WA'S PARKS, WILDLIFE AND CONSERVATION MAGAZINE

LANDSCOPE

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WET AND WILD
Investigative eco education

Preparing for impact
Myrtle rust moves in

Rare astronomical event
Total solar eclipse

Back for the future
Bilbies in Matuwa

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ON THE COVER

Front cover Motorbike frog (*Litoria moorei*).
Photo – Alice McGlashan/Sallyanne Cousans Photography

Back cover Canning River wetlands.
Photo – Marie Lochman

LANDSCOPE *is produced and printed on Whadjuk Noongar Boodjar, the traditional lands of the Whadjuk people of the Noongar Nation. We pay respects to them, their Elders past and present and to all Aboriginal people and acknowledge their continuing connection to lands across Western Australia.*



Partnerships are vital to achieving meaningful and lasting conservation outcomes, particularly in a State as vast as Western Australia. As Helen Keller observed, "Alone we can do so little; together we can do so much".

Together with community groups, volunteers, scientists and other land managers, the Department of Biodiversity, Conservation and Attractions (DBCA) can more successfully tackle and solve big problems.

The challenge of responding to an incursion of myrtle rust, an emerging biosecurity threat to WA's unique and special plants and animals, is bringing together government agencies and scientists from Western Australia and Queensland (see '*Defending WA against myrtle rust*' on page 17). A single confirmed report of this pathogen has led to a dedicated group considering the potential impact and response options while raising community awareness.

The myrtle rust incursion occurred in a small 'island' of a particular vegetation type. Western Australia has more than 4000 islands along our coastline, each with significant value. Understanding of WA's islands has been achieved through a lifelong scientific collaboration (see '*Island life*' on page 28). These islands include Dirk Hartog, on which dedicated volunteers and scientists have partnered over almost 40 years to build our understanding of threatened loggerhead turtles (see '*Tagging turtles on a remote and ruggedly beautiful island*' on page 48).

Another area where partnerships and collaboration are critical is in planning for new parks and reserves, and then managing and protecting these areas of lands and waters. Under the Plan for Our Parks initiative, DBCA is working with Traditional Owners, stakeholders and users to extend Marmion Marine Park in the Perth metropolitan area and develop joint management arrangements for a number of new terrestrial reserves across the State. Under the *Forest Management Plan 2024–2033*, we will also be working with Noongar people and other stakeholders to create new conservation reserves in south-west forests. This is an exciting time, heralding a new way of working together to care for our unique and special plants and animals and their value to culture, recreation and tourism.

Dr Fran Stanley, ***A/Deputy Director General***
Department of Biodiversity, Conservation and Attractions

Contributing

Jim Baker has been a volunteer with the Bibbulmun Track Foundation for almost 20 years. He has walked the entire Track four times and currently works in the Bibbulmun Track Foundation office offering advice to other walkers. Jim co-edits the Bibbulmun Newsletter and has written and published a book about the Track as well as travel articles, short stories and poetry for other magazines.



Zander Schott is 10 years old and lives in Perth's southern suburbs. He has enjoyed several school holiday activities with *Nearer to Nature*, *Know Your Patch* and *River Guardians* over the last few years, and especially loves when he gets up close and personal with the wildlife he is learning about. Zander's passions include caring for animals, creating art, learning to code and making video games. When he grows up he wants to create his own video games, be a famous YouTube star and work as a scientist to save species from going extinct (and maybe bring extinct animals back to life!).



Loretta Lewis is a Technical Officer in DBCA's Plant Diseases Program, working with priority plant disease such as *Phytophthora cinnamomi* (dieback) and *Austropuccinia psidii* (myrtle rust). Loretta brings a holistic perspective to her work with plant diseases, understanding that these tiny pathogenic organisms have the potential to alter entire ecological communities, including native fauna that depend on impacted plants for food and shelter.





Features

8 Parks for people: Murujuga National Park
Western Australia's 100th national park

12 Total eclipse of the park
Astro tourists experience rare event in Ningaloo

17 Defending WA against myrtle rust
Preparing for impact from a dangerous plant pathogen

22 Bilbies have returned to Matuwa
Iconic species settling back in

28 Island life
Celebrating the plants and animals of WA's islands

35 Touched by nature: Roy and the arum lilies
Rottnest Island volunteer's mission to eradicate weeds

38 Evolution of the Bibbulmun Track
How the long-distance walk trail has evolved over 25 years

44 Adventure out: Wetland Wildlife Investigators
Ten-year-old Zander Schott gets investigating

48 Tagging turtles on a remote and ruggedly beautiful island
Monitoring sea turtles on Dirk Hartog Island

Regulars

3 From the desk of Dr Fran Stanley
A foreword from the Acting Deputy Director General, Department of Biodiversity, Conservation and Attractions.

6 Bush telegraph
Short stories from around the State, reader's pic and a guest word.

11 In review
A collection of books and applications.

47 Discovered
Amanita marinae.

53 Kaleidoscope
Connecting kids with nature.

54 Nature's pin-up
Painted finches (*Emblema pictum*).

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This page Cape Barren goose (*Cereopsis novaehollandiae*).
Photo – Daniella Van/Sallyanne Cousans Photography

Department of **Biodiversity, Conservation and Attractions**

Snap shot



READER'S PIC

Osprey (*Pandion haliaetus*)

Photo and words by Gary Tate

"We were heading north to the stunningly beautiful Kimberley coast when the ship docked at Broome Wharf. The wharf has provided a couple of nesting platforms for the local osprey (*Pandion haliaetus*). As the ship docked, I could hear the calling of an osprey and could see three perched around the wharf. This was a unique opportunity to capture images from above and alongside these beautiful fish-catching eagles."

Have you got a fantastic nature photograph you would like to see published in *LANDSCOPE*? Send it, along with a 100-word description of the species or how and where you took the shot, to landscope@dbca.wa.gov.au

Resilient Reef strategy finalised

The Ningaloo Coast has become the first World Heritage site to finalise a resilience strategy to help Ningaloo Reef and the local community adapt to climate change.

The strategy outlines actions to support thriving, resilient ecosystems, an educated and empowered community as well as sustainable development. It was developed through a community-driven process led by the *Resilient Reefs* initiative, supported by the Department of Biodiversity, Conservation and Attractions in consultation with the Baiyungu, Thalanyji and Yinikurtura Traditional Owners, scientists and local businesses.

The Ningaloo Coast is one of four World Heritage sites participating in the *Resilient Reefs* initiative, along with the Lagoons of New Caledonia, Rock Island Southern Lagoon in Palau and Belize Barrier Reef.

To find out more, visit dbca.wa.gov.au/parks-and-wildlife-service/resilient-reefs-ningaloo



Aboriginal Ranger Program—Round 6 Innovation fund

On 14 April 2023, the McGowan Government launched Round 6 of the Aboriginal Ranger Program (ARP)—the Innovation Fund. In this round, up to $11 million is available for projects that explore innovative ways to maximise the benefits of the program.

The ARP Innovation Fund has been established to fund one-off projects or pilot programs and is part of a $66.5 million investment.

Projects should align with the themes of Protecting Country, Empowerment and Collaboration.

Since 2017, WA's Aboriginal Ranger Program has funded more than 35 ranger programs and created more than 650 ranger jobs on Country across Western Australia—nearly half of which went to women.



The learnings generated from projects funded under the Innovation Fund will be made public to the wider Aboriginal ranger sector to support the continual improvement and success of ranger programs across the State.

Ineligible applicants could still apply by teaming up with an eligible Aboriginal organisation.

The Round 7 Development Fund will also launch mid-2023 making up to $13 million available for new and emerging ranger programs.

For more information on the State Government's Aboriginal Ranger Program and the benefits, visit dbca.wa.gov.au

Left Coral Bay.
Photo – Johnny Gaskell

Above Connecting on Country.
Photo – DBCA



Swimming with Australian sea lions

A licensed swimming with Australian sea lions (*Neophoca cinerea*) trial will soon be underway in Jurien Bay and Rockingham.

Four tour operators have been chosen to be part of the trial and will be licensed by Department of Biodiversity, Conservation and Attractions (DBCA), with licence fees reinvested into seal research and conservation.

The outcomes of the trial will guide management of tourism, recreation and other human interaction activities affecting seals in WA waters.

To find out how you can observe these playful and curious creatures from a distance and for more information visit dbca.wa.gov.au/sealwise



New accessible playground for Bunbury

There's a new addition to Bunbury's Mangrove Cove with the completion of a wheelchair accessible and interactive playground for locals and visitors to enjoy. The Mangrove Cove all-abilities nature play area draws its inspiration from the unique mangrove system found in the Leschenault Inlet. It hosts an array of features including mangrove root inspired climbing frames, ladders, rope nets, slides and rope bridges. Inclusive play opportunities are on offer for the ground level of the site, featuring a water play area, a wheelchair accessible sand pit and tunnels. A universally accessible walkway winds its way through the play area, providing access to a cantilevered lookout deck with sweeping views across the Leschenault Inlet. The play area was constructed by BGC Construction Bunbury and delivered by the Department of Biodiversity, Conservation and Attractions (DBCA) and the Department of Finance. The site is managed by DBCA.

Top Australian sea lion (*Neophoca cinerea*).

Above The new Mangrove Cove playground.
Photos – DBCA

Guest column



Kathleen Broderick
Chair, Bibbulmun Track Foundation

It is an immense achievement to develop and maintain the Bibbulmun Track and it takes a great deal of dedicated effort and a willingness to change over time.

This year, it has been 25 years since the Track was realigned and underpinning its ongoing success are the people and their relationships, including volunteers, who make and grow partnerships. Key to this has been a strong relationship between DBCA's Parks and Wildlife Service and the Bibbulmun Track Foundation.

At this 25th anniversary milestone, we are looking to the future, nurturing relationships and forging new partnerships.

A quality trail is not just good surfaces and infrastructure, it provides an experience of the natural and cultural environment and we're thinking about our role in maintaining the Track and how that can be continued and enhanced to cater for increased and diverse use (see '*Evolution of the Bibbulmun Track*', on page 38).

In recent years, ageing infrastructure has been upgraded and new group campsites constructed with the State Government's major investment and the emergence and activation of 'Support Volunteers'—people who bring a wealth of expertise and work together as a team and with section volunteers in priority projects along the Track.

Our society is changing, and walkers want to know more about Aboriginal culture. We're focusing on working with Aboriginal people so we can understand each other better and share knowledge.

The qualities of the landscapes we walk through are important, and there are challenges with a changing climate and increasing development pressures. We support those working to retain and restore rivers, plants, and animals, that have always been fundamental to the Track experience.

I'm wondering who will partner with us on the Bibbulmun Track now, and for the journey ahead—will it be you?

Bibbulmun TRACK FOUNDATION



Murujuga National Park

Just north of Karratha, across a wide salt flat, is the Burrup Peninsula—home to an area of immense cultural significance, which could soon gain global recognition. The Murujuga Cultural Landscape, including Murujuga National Park, has been formally nominated for inscription on UNESCO's World Heritage List.

Murujuga National Park is Western Australia's 100th national park and is situated within the land and sea country of the Murujuga Cultural Landscape on the Pilbara coast.

There are five Traditional Owner and custodial groups, collectively known as the Ngarda-Ngarli, who have been part of this cultural landscape for tens of thousands of years instilling a deep, spiritual connection to it.

That connection is most visible through the remarkable Aboriginal rock art engravings, or petroglyphs, found amongst the area's iconic red rocks. It is one of the densest and most diverse collections of rock art images in the world.

Murujuga has an estimated 1–2 million images in an area of more than 100,000 hectares, demonstrating an extraordinary diversity of style, theme, mode of production and aesthetic repertoire.

The petroglyphs at Murujuga capture at least 47,000 years of human existence and light up the imagination. They show human images, extinct animals, including thylacines (Tasmanian tiger), as well as the same birds and fish found there today.

The landscape of Murujuga is just as diverse. There are rock-strewn cliffs, narrow valleys, mangroves, and mudflats. More than 14 native mammal species live there including 14 species of bats. Other creatures include 58 reptile species including the Pilbara olive python (*Liasis olivaceus barroni*), as well as Rothschild's rock wallaby (*Petrogale rothschildi*) and the northern quoll (*Dasyurus hallucatus*).

WORLD HERITAGE NOMINATION

In February 2023, a joint announcement between Murujuga Aboriginal Corporation (MAC) and the Australian and Western Australian Governments that the World

Above Murujuga National Park has one of the world's richest and most diverse assemblages of rock art.
Photo – Jo McDonald/Centre for Rock Art Research and Management

Opposite page
Top left Hearson Cove is part of the Murujuga cultural landscape.
Photo – David Bettini
Top right Nganjarli Trail in the national park.
Photo – Daniel Fowler/Fuzz Digital
Above left Mangroves and inlet to the ocean from within the national park.
Above right Murujuga Aboriginal Corporation jointly manage Murujuga National Park with DBCA.
Photos – Amy Stevens/Murujuga Aboriginal Corporation









Heritage nomination had been formally submitted to UNESCO, was a long time coming.

In 2007, the Dampier Archipelago, including the Burrup Peninsula and Murujuga National Park, was placed on Australia's National Heritage List. And in 2020, Murujuga was added to Australia's World Heritage Tentative List.

For four years, MAC and the Western Australian Government, led by the Department of Biodiversity, Conservation and Attractions (DBCA), worked on the official nomination, with support from the Australian Government and technical experts.

The nomination was delivered to UNESCO at the end of January 2023. This was celebrated with an event on Country and a signing ceremony in February 2023 attended by attended by Federal and WA Environment Ministers.

UNESCO's rigorous assessment process will take at least 18 months.

JOINT MANAGEMENT

Murujuga was the first national park in WA to be managed jointly between Traditional Owners and State Government.

It is owned by MAC, leased back to the State Government and jointly managed by MAC and DBCA. This joint management approach recognises the continuing Aboriginal connection to Country and embodies the Ngarda-Ngarli philosophy "Ngayintharri Gumawami Ngurrangga" (We all come together for Country).

