colour but will soon take on their distinct grey or brown colour a few weeks after several moults.

This colourful little spider is known as the jewel or Christmas spider. This species is formally known as *Austracantha minax* and was found in Mylor Conservation Park near Adelaide, South Australia. It is a member of the orb-weaver family Araneidae and is facultatively gregarious. This basically means that this is a social spider and can often be seen aggregating in large colonies in the bush, whereas the majority of spiders are solitary and demonstrate aggression towards members of the same species. The jewel spider is fine with bunking in tightly with its family members. This is most likely an adaptation that increases the hunting productivity, as the webs are larger and more dense due to the high number of spiders working together.

This big-eyed beauty is known as a wolf spider. This one is a female. They are strong, agile predators that live amongst ground plants in burrows and under leaf litter. They are often found in the backyard crawling around looking for prey. They hunt in solitude and only interact with members of the same species during mating season. They do not spin webs and are in fact opportunistic hunters, pouncing upon prey and even chasing it over short distances. This is where they get their name. Some stalk and wait for prey in or around their burrows, which is similar to trapdoor spider behaviour. A female raising her offspring will roll up her eggs into a protective silk ball. She then attaches it to her abdomen and will carry it around until her eggs hatch. Post hatching, the babies will crawl out and onto the mother's back, where they remain until they are ready to start finding their own food, a process that may take several months.

This is the epitome of a disappointed spider. Have you ever taken a cold shower?

Well, multiply that by 15 million times – that's how mad this spider is. I'm totally kidding of course – this spider is long gone. He met his fate at the beginning of springtime. While working at a retirement village in Mount Barker, I came across this ghastly sight in a bird bath that had completely frozen over. This little guy (a male based on the small size of his abdomen) was unlucky enough to slip into the water

before it froze, encapsulating him in an icy grave. Despite this tragic moment for him, it made for quite a photo. Some spiders can actually breathe underwater by collecting air bubbles on their body and their underwater webs. They hunt in and around the water, catching small aquatic insects, fish, tadpoles, and possibly even amphibians. Some species are also capable of diving and running across the bottom and remaining there for up to an hour. Perhaps this guy was one of those species that was in the wrong place at the wrong time.

This spider is also a member of the Salticidae family. While these creatures have extremely small brains – roughly the size of sesame seeds – they possess intelligence normally associated with much larger animals. They will plan complex detours to reach prey and are able to demonstrate precise environmental awareness as well as in-depth problem-solving skills. Just by watching them, you're able to see something that other spiders just don't have. Their body language provides a sense of curiosity, interest and inquisitiveness which really gives these spiders a unique and fascinating charm. The way they move their heads back and forwards trying to see you and make judgments about what it is you are and what it is you're doing shows just how aware they are. Their attentive, alert and overall cute nature makes this family of spiders my favourite of all. This species is called *Servaea incanna* and is a female (you can tell by the large abdomen). The males are also generally smaller, more slender and darker, with larger front legs. Like most species

of Salticidae, this one is very photogenic , quite happy to sit in the sun on bark or on a leaf and gaze into the camera lens, most likely analysing its own reflection. This species is found most commonly in eucalypt forests, where it builds its home underneath the bark.

Instead of boring you with a long conclusion, I'll leave you with a quote by Jacqueline Emerson: "If I see a spider in my house, I put it in a cup, and then I take it outside. I save it. What is wrong with me?" Nothing at all, Jacqueline, nothing at all!

Book Reviews

I am the Seed That Grew the Tree.
Selected by Fiona Waters and Illustrated by Frann Preston-Gannon

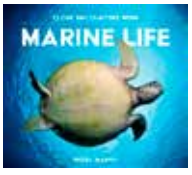
This gorgeous book is an unbelievably ambitious, utterly enthralling and lavishly produced selection of nature poems. Containing a collection of 366 poems, filled with some timeless classics and familiar favourites, as well as introducing the reader to new discoveries, this is an exceptional book to return to again and again.
Publisher: Allen & Unwin | RRP: $49.99

Discover the best places to spot 300 of the world's most exciting and unusual creatures, from the soaring Andean condor and prowling Bengal tiger, to singing humpback whales and migrating wildebeest. For many people, one of the most rewarding experiences of travel is seeing creatures they wouldn't encounter back home. Whether you set out to see them on safari or spot them by sheer luck, there's a thrill and a beauty in watching a wild animal in its natural habitat.

It's packed with stunning photos, details of each creature's habits and characteristics, and tips on how to increase the chances of an encounter. Inside, you'll find all the most iconic animals like lions, tigers, elephants and sharks, but the book also showcases the mind-blowing diversity of the natural world, with other animals including: snow leopards, mountain goats, antelopes, fennec foxes, giant albatrosses, hog-nosed bats, giant clams, corals, whales, wobbegongs, birdwing butterflies and Hercules beetles.

Dictionary of Dinosaurs **Illustrated by Dieter Braun**

Any children interested in dinosaurs will love this book where they can find out about every dinosaur that's ever been discovered. Read about when they lived, what they ate and much more. Featuring epic artwork by Dieter Braun and up-to-date facts from top dinosaur experts, the book includes the world's best-loved dinosaurs such as *Diplodocus, T-rex, Triceratops,Velociraptor, Stegosaurus* and *Brachiosaurus*.
Publisher: Allen & Unwin | RRP: $29.99



Close Encounters with Marine Life **by Nigel Marsh**

Wildlife photography on land is nearly always done with a telephoto lens, with the photographer rarely getting close to the subject. Underwater photography on the other hand is the complete opposite, with the photographer required to get very close to the subject to capture great images. Fortunately, most marine animals are happy going about their daily lives with a diver looking on, allowing for memorable close encounters with these wonderful creatures of the deep. Nigel Marsh has been documenting his close encounters with marine life for more than 40 years and in that time he has observed and photographed octopus mating, sharks feeding, fish fighting, seals showing off and many other incredible sights. *Close Encounters with Marine Life* details Nigel's underwater adventures with camera in hand, featuring some of his best images and many remarkable stories of his experiences with amazing marine life.
Publisher: New Holland | RRP: $35

Amazing animal ability:

