AUSTRALIAN Wildlife

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Celebrating a new century of wildlife preservation in Australia

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

Tiliqua rugosa is a short-tailed, slow-moving species of blue-tongued skink found in Australia. Three of the four recognised subspecies is found only in Western Australia, where they are known collectively by the common name **bobtail.** See story on Page 24.

The **little cormorant** (*Microcarbo niger*) is a member of the cormorant family of seabirds. It forages singly or sometimes in loose groups in lowland freshwater bodies, including small ponds, large lakes, streams and sometimes coastal estuaries. Like other cormorants, it is often found perched on a waterside rock with its wings spread out after coming out of the water. The entire body is black in the breeding season but the plumage is brownish, and the throat has a small whitish patch in the non-breeding season. These birds breed gregariously in trees, often joining other waterbirds at heronries.

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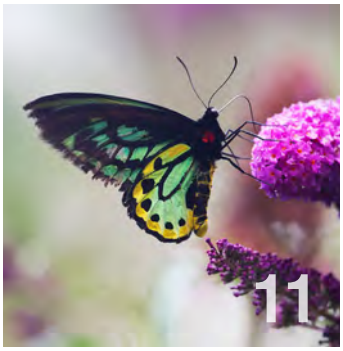

regulars

Suzanne Medway AM
Editor, Australian Wildlife

Sabine Borgis
Sub-Editor, Australian Wildlife

On the cover:
A female megachilid, *Megachile erythropyga,* provisioning her nest at one of Kit Prendergast's bee hotels.

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 2017

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

Over 90 percent of Australia's plant species, 87 percent of our mammals and 45 percent of our birds are endemic to the country.

Biodiversity, a shortened version of 'biological diversity' refers to the variety of life: variety in ecosystem types, the variety of species, and generic variety within a species. Every organism, big or small, plays a role. Our world is becoming less diverse. Due in part to human activities, the rate of extinction is accelerating rapidly.

Unlike previous mass-extinctions, this one is predominantly of our making.

The Red List (of the world's endangered species) produced by the International Union for the Conservation of Nature and Natural Resources (IUCN) shows Australia has the worst rate of mammal extinction of any developed country. Our geographic isolation has meant that over many millennia native flora and fauna have evolved to be uniquely adapted to Australia's landscapes.

Over 90 percent of Australia's plant species, 87 percent of our mammals and 45 percent of our birds are endemic to the country.

What we do and how we choose to do it matters a lot to other organisms – and ourselves.

The loss of one species can disrupt an entire ecosystem. For example, the honeybee is in decline due to a disorder that can wipe out an entire colony. There are many causes behind these collapses, making it tricky to find a solution. Research showing the chemical group of neonicotinoids (NNIs) as the main culprit has led to their ban in Europe with the USA also resolved to take action. But, here in Australia, there is no ban or even an investigation. Two years ago, in a historic move to save beleaguered bee populations, the European Commission enforced a continent-wide ban on NNIs. There is no ban on their use in Australia and no investigation into their use has been instigated here.

Honeybees pollinate about 90 percent of our edible crops and are integral for the production of one-third of the human diet. As well, many animals (including livestock) are dependent on bees for their food supply.

Deforestation

When we cut down forests for lumber, construction and farmland, we affect the homes of some 70 percent of the world's land animals. Their habitats may become fragmented or isolated, leaving them vulnerable to many threats. For instance, since European settlement, approximately 80 percent of Australia's eucalypt forests have been cleared. Almost none of the 20 percent remaining is protected, and most occurs on privately owned land.

Farmers have favoured the rich fertile lands along the eastern seaboard to have their farms, and urban development is also predominant there. Unfortunately, this is where the majority of koalas are already living because they favour trees in the same fertile soil.

Without the protection of eucalypt forests, koala numbers are in decline.

Climate change

Climate change is heating up and acidifying the world's oceans. This is bad news for coral reefs, which are sensitive to even small changes. When conditions change, corals expel the tiny algae living inside them. Since these algae provide corals with nutrients and bright colouring, their absence kills and 'bleaches' entire reefs – threatening the many species living on and around the reefs as well.

Weeds are a serious problem throughout Australia. Successful weed management requires a coordinated national approach which involves all levels of government in establishing appropriate legislative, educational and coordination frameworks in partnership with industry, landholders and the community. Photo: Patty Jansen

Rapid, human-induced climate change is one of the greatest threats to the long-term future of the Great Barrier Reef. Climate change has the potential to affect the Reef in many ways, including increased frequency of severe weather events, rising sea temperature, ocean acidification, and rising sea levels.

Invasive species

Whether introduced intentionally or accidentally, non-native plants and animals can dramatically alter ecosystems. They compete for space, light and food. They spread disease and even prey on native species.

Australia's native plants and animals adapted to life on an isolated continent over millions of years. Since European settlement, they have had to compete with a range of introduced animals for habitat, food and shelter. Some have also had to face new predators. These new pressures have also caused a major impact on our country's soil and waterways and its native plants and animals.

In Australia, feral animals typically have few natural predators or fatal diseases, and some have high reproductive rates. As a result, their populations have not naturally diminished, and they can multiply rapidly if conditions are favourable.

Feral animals impact on native species by predation, competition for food and shelter, destroying habitat, and by spreading diseases that native animals have no immunity to.

When we send animal cargo from one place to another, a disease can tag along. In 1998, scientists in Australia and Central America simultaneously identified a fungus as the killer of many different frog species in those regions. Today the fungus, which probably originated in shipments of African frog specimens, is killing amphibians worldwide. These losses can impact entire ecosystems.

Black market

Each year, poachers illegally capture or kill millions of animals to sell at great profit. Some species make expensive trophies or exotic pets. Others become ingredients in 'traditional' medicines or beauty products.

Trade in wildlife can pose a serious threat to Australia's unique biodiversity and plants and animals around the world. That is why Australia strictly regulates the international movement of animals and plants, and animal and plant products.

The illegal wildlife trade is a multi-billion dollar industry, and although Australia does not have the scale of poaching found in Africa or Asia, some species of birds and reptiles are highly sought after.

The main species which are under threat from the 'pet collector' market are Australia's parrots, cockatoos, snakes and lizards.

What can we do?

Our Society wants Australia's unique landscapes to be places where plants, wildlife and people can thrive.

One of our main goals is to reverse native species decline and help our unique native fauna and flora to thrive again. Not just the headline-grabbing animals like koalas and echidnas matter. Every creature from the smallest beetle to the biggest bird plays a role in keeping our landscapes healthy and productive.

We know that over time our landscapes have been degraded – creating serious problems for wildlife, native habitats and people. Our Society works in many ways to encourage, motivate and enable the right balance, including sustainable agriculture, pest and animal control measures, public education and community engagement.

Since the foundation of our Society in 1909, it has been our credo that the protection of Australia's precious native wildlife (flora, fauna and habitat) has to be enshrined in legislation.

Indian or common mynah. The range of the common mynah is increasing at such a rapid rate that in 2000 the IUCN Species Survival Commission declared it one of the world's most invasive species and one of only three birds in the top 100 species that pose an impact to biodiversity, agriculture and human interests. In particular, the species poses a serious threat to the ecosystems of Australia.

THREATENED WILDLIFE PHOTOGRAPHIC COMPETITION

Winners Announced

The Australian Wildlife Society Threatened Wildlife Photographic Competition is a national competition that awards and promotes endangered Australian wildlife through the medium of photography.

The Australian Wildlife Society invited photographers to raise the plight of endangered wildlife in Australia. Our Society aims to encourage the production of photographs taken in Australia, by Australians, which reflects the diversity and uniqueness of endangered Australian wildlife.

The annual judge's prize of $1,000 was won by Native Animal Rescue of Western Australia (Mike Jones, Black Cockatoo Coordinator).

The winning entry was a photo of a forest red-tailed black cockatoo named Makuru.

The forest red-tailed black cockatoo (*Calyptorhynchus banksia naso*) is listed as Vulnerable; only two of the five subspecies of black cockatoo are listed as Threatened on account of habitat destruction and competition for nesting hollows.

The photograph was taken in Native Animal Rescue's Black Cockatoo Facility (opened 2011 thanks to a generous grant from Lotterywest), which allows them to receive and care for injured or ill black cockatoos.

Makuru (a Nyungar word meaning The First Rains or Fertility Season) was the first captive-born black cockatoo at the facility in July 2016. The photo depicts the young cockatoo emerging from its breeding hollow at two months and 15 days.

Thank you to all the contributors to the Society's inaugural Threatened Wildlife Photographic Competition – please enter again next year.

A selection of the photographic entries is featured in the magazine

The annual people's choice prize of $500 was won by Matt White

Matt's entry was a photo of a greater glider (*Petauroides volans*). He photographed the glider in Brisbane, Queensland.

The reason Matt photographed the greater glider is that they are Australia's largest glider species and are at great threat of disappearing due to land clearing. The thing he likes about these animals is not one animal is the same and all have various colours. They range from standard black forms to the rare white colour. Their diet consists of eucalypt leaves, similar to the koala, which is also facing big challenges, especially in South East Queensland. Matt believes that our state and federal governments need to do more to stop habitat loss as gliders need hollows which are only found in trees hundreds of years old.

Matt Wright lives on the Gold Coast in Queensland and is an avid wildlife photographer. He spends most of his free time out amongst nature looking for wildlife to learn about and photograph. He enjoys the challenges of trying to find the animals in the specific habitats they live in and even more trying to get a beautiful image of them.

Greater bilby (*Macrotis lagotis*)

Photo by Jasmine Vink

A greater bilby, listed as Vulnerable, from the Arid Recovery reserve in South Australia. Bilbies used to be found on 70 percent of mainland Australia, but a combination of cats and foxes saw drastic reductions in population through the early to mid-1900s. A small number of bilbies persist with feral predators, but most are found in predator-free reserves. These reserves are extremely important to create sustainable and self-sufficient populations of endangered species until we can figure out how to manage cats effectively.

Collared delma (*Delma torquata*)

Photo by Jasmine Vink

Reptiles are overlooked, and this is especially true for species such as the collared delma. This tiny legless lizard lives under rocks, logs and in the thick leaf litter of South East Queensland. Its habits makes it extremely elusive and not easily found. Extensive land clearing through this region has led to this species being classified as Vulnerable under the EPBC Act. Jasmine hopes to bring awareness to our less charismatic species which are equally deserving of our attention and support.

Rosenberg's monitor (*Varanus rosenbergi*)

Photo by Matthew Higgins

Rosenberg's monitor (also called the heath monitor) is listed as Threatened throughout most of its range in Australia: in New South Wales, Victoria and South Australia. Matthew has been studying these goannas in the Australian Capital Territory, where he discovered a population on Mt Ainslie almost in the centre of the national capital. During January-–February 2016 he took the first photos of breeding activity by this species ever taken in the Australian Capital Territory. Matthew witnessed the female laying eggs in a termite mound, then the female guarding the mound against predation including by other monitors (she was joined by her male partner for some of this time). Eight months later, in September-–October, he recorded the hatching of the eggs and emergence of the young and their dispersal into the bush, which is the subject of the photo. The hatchling, therefore, represents a new generation of a threatened species going forth. The adults grow to 1.5 m; the hatchlings are about 25 cm. The project received substantial media coverage by the Canberra Times newspaper and ABC television news.

Orange-bellied parrot (*Neophema chrysogaster*)

Photo by John French

While spending the Christmas-–New Year period with his son in Melbourne, John took the opportunity to visit Healesville Sanctuary. The Sanctuary has a breeding program for the orange-bellied parrot – one of only two species of migrating parrot in Australia, the other is the swift parrot. Both these species are listed as Threatened. The orange-bellied parrot is on the verge of extinction in the wild – there are thought to be currently less than 20 birds. John stayed in the walk-in aviary at Healesville for ages – transfixed by the exquisiteness of these little parrots. The joy of seeing their beauty for the first time was levelled by the thought that he (and anyone else) would probably never get to see a flock of these gorgeous birds in their native habitat.

Southern brown bandicoot (quenda) (*Isoodon obesulus*)

Photo by Joanne Brazier

Gooseberry Hill in Western Australia has a native vegetation corridor that allows the quenda to freely roam this beautiful hills location. Bandicoots are mistaken for rats and mice then poisoned and trapped because of this misidentification. Joanne would love to be able to save these beautiful native marsupials by sharing the wonder of them through photographs and education. With gestation as little as 12 days, even Google is not aware of the wonder of our beautiful native marsupial – it's about time we changed that.

Richmond birdwing butterfly (*Ornithoptera richmondia*)

Photo by Ross Coupland

The Richmond birdwing butterfly is threatened by habitat loss and degradation – now restricted only to the remnant rainforest patches in South East Queensland and northern New South Wales. The larvae are susceptible to poisoning from feeding on introduced Dutchman's pipe vine, which resembles their only two endemic native food plants. It is a spectacular species, large and colourful and a joy to see in the wild. This individual was photographed while Ross was away on Christmas holidays at Springbrook National Park in South East Queensland. It was readily feeding on buddleja flowers around the guesthouse throughout the day, but Ross only managed one good photo. He wanted to get a photo as it is such a rarely seen and spectacular species which needs to be saved.

