

WA'S PARKS, WILDLIFE AND CONSERVATION MAGAZINE

# LANDSCOPE

Volume 39 Number 4 Winter 2024 \$7.95

## ROLLING IN THE DEEP

Basking in a biodiversity  
hotspot



**Forest orchestra**  
Tuning into a new  
soundscape

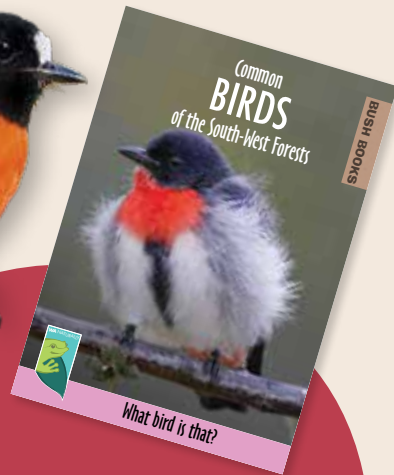
**Magenta magic**  
An elusive species  
endures

**On your bike**  
Jarrahdale gem restored



# Bird lovers flock to **wa** naturally

Photographs, artwork, articles and facts about Western Australia's incredible birds.



Purchase online at [shop.dbca.wa.gov.au](http://shop.dbca.wa.gov.au)

Bush Books  
**\$6.95**

LANDSCOPE  
**\$7.95**

Art prints  
from **\$15.00**

Greeting cards  
**\$4.95**



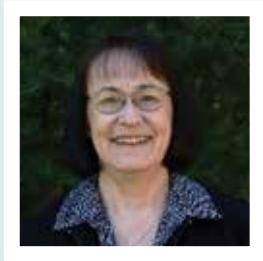
ON THE COVER

**Front cover** The Rowley Shoals are home to vivid nudibranchs, also called sea slugs, like this *Goniobranchus kuniei*.  
Photo – Peter Nicholas

**Back cover** Rowley Shoals Marine Park.  
Photo – Tourism WA

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.

We are living in an increasingly complex world, and the pace of change can be relentless. An open inquiring mind is essential for thriving in this environment and innovation is a critical component of driving improvements—to not only what we do, but how we do it.



Thoughts of innovation often go to digital transformation, and this is an important aspect of maintaining effectiveness in an increasingly connected world. Of course, innovation is much broader and can be applied in all business contexts. Innovation is fundamental to the Department of Biodiversity, Conservation and Attractions (DBCA) as a science-based organisation, and innovation is evident in our science endeavors as well as our management practices.

This issue of *LANDSCOPE* highlights some of the innovations being implemented in DBCA's science programs. Ghost bats are difficult to study, and new approaches are using GPS tags and autonomous ultrasound recorders to monitor these nocturnal animals in the Pilbara, and DNA fingerprinting is being used to determine dispersal patterns and use of maternity caves (see *'Interview with a (false) vampire'* on page 34).

Similarly, the heath mouse has proved to be quite elusive and difficult to detect. You can read about how our scientists are using camera traps and eDNA techniques to help locate presence of these animals (see *'Pursuit of the elusive heath mouse'* on page 22).

Ecoacoustics is a new approach to studying the diversity in WA's natural places and DBCA is incorporating ecoacoustics into monitoring the health of forest ecosystems under the new *Forest Management Plan 2024–2033* (see *'Forest orchestra'* on page 12).

We can all foster innovation in our work by bringing a forward-thinking, inquiring mindset and challenging ourselves and each other to think about how we can do things better, and strive to identify and utilise new approaches to achieve our objectives efficiently and effectively.

**Dr Margaret Byrne PSM, Executive Director, Biodiversity and Conservation Science**  
Department of Biodiversity, Conservation and Attractions

**Contributing** **Dr Andrew Crawford** is the manager of DBCA's Western Australian Seed Centre. Andrew has been collecting native seeds for more than 30 years and started seed conservation work with DBCA in 2001. Andrew's work covers all aspects of the seed conservation process; from seed collection and processing, to seed storage and testing, generating plants for translocations, as well as seed-focused research aiding in threatened species management and recovery.



**Lauren Hawkins** is a research scientist with DBCA's Ecosystem Science program. She uses ecoacoustics to study the acoustic communities residing within the south-west forests of Western Australia. Her research aims to improve scientific understanding of the ecological functions, habitat quality, and acoustic biodiversity of these ecosystems to inform the monitoring of forest health.



**Dr Kym Ottewell** is a senior research scientist and conservation geneticist with DBCA's Animal Science program, undertaking genetic analyses to determine species health and inform their management. Kym is also passionate about developing genetic tools for conservation managers to assist in monitoring threatened species, including for DBCA's flagship Dirk Hartog Island National Park Ecological Restoration Project.



**Editor** Lauren Cabrera.

**Editorial assistance** Jenna Oliver.

**Scientific/technical advice** Margaret Byrne, Steven Dillon, Carl Gosper, Lesley Gibson and John Huisman.

**Special thanks to** Andrew Burbidge.

**Design and production coordination** Sonja Rose and Tiffany Taylor.

**Design** Katie Bryden, Gooitzen van der Meer and Lynne Whittle.

**Illustration** Gooitzen van der Meer.

**Cartography** Promaco Geodraft.

**Prepress and printing** Advance Press, Western Australia.

All material copyright. No part of the contents of the publication may be reproduced without the consent of the publishers.

Maps should be used as a guide only and not for navigational purposes.

ISSN 0815-4465

Please do not send unsolicited material, but feel free to contact the editors by email ([landscape@dbca.wa.gov.au](mailto:landscape@dbca.wa.gov.au)).

Published by the Department of Biodiversity, Conservation and Attractions, 17 Dick Perry Avenue, Kensington, Western Australia.

© State of Western Australia, June 2024.

### Subscription information

Annual subscriptions to *LANDSCOPE* are available for \$33\* (four issues plus free postage within Australia). \*Overseas subscriptions add \$22.

**For more information contact us:**

**On the web** [shop.dbca.wa.gov.au](http://shop.dbca.wa.gov.au)

**By email** [landscape@dbca.wa.gov.au](mailto:landscape@dbca.wa.gov.au)

**By phone** (08) 9219 9000

**By free post** Reply Paid 25, Locked Bag 29, Bentley DC, Western Australia 6983

To purchase *LANDSCOPE* online, visit [shop.dbca.wa.gov.au/landscape](http://shop.dbca.wa.gov.au/landscape)



*LANDSCOPE* is printed on recycled paper which contains 55 per cent recycled fibre and is made from pulp, which is derived from well-managed forests, controlled and recycled sources.

**This page** Kalbarri yellow bells (*Geleznovia amabilis*).

Photo – Kelly Shepherd/DBCA



Department of Biodiversity, Conservation and Attractions

## Features

- 8 **Parks for people: Kalgulup Regional Park**  
A mosaic of lands around Bunbury
- 12 **Forest orchestra**  
Listening to the forest to uncover biological clues
- 18 **Adventure out: Kayaking on the Swan River**  
Rebecca dusted off her kayak and hit the water
- 22 **Pursuit of the elusive heath mouse**  
Detecting a mouse that's good at hiding
- 28 **Shining a light on the Shoals**  
Rowley Shoals are just as renowned for scientific research as they are for tourism
- 34 **Interview with a (false) vampire**  
Secret lives of the largest micro bat species in Australia
- 42 **Glorious *Geleznovia***  
The beautiful yellow flower with a tumultuous history
- 48 **Langford Park: Milling, mining and mountain biking**  
From bauxite mine to popular trails network

## Regulars

- 3 **From the desk of Dr Margaret Byrne**  
A foreword from the Executive Director, Biodiversity and Conservation Science.
- 6 **Bush telegraph**  
Short stories from around the State, reader's poem and a guest word.
- 27 **In review**  
A collection of books and applications.
- 41 **Discovered**  
Red seaweed (*Hypnea* sp).
- 53 **Kaleidoscope**  
Connecting kids with nature.
- 54 **Nature's pin-up**  
Freckled hawkfish (*Paracirrhites forsteri*).



READER'S POEM

Yellagonga  
Regional Park

By Gary Tate

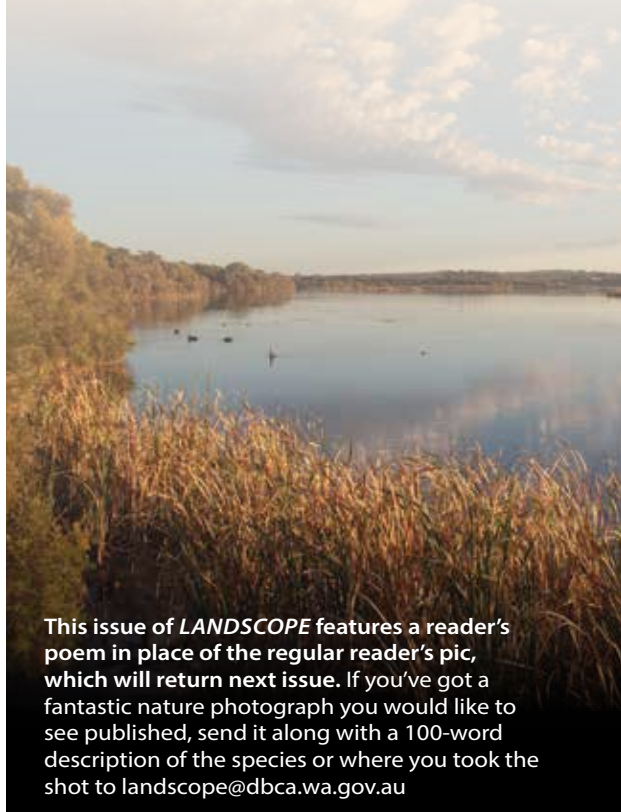
Through the beautiful expanse of Yellagonga  
On my bicycle or just to wander  
Pedalling past groves of paperbark  
Hearing the call of mudlark

Out on the lakes are swans and coots  
The odd looking musk duck gives loud hoots  
Makuru season brings the rain  
Fungi multitudes flourish again

Spring time wisteria flowering purple  
At Neil Hawkins you may sight a turtle  
Around the edges of the lakes  
One may sight frogs hunted by snakes

Overhead in cloudless sky  
A whistling kite issues a cry  
Take some time off your phone  
Through Yellagonga enjoy a roam

Photo – Gooitzen van der Meer



This issue of *LANDSCOPE* features a reader's poem in place of the regular reader's pic, which will return next issue. If you've got a fantastic nature photograph you would like to see published, send it along with a 100-word description of the species or where you took the shot to [landscape@dbca.wa.gov.au](mailto:landscape@dbca.wa.gov.au)



Mountain bike trails  
for Yellagonga

Work is underway on the \$4.2 million Yalbunullup mountain bike trails project at the northern end of Yellagonga Regional Park.

The family-friendly, seven-kilometre trail network is due to be completed by spring 2024, with the project also including a new carpark, toilets, shade pavilion, yarning circle and interpretive signage.

Located at the corner of Lakeside Drive and Joondalup Drive, the new infrastructure will have a view across Lake Joondalup and was designed to complement the surrounding bushland setting.

The name Yalbunullup reflects the Noongar name for the site.

A smoking ceremony and site blessing was held in April ahead of construction getting underway.

The trails will be suitable for beginner and intermediate riders.

**Above** Yellagonga Regional Park.

Photo – Ron D'Raine

***PEAT project in the Walpole Wilderness***

Funding of \$1.43 million over five years has been provided by philanthropic organisation the Ian Potter Foundation in a bid to learn more about the peatlands' strong carbon storage capabilities in critical peatland ecosystems in Western Australia's south-west.

The Protecting Peatland Ecosystems and Addressing Threats (PEAT) project is being undertaken by Edith Cowan University (ECU), the University of Western Australia (UWA), the Department of Biodiversity, Conservation and Attractions (DBCA) and the WA Museum.

Researchers are investigating the ecosystems of the 363,000-hectare Walpole Wilderness area—home to rare species including the sunset frog and the Albany pitcher plant fly (*Badisis ambulans*).

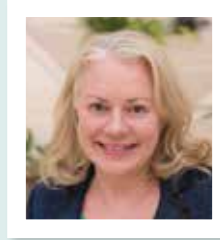
The project will involve sampling and fully characterising peatland diversity to assist with management of its biodiversity, carbon and bushfire risk.

The collaboration is guided by Elders from the Walpole-Nornalup National Park Association and involves citizen scientists and volunteers, including the Undalup Association.

It is hoped that working with Indigenous experts will enable researchers to better understand the area's cultural significance.

Guest column

**Suzanne Hillier**  
Chairperson, Trails WA



As the Chairperson of Trails WA, I've had a front-row seat to the incredible boom in trail activity in recent years. Bolstered by the State Government's substantial

investment in trail infrastructure and the surge in trail usage during the COVID-19 pandemic, it's evident that trails have become an integral part of WA's recreational landscape with enduring popularity.

From day one in this role, the impact of trails became abundantly clear. With more than 100,000 members across Trails WA's social platforms, we've observed firsthand how trails serve as avenues for individuals to reconnect with themselves and their loved ones, facilitating meaningful conversations away from the distractions of daily life.

Trails WA stands out as a beacon of innovation in this space. Thanks to the forward-thinking initiatives of Department of Local Government, Sport and Cultural Industries, DBCA and the pioneering trail foundations of WA, we've developed a cutting-edge digital platform featuring a comprehensive database of more than 1000 trails with detailed maps, images and official information. This unparalleled resource showcases WA's diverse and breathtaking landscape, offering both visitors and Western Australians alike unparalleled access to WA's epic trails network.

As we continue our mission to promote the safe and sustainable use of trails, our focus at Trails WA remains steadfast—to streamline trail access and alleviate the mental burden associated with planning outdoor adventures. Moving forward, we envision our role as a catalyst for knowledge sharing. We aspire to deepen connections to our land by fostering a greater understanding of Aboriginal culture.

Moreover, we recognise the multifaceted benefits of trails, beyond recreation. From birdwatching to wildflower appreciation, from encountering endemic and endangered species to embracing nature play opportunities, trails serve as gateways to myriad experiences. By prioritising access to such information, we not only enhance trail accessibility for all users but also cultivate a community of environmental stewards committed to preserving our natural heritage for future generations.