Dolphins sleep with one eye open

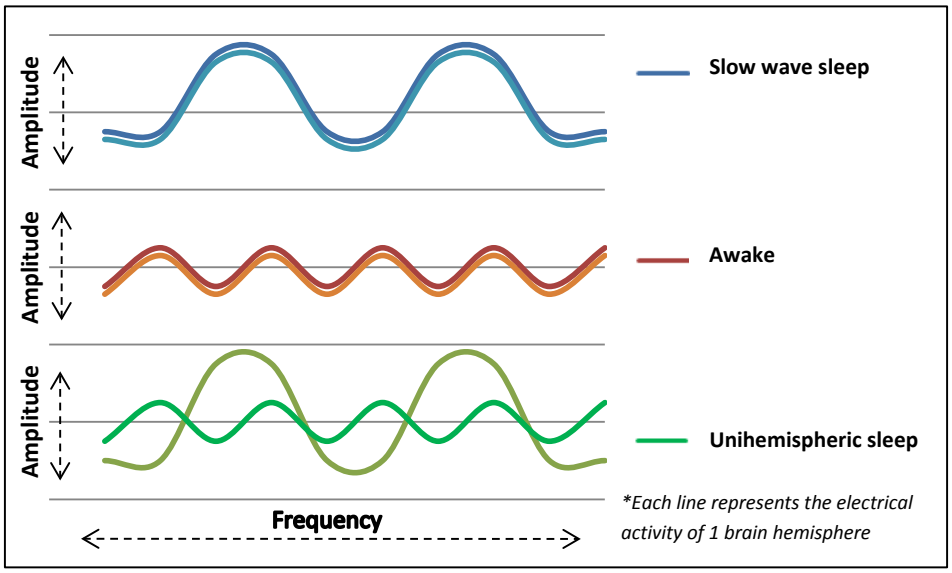
The phenomenon of unihemispheric sleep

Dr Jai Green-Barber

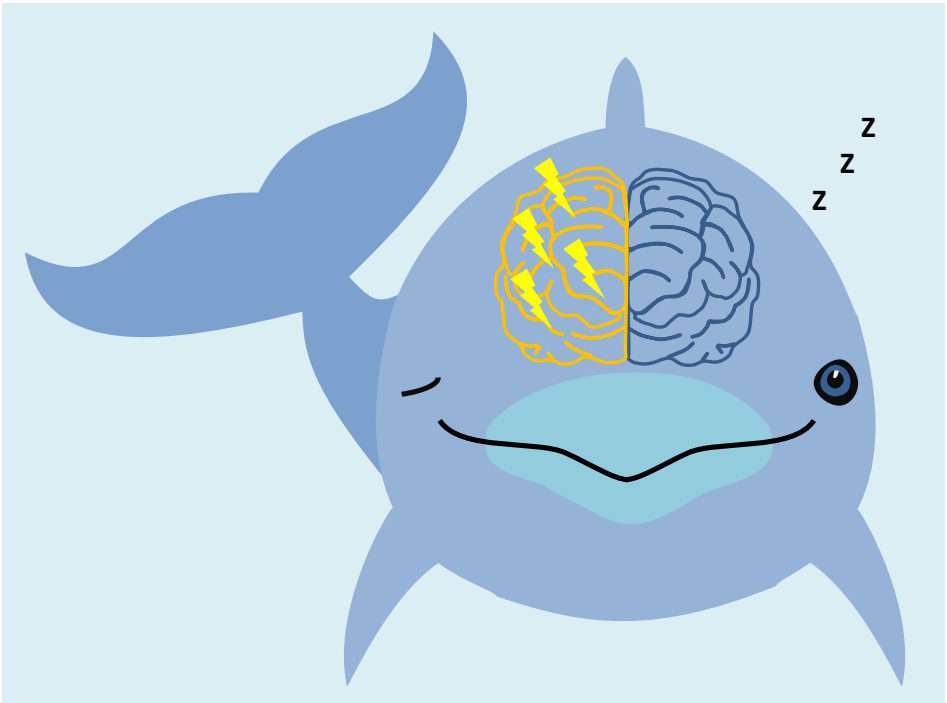
If you were to try to imagine what a dolphin looks like when it sleeps, a few questions might come to mind: Do they sink to the bottom of the sea floor? Or do they float on the surface of the water? And how do they breathe while they are asleep? The truth is that they don't sleep … at least not in the way that humans do.

When humans and other land mammals sleep, their brains enter into an unconscious state, and they lose voluntary control of all their muscles. In contrast, dolphins have evolved to have an ability called unihemispheric sleep, which is essentially sleeping with one hemisphere of the brain at a time while allowing the other hemisphere to stay conscious. This ability is essential to the survival of dolphins and other marine mammals because they live predominantly underwater and do not have gills to extract oxygen from their surroundings, so they need to surface periodically to breathe. Breathing in land mammals occurs automatically and doesn't require conscious control so it can continue normally while the brain is asleep, but dolphins have no involuntary mechanisms for breathing and need to consciously decide when to breathe. This is necessary so that dolphins can choose to take a breath only while at the surface of the water; however, if a dolphin went into a deep unconscious sleep, it would not be able to consciously breathe and would drown.

Sleep can be measured using an electroencephalogram (EEG) to examine the electrical activity of the brain. High-amplitude, low-frequency waves (slow waves) occur during sleep, and low-amplitude high waves occur when awake. Unihemispheric sleep in dolphins is characterised as an EEG showing one hemisphere of the brain in a state of slow-wave sleep, and the other hemisphere either awake or in an intermediate state with a mixture of high- and low-amplitude waves. Sleeping with half the brain allows dolphins to benefit from the essential functions of sleep such as homeostasis, immune system regulation, thermoregulation, and consolidation of memories, while also controlling their breathing and watching out for threats.



The above figure is a simplified example of the typical wave patterns of brain activity during different states of sleep and alertness. Amplitude refers to the distance between the highest and lowest points in the wave, and frequency refers to the number of waves that occur within a set period. During unihemispheric sleep the wave pattern in one hemisphere matches that of slow wave sleep (high-amplitude, low-frequency) and the waves in the other hemisphere resembles those that occur when awake (low-amplitude high-frequency).



Unihemispheric sleep means sleeping in one hemisphere of the brain at a time while the other hemisphere remains active and controls voluntary functions such as swimming and breathing. The eye on the side opposite the active hemisphere remains open to watch for threats.

During unihemispheric sleep, dolphins can either float motionless near the surface of the water or swim along slowly close to the surface. Dolphins can sometimes be seen resting with one eye open and the other closed. Interestingly, the eye that is open is on the side opposite the brain hemisphere that is active. This is because just like in humans, dolphins' eyes are connected with the hemisphere on the opposite side of their head.

For cetaceans such as dolphins and whales, unihemispheric sleep is the only way they can sleep; however, some marine mammals such as seals and sea lions can sleep on land, so they use a combination of unihemispheric and bihemispheric (both hemispheres) sleep. Fruit bats and some species of birds such as ducks and penguins also use unihemispheric sleep to avoid predation, and some migratory birds use unihemispheric sleep to rest during long flights. There is evidence to suggest that crocodiles are also capable of unihemispheric sleep and are more likely to use it in the presence of perceived threats such as humans.

Dr Jai Green-Barber is an experienced wildlife researcher with a PhD in animal behaviour. Jai's research is a combination of zoology, ethology, ecology, and demography. Jai is a unit coordinator and sessional academic at Western Sydney University and teaches a range of units in the natural science program.

Australian Wildlife Society Wildlife Ecology Research Scholarship

This $5,000 scholarship is awarded each year to University of Technology Sydney postgraduate research students who are undertaking a research project that is of direct relevance to the conservation of Australian native wildlife (flora or fauna).

The scholarship is provided to support operational costs associated with the successful candidate's research project, such as travel associated with the research project, fieldwork expenses, and specialist software and small items of equipment.

The winner for 2017 is Etsy Yanco, who is conducting a scientific research project in Australian wildlife ecology

Foxlights: A tool for coexisting with wildlife on production landscapes

Esty Yanco, MSc.

The inventor of *Foxlights* only wanted to sleep through the night without having to worry about his newborn lambs. He figured if he was able to create something that could mimic the presence of humans, maybe he could rest easy knowing that the foxes would stay out of his paddocks. From this, *Foxlights* was born.

Winner of the People's Choice award on ABC's 'New Inventors' program, *Foxlights* are a novel non-lethal wildlife deterrent used by farmers and ranchers worldwide who are committed to protecting their livestock and the environment. The wildlife-friendly device employs a series of randomly flashing light to protect livestock and poultry from predation at night. Invented in the Central Tablelands of New South Wales, *Foxlights* are now used in a range of livestock enterprises across the world, from the commercial grazing operations in the federal forests of the western USA to the nomadic herds of the Himalayas.

While sheep farmers are concerned about predation on lambs by native and introduced carnivores in Australia, evidence suggests that reducing human pressure on these species can benefit both farmers and wildlife, despite being initially counterintuitive. Likewise, kangaroos are lethally controlled across Australia's

Esty Yanco in the field.

agricultural landscapes to reduce grazing pressure. *Foxlights* can be used as a tool to protect production assets by warding off wildlife, but they can also contribute to conservation goals by reducing reliance on lethal methods of wildlife control, lowering management costs and enabling coexistence with wildlife. Though traditionally used in Australia to keep foxes away, *Foxlights* are also used in non-traditional ways to protect production while reducing lethal pressure on Australia's fauna. Examples include scaring ducks out of rice paddies, keeping flying foxes out of fruit crops and sheds, and deterring kangaroos from grazing in paddocks.

The adoption of non-lethal and wildlife-friendly farming methods is a growing global trend. Only by finding sustainable practices in shared landscapes that promote coexistence can we truly begin to halt the extinction crisis. This starts with reducing lethal pressure on wildlife by using non-lethal deterrents such as *Foxlights*.

The use of *Foxlights* worldwide has increased in response to the vocal support by innovative farmers, but their efficacy has not yet been scientifically evaluated. Questions outstanding are how efficacy varies for different species and how soon wildlife habituates to the device.

With the generous support of the Australian Wildlife Society Ecology Science Research Scholarship, and in collaboration with the founder and national distributors of *Foxlights*, part of my doctoral research is dedicated to examining these questions.

In an effort to reduce lethal control of Australia's wildlife on food production landscapes, we are interested in testing the response of different species to *Foxlights*, how long responses will last, and whether different species can habituate to the lighting system. We want to understand not only *Foxlights*' effect on predators but also their ability to reduce additional grazing pressure by native fauna. Accordingly, our study utilises non-invasive wildlife monitoring techniques to measure changes in wildlife behaviour in response to the activation of *Foxlights*. Our study design employs motion-sensored cameras to record wildlife activity while *Foxlights* are either activated or deactivated along the fence line of grazing paddocks. The camera trap array has so far captured over 300,000 images of kangaroos, wallabies, wombats, possums, birds and foxes, which are now being handprocessed for analysis.

