AUSTRALIAN Wildlife

SUMMER Vol: 1/2015
$10 (non-members)

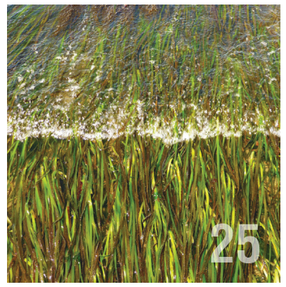
Celebrating a new century of wildlife preservation in Australia

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

Eastern water dragons Photography by Andrew Aylett

Contents

features



regulars

Suzanne Medway AM
Editor
Australian Wildlife

Front cover and back cover:

The Eastern water dragon (*Physignathus lesueurii*) is a medium sized lizard, with some specimens growing up to 80 centimetres in length including their long tail. Eastern water dragons have large heads, with a row of spines beginning on the head and leading down along their back. Eastern water dragons are semi-aquatic lizards that are found along the east coast of Australia. They are normally found around creeks, rivers or lakes. The lizards can remain submerged for up to 30 minutes and rise to the surface where they are able to breath, while checking the area for danger before emerging back onto land.

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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Australian Wildlife Society

Conserving Australia's Wildlife since 1909

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Notice to our members

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

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

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

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

Our Mission

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

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

From the President's desk

Dr David Murray - President

Earlier this year the Linnean Society of NSW raised the alert about the proposed Needles Gap Dam on the Belubula River, near Canowindra, and the fact that it would inundate the Cliefden Limestone Caves.

I put this problem to a monthly AWS Board meeting, and we agreed to support the Linnean Society campaign to save the caves. The Linnean Society itself is holding a scientific conference on the caves in September 2015, but this is some way down the track, and after the next state election.

Cliefden Limestone Caves date from the Ordovician Period (around 490 to 434 million years before the present), and this series of limestone caves is reputed to be the earliest discovered in inland New South Wales. The conodont fossils in the limestone are of national and international importance. There are other highly significant fossils as well, including trilobites, brachiopods, rugose corals, and "one of the most diverse deepwater sponge faunas ever recorded" (Ian Percival, personal communication). Of scientific interest also is the occurrence of blue stalactites, evidently caused by copper, chromium and possibly nickel impurities in the aragonite form of calcium carbonate found here, and rarely found elsewhere.

Coming to the present day, the caves provide protective habitat for bats, birds, lizards, amphibians, and invertebrates, such as worms and centipedes. Bats need the protection afforded by caves against extremely hot days (temperatures between 40 and 45 degrees centigrade) as such extreme days have caused the deaths of literally thousands of bats between 2009 and the present. The bat that occupies the main Cliefden Cave is the eastern bent wing bat (*Miniopterus orianae oceanensis*, syn. *shreibersi*). This bat is a very important nocturnal insectivore, and assists farmers' crops by consuming pest insects. Another bat present in other caves is the eastern horseshoe bat (*Rhinolophus megaphyllus*). So the chief bat species is beneficial to farmers, as an agent of integrated pest management.

So why would farmers want to get rid of their natural assistants by flooding their caves, by building an unnecessary dam on the Belubula River? Building dams is an outmoded and wasteful technology, usually 'laying water out to dry'. The *7.30 Report* program on 3 October 2014 indicated that this would be the fifth dam on a very short stretch of river. The dam would not be sustainable, and this was underlined by the geological assessment of what would happen to dammed water entering the cave system, which is riddled with crevices and faults. The water, instead of being stored or used, would simply disappear underground.

The Nature Conservation Council of NSW has a 'no dams' policy, and a motion was passed affirming this with regard to the proposed Needles Gap Dam, and four others, at the Annual Conference on 2 November 2014. The NCC will be writing to the State Government accordingly.

The estimate for the cost of this dam is between $150 and $300 million of taxpayers' funds. If taxpayers were properly consulted, they would give it the thumbs down. If local farmers were properly consulted, which they have not been, they too would give it the thumbs down. The farmer on whose property the entrance to the main Cliefden Cave is situated has not been told anything. This is damming by stealth, and by deception.

The Government that has decided to put $3 million into a feasability study for this dam needs to reassess its mistake very quickly. Even this preliminary funding is a total waste of money. Having spent quite some time on various water committees advising the NSW Government through the 1990s, I can give free and expert advice not to do it. It is clearly not in the farmers' best interests, and in addition it is scientific and cultural vandalism. A government that wastes money on unnecessary ventures, and sides with environmental vandals, is on the slippery slope to extinction. It shows very limited intelligence, and why should we support unintelligent representatives in Parliament? Let's make sure we improve the quality of our parliamentary representatives at the next state election by examining every candidate's environmental policies, or lack of them, very closely.

Cliefden Caves are located on the Belubula River, New South Wales, between the towns of Carcoar and Canowindra, about 20 kilometres east of Canowindra

Eastern water dragons

Andrew Aylett

These series of photos were taken back in January 2013 when Sydney officially hit the hottest day on record reaching 45.8 degrees Celsius. According to ABC News, the previous record was 45.3 degrees in January 1939.

I headed straight to Royal National Park to see the eastern water dragons. I have often seen them in large numbers resting on the boulders enjoying the sun near the pond. I was curious to see how the dragons would cope with the heat and hoping to capture some unique photographs.

As I arrived at the pond, I could see very few dragons, less than half of those I would normally see. The extreme heat had forced most dragons to hide out in the shade avoiding the direct sun. Some dragons were in the pond under the overhanging rock and it was here I captured one of my most intriguing photographs. Eastern water dragons are known to drop into water if disturbed and will stay under for up to 30 minutes if necessary to wait for danger to pass. I really think that on this particular day, the dragons were in the water to cool down. I began to wonder how the rest of the wildlife was coping with the heat.

These photographs are examples of wildlife facing difficult and unexpected challenges and highlighting what may happen with global warming and climate change

Andrew Aylett is a Sydney-based fine art photographer. His passion for photography, combined with love of animals, inspired him to undertake formal photographic training, graduating from TAFE Ultimo College in 2011 with a Diploma. Andrew loves to travel and explore new cultures, he is dedicated to his craft and always on the lookout for new photographic challenges that have pushed Andrew and developed his skills as a truly professional photographer.

Australian Wildlife Society

(ACN 134 808 790)

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

Patron: His Excellency General the Honourable Sir Peter Cosgrove AK MC (Retd)
Governor-General of the Commonwealth of Australia

Australian Wildlife Society
Conserving Australia's Wildlife since 1909

The President and Directors cordially invite all members to attend the 2015 Annual General Meeting of the Society

A President's Luncheon will be held on Level 4 at the conclusion of the meeting

106th ANNUAL GENERAL MEETING

AGENDA

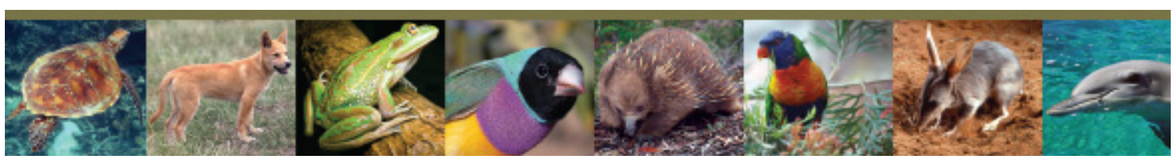
Wednesday 4 March 2015
Commencing at 11.30 am

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

1. Welcome and recording of those present
2. To receive apologies
3. Minutes of the 105th Annual General Meeting held on Wednesday 18 March 2014
4. President's Report for 2014
5. Treasurer's Report for 2014. Receive and adopt the Balance Sheet and Income and Expenditure of the Society for the year ending 31 December 2014 in accordance with our Constitution.
6. To appoint the Auditors for 2015
7. Closure.

Issued by authority of Council of the Wildlife Preservation Society of Australia Limited.

Patrick W Medway AM
Chief Executive Officer/Honorary Secretary



Australia's marvellous mammals

The marsupials

Kit (Amy) Prendergast

Australia boasts a rich, diverse assemblage of species, many of which are endemic: found nowhere else in the world. Australia's extraordinarily unique wildlife is a consequence of how, for hundreds of thousands of years, the Australian continent existed in isolation from the rest of the globe. Australia's amazing array of unique biota however have been, and continue to be, highly jeopardised by the actions of mankind. As such, Australia's wildlife has become a key point of focus for individuals around the world.

Whilst Australia's astounding wildlife includes species from many groups of animals and plants, this article will focus on one of Australia's most charismatic and distinctive groups: the marsupials. Seventy percent of the world's marsupials live in Australia. Most people are familiar with the kangaroo and koala, which are ambassadors for Australia's marsupials. However, there are many other Australian marsupials, many of which need our ongoing attention, deserve our concern, and require our dedicated commitment to ensure their continued existence.

Mammals are classified into three key groups: 1) monotremes, the species-poor group of egg-laying mammals which include Australia's duck-billed platypus, and the spiny insect-eating echidna species of Australia, New Zealand, and Papua New Guinea; 2) placentals, and 3) marsupials. Most people are familiar with placentals, which, comprising almost 95 percent of the estimated 5,400 mammal species in the world, are the predominant types of mammal today, and occupy all continents. However, less people are aware of the amazing marsupials, which are the predominant mammals in Australia.

Australia, Antarctica, South America, Africa and India were once joined together in a huge southern supercontinent known as Gondwana. Both placentals and marsupials first evolved from a common mammalian ancestor about 160 mya (million years ago) in the Northern Hemisphere in what is now China. However, marsupials subsequently became extinct in the Northern Hemisphere, and now only occur in the Southern

Above: Kangaroo and joey. Photo: Kit Prendergast

Newborn joey: this newborn joey of a brushtail possum illustrates the features of all marsupials at birth. It is tiny (about the size of a jellybean!), entirely lacks hair, its eyes have yet to open, and it has yet to be capable of hearing. Despite having tiny hindlimbs, it has relatively large forelimbs. This vulnerable little joey is kept within the warm, safe confines of its mother's pouch, permanently attached to one of her teats and, at this stage of its life, consumes small volumes of dilute milk, fairly low in fats, but rich in proteins and especially carbohydrates. As it develops, the mother will increase the volume of milk produced, and the milk will switch to being highly concentrated, rich in fats, but with relatively lower carbohydrates content. Photo: Kit Prendergast

The numbat is unusual among marsupials: it feeds exclusively on termites, and unlike most marsupials that are active during the evening and early hours of the morning, it is diurnal (active during the day). It is the only member of the entire family – Myrmecobiidae – in which it is classified. Once distributed across most of Australia, it has declined greatly in distribution and abundance and is now restricted to Western Australia. However, conservation biologists and captive breeding at Perth Zoo have made notable progress in the recovery of this species. Photo: Kit Prendergast

Hemisphere where they inhabit South America, Australia and New Guinea. The ancestor of Australian marsupials dispersed from South America, across Antarctica, and into Australia some 55 mya when these three continents were still connected. Following the rifting of Australia from Antarctica about 45 mya, this isolated Australia and its marsupial fauna, leaving them free to evolve in isolation from placentals. With a diversity of habitats associated with Australia's large landmass, and in the relative absence of competition from other animals, marsupials radiated explosively, diversifying to occupy a huge range of lifestyles.

Many species of marsupials and placentals share similar lifestyles and appearances. Consider for example the similarities in appearance and lifestyle between the so-called marsupial 'mice' such as species of dunnarts, planigales and antechinuses with placental rodents like house mice; between marsupial 'moles' with golden moles of Africa's Namib desert; between the marsupial Tasmanian 'tiger' or 'wolf' known more accurately as the Thylacine (sadly now extinct) with 'true' wolves and tigers; between marsupial 'cats' properly known as quolls with placental felines; and between the rabbit-like bilby and 'true' rabbits. Yet these superficial similarities are not due to such pairs of species being closely related evolutionarily. Evolving in isolation on different continents, these marsupial and placental species are a perfect demonstration of convergence, where species that are not closely related evolutionarily 'converge' on a particular body type or lifestyle that natural selection favours owing to being exposed to similar environmental pressures. Hence, given that marsupials diverged from placentals 160 mya, despite similar appearances, a marsupial 'mouse' like a dunnart is actually more closely related to a koala, and likewise placental mice are more closely related to elephants than they are to dunnarts!

Along with aspects of their skeleton, the key traits differentiating marsupials from placentals relate to reproduction. One of the major differences between marsupials and placentals relates to the amount of time dedicated to gestation (when a baby develops in the uterus prior to birth) vs. lactation (when the baby is nourished from the mother's milk), and the size of the offspring at birth. All marsupial species have an extremely short gestation, with some species such as bandicoots and opossums giving birth after a gestation merely 12 days long. Larger macropods (kangaroo and wallaby species) have the longest gestation lengths for marsupials, yet, lasting approximately five weeks, this duration is comparable with what are considered short gestation lengths by placental standards, and their five-week gestation period is remarkably brief relative to the nine months we humans bear our young for before giving birth, and absolutely pales in comparison to the 22-month-long gestation of elephants. However, marsupials' characteristically short length of development in the womb is compensated for by their comparatively long lactation phase. Lactation in marsupials is not only long but remarkably complex. Unlike placentals, the volume and composition of the milk changes throughout the lactation period, uniquely tailored to meet the growing and changing needs as a female's offspring grows and develops from a tiny, underdeveloped newborn to independence.

With such a remarkably short gestation period, it is no wonder that a diagnostic feature of marsupials is how all species give birth to tiny, poorly developed young. Across all marsupial species, the weight of an entire litter at birth never exceeds more that one percent of the mother's body weight. This contrasts markedly with placentals, where some species of small rodents produce litters that are 50 percent of the mass of their mothers! A newborn kangaroo joey is only half the size of a newborn mouse, despite the fact that a mother mouse is certainly significantly smaller than a mother kangaroo! Eastern grey kangaroo females, one of the largest of marsupial species, weigh 28 kilograms, yet they give birth to a joey that weighs a mere 839 grams: only 0.003 percent of the mother's body weight. Most newborn joeys weigh only 200-400 grams. The record for the smallest newborn is held by the tiny 7-16 gram honey possum. Honey possums give birth to joeys that are truly minuscule: being smaller than a grain of rice, and weighing a mere 4 milligrams!

Not only are newborn marsupials tiny, they are born in a developmental stage comparable to that of a placental embryo. Newborn joeys are blind, hairless, unable to regulate their body temperature, various parts of their brains have not even developed, and their hindlimbs are rudimentary. However, certain aspects of the newborn joeys are relatively well-developed, including the forearms, muscles around the mouth and throat, and their sense of smell. These well-developed features of the newborn relate to how, despite being minuscule and extremely vulnerable, a newborn joey must be able to travel from the vagina from which the joey emerges at birth, to find the mother's teat without any assistance whatsoever from the mother: a truly remarkable feat! Once it locates a teat, the joey will latch on to the teat and will remain permanently attached to the teat for the first third of the lactation period – a feature unique to marsupials.