GEOLOGY

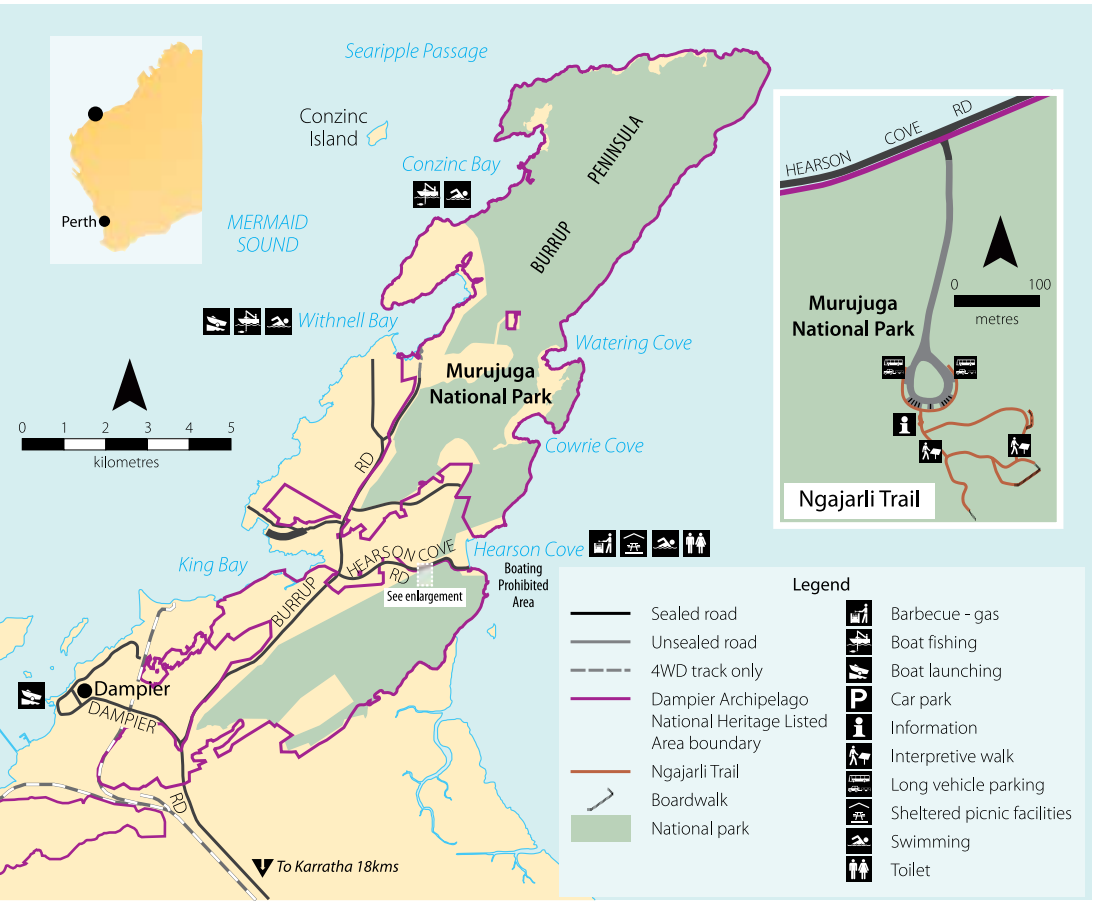
The rocks of Murujuga are comprised mostly of granophyre (a fine-grained granite) and gabbro that intruded as a sill of magma between layers of surrounding volcanic and sedimentary rocks. The sill is at least two kilometres thick and was formed around 2.7 billion years ago.

The archipelago was formed between 5000 and 6000 years ago when the sea level was rising following the last ice age. This once hilly area was flooded, leaving hilltops as islands. Coastal dunes of shelly lime-sand, then accumulated around the newly formed islands, the grains of which later formed limestone.

The huge rock piles are unique to this part of the Pilbara coastline and are a result of the physical breakdown of the parent material—the fine-grained Gidley granophyre—and the coarse-grained gabbro. Both are resistant to erosion. Oxidation of the rock surface over thousands of years has created the rich red colour seen today. A recently split rock is blue-grey inside.

Discover more about Murujuga National Park

Scan this QR code or visit Parks and Wildlife Service's '*LANDSCOPE*' playlist on YouTube.







Top Intertidal flats are exposed at low tide. *Photo – DBCA*

Above Mudskippers (*Periophthalmus argentilineatus*) are abundant at Murujuga. *Photo – Ann Storrie*

BIRD LIFE

Every year, thousands of migratory shorebirds visit the beaches of Western Australia's north-west on their mega journeys across the globe.

Murujuga National Park provides sand bars, rocky shores, beaches, salt marshes, intertidal flats and mangroves, all of which are important feeding and nesting habitat.

Migratory birds visit this habitat during spring and summer, when they escape the winter of their breeding grounds in the northern hemisphere. Some migratory shorebirds, mostly first year birds, stay all year round.

NGANJARLI TRAIL

Located off the Hearson Cove Road, the Nganjarli Trail enables visitors to view an array of rock art, a shell midden, grinding stone and other cultural artefacts.

The 700-metre Class 2 trail is designed to be accessible for wheelchairs and features interpretive signage, viewing platforms and an elevated boardwalk following the edge of natural rock piles.

The rock art is deeply meaningful to Aboriginal people as it provides a link to stories, customs and knowledge of their land and resources. It connects them to the events and people of the past and to their beliefs today.

PARTIAL CLOSURE

A section of Murujuga National Park, north of Withnell Road, is currently closed due to preparatory works ahead of the Murujuga access road and day-use site development. This closure will remain until late-2024, with no unauthorised access permitted to sites including Conzinc Bay, Casper's Pool and a drive trail known locally as the 'Jump-up'. Ancient Pools are now protected from unauthorised access under the *Aboriginal Cultural Heritage Act 2021*.

The Withnell Bay boat ramp is still accessible, and boats are still permitted to visit Murujuga National Park.

For further information visit alerts.dbca.wa.gov.au

Do it yourself

Where is it? 1540 kilometres north of Perth and 30 kilometres north-west of Karratha.

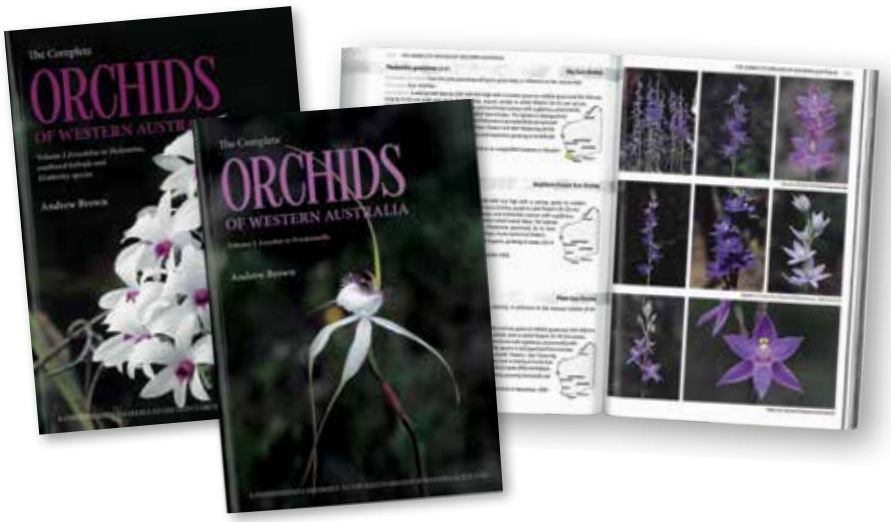
Things to do: Boat launching and fishing, bushwalking, bird watching, picnicking, swimming, snorkelling and cultural tours. For more information on cultural tours visit experiencemurujuga.com. No camping is permitted in Murujuga National Park.

Facilities: Interpretive signage, walk trail, viewing platform and elevated boardwalk at Nganjarli (also known as Deep Gorge).

Public toilets are located at Hearson Cove beach, managed by the City of Karratha, and at Windy Ridge Oval in Dampier.

Nearest Parks and Wildlife Service office: Pilbara Regional Office, Cnr Anderson and Mardie roads, Karratha Industrial Estate, Karratha, (08) 9182 2000.

Know before you go: Visitors should be prepared for extreme summer temperatures. Please visit exploreparks.dbca.wa.gov.au for important safety information.



THE COMPLETE ORCHIDS OF WESTERN AUSTRALIA

BOOK

Andrew Brown is one of Australia's leading orchid authorities and his latest two-volume collection, *The Complete Orchids of Western Australia*, will delight orchid enthusiasts and novices alike.

To call it a comprehensive resource would be an understatement, as the two volumes cover every native orchid known to occur in Western Australia with Volume 1 also including a detailed introduction and history of orchids.

There are beautiful photos and descriptions of all 42 genera and 470 known Western Australian orchid species and information including who named them and where they were first collected, habitat, distribution, flowering period, size, and distinguishing features.

Volume 1 covers south-west orchids *Anzybas* to *Ericksonella*, with Volume 2 covering *Eriochilus* to *Thelymitra*, south-west hybrids and Kimberley orchid species.

The Complete Orchids of Western Australia *is available from Aspects of Kings Park and via the Australian Orchid Foundation website for $70 for both volumes.*

HOUTMAN ABROLHOS: A NATURAL HISTORY (REVISED EDITION)

BOOK



If you think you might be suffering from déjà vu, you'd be correct—we previously reviewed *Houtman Abrolhos: A Natural History* in the Autumn 2021 edition of *LANDSCOPE* magazine.

But in great news, particularly for bird lovers visiting the Houtman Abrolhos, Dr Christopher Surman published a bigger and better revised edition in November 2022 with a new supplementary bird identification guide among the 30 pages of new information.

The 'Geological History' chapter has been updated and expanded as has the chapter 'Human Impacts & Changing Seas!' to include information about how micro plastics in the sea, artificial lighting, and increasing human visitation have impacted the islands.

The startling fact that nearly 25 per cent of all seabird nests on the islands contain at least one piece of plastic is a wake-up call to all of us to dispose of our rubbish correctly and take it home with us when we cannot.

With those who have praised the book including Sir David Attenborough, it is a must-read for nature enthusiasts.

Houtman Abrolhos: A Natural History *can be purchased from halfmoonbiosciences.com for $59.95 with all proceeds helping to support seabird research at the islands.*

FIRST AID

APP

First aid should always be front of mind when visiting our State's beautiful parks, particularly if you're exploring more remote locations.

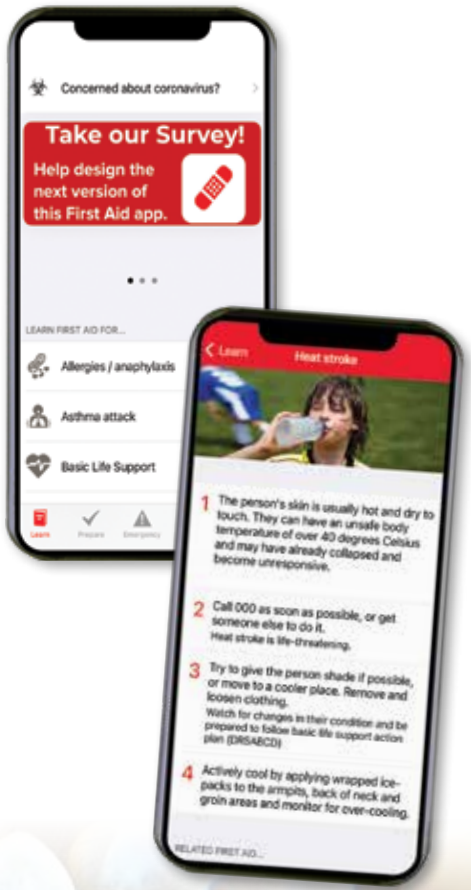
The *First Aid* app by Australian Red Cross provides quick and easy advice and step-by-step instructions for many common first aid emergencies including strains and sprains, heat stroke, snake bites and asthma attacks.

There is information about first aid preparedness for a wide range of scenarios, and a series of tests you can complete to check your first aid knowledge and see where you might need to brush up.

The app does not require Wi-Fi or a 4G signal once downloaded, so can be used in areas without mobile coverage.

Don't forget, you can't call Emergency Services via a mobile phone if there's no mobile coverage, so it is always recommended you carry a satellite phone or personal locator beacon when travelling in more remote locations.

First Aid *app by Australian Red Cross is free to download from the App Store and Google Play.*





TOTAL ECLIPSE OF THE PARK



On Thursday 20 April 2023 just before 11.30am, a rare astronomical event occurred over the World Heritage listed Nyinggulu (Ningaloo) Coast, 1200 kilometres north of Perth. Eyes around the world were glued to the region when, for 62 seconds, the moon was directly in front of the sun in perfect alignment, plunging the area into near darkness with just the sun's glowing outer atmosphere, known as the corona, visible around the moon.

by Conor Doherty, Greg Mair and Felicity Kelly





"The roads were quiet and everyone was very respectful of one another and the natural environment. Even the wildlife began to grow calm as the sky began to darken."

While a total solar eclipse occurs somewhere on Earth about every 18 months, it is rare that the narrow path of totality occurs over a populated area of land.

The Nyinggulu (Ningaloo) Coast and town of Exmouth were in the path of a 100 per cent eclipse with nearby Onslow and Coral Bay experiencing 99 percent darkness. Years of planning went into preparing the region for the huge influx of scientists, eclipse chasers, astro-tourists and those just curious who were expected from around the globe.

Up to 20,000 people were predicted to be in Exmouth and surrounds on 20 April—well exceeding the permanent population of around 3000 residents, and the usual 6000-person peak at the height of tourist season.

The event was logistically complex given distance and the demands on facilities and infrastructure from such large crowds. Planning and management involved collaboration amongst 14 State Government agencies, local and Commonwealth governments, business and the community to ensure the event was safe and enjoyable.

The Department of Biodiversity, Conservation and Attractions (DBCA) manages the national parks and conservation estate across the Nyinggulu (Ningaloo) Coast and had a considerable task to prepare for the level of visitation anticipated.

PROTECTING OUR PARKS AND KEEPING VISITORS SAFE

The Nyinggulu (Ningaloo) Coast was inscribed on the World Heritage list in 2011 due to its incredible natural beauty and biological diversity.

The World Heritage Area includes Cape Range National Park, Ningaloo Marine Park and Jurabi and Bundegi Coastal Parks and is bordered by Nyinggulara National Park and Nyinggulu Coastal Reserves, which were considered some of the best places to view the eclipse.

DBCA, together with Traditional Owners, jointly manages lands and waters situated within the path of totality including Nyinggulara National Park, Cape Range National Park and Ningaloo Marine Park. Managing the unprecedented influx and ensuring people were kept safe and environmental and cultural values were protected was a priority.

To ensure a safe and enjoyable visitor experience and ensure the natural and cultural values of the lands and waters were treated with respect and care, additional staff were brought to the region from across the State, as well as additional operational vehicles, vessels and charter aircraft.

ON THE GROUND

A controlled access system was put in place between 17 and 23 April for Cape Range National Park and Jurabi Coastal Park. Access was on a first in, first served basis for day users, with local residents, commercial tour operators and their clients, Yardie Homestead clients, and people with campground bookings allowed through control points.

Only those with campground bookings, local residents and commercial tour operators could access Nyinggulara National Park.

Exmouth District Conservation Employee Zoe Gillam said temporary closures occurred at some popular snorkelling sites and beaches in Cape Range National throughout the week as capacity was reached.

"Capacity numbers were monitored by park rangers based on carpark availability, risk of disturbance to vegetation and emergency access," Zoe said.

"Although visitors had travelled to Exmouth specifically for the once in

Previous page
Main Ningaloo solar eclipse totality.
Right Tourists view the eclipse from the beach at Coral Bay.
Photos – Department of Jobs, Tourism, Science and Innovation
Inset Photographing the eclipse.
Photo – Judy Dunlop

Left Totality in Cape Range National Park.
Photo – Greg Mair/DBCA







Above left Total solar eclipse coordination centre, Exmouth.

Above Watching the eclipse from a stand up paddle board in Coral Bay.
Photos – Department of Jobs, Tourism, Science and Innovation

Right Waiting for totality.
Photo – Judy Dunlop

a lifetime event, many still wanted to experience the other natural attractions the Ningaloo Coast had to offer.

"On the day of the solar eclipse there was a line-up of excited eclipse chasers waiting eagerly at the entrance gate to the national park at first light, however things quickly slowed down as the morning went on and visitors found their perfect eclipse watching spot and patiently waited for the special moment."

Zoe said the energy in the national park on the day of the eclipse was calm.

"The roads were quiet and everyone was very respectful of one another and the natural environment. Even the wildlife began to grow calm as the sky began to darken," she said.

REFLECTIONS FROM AN ECLIPSE CHASER

'Busier than usual but still manageable and enjoyable' was how Jean-Charles Dumas described visiting Cape Range National Park.