Once the data is processed, we will model the relationship between wildlife activity and the presence of the *Foxlights* by comparing the metadata of each image (e.g., species, date, time) to the activation of the light deterrents. In other words, we will examine how the activities of different species change, both in space and time, in response to the presence of *Foxlights*.

Foxlights are part of a suite of non-lethal strategies that have the potential to reduce conflict between wildlife and food production systems – no single strategy works perfectly on its own – but adoption of wildlife-friendly management practices is a major step towards protecting Australia's wildlife. This project will test the efficacy of *Foxlights* on both predators and herbivores, contribute to the conservation and protection of native species and if successful, provide farmers with confidence in using non-lethal management tools to coexist with Australian wildlife.

Further information on Foxlights can be found at www.foxlights.com.

Esty Yanco is currently pursuing a PhD in socio-ecology at the Centre for Compassionate Conservation (CfCC) at University of Technology Sydney. Following years of wildlife veterinary training in Israel, Esty shifted her focus from rehabilitating injured wildlife to addressing sources of common wildlife injuries. She received her Masters in Science in Conservation Medicine, an emerging field that approaches wildlife health and conservation issues holistically by integrating all aspects of animal, human and environmental health into a comprehensive discipline, from Tufts University (USA) in 2016. Inspired by her conservation medicine background, Esty's doctoral research uses a holistic approach to analyse a leading example of a livestock farming system striving to be a sustainable agriculture model – wildlife-friendly farming. By reducing lethal control of wildlife and embracing local ecologies, wildlife-friendly farming fosters the improvement of shared health outcomes to achieve long-term food production potential and wildlife conservation goals. As part of the CfCC's goal to test the efficacy and sustainability of wildlife-friendly farming practices, Esty brings her holistic conservation medicine background to the CfCC with a project that explores the ecological, sociological and production benefits of wildlife-friendly farming.

2018 University Student Grants Scheme winners

The Australian Wildlife Society's University Research Grants are scholarships offered to honours or postgraduate students at Australian universities. Each year, ten grants of $1,500 are awarded. Grants are available for research projects of direct relevance to the conservation of Australian wildlife – plant or animal. Grants may be used for the purchase of equipment and consumables, travel expenses related to field research, or attendance at conferences at which you are presenting your work.

The Australian Wildlife Society is delighted to announce the winners of the ten grants of $1,500 each to honours or postgraduate students conducting research that will contribute to the conservation of Australian wildlife. The winners for 2018 are:

MICHAEL G. BERTRAM - School of Biological Sciences, Monash University
Project Title: Sex on steroids: Effects of a widespread agricultural pollutant on reproductive processes in fish

KIMBERLY CHHEN - School of BioSciences, University of Melbourne
Project Title: Preying upon a pathogen: The effects of species interactions on chytrid fungus

ANITA FREUDMANN - School of Earth, Environmental and Biological Sciences (Queensland University of Technology)
Project Title: Foraging ecology and behaviour of eastern tube-nosed fruit bats (*Nyctimene robinsoni*)

ANGELA HANSEN - University of Tasmania
Project Title: Plastic pollution in Australian waterfowl and wetlands

JACINTA HUMPHREY - La Trobe University
Project Title: Beyond the fringe: Temporal and spatial change in peri-urban land-use and avian communities

OLIVER JEWELL - Centre for Sustainable Aquatic Ecosystems, Harry Butler Institute, Murdoch University, Western Australia
Project Title: Functioning without food? Energy landscapes and foraging energetics of white sharks

PETER PUSKIC - University of Tasmania; Institute for Marine and Antarctic Studies (IMAS)
Project Title: More than skin deep: Examining the cellular-level effects of ingested plastic on the flesh-footed shearwaters of Lord Howe Island

ALEXANDRA ROSS - Centre for Ecosystem Science, University of New South Wales
Project Title: The Nailtail Nursery: Assessing a novel conservation strategy

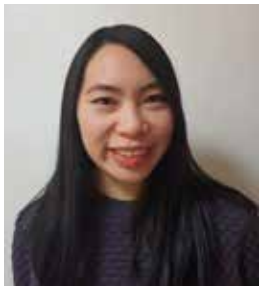
ANTHONY WADDLE - James Cook University
Project Title: Using emergent genetic tools to identify genes associated with resistance to chytridiomycosis

WYTAMMA WIRTH - James Cook University, Epidemiology
Project Title: Epidemiology of *Ranavirus* in Australian freshwater turtles









The Nailtail Nursery: Assessing a novel conservation strategy

ALEXANDRA ROSS
Centre for Ecosystem Science,
University of New South Wales

You may have never even heard of a bridled nailtail wallaby, but there was once a time when it was the most common species in eastern Australia. Today there are just 500 individuals left in the wild. Although land clearing has played a big part in their decline, their top threat is currently invasive predators like the feral cat and fox. In fact, **cats alone kill almost half of all juvenile wallabies**. We realised that in order to save the species we needed to focus on protecting that half. But how?

Sometimes we protect animals by building a fence around them to stop predators getting in, but fences can act like 'inland islands', and fenced populations tend to lose all their anti-predator behaviours. Have you ever seen the quokkas on Rottnest Island or the kangaroos at wildlife reserves? Sometimes they'll hop right up to humans without being scared! That's because they've been isolated for so long that they've lost their predator avoidance strategies, which actually makes them *more* susceptible to predation if they are ever faced with a real predator. We call this 'prey naïveté', and it's one of the key reasons why many conservation strategies fail.

So how do we protect a wild population of nailtail wallabies without turning them into a naïve population?

Introducing the Nailtail Nursery!

To protect vulnerable juveniles, a 'nursery' was constructed within one of the last remaining bridled nailtail wallaby populations. The nursery is fenced and predator-free and was designed to hold juveniles in the most vulnerable weight range (less than three kilograms) until re-release. At three kilograms and above, their survival rate increases from 47 percent to 80 percent as they become less vulnerable to feral cats. This means that we can **protect juveniles when they're most at risk of predation without creating a naïve fenced population**.

Bridled nailtail wallabies have distinctive markings, including the white and black stripe beneath their arms, giving them the name 'bridle'.

Juvenile bridled nailtail wallabies weigh less than three kilograms and are the perfect size for a hungry cat.

The Nailtail Nursery is the first of its kind and could herald a new era of conservation in Australia. Construction of the nursery was completed by the non-profit organisation WildMob in 2015, and since then over fifty individuals have hopped in and out of its gates.

There are many species in Australia which suffer from the dual threat of predation and prey naïveté, and the Nailtail Nursery may offer a solution that allows protection of a wild population without individuals losing anti-predator behaviour.

To assess the success of the nursery, I'm comparing nursery-raised and wild-raised individuals. I'm radio-tracking wallabies every month after release and checking their wariness using a 'flight initiation distance' comparison. I'm also analysing the size and growth of the population over the last decade to determine how effective the nursery is as a strategy not only for protecting vulnerable juveniles but also for increasing population size and saving the species from extinction.

I would like to express my gratitude to the Australian Wildlife Society, who have made this project possible! With their help, I am now able to continue this research and provide definitive answers on the success of the Nailtail Nursery as a novel conservation strategy.

The VHF radio-collars are lightweight and have been modified to include a weak link.

2014 Community Conservation Award

The award for 2014 was made to the WildMob of Brisbane. Although WildMob has a Brisbane base its work ranges from the Barrier Reef to Tasmania. They have focused their attention on saving endangered species. WildMob chooses to collaborate with partners as the most effective way of making a difference. Accordingly, they have collaborated with scientists, government departments, educational institutions (both schools and universities), environmental groups and volunteers. Their work began with eradicating invasive weeds on Brampton Island and, while the removal of weeds is still important, particularly in the educational work with students, the work of WildMob is now much more diverse. They have thrown their weight behind continuing the preservation of the bridled nailtail wallaby and are raising funds to build a nailtail nursery on Avocet station near Emerald. In Tasmania they are working at the mouth of the Arthur River in the north west of the State and have focused on weeding in areas of importance to the endangered orange-bellied parrot, surveying seabird populations, monitoring the number of feral cats and Tasmanian devils and gathering data on rare plant life such as endangered orchids. Where possible, educational talks are given to local groups.

Response from Andrew Elphinstone

The WildMob team is thrilled to receive this award from the Australian Wildlife Society. We are a small team of only eight people and we work across many projects ranging from Central Queensland to the Great Barrier Reef islands, and from Tasmania to Norfolk Island.

This award serves as a great motivator to continue giving everything we can to our projects and partners.

In all our project areas we work closely with the local community. We draw on their expertise as well as that of universities and industry partners. This is well known as the collective impact approach. It ensures we have the skills and background knowledge to determine what success looks like for each project.