Marsupials' uniformly extremely short gestation period resulting in tiny, 'embryonic' newborns is likely a consequence of a quirk of how the urinary and reproductive tracts form during a marsupial's embryonic development. During development, the ureters – the tubes which drain the kidneys to carry urine to the bladder – pass in between the developing female reproductive tracts. This prevents the left and right female reproductive

The quoll (*Dasyurus*) is a carnivorous marsupial native to mainland Australia, New Guinea, and Tasmania. It is primarily nocturnal and spends most of the day in its den. Of the six species of quoll, four are found in Australia and two in New Guinea. Photo: Kit Prendergast

tracts from fusing. As a consequence, all female marsupials have not only a separate left and right oviduct, as in placental mammals, but also separate left and right uteri and vaginae. In placentals, the ureters develop on the outside of the developing reproductive tracts, allowing the reproductive tracts of placental females to fuse to form a single uterus and vagina. During mating when a male inseminates the female, in marsupials the male's sperm pass up a left or right lateral vagina to fertilise an egg released from the ovaries as it travels down an oviduct. Following fertilisation of the egg, and development in one of the uteri, the joey then must be born through a central birth canal, also known as medial vagina, which lies between the ureters, which in turn lie between the lateral vaginae. Because, during development, the female marsupial's reproductive tracts cannot fuse due to the position of the ureters, this means the uteri are constrained in size and can only accommodate housing small offspring, and the birth canal through which the joey is born is likewise constrained in size, placing a limit on the size at which the baby can develop prior to when the mother gives birth.

Kit Prendergast is well-qualified to write on this topic. She has a degree in Zoology, Conservation Biology, and English and Cultural Studies from the University of Western Australia, an Honours degree in Zoology and Conservation Biology, and studied Marsupial Biology specifically. Kit has written and published numerous articles, both in the scientific and popular literature on marsupials, as well as other aspects of Australian wildlife and animals in general. She has been published in many animal and wildlife magazines aimed at general public audiences, including *Australian Wildlife*, *Wildlife Australia*, *BirdKeeper*, *Crikey!* (Steve Irwin's Australia Zoo's magazine for youths), *Wildlife Secrets*, and Western Australia's Department of Parks and Wildlife's magazine *LANDSCOPE*. Kit has a deep love of animals, and is passionate about sharing her knowledge and communicating the need to respect, love and cherish the many animals we share this planet with.

Most people immediately think of the pouch, or 'marsupium' – suggested in the name 'marsupial' – as the defining characteristic of marsupials. However, whilst it is true no placentals possess a pouch, not all marsupials feature a pouch either! Whilst the pouch is deep and well-developed in female kangaroos and honey possums, it is only poorly developed in other species, and female numbats, various South American possums, and many small marsupial mice such as phascogales lack a pouch entirely. Moreover, echidnas also feature a pouch. Another misconception is that only placentals possess a placenta: the organ that forms during pregnancy involved in the exchange of nutrients, gases and wastes between the developing foetus and the mother. Whilst the placenta tends to be much more developed in placentals, all marsupials also form a placenta. Marsupials tend to have what is known as a yolk-sac placenta, whereas the major placenta in placental mammals is what is known as a chorioallantoic placenta. The exception among marsupials are bandicoots, which, like placentals, develop a highly invasive, well-developed chorioallantoic placenta. It appears this placental type is more effective at nutrient and gas exchange because despite bandicoots having the shortest gestation of any mammal – a mere 12 days – newborn bandicoots are relatively well-developed compared with other marsupial newborns.

Marsupials have suffered greatly from human activities. Following the invasion of Australia by Aborigines some 50,000 years ago, this culminated in the mass extinction of about 50 marsupials, mainly megafauna. Australia once boasted wombat-like marsupials known as diprotodons that were three metres long and weighed approximately 2,800 kilograms; giant marsupial carnivores comparable to sabre-toothed tigers; and kangaroos so huge they had to walk rather than hop. Through burning the marsupial's habitat and food, and ruthless hunting, Aborigines drove these remarkable beasts to extinction. Following colonisation of Australia by Europeans in the 18th Century, marsupials suffered another wave of extinctions, wiping out eight percent of marsupial species and subspecies. Many other marsupial species have experienced drastic declines in abundance, number of populations, and distribution. Species most affected are within the 'critical weight range' of 35 and 5,500 grams. Extinctions and declines over the past two centuries have been the result of persecution; land-clearing for agriculture (especially livestock) and urbanisation, accompanied with habitat loss, degradation, and fragmentation; and over-predation from introduced predators, namely cats and foxes. These threats continue today, placing Australia's remaining amazing marsupials at risk of succumbing to extinction. In addition, climate change poses a new, ongoing threat that will escalate the risk of extinction many species already face.

Concerningly, just under one fifth of all marsupial species are recognised as being threatened with extinction. Thankfully however, many dedicated people are working diligently to conserve them, and there have been some notable achievements. Conservation biologists have contributed to marked recoveries of various species. One notable example is the dibbler: re-discovered after being thought to be extinct for 83 years, from a mere handful of individuals, captive breeding, research, habitat restoration, reintroductions and introductions into predator-free islands and enclosures has led to this species now numbering over 300 individuals. Whilst this is still an extremely small population size, it nevertheless proves that science and dedication can save marsupial species from the brink of extinction.

In addition to these efforts by the scientific conservation community, a number of actions are vital for securing the persistence of marsupials. To secure the future of marsupials, funding into conservation and habitat protection is vital. The Australiam Wildlife Society is an important component of this mission. We need to limit destructive practices like mining, hunting, livestock production, and further land clearing, and we can all do our part in reducing climate change and habitat destruction, a key practice involving switching to a plant-based diet.

Dibbler is the common name for *Parantechinus apicalis*, a small marsupial with coarse brownish grey fur, speckled with white. It has distinctive white eye-rings and a tapering hairy tail. The dibbler is one of Australia's most endangered species and is classified as Critically Endangered. Photo: Kit Prendergast

In light of the remarkable marsupials now lost forever, we must acknowledge past mistakes, and make a concerted effort to live in harmony with other life forms on Earth: in Australia, as well as all other countries across the globe, and including animals inhabiting both the terrestrial and aquatic realms. Conserving biodiversity, and improving the lives of the animals we share this planet with, is an enormous but most worthy task. The lives of the wondrous diversity of species we share this planet with, and ultimately ours, depend on it. AWS's vision of a world free of animal suffering is both achievable and laudable: together, we can transform for the better the lives of all animals, both human and non-human.

Brushtail possum joey. Photo: Kit Prendergast

Australian Wildlife Society
Conserving Australia's Wildlife since 1909

Dr David Murray, President
and Directors of the Board of the

Australian Wildlife Society

Cordially invite you to the

ANNUAL PRESIDENT'S WINE TASTING LUNCHEON

of the Society

Wednesday 4 March 2015
Commencing at 12 noon

in

the Cello Restaurant
Castlereagh Inn Boutique Hotel
169 Castlereagh Street Sydney

RSVP by 28 February 2015. Booking and prepayment essential

Acceptance form:

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

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The rustle of pond reeds

The importance of protecting our wildlife and staying close to nature

Robert Hollingworth

To lose sight of our origins is to lose sight of ourselves.

It's been six years now since Rusty, a stray chocolate Labrador, took up residence in an Illinois nursing home. The facility cares for sufferers of dementia and Alzheimer's, and it soon became obvious that Rusty had profound healing properties, transforming the lives of many who seemed to identify with the animal. Unaided, Rusty suddenly improved the patients' mental outlook, their physical behaviour and their general health.

Researchers have now confirmed that pets have the power to heal. Dogs and cats, it is said, replace loneliness, offer affection and take the mind off grief, pain and fear. But perhaps their true role goes much deeper. After all, even children bond with animals of many kinds, from budgies to horses to hermit crabs.

It's possible that domestic pets offer a direct and unfettered connection to the living/breathing planet, a world that is not 'about' us, but one that we are intrinsically linked to. They may unite us with something crucial about being alive, something deeply embedded in the fabric of life itself. It's a domain that we often disregard while pursuing our busy, technology-driven lifestyles. Surrounded by the mad tear of traffic, shopping, careers, commuting and kids, Rusty the nursing home pet stands in as a surrogate for elemental experiences that we once found elsewhere. Indeed, perhaps our first and real 'Rusty' was the natural world itself.

I live with my wife in inner-city Melbourne, but own a secluded mountain hideaway in the rocky mountains of Central Victoria. It is here, for us, that some founding principle about life seems to reside. One might call it a 'healing environment' but in reality, we are just reuniting with something that seems indispensable, like a fish returning to the sea. Here, we can re-engage with the exact source of what it means to be alive. It can be found in the air, the light, the colours and textures, the soft rustle of pond reeds – or the rough wind – the sweet scent of tree resins or the damp earth at the mouth of wombat burrows. These are not powerful forces, but collectively they represent a palpable operation that humans play no part in, that exists whether we acknowledge it or not, that has no interest in us whatever. It is a reality imbued with grace and dignity. And that is what we can absorb here in bucketfuls. It actually makes me want to be a better person, to quote a famous actor.

I love our rocky mountain and want to protect it from farming encroachment, introduced animal and plant species and to maintain a space where native flora and fauna can thrive. But should anyone care if a bit of bush is degraded by humans? Aren't I being just a little sentimental?

To answer this, perhaps we should step back from our planet and observe it as though it was a kind of zoological enclosure. First of all we might see that the earth is indeed an enclosure; so far, nothing living has escaped it. Then we might see that the dominant species (*Homo sapiens*), like termites or a swarm of locusts, is gradually and inexorably eating its way through everything. Each day, an extra 35,000 hectares of rainforest is lost, along with 137 species of plant, animal and insect.

Above: Pond in the Tallarook Ranges

Granite in the Tallarook Ranges

The World Wildlife Fund's 2010 Living Planet Report shows that humanity's ecological footprint (our impact on the planet) has doubled since 1966 and exceeds the world's ability to regenerate by 25 percent. Around 1,300 scientists from 95 countries have issued their Millennium Ecosystem Assessment which recognises that 15 of the earth's 24 ecosystems vital for life are in a degraded or overdrawn state. Meanwhile, our global population grows by more than 80 million a year, the size of Germany's. In 1970 the world was half the population it is now and we will add another three quarters of a billion people in the next ten years.

These are the hard facts. They demonstrate that there has never been a more urgent time for humans to act, to preserve what we have left, to recapture what we have lost, to restore that which is endangered. Sentimental indeed! We need to recognise that, for the physical and mental wellbeing of humanity, we must re-engage the crucial role of nature – people's lives are compromised without it. Apart from clean air and water, nature provides a link to the raw grounds of humility and selflessness, an underpinning that has gone missing from our 'virtual' realms.

To lose sight of our origins is to lose sight of ourselves. We are much more than a set of socially orchestrated responses to technology-driven stimuli. We are living, breathing organisms that, deep down, have the same grace and dignity as the rest of the natural world. We need to find it, to balance the gratifying comforts of our contemporary lives with a recognition that the natural world is more than a thing of beauty, it is a core component of who and what we are.

Robert Hollingworth's new novel is *The Colour of the Night* (Hybrid Publishers, $24.95), available in all good bookstores. It tells the story of Shaun Bellamy, an orphaned country boy. In the city, he meets a host of mixed-up souls and confronts modern life full on. Can his world of benign nature and this new one of frenetic culture be reconciled?

Pond and House, Tallarook Ranges

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

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

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

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

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

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

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

Finding such a juvenile would give hope that the baiting program against feral animals is having some effect

Above: One of Australia's cutest and rarest wallabies

and that the juveniles are making it to adulthood. The reality is that the researchers commonly see females with pouch young but rarely do they subsequently see those joeys make it to adulthood.

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

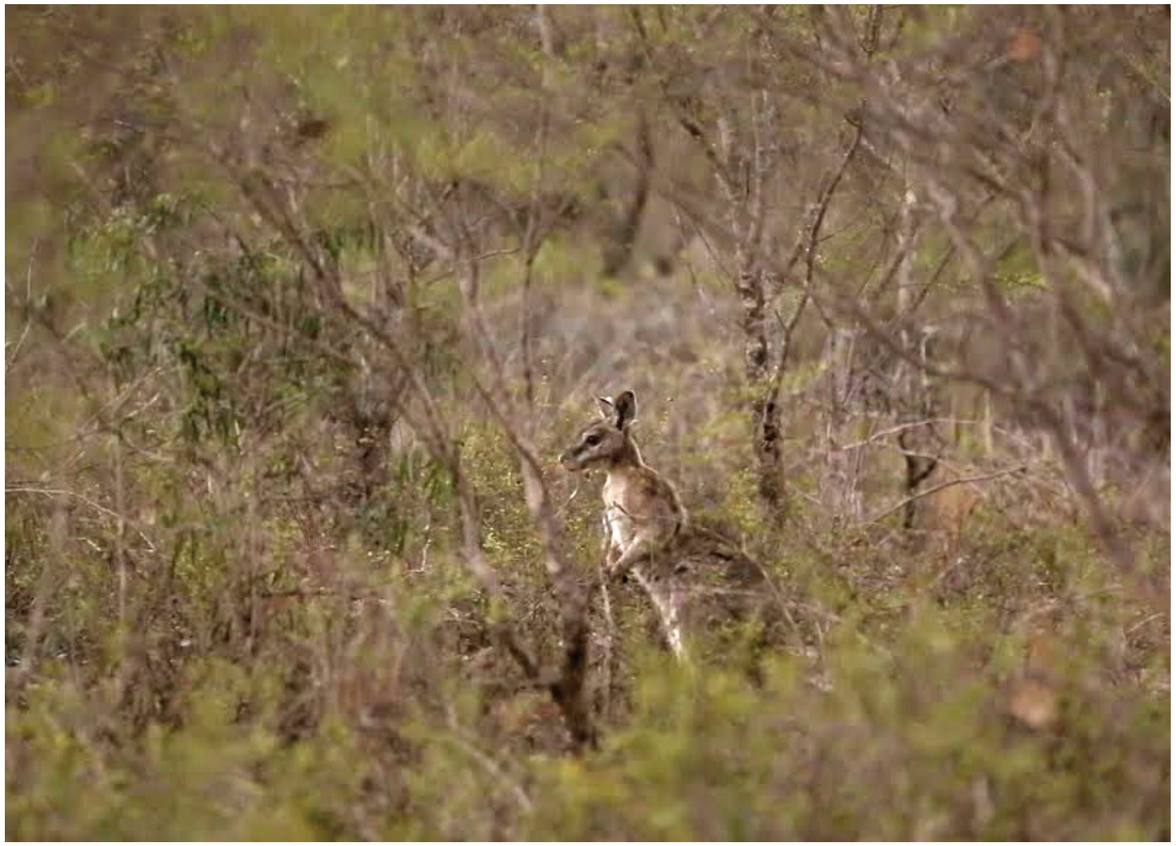
An adult female known by her ear tag as *Green 6* (G6) has been monitored on the refuge for several years and this year she is being tailed by her son – the almost independent and incredibly cute *Orange 31 (O31)*. *O31* has been trapped three times over the course of the week's survey: twice on his own and once with G6. This trapping pattern indicates that *G6* is his mother and also that he is nearly independent – already spending time foraging on his own. *O31* weighs slightly over 0.5 kilograms and while being such a lightweight makes him adorable it also makes him highly vulnerable.