Green-thighed frog (*Litoria brevipalmata*)

Photo by Ross Coupland

This is a species of frog Ross hoped to find and photograph one day, and after many failed attempts he managed to locate one south of Brisbane in city council bushland. It is a beautiful ground-dwelling tree frog that can be hard to find due to its small size and particular habitat requirements. The frogs are also very specific about which weather conditions they will appear in, preferring extremely wet nights in areas prone to flooding. Their distribution has become extremely fragmented due to urban and highway development. This has destroyed suitable habitat and has led to the restriction of movement between populations, therefore reducing genetic diversity and in turn increasing the risk of disease. It is listed as Endangered by the IUCN and there is currently no management plan in place for the recovery of this species.

Fleay's barred frog (*Mixophyes fleayi*)

Photo by Amy (Kit) Prendergast

Fleay's barred frog is classified as Endangered on the IUCN Red List of Threatened Species. Like many anurans, it has suffered declines due to the devastating emergent infectious disease chytridiomycosis, caused by the chytrid fungus Batrachochytrium dendrobatidis. Sharing a similar fate with other frogs across the globe, and indeed in Australia, it has suffered from habitat loss and is now restricted to small, isolated pockets of rainforest in New South Wales. This photo was taken on a bamboo property near Bonalbo, close to the biodiverse Northern Rivers region of New South Wales. Kit discovered it on a night-time biodiversity hunt near a small dam and was enamoured by this large charismatic patterned frog. Further research following the discovery revealed its dire conservation situation but also provided hope: monitoring has revealed that this species has undergone a degree of recovery in numbers.

Western ringtail possum (*Pseudocheirus peregrinus occidentalis*)

Photo by Robert McLean

The western ringtail possum is now listed as Critically Endangered in Western Australia. Habitat loss, predation by feral animals and car strikes are taking their toll on this native, and drastic steps need to be taken to ensure its survival into the future. Robert managed to spot this possum in a stand of sheoak on a recent trip to Albany.

Dingo (*Canis lupus dingo*)

Photo by Nicole Manteit

The dingo is listed as Vulnerable. The photo of this dingo pup was taken at the Dingo Discovery and Conservation Centre in Toolernvale, Victoria, which is an important sanctuary where people can learn more about these beautiful animals. Nicole photographed the dingo pup because she wants people to realise dingos are an important part of the Australian ecosystem, not a pest. She wanted to capture their unique personalities and natural beauty.

Broad-shelled turtle (*Chelodina expansa*)

Photo by Claudia Santori

This photo is of a juvenile broad-shelled turtle, which is a very rare Australian freshwater turtle living along the Murray River. Out of the three species that live in the river, the broad-shelled turtle is found in the lowest numbers, and because of this, it is listed as Vulnerable under the *National Parks and Wildlife Act 1972* and as Endangered under the *Victorian Flora and Fauna Guarantee Act 1988.* These turtles suffer from a variety of different threats, including fox predation of their eggs and vehicle collisions.

Numbat (*Myrmecobius fasciatus*)

Photo by Robert McLean

This photo is of a litter of young numbats sunning themselves at the entrance to their burrow in Dryandra Woodland, Western Australia. Robert watched this family grow until they eventually dispersed to find territories of their own. Numbats are listed as Endangered, their main threats being predation by introduced predators and habitat destruction. Robert came across this female numbat with pouch young late one afternoon and managed to get a few photos before she disappeared into the bush.

Green and golden bell frog (*Litoria aurea*)

Photo by Leesa (Lisa) Pratt

The green and golden bell frog is a large, stout frog, approximately 45–100 millimetres long. It features a gold or cream/white stripe along its side, with a narrow, dark-brown stripe beneath it. It is blue or bluish-green on the inside of the thighs. Its body is vivid pea-green, splotched with metallic brassy brown or gold. The backs of some individuals may be entirely green, while in others golden-brown markings dominate. Since 1990 there have been approximately 50 recorded locations in New South Wales. Large populations in New South Wales are located around the metropolitan areas of Sydney, Shoalhaven and the mid-north coast. There is only one known population on the New South Wales Southern Tablelands. This photo was taken at Australian Reptile Park at Gosford.

Grey-headed flying-fox (*Pteropus poliocephalus*)

Photo by Marcia Riederer

The grey-headed flying-fox is considered Vulnerable in Australia, mainly due to lack of suitable habitat. In Melbourne, the animals roost along the Yarra River and fly overnight foraging. This particular individual visited Marcia's backyard apple tree regularly. It created the perfect opportunity to observe and take a photo of the bat eating.

Spotted-tailed quoll (*Dasyurus maculatus*)

Photo by Amber Gillett

This photo was taken in Maryland National Park on the border of New South Wales and Queensland. These endangered quolls exist in very low densities in this very small and isolated park, which is surrounded by farmland, and appear to have undergone significant declines over the past ten years. Amber is a wildlife veterinarian and an ecologist who has conducted two surveys in the park. She has radio-collared and monitored a small number of quolls during the past two years to determine how they use the national park and surrounding farmland, and to see if there are important areas of habitat to protect. 'Evan' (featured in this photo) was one of the few collared quolls helping to find out more about these rare, endangered and amazing animals. Amber took the photo at his release. It is extremely hard to capture images of spotted-tailed quolls in New South Wales and Queensland as their numbers are much lower than in Tasmania, where they are more commonly seen.

Southern cassowary (*Casuarius casuarius*)

Photo by Lyndal White

The southern cassowary is evaluated as Vulnerable on the IUCN Red List of Threatened Species. It is estimated that less than 2,200 cassowaries remain in their habitat situated between Mission Beach, Cooktown and Cape York in northern Queensland. The low numbers are due mostly to loss of habitat, road traffic and vehicle strikes, dogs attacking and killing adults and chicks, and feral pigs damaging habitat and killing chicks. Only 20-–25 percent of their natural habitat remains, and this is under pressure. This photograph was taken just outside Millaa, Atherton Tablelands, Queensland.

Swift parrot (*Lathamus discolour*)

Photo by Beau Jordan Meney

In winter 2016, Beau visited a local suburban street north-west of Melbourne scanning flowering roadside yellow gums for the critically endangered swift parrot, which had recently begun arriving on the mainland in its annual migration from Tasmania. Beau managed to capture this brief moment of a juvenile swift parrot pausing from feeding on nectar in the setting sun. The rare nature of this species and its vibrant plumage were the main motives for capturing this photograph. The swift parrot is at high risk of extinction, with wild population estimates believed to be less than 2,000 mature birds. The decline of this species is largely due to habitat loss throughout its mainland and Tasmanian range. Observing such a highly threatened species existing on people's doorsteps highlights the importance of both retaining and enhancing existing native habitat within our urban landscapes by planting locally native vegetation.

New Zealand fur-seal (*Arctocephalus forsteri*)

Photo by Leesa (Lisa) Pratt

The New Zealand fur-seal is an otariid seal which preys predominately on fish and cephalopods both in shallow inshore waters and around the continental shelf. The species utilises rocky habitats as breeding and haul-out sites. In Australian waters, the species has been reported from Western Australia, South Australia, Victoria, Tasmania, New South Wales and Queensland (south of Fraser Island). The seal population suffered a severe decline as a result of commercial sealing from 1798 until protection measures were introduced in Western Australia in 1892 and in South Australia in 1919. It is only recently that the species has shown signs of comeback. The New Zealand fur-seal is threatened by commercial and recreational fishing operations, particularly through bycatch mortality. The species also is threatened by entanglement in or ingestion of plastic debris. This beautiful photograph is of 'Benny', resting on location at the Opera House in Sydney.

Tasmanian devil (*Sarcophilus harrisii*)

Photo by Leesa (Lisa) Pratt

The Tasmanian devil is a carnivorous marsupial. While it was once native to mainland Australia, today it is only found in Tasmania. It became the largest carnivorous marsupial in the world following the extinction of the thylacine in 1936. It has a stocky and muscular build, black fur, pungent odour, is extremely loud, has a keen sense of smell and is ferocious when feeding. The devil's large head and neck allow it to generate among the strongest bites per unit body mass. It hunts prey and scavenges carrion. Usually solitary, it sometimes eats with other devils and defecates in a communal location. The devil thermoregulates effectively and is active during the middle of the day without overheating. Despite its rotund appearance, it is capable of surprising speeds and endurance, plus it can climb trees and swim across rivers.

Bridled nail-tail wallaby (*Onychogalea fraenata*)

Photo by Linda Dennis

This species is listed as Endangered in Queensland (*Nature Conservation Act 1992*) and nationally (*Environment Protection and Biodiversity Conservation Act 1999*). In the mid-nineteenth century, the bridled nail-tail wallaby ranged from the Murray River in the south to Charters Towers in the north and was common over part of the range. Today, it is restricted to a small pocket near Dingo in central Queensland. This photo was taken at Safe Haven AACE is in Mt Larcom, Queensland, where a successful breeding program is in place for the species.

Powerful owl (*Ninox strenua*)

Photo by Laura Ainsley

The powerful owl is listed as Threatened in Queensland. This photo was taken in Bunyaville, Queensland. The Powerful Owl mates for life (over 30 years in some cases) and pairs defend an all-purpose territory year-round. The male prepares the nest, which is usually a vertical hollow in a large old tree, and provides the female and young with a constant supply of food during the early part of the nesting period. The female incubates the eggs and broods the young, emerging later in the nesting period to hunt for food as well. Young birds remain with the parents for several months after fledging and may stay within their parents' territory for over a year.

Ghost bat (*Macroderma gigas*)

Photo by Kymberly Robinson

The ghost bat has just been upgraded to the status Endangered in Queensland. The ghost bat is the only carnivorous bat in Australia. Mt Etna National Park is one of few places where ghost bats roost and use the cave as a maternity ward. Kymberly chose this photo because bats are not often a well-loved animal and this photo shows their cute and unique features. The photo was

Megachile (Austrochile) rottnestensis

Photo by Kit Prendergast

Evidence (mainly from Europe and America) demonstrates declines in distribution and abundance of bees, leading to listing some species as threatened with extinction. There have been virtually no assessments of the conservation status of Australia's native bees; their diversity and ecological requirements are woefully unknown. As they share some factors known to threaten bees elsewhere on Earth (e.g. habitat destruction and fragmentation, pesticides, climate change), it is likely some Australian bees warrant being listed as Endangered too. This bee was photographed at Shenton Park in Western Australia, an area of remnant bushland threatened by urban expansion. Kit is studying native bees in the urbanised south-west Western Australia biodiversity hotspot to help inform management decisions to protect our native pollinators and identify bees of conservation concern. Like this bee, Kit hopes Australia's native bees are 'holding on' and will continue to do so into the future, despite the threats they currently face.

Hawksbill turtle (*Eretmochelys imbricata*)

Photo by Marcia Riederer

The hawksbill turtle is listed as Vulnerable in Australia, mainly due to damage to coastal habitat, over-fishing and predation of nests. Lady Elliot Island in the Great Barrier Reef is a turtle refuge, where sea turtles of different species come to breed and feed. The clear and shallow waters created the perfect opportunity to observe and take a photo of the curious turtles that like to check out the snorkellers.

Square-tailed kite (*Lophoictinia isura*)

Photo by Danny McCreadie

Listed as Endangered in South Australia, there are estimated to be fewer than ten square-tailed kites in the state. In the 2016 breeding season, only one known nest was successful, resulting in one chick fledging. Historically they have experienced decline from habitat loss because of their preference for woodland habitat, which in South Australia has been cleared for agriculture. In addition to habitat destruction, records from the 1950s reveal square-tailed kites having been shot and nests raided by egg collectors. The kite photographed is one of a pair that has returned to the same nesting area for several years and has been recorded as raising two chicks most years. As little is known about the kites' feeding requirements and the ecosystem which supports them, Danny has been providing researchers with photographs of their behaviour around the nest area. Here they take a break from nest-building to mate.

The curious wombat

Spending carefree days in the Blue Mountains bush instilled a love for Australia's wildlife in Jacqui, particularly for the curiously rotund wombat. When she discovered that one of Australia's three wombat species is critically endangered with less than 200 remaining, she resolved to do something about it.

In 2005, Jacqui came one step closer when, as a member of The Wombat Foundation, she became one of a handful of people at that time ever to come face to face with a northern hairy-nosed wombat at Queensland's remote Epping Forest National Park.

Jacqui said, "I remember that I was out there for two weeks only and I was determined to see a wombat. These animals are notoriously secretive. When late one night, the spotlight finally revealed a rustling in the grasses and a wombat's rump scuttling away, I was so happy!"

While the days were scorching and the park facilities basic, Jacqui was now hooked.

A few years later, she seized the opportunity to take on a role on The Wombat Foundation board and has never looked back.