In essence, the journey ahead for Trails WA is one of continuous evolution and empowerment. By harnessing the transformative power of trails, we not only enrich lives but also foster a deeper appreciation for the diverse landscapes and cultures that define Western Australia.



**New picnic area and trails at John Forrest**

The first major component of the John Forrest National Park improvement project was completed in early 2024, with a new picnic and barbecue area opening in March.

Located in the visitor precinct adjacent to the site of the future park hub complex, the new day-use area has a gas barbecue and picnic tables and retains the heritage character of the precinct with new rock retaining and feature walls crafted by local stonemason Will Wake.

Visitors to John Forrest National Park can also enjoy the newly expanded trail network.

The new Noolbenger off-road trail has opened and is being well utilised by cyclists and trail runners. The shared use trail is a 16-kilometre-long, cross-country style adventure trail that traverses a wide range of terrain with scenic vistas, granite outcrops and seasonal brooks.

The upgraded trail network includes 10 kilometres of new Class 3 and 4 hiking trails. The new eight-kilometre Little Eagle hiking loop weaves through impressive wandoo woodland. Realignments, maintenance, and extension work has also been completed on the popular Eagle View, Wildflower and Glen Brook trails.

**Above** The new day-use area at John Forrest National Park.  
Photo – DBCA



**New accessible facilities at Nornalup**



**Above** Nornalup boat ramp.  
Photo – DBCA

Visitors of all abilities are now able to better access Walpole and Nornalup Inlets Marine Park with the completion of the upgraded boat ramp and new accessible paddle facility.

All visitors can now safely launch their dinghies, kayaks, or stand-up paddle boards to explore the scenic Frankland River up to Monastery Landing, which was upgraded in late 2023.

The new jetty features an all-abilities ramp and boardwalk connecting the carpark to the platform, complete with seating and an accessible paddle launch chute. This facility accommodates anyone who wants to paddle the river and explore the Walpole and Nornalup Inlets Marine Park.

The site officially opened for use to the public in March 2024 and was funded through the WA Recovery Plan, in partnership with Department of Biodiversity, Conservation and Attractions and the Shire of Denmark.



## Kalgulup Regional Park

*Covering 3168 hectares of land across three locations in and around greater Bunbury, Kalgulup Regional Park offers beaches, the Leschenault Estuary and Inlet foreshores, parts of the Collie, Brunswick and Preston river foreshores, landscaped parks, and natural bushland.*

**K**algulup Regional Park (pronounced 'Kaal-gool-up') is made up of the previously proposed Preston River to Ocean and Leschenault regional parks and includes the popular Leschenault Peninsula Conservation Park, Maidens Reserve, Mangrove Cove, Leicester Reserve, Manea Park, Eaton Foreshore, Ridley Place Foreshore, Clifton Community Reserve and Watson Reserve.

**Top left** Mangrove Cove Nature Playground.  
Photo – Shem Bisluk/DBCA

**Top right** The woody cone of the mangite (*Banksia grandis*).  
Photo – Ian Brodie

The Kaneang, Pinjarup, Wardandi and Wiilman people are the Traditional Owners of Kalgulup Regional Park. The Noongar word Kalgulup means 'place of fire' or 'place of burning camp'. The significance of the name derives from the campfires that were common around the estuary when Noongar people camped there in large numbers to fish and practice seasonal customary activities on their Country.

Fire and its elements (smoke, coals, ash) are at the koort (heart) of Noongar culture and the park motif is the woody cone of the mangite (*Banksia grandis*), which was used as a firestick.

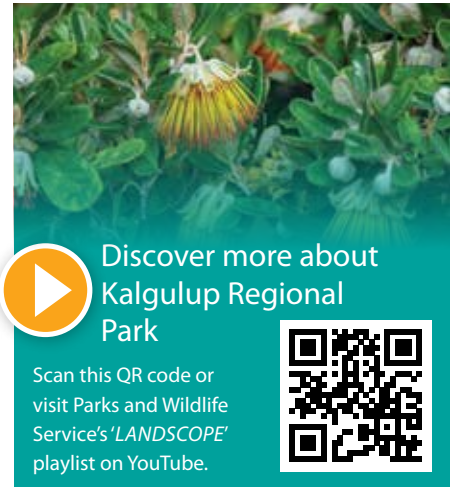
There are heritage sites associated with early exploration, whaling, shipping and settlement throughout the park, including a memorial for John Boyle O'Reilly—an Irish

poet, journalist, author and activist who was sent to Western Australia as a convict in 1867 and transferred to Bunbury where he remained for about a year before escaping and travelling to America.

### NATURAL ATTRACTIONS

The regional park was established in 2021 through the State Government's Plan for Our Parks initiative to ensure the conservation of the coastal plains, wetlands and woodlands of Kalgulup Regional Park that provide habitat for a wide range of mammals, birds and reptiles, including many threatened plant and animal species.

Vegetation along the coastal areas and riverbanks of the park includes the tuart (*Eucalyptus gomphocephala*), peppermint (*Agonis flexuosa*), flooded gum (*Eucalyptus*



*rudis*) and swamp paperbark (*Melaleuca raphiophylla*). Visitors to more inland areas of the park will encounter jarrah (*Eucalyptus marginata*), marri (*Corymbia calophylla*) and slender banksia (*Banksia attenuata*).

During spring, parts of the park transform into a wildflower wonderland as the flowering native trees burst into bloom and the colourful understorey comes to life. Prominent flowering species include the distinctive yellow-orange and red flowers of Skinner's pea (*Pultenaea skinneri*), the iconic red and green kangaroo paw (*Anigozanthos manglesii*), and eagle-eyed visitors may spot a sandplain white spider orchid (*Caladenia speciosa*).

The Leschenault Estuary and inlet at Mangrove Cove are home to the most southern occurrence of white mangroves (*Avicennia marina*) in WA. Mangroves are highly specialised land plants that have adapted to living in salt water.

The park provides habitat for many native animals of conservation significance including the critically endangered western ringtail possum (*Pseudocheirus occidentalis*) and the vulnerable chuditch or western quoll (*Dasyurus geoffroii*). Western grey

kangaroos (*Macropus fuliginosus*) are often seen in the park, as is the occasional venomous snake, so bushwalkers should stay alert and keep to the tracks.

Birdlife is abundant in Kalgulup Regional Park and many areas are popular with twitchers. Forest red-tailed cockatoos (*Calyptorhynchus naso*) are often spotted, and lucky visitors may also encounter the endangered white-tailed Carnaby's (*Zanda latirostris*) and Baudin's (*Zanda baudinii*) cockatoos amongst the eucalypt woodlands.

The wetlands provide a sanctuary for waterbirds including vulnerable and endangered species such as the greater sand plover (*Charadrius leschenaultia*), fairy tern (*Sternula nereis*) and curlew sandpiper (*Calidris ferruginea*).

## MAIDENS RESERVE

Just a few minutes' drive south of central Bunbury, Maidens Reserve is named for the pair of sand dunes 65 and 67 metres above sea level, which are the highest points in Bunbury.

Two brand new lookouts offer stunning views across Kalgulup Regional

Park, the ocean and wider Bunbury. The lower 45-metre-high viewing platform is accessible via a 670-metre-long assisted wheelchair accessible pathway or by climbing 152 steps. A second, 67-metre-high upper lookout can be conquered by

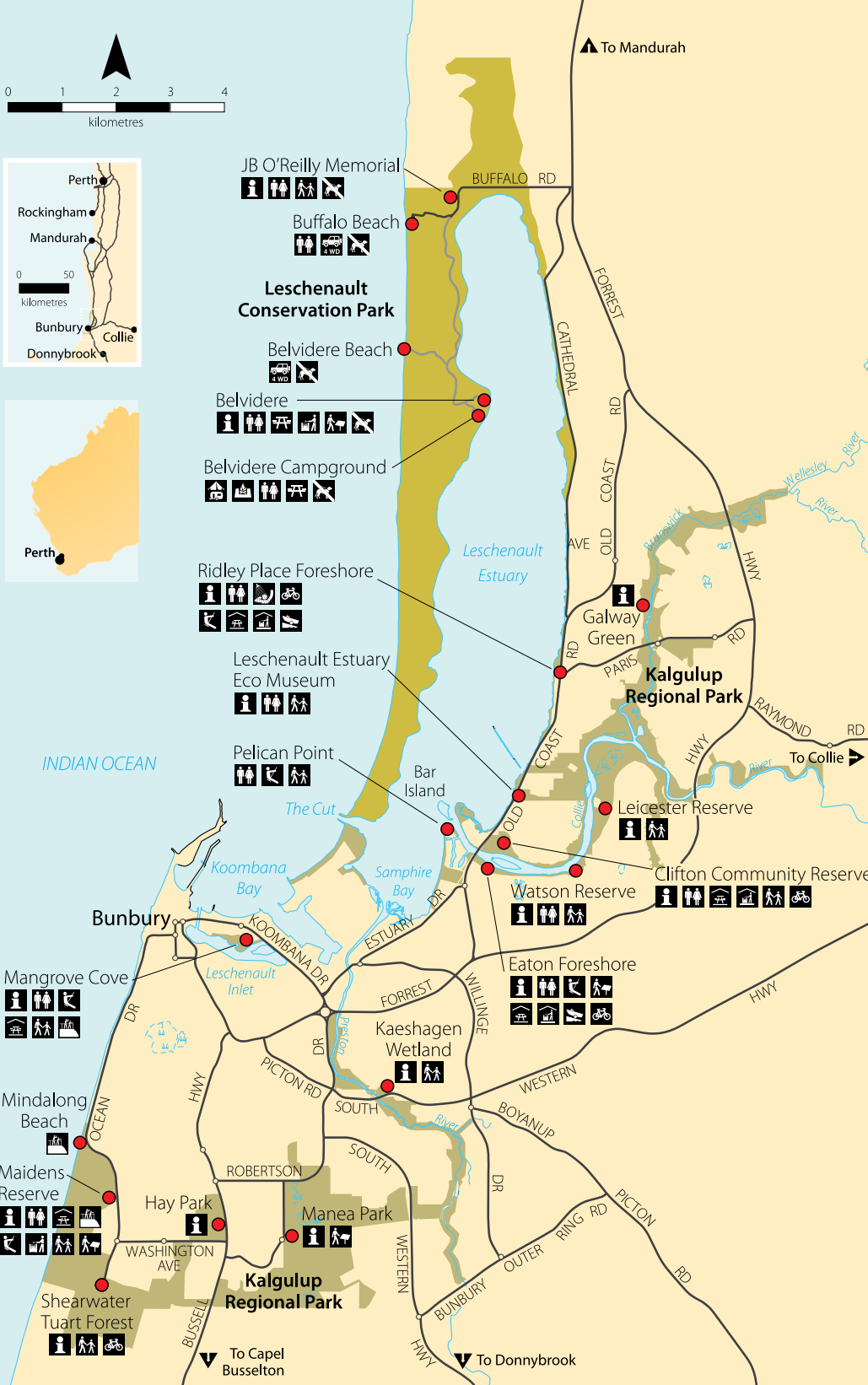
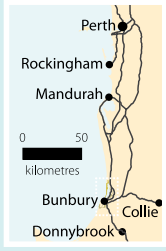
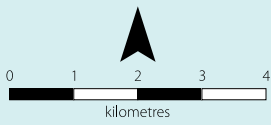
.....  
**Top left** Maidens Reserve new steps.

**Top right** Maidens Reserve walk track.  
Photos – Cliff Winfield

**Above far left** Wambenger brush-tailed phascogale (*Phascogale tapoatafa wambenger*).  
Photo – Jiri Lochman

**Above left** New upper lookout at Maidens Reserve.  
Photo – Cliff Winfield

**Above** Southern diplolaena (*Diplolaena dampieri*) at Maidens Reserve.  
Photo – Ian Brodie



| Legend |  |  |  |
|--------|--|--|--|
|        |  |  |  |
|        |  |  |  |
|        |  |  |  |
|        |  |  |  |
|        |  |  |  |
|        |  |  |  |



climbing a further 153 steps. There are barbecues, toilets and a playground near the car park.

Newly installed interpretive signage shares the natural, cultural and historical values of Maidens Reserve with visitors.

Walk trails meander through the reserve including the dual-use Tuart Walk between Dalyellup and Usher which is popular with cyclists.

### MANGROVE COVE

Mangrove Cove is located along the Leschenault Inlet in Bunbury. It is home to a popular all-abilities playground, a viewing tower, and a picnic area with barbecue and toilet facilities. A nearby pathway winds alongside the white mangroves that are nestled into the inlet.

The Mangrove Cove accessible playground opened in early 2023 and features mangrove root inspired climbing frames, ladders, slides, rope nets and bridges. The ground level facilities include a wheelchair-accessible sand pit and tunnels, water play area, basket swing, drums, chimes and cubbies.

**Top** Lemon-scented Darwinia (*Darwinia citriodora*).

**Above** Red knot (*Calidris canutus*).  
Photos – Jiri Lochman



*Parks for people* Kalgulup Regional Park

“Maidens Reserve is named for the pair of sand dunes 65 and 67 metres above sea level, which are the highest points in Bunbury.”

And things are only getting better at Mangrove Cove, with work on a new boardwalk due to be completed in late 2024, replacing the previous 190-metre-long boardwalk that was more than 20 years old. The new boardwalk follows the same footprint as the original, winding its way through the mangroves. It will cater for a wider range of visitors as it will be accessible for people in wheelchairs and with prams. To complement this, an upgrade of the existing pathway along the inlet within the Mangrove Cove precinct is also underway to provide safer access.

**LESCHENAULT PENINSULA**

Covering the thin strip of land separating the Leschenault Estuary from the Indian Ocean, Leschenault Peninsula Conservation Park in Australind, just north of Bunbury, has established bushwalking trails, and quiet nooks to observe the abundant bird and animal life or do a spot of fishing at popular Belvidere and Buffalo beaches.

For those who'd like to make a day of it, Belvidere recreation area has picnic facilities, gas barbecues, toilets and stunning views across the estuary.

Camping is available at Belvidere Campground, which has 28 sites (19 of

which are suitable for caravans), each with a picnic table and plenty of space. The Cut, located at the southern end of the peninsula where the estuary opens to the ocean, is accessible only by boat or a nine-kilometre walk from Belvidere along the Ridge Trail.