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

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

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

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



Wallaby in the bush

The almost independent and incredibly cute *Orange 31 (O31)*

suffer population reductions of over 50 percent.

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

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

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

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

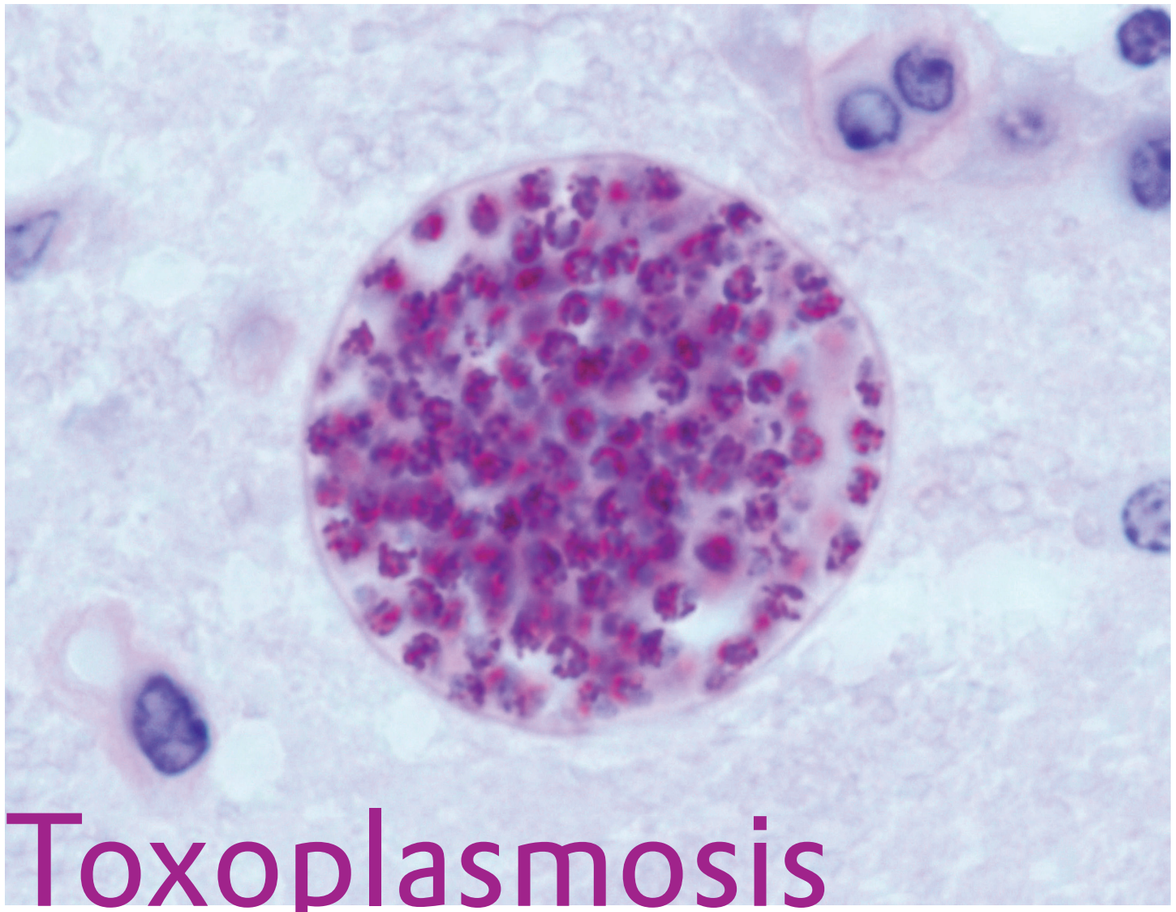
The nursery will have a 'hands-off' management approach. Custom-designed and remote monitoring technology will weigh and identify the wallabies as they make their way to a water source within the nursery. Images and data will then be sent to an off-site database as they pass over the weigh stations.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

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

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

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

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



Toxoplasmosis

How feral cats kill wildlife without lifting a paw

Bronwyn Fancourt, PhD candidate in wildlife ecology at University of Tasmania

Feral cats are a huge threat to our native wildlife, hunting and killing an estimated 75 million animals across Australia each and every night. But the killing spree doesn't end there. There's a parasite lurking in kitty's litter that continues to kill wildlife long after the perpetrator has left the scene of the crime.

The killer is toxoplasmosis, a disease caused by the parasite *Toxoplasma gondii*. The parasite is spread by cats but it can infect any bird or mammal. Around one-third of humans worldwide are infected with the parasite. But the deadly effects on our wildlife are often overlooked.

What does toxoplasmosis do?

In many animals, *Toxoplasma* infection causes nothing more than a mild case of the sniffles. If the animal is healthy, the immune system usually produces antibodies that keep the parasite under control. The parasite then goes into a relatively dormant state, forming invisibly tiny cysts mainly in the heart, lungs, brain, eyes, and spinal cord. While the cysts stay with the animal for life, they rarely cause any direct harm.

But for some animals, infection can be deadly. If an animal's immune system isn't quite up to the task, either through illness or stress, the initial infection can lead to toxoplasmosis. The disease has a range of debilitating symptoms, including anorexia, lethargy, reduced coordination, apparent blindness, enlarged lymph nodes, disorientation, breathing difficulties, jaundice, fever, abortion, and death. Some of these side-effects may kill the host directly, while for others, they will make the host an easier target for predators. For example, blinded wildlife cannot see predators, while lethargic or badly coordinated animals might be too slow to escape.

Another threat to our wildlife

Unfortunately, Australian marsupials are very susceptible to toxoplasmosis. Species such as the eastern barred bandicoot typically die within 2–3 weeks of infection. As a result, toxoplasmosis has thwarted conservation attempts to introduce the species to French Island in Victoria.

But bandicoots are not the only victims. Toxoplasmosis is a confirmed killer of other Australian wildlife, including Tammar wallabies, koalas, wombats, and several small dasyurids.

In Tasmania, toxoplasmosis kills Bennett's wallabies and pademelons, with infected animals found dead or stumbling around blindly during the day, vulnerable to predators or cars as they stumble onto busy roads.

Above: Toxoplasma gondii tissue cyst in mouse brain. Photo credit: Jitinder P. Dubey/ Wikimedia Commons

A manipulative parasite with a motive

For animals lucky enough to survive the initial infection and its symptoms, the threat doesn't end there. While the parasite might appear to be dormant, it may be secretly manipulating its host's behaviour.

Several studies have linked certain 'risky behaviours' with latent *Toxoplasma* infection. For example, studies have shown that rats and mice infected with *Toxoplasma* not only lose their natural fear of cats, but are actually attracted to them.

Why? It all comes down to motive. The *Toxoplasma* parasite needs to pass through two different animal hosts to complete its life cycle. Some stages of the life cycle can occur in any warm-blooded animal (the intermediate host), but the sexual stages can only occur in a cat (the definitive host). So when the parasite is in an intermediate host such as a mouse or a rat, it needs to pass back into a cat to complete its life cycle. To achieve this, the parasite manipulates the rodent's behaviour, making it an easier meal for a cat. But in wildlife, these risky behaviours will increase the risk of predation – not just by cats, but all predators including foxes, dogs, raptors, and reptiles. And in a strange evolutionary twist, mothers infected with *Toxoplasma* have been found to give birth to more sons in both mice and humans. While the reasons for this are unclear, infection with *Toxoplasma* may gradually skew

Feral cats are a triple threat to our wildlife through predation, competition and diseases such as toxoplasmosis. Photo credit: Eddie Van 3000/Wikimedia Commons

Infection in eastern barred bandicoots is almost always fatal. Photo credit: JJ Harrison/Wikimedia Commons

To control toxoplasmosis, we need to control feral cats. Photo by Bronwyn Fancourt

the sex ratios of our threatened wildlife in favour of males. Over time, this would reduce the number of females in a population, further reducing the reproductive capacity of many declining species and exacerbating ongoing population declines.

Why are feral cats to blame?

Newly infected cats only shed the parasite for around two weeks. However, in that short time, a single cat can shed more than 20 million parasites in its faeces. Thousands of mammals and birds can then become infected by eating food, soil or water contaminated by a single cat. Under cool, humid conditions, these parasites can survive in the environment for at least 18 months, continuing to kill wildlife long after the cat has left the area.

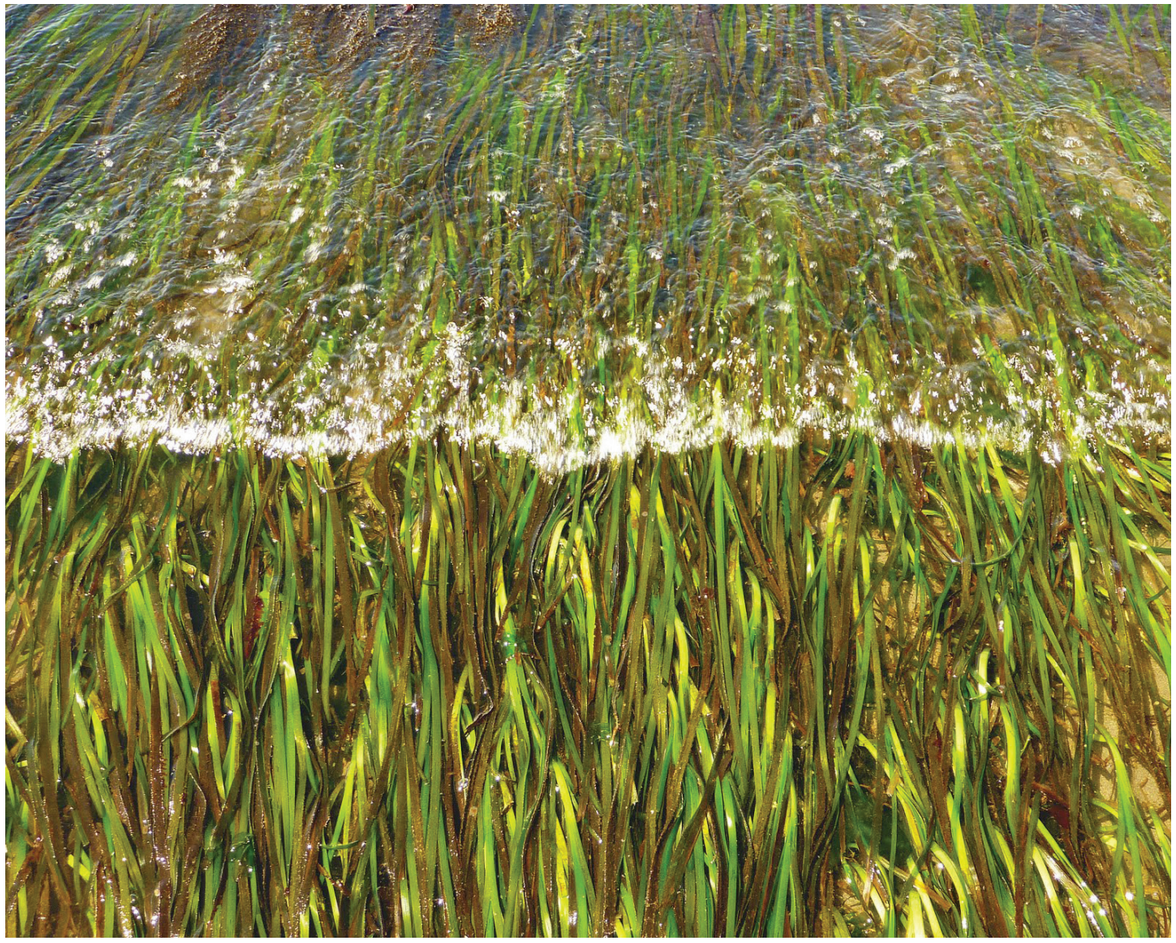
Infected rodents are fatally attracted to cats. Photo by Wendy Ingram

While the parasite can also be transmitted by eating infected prey, studies have shown that marsupials in areas where cats may roam were 14 times more likely to be infected than those in areas without cats. Most responsible pet owners keep their domestic cats indoors and restrict their hunting activities, minimising the risk of infection. But feral cats need to hunt and kill to survive. Therefore, feral cats are the most important player in the *Toxoplasma* cycle. To break the cycle and eliminate the parasite, we need to eliminate feral cats.

A recent study found that 84 percent of feral and stray cats tested in Tasmania were infected with the parasite. Previous studies have found a similarly high prevalence in feral cats on both Christmas Island and Kangaroo Island.

These islands are currently refuges for a range of endemic and threatened species, many that have been driven to extinction on the Australian mainland. While Christmas Island has recently been earmarked for feral cat eradication, all three island refuges should be prioritised for targeted feral cat control programs.

Toxoplasmosis is yet another threat posed by feral cats against wildlife. The future of many of Australia's threatened species increasingly hinges on our ability to control feral cats.



Eel grass - ribbon weed - strap weed - paddle weed

Bernie Clarke OAM

What do you know about seagrasses, the world's number one sequester of carbon? Concentration of carbon in seagrasses is about 1,000 parts per million and when left undisturbed they can live for thousands of years.

Australia has 25 species of seagrass, including the world's largest single seagrass bed, the Wooramel Bank in Shark Bay, Western Australia. It has 1,000 square kilometres in area and has taken 5,000 years to develop.

Seagrasses are not true grasses (nor are they algae or seaweed). They are flowering plants with stems, leaves, roots and horizontal stems, shed leaves and provide food, shelter, breeding grounds and nursery habitats for fish and aquatic crustacean. They help to create permanent communities for algae and marine animals with an endless food source in the form of detritus, composed of decayed leaf litter, lining the seabed. They stabilise the seabed with their roots and horizontal stems, and this prevents fragile estuary sea bottoms eroding. Like terrestrial grasses they are all monocotyledons (only one seed leaf).

Seagrasses play a pivotal role in coastal ecosystems of the world. They are particularly important in the sustainability of commercial and recreational fisheries, primarily because of their roles in maintaining sediment stability and water quality and in providing shelter and food critical to the survival of a wide variety of aquatic biota. They produce a large amount of organic material which enters the food chain.