Above: Northern hairy-nosed wombat. Photo: Phil Baily

The Wombat Foundation is the only organisation dedicated exclusively to saving the northern hairy-nosed wombat, Queensland's most endangered mammal.

Jacqui said, "We're a small team, so we rely on the input and generosity of so many people to fund conservation and research. We're really the gateway to the community, and I have to say that ten years ago when I asked people what they knew about the northern hairy-nosed wombat, I was often met with a blank gaze. These days, more and more people know and, most importantly, actively support its conservation."

Earlier this year, The Wombat Foundation held a successful crowdfunding campaign that ended up raising more than $25,000 to progress the search for a new site for the wombats.

"It was really timely. We've seen 15 years of slow and steady population growth, and we're now at 240 wombats. However, most of the wombats remain in a single population at Epping Forest National Park."

While they are surrounded by a predator-proof fence, the species remains at serious risk in the event of fire, flood or disease outbreak. What's more, The Wombat Foundation estimates that by 2020, they will run out of room to grow at the single site they currently occupy.

"We want to see them living happily in communities across their former range, and we need to act now".

Website: wombatfoundation.com.au.
Email: enquiries@wombatfoundation.com.au

Jacqui has a longstanding affinity with wombats and is committed to campaigning for wildlife. She works for World Animal Protection.

Jacqui in 'whiskers' for Hairy Nose Day. The Wombat Foundation's flagship public engagement event, Hairy Nose Day, is held every year on 11 May. You can join us with The Wombat Foundation and Wear Whiskers for Wildlife to shine the spotlight on the plight of the northern hairy-nosed wombat and Australia's endangered wildlife.

Iddy-bitty birds of the South West

Part II

Chrissy Banks

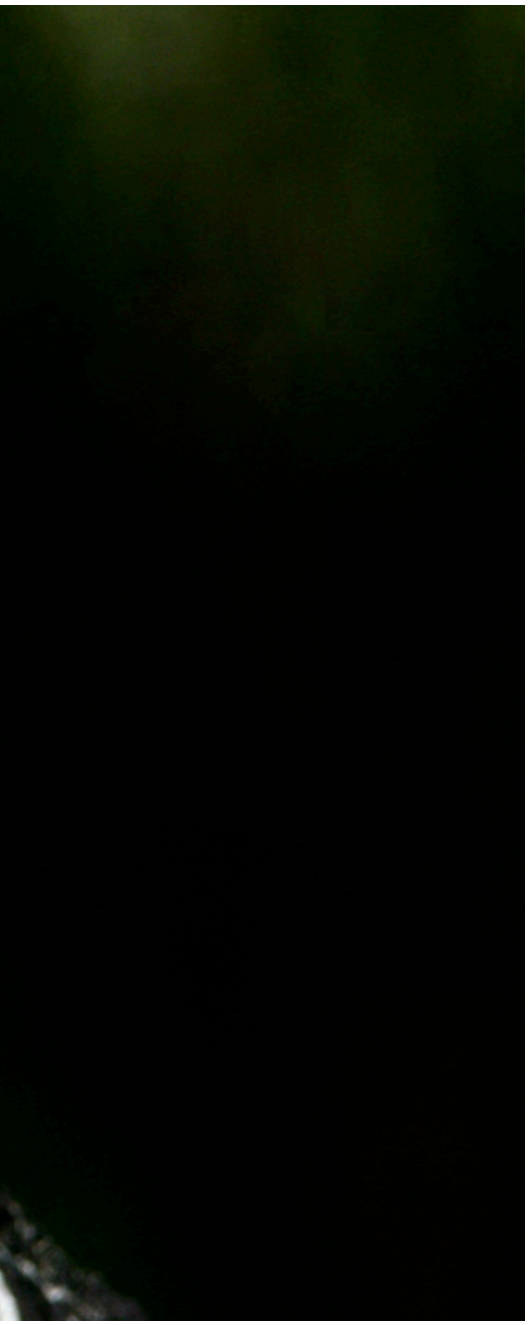
Recently, I watched a documentary on Wild Columbia and was simply amazed by the vibrancy and colour of the wildlife, a seemingly endless array of exotic creatures endemic to their country. Enthralled, I saw a small bird beat its wings one hundred times a second to create a whistling sound, not from its vocal abilities but from the tail feathers themselves. Incredible. A golden dart frog lapped up semi-poisonous ants and termites to top up its own incredible poison so potent it will kill most animals, including fully-grown humans. This frog is tiny, no more than 5.5 centimetres. It is truly a land of wonders, but no more so than our own home – the beautiful Great Southland, Australia.

Did you know that aside from the fact that we have some of the most curious creatures in the world, such as the platypus, the kangaroo, the koala and the frill-necked lizard to name a few, we have 828 known species of bird, a number that does not include the introduced species. How incredible! One fascinating aspect of our birdlife is the amount of subspecies living here, for example, we have approximately 80 *different wren species* in about twenty genera. And that's just the birds.

We are a country *rich* in wildlife treasures, from our oceans to our mountains, from our skies to beneath our earth we are jam-packed with creatures of all varieties. And slowly, article by article, I am enjoying bringing them to you to discover and learn a small amount – to put them on your radar so that your curiosity compels you to investigate them further.

In the last article, I introduced you to the stunning splendid fairy-wren in the first of this two-part article on our little feathered friends in the south-west of Western Australia. Here, in part two, allow me to introduce you to two more.

First up, the stunning red-eared firetail (*Emblema oculata*). I remember the moment I first laid eyes on this tiny little bird. The family and I had surrendered ourselves to the beauty of the ancient Tindle and Karri forest in Walpole–Nornalup National Park. The day was overcast, and the remnants of an earlier shower dripped from every living thing, including us. The air was rich with the smell of the forest, a fragrance so pure it awakened our senses; we felt alert, energised, *alive!* Shrugged deep within our coats against the cold, our footsteps were muffled on



padded paths of moss, vegetation and softened earth, which is probably why we were able to come across the firetail without it taking flight. We heard it before we saw it, a tiny peeping cheep and flutter, then there it was, a bird I had never seen before.

It was small, no more than 130 millimetres, predominantly brown with thin soft black barring across the head, chest and back – a design known as vermiculations; a perfect camouflage coat for its surroundings. But that was where the 'dullness' ended. A thin black line traced the top of its beak and eye encircling a white eye-ring. The beak was bright red matching perfectly to the splash of red sweeping away from the eye, the red rump and the stunning red top feather in the tail. The abdomen was soft black, speckled with white dots that changed to black and white bars beneath the tail. In a word, it was *captivating*.

We didn't move, we barely breathed, as it hopped about in front of us, searching the path for edibles and chirping to an unseen mate. Then, suddenly, it flew away and the spell was broken. We looked at one another and smiled, sensing we'd just seen something special.

And we had.

This is one of Australia's most solitary grass finches, endemic to the south-west, and notoriously shy, easier to hear in the wild if you know what to listen for than to see. This comes down to the fact that their natural habitat resides in heavily forested areas in which they enjoy low shrubs growing in the relative safety of deep gullies. Catching an extended moment with one in its natural habitat was fairly lucky, maybe even rare, but not unthinkably so. You see, it unfolded for us the way it did because we were moving quietly, stayed still when we saw it, and while I have no doubt it knew we were there, it consented to stay until ready to go. Interaction with this stunning little bird comes down to us really and how *we* behave around *it*.

How they behave around each other is quite interesting. A male intent on finding a mate begins high up in a tree. Hopping between branches with a carefully chosen stem of grass in his beak, he swings it pendulum-style while calling to the female. 'Casually' he draws closer and begins to dance. He fluffs up his feathers and either points his beak skyward or arcs his neck down, then bobs up and down on his perch endearingly. What female could resist? She invites copulation with a little quivering tail movement, and his efforts are rewarded.

Mated red-eared firetails establish a permanent territory of no more than 200 metres that is complete with all they need to survive, including a ready water source for drinking and bathing. During the day they often forage apart from one another keeping in contact with a low whistle. Foraged seeds are the staple diet, but also on the menu are small insects. At night the pair will rest in one of a few roughly made roost nests they have in their territory. These are *not* breeding nests. The breeding nest is set apart, deep under cover and is heavily defended during mating season (September–January). This nest is a tightly woven bottle shape lying horizontally, with a circular entrance tunnel that leads to the main chamber. Lined with feathers for comfort, four to six, pure white eggs are laid and incubated by both parents in twelve-hour shifts. Within two weeks their young are hatched and cared for by their parents for up to a month before being shown the front door to freedom and self-reliance. In a season of plenty, two broods may be raised successfully.

For the most part, you will only ever see one or two of these birds at any one time, but occasionally they do come together with others for a social gathering and will tolerate feeding with other grass-seed eaters, such as parrots or pardalotes. While I often see a substantial group of up to eight birds down by the river here in Sydney, I have never seen more than two of their south-west cousins at any one time.

Since it's hard to monitor just how secure these beautiful little birds are in the wild due to their secretive nature, for now, it is assumed they are of least concern on the conservation status. Having had the privilege of seeing them more than once in the wild, I can only hope that is true. With a scientific name that sounds a lot like a spell from Harry Potter (*Emblema oculata*) , I can only hope a little bit of magic keeps them safe always.

And now for another little sweetheart, perhaps a little less known to you: the rufous treecreeper (*Climacteris rufa*). The only species of treecreeper residing in the southwest, it lives in open woodlands and jarrah forests in satisfying numbers. From the south-west this species of treecreeper extends as far around the southern coast as the Eyre Peninsula in South Australia; however, it is rarer there than in the south-west of Western Australia. Growing up to 17 centimetres and of the most pleasing rich rufous colour, this bird seems to have a fairly casual and calm personality, not prone to flight at first sight of humans. Instead, from my experience, so long as one keeps a respectable distance it seems quite content to hunt and hop about without alarm.

Above: Caught framed in the light of mid-morning, this rufous treecreeper seems to simply glow. Its beak is a perfectly designed tool for digging morsels out of tree bark.

Red-eared firetails have a vocal repertoire of at least five sounds to communicate with one another over a 200-metre distance.

Rufous treecreepers are insectivores, more often than not probing a meal out of the cracks and crevices of trees and by peeling back bark to find hidden morsels within. Interestingly, a treecreeper can only climb upwards, putting one foot ahead of the other in a hopping motion, its balance stabilised by a lateral tail swing as it spirals higher up the tree. Once it has had enough or wishes to explore another tree, it simply spreads its wings and flies to the new location. More often than not, that is the ground as ants are also on the menu. It's when they are grounded that their colour becomes a fantastic camouflage.

The rufous colouring of this treecreeper is almost an exact match to the red-brown soil of the south-west forest floor. Having just arrived for a hike through the Porongurup National Park, I became aware of a clear, pure *peeping* somewhere very close by, but it took a while before I saw what was making the sound. This was the very first time I had ever seen this bird and was amazed by how well it matched its surroundings. When it flew to an old tree the contrast of the bird against the background was simply beautiful. Its feathers, an expertly blended combination of grey, brown and rufous, glowed richly in the light of mid-morning.

While this was a singular encounter for us, rufous treecreepers often get about in a group of three rather than just the usual mating pair, in established and permanent territories. It is speculated that the third member of the group is from a previous brood that helps in guarding territory and assists in the raising of the next generation.

Breeding takes place between July and November with courtship short and sweet. A lot isn't known about the rufous treecreeper; however, in the case of its close cousin, the eastern brown treecreeper, the male approaches the female with a series of bows and if recipient to his attentions, she will quiver her wings. Still bowing, he will circle behind her

The rufous treecreeper blends almost seamlessly with the bare earth of its home in the south-west of Western Australia.

for copulation. It is thought that this courtship ritual is the same for the rufous treecreeper, as its biology is very similar to its eastern relatives.

You would be quite within your rights to assume eggs would be a light reddish-brown colour; however, just to mix things up, they are reported to be a light pink (anywhere from one to four) splattered with brown and purple splots. They are oval in shape and are kept safe in a vertical tree hollow cradled within a cup-shaped nest of bark, feathers and soft plant material. While only the female incubates, all three adults feed the chicks. They communicate through a series of soft peeps and trills.

Calm, seemingly gentle and truly lovely, I am very pleased to have met and learned as much as I can to date of the rufous treecreeper, and it does my heart good to know it is a secure species. It was an unexpected encounter that allowed me a couple of lovely snaps I can share with you.

And there you have it, three of the south-west's iddy-biddy birds that are a part of the remarkable family that is Australia's wildlife: the splendid fairy-wren, the red-eared firetail and the rufous treecreeper. We live in a land of fantastical creatures. Sure, Colombia has the golden dart frog, but we have the corroboree frog. They might have a sloth, but we have a platypus and an echidna. They might have spectacled bears, but we have koalas, kangaroos, some of the world's most poisonous snakes and some of the world's most beautiful snakes. We have prehistoric reptiles and a coast of underwater wonders. We have devils and raptors, sand plain worm lizards and giant forest roaches and that's not even the half of it. I've said it before, and I'll say it again; here in Australia, we don't have to go very far to interact with some of the world's most stunning wildlife in some of the world's most spectacular places.