Jean-Charles travelled from Perth to the Nyinggulu (Ningaloo) Coast with his partner, Jutta Kober, specifically to experience the total solar eclipse from the path of totality. They spent a week in the area, mostly snorkelling and trail running in Cape Range National Park.

"I've been going to the region regularly for more than 20 years and visiting the national parks for scuba diving, snorkelling, running, rock climbing and hiking," Jean-Charles said.

"It was noticeably busier than previous times but not to the point where it was chaos. It actually wasn't bad at all.

"We pulled up to the rangers at one point and asked if we could park on the side of the road where one of the carparks was full. They told us where we could park without impeding traffic.

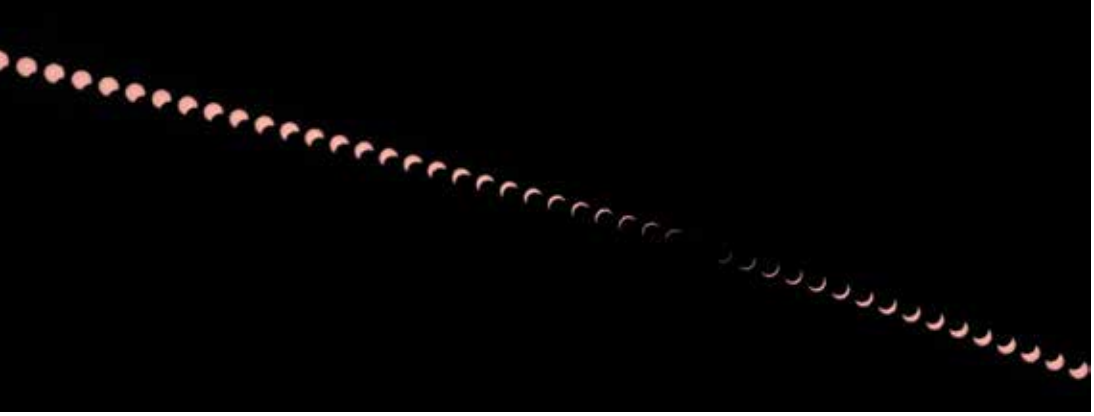
"It was a really good experience. It seemed really well managed."

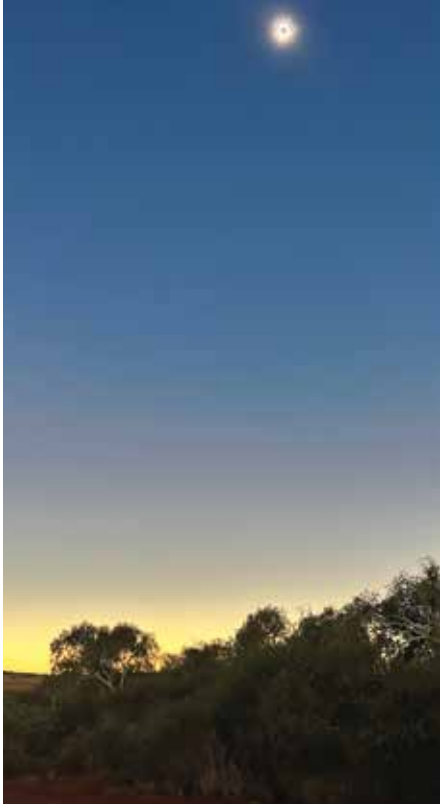
The pair had carefully planned their eclipse day viewing experience.

Fast facts

- Exmouth's population swelled to around 15,000 people with accommodation in the town during the week of the eclipse at a premium, with significant numbers of international and interstate visitors.
- Including day-trippers, it is estimated visitation peaked at 18,700 people in Exmouth to experience the total solar eclipse.
- Milyering Discovery Centre in Cape Range National Park experienced the highest level of visitation on record at 1300 people on 19 April (the previous record was 825).
- Vehicle entry through Cape Range National Park gate: 18 April – 744, 19 April – 905, 20 April – 550, 21 April – 809.
- 125 DBCA staff, six vessels and 48 vehicles were deployed to the Exmouth Region for the week.
- The Time and Date website recorded 10.5 million views of its eclipse live stream. This was one of many different sites beaming the eclipse globally.











"We really wanted to be in Cape Range National Park, but the problem was that you could be in the totality but on the side of it where you'd only get a shorter experience," Jean-Charles said.

"So we drove to one of the bays and hiked about 12 kilometres into the national park where you could intersect the actual centre of the eclipse where you'd get the full 60 seconds."

Their plan worked perfectly and they arrived at their viewing destination about an hour before totality with not another visitor in sight.

"Just before totality we went out into the open and waited for it and it was spectacular. It exceeded all my expectations," Jean-Charles said.

RESEARCH DURING AN ECLIPSE

Many scientists and researchers took the opportunity to travel to Exmouth to build their knowledge of this spectacular phenomenon.

One group from the University of Hawaii launched a kite-mounted imaging spectrometer to examine the physical properties of the sun's corona.

They used a 'Cody' box kite weighing in at 22 kilograms and spanning 6.5-metre. The scientific payload weighed about 12 kilograms. The team was led by Dr Shadia Habbal, an astronomer and physicist who specialises in space physics. Dr Habbal focuses on the origin and evolution of the solar wind, solar magnetic fields and eclipse polarimetric observations.

After the marathon journey bringing a multi-national team to Exmouth as well as about 400 kilograms of equipment, the kite and imaging spectrometer was successfully launched during the eclipse and Dr Habbal was very pleased with the expedition.

"My postdoc loved the place so much that he didn't want to go back," she said. "We all had wonderful memories of your part of the world and your people."

ECLIPSE LEGACY FOR NINGALOO

The Western Australian Government made a significant investment planning and preparing for the total solar eclipse including a number of legacy items of future benefit to the local communities and national parks.

Following the huge success of the total solar eclipse and the exposure the event gave the Nyinggulu (Ningaloo) Coast across Australia and around the world, a five-hour direct flight between Melbourne and Exmouth's Learmonth Airport began running twice a week from 1 May 2023.

The direct flight saves travellers from Melbourne more than three hours' travel time compared to flying to Learmonth via Perth, making it quicker and easier to experience all the Nyinggulu (Ningaloo) Coast has to offer.

Top left Phases of the eclipse.
Photo – Roger Groom/Astro Photography

Above far left A kite-mounted imaging spectrometer was launched in Cape Range National Park.
Photo – Michael Heydon

Above left Jutta Kober and Jean-Charles Dumas enjoyed the clipse from Cape Range National Park.

Above Cape Range National Park darkened as totality was reached.
Photos – Jean-Charles Dumas

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Defending WA against MYRTLE RUST

by Mia Townsend, Kylie Ireland and Loretta Lewis

Twelve years after reaching Australia, myrtle rust (*Austropuccinia psidii*) has been detected in Western Australia for the first time in the remote and rugged east Kimberley. Dealing with this serious environmental pathogen in such a vast landscape has its challenges. Citizen surveillance and community awareness are key to managing and protecting WA's myrtaceous flora from the disease.







For more than a decade, an introduced pathogen known as myrtle rust (*Austropuccinia psidii*) has significantly impacted the east coast of Australia, spreading quickly throughout New South Wales, Queensland, Victoria, Tasmania and the Northern Territory after its initial detection north of Sydney in 2010. Until recently, Western Australia has avoided infection largely due to the arid land in the centre of the State acting as a natural barrier, and the careful implementation of hygiene and quarantine protocols. Unfortunately, this honeymoon period of being 'myrtle rust free' in WA ended abruptly in June 2022, when the pathogen was detected for the first time at a remote site in the east Kimberley, about 100 kilometres north-east of Kununurra.

Now, the management of this serious plant disease is relying on teamwork and community participation to monitor and control the spread.

Previous page
Main *Eucalyptus miniata* overlooks the Ord River and surrounding east Kimberley landscape from the Five Rivers Lookout in Wyndham
Photo – Amy Priemus
Below Myrtle rust confirmed on *Melaleuca* north-east of Kununurra.
Photo – Louise Shuey

Above left *Melaleuca quinquinervia* symptoms.
Photo – Geoff Pegg

Top right Aerial view of a mound spring.
Photo – Louise Shuey

Above right *Eucalyptus* seed.
Photo – Amy Priemus

MYRTLE RUST IN WA

Myrtle rust is an introduced and highly invasive fungal disease. It is native to South and Central America but has invaded a number of other regions globally. Myrtle rust can be recognised by its characteristic masses of bright yellow or orange-yellow spores, which are often surrounded by a purplish or reddish-brown halo. It affects plants within the Myrtaceae (myrtle) family, which includes many of WA's iconic native tree and wildflower species.

Since its arrival in Australia, experts have been working to keep the pathogen out of WA through a combination of hygiene and quarantine protocols, proactive surveillance and awareness-raising activities.

In 2022, myrtle rust was detected as a part of the proactive targeted surveillance carried out by the Department of Biodiversity, Conservation and Attractions (DBCA) and the Department of Primary Industries and Regional Development (DPIRD). Myrtle rust is thought to have been introduced to the Kimberley via windblown spores from existing infestations in the NT. The infected site was one of a series of important ecosystems that form the priority ecological community of wetlands associated with the organic mound springs on the tidal mudflats of the Victoria Bonaparte Bioregion.

"While it is very concerning to have finally found myrtle rust in WA, the remote and relatively inaccessible location really is a best-case-scenario," Mia Townsend, DBCA's former Plant Diseases Program Coordinator said.

"While we are unable to do anything about the spores blowing in on the wind from the NT, we are now well placed to address other pathways that may move spores around, such as the movement of people.

"To do this, we need to keep track of where the pathogen occurs."

Discover more about myrtle rust

Scan this QR code or visit Parks and Wildlife Service's '*LANDSCOPE*' playlist on YouTube.



Protecting WA's biodiverse south-west

A priority for the management of myrtle rust in WA is to attempt to stop the spread into the south-west ecoregion, where the species diversity of myrtaceous plants is astoundingly high. Modelling shows that the climate in south-west WA is ideal for the pathogen to thrive. Coupled with a plethora of potential host species, the impact of this disease in the south-west could be very high.

Scientists are not only concerned about the potential impacts of the disease on native plants but have also expressed concerns about the impact that loss of habitat could have on fauna. Dr Bronte van Helden is leading important research into the way that mammal species in south-west WA utilise habitat, particularly in urban and peri-urban environments where myrtle rust is likely to thrive due to factors like irrigation, frequent pruning and more regular burning.

"Myrtaceous plants are critical for many mammal species in WA, often forming the key species of woodland and forested habitats," Dr Bronte van Helden said.

"Myrtle rust could have devastating consequences for these mammals, particularly threatened species. One such example is the critically endangered western ringtail possum (*Pseudocheirus occidentalis*), which relies on myrtaceous trees such as peppermint (*Agonis flexuosa*), marri (*Corymbia calophylla*) and jarrah (*Eucalyptus marginata*) for food and shelter.

"If these trees and associated habitats are degraded by myrtle rust, the possum and other threatened species will face an even greater risk of extinction."

With arid regions to the north and east of south-west WA and little cyclonic activity connecting it to known myrtle rust infected areas, the main risk of introduction to the south-west comes from human movement. It's important for visitors to think carefully about hygiene and be sure to wash or wipe down clothes and gear before and after getting out in nature.

Myrtle rust has had a devastating impact on some species and communities in Queensland and New South Wales, driving formerly common species such as the native guava (*Rhodomyrtus psidioides*) to the brink of extinction.

"From what we've seen with myrtle rust, it's particularly impacting on the Melaleuca species or paperbarks," Dr Geoff Pegg, Senior Forest Pathologist at Queensland's Department of Agriculture and Fisheries said.

"In some situations, what we're finding is reduced levels of flowering, and that plants can't compete with surrounding vegetation because they are being impacted repeatedly by the fungus.

"Finding a solution to manage this once it escapes into the surrounding environment is extremely challenging."

PREPARING FOR IMPACT

Perhaps one of the most challenging aspects to managing myrtle rust in WA is the lack of information on the potential



Top left Western ringtail possum (*Pseudocheirus occidentalis*) or ngwayir.
Photo – Jiri Lochman

Above Native guava (*Rhodomyrtus psidioides*) trees found dead four years after myrtle rust arrived in Australia.
Photo – Peter Entwistle

Right Myrtle rust on weeping paperbark (*Melaleuca leucadendra)*, found in the Kimberley in 2022.
Photo – Nathan Ashburner



Spotlight on Myrtaceae

The taxonomic family Myrtaceae represents a highly diverse and ecologically important group of plants in WA. They are found in a wide range of habitats, including forests, woodlands, heathlands, and wetlands, and play a crucial role in the ecosystem by providing food, shelter, and habitat for a diverse range of fauna, including birds, insects, and mammals. Many myrtaceous species have also been traditionally used by Aboriginal people for medicinal and cultural purposes, highlighting their cultural significance.

Myrtaceous plants can be identified using several key features that are characteristic of the family Myrtaceae.

Scent: (1) One of the most distinguishing features of Myrtaceae is the presence of aromatic oils in the leaves, stems and flowers, which gives them a characteristic scent when crushed. If held up to the light and viewed through a magnifying glass or hand lens, distinctive oil dots can be seen on the leaves of Myrtaceous plants.

Leaves: (2) Other characteristics include simple leaves that are usually opposite or alternate on the stem and have entire margins (i.e. no teeth or serrations).

Flowers: (3) The flowers of Myrtaceae are usually solitary or in clusters, with five petals and a conspicuous ring of stamens around the base of the ovary.

Fruit: (4) The fruit of Myrtaceae is typically a berry, capsule, or nut, which contains small seeds. In some species, the fruit is edible and can be used for food.

Some well-known Myrtaceae genera include:

Agonis (5) includes the WA peppermint tree (*Agonis flexuosa*), which is widespread through natural areas and gardens in the south-west of WA. *Agonis* is known to be highly susceptible to myrtle rust.

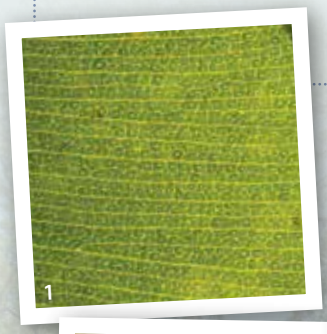
Callistemon*/*Calothamnus*/*Beaufortia (6) genera include plants commonly known as bottlebrushes. Bottlebrushes are often used as bird-attracting plants in gardens.

Melaleuca (7) genus includes paperbark trees, which are often traditionally used in Aboriginal cultural practices and some tea trees that are used in the essential oils industry. Myrtle rust was detected on two species of *Melaleuca* in the east Kimberley.

Eucalytpus*/*Corymbia (8) are the iconic gum trees and are the dominant genera in many Australian woodlands and forests. Although these genera are not highly susceptible to the pandemic strain of myrtle rust we have in Australia, they are more vulnerable to other exotic strains of myrtle rust. If a new strain was to enter Australia, the impact could be devastating for bushland areas, gardens and industries like honey production and specialty timber products.

Chamelaucium (9) includes Geraldton wax, a stunning plant that is commonly used in gardens and in flower arrangements. Many of the waxes are known to be highly susceptible to myrtle rust.

Eugenia (10) (*E. reinwardtiana)* is categorised as a Priority 1 species as not much is known about its occurrence in northern WA. If you see this plant, make a report, whether you see myrtle rust on the plant or not! Myrtle rust has had considerable impact on this species in Queensland.





