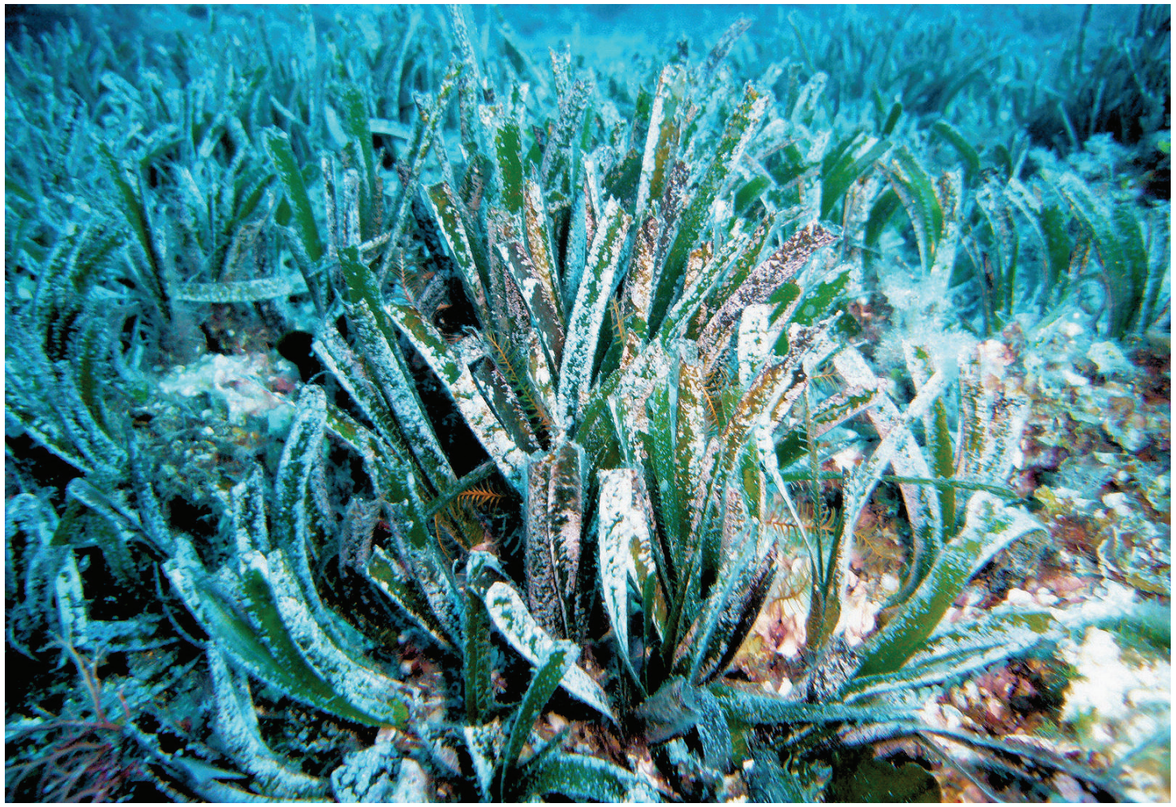
Seagrass beds are a microcosm of organisms; every blade is enriched with epiphytes, and they are the main food source also for filter feeders such as echinoderms, crustaceans, molluscs, starfish and many fish species.

Studies have shown 15 square kilometres yielded 235 million prawns, including their larvae and 95 billion molluscs, and seagrass beds rate second only to coral reef communities in productivity.

Seagrasses are a fragile habitat with *Posidonia* (strap weed) and are comparatively restricted in their distribution. Attempts to regrow *Posidonia* in denuded habitats will fail.

I assisted Emeritus Professor Tony Larkum in a number of studies relating to seagrasses, including many attempts to regrow *Posidonia* spp. over a 30 year period without success, along with other scientists worldwide. Our studies

Above: Eel grass



Posidonia (strap weed)

included the effects of prolonged shading and varying stress levels on growth and survival of various seagrass, in particular *Posidonia* spp.

The three most important seagrasses in Sussex Inlet waters (South Coast, New South Wales) in terms of seabed stability and food source for marine animals and water birds are strap weed, eel grass and flowering ruppia. The last mentioned is the seagrass swans prefer. They are often observed grazing in the Riviera Keys (Sussex Inlet). I successfully planted some clumps of *Ruppia* 12 years ago.

We are losing our seagrasses worldwide at an alarming rate due to dredging. If the loss continues at the present rate the health of humans worldwide will be beyond the reach of the medical profession. Think of the alarming increase in respiratory ailments plus the climbing increases in carbon emissions which reached a staggering 25,235 billion tonnes and still climbing.

We had better manage our carbon emissions and save our seagrasses, for every second breath we take comes from the ocean.

Editor's note

Bernie Clarke OAM

Bernie Clarke OAM received our Society's Serventy Conservation Medal in 1999. A strong Botany Bay conservationist and environmentalist, he received the award for his lifetime devotion as a local environmentalist and long-time Towra/Botany Bay campaigner. Bernie also became Patron of the George's River Keeper program in 1997, which aims to keep the river and bay free from pollution. Clarke has been working and fighting to protect the Kurnell Peninsula for decades. "My first time in a police paddy wagon was after I set up a roadblock in the 1950s to try and stop the oil refinery being built" he said. While campaigning to improve the Kurnell Peninsula, Bernie became President of the Botany Bay Planning and Protection Council, a residents' action group. Bernie stated "Countries around the world revere their birthplace [while] Australia has buried its under a local oil refinery!" Bernie Clarke is quick to point out the special character of Towra Point, which hosts some 34 species of migratory wading birds each year. "The International Wetlands Body, RAMSAR, has listed Towra Point as an internationally significant site. Australia is a signatory to three international ornithological agreements to preserve and look after these sites in perpetuity. "More needs to be done to protect these special areas," said Bernie Clarke OAM. He was recognised and awarded the Medal of the Order of Australia for service to conservation on 12 June 1989.

Slaughtered in the name of 'culture'

How the *Native Title Act 1993,* allows Indigenous hunting of Australia's endangered dugongs

Kit (Amy) Prendergast, zoologist, conservation biologist, and scholar of cultural studies

Many Australians are rightly outraged at the horrific and inhumane slaughter of hundreds of whales and dolphins by the Japanese whaling fleet under the guise of 'science' or 'culture'. The Australian government rightly has taken a stand against this disgusting and terrible practice, yet in an act of extreme hypocrisy, under the *Native Title Act 1993,* it allows the slaughter of **thousands** of other gentle giants of the oceans – dugongs (*Dugong dugon*) – in Australia's very own waters under the similar unjustifiable excuse of Aboriginal and Torres Strait Islander culture.

Dugongs are officially recognised as being threatened with extinction, at both state and federal levels in Australia, as well as internationally. Dugongs are listed as Vulnerable on the IUCN (International Union of Conservation and Nature) Red List of Threatened Species, however the true threatened status of the dugong is likely even more severe. Although boat strikes, entanglement in fish and shark nets, disease, and habitat degradation contribute to the dugong's threatened status, the data evidencing the extent of dugong deaths from hunting clearly indicates Indigenous hunting is the predominant factor imperilling the existence of this species. Indeed, scientific experts, including the IUCN, agree that hunting is the greatest contributing factor in the decline of Australia's dugongs.

Recognised legislatively as being threatened with extinction, this makes it illegal to kill these animals – except if you're an Aborigine. Under the Native Title Act, Aboriginal and Torres Strait Islander people are given free licence to kill dugongs. The extent of Indigenous hunting is far from trivial: every year, thousands of dugongs are killed. In any hunting trip, often multiple dugongs are caught and butchered. The unregulated free-for-all 'harvesting' of dugongs by Indigenous people means there is little data on the true magnitude of this source of mortality across Australia, however numerous lines of evidence indicate dugong numbers are declining, annual mortality from slaughter numbers in the thousands, and scientific studies (e.g. by Heinsohn *et al*. 2004, and Marsh *et al*. 2004) using population modelling confirm that Indigenous harvesting is unsustainable.

The slaughter of large marine mammals in Australian waters by Aborigines is even more horrific than that occurring by the Japanese. The methods by which Aborigines kill these gentlest of giants are nightmarishly cruel. Aboriginal hunters will chase a dugong for hours until the poor targeted

animal is completely exhausted and is forced to pause and surface to breathe. Hunters then harpoon the dugong with a spear bearing multiple metal tips, typically made of nails, and then reel in their victim. The hunters then grasp the dugong by the tail, forcefully submerging its face underwater so that it is unable to breathe and eventually drowns. It may take 20 minutes for the animal to finally pass away. Throughout the process the dugong clearly suffers, struggling and thrashing in pain in a desperate attempt to reach the surface to breathe. Some hunters drag the animal tied to the back of their boat to the shallows in order to drown it, where drowning may take several hours. And if the animal is being 'difficult' and attempts to drown it are unsuccessful, the hunters drag the poor animal ashore, and, in one of the vilest acts imaginable, butcher the dugong alive with knives, or kill it via hurling rocks at its head.

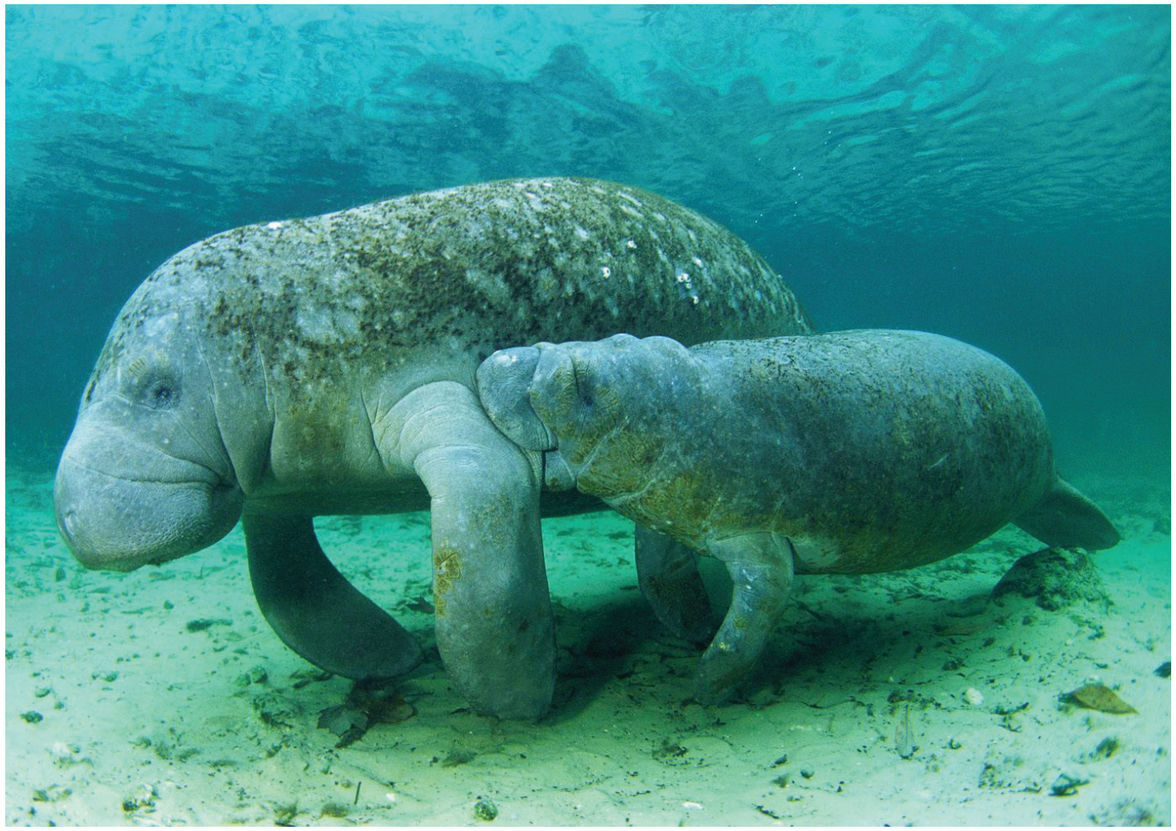
A further point deepening the horrific inhumanity of dugong hunting by Aborigines is how hunters routinely ensnare young, vulnerable dugong calves and use the calves as bait to entice the mothers to come close to the boat so as to increase the ease at which they can catch and execute her. In desperation, the distraught mother will chase after the boat for hours, vainly calling to her stolen calf. Hunters will then spear or catch the exhausted mother and butcher her. The calf will either be also butchered, or is released and, consequently, without its mother, the orphan then will die of starvation.

The above details describing the horrific means by which Aboriginal and Torres Strait Islanders kill dugongs is no story: this has been repeatedly documented and there are multiple sources of evidence revealing these acts of barbarism. These barbaric harvesting methods are in fact contained in *Dugong and Marine Turtle Knowledge Handbook* published by the Northern Australian Indigenous Land and Sea Management Alliance, and Colin Riddell – an assiduous conservation campaigner for publicising the dugong's plight – has witnessed first-hand this carnage and has hundreds of images providing photographic documentation.

Aborigines and Torres Strait Islander hunters preferentially target healthy individuals with a good body condition since such animals produce meat with a higher fat content. Yet these animals, which tend to be fecund, pregnant females, are those most critical to the persistence of the dugong population. By targeting the most fertile dugongs, and killing calves that have not even reached sexual maturity, this represents the worst-case scenario from a population sustainability perspective because this demographic is that most critical for the growth or decline of the dugong population.

Females invest a remarkable amount of parental investment into each offspring: after an extremely long gestation of 13–15 months, there is a similarly lengthy lactation period of at least 18 months, during which the baby is nourished by its mother's milk, suckling from the teats which are located just below the 'armpit'. A mother and her calf remain continuously in close contact. Even after the offspring is weaned and no longer nursing, the mother dugong and her calf remain intimate. The close, loving bond established from birth between mother dugongs and their calves persists up to seven years, ending only when the calf leaves its mother just before reaching sexual maturity. The dugong mother's careful parenting has been remarked upon, and it has been observed that dugong mothers will display affectionate behaviours towards their calves that bear a resemblance to the gentle caressing by human mothers, and calves will reach out with their flippers to touch their mothers to seek reassurance.