This is a wonderful place we live in.

Grass seeds are a predominant part of the red-eared firetail's diet. The red tail and splash of red near the eye give this bird its name.

A stunning contrast of browns, black, white and red, show the true artistry of the firetail's colouring.

NATIVE ANIMAL RESCUE

PLEDGED TO HELP WILDLIFE IN NEED!

BRIGHTON DOWNING

Native Animal Rescue (NAR) is a Western Australian volunteer organisation dedicated to the rehabilitation and release of sick, injured, orphaned and displaced wildlife. With additional facilities located in Broome and the tireless commitment of volunteers every day of the year, NAR substantially contributes to helping rehabilitate wildlife from all across Western Australia with the aim of returning such native fauna back into the wild.

NAR started its journey in 1982 when a group of local carers banded together to care for native ducks affected with botulism. Together the group of carers established the Fauna Rehabilitation Foundation, located on a fifteen-hectare natural Bush Forever site in Malaga, Western Australia. From its humble beginnings with a single small building on a bush block, NAR has since grown to a state-of-the-art facility, capable of caring for the widest range of wildlife in the state. NAR's specialist training of engaged volunteers allows them to care for all kinds of wildlife, even venomous snakes! From Western quolls (*Dasyurus geoffroii*) to Carnaby's black cockatoos (*Calyptorhynchus latirostris*), bobtail skinks (*Tiliqua r. rugosa*) to little cormorants (*Microcarbo niger*), NAR has cared for over 260 different species of Western Australian wildlife in the last 35 years. With the help of over 200 volunteers from all over Western Australia, NAR cares for on average 3,000 native animals annually.

Among the most treasured threatened Western Australian species, NAR is instrumental in the rehabilitation and release of three species of black cockatoo: the forest red-tail (*Calyptorhynchus banksii naso*), the Baudin's white-tail (*Calyptorhynchus baudinii*), and the Carnaby's white-tail (*Calyptorhynchus latirostris*). These animals are threatened by habitat destruction, altered fire regimes, vehicle strikes and competition for nest hollows with native species (e.g. ducks) (Johnstone, 2010a) as well as exotic species (e.g. feral bees and rainbow lorikeets) (Johnstone, 2010b). NAR is one of only two facilities in the state that rehabilitates these amazing species.

In February 2011, NAR opened a dedicated black cockatoo rehabilitation facility thanks to a generous grant from Lotterywest. Here NAR receives black cockatoos for isolated care, eventually progressing them into an open flight area with the capacity for 30 birds. This area, named the 'Flight Path', allows the cockatoos to regain their wing strength, interact with food naturally, and socialise with other birds. Cockatoos often require long-term care, with most birds

Above: Forest red-tail (*Calyptorhynchus banksii naso*) being released into the John Forest National Park by dedicated NAR volunteers in June 2017.

requiring at least 12 months' recovery time from injury and/or illness. With steadfast work from our dedicated black cockatoos' volunteer team and support from the Perth Zoo, NAR has successfully rehabilitated and released 36 black cockatoos since 2014, and 13 more are still undergoing rehabilitation.

NAR also supports local government projects and research to help improve knowledge and community awareness of local wildlife. In 2014, NAR purpose-built 40 enclosures to assist the Department of Biodiversity, Conservation and Attractions (DBCA was formerly Department of Parks and Wildlife) with temporarily housing *D. geoffroii* before translocation to the Flinders Ranges in South Australia. These enclosures are now used to acclimatise all kinds of rehabilitated wildlife before release. NAR has also assisted Murdoch University and DBCA by housing woylies (*Bettongia penicillata*) for behavioural and physiological studies to help future management. Soon those woylie enclosures will be used to study the highly contagious and devastating bobtail flu with Murdoch, Curtin and Flinders universities in a joint effort with other wildlife centres across Perth. These grounds have also been used for local snake research with Curtin University. This research involves GPS tracking snakes on NAR's property to learn about their spatial ecology in urban bush patches.

NAR volunteers are also community ambassadors, helping to improve local habitats for wildlife and spreading awareness in the local community. Since 2015, the DBCA has entrusted NAR with emptying approximately 40 fishing line bins installed at popular fishing locations along the Swan and Canning rivers in Perth as part of its Reel It In campaign. In that inaugural year, NAR emptied nearly 15,000 metres of fishing line and 5,000 other pieces of fishing paraphernalia that would have otherwise ended up in our waterways. In the first two years, NAR completed this task with the help of the Youth Policing Division of WA Police, PCYC and at-risk youth. In 2017, NAR is tasked with supporting the Department's volunteers who have 'adopted' approximately half of the 63 fishing line bins currently installed in the Swan Canning Riverpark. Together, NAR and the volunteers empty these bins on a weekly basis and report findings back to the Department.

Brush-tailed possums (*Trichosurus vulpecula*) are most commonly admitted to NAR on account of vehicle strikes, habitat destruction, displacement, orphaning and cat or dog attacks.

NAR also provides support to the 'Healthy Wildlife, Healthy Lives' initiative run by the Eastern Metropolitan Regional Council. Expert volunteers have presented talks, both at Malaga and at local wetlands, on the dangers of feeding ducks, how to promote healthy interactions with magpies (*Cracticus tibicen*), information about backyard possums, and how to make gardens reptile-friendly. As this fauna makes up some of NAR's most common admissions, these presentations have positively contributed towards raising awareness for community members of all ages.

NAR's dedication to helping wildlife, assisting with research and promoting environmental awareness in the community has played an important role in protecting Western Australia's unique and amazing biodiversity and will leave a lasting legacy for generations to come. It is only with the commitment of countless volunteers and donors that such a positive contribution towards conservation can be achieved. The goals and values from the humble beginnings of NAR in 1982 are still true 35 years on in 2017 and will remain in perpetuity.

Two tawny frogmouth (*Podargus strigoides*) hatchlings admitted at NAR in November 2016 after they fell from their nest.

Animal admission entrance at the Native Animal Rescue.

2017 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 2017 are:

GLEN BAIN - School of Biological Sciences, University of Tasmania
Project title: Restoring Resilience in woodland bird populations of the Tasmanian Midlands

SIEARA CLAYTOR - James Cook University, Cairns
Project title: The role of serotonin in frog host response to chytridiomycosis

CHRISTOPHER GATTO - Monash University, Melbourne
Project title: The role of nest moisture in sea turtle primary and operational sex ratios Introduction

ANA GRACANIN - University of Wollongong
Project title: Does deforestation promote developmental stress in spotted-tailed quolls?

MD ANWAR HOSSAIN - School of BioSciences, University of Melbourne
Project title: Assessment of the vulnerability of freshwater crayfish to climate change

LE MA - School of Veterinary and Life Science, Murdoch University, Perth
Project title: Protecting our unique key stone species, *Westralunio carteri,* the only species of freshwater mussel in South-western Australia

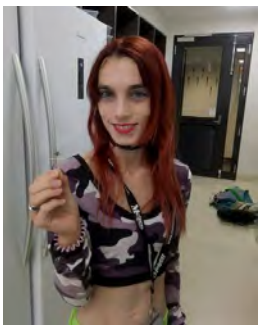
DIANA PRADA - School of Veterinary and Life Sciences, Murdoch University, Perth
Project title: Conservation of insectivorous microbats; connecting genetics and infectious disease threats in Australia's global biodiversity hotspot

KIT PRENDERGAST - Curtin University, WA
Project title: Determinants of native bee assemblages in urban habitat fragments in the southwest Australian biodiversity hotspot and interactions between honeybees (Apis mellifera) and native plant-pollinator communities

PETER PUSKIC - School of Biological Sciences, University of Tasmania
Project title: Novel assessment of the relationship between plastic ingestion and fatty acid profiles in three species of Australian shearwaters

EMILY QUINN SMYTH - University of Technology Sydney
Project title: Impacts of lantana invasion in remnant forest on habitat use by native fauna: a multi-taxon approach for conservation










Glen Bain with a male superb fairy-wren (*Malurus cyaneus*) moulting into nuptial plumage.

Restoring resilience in woodland bird populations of the Tasmanian Midlands

GLEN BAIN
The University of Tasmania

"What to restore?" remains a central question for restoration ecologists. This is particularly so when considering long-degraded landscapes where a clearly defined historical state is often unknown. The University of Tasmania has partnered with Greening Australia to take an animal-centric approach to landscape restoration in the Tasmanian Midlands – one of fifteen nationally recognised biodiversity hotspots and Australia's second oldest agricultural landscape. Behavioural data collected from local wildlife will be used to guide restoration efforts and ensure that those habitat elements most important to fauna are prioritised. This is in contrast to traditional methods of restoration that have been guided by human perceptions of 'good quality' habitat. Plantings are often established with the hope that wildlife will naturally settle and recreate a complex community structure but instead many remain devoid of wildlife or support only the most common or exotic species. This is an experience so frequently encountered it has appropriately been described under the title of *field of dreams hypothesis*. The Midlands Restoration Project explores habitat use and gap-crossing behaviour in a range of wildlife including eastern bettongs (*Bettongia gaimardi*), eastern and spotted-tailed quolls (*Dasyurus* spp.), Tasmanian devils (*Sarcophilus harrisii*), feral cats (*Felis catus*), microbats (Microchoptera) and the focus of my research – woodland birds.

The woodland bird community of the Tasmanian Midlands is unique within Australia. However, it is increasingly threatened by habitat clearing for the installation of large pivot irrigation systems and a rise in feral cat activity following the decline of the native apex predator (Tasmanian devil). Eleven of Tasmania's endemic bird species can be found in the Midlands. Much of the region's avifauna is also distinctive at the subspecies level with unique colourations, vocalisations and migratory behaviours that set them apart from their mainland cousins. It is perhaps surprising then that Tasmania's woodland birds are so poorly represented in Australian bird data. Very little is known about local population dynamics. To begin to address this, I have collected two years of observational and acoustic bird survey data from 75 sites across the Midlands. This information will be related to vegetation and landscape characteristics at each site and be used to form a baseline against which the effectiveness of restoration efforts can be gauged in the future. Through comparisons with historical data collected at the same locations 20 years ago, I also hope to obtain a sense of which species are increasing in number

Striated pardalote (*Pardalotus striatus*) nesting in a tree hollow. Striated pardalotes (8g) migrate from Tasmania across the Bass Strait to the mainland each winter.

Aerial photo showing a small section of the restoration works adjacent to the Macquarie River.

Tasmanian wedge-tailed eagle (*Aquila audax fleayi*) soaring above the often foggy Midlands.

Tasmanian silvereyes (*Zosterops lateralis*) migrate as far north as Queensland and can be identified by their chestnut brown flanks.

(e.g. introduced long-billed and little corellas) and which species may show signs of population decline.

Initial survey data has highlighted the significance of noisy miners (*Manorina melanocephala*) as a key management challenge for the restoration program. Noisy miners favour open and degraded landscapes such as occur in the Midlands. They have been described as hyper-aggressive, despotic, reverse-keystone species and are well known to exclude smaller birds from suitable habitat across eastern Australia. Such exclusion by noisy miner colonies has been listed as a key threatening process under environmental legislation. My preliminary data shows that those sites where noisy miner densities have significantly increased have also experienced worrying declines in species richness. Thankfully, the opposite appears true for sites where miner densities have decreased. To better understand how miners and habitat degradation influence the way in which small birds perceive their environment, I am using differential white blood cell counts to measure chronic stress in a model bird species, the superb fairy-wren (*Malurus cyaneus*).

In birds, the ratio of white blood cell types in the blood is regulated by the stress hormone corticosterone. I will collect blood samples from wrens, create blood smears and determine the ratio of heterophil cells to lymphoctyte cells. This ratio is known to provide a reliable measure of long-term stress levels (i.e. weeks to months) in birds. I will compare stress in wrens that occupy degraded noisy miner dominated woodland with that of wrens living in undisturbed covenants, plantings and nature reserves. Chronic stress will be related to site-specific vegetation structure and the composition of the bird community (e.g. number of predatory birds) to explore what factors might moderate the stress response.

For any restoration program, successful reproduction by resident wildlife is an ultimate goal. Given that nest-predation is the main cause of reproductive failure in birds, I am also investigating what aspects of vegetation structure might explain the incidence of nest-predation in the Midlands. I have used motion-sensor cameras to monitor nests of brown thornbills (*Acanthiza pusilla*) and superb fairy-wrens. Cameras have allowed me to identify the local nest predator assemblage and calculate the frequency of nest predation in this highly modified agricultural landscape. I used cutting-edge handheld LiDAR techniques to model vegetation structure at nesting sites and measured features such as canopy cover above the nest and nest concealment. Though this research is in its infancy, it appears that rates of nest failure in the Midlands remain comparable to populations of these species elsewhere in Australia. However, the nest predator assemblage is unique with native mammals like the Tasmanian devil and spotted-tailed quoll recorded raiding nests more frequently than was anticipated. Future research could consider how the frequency of nest predation in wrens and thornbills compares between remnant woodlands and planting sites as they mature.