Importantly, it also means that while we're working to save species now, we're also contributing to our overarching goal, which is to equip communities with the tools to manage their own environmental assets.

If you would like to find out more about us or join a conservation expedition visit www.wildmob.org

Plastic pollution in Australian waterfowl and wetlands

ANGELA HANSEN
University of Tasmania

Are Australian waterfowl eating plastic? That is a question I have been asked by school children, university students, professors, duck hunters and other people in the community. The reason why we are worried is that plastic ingestion by wildlife has become a big problem in ocean environments, and what is upstream of the ocean? Rivers, streams, lakes and wetlands of course, and our pollution makes its way downstream through many of these habitats to the ocean. My research is answering this question, and related questions, such as: how contaminated with plastic and metal pollution are important wetland habitats? Are Australian waterfowl still ingesting lead shot since the ban on the use of lead shot a decade ago? Are levels of lead and other toxic trace elements high enough to cause harm to the birds or to people who harvest them?

Birds are a very useful indicator species for monitoring habitat changes, such as human impacts on resource availability and pollution levels. In other parts of the world, including North America, Europe, and Africa, waterfowl have been used to monitor levels of toxic trace elements and plastic in their freshwater habitats. Here in Australia native waterfowl species are harvested annually by recreational hunters, providing an opportunity to answer some of these questions, while engaging citizen scientist hunters to provide the samples needed.

To answer my research questions, I have collected duck stomach samples from hunters, conducted shoreline surveys, and collected sediment and water samples from Moulting Lagoon, a relatively unpolluted and remote Ramsar wetland on the east coast of

Angela collects a spent shotgun shell during a shoreline survey of plastic debris from hunting and other human activities at Moulting Lagoon, Coles Bay, Tasmania.

Tasmania. For comparison, I will also collect duck stomach samples from Geelong, Victoria, near Melbourne to look for ingested debris in ducks collected near a major city.

Preliminary results have found no evidence of plastic ingestion in ducks from Moulting Lagoon, Tasmania, and a low incidence of spent metal shot ingestion. However, approximately half of the metal shot ingested was toxic lead, which can be very harmful to birds. Next steps are to measure concentrations of trace elements in the tissues of the ducks analysed from Tasmania, along with the sediment samples, to see if lead and other toxic trace elements pose a risk to the health of birds or humans. I will also analyse stomach contents from ducks collected in Geelong, Victoria, to see how they compare to the those of the ducks collected in Tasmania.

Wetlands are vital habitats with environmental, cultural, social and economic values here in Australia, but humans are impacting wetlands here and globally, causing degradation through over-use, development and pollution. The conservation of wetlands and wetland birds is vital to the health of upstream terrestrial ecosystems and the ocean downstream. Greater awareness and understanding of all the pressures from human activities such as pollution is invaluable for effective conservation and management efforts in the future. This project will help to illuminate the risks posed by plastic, toxic metal and trace element pollution to birds in Australia, and I am honoured to be awarded a University Grant by the Australian Wildlife Society in support of my research.

Are ducks eating plastic? Graphical abstract of research project by Angela Hansen.

Two hunters walk out to their hide on Moulting Lagoon for the evening shoot. Ducks and swans spot the surface of the lagoon in the background.

Moulting Lagoon is a temperate coastal saltmarsh and a vital habitat for waterbirds on the east coast of Tasmania. It is home to 80 percent of Tasmania's black swan population, supports numerous waterfowl and aquatic bird species year round, and is an important feeding and resting habitat for shorebirds during seasonal migrations.

Foraging ecology and behaviour of eastern tube-nosed bats (*Nyctimene robinsoni*)

ANITA FREUDMANN
School of Earth, Environmental and Biological Sciences
Queensland University of Technology

Although fruit bats (Order Chiroptera: Pteropodidae) play crucial roles in maintaining healthy forest dynamics by contributing ecosystem services such as seed dispersal and pollination, particularly the smaller and inconspicuous species remain considerably understudied. One such example is the subfamily of tube-nosed bats (Nyctimeninae), comprising species listed as Endangered, Vulnerable or Data Deficient by the IUCN. The need for research on their ecology has been emphasised in the Action Plan for Old World Fruit Bats (1992), yet the subfamily as a whole is still poorly understood.

Eastern tube-nosed bats (*Nyctimene robinsoni*) are native to the north-eastern coast of Australia. These frugivores easily manoeuvre through the dense understorey and subcanopy and may be important seed dispersers for plants that the large flying-foxes cannot easily reach. Unfortunately, information on these charismatic bats is dominated by anecdotes rather than rigorous scientific data. As their elusiveness and cryptic lifestyle (inconspicuous roosting habits and fast, agile flyers) complicate direct behavioural observations, virtually nothing is known about their mating behaviour and social lives. Their presumed solitary lifestyle is confounded by observations of multiple bats roosting together in the foliage. Home ranges are alleged to be small, yet individuals are frequently found caught on barbedwire fences in considerable distances from forest, indicating longer travel distances.

My project will make an important contribution to a better understanding of the foraging ecology and behaviour of eastern tube-nosed bats by investigating their habitat and resource use. To identify movement patterns and roost characteristics, bats are captured in mist nets and fitted with small, self-detaching glue-on GPS dataloggers (including a radio-transmitter). This allows me to locate the animals in their roosts daily and collect valuable data on their roosting behaviour until loggers detach and have to be retrieved to obtain the movement data. Overall project outcomes will be the identification of landscape utilisation patterns, home ranges and key habitat features of roosting areas.

The identity of bats found roosting together is confirmed using an established picture library of individuals, based on their unique wing spot patterns. Analyses of relatedness in the study population will provide first insights into the secret social lives of these bats and whether the observed roosting associations are explained by kinship. Pollen swabs from their fur and identification of food plants from faeces using DNA-metabarcoding will give an overview of their food spectrum. Integrating tracking and dietary data will elucidate the role of eastern tube-nosed bats as seed dispersers and potential pollinators, as well as identify their food sources and foraging grounds at the interface of rainforest habitat and an anthropogenic landscape in the Queensland Wet Tropics. Understanding their movements and foraging behaviour is crucial as even small bats can disperse relatively large seeds or pollinate over considerable distances, and thereby help maintain functional connectivity in fragmented landscapes.

Radio-tracking is used to find the roost sites and to retrieve the GPS tag once it has detached.

An eastern tube-nosed bat (*Nyctimene robinsoni*) roosting in foliage.

Using emergent genetic tools to identify genes associated with resistance to chytridiomycosis

ANTHONY WADDLE
James Cook University

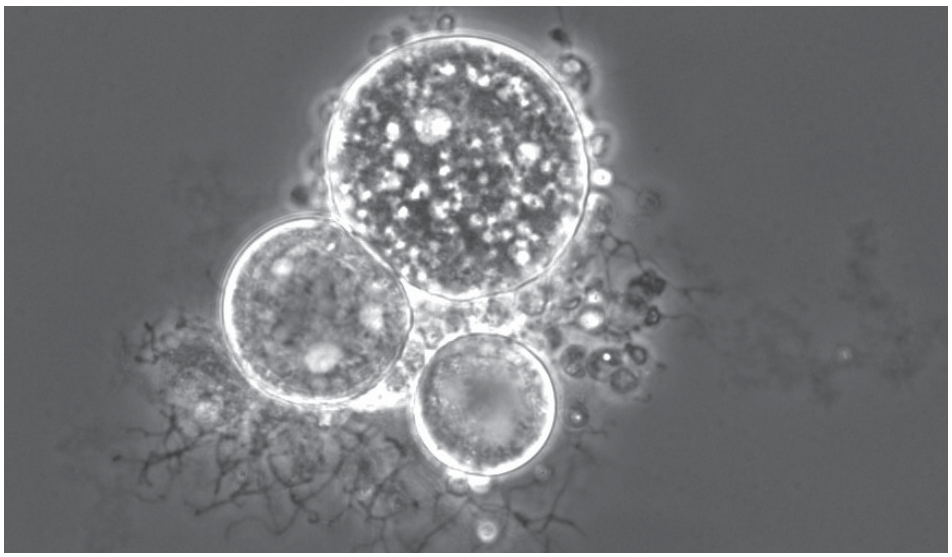
The amphibian chytrid fungus (*Batrachochytrium dendrobatidis* – *Bd*), which causes the disease chytridiomycosis, has had devastating impacts on amphibian populations and species worldwide. **Australia is particularly affected, with the pathogen having driven six species to extinction and causing the decline of 37 others.** For many persisting amphibian species that are highly susceptible to chytridiomycosis, the main reason they still exist is captive breeding and reintroductions. One such species, the critically endangered southern corroboree frog (*Pseudophryne corroboree*) has experienced precipitous declines since the arrival of *Bd* and is now functionally extinct in the wild. Though captive breeding and reintroductions allow for the persistence of a small number of frogs in the wild, mark-recapture data indicates that many of the frogs are still succumbing to chytridiomycosis. Without efforts to increase the survivorship of reintroduced frogs, this iconic species may never serve an ecological role in its former habitat and may ultimately go extinct.