Main Jarrah forest. *Photo – Jiri Lochman.*
1) Oil dots on marri leaf. *Photo – Cliff Winfield* **2)** Jarrah leaves. *Photo – Marie Lochman* **3)** *Calytrix depressa* flowers. *Photo – Cliff Winfield*
4) Leaves and fruits of marri tree. *Photo – Sallyanne Cousans*
5) Peppermint *(Agonis flexuosa)*. *Photo – Marie Lochman* **6)** *Callistemon*. *Photo – Cliff Winfield* **7)** Graceful honeymyrtle *(Melaleuca radula)*.
8) Large-fruited mallee *(Eucalyptus youngiana)*. *Photos – Marie Lochman*
9) Geraldton wax *(Chamelaucium uncinatum)*. 10) *Eugenia reinwardtiana*. *Photos – Geoff Pegg*

What can you do to help?

WA is a vast State, and many relatively remote areas such as the Kimberley are at risk from myrtle rust. The only way to combat the spread is for everyone to be aware of myrtle rust, know what to look for, and know what to do if it's spotted.

If we can build a network of citizen scientists keeping an eye out, we stand the best chance of finding myrtle rust early if it spreads into towns or national parks and managing it as proactively as possible.



ARRIVE CLEAN, LEAVE CLEAN!

Being aware of environmental hygiene to limit the spread of myrtle rust by people and other biosecurity threats such as dieback is another key area where everyone can play a part. Myrtle rust spores are abundant and spread mostly via wind, but they can also be spread via infected plant material, contaminated equipment, vehicles and clothing—even skin and hair.



BIOSECURITY IS EVERYONE'S RESPONSIBILITY

- Ensure items are free of soil and organic matter before entering and exiting bushland.
- Use wash down and boot cleaning stations where available.
- Wash and disinfect all items on your return home.
- Always stay on roads and trails.

If you suspect you have found myrtle rust—don't touch it! Take a photo and report it via the MyPestGuide® reporter app or by contacting the Pest and Disease Information Service on (08) 9368 3080, email padis@dpird.wa.gov.au. For general myrtle rust related enquiries, contact enquiries@dbca.wa.gov.au

susceptibility in Myrtaceous species, many of which are unique to WA. To safeguard species potentially at risk, teams at the WA Seed Centre are storing seed and growing ex-situ collections for species potentially at risk.

Screening for myrtle rust susceptibility is also underway, with University of Sydney PhD candidate Alyssa Martino conducting glasshouse trials using seed from the WA collections. Preliminary results from this pivotal research indicate that certain WA species have little to no natural resistance to the disease and may be impacted severely if the pathogen were to become widespread in WA.

Understanding how vulnerable certain species are to myrtle rust is key for directing future conservation and seed collection efforts so that WA is as prepared as possible to deal with this imminent biosecurity threat.

Meanwhile, DBCA officers are working closely with DPIRD on a range of myrtle rust preparedness activities, including communication and awareness raising, capacity building of surveillance staff and improved climate suitability modelling. To ensure WA is ready to manage myrtle rust should it establish in the State, DPIRD's subject matter experts are staying up to date on the latest developments in the detection, treatment and control of myrtle rust.

DBCA and DPIRD are engaged in State and Federal myrtle rust working groups, bolstering stakeholder engagement, policy and response capacity. Awareness raising is targeting the highest risk pathways for myrtle rust to spread, especially at State borders and amongst tourists who may visit infested areas and inadvertently travel with spores on their clothing and belongings.

Inset right Myrtle rust spores are bright yellow or orange-yellow.
Photo – Angus Carnegie

Inset above MyPestGuide® reporter app.

Right *Melaleuca quinquinervia* symptoms.
Photo – Geoff Pegg



Mia Townsend was formerly the Plant Diseases Program Coordinator with DBCA's Conservation and Ecosystem Management Division. She is now the Chief Executive Officer for the Dieback Working Group and can be contacted at exec.officer@dwg.org.au

Kylie Ireland is the Plant Diseases Program Coordinator with DBCA's Conservation and Ecosystem Management Division after moving from the Department of Primary Industries and Regional Development where she worked as a Research Scientist. She can be contacted at kylie.ireland@dbca.wa.gov.au

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Bilbies have returned to Matuwa

Sixteen years after their reintroduction to Matuwa, bilbies are still surviving without predator-proof fencing, the only location in Australia with a successfully reintroduced population of bilbies in an open landscape.

by Dr Cheryl Lohr and Dr Martin Dziminski









Matuwa Kurrara Kurrara National Park, 160 kilometres north-east of Wiluna in the Gascoyne Murchison region, protects Martu Aboriginal cultural values and the area's unique biodiversity. The newly established national park is jointly managed by Tarlka Matuwa Piarka Aboriginal Corporation for the Wiluna Martu people and the Department of Biodiversity, Conservation and Attractions, and is once again referred to by its traditional name, Matuwa.

Previous page
Left Rugged terrain of Matuwa.
Photo – Judy Dunlop/DBCA
Right Greater bilby (*Macrotis lagotis*).
Photo – Jiri Lochman
Inset Releasing a bilby at Matuwa.
Photo – Judy Dunlop/DBCA

Top Honeysuckle Grevillea (*Grevillea juncifolia*).

Top right Local sign made by Wiluna Martu people.

Above right Brown falcon (*Falco berigora*).
Photos – Simon Cherriman

CREATING A SAFE SPACE

Since the government acquired Matuwa, windmills have been decommissioned and stock has been removed. Transient introduced herbivores such as camels have been removed through culling programs and deterred from entering the property by a solar-powered electric fence around the boundary of Matuwa.

Volunteer caretakers inspect this fence every month repairing any breaks. Annual feral cat control using Eradicat® baits together with supplementary trapping began in 2004 and the apparent abundance of feral cats has been reduced by 60–70 per cent. After several years of threat mitigation activities, bilbies were reintroduced to Matuwa.

LITTLE DIGGER

The greater bilby (*Macrotis lagotis*) is a burrowing marsupial with distinctive large ears and a pointed snout and weighs around 1–2.5 kilograms. Wild populations are currently found in north-west and central WA, western parts of the Northern Territory and in a small, isolated area of south-west Queensland. This represents a contraction to approximately 20 per cent of their former range and the species is listed nationally as Vulnerable.

Predation by introduced predators, particularly foxes, is thought to be a primary threat for the bilby. Unsuitable fire regimes and habitat degradation by introduced herbivores and land clearing are landscape-scale factors also affecting bilby range and prevalence.

Bilbies are nocturnal animals. They dig prolifically and use burrows, which descend in a spiral up to three metres deep. Many other animal species use bilby burrows

Hear more about conservation at Matuwa

Scan this QR code or visit Parks and Wildlife Service's podcast.









for shelter, including brush-tailed mulgara (*Dasycercus blythi*), spinifex hopping mice (*Notomys alexis*), echidnas, and sand goannas (*Varanus gouldii*). Bilbies may occupy very large home ranges and are rarely seen in the wild. Digging activity by bilbies also helps to restore ecosystem function by reducing soil compaction and facilitating seed dispersal.

MONITORING BILBIES

Despite the lack of historical records of the bilby at Matuwa, their broad distribution within this region would suggest they did occur there. In order to establish a viable self-sustaining population of bilbies in 2007, the Department of Biodiversity, Conservation and Attractions (DBCA) commenced reintroducing bilbies to Matuwa. If successful, this translocation would also help to restore their ecosystem function. Bilbies for the translocation were sourced from a captive breeding program at the Peron Captive Breeding Centre in Shark Bay, and the Return to Dryandra captive breeding facility, near Narrogin. Some animals were also sourced from an introduced population on Thistle Island, South Australia. In total, 144 bilbies were released in areas of Matuwa without predator-proof fencing. Around 38 per cent of the bilbies were radio-tracked using tail-mounted radio-transmitters to monitor their survival.

Despite the threat mitigation activities, the initial survival rates of the translocated bilbies, and population viability analyses, suggested that the probability of the Matuwa bilby population persisting for more than 20 years was low. Ongoing monitoring of the bilby population and feral cat control at Matuwa was prioritised as a result.

SUCCESS

In 2015 and 2016, DBCA scientists developed and used a technique to monitor bilbies by using genetic analyses to identify individuals from DNA in their scats. They found that within ten years the bilby population at Matuwa had increased sevenfold to at least 971 individuals from the original 144 founders. Similarly, the area used by bilbies increased from the three original reintroduction locations to 188,400 hectares.

"Around 38 per cent of the bilbies were radio-tracked using tail-mounted radio-transmitters to monitor their survival."

Top Bilby burrow.
Photo – Simon Cherriman

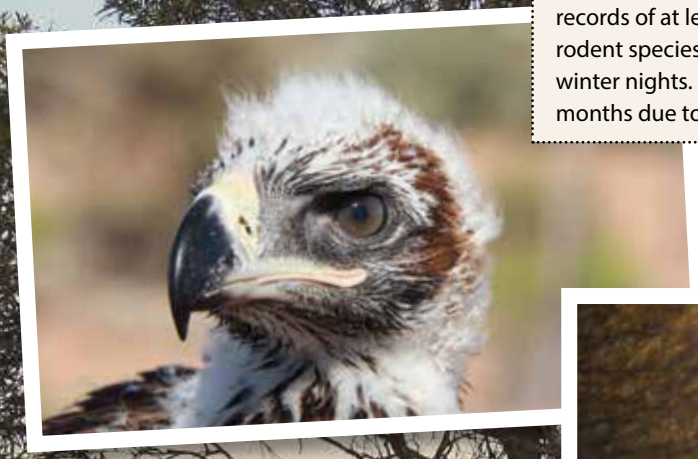
Top right Distribution map of bilbies in Australia.

Above left Collecting bilby scats at Matuwa.
Photo – Martin Dziminski/DBCA

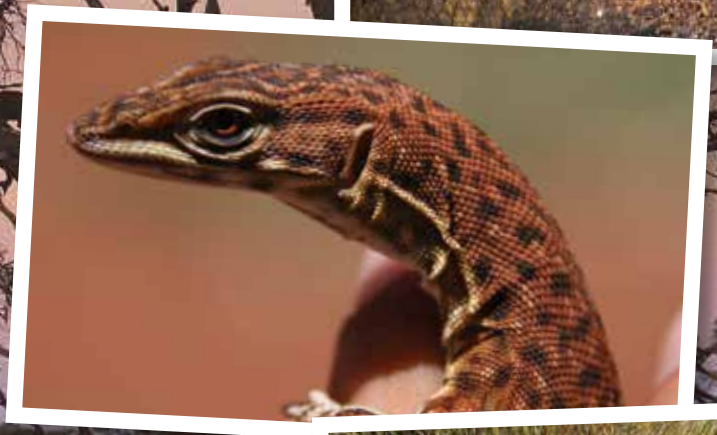
The magic of Matuwa

Matuwa spans 244,000 hectares and lies in central Western Australia. It contains at least 20 different land systems and vegetation types such as hummock grasslands, shrublands and mulga woodland. This diverse habitat supports a remarkable array of flora and fauna, with 480 vascular plant species and 220 vertebrate animal species occurring on the property.

The diversity of small vertebrates is one of the highest recorded in Australia, with records of at least 75 reptiles, five frogs, 133 birds, four bats, nine dasyurids and four rodent species. Matuwa has an arid climate with blistering hot summers and freezing winter nights. Rain (a mean at 262 millimetres per year) primarily occurs in the summer months due to remnant tropical low-pressure systems.









Main Matuwa at sunset.

Top Wedge-tailed eagle (*Aquila audax*) chick.

Top right Red kangaroos (*Osphranter rufus*).
Photos – Simon Cherriman

Above right Stripe-tailed goanna (*Varanus caudolineatus*).
Photo – Cheryl Lohr

Right Snow flower (*Macgregoria racemigera*) and arid zone stylewart (*Levenhookia chippendalei*).
Photo – Simon Cherriman









The Wiluna Martu Rangers have been using surveys of two-hectare track-plots to monitor the persistence of bilbies at Matuwa. Their data suggest that bilbies are continuing to persist.

In 2018, scientists set up 120 camera-traps to identify which habitats bilbies used on Matuwa. Bilbies were most common in areas with *Eucalyptus* species over spinifex hummock grasslands and sandy soils. They were less likely to be found in open mulga woodlands, on stony soils, or on salt lakes with a lot of bare ground.

Surprisingly, in 2015 and 2017, two bilby sightings, far to the west of Matuwa, were confirmed. These points were a minimum of 100 kilometres south of the nearest known naturally occurring bilby population in the Little Sandy Desert and were most likely individuals expanding out of Matuwa, 50 kilometres to the east.

Bilbies are still surviving at Matuwa without predator-proof fencing 16 years after reintroduction. Matuwa is the only location in Australia with a successfully reintroduced population of bilbies in an open landscape.

Successfully reintroducing bilbies to an unfenced area appears to hinge on effective landscape-scale control of introduced predators. Bilbies can survive and breed well when feral cat numbers are low (e.g. 0.46 cats per square kilometre). At Matuwa, the abundance of feral cats is consistently suppressed using aerial baiting.

Appropriate fire management, too, is likely a key component to the success of the bilbies at Matuwa. Since 2000, DBCA staff, together with the Martu Rangers, have been implementing patch mosaic burning. This type of fire management is similar to that used by Traditional Owners when they lived on the land prior to European settlement. This promoted the food and habitat diversity that bilbies require.

Above Predator-proof fencing.
Photo – Judy Dunlop/DBCA

Top left Bilby signs are in place at Matuwa.
Photo – Martin Dziminski/DBCA

Middle left Scientists in the field.

Below left Bilby burrow.
Photos – Martin Dziminski/DBCA

Below Bilby captured on camera.
Photo – Cheryl Lohr/DBCA



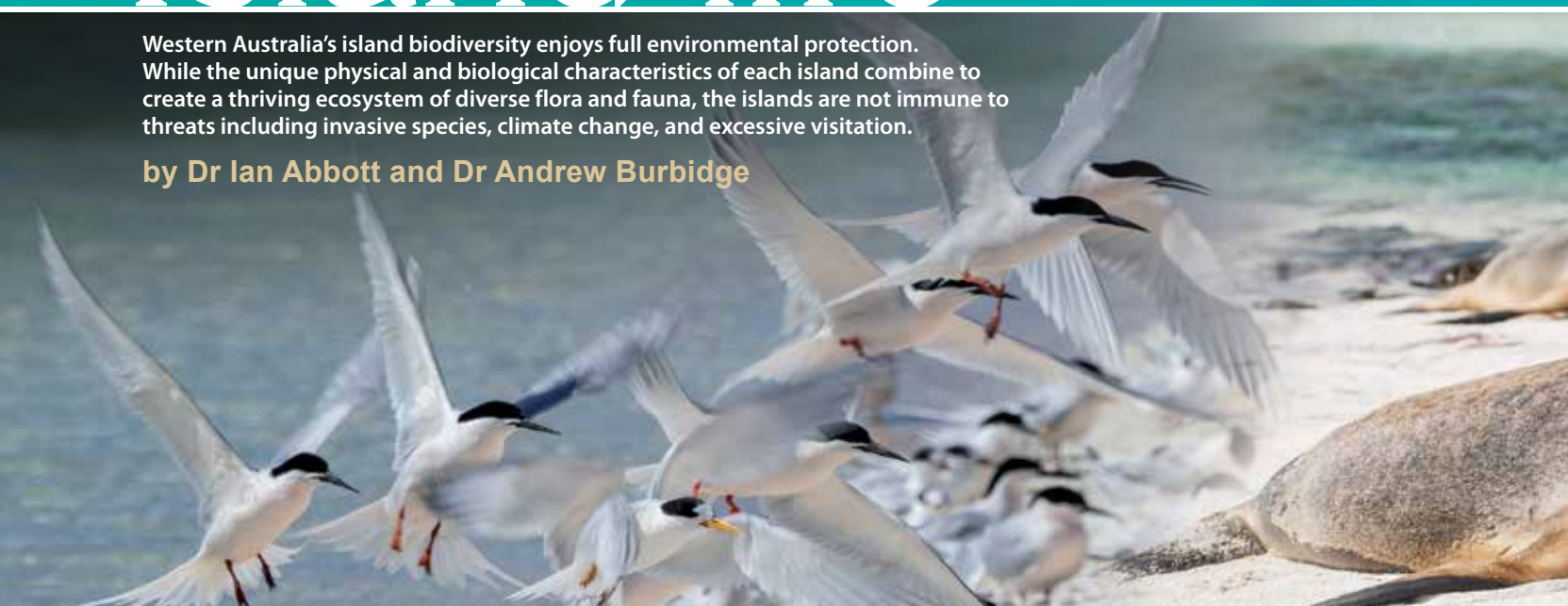
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Island life

Western Australia's island biodiversity enjoys full environmental protection. While the unique physical and biological characteristics of each island combine to create a thriving ecosystem of diverse flora and fauna, the islands are not immune to threats including invasive species, climate change, and excessive visitation.

by Dr Ian Abbott and Dr Andrew Burbidge









Western Australia has nearly half of Australia's 8300 islands, with most (2633) occurring in the Kimberley region. All islands are very important for biodiversity conservation in Western Australia. In WA, almost every island south of the Kimberley is a conservation reserve, while most Kimberley islands are now within indigenous protected areas, a situation unique in the world.