Dugongs, despite being superficially similar to whales and dolphins, are actually most closely related to elephants. And like elephants, dugongs



A female manatee and its baby. Classified in the same family (Sirenia), manatees are closely related to dugongs. Sirenians are large, fully aquatic, mostly herbivorous marine mammals, sometimes known as sea cows.

are highly intelligent, sentient, emotional creatures. Dugongs are also highly affectionate. Aboriginal hunting deprives us of establishing a close intimate relationship with these affectionate animals, not only by reducing the abundance of dugongs in our waters, but also making these long-lived cognisant animals steer well clear of humans. In regions where dugongs are not hunted, and do not have to fear the presence of humans, it has been found that dugongs do not swim away but will actually allow humans to approach, touch and pet them, something that they appear to enjoy and find pleasurable! Few species are more peaceful and harmless than dugongs. They pose no threat to humans whatsoever, and few species could be considered more vulnerable when it comes to being faced with the fatal attacks from Aboriginal and Torres Strait Island hunters. Dugongs are one of the most gentle of creatures, and are completely defenceless in the face of their killers. They have absolutely no means of defending themselves from attack, and with their ponderous speed of typically no more than 10 kilometres per hour, their slow lumbering swimming style means they have no hope of escape. Permitting Indigenous slaughtering of dugongs is a most heinous practice, potently violating the Universal Declaration of Animal Rights, and is completely antithetic to our evolved ethical understanding of animal rights.

Dugongs represent an amazing product of evolution, and the world will suffer a significant loss of its evolutionary heritage if they were to become extinct.

The dugong (*Dugong dugon*) is the sole species in the family Dugongidae, which evolved in the mid-Eocene. This family was once diverse, however all other species have become extinct, with the species most closely related to dugongs, Steller's sea cow (*Hydrodamalis gigas*), being hunted into oblivion in the 18th century. If Indigenous hunting continues, we may lose the Dugongidae's last representative.

Of extant species, the three species of manatees (family Trichechidae) are the dugong's closest relatives. The distributions of manatees and dugongs do not overlap, and whereas dugongs are adapted to a marine environment, manatees are restricted to inhabiting freshwater habitats. Together, dugongs and manatees comprise the order Sirenia. Whilst bearing some similarities in body shape and diet, dugongs can be distinguished from manatees in possessing a unique skull and teeth, and somewhat different snout form, and unlike the paddle-shaped tail of a manatee, dugongs have a fluked tail, convergent with that of a cetacean (dolphin or whale). Unlike most cetaceans, dugongs as well as manatees lack a dorsal fin and have hairs that cover their body. Their hair is sparse over much of the body, but is more densely concentrated in on the snout. These specialised hairs – known as vibrissae (aka whiskers) – provide a tactile function for sensing their environment. With their small eyes, their visual perception is limited, and they navigate and forage primarily via their excellent tactile sensitivity, as well as by their acute hearing abilities. Dugongs and manatees are unique among mammals, in that not only do they use their vibrissae to navigate their

environment, they additionally use the short bristles around their mouth in a prehensile way to grasp seagrass! Dugongs possess many features in common with other marine-adapted mammals like cetaceans, including a large body size, and a dense layer of subcutaneous fat to provide insulation and retain their body heat; a smooth, torpedo-shaped body; dorsally located nostrils that can be closed by valves during diving; paddle-like forelimbs; the loss of hind-limbs and external ears (known as pinnae); featuring elongated kidneys that are capable of producing highly concentrated urine adapted to excreting the high amounts of salt dugongs consume in their diet; and having solid, dense bones to reduce buoyancy so that they can remain suspended beneath the surface of the water. Dugongs are remarkable in that their bones are among the densest of all animals!

Males and females are hard to distinguish, looking very similar. The main difference between the sexes is that, unlike females, males bear two small tusks formed from enlarged incisors that erupt following sexual maturity to protrude a few centimetres from the gums, and females tend to be slightly larger. Adult dugongs typically weigh a bit over 250 kilograms, yet are born almost a magnitude lighter, with newborn dugongs weighing in at about 20–35 kilograms. Dugongs, when free to live out the duration of the lifespan as they have a right to do so, can live up to 70 years. The oldest recorded dugong was estimated to be 73 years of age.

The global distribution of the dugong ranges from the western Pacific Ocean to the eastern coast of Africa. Australia presently boasts the largest population of dugongs, which occur in near-shore waters across the top of the continent from Shark Bay, Western Australia, to Moreton Bay, Queensland. Dugongs inhabit warm, wide, shallow (~10 metres or less) bays around the coast. Sadly, their preference for such shallow coastal habitats makes it easier for Indigenous people to hunt them. Worse still, pregnant females move to shallower waters to give birth. Whilst this minimises the risk of predation from natural predators (namely sharks), it brings pregnant females, and mothers and their newborn calves, into direct contact with their unnatural human 'predators'.

Dugongs are remarkable in being the only herbivorous marine mammal species in the whole world. Although in some localities they may consume invertebrates, their diet is dominated by seagrass. Their colloquial name 'sea cow' refers to how they fulfil a grazing niche analogous to that of cows on land. The dugong's downturned, bristle-covered snout (which some believe make them resemble hoovers!) has a horseshoe-shaped, muscular upper lip, which is adapted for grazing and uprooting seagrass. During foraging, they grasp a plant with their mobile upper lip and rip it out; consequently they tend to consume the entire plant – roots and all – rather than cropping just the plant tips.

Being completely reliant on seagrass meadows, their distribution is restricted to coastal habitats where seagrass meadows predominate. Yet their habitat has been drastically reduced and degraded through climate change and sedimentation and pollutants in run-off stemming from industrialised livestock farming (another reason why, to help save these cows of the sea, we should not eat cows of the land either!). The current distribution of the dugong has consequently been reduced, and many of the disjunct populations are nearly extinct. When a dugong is unable to meet its energy and food requirements, as occurs when its habitat is degraded, the malnourished animal will cease reproducing, or if a female has a calf, she will be unable to supply her calf with the quantity and quality of milk it requires, resulting in the calf's death. The critical state of seagrass meadows, which will likely worsen as the effects of climate change are exacerbated in the future, means that the dugong population is completely unable to sustain any loss of animals from hunting, and cannot recover when overexploited.

In the Torres Strait the worst of the islands for the mistreatment of dugongs is Saibai. The tusk is valued in the dugong as well as the rib bones – the hunters carve them into trinkets and sell them on the sly, mainly to the Papuan people. Photos: Colin Riddell

The reduction of dugongs has serious consequences for the wider ecological community. Dugongs are keystone species, and through their cultivation grazing, act as ecosystem engineers.

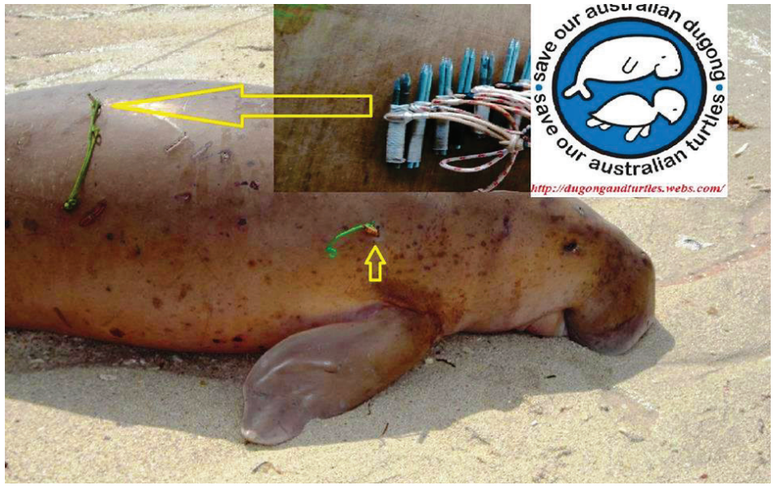
A study by Preen (1995) published in the scientific journal *Marine Ecology Progress Series*, revealed how intensive grazing by dugongs has profound effects on their seagrass habitats. A dugong's staple diet consists of seagrasses, and they are the primary consumers of this food source. Normally, dugongs graze at high densities in herds of about 140 individuals on a given area for weeks or months at a time. Whilst foraging, each dugong creates linear, meandering, serpentine feeding trails that span the width of their approximately 22-centimetre-wide muzzles. To achieve adequate nutrition, they concentrate their feeding in areas dominated by their preferred early pioneer species of seagrass *Halophila ovalis,* which is relatively high in nitrogen, low in fibre, and more easily digestible. Remarkably, the dugongs' grazing pattern was concluded to be a deliberate strategy for improving the quality of their diet. Unlike under dugong grazing disturbance, other disturbances to seagrass caused by storms, sedimentation, or die-off from disease or unfavourable water temperatures, impact the entire seagrass meadow uniformly, eliminating all plants, and recovery is only possible from colonisation from outside sources, making recovery slow. In contrast, despite high densities of overlapping trails, the meandering trails from dugong feeding leave small tufts of undisturbed plants which act as nuclei, allowing rapid recovery. Moreover, by fragmenting the seagrass rhizomes, this promotes

HOW WOULD YOU LIKE TO BE HELD UNDER FOR 7 MINUTES TILL YOU DROWN?

determinate shoots to be converted to indeterminate shoots, catalysing proliferation of the seagrasses. These regenerating seagrasses furthermore have a higher nutritional quality (high nitrogen, less fibre), and this improved food resource is concentrated in a way that allows dugongs to effectively harvest it. In addition, in the heavily cropped areas, dugongs' 'cultivation grazing' maximised the abundance and concentration of their preferred seagrass species whilst excluding the otherwise competitively dominant seagrass species *Zostera capricorni* – a highly fibrous, nutritionally poor species. With their rudimentary dentition, dugongs are ill-adapted for processing fibrous vegetation, and are constrained by the limited amount of dietary nitrogen that is especially low in seagrasses.

Yet Preen's study found these effects only occurred under intensive grazing: at low densities, individual dugongs are unable to change the species composition of the seagrass beds nor concentrate regrowth of preferred species into distinct patches to be

IF ONLY THEY DID NOT KILL IT. SHOW THE CHILDREN A LIVE ONE!!



efficiently harvested. Only when dugong numbers are high, so that each individual's meandering feeding trails overlap and create disturbances over large areas, can dugongs effectively favourably 'cultivate' the seagrass. When dugong numbers are reduced, grazing pressure is insufficient for converting seagrass meadows into the nutritious early-growth stage dominated by the palatable preferred seagrass species, and the low-quality seagrass species takes over, reducing the environmental carrying capacity of the number of dugong species that the habitat can support. Hence, the reduction of dugong numbers from Indigenous hunting will result in a feedback where, due to insufficient densities, dugongs will be unable to maintain the seagrass community in their preferred successional stage, and as seagrasses become increasingly dominated by the poor-quality unpalatable species, this will cause further reductions in dugong numbers from being unable to meet their nutritional needs, causing dugongs to cease to reproduce, or even die from inadequate food intake, exacerbating the situation.

Dugongs face multiple threats, including loss of seagrass habitat, boat strikes, disease, entanglement in netting, and increasingly, climate change. Many of these threats are difficult to manage, yet the single greatest threat – hunting – is simple to reverse. The survival of this species depends upon abandoning this archaic practice of 'traditional' hunting. In a review of scientific studies on dugong breeding cycle and life history, Marsh *et al.* (1984) concluded: "It is obvious that if dugongs are to be maintained in an area, man-induced mortality must be minimised." Boat strikes and entanglement in nets represent only a minor component of anthropogenic morality, and such sources of mortality are hard to eliminate entirely, whereas eliminating the greatest source of mortality – Indigenous hunting – is completely achievable.

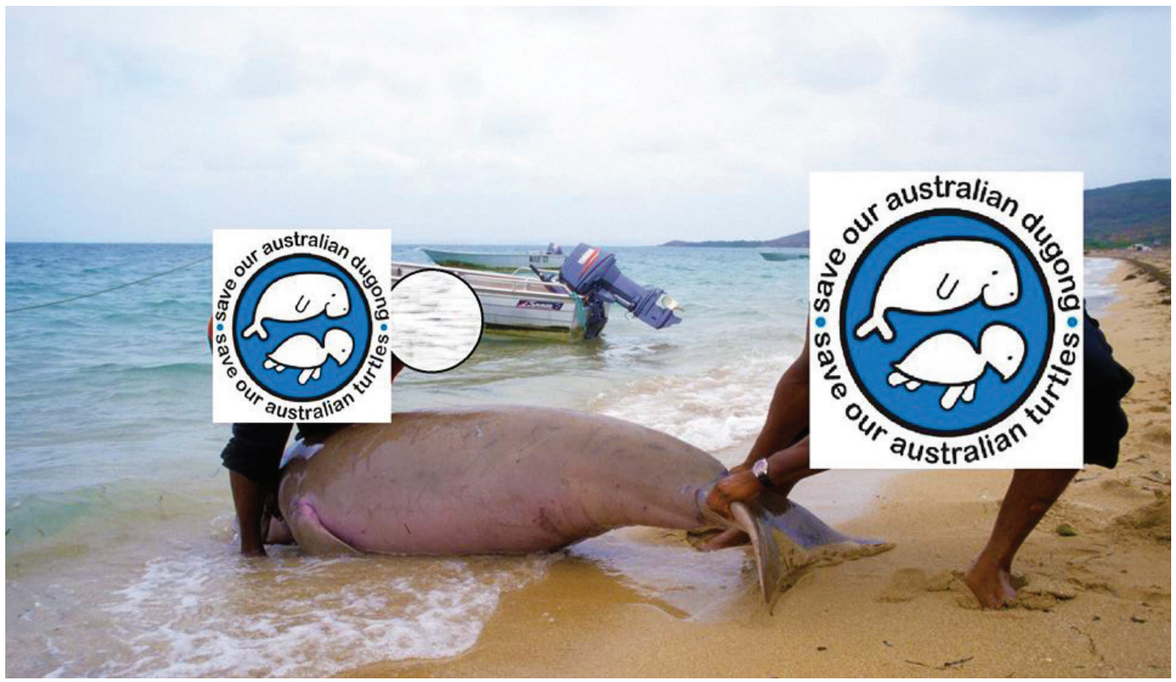
Under the canard of the Indigenous person at one with nature, it is proclaimed that all Aborigines and Torres Strait Islanders have a deep respect for other animals and are environmentally benign, and that their hunting practices are intrinsically sustainable. This argument is wrong and can be thoroughly criticised. The romanticised notion of Indigenous people as ecologically benign stewards of nature merely by virtue of their ancestry is a myth. There is sound scientific evidence that Aborigines were behind Australia's mass extinction of megafauna during the Pleistocene which wiped out approximately fifty species. When Europeans arrived, they arrived in a land depauperate in large grazing herbivores including the hippo-sized, wombat-like diprotodons – the largest marsupials to have ever existed, marsupial 'lions', giant varanids and birds. Moreover, hunting by both Indigenous and non-Indigenous people drove the dugong's closest relative, Steller's sea cow, to extinction. If Indigenous hunting of dugongs is permitted to continue, it is likely the dugong will suffer the same tragic fate as its evolutionary cousin. When it comes to animal exploitation and hunting species to extinction, Indigenous people are no different from any other race. It is ironically a form of perverse racism to support the notion of the 'noble savage', with damaging consequences for species imperilled with extinction today.