Camp sites at Belvidere Campground cannot currently be booked in advance, so it's first in, best dressed! As it can be particularly busy during weekends and holiday periods, a back-up accommodation plan should be in place in case no sites are available.

Visitors need to be aware that some areas may be subject to waterborne pathogens and Ross River virus is known to be present in the area. Mosquito repellent is highly recommended when visiting the peninsula.

**Top** Walking the dog at Manea Park.  
*Photo – Lorna Charlton/DBCA*

**Top right** Views of Buffalo Beach at Leschenault Peninsula.  
*Photo – Marie Lochman*

**Above right** Mangrove Cove Nature Playground.  
*Photo – Shem Bisluk/DBCA*

**Do it yourself**

**Where is it?** Bunbury, Australind, Eaton and the Leschenault Estuary.

**Total area:** 3168 hectares.

**What to do:** Boating, camping, bushwalking, swimming, fishing.

**Camping:** Belvidere campground—non-bookable, camping fees apply.

**Must see sights:** The wheelchair-accessible, interactive playground at Mangrove Cove, and the recently completed scenic lookouts and trail at Maidens Reserve.

**Furry friends:** Dogs are not permitted in Leschenault Peninsula Conservation Park, but are allowed in most other areas of Kalgulup Regional Park provided they are on a leash at all times.

**Nearest Parks and Wildlife Service office:** Bunbury Regional office, corner of Dodson Road and South West Highway, Bunbury. (08) 9725 4300. Wellington District office, 147 Wittenoom Street, Collie. (08) 9735 1988.



Forest  
**ORCHESTRA**

Capturing the sounds of  
WA's south-west forests

by Lauren Hawkins and Alan Gill



**The soundscape of an environment can help detect creatures that might be otherwise hard to see. Innovative scientists are recording sounds of Western Australia's forests in the south-west to uncover clues about what types of species occur there and how the environment changes throughout the day.**



**P**icture, for a moment, a eucalypt forest. You see tall trees stretching skyward while dappled light casts shadows on the forest floor. You smell the distinct scent that eucalypts have, tinged with the musty, damp odour of leaf litter wet with dew. You carefully run your hand along a tree trunk, with its coarse, stringy bark confirming you're in a jarrah forest.

But what do you hear? Perhaps it's a bird call, or the wind rustling the leaves. Maybe you hear the soft thud as a kangaroo stirs and bounds away. And what of the insects: do you hear that all-consuming wave of sound that seems to swell and swirl around the forest?

.....  
*Previous page*  
**Main Jarrah forest.**  
*Photo – Cliff Winfield*

**Above** Blue-breasted fairy-wren (*Malurus pulcherrimus*), singing.  
*Photo – Wayne Eddy/Sallyanne Cousins Photography*

**Top right** Slender tree frog (*Litoria adelaidensis*) calling.  
*Photo – Ann Storrie*

**Above right** Raspy cricket (*Paragrillacris* sp.).  
*Photo – Jiri Lochman*

The soundscape of an environment contains clues about the ecosystem, providing an opportunity to detect some of the most hard-to-find creatures. Technological advances mean innovative scientists can tune into the forest's soundtrack to uncover what our eyes might struggle to see.

### WIRED FOR SOUND

It is early morning, and Department of Biodiversity, Conservation and Attractions (DBCA) researcher, Lauren Hawkins, is leading a team through the Northern Jarrah Forest near Mundaring.

This morning's task is to retrieve the equipment used to record the soundscape; an emerging discipline known as 'ecoacoustics'.

"Ecoacoustics is a way of understanding the acoustic signature of an environment and how it changes over time," Lauren said.

"We currently know very little about the soundscape of the Northern Jarrah Forest, so we are deploying a network of audio recording units to develop a baseline of what's out here."

Acoustic loggers such as AudioMoth units are equipped with omni-directional

microphones that are highly sensitive to sounds from all directions. The loggers are programmed to record one minute of audio out of every three, and are placed in the landscape for a week to capture the cycle of sound over several day/night periods. The data they capture are then later analysed back in a laboratory using specialist software.

In addition to determining baseline soundscapes for the Northern Jarrah Forest, this research is looking at how frequently AudioMoths should be recording in order to best capture the acoustic environment.

"A one-in-three sampling frequency allows us to record the environmental soundscape without unnecessarily draining battery power or filling up memory cards," Lauren said.

"What we need to know is what length of recording works best: is it one minute out of every three, or perhaps five minutes out of every fifteen? Some of our sites have two units deployed so we can compare detection rates between different settings."

### LISTENING AND LOOKING

While fieldwork often gets the glory, it's back in the laboratory where these



## Global applications of ecoacoustics

DBCA is participating in the LIFEPLAN project led by the University of Helsinki that aims to develop methods for a global inventory of biodiversity using non-invasive monitoring techniques, including the use of ecoacoustics, eDNA, and camera trapping. Acoustic recording devices have been deployed at two sites near Perth to capture the vocalisations of bats and birds, contributing to the development of a global library of species-specific biological sounds. This will facilitate the advancement of AI technology to improve the efficiency and effectiveness of automatic call detectors and increase the scope of the application of ecoacoustics to ecological monitoring and management.



**Above** Acoustic recording devices deployed in the Northern Jarrah Forest.

Photo – Alan Gill/DBCA

**Above far left** Installing acoustic recording devices.

**Below** Appreciating the sounds of the Northern Jarrah Forest.

Photos – Samille Mitchell/DBCA



technologies start to uncover the acoustic fingerprint of a landscape.

Once the team has downloaded and backed-up the data captured by the recording units, they can put on some headphones and listen to the greatest hits of the forest.

“The first listen is always exciting because you never quite know what animal sounds you might have recorded,” Lauren said.

“The data were captured during warm summer nights. When listening to the first few audio files, I could hear the rustle of animals moving over leaf litter, the high-pitched clicks of white-striped freetail bats (*Austronomus australis*), and the distinctive call of the boobook owl (*Ninox boobook*).”

This ‘first listen’ acts like an audition to ensure the AudioMoths have done their job, ready for analytical tools to help scientists see the soundscape.

The audio files are loaded into software that creates graphical representations of the soundscape, separating out sounds by frequency and time. This enables scientists to visually scan the soundscape to identify long-duration calling events like insect choruses

or short, sharp sounds such as bird calls.

“A range of sound-making species produce a cacophony of sound over long durations, such as birds, insects and frogs,” Lauren said.

“Identifying a chorus such as this and determining which species are singing is integral to understanding the ecosystem we’re studying.”

Visualising the audio spectrum by pitch aids researchers in narrowing down the species that may be responsible for different sounds. The concept of an ‘acoustic niche’ suggests that animals choose a frequency range, time and volume to call so that their audience—usually others of their own species—can hear them easily.

“Two different species making sounds at the same pitch and the same time will have a hard time communicating with their own kind,” Lauren said.

“Research has shown that in habitats with diverse communities of animals, most sound-producing species evolve to use a particular range of frequencies and time intervals for communication and navigation, minimising interference with other species.

“These graphical representations make it easier to spot each acoustic niche



Listen to more about ecoacoustics

Scan this QR code to listen to the episode or search for ‘Western Australia by nature’ wherever you get your podcasts.





### Hearing with your eyes

Being able to visualise the sounds is essential to ecoacoustics research. It is a way to check the quality of the recordings, to ground-truth sounds we hear, to examine the spectral characteristics of sounds and to identify calling patterns in specific soundscapes. Specialised computer software programs can generate several types of graphical representations of sounds.

and increase our understanding not just of the landscape as a whole, but how these species interact in a noise-competitive environment.”

### LOOKING FOR PATTERNS

Comparing the acoustic signatures of different sites within a habitat allows scientists to determine how much variance they should expect within a landscape.

Concentrations of sounds might indicate feeding, nesting, or resting areas, or even identify movement corridors. Conversely, the relative absence of sounds may indicate a threat or disturbance in the landscape.

“We heard more bat vocalisations at one site than we recorded elsewhere in the study area,” Lauren said.

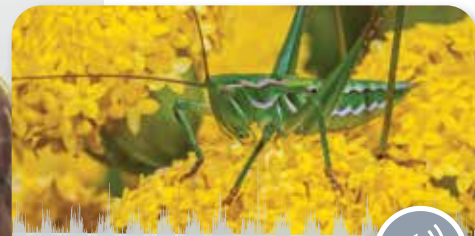
“These detections told us we needed to go back into the forest to look at this particular location to see what made it so different from the others. We could see that the site was situated close to an extended open area in the forest canopy, giving it potential as a bat flyway. Finding an acoustic anomaly like this provides valuable data on how these animals use the Northern Jarrah Forest and can inform future surveys.”

Confirming data analysis with field observations, known as ‘ground-truthing’,

is an important part of an iterative process in understanding what drives the soundscape of an environment. With a variety of variables impacting local biodiversity, measurements such as tree density, canopy cover and vegetation composition are integral to understanding why some sites sound different.

“Projects such as this are critical to building a picture of what we should expect the landscape to sound like,” Lauren said.

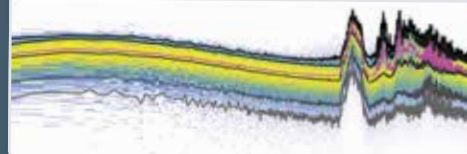
“We can then look for changes in the acoustic environment as a way of tracking changes in environmental conditions, including climate change



### Scan to listen



**Power spectral density plots** like the one below show the acoustic energy spread over the frequency spectrum. Scan the QR code to listen to sounds of insects represented by the graph below. Can you match what you see with what you hear?



### Scan to listen



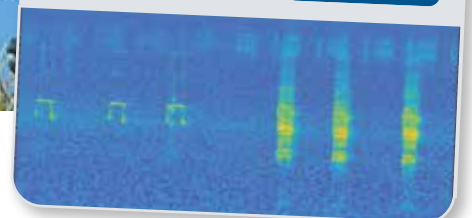
**Oscillograms** show the loudness of sounds over time. Scan the QR code to listen to sounds of birds represented by the graph below. Can you match what you see with what you hear?



### Scan to listen



**Spectrograms** show the loudness of sounds over frequency and time. Scan the QR code to listen to sounds of forest red-tailed cockatoos represented by the graph. Can you match what you see with what you hear?





impacts, habitat degradation and human disturbance.”

## AI STEPS UP TO THE MIC

Soundscape recordings are not new, but advances in technology—particularly machine learning and artificial intelligence (AI)—mean scientists can now record, process and analyse vast amounts of data than would otherwise be possible.

Computers, though, don't really know what a Carnaby's cockatoo (*Zanda latirostris*) or a sunset frog (*Spicospina flammocaerulea*) sound like without first being told. Machine learning allows humans to teach an AI program to distinguish different calls and the species responsible for them. Scientists label different sounds, then progressively let the program identify them, followed by validation and verification.

“The most recent field trip produced more than 1000 hours of audio recordings,” Lauren said.

“It would be impossible to listen to these files play in real-time and write down what sounds we hear and when

we heard them: it would take more than six months for one research scientist to process the audio files from this single study. Graphical tools can help identify moments when the soundscape requires further investigation, but bringing machine learning into the process unlocks a level of data analysis that is otherwise impossible to attain.”

The advance of AI and machine learning may create concern for humans who might find their jobs replaced, but for scientists, these tools enable them to do their jobs better and more effectively.

“Ecoacoustics can be a valuable tool for understanding our landscapes and informing future survey and conservation projects,” Lauren said.

“The field is advancing rapidly thanks to technological innovation, developing into a valuable tool for ecological monitoring and management. In a rapidly changing world, ecoacoustics may play a pivotal role in our efforts to monitor, protect, and restore the forests of south-west WA for years to come.”

“Projects such as this are critical to building a picture of what we should expect the landscape to sound like.”

*Opposite page*

**Top far left** Lauren examining a picture of forest sounds.

*Photo – Samille Mitchell/DBCA*

**Inset top left** Marauding katydid male (*Metaballus frontalis*).

*Photo – Jiri Lochman*

**Inset far left** Western whistler (*Pachycephala fuliginosa*) calling.

*Photo – Ann Storrie*

**Below left** Forest red-tailed cockatoos (*Calyptorhynchus banksii*).

*Photo – Doug Coughran/DBCA*

**Above left** Measuring the height of the canopy with a laser height meter.

**Above** Laying site transects.

**Below** An instrument used to measure tree canopy cover, called a spherical densiometer.

*Photos – Alan Gill/DBCA*

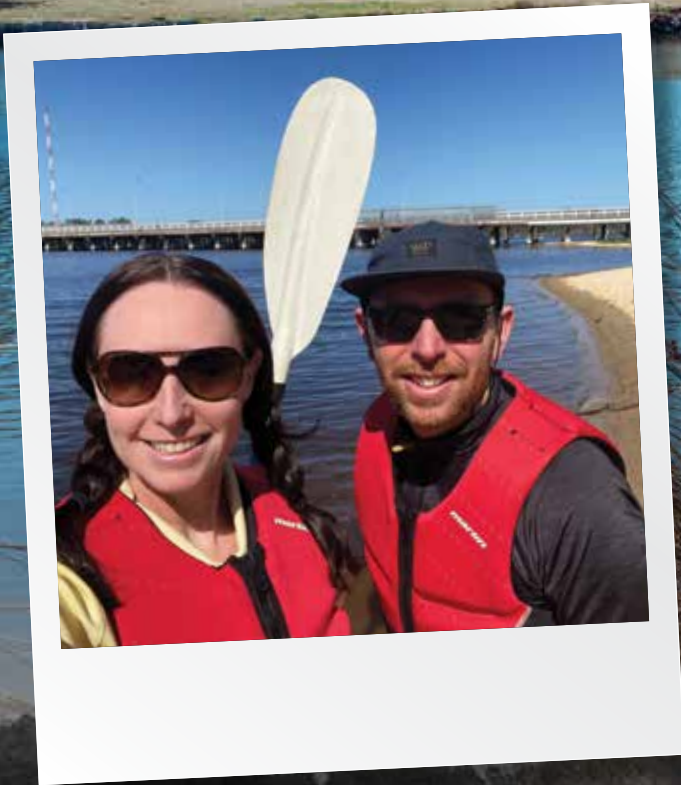


**Lauren Hawkins** is a Research Scientist with DBCA's Biodiversity and Conservation Science. She can be contacted at [lauren.hawkins@dbca.wa.gov.au](mailto:lauren.hawkins@dbca.wa.gov.au)

**Alan Gill** is a Science Communications Officer with DBCA's Biodiversity and Conservation Science. He can be contacted at [alan.gill@dbca.wa.gov.au](mailto:alan.gill@dbca.wa.gov.au)

# KAYAKING ON THE SWAN RIVER

by Rebecca Tapp



All too often we reach the end of the weekend and wonder where it went. Between family commitments and household chores, there never seems to be enough time for leisure before Monday rolls around. Or is there? Rebecca Tapp dusted off her kayak and made time to head out for a paddle on the beautiful Swan River.