Even though they constitute only 0.12 per cent of WA's land area, islands are essential for conserving the State's natural environment and biodiversity.

Recently, conservationists have focused their attention on creating safe havens for rare species that may never have occurred on any WA island but are now endangered or extinct on the mainland due to foxes, feral cats, wildfires, and habitat destruction.

Nature conservation on WA islands began in 1874 when shooting of the banded stilt on Rottnest Island was prohibited. In 1898, it became illegal to shoot seabirds and collect their eggs for food in the Houtman Abrolhos. The crown jewel decision was the reservation of Barrow Island in 1908 for the protection of its mammal and bird fauna.

WA's island biodiversity now enjoys full legal protection, and several islands demonstrate that it is possible for astute nature conservation management to coexist with a naval base (Garden Island), an oil and natural gas hub (Barrow Island), and mass tourism (Rottnest Island).

Other threats such as exotic plant species continue to pose a problem. Silver gulls feeding around rubbish tips on the mainland can transfer seeds of weeds (mostly British and South African plant species) to their island breeding colonies. These species flourish in the soil fertilised by seabirds.

Silvereyes have spread the fruit of African boxthorn (*Lycium ferocissimum*) to several islands. Although it is a relatively simple process to eradicate boxthorn bushes, it is much more difficult to eliminate introduced grasses and the ice plant (*Mesembryanthemum crystallinum*), which often cover much of the soil and eliminate native plant species.

VISITORS AND RESIDENTS

One intriguing attribute of islands is their enigmatic pattern of distribution of some related species. For example, Rottnest Island has the quokka (a wallaby) and dugite (a snake), whereas nearby Garden Island instead has the tammar wallaby and two different species of snake (carpet python, tiger snake). Goanna (*Varanus*) species occur on many Pilbara and Kimberley islands, but which species is present on a particular island varies remarkably. Determining the causes of these disparities awaits scientific study.

The Houtman Abrolhos, west of Geraldton, one of WA's best-known archipelagoes, illustrates another interesting feature of islands. Fourteen seabird species breed on 122 islands but are not evenly distributed. The bridled tern (*Onychoprion anaethetus*) (breeding on 90 islands) and Pacific gull (*Larus pacificus*) (63) are the most widely distributed, whereas two species, brown noddy (*Anous stolidus*) and lesser noddy (*A. tenuirostris*), breed only on three or fewer islands.

Absence of predatory mammals has led to prodigious populations of some species.





Previous page
Main Northern part of the Dampier Archipelago, Pilbara, showing Gidley and adjacent un-named islands.
Photo – David Bettini
Inset from left Roseate terns (*Sterna dougallii*) and a single fairy tern (*Sternula nereis*), Houtman Abrolhos. *Photo – Cliff Winfield*; Australian sea lions (*Neophoca cinerea*), Houtman Abrolhos. *Photo – Chris Surman*; Rothschild's rock-wallaby (*Petrogale rothschildi*) occurs on islands in the Dampier Archipelago. *Photo – Jiri Lochman*

Above Tammar wallaby (*Notamacropus eugenii*), West Wallabi Island, Houtman Abrolhos.
Photo – Andrew Burbidge

Above left Silvereye (*Zosterops lateralis*).
Photo – Sallyanne Cousans

Left Quokka (*Setonix brachyurus*), Rottnest Island.
Photo – Tourism WA





Above Tiger snakes (*Notechis scutatus*) occur on Garden and Carnac Islands near Perth.
Photo – Sallyanne Cousans

Above right Seabird colony Ashmore Reef island.
Photo – Rohan Clarke/Monash University

Right Lesser noddy (*Anous tenuirostris*). Houtman Abrolhos.
Photo – Chris Surman

What makes islands often so different from the coastal region of the adjacent mainland?

- Twenty-five species of seabirds nest almost exclusively on islands, safe from predators.
- Two species of seals breed on many islands of the south-west, and four species of sea turtles nest on islands between Shark Bay and the Kimberley.
- Many medium-sized species of mammals persist on larger islands, safe from two very destructive exotic predators—the fox and the cat. Four of the native species (Shark Bay bandicoot, banded hare-wallaby, boodie, Shark Bay mouse) were found only on Bernier, Dorre, and/or Barrow Islands, because they became extinct on the mainland as a result of disease and predation by foxes and cats.



Hundreds of thousands of wedge-tailed shearwaters (*Ardenna pacifica*), sooty terns (*Onychoprion fuscatus*), and brown noddy terns have been counted breeding in the Abrolhos.

Tammar wallabies and quokkas remain abundant on some islands compared with mainland populations. Tammar wallabies have been illegally introduced to North Island (Houtman Abrolhos). Without carpet pythons, a natural predator, the population became hyperabundant and has denuded the island of palatable vegetation leading to the disappearance of the endemic Abrolhos painted button-quail (*Turnix varius scintillans*). Removal of the wallabies is underway.

The relatively few instances where introduced mammals, especially the red fox and the domestic cat, have established on islands from shipwreck, swimming from the mainland, or via deliberate release, have shown how destructive invasive species can be. More than 20 populations (mostly of native mammal species) have been extirpated on 12 islands by foxes or feral cats. These vermin have now been eradicated from all WA islands, and a serious effort has been made to repatriate the extirpated native species with great success. In addition, house mice, black rats, rabbits, sheep and goats have been eradicated from most islands.

INTERCONNECTIVITY

Although islands share a common trait of being surrounded by water, they differ from each other because each has a unique combination of physical and biological characteristics. Physical characteristics include area, shape, elevation, topography, distance from the mainland, degree of exposure to wave action caused by gales, cyclones, and tsunamis, geology, amount of soil present, climate (temperature, annual rainfall, seasonality of rainfall), and how long the island has been separated from the mainland. Most of these factors interact to provide the environmental setting for the species that occur on islands.

These species include bacteria, viruses, fungi, mosses, lichens, invertebrates, vascular plants, frogs, reptiles, birds, and mammals. The species interact in various ways: reptiles, land birds, and smaller mammals eat insects, spiders, and other invertebrates; some mammals browse foliage of plants; some birds eat fruits; and some mammals prey on other animals.

Seabirds feed on fish and marine invertebrates captured at sea but transfer the nutrients acquired to their breeding islands. Their excreta fertilises island soils, altering the composition of the flora and providing improved nutrition for animals feeding on foliage and on the larger populations of invertebrates. Islands accessible to Aboriginal people have experienced cultural burning, hunting of mammals and reptiles, and consumption

Animals translocated to WA islands, providing safe havens

Species	Island reintroductions	Island introductions
dibbler (*Parantechinus apicalis*)	Dirk Hartog	Escape, Gunton
Shark Bay bandicoot (*Perameles bougainville*)	Faure, Dirk Hartog	
golden bandicoot (*Isoodon auratus*)	Hermite	Doole
boodie (*Bettongia lesueur*)	Boodie, Faure	Alpha
nilgyte (Gilbert's potoroo) (*Potorous gilbertii*)		Bald, Middle
rufous hare-wallaby (*Lagorchestes hirsutus*)		Dirk Hartog, Trimouille
spectacled hare-wallaby (*Lagorchestes conspicillatus*)	Hermite	
Rothschild's rock-wallaby (*Petrogale rothschildi*)		West Lewis
maning (banded hare-wallaby) (*Lagostrophus fasciatus*)	Faure, Dirk Hartog	
djoongari (Shark Bay mouse) (*Pseudomys gouldii*)	Faure, Dirk Hartog	North West
wopilkara (greater stick-nest rat) (*Leporillus conditor*)	Dirk Hartog	Salutation
noisy scrub-bird (*Atrichornis clamosus*)		Bald
Barrow Island black-and-white fairy-wren (*Malurus leucopterus edouardi*)		Hermite
spinifexbird (*Eremiornis carteri*)	Hermite	



Left Faure Island, Shark Bay.
Photo – David Bettini

Above Dibbler (*Parantechinus apicalis*).
Photo – Jiri Lochman

Below Boat tour, Rottnest Island.
Photo – Tourism WA

of breeding seabirds, marine turtles, and their eggs.

Immediately before islands were formed by the rise in sea level following the end of the last ice age, they likely had a full complement of species then present on the mainland coast. A lengthy period of isolation, from about seven to 14 millennia, has resulted in many of the original species failing to persist to the present.

The composition of species has changed because islands have limited physical space and smaller islands have increased exposure to salt-bearing winds that change the habitat, while some species outcompete others, and predators eliminate some of their prey and then themselves become extinct. None of these changes happens in a totally predictable way, resulting in unique patterns in the occurrence of some species.

NOW AND THEN

Island names bestowed by Aboriginal people are generally not well known. Capturing this cultural information in consultation with Traditional Owners and assigning dual names to islands is an important process. It is not widely recognised that many WA islands are historically important. Dutch ships sailing towards Batavia were wrecked within the Houtman Abrolhos in 1629 and 1727 and their crews were the first Europeans to see Australian marsupial, plant, seabird, and seal species. Several renowned navigators (Dirk Hartog, William Dampier, Willem de Vlamingh, George Vancouver, Bruny d'Entrecasteaux, Matthew Flinders, Nicolas Baudin, and Phillip King) sailed in WA waters between 1616 and 1829. They landed on a few islands and named many. Aboriginal names of islands should have priority over European names.

Sadly, more threats to island populations are likely due to changing environmental conditions. Small, low, sandy or coral rock islands are likely to be destroyed by increased exposure to wave action caused by rising sea-levels, a result of global warming.

Human visitation is another potential threat, but well-managed nature-based tourism enables visitors to WA to see the unique natural characteristics of some of our islands with minimal impact. Most islands are not conducive to overnight visitation and most ecotourism visitors to islands sleep on tourist boats and small cruise ships.



Dr Ian Abbott and Dr Andrew Burbidge AO, both now retired, were research scientists in WA Government departments that preceded DBCA. They also held senior administrative positions. Both have studied the biodiversity of islands, with emphasis on island biogeography and the functioning of island ecosystems (Abbott) and biological survey, the monitoring of seabird populations, eradication of vermin, and the restoration of depleted island ecosystems (Burbidge).

Island Jewels: The Natural History of Western Australia's Islands *co-authored by Ian Abbott and Andrew Burbidge was published in 2022 and can be purchased online or from selected bookshops.*



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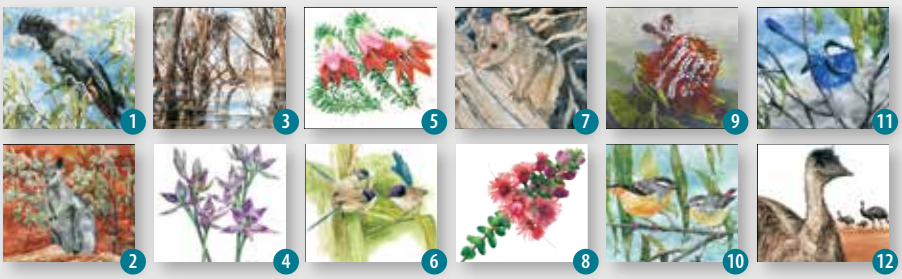
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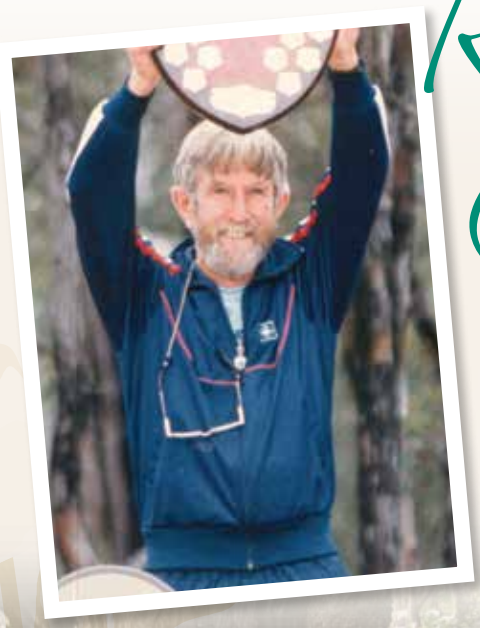
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Roy and the arum lilies



Roy Hiller (1924-2009) was an environmental warrior whose dedicated efforts led to the eradication of arum lily (*Zantedeschia aethiopica*) from Wadjemup or Rottnest Island. His efforts protected the island's environment from this weed and saved massive control expenditure if it had become widely established.

by Elizabeth Rippey and Jon Dodd



During the 1990s, an infestation of arum lilies (*Zantedeschia aethiopica*) on Wadjemup, or Rottnest Island, was spreading around Garden Lake into the adjacent heath and the settlement.

In 1992, Roy Hiller joined the Rottnest Voluntary Guides Association (RVGA) and was an active member for some 15 years. Roy first became aware of the spread of weedy arum lily when he attended a talk for the Rottnest Guides about the vegetation of the islands off the coast of Perth.

He then committed himself to spending the next four years of his life getting rid of the arums on Wadjemup. His wife Jo Hiller OAM said recently that he became "savagely devoted to removing them because they were seeding themselves so rapidly."

DANGEROUS BEAUTY

Arum lily is a spectacularly beautiful South African wildflower, long prized as a garden plant but now a Declared Pest in the south-west of Western Australia.

It is poisonous to livestock and humans and is sometimes called 'death lily' or 'funeral flower' as it was traditionally used at funerals. It also invades native vegetation, outcompeting pastures in wetter areas of the south-west. A large perennial, it is spread by birds attracted to its fleshy red fruits and persists by means of its underground rhizomes.

Surprisingly, arum lily flourishes on the larger Perth offshore islands where there is virtually no surface fresh water. It was first recorded on Wadjemup, or Rottnest Island, in 1959, on Carnac Island in 1975 and on Garden Island in 1978.