Along with the fact mammals like dugongs are highly sentient creatures, capable of both suffering and joy, killing them for meat clearly is unnecessary. No human has any biological requirement to eat meat. Countless scientific studies have revealed not only do humans not need to eat meat, but people in fact live longer and suffer fewer health problems by not consuming meat. The idea that 'harvesting' dugongs can be 'sustainable' is a dangerous myth. World-leading dugong experts have concluded the legal (and also illegal) Indigenous hunting of dugongs represents the most significant source of dugong mortality, and is by no means sustainable. Sadly, the risk of extinction is no myth – the possibility is very real. Already dugongs have become extinct in the Province of China, Mauritius, and Taiwan, and extinction is imminent for dugongs in Mozambique, Japan, Cambodia, Vietnam, Vanuatu and the South Pacific Islands. When last assessed back in 2008, the IUCN found that the dugong has declined or become extinct from at least a third of its historical range; yet the true situation is likely worse, for in half of its range there is insufficient information to determine the dugong's status. In Queensland, one of the few areas where relatively robust long-term quantitative data on population size has been obtained, dugong numbers in 1999 were only 3 percent of that in 1962, which, according to IUCN criteria, would qualify for recognising the dugong population there as being in the most severely threatened category of Critically Endangered. Dugong numbers since the last Outlook Report in 2009 have declined by 60 percent, reduced to a mere 600 animals at best.

The life history characteristics of dugongs means they cannot readily recover when their populations suffer a decline. Dugongs are not capable of reproducing until at least 10 years of age, however some do not breed until 18 years of age. This age at which reproductive maturity is reached is much later than most mammals. Only one offspring is produced per pregnancy, and after giving birth females will not reconceive again for at least 3–7 years. Thus, despite a long lifespan, females will only reproduce a few times during their lifetime, and there is evidence suggesting older male dugongs become infertile. As long-lived mammals with extremely low reproductive rates, long generation times, and a large investment in each offspring, populations can only be maintained under high survivorship rates where causes of mortality are minimal. Even under ideal conditions, when natural mortality is low and dugongs are free from suffering human-induced mortality, the maximum growth rate a population can achieve is a mere 5 percent. Scientists have determined that, in the absence of human-induced mortality, the natural mortality rate of dugongs is 5 percent. This means that only when human-induced causes of death are eliminated will dugong populations be able to remain stable. With hunting, populations will decline, as has been borne out by the data on trends in dugong numbers indicating dugong populations are undergoing a severe, ongoing decline. Hence permitting Indigenous hunting essentially dooms this species to extinction.

Culture or tradition is no justification for allowing Indigenous hunting of dugongs. Culture is not inert but changes and evolves as we become more ethical. Having slaves was part of European culture in history, but we correctly acknowledge that this is immoral, and consequently cultural practices have shifted. If tradition and culture can (rightly) not be a justification for slavery and denigration of people of other races by Westerners, it stands to reason that tradition and culture are no excuse for the unethical and immoral slaughter of dugongs. When a cultural practice is found to conflict with progressive ethics, then the cultural practice must be abandoned.

The claim that Aboriginal hunters nevertheless 'respect' dugongs is clearly false regarding the way they ruthlessly slaughter dugongs. And any act of killing is a blatant act of disrespect for the life of the animal. Indeed 'respectful hunting' is an oxymoron. True respect, as some progressive Aboriginal groups acknowledge, necessarily entails a complete embargo on dugong hunting and a commitment to refusing to take away the life of the animal. As stated by lawyer Rebecca Smith, regarding how "each year at least 2,000 gentle dugongs are harpooned and drowned legally in Australian waters", "the killing occurs with impunity, under the guise of 'custom.'"



Anyone who rightly speaks out against this atrocious and hypocritical practice of allowing Indigenous people to hunt these otherwise legally protected endangered species is labelled a racist and risks suffering unfair retribution. Colin Riddell, a stalwart defender of dugongs, relates how "Anyone who raises an issue in relation to Indigenous people is called a racist. I have copped heaps of threats since I started this in August 2009. They threaten me daily and I never ever shied away from doing what is right. This isn't [even] an 'indigenous issue' – this is an issue that some Australians are allowed to kill protected animals. I don't care what colour you are." As Mr Riddell rightly asserts, "What part of speaking out against cruelty to an animal or killing an animal vulnerable to extinction is racism? The only part that is racist about this is that the animals that are allowed to be killed are being killed by Indigenous people."

Ms Smith has revealed how the reality of Indigenous slaughter of dugongs is steeped in venality and distortions, averring "I could write forever on corruption in Indigenous Organisations (I have been entrenched in some for many years – and unfortunately cannot compare it to Non-Indigenous Organisations, but my ex-public servant friends tell me it's rife) and deliberate misinformation from Academics and Indigenous organisations/leaders about how many of these animals are killed every year." Despite the critical need to conduct research on this threatened species, and quantify its population size and trends, scientists and academics of late have been continually denied from doing so: recently, research proposals are discriminatorily required to pass a university Aboriginal and Torres Strait Islander ethics clearance, and any proposals that would reveal the severity of the carnage reaped by Indigenous hunting and oblige governmental legislative bodies to constrain Aboriginal and Torres Strait Islander hunting are denied clearance.

Not that any form of hunting, traditional or not, can ever by justified, but a further point undermining the justification by the government in permitting dugong hunting by Indigenous people is that so-called traditional hunting cannot even be considered traditional, for, as witnessed by Mr Riddell and colleagues, Aborigines and Torres Strait Islanders "do not hunt traditionally: they go out and hunt with speedboats."

Hunting of dugongs is even allowed in what are supposed to be sanctuaries and safe havens for endangered wildlife, undermining the value of these protected areas and making Australian environmental policies look like "a joke." Mr. Riddell describes the situation as a "disgrace" in how dugongs "are hunted in green zones, in marine parks. People [locally, interstate, and internationally] come out [to Australia's marine parks] to see these beautiful animals, and instead they witness these animals being butchered and slaughtered by Indigenous people because current law allows it. Marine Parks have become a supermarket for traditional hunting." How can marine protected zones function as protected areas if the greatest threat to dugongs – hunting by Indigenous people – is allowed to continue in areas which are supposed to provide safe havens and encourage wildlife preservation?

The critical need to ban Indigenous hunting is supported by numerous scientists and conservationists, including the venerable wildlife supporter Mr Bob Irwin, father of Australia's renowned wildlife warrior, the late Steve Irwin. As Mr Irwin relates, "All the pointers are indicating that there is a **real risk** that dugongs will become extinct within a few decades. That is a really sad thing to be looking at." Government officials, out of 'white guilt' and 'political correctness' when creating so-called 'Plans' for managing the future of Australia's endangered species, refuse to tackle the greatest issue jeopardising the future survival of dugongs. In response to the 2014 *Plan for the Future of Dugongs and Turtles in Cape York and Torres Strait,* Mr Riddell notes how legislative bodies "hide from the fact that the major threat to dugongs is uncontrolled, unmonitored hunting." Such Plans are ineffective by failing to address the key issue that will determine the future of dugongs in Australia's waters: slaughtering of dugongs by Indigenous people.

It is a disgrace to our country that tradition is used as an excuse to allow Indigenous people to deplete our natural heritage and unique biota. As Colin Riddell describes, "Native Title allows unlimited hunting of these endangered animals, as well as 50 other species of native wildlife that no one else is allowed to touch. They're protected under official government status, yet they're allowed to be killed by Indigenous people." Our international reputation is tarnished, and Indigenous hunters are no less deplorable than those on the Japanese whaling fleets slaughtering cetaceans, as Mr Riddell states: "We rightly condemn Japan for killing whales, but right here at home, this happens. No one needs to kill dugongs, yet these animals are butchered in unlimited, unmonitored numbers. We can't have dugong ribs being cooked in ovens – this is a disgrace – it's a protected listed, IUCN animal. Dugongs are already extinct in numerous countries around the world, but in Australia, if you're indigenous, you can go and take as many as you like. It's Australia's shame, and it needs to be banned right now."

It is deplorable in a supposedly developed, progressive country that brutal, barbaric slaughter of these sentient animals in the name of 'cultural custom' is permitted. Progressive Australians correctly recognise that all people should be treated equally, irrespective of race and culture. This should not only apply to social issues like education and employment, but also prohibition of hunting of endangered species. Allowing Indigenous people to kill Australia's gentle sea cows in the name of tradition is archaic and inhumane. Let us instead embrace a new tradition based on compassion where all members of Australia – Indigenous or otherwise – acknowledge there is no justification for killing dugongs, and respect the lives of these remarkable marine mammals.

Dugongs are part of the cultural heritage of all Australians and thus their preservation is fundamental to our identity; in fact, the dugong populations in Western Australia's Shark Bay and the Great Barrier Reef were noted as important natural features contributing to the World Heritage listing of these areas.

Indigenous hunting of dugongs must be made illegal, and Indigenous communities must follow the admirable Indigenous communities that have recognised the need to respect and not kill these wonderful animals; the future fate of the dugong depends upon this.

You can help save this endangered species of Australia and contribute to their protection from cruel Indigenous hunting by signing the petition at the following link: http://www.savethedugong.org/

2014 University Student Grants Scheme winners

The Australian Wildlife Society is delighted to announce the winners of the ten grants of $1,000 each to honours or postgraduate students conducting research that will contribute to the conservation of Australian wildlife.

The winners for 2014 are:

Amy Northover - School of Veterinary and Life Sciences at Murdoch University.
Project: The ecology of parasite transmission in fauna translocations.

Freda Nicholson - La Trobe University.
Project: Do juvenile hormone analog insecticides disrupt amphibian lifecycles?

Kimberly McCallum - University of Adelaide.
Project: Influence of the spatial arrangement of plants in revegetated systems to gene flow, natural regeneration and long-term viability.

Rebecca Peisley - Charles Sturt University.
Project: Ecosystem services provided by birds in agricultural landscapes.

William Geary - Deakin University.
Project: Carnivores in flames: Predator ecology in a fire-prone landscape.

Jaimie Cleeland - University of Tasmania and the Australian Antarctic Division.
Project: Macquarie Island albatrosses: Assessing the environmental and anthropogenic influences on population and demographic status and trends.

Mark Wong - The Australian National University.
Project: Fine-scale geographic variation in a newly described Australian funnel-web spider (*Atrax sutherlandi*).

Yaara Aharon-Rotman - School of Life & Environmental Sciences, Deakin University.
Project: Migratory shorebird populations are under threat and thus of particular conservation concern.

Blanche D'Anastasi - James Cook University.
Project: The conservation status of Western Australian true sea snakes: Are species disappearing before they have been discovered?

Jonas Bylemans - University of Canberra.
Project: Spawning site identification of Macquarie perch (Macquaria australasica, C. 1830) using environmental DNA.

In this issue of Australian Wildlife we feature the final six articles on the winner's projects.






The ecology of parasite transmission in fauna translocations

Amy Northover
School of Veterinary and Life Sciences,
Murdoch University

My PhD project will investigate how fauna translocations impact the transmission of parasites in critically endangered woylies *(Bettongia penicillata)*, and what consequences this has for translocated hosts and other cohabiting species. As we lack a rigorous understanding of whether current parasite management protocols enhance translocation success, we will also assess the impact of parasite removal on translocated hosts.

Whilst fauna translocations play a pertinent role in the conservation management of Australia's threatened species, less than 50 percent of native fauna translocations within Australia are reported to be successful. Thus, investigating the factors that influence their success is vital. Polyparasitism, in which a host is co-infected with various parasite species or strains, is common in wild animal populations. Whilst parasites have been implicated in a number of species declines, the role of polyparasitism as a potential factor contributing towards translocation failures has never been investigated.

In collaboration with the Department of Parks and Wildlife (DPaW), we have been undertaking field-based research to determine the incidence of polyparasitism in woylies and other cohabiting species, and explore its impact on host fitness, survivability and translocation success. The woylie or brush-tailed bettong has undergone a 90 percent decline in population size over seven years (1999-2006), and now only two remanent wild populations remain; the largest of which exists within the south-west corner of Western Australia – an international biodiversity hotspot. Although predation by feral cats and foxes is a major threat to wild woylie populations, parasitic disease is suspected of playing a role in the recent decline of this small endemic Australian marsupial.

A male joey having his pes measured

For the first translocation, which was successfully completed in June 2014, 182 woylies (90 male and 92 female) were translocated from Perup Sanctuary to two adjacent sites within nearby State Forest, in the south-west corner of Western Australia. Pre-translocation, woylies from both the source and destination sites were measured and weighed (to estimate body condition), and pouch activity was recorded for females (to measure reproductive output). Blood, faecal, and ectoparasite samples were also collected for parasitological examination (gross, microscopic, molecular DNA techniques). In both destination sites, sympatric marsupials (brush-tailed possum - *Trichosurus vulpecula*; western quoll – *Dasyurus geoffroii*) were also sampled so that we are able to quantify parasite transmission between species post-translocation. For the blood-borne protozoan parasite *Trypanosoma*, we will quantify parasite transmission on a finer genetic scale using novel molecular epidemiological tools to track transmission between hosts.

In order to empirically test whether the removal of parasites from translocated woylies improves host fitness, survivability and translocation success, we treated half the woylies (50 percent male and 50 percent female) with an antiparasitic drug prior to translocation. In order to determine the efficacy of our anti-parasite treatment, we collected repeat blood, faecal and ectoparasite samples from translocated woylies four and 12 weeks post-translocation (July and September 2014).

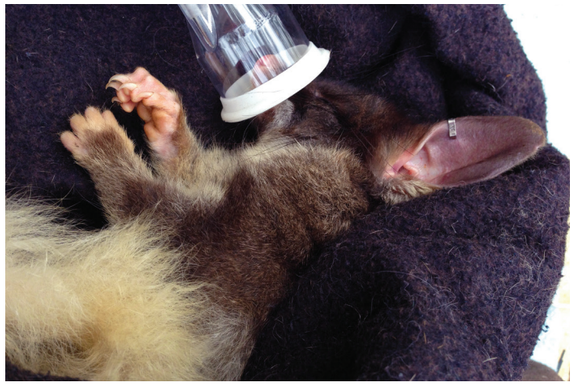
Above: Amy Northover releasing an adult woylie

At present, we have collected preliminary data from our source and destination sites. From September 2014 onward, we will be collecting samples from both destination sites every three months until 12 months post-translocation. After the first 12 months, monitoring will be carried out six monthly until 30 months post-translocation. A second woylie translocation is tentatively scheduled for winter 2015, the details of which are yet to be determined.