My research will use a powerful comparative genomics approach coupled with disease challenge studies to identify gene regions associated with resistance to chytridiomycosis. These data will be a key to developing breeding programs aimed at producing resistant frogs and establishing wild, ecologically functioning *P. corroboree* populations.

About me:

My commitment to wildlife conservation stems from a life-long fascination with biodiversity. I grew up in fabulous Las Vegas, Nevada, which is better known for its casinos than its wildlife. This infamous city, however, is settled in a beautiful Mojave Desert valley and is located just a few hours away from the Grand Canyon and Death Valley national parks. Although not an intuitive place to start a career in wildlife conservation, many iconic and endangered species call these areas home, including amphibians! While in the United States, I became interested in research aimed at decreasing the negative impacts of chytridiomycosis on amphibian populations. To continue these efforts, I am now undertaking a PhD with the world-class researchers of the One Health Research.

The critically endangered southern corroboree frog (*Pseudophryne corroboree*).



Phase contrast micrograph of *Batrachochytrium dendrobatidis.*

Barred frog , *Mixophyes fasciolatus*, from south-east Queensland showing clinical signs of chytridiomycosis. Photo: Dr Lee Berger

Beyond the fringe: Temporal and spatial change in peri-urban land-use and avian communities

JACINTA HUMPHREY
La Trobe University

Increasing urban development is a global issue which threatens native wildlife. While some animals can adapt to life in the suburbs, many others are unable to persist in urban areas. What is it that excludes some species from living in our streets? What roles do housing density and native vegetation play? And can we predict which suburbs will be home to the greatest diversity and abundance of species?

Today, around 85 percent of Australia's human population resides in cities and towns, and these urban centres are expanding. Such expansion often occurs around the urban fringe of a city within what is termed the 'peri-urban' zone. Peri-urban areas are characterised by low-density housing within a mixture of agricultural land and native bushland. As development in these areas occurs in close proximity to natural habitats, it has the potential to impact the distribution and abundance of native species. Knowledge of how urbanisation affects fauna, and the factors that increase the likelihood of species persisting in urban environments, can assist in planning for more sustainable, wildlife-friendly cities.

Urban development has the potential to impact native birdlife due to an increase in housing density and a decrease in native vegetation.

Birds are a well-studied group in urban ecology and can provide valuable insights into the consequences of landscape change. Research to date has indicated that urban development has an overall negative impact on avian species richness, but may promote the abundance of urban-tolerant species. Much of this work, however, has been carried out in the northern hemisphere. Urbanisation in Australia is relatively more recent than in many European cities, so there is a need for further research into the processes of change associated with Australian urban centres.

The most recent *State of Australia's Birds* report indicated that many bird species in eastern Australia are currently in a state of decline. This is especially true for woodland birds, hollow-nesters and aerial insectivores – species likely to be affected by further development throughout the urban fringe. Conversely, Melbourne's human population is booming. By the year 2051, the population of Greater Melbourne is predicted to reach eight million people, at which point Melbourne will surpass Sydney as Australia's most populated city. Given the ongoing urban expansion required to meet the needs of this growing population, and the increasing pressure on native avifauna, it is vital that we, firstly, determine the extent and types of impacts of urbanisation on avian communities, and secondly, identify practical measures to conserve native birdlife in the face of future development.

My PhD research aims to investigate the influence of urban development on wildlife at the landscape scale, using avian communities in Greater Melbourne as a case study. I will test the relative influence of a) extent of native tree cover, b) housing density and c) the presence of waterways on the structure and composition of avian communities. I will conduct bird surveys in 30 suburbs around Melbourne along a series of urban–rural gradients. I will assess the influence of these landscape attributes on avian species richness and community composition, and on the occurrence of individual species. In addition, I aim to investigate the human perspective in wildlife conservation by quantifying the knowledge, attitudes and behaviours of local residents towards birdlife in different urban environments. Finally, by using historical bird data, I aim to investigate the change in avian communities over time around Greater Melbourne.

Overall, I hope that my research will help to generate practical advice for landholders, natural resource managers and local governments on how to conserve native avifauna as the city of Melbourne continues to grow. I am incredibly grateful for the financial support of the Australian Wildlife Society University Research Grant. This funding will be used to cover the costs my fieldwork travel throughout the upcoming spring field season. My research is also generously funded by the Field Naturalists Club of Victoria Environment Fund and the BirdLife Australia Stuart Leslie Bird Research Award.

About the author

Jacinta Humphrey is a PhD candidate at the Research Centre for Future Landscapes, La Trobe University. After completing her undergraduate degree in Wildlife and Conservation Biology, Jacinta was keen to pursue a career in applied conservation research. She went on to complete her Honours in Zoology studying the efficiency of detection methods for the threatened swamp skink (*Lissolepis coventryi*). She is interested in understanding how animals persist in, and adapt to, urban environments, and is passionate about improving the way our society coexists with native wildlife in and around cities.

As the city of Melbourne continues to expand, neighbouring natural environments may be at risk.

Some species are able to persist in urban areas, such as this little corella, photographed in suburban Melbourne.

Jacinta will be conducting bird surveys across the northern and eastern suburbs of Melbourne to gain a better understanding of how urban development impacts birdlife. Photo: Sui Lay, La Trobe University.

Preying upon a pathogen: The effects of a species interaction on chytrid fungus

KIMBERLEY CHHEN
School of BioSciences
University of Melbourne

Frogs around the world are currently experiencing a mass extinction event. Many frog populations have severely declined – some to the point of no return. The cause of this is the infectious frog disease, chytridiomycosis.

The frog killer

Chytridiomycosis, caused by the chytrid fungus, *Batrachochytrium dendrobatidis,* spreads through sperm-like zoospores in water. These zoospores infect the outermost layer of the frog's skin containing keratin. Once a frog has been infected, chytrid fungus can result in an imbalance of water and salts in the frog's body fluids. This then leads to cardiac arrest and ultimately, death.

Because it is a highly infectious disease, chytridiomycosis has been associated with the global extinction of around 200 frog species. Approximately 52 percent of vulnerable frog species found in Australia are also threatened with this disease.

While it has been decades since the identification of chytrid fungus, there are currently no practical methods to mitigate this disease. But a tiny water flea may just be the solution to this.

The predator

Water fleas are aquatic crustaceans known as *Daphnia*. They are commonly found in ponds and lakes around Australia. Like chytrid fungus, they are prevalent in winter but are predominantly absent in summer.

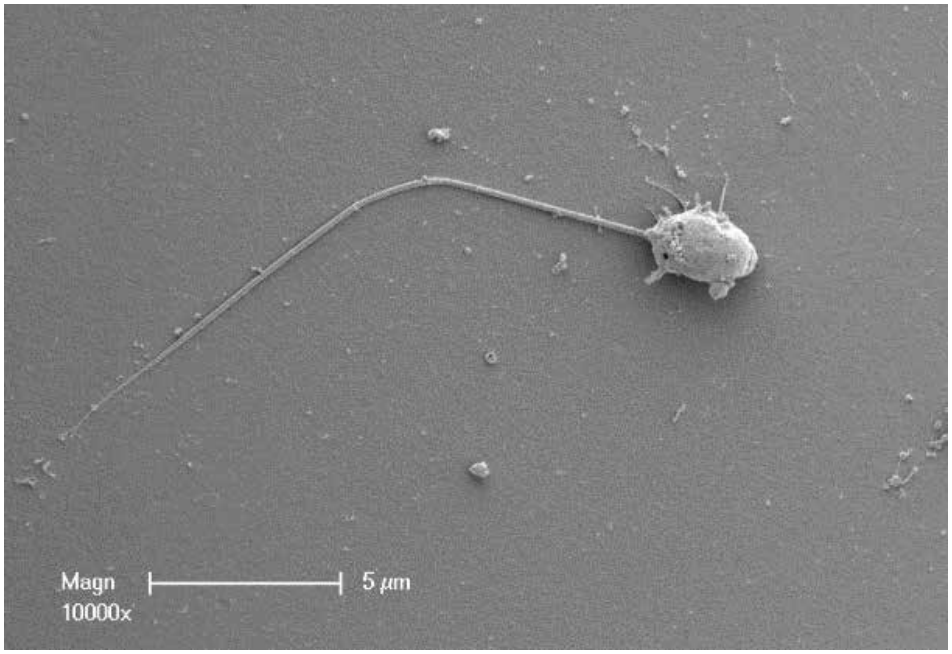
Being filter feeders, the water fleas also prey on chytrid fungus zoospores in the water. Therefore, they can potentially reduce frog infection rates by this disease. However, they are, in turn, preyed upon by the invasive eastern mosquitofish, *Gambusia holbrooki*.