GETTING STUCK IN

Roy tackled the problem on the island simply by digging the arums out. He wrote: "It sounds easy, but…! Around the fig trees one has to saw off many branches and roots to get at the plants, and remove



Previous page
Main Invasive arum lily.
Photo – Nature Conservation Margaret River
Below Aerial view of Rottnest Island.
Photo – Garry Norris Photography
Inset Roy Hiller.
Photo – The Hiller family

Above right Arum lily infestation, Garden Island.
Photo – Elizabeth Rippey

Below Rottnest Island.
Photo – Panther Media Gmb/Alamy







"After four dedicated years, Rottnest Island was largely free of arum lilies and remains so today."

a century's worth of junk…Among the reeds one has either to wade or wait for the summer drought…Then one has to dig to remove all the rhizomes—sausage-like objects, which range in length from 5-200 millimetres and in number up to perhaps 30 per plant. One is unlikely to get them all at one hit. So, they grow again. Some areas have already been dug over six times."

He went over to Rottnest Island every week during the arum growing season, armed with a trowel, mattock, saw and secateurs to dig out any he encountered, then leaving the bagged plants in the ranger's office for disposal.

Roy initially targeted what was then thought to be the island's sole infestation, restricted to the area around Garden Lake and the settlement. However, he soon found several more populations, scattered around both lighthouses, the nursery, the airstrip, and an old army camp beside Oliver Hill where arum had probably been spread recently as seeds by fruit-eating birds, especially silvereyes (*Zosterops lateralis*).

After four dedicated years, Rottnest Island was largely free of arum lilies and remains so today. Staff still continue to monitor for arum lily and treat it accordingly—a task made so much easier thanks to Roy's amazing efforts.

MAKING IT WORK

Roy had a rare combination of attributes that enabled him to achieve his goal of controlling Rottnest Island's arum lily infestation. Four major aspects of Roy's life showed that, firstly, he had great courage and commitment; secondly, he was a fine administrator and organiser; thirdly, he could expertly survey and interpret the landscape; and, fourthly, he was fit enough to cross Rottnest's hilly terrain on foot or by bike to search for and remove this weed. And he was also utterly delightful, with the magnanimity and determination to pursue arum lily relentlessly for four years.

In addition to guiding on Wadjemup and orienteering, Roy's other environmental interests included carrying out repairs on the Bibbulmun Track, organising volunteers for the annual Clean Up Australia campaigns, and being a regular rogaining competitor.

"He was an absolutely gorgeous man," Jo Hiller said. "He was an exciting father to our two girls, and we had a fantastically happy time always."

In 2000, Roy won the Rottnest Island Authority CEO's Award in recognition of his environmental work. Roy's lasting legacy is Rottnest's relief from this major environmental weed and showing just how much one retired volunteer can achieve!



Above Flowering arum lily.
Photo – Jon Dodd

Above right Areas around Rottnest's salt lakes are prone to arum infestation.
Photo – Adobe stock

Right Roy received the CEO Award for his work on Rottnest Island.
Photo – The Hiller family

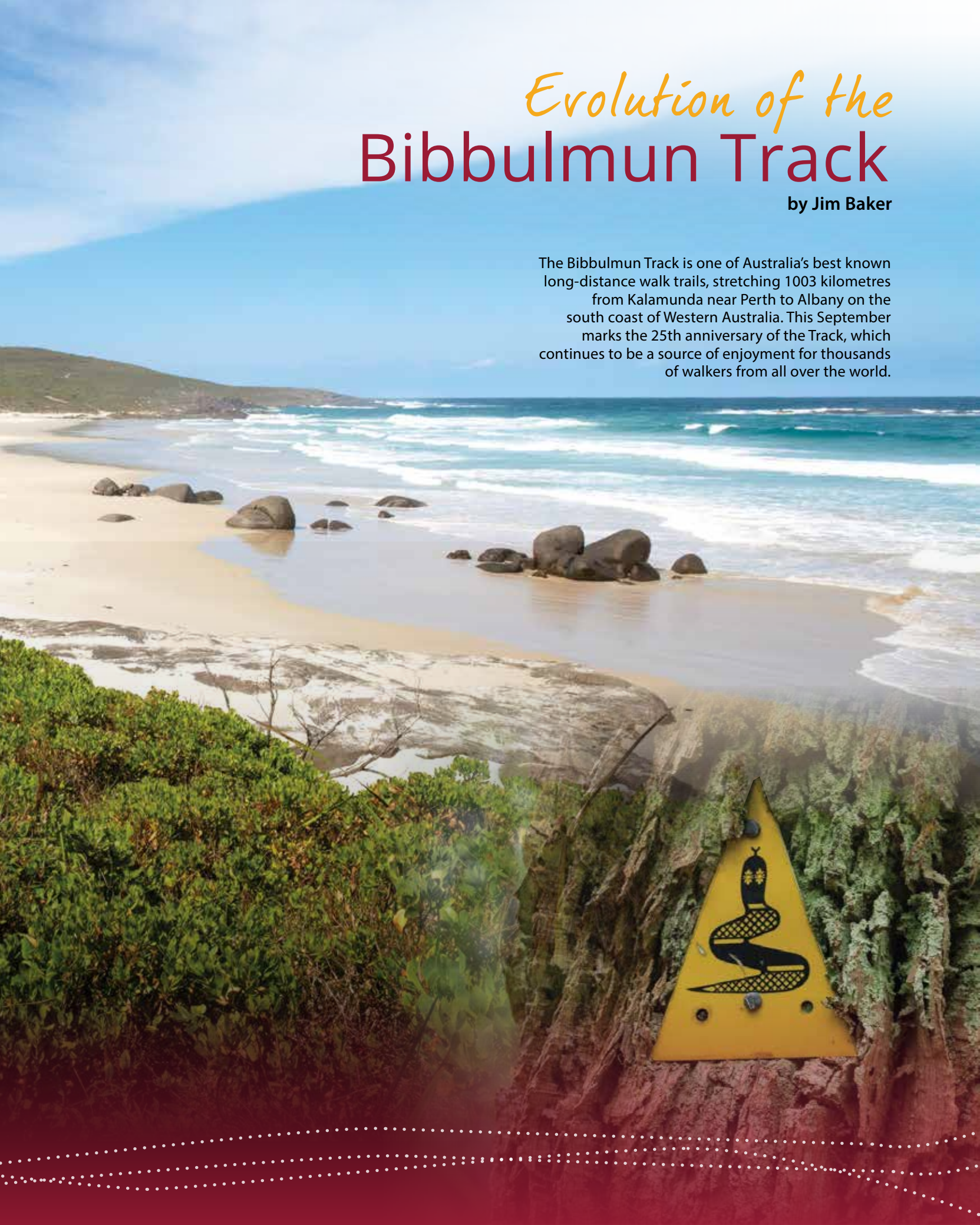
Dr Elizabeth Rippey is an island ecologist, author and a volunteer guide at Rottnest Island.
Dr Jonathan Dodd is a botanist, natural historian and volunteer guide at Rottnest Island and Kings Park.



Evolution of the Bibbulmun Track

by Jim Baker

The Bibbulmun Track is one of Australia's best known long-distance walk trails, stretching 1003 kilometres from Kalamunda near Perth to Albany on the south coast of Western Australia. This September marks the 25th anniversary of the Track, which continues to be a source of enjoyment for thousands of walkers from all over the world.





Previous page
Main Walking Walpole to Denmark along the Bibbulmun Track.
Photo – Janine Guenther
Inset A waugal trail marker.
Photo – DBCA

Above Walking into Chadoora shelter.
Photo – Bibbulmun Track Foundation

Bushwalking or hiking is one of the oldest outdoor recreations, enjoyed by people of all ages and abilities. Hiking trails inspire tourists from around the world to discover new landscapes, vegetation types and terrain.

In the late 1960s in Western Australia, it was becoming obvious to a growing interest group that, despite having incredibly beautiful countryside, WA did not have a long-distance walk trail worthy of international appeal.

A conversation between the founder of the Perth Bushwalkers Club, Geoff Schafer, and the then Minister of Forests changed all that and the concept of the Bibbulmun Track was born.

The Forests Department was small, with limited funds or knowledge of long-distance trails. However, there were some, notably Peter Hewett and Ross Gobby, who worked hard to plan and design a route for the track.

The Bibbulmun Track was opened in October 1979 in recognition of Indigenous people who had inhabited the south-west corner of the State and had a practice of walking long distances to ceremonial events. The Track started in Kalamunda and finished in Northcliffe and was officially opened as part of the celebrations for the 150th anniversary since the founding of the Swan Colony.

The opening was marked by the 'Bibbulmun Walk '79' involving more than 1000 walkers and attracted much attention with local communities along the way.

EARLY DAYS

It had always been part of Geoff Schafer's dream to create a trail that could be used by walkers of all ages, from those who simply wanted the opportunity to take the kids into the bush for the day, to hardened bushwalkers prepared to take on an end-to-end walk.

However, the first iteration of the Bibbulmun Track mostly followed gravel roads. There were no designated campsites, no toilet facilities, limited water supply and insufficient trail markers. A track for hardened walkers, perhaps, but not very family friendly or suitable for novices.

In 1987, the Track underwent a significant overhaul under the auspices of the Department of Conservation and Land Management (CALM).

This project, overseen by project officer Drew Griffiths, saw the northern section rerouted further east to avoid bauxite mining areas and the southern section extended down to the coast as far as Walpole. Over the next few years, it was estimated that some 5000 people per year were using the Track, justifying Geoff Schafer's concept of encouraging people into the bush.

The basic black and white guidebooks for the route were replaced by coloured versions, and 'waugal' trail markers improved the signage. The distinctive black and yellow markers depict a rainbow serpent, deeply significant in Aboriginal mythology.

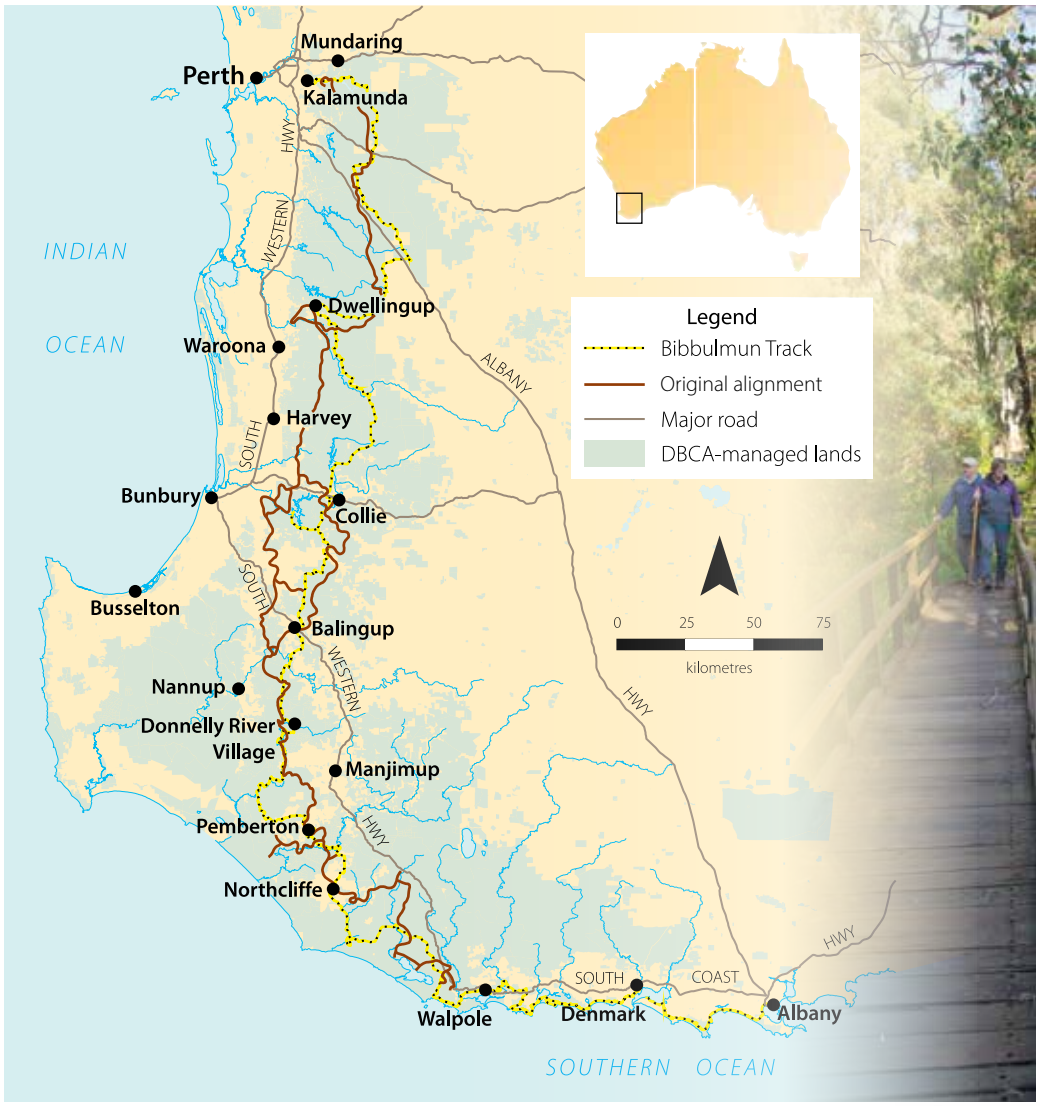
BUILDING A BETTER TRACK

CALM recognised the inadequacies of the Track and in October 1993 the *Build a Better Bibbulmun Track* project was set up with the objective of turning the Track into a world-class long-distance walk trail.

CALM's Jim Sharp headed a steering committee along with Jesse Brampton, who was appointed as project contractor. Jesse had recently returned to WA after walking the Appalachian Trail in the USA—one of the oldest and arguably the most famous hiking trail in the world, running almost 2200 miles from Georgia to Maine. The new model for the Bibbulmun Track was inspired by Jesse's experience on the Appalachian Trail.

In February 1994, the Track was realigned to extend to Albany and a strong emphasis was placed on involving the community at large in the project. Premier Richard Court threw his support behind the upgrading and extension of the Track and its capacity to become an icon for the tourist industry of WA.

The word was sent out to local governments, regional tourist centres, Aboriginal corporations, community







groups and bushwalking clubs. The response was outstanding, and it was obvious that a formal group needed to be established to harness all that public enthusiasm.

GETTING ORGANISED

In mid-1994, the project needed funding as well as the provision of labour, materials and tools. A turning point came later in the year when the Ministry of Justice announced funding and support by offering to prefabricate campsite shelters in prison workshops. Prisoners were allowed to assist in reconstructing the shelters on the Track and in land clearing activities.

To be a member of a work crew on the Bibbulmun Track became a sought after privilege and the efforts of individual prisoners were recognised in various ways. The growth in self-esteem of these men and the pride they took in creating the Track became very clear, and a strong rapport grew between the prisoners, the officers and the CALM supervisors.

By the end of 1998, the benefits to CALM and the Ministry of Justice were becoming obvious and high-level talks were held between the two agencies regarding the use of prison labour for further projects.

In 1998, the Premier's Award for Public Sector Management was awarded jointly to CALM and the Ministry of Justice for their combined efforts in creating the Bibbulmun Track. At the time it was noted that the contribution 'in-kind' support from the Ministry exceeded $1.5 million.