As a veterinarian, I have always had a passion for wildlife conservation (studied Veterinary Science and a Master of Veterinary Studies in Conservation Medicine at Murdoch University). With the aim of improving the outcome of native fauna translocations, it is hoped that the information obtained from this research will directly assist our partner organisation (DPaW) in planning future fauna translocations. Importantly, the insights gained from this project will be broadly applicable to other conservation agencies for the management of fauna translocations, which will assist in the conservation management of threatened native fauna species and ensure the sustainability of wildlife and ecosystem health.

Field anaesthesia on a brushtail possum

An anaesthetised chuditch (Western quoll) having his head measured



An anesthetised brushtail possum

A woylie joey. All furred pouch young receive a health check (including head and pes measurements) prior to being reinserted into their mothers pouches and released.

What's driving our albatross populations?

Jaimie Cleeland
University of Tasmania and
the Australian Antarctic Division

Project: Macquarie Island albatrosses: Assessing the environmental and anthropogenic influences on population and demographic status and trends.

Understanding the interaction between a species and its environment is crucial to understanding the drivers of population trends. For albatross populations, drivers can originate from the 'bottom' of the food chain by affecting the food resources available, or from the 'top' through increased mortality. Long-line and trawl fishing operations have been identified as a key contributor to a global downward trend in breeding numbers by increasing adult mortality through by-catch. Less known is the influence of climate on these populations. Climate-driven changes to the Southern Ocean can impact the survival and individual body condition of marine predators through fluctuations in the availability of prey resources.

Wandering albatross

For Australia's albatross populations the extent to which fisheries interactions and climate influences have contributed to observed trends is unknown. Sub-Antarctic Macquarie Island is home to four albatross species: wandering, light-mantled, grey-headed and black-browed albatrosses. After spending three summer seasons working on Macquarie Island's escarpment observing these incredible creatures, I have developed a deep respect for their extreme life-history strategy and am passionate about disentangling the key drivers affecting their populations.

To evaluate the nature of climate and fisheries interactions on albatross life-history strategy requires knowledge of their key foraging areas and robust statistical methods. With the support of the Australian Wildlife Society I am able to present the results of a Macquarie Island albatross tracking analysis at the 5th BioLogging Science Symposium in Strasbourg, France, and with scientists from the British Antarctic Survey (BAS) in Cambridge, United Kingdom, learn the latest techniques in demographic modelling.

Developing a strong understanding of past trends will assist us in predicting the future under different plausible scenarios of climate and fishing effort supporting effective management for protecting these iconic ocean wanderers.

Black-browed albatross

Light-mantled albatross

Wandering albatross

Do the natural arrangements of plants need to be incorporated into revegetation design?

Kimberly McCallum, PhD Candidate
School of Earth and Environmental Sciences
The University of Adelaide

In Australia, widespread vegetation clearance was common following European settlement and often occurred for agricultural use (Hobbs 1993). Vegetation clearance did not occur evenly across the country, with disproportionate clearing occurring on higher productive lands (Paton and O'Connor 2010). In some areas, such as the Mt Lofty Ranges and Adelaide Plains, less than 10 percent of the original vegetation remains (Paton 2010; Bradshaw 2012). This has led to a number of environmental issues as native vegetation provides habitat and food for wildlife and maintains land, soil and water health (State of the Environment 2011; Environment Protection Authority 2013). Many regions are now faced with severe land degradation and biodiversity losses, and the number of threatened species and ecological communities continues to increase (Saunders *et al.* 1991; Ford *et al.* 2001; Vesk and Mac Nally 2006; Environment Protection Authority 2013). These issues are particularly evident in temperate southern Australia, where extensive vegetation clearance occurred for cereal cropping and sheep grazing (State of the Environment 2011).

Research suggests that the protection and restoration of remnants alone will not be enough to counter biodiversity decline; large-scale revegetation will be required (Bennett *et al.* 2000; Mac Nally 2008). However, the presence of restored sites in the landscape may not necessarily result in long-term species persistence (Broadhurst 2013), as revegetated areas can take decades to centuries to mature (Mac Nally 2008; Vesk *et al.* 2008) and may not be ecologically equivalent to native vegetation (Kyle and Duncan 2012). One aspect of restoration that has received little attention is the influence of plant spatial arrangements (Miller *et al.* 2010). In natural systems, spatial patterns occur for a number of reasons and at a variety of scales (Alados *et al.* 2007) and include environmental factors such as climate, soil type and topography, and ecological factors such as seed dispersal, succession, facilitation and competition (Bartha *et al.* 2004; Alados *et al.* 2009; Miller *et al.* 2010; Gastŏn and Garćia-Viňas 2013). Finer scale arrangements of plants are rarely considered in revegetation design (Miller *et al.* 2010), even though patterns at population and community level are common in natural systems (Alados *et al.* 2010).

Kimberly collecting fruit from *Eucalytpus leucoxylon* (South Australian blue gum) at the Monarto Revegetation area, South Australia. Photo: Rachel Ladd, 2014

Revegetation undertaken with little or no thought to planting arrangements may limit natural regeneration and ecosystem function, impact plant growth and biodiversity, and reduce the long-term persistence of revegetated areas (Silvertown *et al.* 1992; Balvanera *et al.* 2005; Alados *et al.* 2010; Miller *et al.* 2010). However, to date the influence of planting arrangement on revegetation success is not well understood. If revegetated populations do not have the ability to become self-sustaining, replanting will be required as original populations senesce. Consequently, revegetated areas may not be viable in the long term (across multiple generations).

My study is centred on understanding how fine-scale planting arrangements in revegetated systems influence gene flow, pollination and plant reproduction and, by doing so, exploring whether it is necessary to recreate natural spatial arrangements in revegetated sites. The research has three major components: first, natural spatial patterns and spatial heterogeneity will be assessed in areas of native vegetation; second, plant reproduction will be assessed as a function of conspecific density for revegetated and remnant sites; and third, patterns of gene flow will be assessed in remnant and revegetated systems. Research will be conducted in three areas of South Australia which are currently a focus for large-scale revegetation – Mt Lofty Ranges, Adelaide Plains and Kangaroo Island.

Initially, systematic surveys will be undertaken in 200m x 200m plots in areas of native vegetation. Location data for all plant species of interest will be recorded with a GPS. This information will be used to determine how variable plant spatial patterns are between species and locations (i.e. nearest neighbour distances, plant density, number of individuals per aggregation). Spatial heterogeneity across the survey areas will also be assessed. Results will be used to determine practical methods for incorporating natural spatial arrangements into revegetation design. In addition, baseline data will be used in sections 2 and 3 of the research and to guide revegetation works.

One of the study species, *Eucalyptus calycogona* (square-fruited mallee) in flower. Monarto revegetation area, South Australia. Photo: Kimberly McCallum 2014

Flowers of *Eucalyptus calycogona*. Monarto, South Australia. Photo: Kimberly McCallum 2014

Buds and flowers of *Eucalyptus leucoxylon*. Monarto revegetation area, South Australia.
Photo: Kimberly McCallum 2014

The second component of the research will examine how seed production and seed viability varies with conspecific density and nearest neighbour distance for three *Eucalyptus* species (*E. leucoxylon, E. porosa* and *E. calycogona*) within the Monarto revegetation area. Hand pollination experiments will be undertaken during the flowering season to determine the response of the study species to selfed and outcrossed pollen and to assess pollen limitation. In addition, pollinator behaviour will be observed to determine if there are any differences in foraging behaviour with conspecific density. Lastly, DNA fingerprinting techniques will be used to examine levels and patterns of gene flow in revegetated and remnant systems. Level of outcrossing and pollen diversity will be assessed as a function of conspecific density and nearest neighbour distances.

If the prediction that fine-scale planting patterns are important to the function of revegetated systems is correct, this work will provide justification for more careful consideration of spatial patterns in revegetation design. It is hoped that this research will contribute to creating self-sustaining and resilient ecosystems that will be viable for the long term.

Many thanks to the Australian Wildlife Society for providing support for this research under the University Students Research Grant scheme. Thanks also to my supervisors Associate Professor David Paton, Professor Andy Lowe and Dr Martin Breed.

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Investigating fine-scale geographic variation in a newly described Australian funnel-web spider (*Atrax sutherlandi*)

Mark Wong, Honours Student
Division of Evolution, Ecology & Genetics
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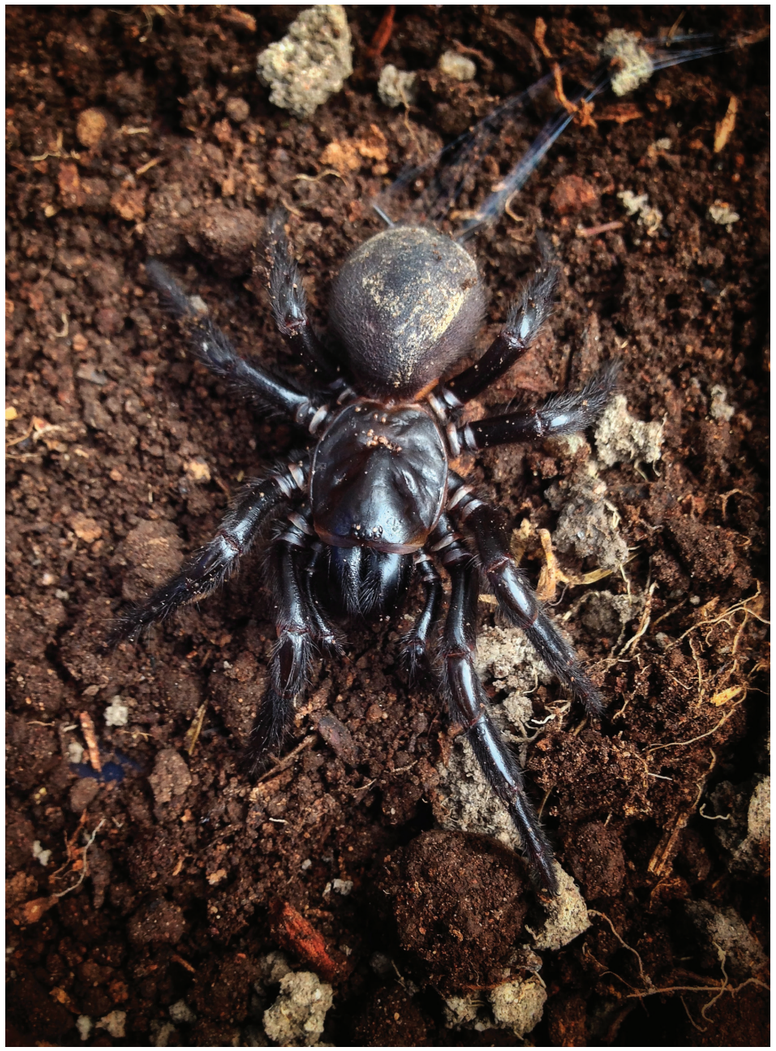
My research focuses on *Atrax sutherlandi*, a newly described species of funnel-web spider belonging to the same genus as the notorious Sydney funnel-web, and named after the late toxicologist Professor Struan Sutherland. *A. sutherlandi* is distributed across south-eastern Australia, including the Tallaganda forests of New South Wales. Previous work in this region has shown that throughout past Pleistocene glacial-interglacial cycling, native eucalpyt forests would repeatedly contract into isolated low-lying hydrological catchments otherwise known as 'refugia'. During such harsh climates, these isolated forest remnants preserved local habitats and enabled a variety of species to persist in an otherwise inhospitable region. While the forest is now continuous, many of Tallaganda's species still reflect this ancient isolation in their genetic makeup. That is, in many groups including water skinks, velvet worms, springtails and flatworms, several distinct genetic forms are presently recognisable across the forest.



Atrax sutherlandi female. Photo: M Wong 2014

Such genetic biodiversity associated with geographically distinct refugia regions is also well illustrated for the funnel-web spider *A. sutherlandi*, where differences between six refugia populations in Tallaganda are of a magnitude generally attributable to distinct species. Given that such unequivocal genetic differentiation and short-range endemism at Tallaganda was induced by historical climate change, it may be advantageous to investigate corresponding geographic variation in *A. sutherlandi* phenotype, since this could potentially aid in elucidating and demonstrating the effects of climate change on a species' physical characteristics. This would in turn be relevant to conservation planning and land management in the face of increasing climate change. Furthermore, as *A. sutherlandi* displays geographically-associated phylogenetic patterns similar to those of other terrestrial invertebrates in Tallaganda, such communities are likely to have shared analogous

Above: Mark Wong laying out a transect in Tallaganda forest. Photo: Thomas Wallenius

responses to previous climate change, and thus information from studying *A. sutherlandi* may be extrapolated to a variety of other important species. Exploring the phenotypic variation associated with ancient geographic refugia regions has therefore been the main focus of my research on these handsome but deadly spiders, and the phenotypic characters I am presently studying range from morphological characters such as body size and shape, to physiological characters which include metabolic rate, water loss rate and venom yield. A secondary aim of my research is to examine the extent to which such variation can also be explained by the contemporary environment.

At present, I am undertaking statistical analysis to interpret the phenotypic and environmental data that I have collected for various *A. sutherlandi* populations distributed across Tallaganda forest. While it is still too early to tell, the initial results do appear to hint at the presence of variation between the geographic regions in some phenotypic characters. My subsequent work will thus focus on scrutinizing and evaluating any apparent variation in an evolutionary and ecological context.

I would like to express my sincere appreciation to the Australian Wildlife Society for not only providing me with support for this research, but also many valuable insights into the conservation of Australia's native species.

Mark Wong in the field

Distinctive 'funnel-web' of *Atrax sutherlandi* on Tallaganda forest floor. Photo: M Wong 2014

Atrax sutherlandi male. Photo: Andras Keszei

Ecosystem services provided by birds in agricultural landscapes

Rebecca Peisley, PhD candidate
Charles Sturt University

Ecosystem services are ecological processes that benefit human society (MEA 2005). There is growing appreciation of ecosystem services provided by birds, particularly for their potential to provide significant benefits, such as pollination and pest control, for agricultural production (MEA 2005, Kellermann et al. 2008, Kross *et al*. 2012). However, birds can also cause damage to crops (Fukuda et al. 2008, Klosterman *et al*. 2013), and as agriculture continues to expand and intensify there is an urgent need to mitigate conflicts between wildlife and production. This requires research into the activity of birds in these agroecosystems.

Studies are now highlighting a range of important services that threatened species can provide for growers and are focusing attention on the potential benefits that agroecosystems can have for animal conservation. For example, Luck *et al*. (2013) and Luck (2013) found that almond crops in northern Victoria provided an important food resource for the threatened regent parrot (*Polytelis anthopeplus*), especially in years when natural food availability is low, and in turn the regent parrot provided a beneficial service to almond growers by cleaning up old, unharvested nuts (a source of fungal infection or insect pest infestations).