## Adventure out

Our kayaks were a sight for sore eyes. Covered in dust and cobwebs, we often lamented that we'd take them out 'soon' when we 'weren't so busy'.

But recently, we decided it was time to make the time.

We live in a beautiful part of the world, with the Derbal Yerrigan (Swan River) right on Perth's doorstep, so even if all we could manage was a couple of hours on the water, we were determined not to let another weekend pass without enjoying some outdoor recreation.

After hosing down the kayaks, we loaded them on to the roof racks, packed a picnic, grabbed the life jackets and threw a few essentials—hats, sunscreen and water—into a waterproof dry bag, and headed to A.P. Hinds Reserve in Bayswater, located in the Swan Canning Riverpark.

As soon as we hit the water, we wondered why we didn't get out more often.

Surrounded by nature, with the water lapping at our sides and the sounds of birds around us, we instantly felt relaxed; our minds calmed.

We made our way east and were greeted by dogs swimming in the shallows near Riverside Gardens. Their pure joy was infectious.

As we passed Eric Singleton Bird Sanctuary and neared Ayres Bushland in Ascot where a boardwalk meanders through wetlands, we paused to admire an abundance of birdlife including Australian pelicans (*Pelecanus conspicillatus*), great cormorants (*Phalacrocorax carbo*), pied cormorant (*Phalacrocorax varius*), great egrets (*Ardea alba modesta*) and so many

---

*Opposite page*

**Main top** King Meadow on Point Reserve.

*Photo – Marie Lochman*

**Inset left** Happy to be exploring the Swan River.

**Left** Ascot wetlands.

**Above right** Great conditions for a paddle.

*Photos – Rebecca Tapp*



“...the best part was that we didn’t have to venture far from home to feel a million miles away.”

species of ducks. Time seemed to stand still as we floated in silence, watching the birds sunning themselves on the river’s edge. We hoped to see one of the river’s resident Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) but missed out this time (see ‘Dolphins in the Swan River, LANDSCOPE Autumn 2022).

We slowly continued upriver, past Garvey Park and all the people enjoying the walk and cycle paths dotted along the shoreline, before stopping at Sandy Beach in Bassendean to stretch our legs. Both Garvey Park and Sandy Beach are great rest spots if paddling with children. They boast impressive playgrounds, public toilets and sandy foreshores perfect for wading and building sandcastles.

Back in our kayaks, we marvelled at the multimillion-dollar mansions on our left along the stretch of the river between Sandy Beach and Pickering Park and debated which one we’d buy if we won the lottery!

We rounded the bend at Guildford, meandering below Success Hill Reserve, an important cultural site for Whadjuk Nyoongar peoples that was known for camping, fishing and hunting and was thought to have served as a vantage point for looking up and down the river.

**Volunteer to help the Swan Canning Riverpark**

You can learn more about caring for the Swan Canning Riverpark including the Indo-Pacific bottlenose dolphins that reside in the Riverpark by becoming a volunteer with River Guardians and/or the Dolphin Watch program. Find out more at [riverguardians.com.au](http://riverguardians.com.au)



Today, it’s a popular swimming and fishing spot, with stairs leading up from a jetty to a tranquil bushland setting that includes barbecues, covered picnic areas and views across the river.

This was our favourite part of the paddle. The water was still, silence filled

the air, and we couldn’t see beyond the bend in the river. We were enveloped in a pocket of trees, shielded from the stresses of the outside world. We felt a deep connection to nature that was palpable and could sense that the area held special significance.

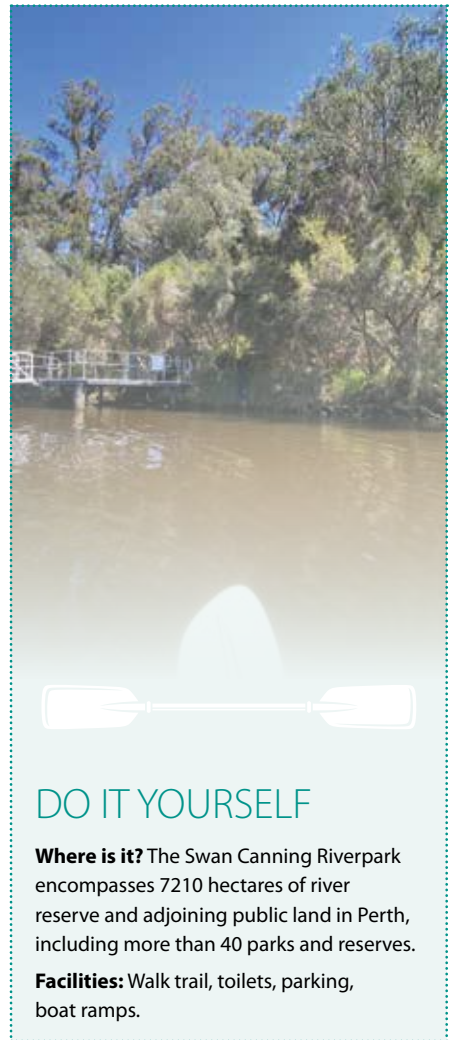
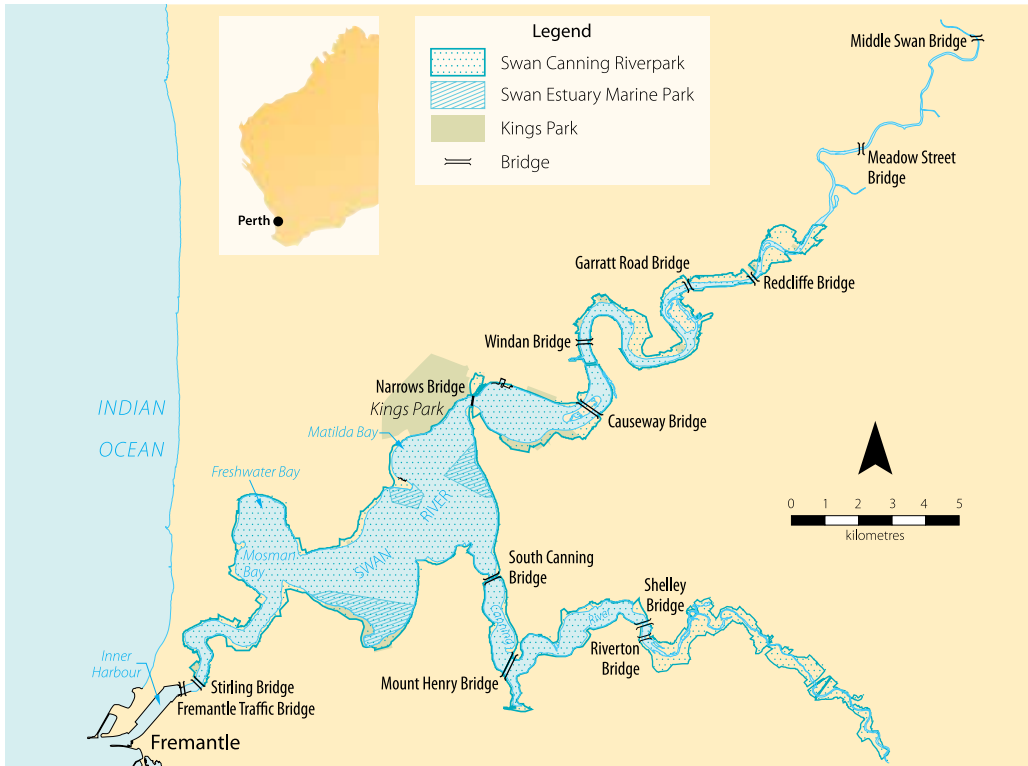
By then we’d been paddling for two and a half hours and had covered eight kilometres, so a little further along we docked at Riverside at Woodbridge, a rustic café on the river’s edge, to enjoy a well-earned coffee while soaking up the peace and quiet.

Our original plan was to turn around and start making our way back at this point but enthralled by the beauty around us we wanted to continue exploring the Riverpark. So, after a quick phone call to arrange a lift further up-stream, our adventure continued!

**Top** Garvey Park with kayaks.  
Photo – Cliff Winfield

**Above left** Australian wood ducks (*Chenonetta jubata*). Several species of ducks nest along the shores of the river.

**Above right** Australasian darter (*Anhinga novaehollandiae*) sunning itself on the banks of the Swan River.  
Photos – Simon Cherriman



## DO IT YOURSELF

**Where is it?** The Swan Canning Riverpark encompasses 7210 hectares of river reserve and adjoining public land in Perth, including more than 40 parks and reserves.

**Facilities:** Walk trail, toilets, parking, boat ramps.



Returning to our kayaks we headed further into the Upper Swan where the landscape changed to farmland and vineyards, and the only sounds we could hear were our paddles gliding through the water. It was so easy to forget we were in the city and our previously pressing chores faded into oblivion. We'd disconnected from our mental to-do list and connected with nature—mission accomplished!

Because we'd packed a picnic, we paddled past the wineries lining the river in Caversham. They would have made a great lunch stop and they also serve up music, art and bush tucker tastings.

With hunger starting to set in we began our hunt for a good picnic spot and found the most perfect location!

We ate at a gorgeous, secluded stone table on the river's edge that felt like a secret hidden location and rested

on a grass clearing under some shady trees being sure to take our rubbish with us.

After lunch, we continued towards Middle Swan Reserve where we were being collected, savouring the remaining solitude, sights and smells of the native flora along the way.

That night, we felt distinctly different compared to our previous Sunday evenings. We were tired, but not exhausted. It was that satisfying type of tiredness you experience when you've spent time outdoors in the sun and fresh air being active.

Prioritising time to get out and explore our local parks and wildlife was the circuit breaker we needed to refresh before the start of another busy week.

For a few hours we left the world behind, and the best part was that we didn't have to venture far from home to feel a million miles away.

**Above left** Riverside Gardens in Bayswater.

**Above** Success Hill includes a boardwalk to the river.

**Below** Taking a well earned picnic on the shores.

*Photos – Rebecca Tapp*



**Rebecca Tapp** is a Policy and Projects Officer with DBCA's Aboriginal Engagement and Heritage Unit. She can be contacted at [rebecca.tapp@dbca.wa.gov.au](mailto:rebecca.tapp@dbca.wa.gov.au)



# Pursuit of the elusive heath mouse

Surveys of the elusive heath mouse, a threatened native rodent, have paid off with the confirmed persistence of the species at Lake Magenta Nature Reserve in Western Australia's southern wheatbelt. New species detection techniques are giving scientists hope of locating more of the species.



by Dr Lesley Gibson, Sarah Comer, Saul Cowen,  
Peter Lacey, Carly Moir and Deon Utber

Until recently, there was limited survey effort focused on the heath mouse (*Pseudomys shortridgei*). Targeted surveys commenced in 2019 to better understand how well this locally rare species was faring in Western Australia. With an average weight of 70 grams, the heath mouse, or dayang, is a relatively large native mouse that is often confused with the native bush rat (*Rattus fuscipes*).

One telltale sign to distinguish the heath mouse is a hairy bi-coloured tail (dark above and pale beneath) minus the distinctive rings typical of rats, and their 'roman' nose is blunt instead of pointy. The heath mouse is listed as Endangered under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and Vulnerable under the *Western Australian Biodiversity Conservation Act 2016*.

## THE GREAT DIVIDE

The heath mouse once occurred across the heathlands of Western Australia, South Australia and Victoria. But, like several other native rodents, the species has disappeared from many areas, most likely because of habitat loss and fragmentation, and predation by introduced predators such as the fox (*Vulpes vulpes*) and feral cat (*Felis catus*).

They are now found in two restricted and widely separated locations in south-western Victoria (and just across the border into South Australia) and southern Western Australia. While there is some disparity in studies investigating genetic differences across this divide, they are currently treated as a single species.

The main preferred habitat difference between these two broad locations seems

.....  
*Previous page*

**Main** Heath mouse (*Pseudomys shortridgei*).

*Photo – Jiri Lochman*

**Inset** Checking traps at Lake Magenta.

*Photo – Saul Cowen/DBC*

**Above** Setting up camera traps to detect heath mice.

*Photo – Carly Moir/DBC*



to be related to the post-fire age of the vegetation. In Western Australia, the heath mouse has been found in areas of long unburnt habitat, with the highest densities recorded in vegetation 30 years post-fire.

In Victoria, the highest densities have been recorded in habitat 5–15 years after bushfire. This may be because it takes longer for the vegetation to recover following bushfire in the drier climate within the species' Western Australian range. Favoured habitat for the species in Western Australia appears to be species-rich and structurally complex heathland, and shrub-mallee woodland. In Victoria it prefers sandy heath and heathy sclerophyll forest.

## IN THE WEST

The rarely-detected heath mouse, first discovered in 1906 in Western Australia's central wheatbelt, was believed to be extinct in WA from the early 1930s. However, it was detected again in 1987 at Fitzgerald River National Park. Since then, it has also been found in low numbers in the Ravensthorpe area near Fitzgerald River National Park, as well as a few other spots in the wheatbelt including Lake Magenta and Dragon Rocks nature reserves. Until 2019, when survey efforts ramped up, the last confirmed sighting of the heath mouse in Western Australia was



● Lake Magenta Nature Reserve

in 2009 at Lake Magenta Nature Reserve, a recognised hotspot for the species

## THE SEARCH WAS ON

Ten years on, heath mice were captured at two locations in an area south of Ravensthorpe, and another near Digger Rocks north-west of Frank Hann National Park. While this provided hope that the species was doing okay, the Digger Rocks site was subsequently burnt in a large bushfire.