Remnant woodland after a light snow. Though the Midlands is a temperate region, in recent years it has experienced extreme drought, unusual snowfall events, record flooding and wildfires.

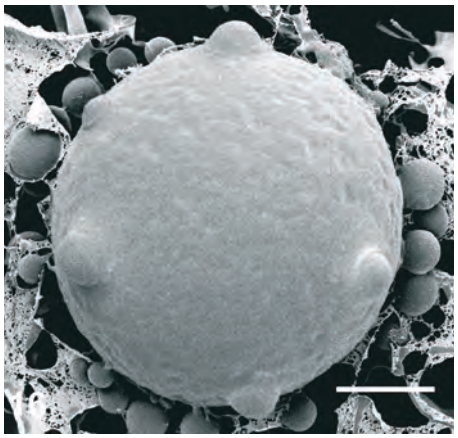
I'd like to express my great thanks to the Australian Wildlife Society for funding my research and supporting my attendance at the Society for Ecological Restoration conference in Brazil. At this conference, I will present my initial findings and use the opportunity to strongly promote the integration of animal behaviour research with the design of landscape restoration. As a whole, the Midlands restoration project provides an excellent example of how researchers studying vastly different wildlife groups can work together and with land managers on the ground to improve conservation outcomes.

The role of serotonin in frog host response to chytridiomycosis

SIEARA CLAYTOR
College of Public Health, Medical and Veterinary Sciences
James Cook University, Cairns

Since the 1980s, frog populations internationally and in Australia have declined dramatically due to the amphibian disease chytridiomycosis, caused by the chytrid fungus *Batrachochytrium dendrobatidis* (Bd). Currently, 15 species of Australian frogs are endangered, 12 are listed as vulnerable, and six have already become extinct. Bd is an aquatic fungus that colonises frog skin and disrupts skin functioning causing electrolyte loss, which then leads to death via cardiac arrest.

My research goals are to: a) investigate the metabolites in frog skin that fight Bd infection, and b) examine if antioxidants are involved in Bd's ability to evade host defences. There is little understanding of how metabolites are used in frog skin. Frogs lack a cellular inflammatory response to Bd infection. This suggests that innate biochemical responses, rather than acquired immunity, are acting in host defence against Bd. Some pathogens have developed antioxidant defences to protect themselves from the host's immune system. Presently, it is unknown how Bd protects itself from oxidative stress from the host.



Scanning electron microscope image of chytrid sporangia. Photo: Dr Lee Berger

L to R: Dr Alexandra Roberts (researcher), Rebecca Webb (research assistant), Sieara Claytor, Dr Tiffany Kosch (postdoctoral researcher) holding Australian green tree frogs.

Currently, there are no means to practically control the disease in the wild. Bd is widely distributed over the continent, making research more important than ever for management and mitigation of the impacts of the disease. It is important to understand how some frogs can resist Bd so that managers can use this knowledge to better protect threatened species. This information may lead to targeted methods to improve frog survival.

Great barred frog (*Mixophyes fasciolatus*) showing symptoms of chytridiomycosis. Photo: Dr Lee Berger

Christopher with a leatherback sea turtle at Cabuyal, Costa Rica.

How does moisture during incubation influence sea turtle sex ratios?

CHRISTOPHER GATTO
Monash University, Melbourne

Sea turtles have existed on our planet for millions of years but today they are at a crossroad, and their survival is anything but certain. There are seven extant sea turtle species, and all seven are listed as vulnerable or endangered by the International Union for Conservation of Nature. Sea turtle populations have been decimated by egg poaching, habitat loss, by the harvesting of meat and shells as well as by individuals drowning as bycatch in fishing nets. This is on top of the fact that only one in 1,000 hatchlings survive to adulthood, thanks to the myriad of predators that feast upon hatchlings as they disperse from their nests. Despite all of this, the greatest threat facing sea turtles today is climate change.

Typically, research into the effects of climate change has focused on the impact that increasing air and sea temperatures will have on incubating sea turtle eggs. Changes in temperature during incubation have been shown to alter hatchling size, incubation duration, hatching success rates and the ability of hatchlings to crawl and swim. Fascinatingly, temperature has also been shown to determine sea turtle primary sex ratios or the ratio of males to females at hatching. Like many reptilian species, sea turtles have temperature-dependent sex determination where, in the case of sea turtles, higher temperatures result in more female hatchlings, and lower temperatures produce more male hatchlings. As our planet slowly warms so do sea turtle nests, resulting in more female hatchlings. Eventually, it is possible that nests will only produce female hatchlings. And despite what some may say, males are a vital part of maintaining a healthy population.

However, temperature is not the only environmental factor that is going to change because of humanity's impact on the Earth. Another key factor is moisture. During my time working with The Leatherback Trust in Costa Rica, I would spend the first few months of the nesting season huddled under my poncho in a vain attempt to stay dry. By the end of the nesting season five months later, I hadn't seen a cloud, let alone rain, in months. The amount of moisture contained in the sand of nesting beaches worldwide is also expected to change as sea levels rise while changes to rainfall patterns are expected to vary depending on location. This means that, like temperature, moisture levels vary across a nesting season and will be altered by climate change. However, very little research has been done to investigate how moisture levels during incubation influence sea turtle eggs and hatchlings. Too much or too little moisture can result in higher rates of egg mortality and increases in moisture result in heavier hatchlings but what about sex ratios or a hatchling's ability to swim?

My project's goal is to understand how moisture during incubation influences sea turtle primary sex ratios and the ability of hatchlings to disperse from their nesting beach. I will collect the eggs of three sea turtle species and incubate them at different moisture levels. I will measure differences in hatchling size, body shape and crawling speed. I will also measure the amount of force that hatchlings produce while swimming to quantify hatchling swimming ability. Finally,

A green sea turtle rests momentarily as it camouflages its nest.

An Olive Ridley sea turtle lays its eggs at Ostional, Costa Rica.

I will determine primary sex ratios by examining hatchling gonads via laparoscopy.

The data collected from the three sea turtle species will be used to create a model that predicts the sex-specific survival of hatchlings and operational sex ratios. Operational sex ratios are the sex ratios of breeding adults in a population and are a key indicator of population viability. Incubation conditions will be used to predict crawling and swimming performance, which will be used to estimate mortality rates. When combined with primary sex ratios, also estimated from incubation conditions, it will be possible to predict how sex ratios and swimming performance interact to determine male and female survival as well as operational sex ratios.

Currently, sea turtle population monitoring, conservation and management all focus on the effects of temperature. This is despite the fact that temperature does not explain 100 percent of observed variation in hatchling traits. Our ability to accurately predict primary sex ratios is vital for the effective conservation and management of these iconic and culturally significant species. This project would be one of the first studies to incorporate hatchling performance variation into predictions of hatchling recruitment and operational sex ratios. My model will aid nesting beach managers by providing more accurate estimates of sea turtle primary and operational sex ratios, which form the basis of any management plan or targets. It will also allow us to predict future changes to primary and operational sex ratios. This will allow managers to identify key beaches, the most productive months for producing males and females as well as the best sites for relocating nests.

Green sea turtle hatchlings, incubated at Monash University, slowly emerge from their eggs.

None of this would be possible without the amazing support of the Australian Wildlife Society. Without their help, I wouldn't be able to buy the load cells that I will use to measure the amount of force that hatchlings produce while swimming or to measure other indicators of hatchling performance. Thank you to all of you for your support!

A green sea turtle hatchling.

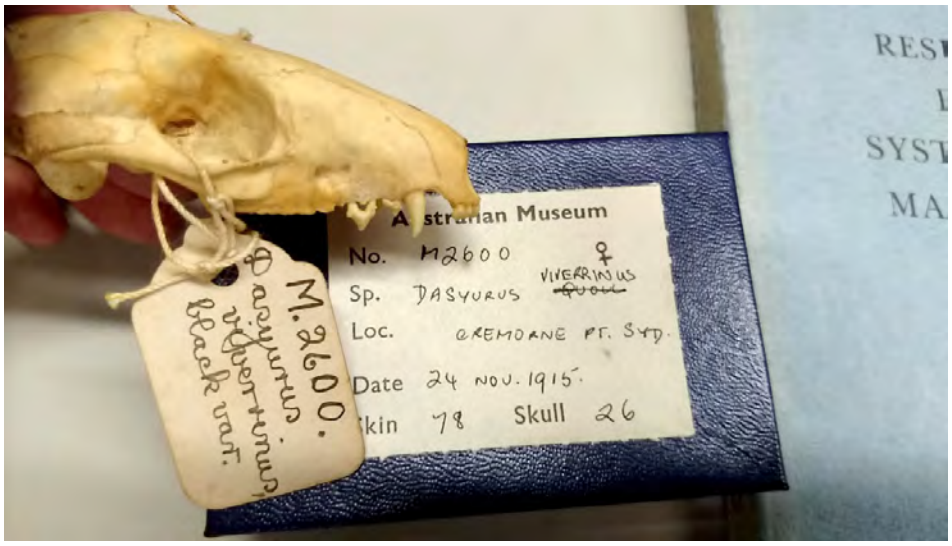
Does deforestation promote developmental stress in spotted-tailed quolls?

ANA GRACANIN
University of Wollongong

The threatened spotted-tailed quoll (*Dasyurus maculatus*) has experienced significant range contraction and population decline. My project is investigating the use of fluctuating asymmetry as a bioindicator of stress in these quoll populations. I will measure asymmetry in the skulls of spotted-tailed quolls, from a range of museums. I will be taking photographs of the skull, and digitising the points of features through software. These landmarks reflect the shape of the skull and can be analysed for asymmetry. Based on where it was found I will then use past satellite imagery (from 1972 and onwards) to calculate a level of deforestation and disturbance associated with each specimen. I will see if this disturbance was a source of significant stress in quolls by relating this with their level of asymmetry. Overall, the specimens span over 100 years. An investigation of these temporal patterns of fluctuating asymmetry in spotted-tailed quoll populations could provide conservation management with information that can: identify areas experiencing significant disturbance, evaluate existing reserves and national parks, and provide an indication of future trends.

Another species of the same genus, the eastern quoll (*Dasyurus viverrinus*), experienced significant decline on the Australian mainland, as the species is now considered extinct. I will also study fluctuating asymmetry in extinct eastern quolls. This will help understand the vulnerability of extant spotted-tailed quolls, by comparing them to levels of fluctuating asymmetry in the extinct eastern quoll. This could provide further evidence for higher prioritisation of conservation initiatives if some populations of spotted-tailed quolls are experiencing similar levels of stress.

Above: Ana holding a spotted-tailed quoll skull.



Eastern quoll skull from Sydney, 1915.

About me:

I'm studying Conservation Biology at the University of Wollongong. This is my first true lab-based project, as so far I've only ever worked on field-work based projects. From camera-trapping quolls on the ground to climbing into the canopy to camera-trap glider species, I'm passionate about studying elusive and threatened species.

My main interests lie in arboreal marsupials and their behavioural ecology. I also help manage the conservation research organisation Team Quoll Illawarra and Southern Highlands. I have yet to see a quoll in the wild though, despite almost three years of searching for them!

Eastern quoll specimens from the CSIRO Wildlife Collection, Canberra.

Protecting our tiny water treatment factories: Carter's freshwater mussel (*Westralunio carteri*), the only freshwater mussel in south-west Australia

LE MA
Centre for Fish and Fisheries Research
Murdoch University, Western Australia

Freshwater is extracted for drinking, irrigation and industrial use, so sustainable freshwater ecosystems are crucially important for human life, as well as for domesticated plants and animals and wildlife. Freshwater mussels are important contributors to the sustainability of freshwater ecosystems. Their filter feeding is able to remove seston, phytoplankton and bacteria from the waterbody and improve water quality. In addition, the activities of freshwater mussels, such as burrowing, excreting and bio-depositing, enhance the nutrient connection between benthic and pelagic systems. After they die, their empty shells may become refuges for other aquatic fauna.

However, freshwater mussels constitute one of the most endangered groups of organisms throughout the world because of habitat destruction, and for some species, overfishing. Carter's freshwater mussel (*Westralunio carteri*) is the only freshwater mussel species in south-west Australia and is endemic to this region. Recent studies have found that the range of the species has contracted by over 50 percent in the last 10 years, principally because of secondary salinization and reduced water flow from a drying climate. As this species of freshwater mussel is able to live for at least 50 years, and we do not know whether extant populations are actively recruiting, its viability remains in doubt. If we continue to do nothing for it, it is possible that the species has a massive extinction debt which will be realised sometime in the coming decades and both the natural ecosystem and human society will pay for this extinction.

This project aims to fill current knowledge gaps by investigating

Mussel survey in Gingin Brook. Photo: Nathan Berkens

A mussel hides in the substrate. Photo: Le Ma

A dead mussel shell occupied by a crayfish. Photo: Le Ma

the habitat preference, population structure and limits of salinity and drought tolerance of the freshwater mussel *Westralunio carteri*. We hope that the information gained from this project will assist the development and implementation of conservation management plans for this species.