Natural predators can also reduce the damage caused by pest species (Mols and Visser 2007, Kellermann *et al*. 2008, Triplett *et al*. 2012). A recent study in New Zealand by Kross *et al*. (2012) showed that introducing the threatened New Zealand falcon (*Falco novaeseelandiae*) into vineyards could reduce grape damage caused by pest birds by 95 percent, with possible savings of US$234–$326/ha in avoided damage due to the falcons scaring the pest birds that consumed the crop.

As part of my PhD research, I will consider both the benefits and costs that birds can inflict in vineyards in northern Victoria. Passerine species

Red-capped robin (*Petroica goodenovii*) hunting for insects in an apple orchard in central Victoria. Photo: Rebecca Peisley

Red-capped robin (*Petroica goodenovii*) contributes to biological control of insect pests in apple orchards in central Victoria. Photo: Rebecca Peisley

Silvereye (*Zosterops lateralis*) provides an ecosystem service to apple growers by gleaning pest insects from trees. Photo: Rebecca Peisley

such as the introduced common starling (*Sturnus vulgaris*) and common blackbird (*Turdus merula*) can cause serious damage to grape crops (Tracey and Saunders 2010), while many native raptor species can potentially reduce the damage caused to grapes by hunting smaller pest species.

I aim to assess the effectiveness of providing perches in vineyards to encourage raptor visitation and by doing so reduce damage to grapes by pest passerine birds. Many raptor species, such as the brown falcon (*Falco berigora*), Nankeen kestrel (*Falco cenchroides*), black-shouldered kite (*Elanus axillaris*) and barking owl (*Ninox connivens*), among many others, occur in this region and prey on small birds (BirdLife Australia 2014, Luck *et al*., in review). I will be conducting bird surveys, both directly and using motion-sensor cameras, as well as grape damage assessments to determine if providing perches is effective for encouraging raptors into a landscape, and if these birds are providing a pest control service for growers within vineyards.

Expanding agriculture is considered a major environmental threat to biodiversity (Foley *et al*., 2005, Ellis, 2011, Baudron and Giller, 2014) and is often viewed as a separate endeavour from conservation; however, we are now seeing clear examples of the conservation benefits of promoting ecosystem services provided by birds in agricultural settings. Understanding the benefits of bird activity will elevate the value of birds beyond their aesthetic appeal and provide an important tool for land managers to make informed management decisions that benefit production and conservation in modified landscapes. The results from this study will have immediate applications for agricultural management within vineyards, and have the potential to be transferred into other agricultural systems.

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Big Desert adventures

Carnivores in flames: Predator ecology in a fire-prone landscape

William Geary
Deakin University

Imagine for a moment you were staring off into the distance from atop a sand dune, with only stunted mallee eucalypts and banksia scrub stretching to the distant horizon. There might be the odd western grey kangaroo or emu poking about, but for the most part there appears to be very little life. However, your eyes would be deceiving you. In fact, this region, encompassing the Big Desert and Wyperfeld National Park, is quite the opposite.

Holding the enviable title of being the most remote place in Victoria, the Big Desert is teeming with life under the surface. Once, it was home to an abundance of native mammals (quolls, bandicoots etc.). However, since settlement, much like the rest of Australia, it has been overrun by an array of invasive species. These invasive species, such as the red fox and feral cat, have since made the Big Desert their home, much to the detriment of the system. In conjunction with a fire regime that is completely different to centuries gone by, the presence of foreign predators has left the region with only the most resilient mammal species.

Therefore, my honours research explores the mechanisms behind how an apex predator (dingo) and two mesopredators (red fox and feral cat) interact with their prey and the landscape around them. As evidence mounts in support of the role dingoes play in suppressing foxes and cats, and thus benefiting prey species, further questions remain over how consistent this relationship is across different systems.

Variables such as habitat structure and fire history can facilitate or dull the strength of these predator interactions – an especially important concept in Australia. For example, feral cats and foxes are known to visit freshly burnt sites, taking advantage of the smorgasbord of prey left without protective vegetation. This double whammy of fire and predation has the potential to devastate fauna populations. As such, the presence of dingoes in a system may become increasingly important after a fire event, insulating prey

A picturesque Big Desert sunrise

Our camera trap setup allows us to survey a range of fauna

species from hungry mesopredators and contributing to native species conservation.

Using both camera traps and scat surveys at a large scale across the Big Desert region, I've set about determining where and when predators are most active and how they interact with their prey. Do foxes and cats prefer more open habitat as it makes hunting easier? Or does this leave them too exposed to being persecuted by dingoes? Or is prey abundance a more important driver of predator distribution? What role does fire play in the interactions between predators and their prey? Answering these questions is vital to further the conservation of our native fauna.

With Australia boasting a worrying mammalian extinction record, understanding how key threatening processes such as predation and fire interact spatially is paramount. Regardless of the outcomes of my study, having the opportunity to explore the wildest place in Victoria is an absolute privilege. Here's hoping the Big Desert continues to remain just that.

Mallee eucalypts like this dominate the Big Desert landscape

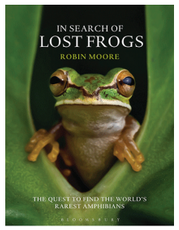
Book Reviews

John Gould's Extinct & Endangered Mammals of Australia by Fred Ford

This is a beautiful book and will be treasured by anyone who is a fan of John Gould's lithographs. How poignant it is to look at some of Gould's beautiful images of Australian wildlife and know that some are no longer with us, and some are fighting for their lives?

In this book, author Fred Ford compares Gould's world, and the world that the animals lived in at that time, with the world today. *John Gould's Extinct and Endangered Mammals of Australia* includes 46 Australian mammal species that, today, are threatened or extinct and that were portrayed in the lavish colour plates in John Gould's 1863 publication, *The Mammals of Australia*.

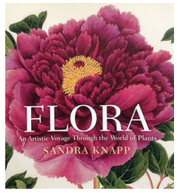
Publisher: NLA Publishing | RRP: $49.99



In Search of Lost Frogs by Robin Moore

In Search of Lost Frogs is a story of perseverance, disappointment, rediscovery, resilience, but ultimately of hope, written with passion and illustrated with the author's superb photographs. This fascinating new book tells the story of the expedition – its highs and lows, discoveries and failures and the campaign's ongoing work. Despite the campaign, one third of the world's amphibians remain threatened with extinction. Most of the species searched for were not found. But those that were provide a glimmer of hope. Understanding why these species have survived when many others have not should help us understand what makes these species different.

Publisher: Bloomsbury | RRP: $39.99



Flora - An Artistic Voyage Through the World of Plants by Sandra Knapp

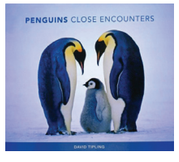
This book is a work of art. The perfect coffee table book. The pages are graced with hundreds of stunning colour illustrations selected from the vast collection of original botanical paintings archived at The Natural History Museum, London. *Flora* is an enchanting voyage of discovery capturing the excitement and wonder of plant exploration through art**.** Through botanical paintings and insightful essays, *Flora* examines the fascinating history of plants and flowers. Over 20 plant families are profiled, including cacti, daffodils, irises, magnolias, poppies, roses, tulips and waterlilies.

Publisher: Allen & Unwin | RRP: $49.99

Birds - The Art of Ornithology by Jonathan Elphick

This remarkably beautiful volume gathers together a selection of the most important and vibrant ornithological art from London's Natural History Museum. *Birds* tells the remarkable story of the development of ornithological art through the ages, from the earliest images of birds in the Renaissance, through the Age of Exploration, to the present day. Brilliantly reproduced original artworks by such renowned artists as Audubon, Gould, MacGillivray, Thorburn, and Wolfe are included. The lively accompanying text tells the story of how ornithological art grew out of the naturalistic tradition of European painting to become a genre on its own, where the artist's focus on aesthetic appeal was married to the scientist's need for precision and detail. Many of the works reproduced in this volume have never before been published. The detailed text interweaves science, art history, biography, exploration, and travel to paint a vast and wondrous picture of the bygone world of artist-scientists, exotic birds, and faraway lands. It makes a perfect gift for anyone who loves fine prints and drawings or has an interest in nature or birding.

Publisher: Allen & Unwin | RRP: $49.99



Penguins Close Encounters by David Tipling

The vibrant and exciting world of penguins is shown in all its glory in this new book from renowned wildlife photographer David Tipling, who has trekked to remote and beautiful locations to capture birds in their natural habitat going about their daily lives. Moments rarely caught by humans have been preserved on film and reproduced in glorious full-colour images. David is one of the world's most widely published wildlife photographers and is renowned for his artistic images of birds. This book is a visual celebration of all aspects of penguin life, and includes diary extracts from David as he provides an insight into how some of his extraordinary images were taken.

Publisher: Bloomsbury | RRP: $39.99

The Unexpected Crocodile by Kim Kane & Sara Acton

This delightfully illustrated children's book is hilarious, quirky, and slightly macabre but loads of fun. The illustrations are fabulous and who doesn't love a crocodile that eats your dinner guests then doesn't even stay for dessert. This gently subversive picture book about irksome dinner guests receiving their just desserts will entertain parents and children alike.

Publisher: Allen & Unwin | RRP: $14.99

Little Rhymes for Little People by John Stewart Westlake

How good it would be if, like Dr Doolittle, we could really talk to the animals and have them really talk to us? Inside this book are some little rhymes to help the imagination of children who love animals. In this lovely children's picture book, author John Stewart Westlake has crafted an enchanting collection of rhymes that aim to educate children about the different kinds of animals and other land and sea creatures. The book, which features beautiful colour illustrations from Sophie Scahill, contains 21 illustrated rhymes, each one about a different kind of animal or sea creature. Children will be delighted and amused by the rhymes, and the illustrations create a unique world where they get to learn more about the animals that roam this earth. Suited for readers aged 3–7.

Distributor: Woodslane Pty Ltd | RRP: $19.99

The Sword of Demelza by J.E. Rogers

Jeanne Rogers is an award-winning author who believes teaching children about the preservation of animals and their environment is important – education is imperative.

In this delightful book she very cleverly introduces Australian wildlife to children with amazingly well-developed characters and a fascinating, adventure-filled storyline. The scenes are vividly described, and the characters are easy to relate to. The story, although it is a fun fantasy adventure, teaches children about true friendship, tolerance, the importance of family and dedication to a good cause. This lovely book is highly recommended to primary-grade children (8–12-year-olds), but reading it with their parents and grandparents could make a great family time together as well.

Publisher: Acadia Publishing Group | RRP: $12.95 | This book is available online through Amazon

Animal Heroes - True Stories of Extraordinary Creatures by Ben Holt

Animal Heroes is full of stories of astonishing courage shown by family pets and wild animals alike. The heart-warming tales will warm your heart even as they stun you. An absolute must-read for anyone who has ever been humbled by tales of courageous animals giving a helping 'hand'.

Publisher: Allen & Unwin | RRP: $19.99

Great oaks
from little acorns grow

When our Director, Clive Williams, learned that William Ryan, publican at the Harold Park Hotel in Sydney, was collecting 5 cent coins in his business, Clive approached him to consider saving them for our Society. William was taken by the link between the echidna on the coin and the echidna we have as our Society's emblem and readily agreed. Not only that, he arranged for Clive to speak to other hotels and businesses in his area. As a result we now have several businesses collecting coins on our behalf.

We have provided signs and collection boxes for those that required them.

The Society has now decided to invite all of you, our members and friends, to participate in this fundraising process. We have purchased collection boxes which we will mail to those of you who request them. Use them at home or at your place of work, invite friends and colleagues to take one and invite your friendly local businesses to join in. By this means small individual efforts can lead to a grand achievement. The proceeds will be used for the Society's programs, such as the university grants.

Once the collection box has been filled, just take it along to your nearest Commonwealth Bank. All the deposit details are printed on the bottom of the box. Once the coins have been banked, let us know your details and how much has been banked and we will send you a tax deductible receipt.

Email us at info@wpsa.org.au for your collection box.

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 $2,500 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 www.australianwildlife.net.au. Completed nomination forms can be sent to the Australian Wildlife Society by email to info@australianwildlife.net.au or faxed to 02 9599 0000 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

The Serventy Conservation Medal

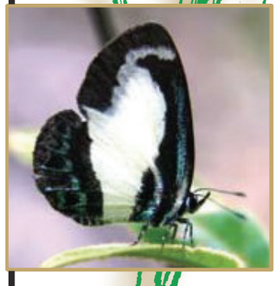
The Australian Wildlife Society created the Serventy Conservation Medal in honour of three members of the Serventy Family.

In memory of Dr Vincent Serventy AM, who was a member of the Wildlife Preservation Society of Australia for more than fifty years, President for thirty years and was the President of Honour. Over the sixty years of his environmental work in Australia, and internationally, Vin worked to realise his vision of a world whose people understand that we do not own this earth, but are trustees for its future, and that we should live in harmony with nature. He has justly been called the *'father of conservation in Australia'*.

In memory of Lucy Serventy who seventy years ago became a Life Member of the Society and so began a lifetime interest in conservation.

In memory of Dr Dominic Serventy, who as the elder of the eight strong Serventy clan, played a leading part in encouraging their interest in natural history. He is regarded as among the world's greatest ornithologists.

Our intention is to award the medal to those who labour as a volunteer in the conservation field for a love of nature and a determination that is should be conserved.



Medal Design

The medal has been designed by Australia's foremost sculptor Stephen Walker. The Australian Wildlife Society also gives a cash reward of $1,000 to the winner. Many conservationists in the past have suffered financially for their devotion to the cause. This cash award will be some tribute for their dedication. The bronze medal will be a constant reminder that the conservation movement has remembered their work in the past, just as history will remember the same achievements in the future.

Nominations

Nominations for the ***Serventy Conservation Medal*** should be made in writing to be received by our Society by 31st December. Nomination forms can be downloaded from our website at www.australianwildlife.net.au. Completed nomination forms can be sent to the Australian Wildlife Society by email to info@australianwildlife.net.au, or mailed to PO Box 42 Brighton Le Sands, or by fax 02 9599 0000.

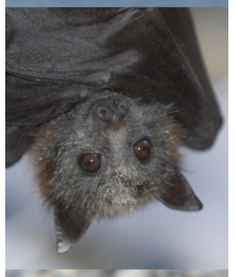
Selection Procedures

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

For further information, please contact the Secretary of the National Office on telephone 02 9556 1537 or by email info@australianwildlife.net.au

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

Be a part of the Australian Wildlife Society's conservation future



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

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- ☐ 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: $1,000

(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)

☐ Cheque ☐ Money Order ☐ Mastercard ☐ Visa Card Security Code (CSC) __ __ __ __

Card Number: |_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|

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

Signature:.....

Amount $.....

Donation $.....

Total $.....

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

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

Consider - A Bequest

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

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

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

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

Eastern water dragons Photography by Andrew Aylett