Further surveys in 2020 were undertaken in areas where it had previously been found, including the Ravensthorpe site. However, capture success across all sites for other small mammals was remarkably low, probably due to successive years of below average rainfall across the region. Some sites were also affected by bushfire and likely to be no longer suitable. Many rodent species



respond to rainfall, with rapid increases in population size following a period of high rainfall, then declining as the conditions dry out—commonly known as a boom/bust cycle. Studies in the Grampians National Park in Victoria have shown a strong correlation between heath mouse abundance and rainfall. This is also likely to be the case in Western Australia, which is concerning given future predictions of a drying climate in the region where the heath mouse occurs.

Drought conditions broke in 2021, which reinvigorated efforts and the search for the heath mouse continued. These surveys did not detect the heath mouse, and low captures generally of other native mammals may have been exacerbated by an ensuing introduced house mouse (*Mus musculus*) plague, and mice filling the traps. Then in May 2023, a heath mouse was captured at Lake Magenta

Nature Reserve and declared (unofficially) Happy Heath Mouse Day! All those early mornings spent checking traps in scratchy, dense heath—literally blood, sweat and tears—finally paid off.

### YOU'RE ON CANDID CAMERA

Now we know that the species persists there, additional surveys to assess the distribution and abundance of heath mice in areas of suitable habitat throughout Lake Magenta are continuing. These surveys are taking advantage of remote sensor camera traps, which have been shown to be effective in detecting heath mice in Victoria.

Feral cat management by the Department of Biodiversity, Conservation and Attraction's Western Shield team is also planned to be carried out in the reserve for the first time. Ongoing monitoring of both heath mice (and

**“The rarely detected heath mouse, first discovered in 1906 in Western Australia's central wheatbelt, was believed to be extinct in WA from the early 1930s”.**

**Top left** Dense habitat at Lake Magenta Nature Reserve.  
Photo – Saul Cowen/DBCA

**Above left** The bush rat (*Rattus fuscipes*) looks similar to the heath mouse.  
Photo – Jiri Lochman

**Above** Tail length of the heath mouse (*Pseudomys shortridgei*) is shorter than its head-body length.  
Photo – Hans & Judy Beste/Lochman Transparencies



other fauna) and feral cat activity in the reserve will help us better understand how effective this feral cat management has been.

## A CHANGING ENVIRONMENT

Investigations are also being undertaken to identify whether there has been any significant change in the vegetation composition and structure at sites in Lake Magenta Nature Reserve where heath mice have been captured. We suspect that some areas, which were potentially suitable 20 years ago, may no longer be so, due to lack of bushfire and vegetation senescence. While the species is believed to prefer long unburnt habitat in Western Australia, this is likely to be related to vegetation cover and structure, which eventually diminishes as vegetation ages. Introducing prescribed fire to create a mosaic of vegetation ages may improve the quality of the habitat overall and prevent bushfires destroying large areas of suitable habitat for the heath mouse.

## IMPROVING DETECTION

Despite the challenge of detecting a species at such low densities and with a patchy distribution, continuing to survey

in other areas remains important to fully understand the conservation status of the heath mouse across its range.

Habitat suitability models—based on historical records and relevant environmental data layers, that also take into consideration future climate scenarios—have been produced to help identify new areas that may be suitable habitat for the heath mouse, and to better target survey efforts.

Ongoing improvements in species detection, such as the use of camera traps and eDNA (i.e., DNA detected in the environment), may reveal the heath mouse is not as scarce as we thought—just really tricky to find.

.....  
**Above** Typical dense habitat preferred by heath mice at Lake Magenta.

*Photo – Saul Cowen/DBCA*

**Top right** Checking traps at Ravensthorpe Range.

*Photo – Sarah Comer/DBCA*

**Above right** Remote sensor camera traps are proving useful for detecting heath mice.

*Photo – Saul Cowen/DBCA*



**Lesley Gibson** is a Principal Research Scientist with DBCA's Biodiversity and Conservation Science. She can be contacted at [lesley.gibson@dbca.wa.gov.au](mailto:lesley.gibson@dbca.wa.gov.au) or (08) 9219 9069.

**Sarah Comer** is a Regional Ecologist in DBCA's Parks and Wildlife Service South Coast Region. She can be contacted at [sarah.comer@dbca.wa.gov.au](mailto:sarah.comer@dbca.wa.gov.au) or (08) 9842 4517.

**Saul Cowen** is a Research Scientist with DBCA's Biodiversity and Conservation Science Animal Science Program. He can be contacted at [saul.cowen@dbca.wa.gov.au](mailto:saul.cowen@dbca.wa.gov.au) or (08) 9405 5119.

**Peter Lacey** is a District Coordinator Conservation in DBCA's Parks and Wildlife Service Wheatbelt Region. He can be contacted at [peter.lacey@dbca.wa.gov.au](mailto:peter.lacey@dbca.wa.gov.au) or (08) 9881 9210.

**Carly Moir** is a Technical Officer and she leads the Animal Science Program with DBCA's Biodiversity and Conservation Science.

**Deon Utber** is Regional Leader Conservation in DBCA's Parks and Wildlife Service South Coast Region. He can be contacted at [deon.utber@dbca.wa.gov.au](mailto:deon.utber@dbca.wa.gov.au) or (08) 9842 4514.

## NGARINYIN



Apps like Duolingo are becoming increasingly popular and making it easier for people to learn the basics of foreign languages, but have you ever considered learning an Australian Aboriginal language?

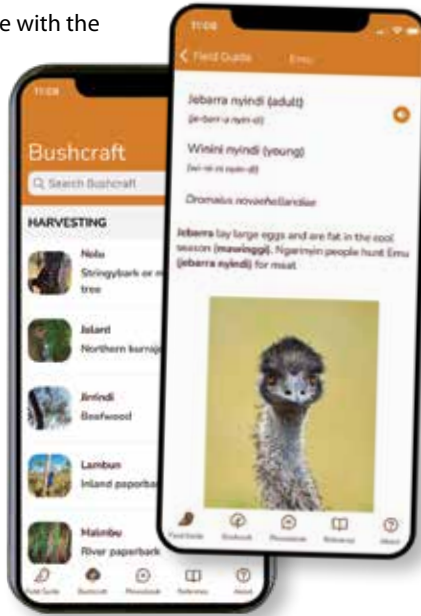
The *Ngarinyin* app was developed by the Wilinggin Aboriginal Corporation and includes common words and phrases in the Ngarinyin language—the traditional language of the Wilinggin Native Title Determined Area in the Kimberley. Ngarinyin speaking people are linked to Worrorra and Wunambal people through their lore and belief in the Wanjina creator being.

Most phrases have been recorded by Elders whose first language was and is Ngarinyin, so you can listen to the recording to learn the correct pronunciation.

The app also has a field guide with the traditional names for local flora and fauna alongside their common and scientific names, some information about each species, and a photograph. A section on bushcraft includes details of trees and plant products harvested and some of the objects created.

Winter is the perfect time for a Kimberley adventure, so if you're heading north this dry season, be sure to download the *Ngarinyin* app before you go.

*Ngarinyin app is free to download from the App Store and Google Play.*



## KNOTS 3D



I've harboured a long-held jealousy of my cousins who sailed competitively as children and know how to tie a multitude of useful and secure knots, while I'm lucky if I can get through a short run without my shoelace coming undone.

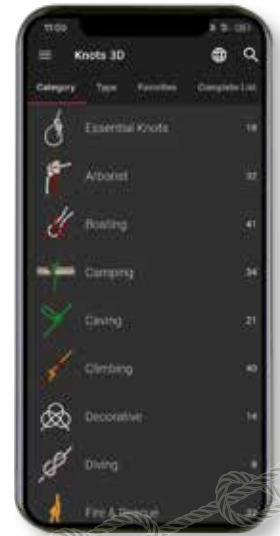
Not anymore though—after investing in the *Knots 3D* app, I'm tying (a few) knots like a pro!

With knots suitable for activities including boating, camping, caving and climbing, this is the perfect app for outdoor adventurers. You can search knots by activity type, knot type, knot name or ABOK reference and knots can be saved to your favourites for easy future access.

Each of the 190 or so knots featured has a description of where it should be used and a history of the knot, amongst other useful information. A 3D animation walks you through how to tie each knot and you can pause and adjust the speed of the animation as needed.

It's not the cheapest app going around, but in my opinion, it is well worth the small investment to know your tent fly isn't going to blow away in the night and your loaded-up trailer is securely tied down.

*Knots 3D can be purchased for \$9.99 from the App Store and \$8.99 from Google Play.*



## WILLIT'S FRIENDS

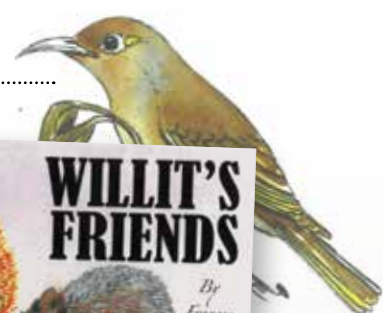
Willit is a northern hairy-nosed wombat and the protagonist of *Willit's Friends – A Baby Wombat's First Year*. The story covers Willit's trials and triumphs as he grows up and learns about the world beyond his burrow.

The friends he meets in the bush help Willit overcome sadness and adversity and find his extended family after his mum suffers a road accident.

Willit's story has been delighting young readers since 2006 when the first black-and-white-illustrated edition of *Willit's Friends* was published in. A second edition in 2009 saw Alexander Hill's beautiful illustrations printed in colour, with two more Willit books to follow as well as a Willit colouring book.

In 2021, *Willit's Friends* was translated into Chinese by Alexa and James Wu, making Willit's story accessible to an audience who may not be acquainted with Australian wildlife. An audio version of *Willit's Friends* is also available on CD and online at [willitthewombat.com](http://willitthewombat.com).

*Willit's Friends can be purchased for \$12 from willitthewombat.com. Willit's Friends – Chinese text is \$19.95. Profits from the sale of all Willit books and CDs goes to the Wombat Foundation, an organisation that funds northern hairy-nosed wombat research and rescue operations.*



An underwater photograph showing a large school of purple fish swimming over a diverse coral reef. The water is clear and blue, and the coral is in various colors and shapes, including some yellowish and brownish structures.

# Shining a light on the Shoals

by Claire Ross and Inês Leal

Some 260 kilometres north-west of Broome lie three picturesque reefs that make up the magical Rowley Shoals. A biodiversity hotspot, the Rowley Shoals are a renowned tourism destination and important scientific reference area. However, these marine parks are facing threats from a variety of sources, making their conservation and management a priority now more than ever.





Lying on the edge of Australia's north-west continental shelf, three oceanic reef systems—Imperieuse, Clerke and Mermaid—make up the Rowley Shoals. Rising from depths of up to 500 metres, these remote reefs consist of exceptionally rich and diverse marine life.

They have become well known for their transparent blue lagoons resembling real life aquariums. Iconic winding turquoise channels provide vessel access and connect the lagoons to the surrounding open ocean. Each reef has unique features—Mermaid's deep open lagoon, Imperieuse with its noteworthy weather station on Cunningham Island, and Clerke's complex reef channels resembling a reef water slide.

Due to their geographical and ecological significance, the Rowley Shoals are protected and managed for conservation. Imperieuse and Clerke form the Rowley Shoals Marine Park. The third and northernmost atoll, Mermaid Reef, is protected by the Commonwealth-managed Mermaid Reef Marine Park.

.....  
*Previous page*

**Main** Highly diverse coral reefs of the Rowley Shoals.

*Photo – Matt Kleczkowski*

**Above** Pineapple sea cucumber (*Theleota ananas*) is an endangered species due to overexploitation throughout its range.

*Photo – Tom Holmes*

**Above right** Aerial view of Clerke Lagoon.

*Photo – Will Robbins*



## OASIS OF MARINE LIFE

Beneath the transparent waters of the Rowley Shoals are underwater limestone forests formed by corals—the foundation species of the reef. Tropical waters are nutrient poor, yet coral reefs flourish like an oasis in the desert. Their success is in part due to photosynthetic algae in the coral tissue that provide the coral with energy for survival and growth.

Warm, crystal-clear waters of the Rowley Shoals allow coral to grow across a range of depths and habitats including the highly exposed outer reef slopes with coral walls descending to over 50 metres.

More than 180 coral species are thought to occur at the Shoals, making them regionally significant. Coral colonies, with their intricate and complex skeletons, are home to a diverse array of life.

Upon close inspection, a myriad of invertebrate life appears nestled within the complex coral reef framework that is held together by pink crustose coralline algae—the 'glue' of the reef. Brightly coloured

sea slugs (nudibranchs) and pin-cushion seastars (*Culcita novaeguineae*) perch among corals. Strawberry drupe snails (*Drupa rubusidæus*) hide away inside their mesmerising pink shells.

These are just a few of the hundreds of inhabitants that make up the overwhelming benthic biodiversity hotspot of the Rowley Shoals.

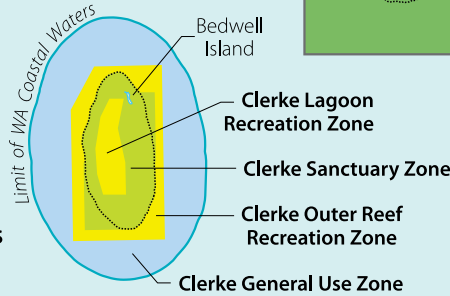
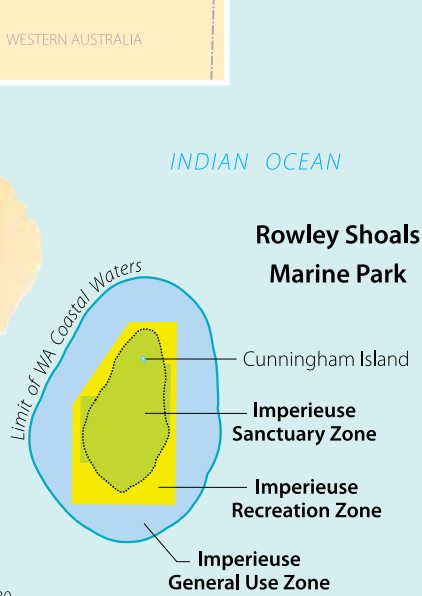
One inhabitant that cannot be easily missed is the critically endangered giant clam (*Tridacna gigas*), which can grow to more than one metre in length and weigh more than 250 kilograms. These iconic tropical bivalves display an array of colours and patterns making every individual unique, like artwork.