So far, a team consisting of my supervisors, staff of Western Australia's Department of Parks and Wildlife, volunteers and land owners have investigated 30 rivers and found that *Westralunio carteri* has a highly aggregated population structure, with a greater density (about 29 mussels per square metre) than other Australian freshwater mussel species. Mussels appear to have a preference for fine and loose silt in shallow and slow running water, with abundant large, woody debris. In a simulated drought experiment, mussels did not increase their horizontal movement but burrowed vertically into the substrate before the substrate completely dried. Loose silt allowed the mussels to burrow more deeply. Shading greatly increased survivorship under drought conditions. Salinity tolerance experiments are ongoing.

Mussels provide us with a salutary lesson. It is not just large, charismatic fauna that needs protection. Sometimes it is the loss of small and seemingly insignificant creatures that will have the greatest impact on our lives and lifestyles. As a society, we would do well to pay more attention to our little aquatic neighbours and learn to live with them in harmony.

Adult and juvenile of *Westralunio carteri*. Photo: Le Ma

Microbats of the South West Botanical Province of Western Australia: Infectious disease risk and its relation to population connectivity

DIANA PRADA
School of Veterinary and Life Sciences
Murdoch University, Perth

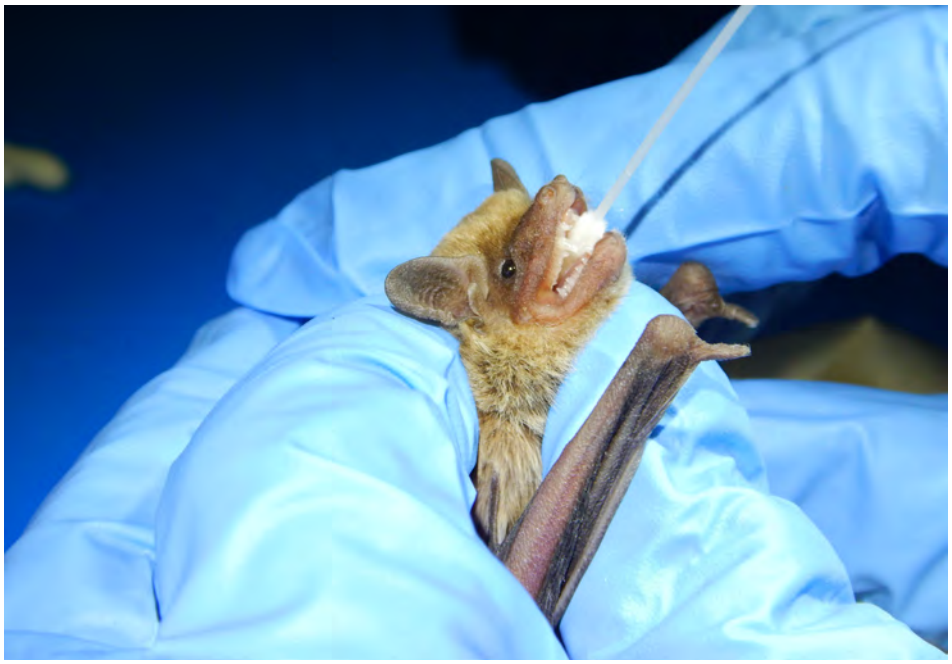
Bats are reservoirs of zoonotic infectious disease agents that impact on global health, such as lyssaviruses and Hendra virus. Large amounts of funding have gone into the study of these diseases as they can have a high fatality rate in humans. Comparatively, little is known about the impacts of infectious diseases on the conservation of Australian microbats. Due to their gregarious nature, combined with specific habitat and climate requirements, bat populations are considered highly sensitive to emerging infectious diseases. This is evidenced by white nose syndrome, an infectious fungal disease currently threatening microbat species with local and regional extinction in the USA and Canada.

The South West Botanical Province (SWBP) of Western Australia, Australia's only global biodiversity hotspot, is home to 13 species of microbats. Despite information on their distribution and ecology, there is limited information on their genetic diversity, population structure, and their infectious disease status.

My study will determine the associations between the infectious agents of microbats in the SWBP and their population structure and connectivity. Combining these areas of study facilitates the understanding of bat movement patterns, which underscores the epidemiology of the pathogens they carry and thus potential infectious threats (inclusive of zoonotic agents) across separate populations at a landscape scale. This information is central to predict possible consequences of distributional changes of microbat species and the pathogens they carry under different climate change scenarios. Additionally, the creation of a baseline dataset of viral species present within healthy bat communities is

Harp traps set up over an open water well. Photo: Mikaylie Wilson

Working the night shift: researchers at the sampling station. Photo: Mikaylie Wilson



Taking a buccal swab of an inland broad-nosed bat (*Scotorepens balstoni*). Photo: Mikaylie Wilson

A Gould's wattled bat (*Chalinolobus gouldii*) about to be released. Photo: Mikaylie Wilson

A long-eared bat (*Nyctophilus geffroyi*) about to be released. Photo: Mikaylie Wilson

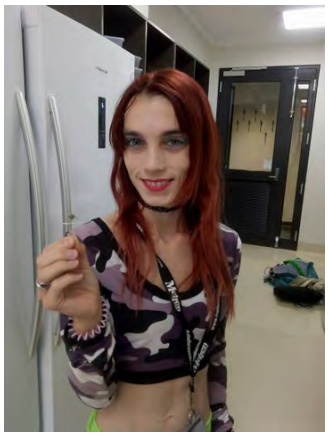
essential to bat conservation. It allows wildlife health authorities to respond to and manage bat mortality events in an informed manner, as well as providing data required for the development of diagnostic tools.

I am using molecular techniques and antibody testing for targeted detection of key viruses, e.g. lyssaviruses and coronaviruses, on all captured bats. These two methods are complementary as they can identify whether the tested individuals are actively infected with, or have been previously exposed to, these viruses. I will employ next-generation sequencing for viral discovery from faecal samples and to isolate genetic markers from tissue samples for four species of microbats with differential distributions and niche requirements: *Chalinolobus gouldii, Nyctophilus geffroyi, Nyctophilus gouldi* and *Vespadelus regulus*.

A fantastic team of volunteers was essential for the sampling of over 300 bats of nine different species during my first field season. We sampled over water bodies at sites within conservation land as well as areas managed by Bush Heritage or the Australian Wildlife Conservancy.

I am very grateful for the financial support of the Australian Wildlife Society. It greatly contributes to my upcoming field season, which is going to be very busy, as I will be trapping at an additional five sites within the south-west of Western Australia. The Gunduwa Regional Conservation Association, the Holsworth Wildlife Research Endowment and the Alistair Bursary also generously support this project.

Chocolate wattled bat (*Chalinolobus morio*), a species widely distributed in the South West Botanical Province. Photo: Mikaylie Wilson



Determinants of native bee assemblages in urban habitat fragments in the southwest Australian biodiversity hotspot and interactions between honeybees (*Apis mellifera*) and native plant-pollinator communities

KIT (AMY) PRENDERGAST
Curtin University, WA

Native bees in the 'burbs' in a biodiversity hotspot

The long history of Australia's isolation from other continents and the unique climatic and geological history has given rise to a very unique flora and fauna. Australia has a rich diversity of native bees, estimated at 2,000 species, many of which occur nowhere else in the world. Pollination, predominantly performed by bees, is a vital ecosystem service that not only contributes to food security for humans, but underpins the health of ecosystems through sustaining the fitness of plants and the myriad organisms that interact with the flora. It is likely that native bees have evolved mutualisms with native flora and that threatening processes such as habitat loss, degradation and fragmentation driven by agriculture, and increasingly by urbanisation, as well as invasive species, jeopardise the integrity of native plant–pollinator networks.

Perth, the capital city of Western Australia, is situated in an internationally renowned biodiversity hotspot. What native bee species exist in this urbanised region, what functional traits they exhibit, and what local and landscape factors determine the abundance, diversity, and assemblage composition of native bees remains unknown. Southwest Western Australia is also renowned for its world-class honey. Unlike most of the world, where honeybees have undergone drastic declines, the thriving honeybee populations in Western Austalia – both managed and feral – may have detrimental impacts on native bees and, in turn, native plant–pollinator communities. Whether the non-native honeybee outcompetes native bees is a topic of ongoing controversy, with negative, neutral and even positive effects on native bees or native flora being reported.

Female *Xanthesma (Xenohesma) vittata:* they may be tiny, but native bees can be incredibly beautiful, as evidenced when seen under magnification.

The results of my study will have a range of important applications. My comparison of techniques of sampling bee communities can inform us what methods are most suitable for monitoring programs – a vital activity to assess the conservation status of bees and their response to environmental changes and conservation schemes that is severely lacking in Australia.

Male *Xanthesma (Xenohesma) vittata:* the males of this brilliant tiny euryglossine species have enlarged eyes, presumably to seek out females as they fly in mating 'shoals'.

Hylaeus (Hylaeorhiza) nubilosus: this 'masked bee' (genus Hylaeus) is relatively unhairy, for it carries pollen not in specialised pollen-carrying hairs, but instead internally in the bee's crop.

My study will also be the first to systematically survey native bees in this biodiversity hotspot, and investigate the relative value of residential gardens vs. bushland remnants as foraging and nesting habitat for native bees. It will also contribute scientific data to resolve the ongoing controversy regarding the impact of honeybees on native bees in Australia and their contribution to native pollination networks. My study will identify what factors jeopardise or promote native bees, so that individuals, communities, and policy makers and institutions can apply my scientific findings to design, manage, and restore urban habitats better so that people, pollinators and plants can thrive.

Australia, and especially the southwest Western Australia biodiversity hotspot, hosts an amazing assemblage of animal and plant species, many of which exist nowhere else on earth. The unique evolutionary history of our wildlife means that losing them entails a loss of our natural heritage.

Discovering what habitats give bees a 'buzz'

To address these key knowledge gaps, my project involves intensive surveying of native bees in bushland fragments and residential gardens across the urbanised region of southwest Western Australia; namely, the 170-kilometre urban sprawl of Perth, the capital city of Western Australia. I am surveying seven sites of each habitat type, dispersed throughout the landscape and at distances exceeding the foraging range of most native bees (one kilometre) to ensure independence of each site. I am conducting my surveys during the spring and summer months, which encompass the main flight seasons of native bees. To determine what influences the abundance, diversity and composition of native bee assemblages, at each site I am measuring local variables and landscape variables that can be predicted to have an impact on native bees, including floral diversity and abundance, the proportion of native flora, the amount of 'greenspace' around a site, and proxies for nesting habitat. These variables have been found to be influential in some cases in previous studies on bees in cities elsewhere across the globe, and on studies on bees in other disturbed landscapes (mainly agricultural landscapes, in which the majority of bee studies have been conducted).

At the local scale, I am measuring food resources by quantifying the following: floral species diversity and abundance, the proportion of these species that are native , the number of woody trees and percentage of bare ground as proxies for nesting habitat for cavity-nesting and ground-nesting bees, respectively, and site area. Landscape variables measured include the distance to the nearest reserve, and the proportion of green space (vegetation) and built space (impervious structures) at a 500-metre radius around each site (within the foraging range of most native bee species, and the scale at which previous studies have found effects to be significant).

The impact, if any, of honeybees on native plant–pollinator communities is being assessed by correlating the abundance of honeybees with native bees, both across sites and across a day. The potential for competition is being evaluated by comparing niche overlap based on both floral visitation data and data collected by analysing the pollen collected by honeybee colonies and cavity-nesting native bees. A before–after control–impact design will be utilised to further experimentally assess the effect of honeybees on native bees by removing feral colonies at half of my sites prior to the second season of surveys. This will additionally assess the impact of feral colonies, which are of concern not only to native bees but also to commercial apiarists (including urban beekeepers) as they may compete with their honeybees. Feral honeybees are also known to usurp the limited tree hollows that threatened native birds and possums rely on.

I am sampling bee communities using a number of well-established sampling methodologies: blue and yellow bee bowls (aka pan traps), blue and yellow vane traps, sweep netting, and trap nests.

To directly look at not only the ability of native bees to forage in urbanised habitats, but also their ability to nest and reproduce in such habitats, as well as look at the fitness impacts of honeybees on native bee reproduction, I am directly quantifying nesting success via 'bee hotels' also known as trap nests. At each of my sites I have installed wooden jarrah blocks with 12-centimetre deep holes, into which cardboard tubes of three diameters (4 mm, 7 mm and 10 mm) are inserted.

Utilised tubes are being collected and the bees reared in the lab to identify the diversity of cavity-nesting bee species; evaluate nesting success, parasitisation and predation rates, emergence rates, sex ratio and body-size; and how these vary according to habitat type, habitat characteristics, and honeybee abundances.