The invader

The eastern mosquitofish was initially introduced from North America to control mosquito larvae. But like most introduced species, they were able to flourish and invade our Australian environment.

The eastern mosquitofish's destructive nature includes feeding on frog eggs and tadpoles. As such, they have been associated with the decline and disappearance of multiple frog species. They can also indirectly decrease frog populations by feeding on the water fleas. So where these invasive fish occur, the water fleas are often absent, allowing chytrid fungus to flourish.

A key characteristic of the eastern mosquitofish is their preference for dense aquatic vegetation. But this results in a trade-off. Dense aquatic vegetation may impede the fish's movement and access across the water column. As such, if water fleas were present, vegetation might also provide refuge for the water fleas to escape from the eastern mosquitofish. This, in turn, would lower the eastern mosquitofish's predation rate on the water fleas.



A chytrid fungus zoospore. Chytrid fungus spreads by releasing zoospores into the environment. These zoospores then infect the outermost layer of the frog's skin. Photo: Dr Matthew West

I have been catching eastern mosquitofish (*Gambusia holbrooki*) from ponds located around the University of Melbourne. Photo: Alison Fong

The investigation

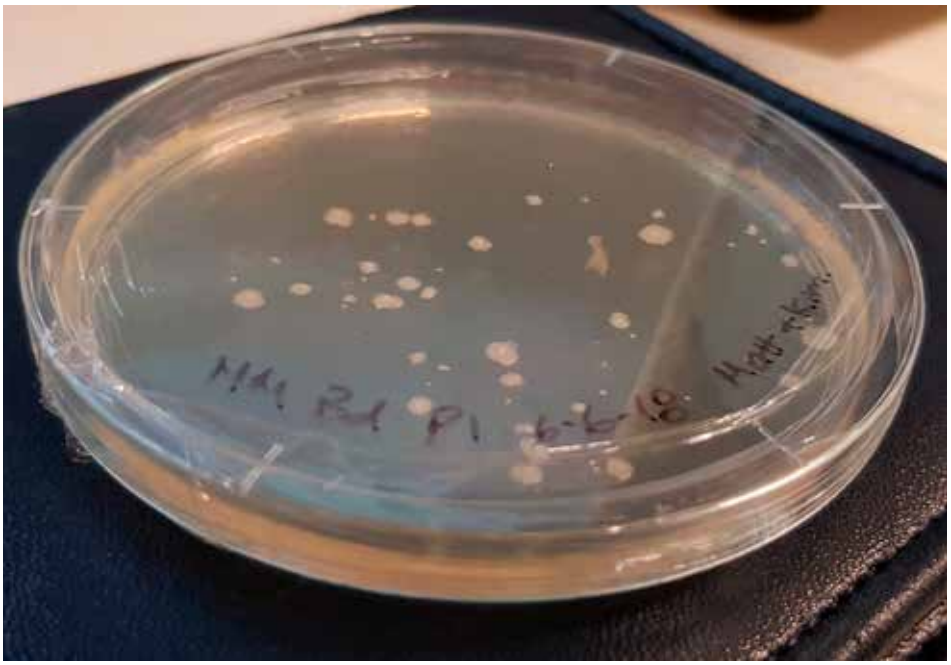
I will be researching the effects *Daphnia carinata* and the eastern mosquitofish will have on chytrid fungus, and likewise, whether vegetation can also indirectly impact chytrid fungus zoospore concentration in the water. To do this, I will measure chytrid fungus zoospore concentration in the presence of only the water flea, only the fish, and both species, with and without vegetation.

To conduct these experiments, I have been growing chytrid fungus cultures on agar plates. After growing them for a few weeks, I then harvest the zoospores and transfer them to a liquid medium. After another few weeks of growth, the end products are zoospores that I can use in my experiments.

I have also caught the eastern mosquitofish from ponds located around the University of Melbourne. Using these fish, I have conducted pilot studies to investigate the number of water fleas the eastern mosquitofish will feed on in 24 hours. This allowed me to determine the initial number of water fleas required for several of them to persist for 24 hours in the presence of the fish. Using these results, I have incorporated them into my primary experiments involving the chytrid fungus zoospores.

Based on my research and with the generous support of the Australian Wildlife Society, we will be able to clarify the role water fleas may play in controlling chytrid fungus in the environment. Likewise, how the eastern mosquitofish and aquatic vegetation may affect these outcomes. From our results, we may be able to encourage the revegetation of natural habitats, particularly in areas where frogs are also subject to habitat loss and degradation. Finally, we may be in the position to suggest whether water fleas have the potential to act as a biological control agent of chytrid fungus. Such results will aid current efforts to conserve our Australian frog species.

Daphnia carinata, an aquatic crustacean also known as a water flea. They can reduce the rate of chytrid fungus infection in frogs by feeding on zoospores released by the fungus. Photo: Sally Drapes



I have been growing a culture of chytrid fungus on agar plates. Photo: Kimberly Chhen

Female eastern mosquitofish (*Gambusia holbrooki*). An invasive species, the eastern mosquitofish has contributed to the decline and disappearance of multiple frog species. Photo: Kimberly Chhen

Sex on steroids: Impacts of hormonally active agricultural pollution on freshwater fish

MICHAEL BERTRAM
School of Biological Sciences
Monash University

Pharmaceuticals are used across the globe in human and veterinary healthcare, as well as for growth promotion in livestock. However, over the past decade, there has been a growing recognition that pollution resulting from the production and consumption of pharmaceuticals poses a major threat to wildlife, ecosystem function and human health. Furthermore, this issue is escalating, with the number of pharmaceutical doses dispensed per annum being predicted to reach 4.5 trillion by 2020, an increase of 24 percent from 2015 levels. This has been driven by a growing and ageing human population, as well as increasing use of pharmaceuticals in food production. Indeed, one of the leading sources of pharmaceutical pollution is run-off of veterinary pharmaceuticals used in agriculture.

While the use of pharmaceuticals in agriculture is primarily for the prevention and treatment of disease, currently, vast amounts of hormonal growth promotants are also administered to beef cattle worldwide. Among the most commonly administered growth promotants globally, including in Australia, is trenbolone acetate. After being implanted, trenbolone is broken down and excreted, and this excrement is often allowed to run off into freshwater systems. Trenbolone has frequently been detected in these systems at concentrations that are sufficient to affect survival, development and reproduction in aquatic species. Despite this, relatively little is known about the potential impacts of exposure to trenbolone – or pharmaceutical pollutants in general – on the behaviour of wildlife. This is concerning because behaviour is vital to individual- and population-level fitness, the functioning of ecosystems and the evolution of species. Furthermore, recent research has shown that animal behaviour is particularly vulnerable to disruption by exposure to low levels of pharmaceutical contaminants, such as trenbolone.

My collaborators and I use freshwater fish, and various other model species, to investigate the potential impacts of contaminants of emerging environmental concern on ecological and evolutionary processes in wildlife.

To address this, my collaborators and I exposed wild-caught adult male guppies (*Poecilia reticulata*) to an environmentally relevant level of trenbolone and tested for potential changes in reproductive behaviour. In standard reproductive trials (i.e. a male–female pair), recent studies have shown that exposure to trenbolone can alter mating behaviour in fish. However, in reality, natural mating systems are complex and very little is known about the potential for chemical pollutants, in general, to disrupt behaviour under more ecologically realistic reproductive scenarios, such as when females are encountered sequentially. Hence, we tested the response of exposed and unexposed males to sequentially presented large and small females. Because female guppy fecundity (i.e. brood size) increases with body size, larger females often represent better reproductive value and are generally preferred by males.

Fish were collected from Alligator Creek, Queensland, and allocated to either trenbolone-exposed or unexposed tanks within a flow-through system for 21 days. To investigate the potential impacts of trenbolone on sequential male mate choice, after the exposure period, we carried out video-recorded behavioural trials in two stages. In the first, a single male and a single stimulus (unexposed) female were placed into an observation tank and allowed to interact freely. The stimulus female was then removed and replaced with a second stimulus female, which was allowed to interact freely with the focal male. Males were presented sequentially with 'small' and/or 'large' females in four different combinations (small/small, large/large, small/large, large/small). Behavioural videos were analysed for the number of courtship bouts and coercive 'sneak' mating attempts performed towards females. Courtship bouts involve a male orienting his body towards a female while performing sigmoid mating displays to solicit copulations, while sneak attempts involve the male surreptitiously approaching a non-receptive female from behind and attempting to mate coercively.