Dotted around the reef is an abundance of holothurians, commonly nicknamed sea cucumbers. Cruising around the sea floor, trawling for food and cleansing the reef environment—they are the 'vacuum cleaners' of the reef.

Sea cucumbers, giant clams and many species of gastropod sea snails are depleted in reefs north of the shoals and across



## Rowley Shoals Marine Parks



**Legend**

- ..... Reef edge
- Rowley Shoals Marine Park**
- Marine park boundary
- Recreation zone
- Sanctuary zone
- General use zone
- Mermaid Reef Marine Park (Commonwealth)**
- Marine park boundary
- National park zone



the Indo-Pacific due to overfishing and habitat loss. Their presence is a reminder of the conservation value of the Rowley Shoals where threatened species have been afforded a high level of protection.

### ROWLEYS AT RISK

Under the *Fisheries Management Act 1991*, commercial fishing is prohibited at the Rowley Shoals, including shell collection. The recent increase in illegal foreign fishing poses a risk as it can change the ecosystem balance, damage coral assemblages and place pressure on vulnerable and threatened species.

The earliest visitors to the reefs were Indonesian fisherman who still visit the Rowley Shoals, Scott, Seringapatam and Ashmore Reefs. Sea cucumbers and shark fins have reportedly been the recent targets of illegal fishing at the Rowley Shoals due to their high demand as a valuable food delicacy.

Dwindling shark and sea cucumber populations can have cascading effects on the entire marine ecosystem, potentially disrupting food chains and destabilising habitats. While not yet suspected as a target at the Rowley Shoals, many species of giant clam (*Tridacna* spp.)

and gastropods (especially *Trochus* and *Cypraea*) are also highly vulnerable or endangered and are closely monitored by DBCA given that their numbers are dwindling across the Indo-Pacific.

Daytime exposure of the intertidal reef flats during low tide provides easy access for reef-walking, making these reefs particularly vulnerable to physical damage by illegal fisherman. The Rowley Shoals are regionally significant being one of the last remaining refugia and strong-holds for the success of many vulnerable and threatened species' existence.

**Above right** The mantle of giant clams (*Tridacna* sp.) have unique patterns.  
Photo – Clay Bryce/Lochman Transparencies

**Right** Crocus clam (*Tridacna crocea*).  
Photos – Inês Leal

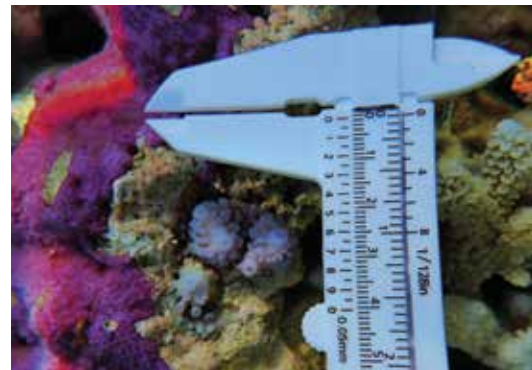


Discover more about Rowley Shoals Marine Park

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



“As one of the last coral reef ecosystems in the Indian Ocean largely spared from human interference, they are critical areas for protection and management.”



The Rowley Shoals are increasingly at risk from disturbances such as marine heatwaves and cyclones. Marine heatwaves are very problematic because higher than normal temperatures can trigger a phenomenon known as ‘coral bleaching’.

When temperatures exceed a locally defined threshold, corals turn bone white due to the loss of their colourful photosynthetic algae, after which they often starve to death. Unlike many reefs around the world, the Rowley Shoals have largely escaped major catastrophic heatwaves and bleaching so far.

The most recent moderate bleaching events in 2016 and 2020 resulted in only low-level damage, but the Rowley Shoals are predicted to be increasingly impacted

by more severe thermal stress and coral bleaching in the future due to ongoing ocean warming.

Cyclones are also predicted to occur at greater intensity with ongoing climate change. Cyclones bring benefits but also have the potential to cause damage depending on the timing and proximity to the reef. A cyclone can save corals from bleaching by cooling waters during a heatwave event—a phenomenon that has occurred previously off the north-west coast of Australia—yet damaging waves from a cyclone can cause destruction depending on its strength and path.

Cyclones are more of a threat during La Niña years when the number and intensity of cyclones typically increase. Many cyclones have passed over or close to the Rowley Shoals, and most of these have not been found to cause substantial damage.

## LONG-TERM MONITORING

The Rowley Shoals Marine Park acts as an important scientific reference area covering a total area of 87,500 hectares with 24 per cent designated as sanctuary zone (look but don’t take).

The Rowley Shoals Marine Park was gazetted as a Class A marine park in 1990 and DBCA’s marine monitoring began shortly thereafter. In collaboration with the Australian Institute of Marine Science, coral monitoring at the Rowley Shoals has been ongoing since 1995 and represents one of the longest coral monitoring programs in Western Australia.

In 2023, a team of scientists from DBCA’s Marine Science program and regional staff from the Broome office conducted surveys of finfish, sharks, coral, juvenile corals, and other macro-invertebrates at a series of long-term monitoring sites. The team set out on a 14-hour boat ride and spent ten days collecting important monitoring data at Clerke and Imperieuse reefs.

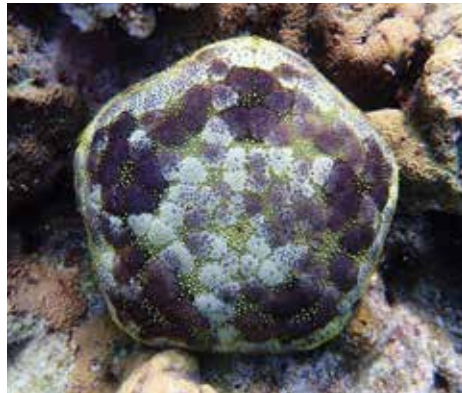
Coral surveys are important as they track changes in coral cover and provide information on the health of the reef following recent environmental disturbances. One of the newest additions to the monitoring program in 2023 was the monitoring of ‘baby corals’ less than five centimetres in size.

These surveys tell researchers the status of new cohorts colonising the marine

**Top left** Reef flat at Clerke channel.  
*Photo – Inês Leal*

**Top right** Retrieval and installation of a temperature logger at the Rowley Shoals.  
*Photo – Miecha Bradshaw*

**Above right** Measuring a baby coral (*Acropora* sp.).  
*Photo – Simone Strydom*



park and are a very important piece of the puzzle to understand coral community recovery following disturbances. Provided that there are no new disturbances, these tiny corals will grow to become adults in five to 10 years depending on the species.

Initial results reveal very high numbers of baby corals—a sign of hope for the ongoing replenishment of these important reefs. Meanwhile shark, finfish, and invertebrate surveys provide a critical benchmark for assessing the impacts of future illegal fishing across these ecologically significant coral reefs.

### SAVING THE SHOALS

While the remoteness and isolation of the Rowley Shoals has meant a historically low level of visitation and recreational fishing pressure, the distance from shore presents a significant challenge for management and enforcement.

Australian Border Force and the Western Australian Department of Primary Industries and Regional Development patrol the waters around Rowley Shoals for illegal fishing. Together with DBCA, they also investigate and report environmental disturbances.

As one of the last coral reef ecosystems in the Indian Ocean largely spared from human interference, they are critical areas for protection and management. This will ensure that these reefs remain in healthy condition, shining a light on the importance of the statewide network of marine parks for conservation of biodiversity in Western Australia.

.....  
**Top left** Sea slug (*Phyllidia cf. varicosa*). Juveniles of Graeffe's sea cucumbers mimic this species to protect from predators.  
 Photo – Inês Leal

**Top right** Scientist rolling out a transect tape for coral and macro-invertebrate surveys at long-term monitoring sites.  
 Photo – Tom Holmes

**Above** Pin-cushion seastar (*Culcita novaeguineae*).  
 Photo – Inês Leal

**Above right** Tiled seastar (*Fromia monilis*).  
 Photo – John Huisman

**Right** Dorid nudibranch (*Gymnodoris impudica*).  
 Photo – Inês Leal

**Claire Ross** is a Research Scientist with DBCA's Biodiversity and Conservation Science, focused on coral reef ecology. She can be contacted at [claire.ross@dbca.wa.gov.au](mailto:claire.ross@dbca.wa.gov.au)

**Inês Leal** is a Research Scientist with DBCA's Biodiversity and Conservation Science specialising in invertebrate ecology and biodiversity monitoring. She can be contacted at [ines.leal@dbca.wa.gov.au](mailto:ines.leal@dbca.wa.gov.au)

The background of the entire image is a dark, textured rock surface, likely the interior of a cave. Two flying foxes are visible. One is in the upper right, with its wings spread wide, showing the intricate structure of the membrane. The other is in the lower right, also with wings spread, looking towards the camera. The lighting is dramatic, highlighting the texture of the rock and the details of the bats' wings and faces.

# Interview with a (false) **vampire**

Insights into the ecology of  
Australia's only carnivorous bat



by Kym Ottewell, Diana Prada, Linette Umbrello and Rujiporn Sun

High-tech research and monitoring approaches are allowing researchers to unravel the secret lives of one of the largest bat species in Australia, the ghost bat. GPS tags, autonomous ultrasonic sound recorders and DNA fingerprinting are allowing researchers to track, monitor and learn more about this unique species.

**W**ith a wingspan of up to 60 centimetres, the ghost bat (*Macroderma gigas*), a species of false vampire bat, has the distinction of being one of the largest micro bat species in Australia, while most megabats (flying foxes or fruit bats) are larger. Because of their large size, they were originally thought to feed on blood like the vampire bats of Central and South America, but they are now known to be carnivorous, preying on large insects, frogs, birds, lizards and small mammals including other bats.

A stealthy hunter, the ghost bat gets its name from its silvery-grey fur, which makes it appear ghostly in the moonlight. Ghost bats occur across several disjunct populations in Queensland, the Northern Territory, and within Western Australia's, Kimberley and Pilbara bioregions. Not to be feared (by humans at least), this enigmatic bat is the subject of fascinating recent research that is revealing insights into its social behaviour and ecology.

## DINING OUT

Ghost bats have a varied diet, feeding often on other mammals, amphibians, birds, reptiles, and insects. They use echolocation to navigate across the dark night but use their outstanding eyesight to find their prey. Ghost bats hunt by perching in trees or rock walls before swooping to the ground and enveloping prey in their wings, then carrying it away to feed. Aerial prey (birds, insects, other bats) can also be captured while in flight, with ghost bats observed to predate on other small bat species they co-habit with as they exit cave entrances.

To develop greater insight into ghost bat foraging behaviour and habitat use in the Pilbara, bat ecologist Robert Bullen



and Rio Tinto biologists Scott Reiffer and John Trainer affixed GPS tags to several ghost bats and used satellite tracking technology to estimate flight distances and foraging times. They found that, on average, bats foraged for 5.8 hours a night, and within an average distance of 8.5 kilometres of their respective roosts. The maximum distance travelled was 17.7 kilometres for males and 11 kilometres for females. Bats were also observed completing long distance commutes of 36 kilometres (male) to 27 kilometres (female) in a single night, travelling at speeds of 22 kilometres per hour!

## GOOGLE TRANSLATE FOR GHOST BATS

Ghost bat researcher Dr. Nicola Hanrahan has always held a fascination for the ghost bat having spent nearly four years eavesdropping on bats in the

Northern Territory to study their acoustic communication.

Nicola used a 'big data' approach involving the use of autonomous ultrasonic sound recorders placed in a roost with continuous recording (see 'Forest orchestra' on page 12) conducted over two years. Analysing this extensive dataset, Nicola identified twelve distinct non-echolocation vocalisations in ghost bats, revealing a complex vocal repertoire of chirp-trills, squabble, whistles and ticks, the greatest repertoire so far recorded for bats.

Vocalisations appear to serve multiple functions such as mum-pup communication, resource defence, fighting, and greeting other individuals as they return to the roost. Interestingly, different dialects were identified among geographically distant colonies suggesting the ghost bat has regional 'accents'.

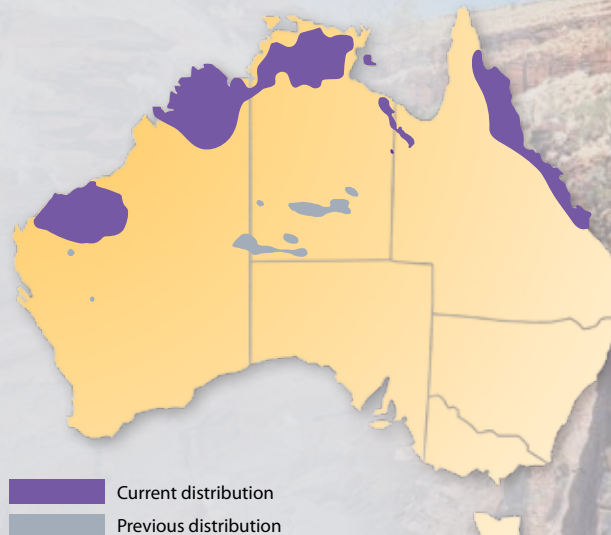
.....  
*Previous page*

**Main** Ghost bats (*Macroderma gigas*) in flight.  
*Photo – Steve Parish/Lochman Transparencies*

**Above right** Ghost bat in its roost.  
*Photo – Perth Zoo*



### Distribution of ghost bats



**Above left** Dr Melissa Millar preparing ghost bat scats for DNA extraction.  
*Photo – Kym Ottewell/DBCA*

**Above** Banded ironstone formation, Chichester Range.  
*Photo – Marie Lochman*

**Left** Purified ghost bat DNA ready for analysis.  
*Photo – Kym Ottewell/DBCA*

There are also bats that very much like to stay at home, with some individuals found in the same cave every year for at least six consecutive years (the extent of records).

### A UNIQUE BAT

The ghost bat is globally unique, being the only species in its genus, *Macroderma*, and the only extant representative of the Megadermatidae family in Australasia. Besides its ghostly silver-grey fur, it also has a prominent nose leaf, long silky ears and large piercing eyes, giving it a distinguished appearance

Under much warmer and wetter historical conditions, the ghost bat was once widely distributed across much of Australia but as the interior of the Australian continent dried out, the ghost bat has become restricted to mesic areas in northern Australia that provide roosting habitat with a suitable microclimate (stable temperature and humidity) to reproduce, sleep, and protect and raise their young.