Analyses will be performed by month, by year and across the two years of my site surveys. This will also uncover patterns regarding how the shift in floral composition across a season influences bee communities, and the variability across years. To identify if there are particular ecological traits that render bees susceptible to urbanisation and/or honeybee competition, I am analysing my data according to key ecological traits of bees (namely, body size, nesting habitat, floral specialisation and taxonomic group).

For the third year of my study, I intend to provide a more controlled experiment to assess the impact of honeybees on native bee fitness, and to look at the relative contributions of honeybees vs. native bees in the pollination of native flora. To do so, I will be looking at pollen deposition and fruit set, and niche breadth and overlap, and reproductive success of cavity nesting native bee species with and without honeybees. This is relevant to native bees in small isolated habitat patches and provides a more rigorous approach to testing competition by controlling extraneous environmental factors. Experiments will be conducted in controlled environments (greenhouses), with two replicates per treatment.

Preserving pollinators in the 'burbs' and beyond

Against the backdrop of a biodiverse community is the realisation that much of our wildlife has been lost and the remainder is threatened. I have a deep love and passion for the flora and fauna of this country I call home, and want to use my skills as a scientist to understand, protect and restore wildlife. I want to address the processes that threaten their existence and the integrity of the ecosystems in which both these organisms co-exist alongside our species, so that the amazing animals and plants in Australia's ecosystems

A megachilid bee, genus *Megachile.*

can thrive now and in the future – including in the regions where the majority of the human population live. Native bees are diverse and have an array of behaviours, morphologies and life-history traits that make them exemplary in representing the biodiversity this country hosts. In turn, they are vital for performing the ecosystem service of pollination, on which the majority of plants depend, and diverse plant communities support a diversity of other organisms. Plant–pollinator networks are incredibly fascinating, as well as pivotal for sustaining biodiversity. I truly get a real buzz out of this project, which I devised and designed myself, and believe my research is vital to understanding how we can manage our gardens and cities so that pollination networks are not jeopardised.

I am honoured to be a recipient of the Australian Wildlife Society university schemes grant. The funding will enable me to extend my research and explore more avenues to really get a thorough understanding of the diversity of native bees in the 'burbs', and how we can better share our living spaces with pollinators, so that people, plants and pollinators – both introduced and native – can coexist, and indeed, thrive.

Euryglossina (Euryglossina) perpusilla: a tiny euryglossine bee.

Novel assessment of the relationship between plastic ingestion and fatty acid profiles in three species of Australian shearwaters

PETER PUSKIC
School of Biological Sciences
University of Tasmania

Shearwaters: sentinels of strange tides

The journey so far

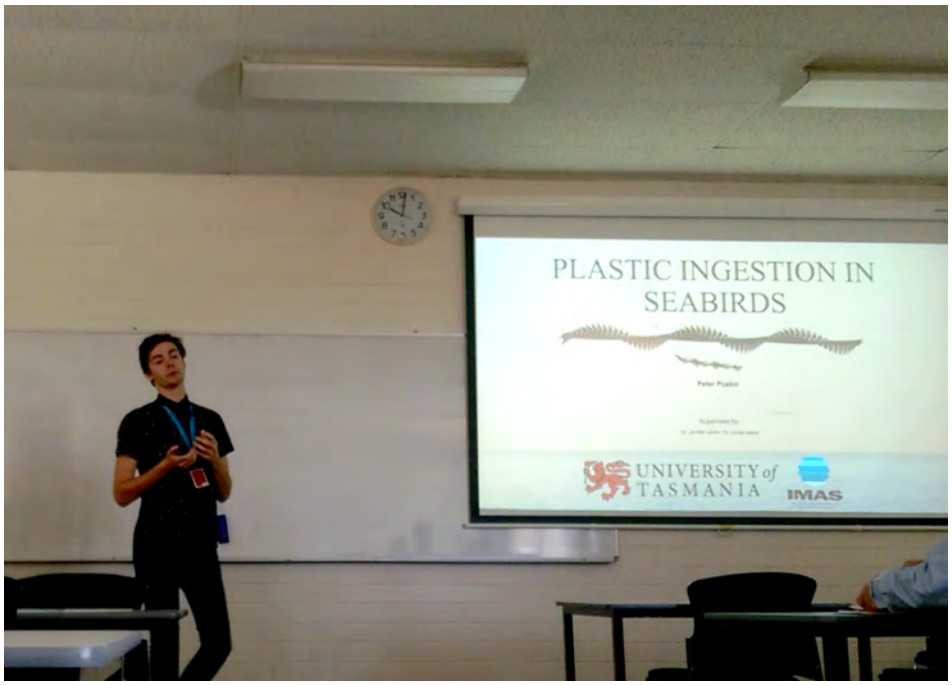
After spending the first 80-90 days of life inside a sandy burrow, hunger and instinct force her to leave the comfort of the only home she has ever known. Stepping out into the daylight she stretches her wings for the first time in anticipation for the epic journey ahead. She must travel to the Sea of Japan, navigating and foraging without the help of any adults, who have already migrated in the weeks before. She will not return here for at least another five years when she will breed. She must undertake this journey never having seen the ocean before!

This timeless story is familiar to many species of Australian shearwater who undertake a migration of epic proportions. Unfortunately, the odds are stacked against them.

Shearwater fledgelings spend their early days of life being provisioned by their parents. Diet varies among species, but populations tend to be faithful to their foraging areas and opportunistically feed in these regions. These first meals are vital in promoting the fledgelings' growth and building up fat stores which are critical for the young birds' early life.

Like most seabirds, shearwaters are regarded as sentinel species, reflecting pressures and changes in their environment. This is because their migration patterns and feeding grounds are predictable and the birds return to the same breeding sites each season allowing us to study individuals and populations over time.

On Lord Howe Island, New South Wales, the largest breeding colony of flesh-footed shearwaters (*Ardenna carneipes*) has been declining for many years. Adults of this species ingest plastic from the surrounding waters of the Tasman Sea, offloading it to their chicks during feeding. Almost every single fledgeling on Lord Howe Island has ingested plastic ranging from 20 to 200 pieces of varying size, type and colour. The ingestion of plastic has many physical effects on the bird, including lacerations and ulcers in the stomach, and in cases where birds have ingested large amounts of plastic, this may lead to death by starvation. Similar impacts are likely being felt by two other Australian species, the short-tailed shearwater (*A. tenuirostris*) and the wedge-tailed shearwater (*A. pacificus*).



Peter presenting an introductory seminar on how we can use seabirds as sentinels of the marine environment.

Plastics have other, more sinister impacts when ingested. Plastics are manufactured using toxic chemicals and when in the marine environment, the surface of plastics provides the perfect medium for persistent organic pollutants (POPs) to sorb to the plastics creating a chemical cocktail. When ingested, these chemicals leach directly into the organism where they accumulate in the tissues, particularly those high in fats.

Fat is important for wild animals as it provides an energy reserve. For young fledgelings, having high-fat stores is vital to surviving their first big migration. Fledglings that have ingested high amounts of plastic may have variable growth and are often malnourished. Understanding the dynamics of this – for example, whether utilising fat stores liberates accumulated POPs – will provide insights into the health of an individual and the likelihood of success during migration.

The use of fatty acid and total lipid analysis will provide robust, quantitative information on tissue lipid composition in healthy and emaciated birds. Gas chromatography mass spectrometry (GC-MS)

will provide crucial data on the concentrations of plastic-derived chemicals present in the birds.

Our team at the Institute for Marine and Antarctic Studies is doing exactly this. To better understand the threats posed by marine plastics, including the less visual impacts of plastic ingestion and associated chemicals, we are analysing muscle, liver and fat tissues of three species of Australian shearwater: flesh-footed and wedge-tailed shearwaters from Lord Howe Island and short-tailed shearwaters from Great Dog Island, Tasmania. We recently completed the first stage of processing (bird necropsy) and have begun dehydrating and extracting the resulting tissue samples in preparation for GC-MS analysis.

The journey ahead

Our knowledge of the processes impacting shearwaters can assist us in understanding these impacts and can be used to call on governments and policy makers to make much-needed changes.

Limiting the impacts of marine plastic pollution is possible, but it requires the assistance of every single one of us. Making small changes in our behaviours and attitudes can have enormous impacts. We can refuse to buy products wrapped in unnecessary plastics and simply say no to single-use plastic items such as straws, bags and coffee cups. Perhaps you can organise a community beach or park clean-up or better yet, create change at the highest, most impactful level by petitioning your local governments to change policy.

There is still a lot of work to be done by researchers, governments, communities and individuals. Working together to prevent plastics from entering our oceans is possible and is the only way to ensure the continued survival of shearwaters and marine life around the world.

About the Author

Peter Puskic is an honours student at the Institute for Marine and Antarctic Studies, University of Tasmania, studying the sublethal impacts of plastic ingestion on Australian shearwaters. He studied zoology and archaeology in his undergraduate degree exploring how people use, impact and depend on the natural world and is passionate about education and outreach to create social and environmental change.

A wedge-tailed shearwater adult returning to its breeding island.

Thirteen pieces of plastic found within the stomach of one individual Tasmanian short-tailed shearwater.

Eight pieces of plastic found within the stomach of one bird. The plastic pieces can be dull (as shown here) or quite colourful.

Chick growth is highly variable. Two same-age Tasmanian short-tailed shearwaters side by side. The smaller one (left) has ingested 11 pieces of plastic and the larger individual has only ingested two pieces.

Avoid, utilise or neutral? Habitat use by animals in response to Lantana camara invasion

EMILY QUINN SMYTH
University of Technology Sydney

Lantana camara is one of Australia's most problematic weeds, particularly in New South Wales, and is recognised as a Key Threatening Process causing biodiversity decline (Australian Weeds Committee 2010). Given the potential for further considerable spread under climate change, lantana is of increasing concern to land managers as well as conservation scientists and practitioners.

It is unclear if faunal responses to lantana invasion are consistent across different animal groups including mammals, birds, reptiles, amphibians and invertebrates. Some fauna species exhibit strong declines in abundance, while others demonstrate neutral or increased abundance in response to exotic plant invasion.

Do native fauna species utilise or actively avoid areas invaded by lantana? Or is there a neutral response? This is where my research comes in. My project aims to determine the impacts of lantana on habitat use by native fauna, across taxonomic groups. By comparing the ecological responses of these faunal groups, I will inform weed management strategies, ensuring that management caters for the differing habitat requirements of fauna.

My study is located in and around the city of Lake Macquarie, where, typical of many coastal cities, lantana readily establishes in disturbed areas within forests, particularly at bushland interfaces with roadsides and at other forest edges. In order to study across taxonomic groups, I am employing a range of sampling techniques including camera trapping, pitfall trapping, active searches and sound recording. This research is integral to filling the gaps in knowledge required for land managers and councils to effectively manage lantana. My research also has the potential to change the way the public thinks about and manages weeds.

Emily measuring tree DBH at one of her field sites in the Lake Macquarie region.

This research would not be made possible without the generous contribution made by the Australian Wildlife Society University Student Grant. The grant provides a significant contribution to my project in allowing me to share my research and contribute to increased understanding of the impacts of lantana on animals. I am incredibly grateful and very excited to see what the future of my project brings!

About me

I have always been passionate about learning about animal and plant interactions and absolutely love being out in the field. Thus, I am excited to study for a Master of Science (Research) with the University of Technology Sydney, to explore habitat use by animals in response to lantana invasion.

Studying across taxonomic groups is a particularly rewarding part of my research. I am able to apply a range of surveying techniques and gain experience in working with a wide range of animals. In the future, I hope to contribute to the conservation of Australia's unique flora and fauna through continued research projects. I also thoroughly enjoy teaching undergraduate environmental science subjects at my university. In the future, I would like to be an educator and mentor for upcoming environmental scientists, while travelling to experience the world's incredible biodiversity first-hand. The assistance provided by the Australian Wildlife Society's University Student Grant is a significant contribution in allowing me to continue my research and progress my academic career. Thank you!

Assessing the vulnerability of freshwater crayfish to climate change

MD ANWAR HOSSAIN
BioSciences 2, Faculty of Science
The University of Melbourne

Freshwater ecosystems are largely neglected in global conservation priority-setting, yet have been shown to be some of the most threatened ecosystems on earth, with similar patterns observed in freshwater species on the IUCN Red List of Threatened Species (IUCN, 2017). Freshwater crayfish are a diverse group of crustaceans with more than 600 species identified globally. Geographically crayfish are distributed in 60 countries with high species diversity found in the south-eastern Appalachian Mountains in the USA and in south-east Australia (**Fig. 1**). Freshwater crayfish are an interesting case study for assessing the vulnerability of freshwater species to climate change because they are economically important and globally threatened (**Fig. 2**).

Climate is the predominant environmental variable that shapes biogeography of organisms, and affects the thermal ecology of freshwater species, controls their growth and performance. Changes in climate may affect a species' persistence through a number of mechanisms including sensitivity, exposure and low adaptive capacity. The Intergovernmental Panel on Climate Change estimates that 20–30 percent of the world's species are likely to be at high risk of extinction from climate change impacts within this century, while 83 species of Australian freshwater crayfish are predicted to be vulnerable due to climate change (IUCN, 2017).