In 1996, a $1.38 million Federal grant meant works could be completed and the 'new' Track was opened in September 1998.

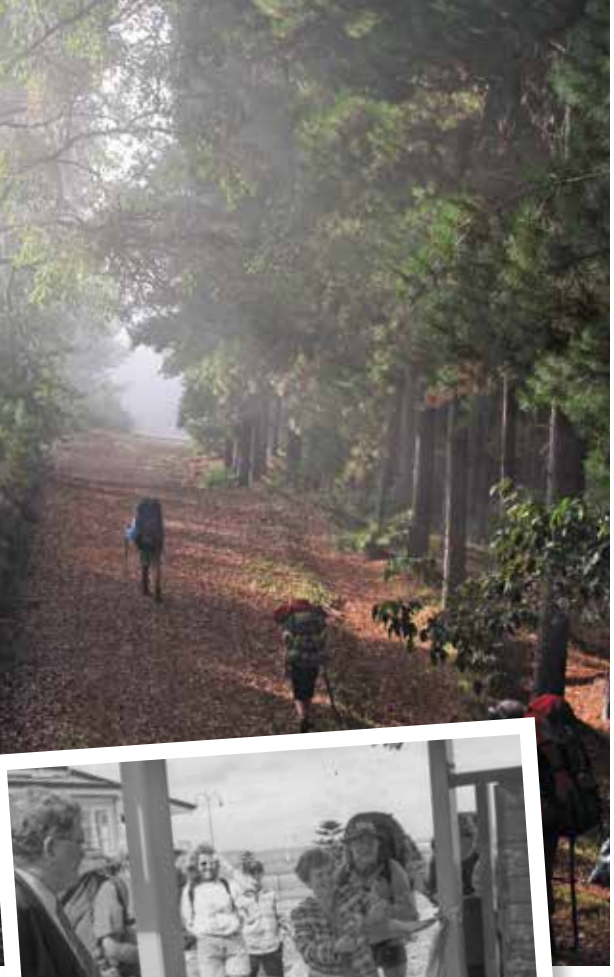
Forty-eight campsites were completed, each with an open-fronted timber shelter, large rainwater tank, toilet facilities and

Top Peter Hewett (left) and Geoff Schafer pictured in 2008.
Photo – Bibbulmun Track Foundation

Above Prisoners clearing the Track.
Photo – DBCA

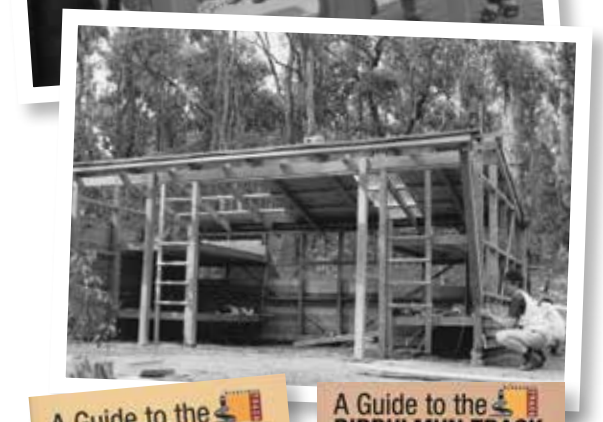
Above left Bridge over Harris Dam.
Photo – Chris Tate

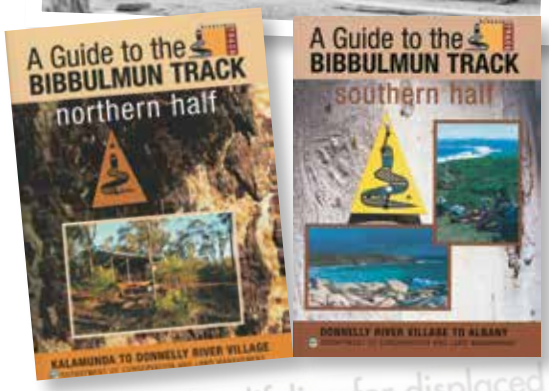
Background Article from *CALM News* 1994.











"The route of the Track remains fundamentally the same as it was in 1998 with the exception of some realignments and two new campsites..."

Top left Walkers through pine forest near Blackwood before it was impacted by bushfire.
Photo – Bibbulmun Track Foundation

Above Noggerup campsite.

Inset top left Then Minister for Environment Cheryl Edwardes opening the Track in September 1998.

Inset above left CALM staff and families constructing a shelter.
Photos – DBCA

Left Detailed guidebooks from 1998.

Background Article from *CALM News* 2002.

areas where tents could be pitched. In addition, a large amount of infrastructure was constructed in the form of footbridges and boardwalks.

Two detailed guidebooks were drawn up covering the northern and southern sections of the Track respectively, along with a new series of eight maps. The opening was marked, just as it was in 1979, with an end-to-end walk from Albany to Kalamunda.

MANY HANDS

The construction of the Track was just one part of a much bigger picture. Maintaining the Track and marketing it to attract local, interstate and overseas walkers was a whole other endeavour.

In 1997, the 'Friends of the Bibbulmun Track' was established in the form of a not-for-profit organisation and the inaugural board meeting was held in August.

Since then, the number of walkers has increased exponentially, and recent surveys show a high level of satisfaction with all aspects of the Track. The Friends of the Bibbulmun Track is now known





DO IT YOURSELF

Where is it? On the Bibbulmun Track from Kalamunda to Albany. Join the epic journey as a sectional walker on a commemorative walk as part of the 25th anniversary celebrations.

Community events As the official end-to-end walkers make their way from Kalamunda to the Southern Terminus in Albany, a community celebration will be held in each of the towns through which the Track passes.

Everyone is invited to join in for the half-way party at Donnelly River Village.

More information Visit bibbulmuntrack.org.au/walk-the-track/25th-anniversary-celebrations/ for key dates and information.



as the Bibbulmun Track Foundation and has increased in size to a membership base of some 2800 and in excess of 450 volunteers engaged to support the Department of Biodiversity, Conservation and Attractions (DBCA) in various aspects of managing, marketing and maintaining the Track.

The Track has been surveyed using modern GPS equipment and a very detailed set of eight guidebooks has been produced.

Track maintenance has been improved by the introduction of a more streamlined volunteer training program and the provision of battery powered tools such as brush cutters and trimmers. In addition, a group of Support Volunteers (see 'It takes a village', *LANDSCOPE* Winter 2019) has been formed, consisting of people with specialised skills who can assist the DBCA's Parks and Wildlife Service staff in more complex tasks such as bridge refurbishment and erosion control.

ADAPTING AND EVOLVING

The route of the Track remains fundamentally the same as it was in 1998 with the exception of some realignments and two new campsites that were created to replace the old Hidden Valley site that was moved to accommodate the Albany Wind Farm.

One major change has been the re-routing necessitated by the tragic loss of the heritage listed Long Gully Bridge to a bushfire. The old wooden bridge was replaced in a new location by a steel suspension bridge to reduce the impact of fire damage in the future.

Bushfires have caused the destruction of seven campsites, and this has led to changes in the materials used to construct the shelters, which are now built with fire resistant materials such as rammed earth.

It is fair to say the Bibbulmun Track has been a resounding success. It has become known as a world-class walking trail and there is no reason to suppose that it will not remain so for at least another 25 years!

This September, in true Bibbulmun Track style, a commemorative walk will be held to honour the 25th anniversary of the beloved Track.

Top far left and far left The Long Gully Bridge lost to fire in 2015 and the new Bilya Djena Bidi across the Murray River.
Photos – Jim Hughes

Above Hiker studying map.
Photo – Janine Guenther

Below South coast trail markers and track.
Photo – Chris Tate



Jim Baker is a volunteer with the Bibbulmun Track Foundation and an avid bushwalker, having completed an end-to-end of the Track four times. He can be contacted at jim_baker@bigpond.com

Wetland wildlife investigators

by Zander Schott

Zander Schott (10) loves learning about animals. He's learned about creatures that live in the Swan River, birds of the night at Piney Lakes, and recently he learned all about the wildlife of the wetlands at Canning River as part of *River Guardians*' Wetland Wildlife Investigators program.

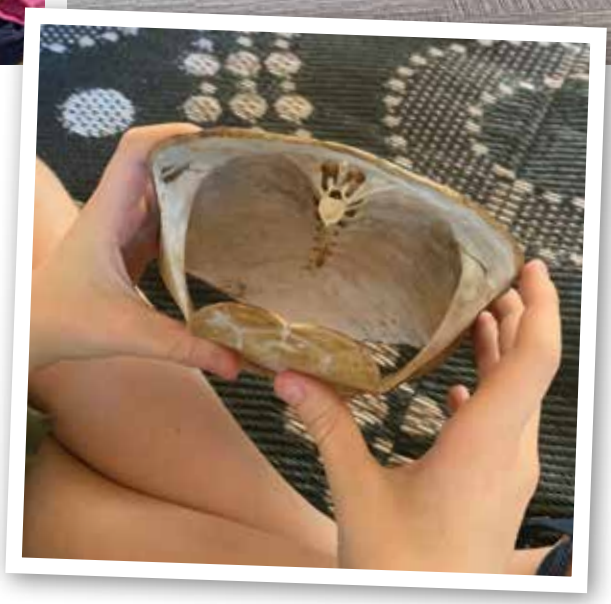














I have always loved wildlife and animals, and I love going to see the reptiles and other animals at the zoo and other places. During the school holidays I go to different classes where I learn about animals and where they live, and I recently learned about the wildlife of the wetlands at Canning River as part of the *River Guardians'* Wetland Wildlife Investigators program.

The class started with Naomi telling us all about the history of the Aboriginal people at Djarlgarro Beelier (Canning River). She told us how the wetlands are important to Aboriginal people because the river provided food and water as well as shelter for their ancestors. And even though people don't live on the river like they used to, the river is still important to us all today.

Naomi asked us lots of questions and we talked about what different kinds of animals live in the wetlands, like fish, turtles, frogs and snakes. One of the kids had seen a brown snake on a path near where the class was, so we had to make sure we kept a look out for it when we went outside for games!

GETTING HANDS-ON

One of my favourite activities was 'Guess that frog'. Naomi played a frog sound and then we matched it up to its picture. I got most of them right because I had seen and heard some of the frogs in our pool, so I knew straight away which one was the motorbike frog.

Next, we passed around some snake skins to look at and touch. They feel like really dry paper with bumps, and they are not very strong, so they got a bit ripped when they got passed around. We also passed around a turtle shell, which I thought was a bit sad. I felt sorry for the turtle that had died, but Naomi told us that the turtle had died naturally, so that made me feel a little better. It was interesting to see the spine of the turtle and where the body attaches to the shell. It looked like some sort of strange creature in the video games I like to play!

Then we went outside, and it was so hot it felt like a bajillion degrees. We sat outside in the shade under a tree, while Naomi showed us how to hold an oblong turtle using a toy one. We learned not to hold it by the neck because it might bite

Previous page
Main Canning River wetlands.
Photo – Marie Lochmann
Inset left Discussing types of animals found in the wetlands with Naomi.
Photo – Sonja Rose/DBCA
Inset centre Motorbike frog (*Litoria moorei*).
Photo – Alice McGlashan/Sallyanne Cousans Photography
Inset right Holding the dried snake skin, from a carpet python (*Morelia spilota*).
Photo – Sonja Rose/DBCA

Above left Naomi showing how to hold an oblong turtle (*Chelodina oblonga*).

Above right Frog racing.

Inset Examining the empty shell of an oblong turtle.
Photos – Sonja Rose/DBCA









Do it yourself

Where is it? *River Guardians* delivers a range of fun and educational events to schools and the community around the Swan Canning Riverpark.

Fun nature-based activities set in a local context are used to encourage a connection to and care for the nature and heritage of our local environments.

DBCA's environmental education programs are designed around a head, heart and hand connection to bring about action by people of all ages to preserve and protect their patch.

Contact For more information on programs we offer, email community@dbca.wa.gov.au

Top Looking for waterbirds in the Canning River.
Photo – Naomi Adamczyk/DBCA

Top right Bird evidence for an investigation activity.

Above Walking with Naomi to outdoor activies.
Photos – Sonja Rose/DBCA

Inset Eurasian coot (*Fulica atra*).
Photo – Jiri Lochman

Right Embroidered baby turtle.
Photo – Sonja Rose/DBCA

you! We got to practise how to rescue and carry a turtle if we found a lost or injured one; that we should use a towel to cover it and put it in a box to keep it safe and not scare it. This is something that I am going to remember for a long time, so I can help any injured turtles I find.

We played a game where we had to find and carry baby turtles. Naomi hid them in the grass and then we had to go find them and carefully carry them back to a box for safety.

WATCHING FOR WILDLIFE

The next activity was to look at pictures of waterbirds and sort them out into groups, depending on whether they had toes or webbed feet. There was one bird called the Eurasian coot that had a mix of both—it has webbed toes and it looks really funny! We then went on a walk around the river for a waterbird scavenger hunt. Even though it was really hot outside, we saw lots of different types of birds hanging out in the shade around the river.

After going back inside for some water and to cool down from the heat, we did another activity where we had to match birds with different pieces of evidence. We had a bag of evidence—things like what the birds eat—and we had to match up the evidence to the bird. Some of the things we had to sort out were feathers, seed pods, eggshells and even pictures of other birds.

CREEPY CRAWLIES

We finished off the day doing an insect scavenger hunt. We went outside looking for evidence of invertebrates. Things like spider webs, cocoons and leaves with bite marks in them. We even found an interesting set of eggs on a fence wire, but even Naomi didn't know what the insect was that laid it!

The best part of the afternoon was learning about looking after wildlife and being able to play with my new friends while we did the activities. I even met up with some kids I knew from another class I went to in the school holidays last year. I definitely want to do more classes like this next school holidays.



Zander Schott is ten years old and his passions include caring for animals, creating art, learning to code and making video games.



Amanita marinae

The genus *Amanita* contains more than 1000 species, including the most recognisable mushroom in the world, the bright red-capped *Amanita muscaria*. This is known as the 'fly agaric' because of its use historically as an insecticide when powdered. Its distinctive red cap, flecked with white scales, can grow up to 20 centimetres in diameter and the species is often featured in fairy tales and other literature. This seemingly innocuous mushroom is also one of several poisonous species in the genus. With common names including the 'death cap' (*Amanita phalloides*) and 'destroying angel' (several species, including *Amanita virosa*), it's not surprising that *Amanita* is best avoided in a culinary sense. There are also several non-toxic species, but it takes a trained eye to distinguish these, and identification can be difficult.

About 100 species of *Amanita* are known in Australia, but it is likely that many more are awaiting discovery. In Western Australia, more than 50 species are known, including *A. muscaria*, which is native to the Northern Hemisphere but has been unintentionally introduced to southern Western Australia. It has been seen in gardens and parks, in areas including the Perth Hills, Manjimup and Margaret River under introduced pines, birch and oak trees. The species is also found in all southern Australian states, reaching as far north as Brisbane on the east coast.

A large portion of the WA species of *Amanita* were recognised and described as new species by Dr Elaine Davison, adjunct Associate Professor at Curtin University, and a Research Associate of the Department of Biodiversity, Conservation and Attractions' Western Australian Herbarium. Elaine, either solely or with associates Danielle Giustiniano and mycologist Neale Bougher (also a Research Associate of the Herbarium), has described 17 species of *Amanita*, mostly from the south-west forests. Elaine conducts detailed morphological examinations of specimens and these are supported by molecular analyses undertaken by Danielle. In addition, Elaine, Danielle and Neale have clarified the descriptions and uniqueness of a further eight named species.