Given their restricted, disjunct distribution and declining population size, the ghost bat is currently listed as Vulnerable. It is estimated that the global population of ghost bats is less than 10,000 individuals.

### PILBARA GHOST BAT

With an estimated 1850 ghost bats persisting in the ancient Pilbara bioregion



Nicola is now working with Dr Laura Ruykys and the Northern Territory Government to use call playback, specifically the 'squabble' call, to lure ghost bats to cameras to facilitate monitoring without disturbing bats in their roosts.

### FROM SCATS TO STATS

Another non-invasive method of monitoring the ghost bat has been developed by the staff at DBCA's Sid James Conservation Genetics Laboratory at Kensington, involving DNA analysis of ghost bats scats (faeces).

The outer surface of each scat contains DNA from the intestinal cells of the bat, which can be extracted and analysed to obtain its unique genetic fingerprint. Taking care not to disrupt bats, scats are collected during surveys from

different roosts and over multiple seasons, and then matched based on their DNA fingerprints.

Like crime scene investigators, researchers can identify individuals using particular roosts and track their movements between sites and across years. Some of the insights gained from this method include confirmation that the number of bats per roost is small in the Pilbara compared to other locations (one to ten bats per roost) and that bats use a network of roosts in their local area, typically moving between two to three caves during survey periods.

In terms of individual movements, there is good agreement with the GPS study above, with bats most frequently using roosts located up to about 10 kilometres apart and making less frequent, longer distance movements between roosts up to 45 kilometres apart.



### *Welcome to my lair*

There is a colony of ghost bats held in the nocturnal house at Perth Zoo, allowing visitors to get up close with a (false) vampire.

of Western Australia, this isolated population forms an important component of the species' distribution, yet is under pressure from intensive mining development.

Other threats include entanglement in barbed wire fences, loss and degradation of foraging habitat, and potential interactions with introduced species such as cane toads and feral cats. Female ghost bats require specific roosting habitat, usually deep natural caves or disused mines that sustain a stable temperature of between 23–28°C and humidity levels between 50–100 per cent to raise their young (pups are very sensitive to heat and drying out) and to protect them from the arid environment.

These 'maternity caves' are often found in the banded ironstone formations that coincide with mining activity. Not all roost caves can function as maternity caves, so it is vital that maternity caves are retained to protect the viability of the ghost bat in the Pilbara.

Given the pressures faced by this threatened species, there is significant interest in understanding aspects of the species' biology, behaviour and ecology to assist in conservation management decisions. New research is making use of novel technologies to help scientists understand this species better.

### WHAT'S NEXT

These high-tech, novel, and largely non-invasive research and monitoring approaches are allowing researchers to unravel the secret lives of ghost bats. This information has been helping to build up a picture of how ghost bats are using their habitat (both roosting and foraging) and to identify what features or components are critically important to protect to assist in their conservation.

Because ghost bats are known to be sensitive to disturbance by humans entering their roosts, there has been a focus on developing low intervention approaches to monitoring, in a bid to keep this species safe.



**Above left** Ghost bat housed at Perth zoo.  
*Photo – Perth Zoo*

**Above** Dr Nicola Hanrahan setting up an ultrasonic sound recorder.  
*Photo – Garrett Eckerson*

**Inset** Artist Milktooth's ghost bat painting on display at WA Museum.  
*Photo – Boola Bardip/WA Museum*

**Kym Ottewell** is a Senior Research Scientist with DBCA's Biodiversity and Conservation Science Animal Science program whose research focuses on developing genetic datasets and monitoring approaches for WA threatened fauna. She can be contacted at [kym.ottewell@dbca.wa.gov.au](mailto:kym.ottewell@dbca.wa.gov.au)

**Diana Prada** is a Research Scientist with DBCA's Biodiversity and Conservation Science Animal Science program. She currently focuses on understanding the ecology of the Pilbara ghost bat from scat DNA. She can be contacted at [diana.prada@dbca.wa.gov.au](mailto:diana.prada@dbca.wa.gov.au)

**Linette Umbrello** is a Research Scientist with DBCA's Biodiversity and Conservation Science Animal Science program who uses genetic information to help understand threatened bats in the Pilbara. She can be contacted at [linette.umbrello@dbca.wa.gov.au](mailto:linette.umbrello@dbca.wa.gov.au)

**Rujiporn Sun** is a Research Scientist with DBCA's Biodiversity and Conservation Science Animal Science program who developed (with Kym Ottewell) the non-invasive genetic monitoring method using scats for the ghost bat and other WA threatened marsupial species. She can be contacted at [rujiporn.sun@dbca.wa.gov.au](mailto:rujiporn.sun@dbca.wa.gov.au)



## Western Australia 2025 Calendar

- 12 stunning photos
- large date squares
- spiral binding

RRP \$14.95 each

**LANDSCOPE subscriber price \$12.70**

\*Apply discount code LANDSCOPE-SUB at checkout for online purchases

### 2025 CALENDAR AND LANDSCOPE SUBSCRIPTION PACKAGE

Purchase the *Western Australia 2025 Calendar* plus a 12-month subscription to *LANDSCOPE* magazine for only \$43 – a saving of \$4.95!\*\*



## WIN A 2-night stay at RAC Karri Valley Resort!

Enjoy a break from the everyday as you lap up the tranquil surroundings of Karri Valley Resort, situated deep within karri forest and overlooking beautiful Lake Beedelup. Will it be a cosy, romantic escape, or full of outdoor adventure?

Pemberton is but a short drive away, as are a large range of local attractions, so settle in and make what you will of this magnificent opportunity.



Purchase online at [shop.dbca.wa.gov.au](http://shop.dbca.wa.gov.au)

# wa naturally

(08) 9219 9000  
 customer.service@dbca.wa.gov.au  
 17 Dick Perry Avenue, Kensington WA 6151  
 Reply Paid 25, Locked Bag 29,  
 Bentley DC WA 6983



@waparkswildlife

**Yes, I would like to order \_\_\_\_ (qty) calendar/s at \$12.70 each (plus postage, see calculator below)**

- Please send all calendars to my address
- Please send \_\_\_\_ calendars to my address and \_\_\_\_ gift calendar/s to gift recipient addresses

### My details

Name \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

Email \_\_\_\_\_

### Gift recipient 1 details\*

Name \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

Email \_\_\_\_\_

### Gift recipient 2 details\*

Name \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

Email \_\_\_\_\_

\*Include additional gift recipients on separate paper and attach to this form.

### SPECIAL OFFER! *Western Australia 2025 Calendar* plus *LANDSCOPE* subscription (within Australia)

- Yes, I would like to order 2025 calendar plus a 12-month subscription to *LANDSCOPE* magazine for \$43.00 – a saving of \$4.95!\*\*
- Yes, I would like to give a gift 2025 Calendar plus a 12-month subscription to *LANDSCOPE* magazine for \$43.00 – a saving of \$4.95!\*\*

\*\*Plus calendar postage, see calculator below

### Payment section

- Payment enclosed: cheque/money order made payable to 'Department of Biodiversity, Conservation and Attractions.'
- Visa  Mastercard

Card number \_\_\_\_\_

Expiry date  /  Amount \$

Signature \_\_\_\_\_

Name (as it appears on card) \_\_\_\_\_

### Postage calculator – 2025 Calendar

Based on Australia Post pricing June 2024. Prices subject to change.

#### Within Australia

- 1 calendar – add \$3.55 (large letter) per address
- 2 calendars going to the same address – add \$9.85 (parcel)
- 3 or more calendars going to the same address – add \$13.40 (parcel)

#### Overseas

Outside Australia add \$14.65 per calendar (Economy air).

# ORDER FORM

|  | SUBSCRIBER'S PRICE | RRP     | QTY |
|--|--------------------|---------|-----|
| Best of the South-West*  | \$14.40            | \$16.95 |     |
| Best of the North-West*  | \$14.40            | \$16.95 |     |
| <b>Bush Books:</b>   |                    |         |     |
| Fungi of the South-West Forests  | \$5.90             | \$6.95  |     |
| Common Trees of the South-West Forests   | \$5.90             | \$6.95  |     |
| Wildflowers of the Stirling Range  | \$5.90             | \$6.95  |     |
| <i>Freckled hawkfish</i> art print available in:<br>A3 \$35, A4 \$25, or A5 \$15 |                    |         |     |

|                            |   |    |
|----------------------------|---|----|
|                            | <b>PRODUCT TOTAL</b>                      | \$ |
| 1-2 items...\$4.00         | <b>Shipping and handling</b>              | \$ |
| 3-4 items...\$6.50         |   |    |
| 5-10 items...\$12.00       | International orders add \$10 per address | \$ |
| 11 or more items...\$15.00 | Express orders add \$5 per address        | \$ |
| * Large format \$12.50     |   |    |
|                            | <b>ORDER TOTAL</b>                        |    |

## Your details

Name

Address

Contact number

Email address

Payment enclosed: cheque/money order made payable to 'Department of Biodiversity, Conservation and Attractions'.

Visa  Mastercard

Card number

Expiry date

/

Amount

\$

Signature

Name as it appears on card

# The art of discovery

A collection of our favourite stories from *LANDSCOPE* showcasing Western Australia. Inspire your next WA adventure.



Freckled hawkfish art print by Gooitzen van der Meer



Purchase online at [shop.dbca.wa.gov.au](http://shop.dbca.wa.gov.au)

# wa naturally

(08) 9219 9000  
customer.service@dbca.wa.gov.au  
17 Dick Perry Avenue, Kensington WA 6151  
Reply Paid 25, Locked Bag 29,  
Bentley DC WA 6983



@waparkswildlife

The advent of DNA sequencing has had a profound impact, affecting all of us in innumerable ways. From the now popular ancestry research (available for humans, cats or dogs!), to establishing paternity, developing medical gene therapies, improving agricultural crops and catching criminals, DNA sequencing is a widely applied tool that has become both accessible and relatively inexpensive. Perhaps most impactful is the use of DNA sequencing in biological research, where it has found a place in virtually all fields, including species and population ecology, conservation biology, environmental surveys, and taxonomy. Scientists at the Department of Biodiversity, Conservation and Attractions (DBCA) are adopting molecular techniques to reveal hidden biodiversity that only a few decades ago would have remained mysteries.

Taxonomy, the science of recognising, characterising, and naming species, has been revolutionised by the use of DNA sequencing. Traditionally based on detailed observations of a species' morphology and comparisons with the morphology of related species, this task is most challenging for species with limited morphological features or where good specimens are lacking. The adoption of DNA sequencing in taxonomy now allows a view of the underlying 'blueprints' that govern that morphology, without the often confounding intrusion of environmental conditions, and greatly improves our understanding of species and their evolutionary relationships in the tree of life.

If we look at the seaweeds as an example, in the latter part of the 20th Century there was a general belief that many species were widely distributed, and many of the earlier-named species in different locations were no longer recognised as unique. When DNA sequencing became common and scientists around the world generated DNA sequences from their local specimens, three things became clear: firstly, that there are considerably more



## Red seaweed (*Hypnea* sp.)

species than previously thought, secondly that in many cases species are not widely distributed, and thirdly the importance of generating DNA sequence data from an 'authentic' specimen to be able to link the genetic entities identified with the correct species names.

These outcomes have recently been re-iterated during the course of molecular research at DBCA. Just as DNA sequencing has revealed that there are many distinct species that in appearance are indistinguishable from one another but are clearly different based on their DNA sequences, so called 'cryptic' species, our research has recently detected a new cryptic species of a seaweed found in the Perth region. For several years this red seaweed at Point Peron has been known as *Hypnea musciformis*, being an excellent match based on morphology, but our molecular data reveal that it does not belong to that species or indeed any other named species. True *Hypnea musciformis* was first described from Trieste in Italy

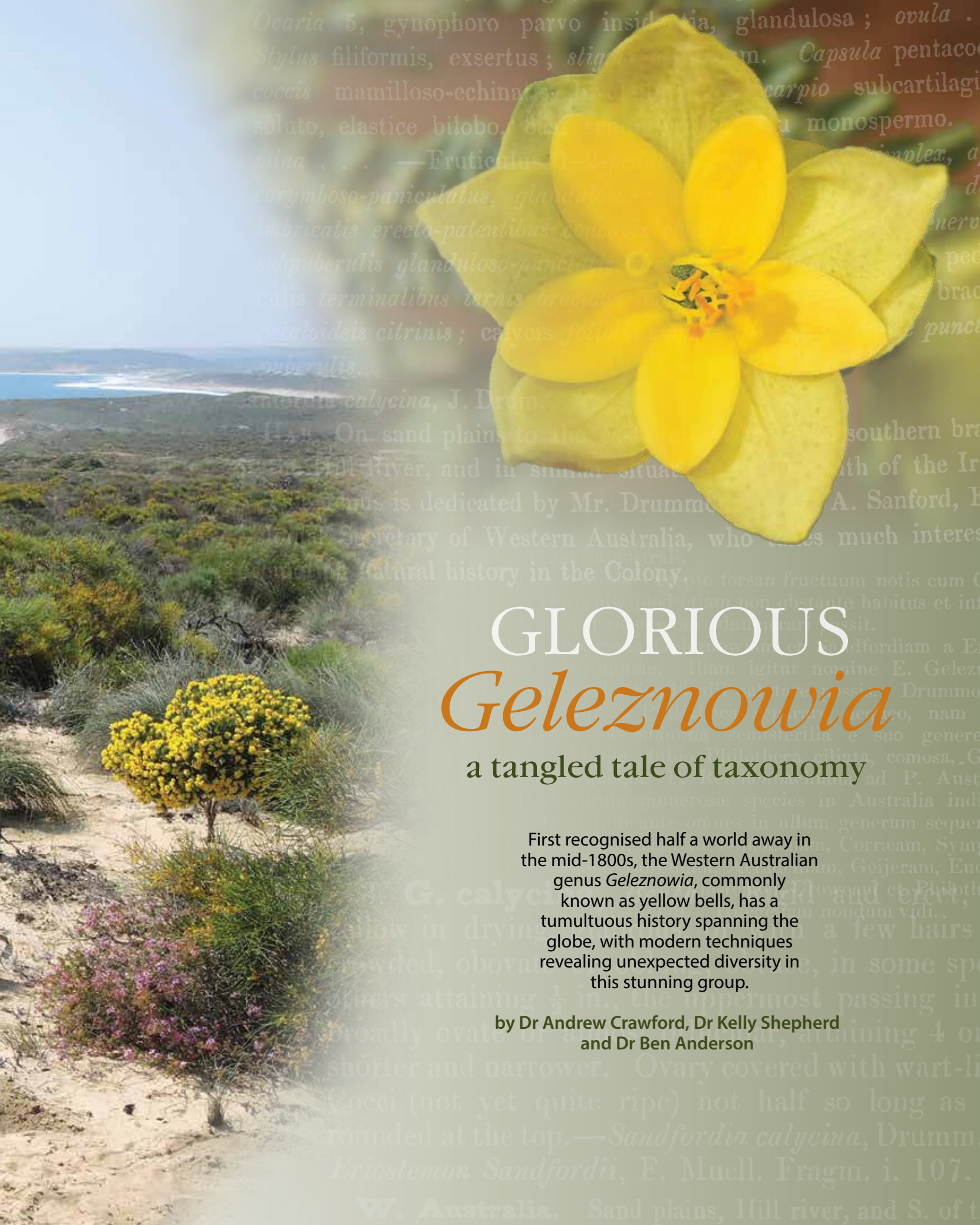
and in the past has been regarded as widely distributed. A cryptic species, also for many years identified as *Hypnea musciformis* but recently named as the new species *Hypnea caraibica*, is regarded as a pest in the Hawaiian islands, where it forms extensive blooms that foul the local beaches. Fortunately, our local entity has never shown a propensity to act similarly and it is a relief that we can now regard it as a native seaweed, albeit one that is yet to be named!