Here, I assess how the specific traits and geographic areas of each species are threatened by climate change and discuss possible mitigation measures to aid adaptation and conservation policy making. I ask three questions:

1. Can the trait-based approach for climate change vulnerability be applied to data-poor freshwater invertebrates, and what are the implications for their conservation?
2. How does uncertainty in trait selection and data quality affect the overall vulnerability assessment?
3. How do the results of the vulnerability assessment compare with species already identified as threatened by climate change on the Red List?

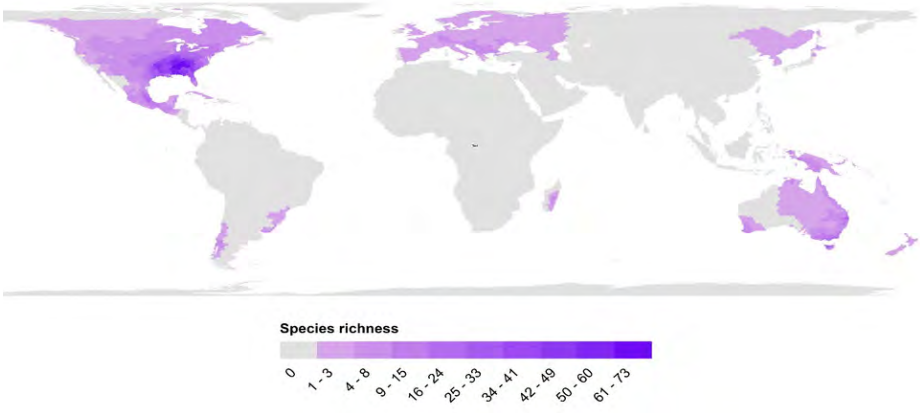


Fig. 1. Global richness map of freshwater crayfish.

In this study, I followed a trait-based climate change vulnerability assessment of 574 species (including 132 species from Australia) of freshwater crayfish included in the global IUCN Red List assessment (IUCN, 2010). This trait-based approach combines three key dimensions of climate change vulnerability: sensitivity, exposure and adaptability. For each dimension, key traits are selected and thresholds used to determine whether a species is scored as 'low' or 'high' susceptibility under that trait. To assess species' exposure to climate change, I used climate change projections at 30 seconds' resolution based on an ensemble of four General Circulation Models from Worldclim (www.worldclim.com), and at three emission scenarios. Species which are highly sensitive and exposed to climate change as well as poorly adaptable are considered as *climate change vulnerable* species.

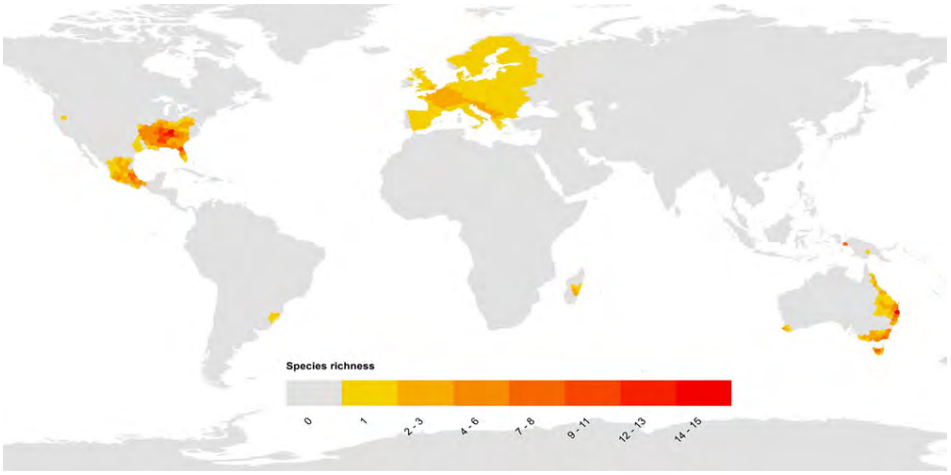


Fig. 2. Global distribution of redlist threatened freshwater crayfish.

For sensitivity, I collected data on habitat specialisation, microhabitat specialisation, restriction to high-altitude habitats, narrow tolerance in temperature and precipitation changes, dependence on high dissolved oxygen, dependence on interspecific interaction, rare within population and fragmented population. For exposure, I collected data on species' distribution in sea-level inundation habitats, changes in mean temperature, changes in temperature variability, changes in mean precipitation, and changes in precipitation variability. To assess species' exposure to climate change, I used climate change projections at 30 seconds' resolution based on an ensemble of four General Circulation Models, and at three emission scenarios. For adaptability, I collected data on geographic range restriction, extrinsic barriers to dispersal, declining population trends, and reproductive output.

The project constitutes the first application of the IUCN climate change vulnerability framework to freshwater invertebrates globally, and generates much-needed ecological knowledge on species' sensitivity and adaptive capacity. Importantly, the project provides the first systematic conservation recommendations for crayfish in Australia.

Book Reviews

All Animal Beings by Ken Drake

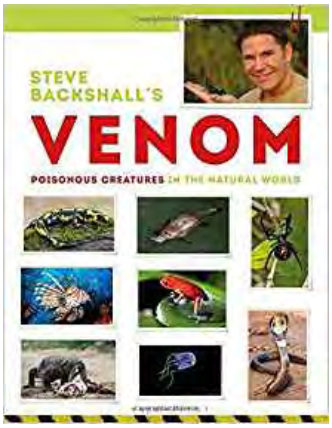
All Animal Beings comprises a stunning collection of heart-warming and curious photographs of the animals in our lives that we think we know best, as seen through the lens of Ken Drake. In this book, readers will find Zoo Studio's signature, stunning portraits of some of the most character-filled beings that Ken has met and photographed. From all manner of pets, iconic wildlife and farmed animals, subjects include the likes of Dundee the cockatoo, Penelope the pig, Cindy the camel and Raymond the koala. Animal lovers and photographic art connoisseurs alike will fall in love with this book.

Publisher: Buzz Group
RRP: $49.99

Shorebirds in Action: An Introduction to Waders and Their Behaviour by Richard Chandler

Shorebirds in Action is an outstanding and well-illustrated reference book on a special collection of birds. It serves well as an introduction to all wader birds and their behaviour as they live and feed around the beaches and lake systems across the world. The photographic collection of high-quality photos of shorebirds or waders covers over 80 percent of known shorebirds around the world. The close variation of the colour patterns of some species such as thick-knees and oystercatchers are very useful to all bird watchers. Australia is blessed with a large collection of shorebirds living and feeding around our vast coastline. The annual migration of these waders each year is one of the unique features of these birds when they fly north to breed in Siberia. A great reference book very well researched and illustrated for the keen bird lover.

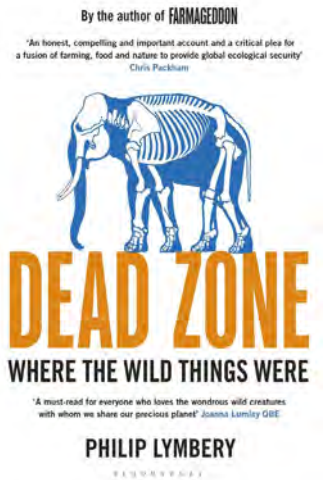
Publisher: Whittles Publishing | RRP: A$31.95



Venom: Poisonous Creatures in the Natural World by Steve Backshall

Venom: Poisonous Creatures in the Natural World is a fascinating book. Steve Backshall, who is an experienced naturalist, takes a fascinating look at the different types of natural venoms. On a tour of the world's continents, he looks at over 60 of the most venomous creatures, describing their main characteristics and explaining how they administer their venom and what its effects are. A wide variety of insects, reptiles and amphibians use toxins to subdue their prey or to stop becoming prey to another predator. Even some mammals and birds resort to poison as a means of securing a meal or deterring attack. Stunning colour photographs and exciting accounts of Steve's encounters with some of these animals bring the world of natural venom alive.

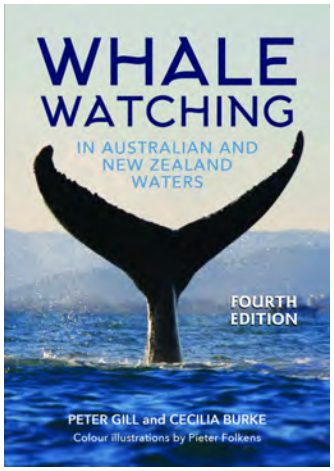
Publisher: Bloomsbury
RRP: $29.99



Dead Zone: Where the Wild Things Were by Philip Lymbery

Dead Zone is a highly readable if frightening examination of the impact of industrial agriculture on the environment, and particularly biodiversity. The book's style is part travel-book, part autobiography and part ecological critique of some of the world's most iconic and endangered species and what we can do to save them. Most of us are aware that many animals are threatened by extinction – the plight of creatures such as polar bears, tigers, and whales has been well publicised. While this is typically attributed to climate change and habitat destruction, few people realise that there is a direct link to consumer demand for cheap meat.

Publisher: Bloomsbury
RRP: $24.99



Whale Watching in Australian and New Zealand Waters by Peter Gill and Cecilia Burke

Whale Watching in Australian and New Zealand Waters is the definitive guide for holidaymakers, nature lovers and marine specialists. In recent years whale watching in Australia and New Zealand has become a passion for many people. Diverse marine environments from tropical to subantarctic mean that numerous species of whales and dolphins are drawn to our waters, while a plethora of tour operators makes it easier than ever to spot these wonderful creatures in their natural habitat.

Publisher: New Holland
RRP: $29.99

Australian Wildlife Society

Community Wildlife Conservation Award

The Australian Wildlife Society Community Wildlife Conservation Award is an annual award to a community conservation group that is making a major contribution to wildlife preservation in Australia.

Our Society is very conscious that we need to join together with other conservation groups to save and protect all native Australian wildlife populations in all its many and varied forms across Australia.

The Australian Wildlife Society wants to recognise and help these conservation groups continue with their good work on behalf of the whole community. Our Society knows that many organisations and thousands of volunteers are already working tirelessly to save our threatened species, as well as the humble and more common Australian species, and the precious wildlife habitat in which they live.

The Award

Our Society will present a crystal trophy and a cash award of $3,000 to the winning conservation group that is helping to save our precious Australian wildlife.

Nominations

Nominations for the Australian Wildlife Society Community Wildlife Conservation Award should be made in writing to be received by our Society by 31st December. Nomination forms can be downloaded from our website at http://www.aws.org.au/community/. Completed nomination forms can be sent to the Australian Wildlife Society by email to secretary@aws.org.au or mailed to PO Box 42 Brighton Le Sands NSW 2216.

Selection Procedures

The decision on the granting of each year's award will be decided by a full meeting of the Council of the Australian Wildlife Society.

For further information, please contact the National Office on Tel 02 9556 1537.

Founded in 1909 and dedicated to the conservation of Australia's unique wildlife

Australian Wildlife Society

Rehabilitation Award

The Australian Wildlife Society Community Rehabilitation Award will be awarded to an individual or a community conservation group that is making a contribution to wildlife preservation in Australia.

Our Society knows that many organisations and thousands of volunteers are already working tirelessly to save our threatened species as well as the humble and more common Australian species and the precious wildlife habitat in which they live. We are all aware of the wonderful work being carried out by volunteers across the country in saving our sick and injured wildlife. They spend many hours and days caring for a single animal that has been injured by a car, savaged by a feral animal or hurt in bush fires. We want to recognise and help these individuals or conservation groups continue with their good work on behalf of the whole community. Our Society will present a trophy and a cash award of $1,000 to the winning individual or conservation group that is helping to save our precious Australian wildlife.

Persons may nominate themselves or their own organisation or they may choose to nominate a third party who they believe should receive recognition. All nominations must be supported by a referee.

Nominations

Nominations for the Australian Wildlife Society Rehabilitation Award should be made in writing to be received by our Society by 31st December. Nomination forms can be downloaded from our website at http://www.aws.org.au/rehabilitation/. Completed nomination forms can be sent to the Australian Wildlife Society by email to secretary@aws.org.au or mailed to PO Box 42 Brighton Le Sands NSW 2216.

Selection Procedures

The decision on the granting of each year's award will be decided by a full meeting of the Council of the Australian Wildlife Society.

For further information, please contact the National Office on Tel 02 9556 1537.

Founded in 1909 and dedicated to the conservation of Australia's unique wildlife

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:.....

Address:.....

City/Suburb:..... Postcode: .....

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

Email: .....

Membership category (please tick)

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

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

Three year membership (please tick)

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

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

Payment details (please tick)

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

Card Security Code (CSC) __ __ __ __

Card Number:

Name on Card: .....Expiry:.....

Signature:.....

Amount $.....

Donation $.....

Total $.....

Mail to the: **Australian Wildlife Society**
PO Box 7336, MT ANNAN NSW 2567.
Email: accounts@aws.org.au Website: www.wpsa.org.au
Tel: (02) 4647 7420

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.