Now we welcome a new species, *Amanita marinae*, described by Elaine in collaboration with Danielle. The new species was collected by Elaine and her husband, Peter, in Lesueur National Park. The park is well known for its botanical richness, with more than 900 plant species recorded, some 10 per cent of WA's known flora, and now its fungal diversity is being explored. The ivory white *A. marinae* grows mostly in sand over limestone, either as individuals or in groups, and can reach up to 85 millimetres in diameter. Compared with the vivid red caps of *A. muscaria*, the new species is not brightly coloured and unlikely to catch the eye. To place the species in *Amanita*, certain features must be present, including a membranous or friable 'universal veil', which is the membrane that initially encases the young mushroom but is broken as it grows larger. The remnants of the universal veil can be seen as the white flecks on the red cap of the fly agaric. Other microscopic features also distinguish *Amanita*, but these require assessment by a trained eye, and the uniqueness of the species must be supported by molecular analyses.

The name of the new species might suggest a beachside species, but it honours Dr Marina Wallace of Fiona Stanley Hospital. Elaine recently had a brush with cancer, and Dr Wallace and her surgical team provided the care that saved Elaine's life. To have a mushroom named for you is certainly an unusual accolade for a physician, but it is bestowed with heartfelt gratitude and admiration.

Above *Amanita marinae* from Lesueur National Park.
Photo – Dr Elaine Davison

TAGGING TURTLES ON A REMOTE AND RUGGEDLY BEAUTIFUL ISLAND

One of Western Australia's longest-running turtle tagging program is providing insights into the world of threatened loggerhead turtles that visit Dirk Hartog Island each summer to nest.

by Samille Mitchell and Clodagh Guildea





It's just gone midnight as the prehistoric-looking beast emerges from the moon-lit sea. Ever so slowly, it drags its 100-kilogram-plus body up the beach, lumbering through the sand towards the cliffs guarding the beach.

This is one of thousands of female loggerhead turtles (*Caretta caretta*) that congregate at this remote, raw and ruggedly beautiful coastline during the summer nesting season. Each night during peak season, hundreds of the threatened turtles visit the aptly named Turtle Bay on Dirk Hartog Island, or Wirruwana in the Malgana language, in the Shark Bay World Heritage Area.

They likely hatched on this very beach, or close by, more than 30 years ago before venturing into the seas, becoming one of the tiny percentage of hatchlings who survive their first years.

When the females reach sexual maturity, they are somehow instinctively guided to return to the area they were born to lay eggs of their own at the foot of cliffs that once greeted the first recorded Europeans to set foot on Australia. So little is known about the 30 years between hatching and returning to their rookery to breed that scientists refer to this time as 'the lost years'.

Previous page
Main Loggerhead turtle (*Caretta caretta*), Dirk Hartog Island.
Inset Loggerhead turtle leaving the beach.
Photos – Samille Mitchell/DBCA

Above Turtle Bay, Dirk Hartog Island.
Photo – David Bettini

TURTLE MONITORING

Population studies of marine turtles formally began in the 1980s, with the formation of the Western Australian Marine Turtle Program (WAMTP) led by Dr Bob Prince, who was a CALM wildlife researcher. As part of this program, monitoring of loggerhead turtles began on Dirk Hartog Island in 1994, and the Dirk Hartog Loggerhead Turtle Tagging Program was initiated.

This ongoing population monitoring program involves tagging turtles for capture-mark-recapture studies and has continued most years since it began, making it one of the State's longest-running marine turtle population studies. Tag identification, measurements and observations are entered into the WAMTP database, along with data from multiple other marine turtle monitoring programs across the state.

A DAY IN THE LIFE

Over four weeks each January, teams of about 10 Parks and Wildlife Service staff and volunteers stay a week at a time on Dirk Hartog Island to help with tagging.



They wait until high tide at night and journey to Turtle Bay where they've divided up a five-kilometre stretch of beach into five sections. Teams of two or three people monitor a section each and begin clambering over rocky outcrops and trudging through the sand on the lookout for tell-tale turtle tracks that can criss-cross the beach like a highway.

Under the light of the moon or using infrared head torches (so as to not disturb the turtles with bright white lights), they follow the tracks up the beach in search of a turtle. If they see a turtle emerge from the sea, they hang back out of sight, allowing the turtle to lumber up the beach to nest.

Often the turtles will begin digging, abandon the site and move on to find just the right place for their eggs. Sometimes they'll declare the beach unsuitable and









"The Dirk Hartog loggerhead population is important for the conservation of regional loggerhead turtles and is clearly a major feature of the Shark Bay World Heritage Area."

(*Dr Bob Prince*)

return to the sea without laying. But, if they find a suitable site, they'll begin the remarkable process of excavating their egg chamber.

Once they've cleared a body pit with their front and hind flippers, they'll use their back flippers to dig a deeper hole. They can reach their hind flippers amazingly deep into the sand, using one flipper to pull out the sand and the other to flick it away. It's a slow but fascinating process.

Then, if she deems conditions just right, the female will lay her eggs, pushing out more than 120 eggs into the chamber. She enters a trance-like state, making it safe to approach closer from behind without disturbing the process. If you're lucky you can just make out the soft white eggs plopping out into the egg chamber below.

Eventually she finishes laying and spends a long time covering the chamber and flicking sand over the nest site in a bid to camouflage it. She then turns and begins her way back to the sea. It's then that the monitoring teams spring into action.

Following a strict code of conduct, they approach quickly, holding the turtle still to check for existing tags. If there's a tag they'll record the data, if not, they'll quickly insert a titanium tag into her front flipper. If there's not many other turtles on the beach, they'll also take the time to measure her. However, the beach is often busy, so they move from one turtle to the next checking for tags, collecting data and adding new tags.

Deep into the night, the turtle traffic begins to slow. The tired turtle monitoring team will wait in the dark, as shooting stars streak across the sky above, until they declare it a night.

The next morning, another staff member returns to the beach before sunrise. Their job is to walk the entire length of the beach, running a pole over the turtle tracks so the night teams can recognise new tracks. They also count all the new tracks to show how many turtles visited the beach after the turtle monitoring team went to bed each night.

FINDINGS

The WA Marine Turtle Program database holds 36 years of monitoring data—including 32 years for loggerhead turtles and information for 10,441 individual turtles that have been tagged at Dirk Hartog Island since the program began.

These data can be used to monitor the distribution, size and health of the loggerhead turtle population nesting on the island. In order to understand turtle population trends, given the reproductive rates and longevity of sea turtles, it's vital to have long-term information that spans several human generations.

Top left Night time monitoring.

Above left Marking and counting tracks.

Above Turtle monitoring.
Photos – Samille Mitchell/DBCA

Discover more about turtle monitoring on Dirk Hartog Island

Scan this QR code or visit Parks and Wildlife Service's '*LANDSCOPE*' playlist on YouTube.





THE ISLAND EXPERIENCE

The staff and volunteer team camps in the relative luxury of the old lighthouse keeper's quarters at Cape Inscription at the northern-most point of the island. Perched atop towering cliffs, the structure was built in 1908 and features thick walls, high ceilings and sweeping verandas. The walls show the evidence of much earlier guests, with graffiti from the 1930s etched into the stone.

After a night of monitoring, the volunteers get up late and spend the days exploring the coastline. It was here, in 1616, that Dirk Hartog visited this very place, becoming the first recorded European to set foot on Western Australia.

He left behind a pewter plate announcing his visit, a replica of which stands at Cape Inscription today. It's fascinating to imagine these adventurers coming ashore here, to a harsh and arid land so vastly different from the gentle green fields of their Dutch homeland.

While the volunteers may not see elusive native threatened animals, they delight in the knowledge that a recent restoration project has seen the eradication of feral animals from the island. The *Return to 1616* program is designed to return the ecosystem to the state it was in 1616 at Hartog's visit. You can read more about the program at sharkbay.org.

This has allowed native species such as the Shark Bay bandicoot, Shark Bay mouse, rufous hare-wallaby, banded hare-wallaby, greater stick-nest rat, and dibbler to once again thrive on the island as they did when Hartog arrived more than 400 years ago.

It has also helped the island to remain as pristine as possible for the turtles who return to their birthplace, emerge from silvery seas, and lay their eggs in the moonlight.

Above left Lighthouse keeper's cottage, Dirk Hartog Island.
Photo – Samille Mitchell/DBCA

Above Loggerhead turtle hatchling.
Photo – Jiri Lochman

Below left Loggerhead turtle at Ningaloo.
Photo – Craig Duncan

Below Turtle Bay, Dirk Hartog Island.
Photo – Samille Mitchell/DBCA

Dr Prince's legacy



Dr Bob Prince began tagging turtles for capture-mark-recapture studies in the 1980s in locations such as the Lacepede Islands, Muiron Islands and Ningaloo. He worked collaboratively with many communities and used his vast networks to identify conservation areas in need of protection and research. Turtle monitoring on Dirk Hartog Island was driven by his interest in determining the southern-most boundary of the loggerhead turtle population and understanding more about what was a little-known marine turtle species. Having started at the Department of Fisheries and Fauna in 1969, Dr Prince continues to volunteer his time to turtle research at DBCA even today—aged 80. His legacy continues, and as recently as this year a turtle that Bob had tagged in 1994 at Dirk Hartog Island was identified at Turtle Bay. This same turtle has returned 13 times in the 19 years since it was tagged!



Samille Mitchell is a videographer, author, former journalist and regular contributor to *LANDSCOPE* magazine. She can be contacted at samille.mitchell@dbca.wa.gov.au

Clodagh Guildea is a zoologist, teacher and the Science Communication and Education Project Officer for DBCA's North West Shelf Flatback Turtle Conservation Program. She can be contacted at clodagh.guildea@dbca.wa.gov.au

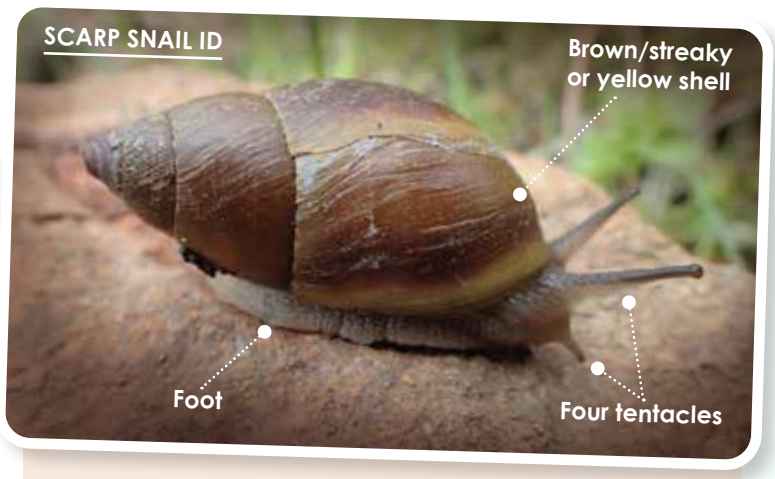
by Marnie Giroud

kaleidoscope
kids exploring nature

Scarp **snails**

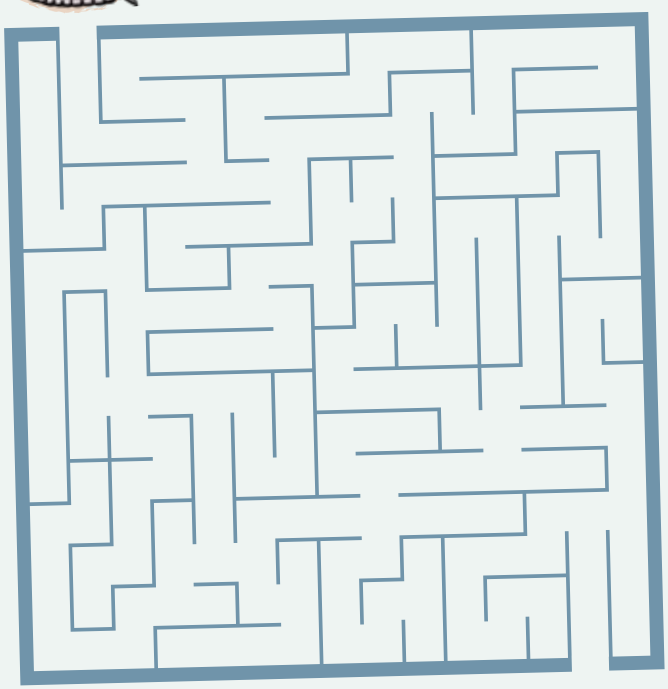
The scarp snail is a species of land snail in the *Bothriembryon* genus. Their habitat includes rocky terrain, gorges and gullies in the Perth Hills.

They are best seen during or straight after rains, often crawling on rocks or footpaths, or among piles of branches and leaf litter. Some hotspots for this species include: Kings Park, as well as Walyunga, John Forrest, Serpentine and Lesmurdie Falls national parks plus many more!



Snail trail

Help your snail through the maze!



Snail **ID**

Found a snail? Find out if the snail you found is a scarp snail or a common garden snail by answering the questions and following the arrows to find out.

Is the snail living in healthy, undisturbed bushland?
No → Not a scarp snail.
Yes ↓

Is the snail's shell long and pointy not squat and rounded?
No → Not a scarp snail.
Yes ↓

Is the shell all brown, sometimes streaky in colour?
(may have lighter coloured streaks or appear yellow if found in Kings Park)
No → Not a scarp snail.
Yes ↓

Congratulations you may have found me, Shelly the scarp snail! Take part in Snail Snap and find out for sure!





Above right Scarp snail. *Photo – Corey Whisson*

Snail Snap

JUNE–AUGUST 2023

Take part in Snail Snap, a citizen science project where you can help WA Museum scientists Corey Whisson and Lisa Kirkendale find out more about the elusive scarp snail and its relatives! Find a snail, snap a picture of it on your phone and upload it on the iNaturalist website. Search 'snail snap' at inaturalist.org and get snapping!

LANDSCOPE's **Kaleidoscope kids exploring nature** page is an exciting regular feature for kids.



Painted finches (*Emblema pictum*)

Painted finches (*Emblema pictum*) are also known as emblas, painteds and mountain finches. They inhabit an area from the Pilbara coast through and inland areas. Western Australian coast, through to northern South Australia, Central Australia and western Queensland. The painted finch is a small passerine that is 10–12 centimetres in length and weighs around 11.5 grams. Painted finches usually occur in pairs or small flocks and congregate around water sources in habitats that consist of rocky areas and spinifex grass. The painted finch feeds on grass seeds mostly from spinifex species and sometimes may consume fruit and blades of grass.

Illustration by Gooitzen van der Meer

Reference photo by Cliff Winfield

Nature's pin-ups
PRINT COLLECTION

Artwork featured in *LANDSCOPE* magazine



Artwork by Gooitzen van der Meer and Gwendolen Monteiro, as featured in *Nature's pin-ups* on page 54 in each issue of *LANDSCOPE*, is now available for purchase.

Using a watercolour technique or acrylics, the pieces depict species featured in the magazine.

Prints of these beautiful pieces of artwork can now be purchased in A3 size ($35), A4 size ($25) or A5 size ($15) plus $3.30 postage for domestic large letters up to 250g. Printed on high quality art paper and delivered to your door, ready to be framed and hung somewhere special.

Proceeds from your purchase go towards managing and conserving WA's plants, animals and natural environment.

To see the collection visit **shop.dbca.wa.gov.au/collections/prints**

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