We found that exposure to trenbolone disrupted reproductive behaviour in male guppies, although sequential mate choice was not affected at the tested dosage. More specifically, in the first presentation, regardless of trenbolone exposure, males demonstrated a preference for larger females by courting these females more often. Further, irrespective of female size, exposure was associated with a trend towards increased male sneaking behaviour. In the second presentation, males from both exposure treatments again demonstrated a preference for greater female size in terms of both courting and sneaking behaviour. Furthermore, exposed fish again performed more frequent sneaking behaviour towards females.

Guppies are an excellent model for investigating the impacts of chemical pollution. The physiological mechanisms that are targeted by drugs like trenbolone are highly conserved across diverse fish species (as well as other taxa), meaning that common species, like guppies, can be used as a 'proxy' for other organisms inhabiting contaminated systems.

We found evidence for sequential male mate choice, although this was not disrupted by exposure. This is because, regardless of exposure, males 'traded down' by significantly reducing the frequency of their courtship behaviour towards small females if they had previously encountered a large female. Considering the pivotal role that mate choice mechanisms play in population dynamics and broader evolutionary processes, this study highlights the need for a greater understanding of the potential impacts of chemical contaminants on sexual selection in wildlife populations.

We use flow-through exposures (pictured here), as well as long-term mesocosm systems, to expose fish to environmentally realistic levels of contaminants of emerging concern.

Functioning without food?
Foraging landscapes and movement energetics of white sharks

OLIVER JEWELL
Centre for Sustainable Aquatic Ecosystems,
Harry Butler Institute
Murdoch University, WA

Sharks are among the most important marine life forms, often moderating the numbers of other species and keeping ecosystems balanced in their role as top predators. However, the global demand for shark fins has driven down populations and today over 30 percent of pelagic species are at risk of extinction with the status of many other populations unknown. One of the biggest hurdles in shark conservation is a lack of basic understanding of the animals and the fear and misunderstanding spread by a never-ending stream of negative news stories, over-hyped television documentaries and an unrealistic portrayal of sharks as man-eaters in Hollywood movies.

As a marine scientist, I've spent almost my entire career striving to learn more about sharks while dispelling misperceptions whenever I can. This has taken me to South Africa, California and has now brought me to Australia, giving me a unique opportunity to study the three main populations of white sharks at their densest aggregation sites. My colleagues from Murdoch University, Monterey Bay Aquarium, Stanford University and the Dyer Island Conservation Trust and I have tagged almost one hundred individual white sharks with high-resolution biologgers, or animal tags, from sites such as Dyer Island in the Western Cape of South Africa to the Farallon Islands off the Californian coast. We fit these tags to white sharks, using a long pole to position a clamp over the dorsal fin as the shark swims by, usually distracted by a piece of bait or a seal-shaped carpet decoy. The

Oliver Jewell preparing to tag a white shark.

clamp then shuts securely on the fin and the shark swims off, immediately collecting data for us. The tags contain a suite of sensors and cameras that allow us to visualise the animal's movements in three dimensions and calculate where, when and how it interacts with its environment, and peeking into the private lives of sharks in a way that was previously inconceivable.

One difficulty with this type of tag, however, is that all the data is logged and stored within it, meaning if we can't get it back then we lose all the data! After a set amount of time, usually determined by how long until the next severe weather approaches or how far the shark is likely to swim, the tags detach from the shark's fins and rise to the surface where they float until we pick them up or they wash ashore. We can track the tags at sea with a satellite or VHF transmitter and bring them back to our field stations to download the data. A significant advantage of this method is that no part of the tag remains on the shark and the tags are completely reusable (as long as you can find them!). We often see sharks within days of the tags detaching with little or no sign that any clamps were ever placed on them.

Once we have downloaded the data, we can calculate measurements of swimming effort, such as bursts of speed, tail beats per minute and vertical velocities, while the camera allows us to determine what kinds of habitat the animals are using, such as reef systems or kelp forest, and what types of potential prey they encounter. We hope to produce research which is both new and important to the basic understanding of sharks as well as being beneficial to their management and conservation. Already these tags have taught us so much about these animals, and I feel myself growing as a scientist under the daily guidance of my supervisors.

The Australian Wildlife Society Student Grant has made a massive difference in the funding of this project and will play an important role as we progress towards adding Australian shark data to our database. Thank you so much for the support! You can follow the progress of the project on Research Gate (www.researchgate.net/profile/Oliver_Jewell) or Twitter (@JewellResearch).

A CATS (Customized Animal Tracking Solutions) Cam biologging tag being placed on the dorsal fin of a white shark as it swims past a cage diving vessel in Gansbaai, South Africa. Photo: Anna Phillips, Marine Dynamics.


A white shark in Gansbaai, South Africa with a CATS Cam in place. Photo: Chapple et al. (2015) Animal Biotelemetry.


Retrieving tags is always a great relief! Photo: Paul Kanive, Monterey Bay Aquarium

Alone at sea, when the world comes to visit

PETER PUSKIC
University of Tasmania; Institute for Marine and Antarctic Studies (IMAS)

There is an island, alone in the middle of the sea, far from the reach of many humans. If you were lucky enough to venture into the island's jungle and sit patiently on the forest floor beneath the palms and banyan trees, after dark an unlikely creature would emerge from a hole deep within the ground with an unlikely story to tell.

Arriving on this island is a surreal feeling. Its mountains rise from the ocean defying all expectations. When landing, the plane soars so close to the water's surface that you almost want to hold your breath in case you go under. Looking out the window, you can glimpse the cliffs and reefs below where tropic-birds dance by their precariously placed nests.

I travelled to Lord Howe Island in May 2018 to continue my research on anthropogenic impacts on our oceans. It seems the least likely location for this work to take place: the beaches are composed of golden sands, the birds and insects are unique and mostly endemic, and the jungle appears green and full of life. This island is paradise. Yet, if you walk through the forest, you need not look hard to find the influence of humans. The dirt is littered with junk – plastic items that have been thrown 'away' carelessly and without thought. But people did not bring these items here; this plastic was carried from land by wind and waves and ends up in the stomachs of the creatures nesting in the burrows – the shearwaters.

Palms and shearwaters: one does not exist without the other. The shearwaters meticulously engineer this island ecosystem through the excavation of their burrows.

I watch the sunrise with a wedge-tailed shearwater (*Ardenna pacificus*) fledgeling, another species of shearwater which inhabits Lord Howe Island.

With the assistance of the Australian Wildlife Society, I studied these incredible seabirds during my honours research year. I explored how the strong and elegant shearwaters undertake a migration from one side of the world to the other after only ninety days of life. I wondered how this was possible when they have never seen the ocean before and live on a diet of only fish and squid. Unfortunately for the shearwaters, many do not get this chance to migrate. Increasingly, their parent birds mistake marine plastic debris floating on the sea's surface for food and starve their chicks with a meal of toxic and sharp plastic.

This is what I have come to bear witness to: the impacts of plastic ingestion on flesh-footed shearwaters (*Ardenna carneipes*).

The first morning on the island was one of the hardest. We woke at dawn to walk stretches of the picturesque beaches across the island collecting dead and dying chicks, washed up in the waves – those that never made it out to sea. Upon inspection, every one of them had ingested plastic debris. This shouldn't be surprising: between 90 and 100 percent of this population ingests plastic. Nonetheless, to read about this is one thing, but to see it is another.

At night we venture out to the colony searching for the shearwaters. My supervisor tells me, "Once the calls of the shearwaters in the forest were deafening". Now, the forest is quiet, and the birds are "thin on the ground", though some persist. They run across the dirt with their wings stretched out, falling over tree roots and logs, even stumbling over their own feet.

These endearing birds are clearly not designed for life on land; the open ocean is where they soar free.

They are not designed to consume plastics, either. This year's record-holder is a 90-day-old chick with 94 pieces of plastic in its stomach(the highest ever recorded amount is more than three times that). Large pieces may puncture the stomach or cause a bird to starve, but plastic, when ingested, may also act as a toxic bullet: the chemicals that make up the plastic as well as those it has absorbed while in the ocean are allingested by the bird. In this way, even small amounts of plastic may pose great danger and unknown risks. This is what my research will explore: the consequences of ingesting plastics and the associated chemicals to the birds' organs, tissues and cells.

Working on the island takes an emotional toll on a person. There is rarely a dry eye in the lab when a shocking bird finds its way onto the necropsy table. To clear my head, I spent my precious spare moments on my third and fourth day exploring the cliff sides, the forests and the beaches, escaping the impacts of the world. Sunlight breaks through the canopy and dances on the palm fronds, to the side of the path, in clearings where shearwaters have dug their nests. These seabirds are ecosystem engineers, excavating vast sandy openings where nothing but the palm is permitted to grow. Amongst the sand and vegetation, balloon clips, bottle caps and an array of plastic items follow me to the beach

This year's record holder: a 90-day-old chick with 94 pieces of plastic in it (the highest amount ever recorded is more than three times that).

where even more plastic has drifted ashore. Here I stand, in the middle of the Tasman Sea, on an island whose small human population are conscious of their impact on the land, where conservation is integral to their way of life and an affinity for the island and all life is ingrained in the people.

I am alone on an island at sea, and the world has followed me here.

I spend seven more days on the island, each very much the same. Morning walk, lab work throughout the day, the search for birds at night, collecting plastics along the way. I have fallen in love with the shearwater all over again. Against all the odds, the power of the ocean and the pelagic gale-force winds, they return to this island every year to breed, but I fear the threat from plastic they now face is too overwhelming. Their population is in decline. Will even the lucky birds that are able to fledge and that have ingested only small amounts of toxic plastic ever return to breed? The question remains, how much plastic is too much plastic?

About the author

Peter Puskic is a research student at the Institute for Marine and Antarctic Studies, University of Tasmania. He studies seabirds as sentinel species to indicate the extent and impact of plastic pollution. His PhD project is titled 'More than skin deep: examining the cellular-level effects of ingested plastic on the Flesh-footed Shearwaters of Lord Howe Island'.

Lord Howe Island, New South Wales, sits alone in the middle of the Tasman Sea, yet it is frequently impacted by what the mainland throws 'away'.

Australian Wildlife Society
University Research Grants

INSTRUCTIONS FOR APPLICANTS

The Australian Wildlife Society University Research Grants are scholarships offered to honours or postgraduate students at Australian universities. Each year, ten $1,500 grants are awarded. Applicants wishing to become a member of the Society can do so at www.aws.org.au

Grants are available for research projects of direct relevance to the conservation of Australian wildlife - plant or animal. Grants may be used for the purchase of equipment and consumables, travel expenses related to field research, or attendance at conferences at which you are presenting your work. The grant is paid directly to the student.

PREPARING YOUR APPLICATION FOR A GRANT

Applications should be a maximum of 3-4 pages (12 point font), including a brief CV, and should be set out under the headings below.

APPLICATIONS EXCEEDING FOUR PAGES WILL NOT BE CONSIDERED.

Introduction: Briefly introduce the background to your research topic, specify the project's aims, and outline its importance to the conservation of wildlife.

Methods: Briefly outline your proposed methodology. We require only sufficient detail to demonstrate that your aims are achievable. Remember that the assessors may not be familiar with your field of research. You must also indicate that you have obtained (or at least applied for) any relevant research licences, permits or approvals (including animal ethics).

Schedule: Outline a proposed timeframe for the completion of your project, listing major milestones, including the submission of a final report to the AWS.

Budget: Itemise the expenses involved in conducting your research. Any funds already secured from other sources must also be declared. (This will not reduce your chances of success, provided there are necessary items in your budget that are not yet funded).

Brief CV: The final page of your application should consist of a short CV, which should demonstrate your ability to produce results of a high standard within a limited timeframe. Also include the details of two referees who can comment on the proposed project, one of whom should be your academic supervisor.

Please prepare your application as a single 'Word' document, and submit it as an email attachment to info@aws.org.au. For convenience, it would be helpful to name your file according to the format: 'Your Name AWS Grant Year', e.g. 'Joe Bloggs AWS Grant 2019'.

CLOSING DATE: APPLICATIONS ARE DUE BY 30 MAY EACH YEAR.

CONDITIONS OF SPONSORSHIP

Recipients of Australian Wildlife Society grants will be requested to acknowledge the Society's contribution in all publications and presentations arising from their project. In addition, recipients will be required to submit a brief report on their project to the Society for use in the Society's magazine, *Australian Wildlife.*

Australian Wildlife Society

(ACN 134 808 790)

Formed in 1909 and dedicated to the conservation of Australia's wildlife
Patron: His Excellency General the Honourable Sir Peter Cosgrove AK MC (Retd)
Governor-General of the Commonwealth of Australia

Australian Wildlife Society
Conserving Australia's Wildlife since 1909

110th ANNUAL GENERAL MEETING
AGENDA

Wednesday 6 March 2019
Commencing at 11.30am

1st Floor Meeting Room, NSW Masonic Club (Castlereagh Inn)
169 Castlereagh Street, Sydney, NSW

1. Welcome and recording of those present.
2. To receive apologies.
3. Minutes of the 109th Annual General Meeting held on Wednesday 7 March 2018.
4. President's Report for 2018.
5. Treasurer's Report for 2018. Receive and adopt the Balance Sheet and Income and Expenditure of the Society for the year ending 31 December 2018 in accordance with our Constitution.
6. Election for the Board of Directors of the Society:
   a) Stephen Grabowski retires in accordance with the Constitution (10.3) and being eligible, offers himself for re-election
   b) Assoc. Professor Julie Old offers herself for re-election to the Board after filling a casual vacancy (Constitution 10.5(b))
7. Amendment to the Constitution - 9.16 Right to appoint proxy.

   Subject to the Australian Charities and Not-for-profits Commission (ACNC), a Member entitled to attend at a meeting of the Company is entitled to appoint another Current Member as proxy to attend in the Member's place at the meeting. A proxy has the same right as the Member to speak and vote at the meeting and may be appointed in respect of more than one meeting.
8. Appoint the Auditors for 2019 - John Dickie and Co
9. Closure.

Issued by authority of the Board of the Wildlife Preservation Society of Australia Limited Trading as Australian Wildlife Society.

Patrick W Medway AM
HONORARY SECRETARY/CHIEF EXECUTIVE OFFICER
15 January 2019

All members are cordially invited to attend the annual President's luncheon at the conclusion of the Annual General Meeting.

National Office: PO Box 42, Brighton Le Sands NSW 2216

Tel: 02 9556 1537 **Mob:** 0402 435 049

Email: info@wpsa.org.au
Website: www.wpsa.org.au

Australian Wildlife Society
Conserving Australia's Wildlife since 1909

The President and Directors of the Board of the

Australian Wildlife Society

Cordially invite you to the

ANNUAL LUNCHEON

to celebrate 110 years of wildlife conservation

of the Society

Wednesday 6 March 2019
Commencing at 12 noon

in

Cellos Restaurant
Level 4, Castlereagh Inn Boutique Hotel
169 Castlereagh Street Sydney

RSVP by 26 February 2019. Booking and prepayment essential

Australian Wildlife Society
Conserving Australia's Wildlife since 1909

Acceptance form:

I am pleased to accept your kind invitation to the Annual Luncheon.

$.....for ..... Tickets at $70 per person
2 course - main, dessert and coffee. Includes a glass of wine, beer or soft drink. Additional drinks to be paid on consumption.

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BSB: 062 235
Account No: 1069 6157
Confirm details via email at accounts@aws.org.au

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To commit to being a part of our future, please complete this form. You may cancel your donation subscription at any time by notifying the national office.

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All donations of $2 or more are tax deductible.

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

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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.

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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 write to PO Box 7336, Mt Annan NSW 2567 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

Membership

Become a member of the Australian Wildlife Society
Simply fill out this form.

Australian Wildlife Society
Conserving Australia's Wildlife since 1909

Name: .....

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Telephone: ..... Fax: .....

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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)

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Amount $ .....

Donation $ .....

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PO Box 7336, MT ANNAN NSW 2567.
Email: accounts@aws.org.au Website: www.wpsa.org.au

Direct debit: **BSB:** 062 235
Account No: 1069 6157
Account Name: Wildlife Preservation Society of Australia trading as the Australian Wildlife Society

Membership Hotline: Mob: 0424 287 297

Note: All cheques to be made out to the Australian Wildlife Society

Consider - A Bequest

Another way which you can support the work of the 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 trading as the Australian Wildlife Society 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 trading as the Australian Wildlife Society.

"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.

TYLER, a male koala living near Toondah Harbour ferry terminal on Brisbane's bayside. Tyler was one of eight koalas included in a tracking program managed by the local Koala Action Group in 2017. It is possible to encounter koalas regularly in the area around the harbour in Cleveland which is where ferries depart for North Stradbroke Island. Photos: Chris Walker