With ongoing global efforts to share sequence data and properly document authentic type specimens, DNA sequencing of seaweeds and other morphologically challenging groups will only continue to reveal more of the unique and wonderful biodiversity of the natural world.

---

**Above** Hiding in plain sight, a new species of red seaweed (*Hypnea* sp.).  
Photo – John Huisman





# GLORIOUS *Geleznovia* a tangled tale of taxonomy

First recognised half a world away in the mid-1800s, the Western Australian genus *Geleznovia*, commonly known as yellow bells, has a tumultuous history spanning the globe, with modern techniques revealing unexpected diversity in this stunning group.

by Dr Andrew Crawford, Dr Kelly Shepherd  
and Dr Ben Anderson



**T**axonomy is the science of naming, describing, and classifying organisms. Historically, botanists relied on morphological features alone to determine relationships, assuming plants that appear more similar are more closely related.

For the most part this is correct, but not always. With the development of sophisticated methods to examine plant DNA, scientists can now test their ideas about plant relationships. Molecular data can corroborate what we already understand, highlight unexpected relatedness between groups that appear quite distinct at first glance, or even reveal hidden diversity that was previously overlooked.

Resolving the taxonomy of a group of closely-related species is not always easy, even with newer DNA tools. The genus *Geleznovia*, commonly known as yellow

bells, is a case in point. This genus has a long and tangled history hidden behind its name, presenting a complex taxonomic problem spanning 174 years.

## BACK IN TIME

In 1849, Nicolai Turczaninow, a Ukrainian-Russian botanist, recognised *Geleznovia* as a new genus in the Rutaceae family. This genus was named after the Russian botanist Nikolai Zheleznov (1816–1877) using the German spelling of his name, Geleznow.

Turczaninow recognised just a single species, *Geleznovia verrucosa*, from a single dried herbarium specimen collected in Western Australia in 1845 by the botanist James Drummond. Drummond was among the first colonists to arrive with Captain James Stirling to establish the Swan River Colony in 1829. Over the years he supplemented his income by selling plant specimens and seeds to herbaria across Europe, some of which were eventually obtained by Turczaninow. Drummond's precious specimen is called a holotype, as it is the reference specimen for the name *Geleznovia verrucosa*. In modern times, the holotype resided in the National Herbarium of Ukraine in Kiev; however, due to the current war with Russia it was evacuated along with other critical specimens to another location for safe keeping.

Turczaninow's original description of *Geleznovia verrucosa* was written in Latin and published in a journal based in Moscow. As was often the case, this early publication was not seen by other taxonomists. Consequently, in 1855 an Irish botanist, William Harvey, named another new genus comprising a single species *Sanfordia calycina*, again

from material originating from James Drummond.

Sir Ferdinand von Mueller, the then-director of the Royal Botanic Gardens, Melbourne, did not agree with the taxonomy of Turczaninow and Harvey, and declared in his book *Fragmenta Phytographiae Australiae* published in 1859, "I do not see how *Geleznovia* and *Sanfordia* can be distinguished from the genus *Eriostemon*" (note that he spelled *Sanfordia* incorrectly when he did this, just to add to the confusion). *Eriostemon* was a genus within the Rutaceae family that had first been described in 1798, prior to either *Geleznovia* or *Sanfordia*, hence this name had precedence, meaning that *Geleznovia verrucosa* became *Eriostemon geleznovii* and *Sanfordia calycina* became *Eriostemon sanfordii*.

Only four years later in 1863, George Bentham, a botanist based at the Kew Royal Botanic Gardens in London, published the first volume of his *Flora Australiensis* series, and he concluded that *Geleznovia* should be reinstated as a genus distinct from *Eriostemon*. *Eriostemon geleznovii* reverted to its original name of *Geleznovia verrucosa*, while *Eriostemon sanfordii* was given the new name *Geleznovia calycina*.

In addition to these two previously recognised species, *Geleznovia macrocarpa* was also recognised as distinct based on a fragmentary specimen, as Bentham thought it had larger flowers.

## RENEWED INTEREST

For the next 90 years there were no changes to the naming of *Geleznovia*. Then, in 1954 Blackall and Grieve's seminal work on the identification of the flora of south-western Australia, *How to Know*

.....  
*Previous page*

**Main** *Geleznovia amabilis* growing south of Kalbarri.

*Photo – Kelly Shepherd/DBCA*

**Top far right** *Geleznovia verrucosa*.

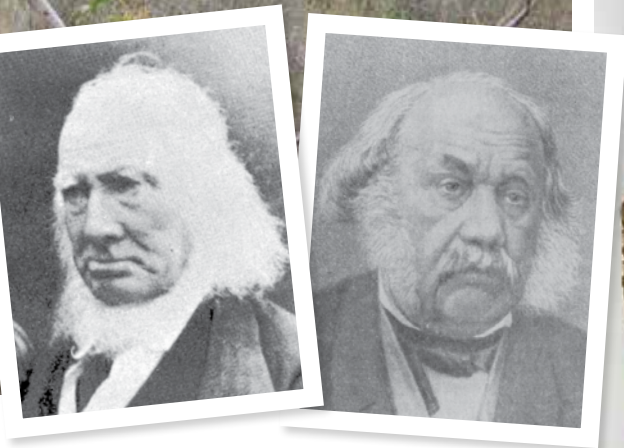
*Photo – Fred and Jean Hort*

**Background far right from top** Extract from Willam Harvey's letters in *Hooker's Journal of Botany and Kew Garden* (1855); Extract from Sir Ferdinand von Mueller's book *Fragmenta Phytographiae Australiae* (1859); Extract from George Bentham's book *Flora Australiensis* (1863).

**Above** *Geleznovia narcissoides* flowers are reminiscent of daffodils.

**Above right** Ben Anderson photographing *Geleznovia eximia*.

*Photos – Kelly Shepherd/DBCA*

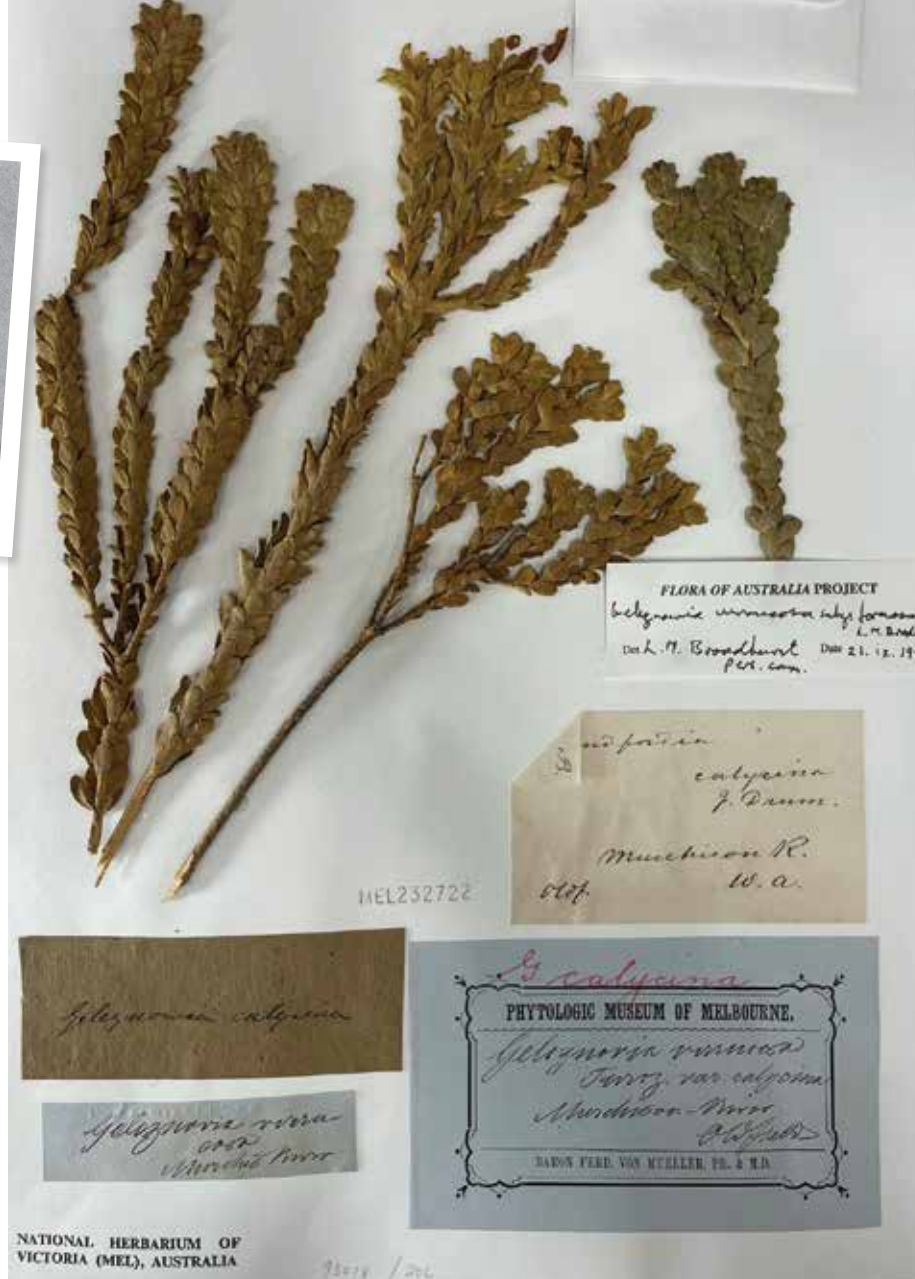


“Turczaninow recognised just a single species, *Geleznovia verrucosa*, from a single dried herbarium specimen collected in Western Australia in 1845 by the botanist James Drummond.”

*Western Australian Wildflowers*, was published. In this book there is no reference to *Geleznovia macrocarpa*, and although *Geleznovia calycina* is listed as a species, it is noted as being “... only a small form of *G. verrucosa*”. By 1981, when Green’s *Census of the vascular plants of Western Australia* was published, only *Geleznovia verrucosa* was recognised as distinct.

The late 1990s saw a renewed interest in the taxonomy of *Geleznovia*. Yellow bells, due to their stunning floral display, were a popular target for wildflower pickers supplying cut flowers for the floriculture industry. Despite only one species of *Geleznovia* being recognised at this time, the pickers and sellers of the yellow bells recognised that there were several forms of *Geleznovia*, known by colloquial names such as ‘daffodil’, ‘tinged’ and ‘mini’.

Identifying these forms was important to the industry, for example the form known as ‘daffodil’ was more valued due to its large showy flowers. Two scientific studies on *Geleznovia* started around this time. The first was a PhD study by Linda Broadhurst at Curtin University examining the morphology and genetics of the species, and the second was a floriculture project headed by Dr Julie Plummer at the



University of Western Australia (UWA) seeking to determine whether *Geleznovia* could be established in cultivation as a cut flower crop.

Linda Broadhurst concluded, with support from the genetic techniques of the day, that two subspecies of *Geleznovia verrucosa* merited taxonomic recognition, and a third form was suggested to be a hybrid. Meanwhile, the floricultural project recognised six distinctive floricultural forms.

Unfortunately, no further work was undertaken to try and resolve the complexity evident within this group and by 2013 when Paul Wilson published his treatment of the genus in *Flora of Australia*, only the single species *Geleznovia verrucosa*

Above A scan of *Geleznovia* specimen collected by A.F. Oldfield.  
Photo – National Herbarium of Victoria

Inset above far left Botanist James Drummond collected *Geleznovia* specimens in 1845 from Western Australia.  
Photo – Ewen Mackenzie

Inset above left Botanist Nicolai Turczaninow recognised *Geleznovia* as a new genus in 1849.

was recognised. Although Wilson did note that due to the variation seen in its leaves, hairs and flowers, there may be several unrecognised subspecies. After the completion of the floricultural project at UWA, one of the project participants,

# Timeline of taxonomy of *Geleznovia*

| Botanist                                | Taxonomy   |
|---|--|
| 1849 Nicolai Turczaninow                | <i>Geleznovia verrucosa</i>  |
| 1855 William Harvey                     | <i>Sanfordia calycina</i>  |
| 1859 Sir Ferdinand von Mueller          | <i>Eriostemon geleznovii</i> and <i>Eriostemon sanfordii</i>   |
| 1863 George Bentham                     | <i>Geleznovia macrocarpa</i> , <i>Geleznovia verrucosa</i> , and <i>Geleznovia calycina</i>  |
| 1954 W.E. Blackall and B.J. Grieve      | <i>Geleznovia verrucosa</i> and <i>Geleznovia calycina</i>   |
| 1981 J.W. Green                         | <i>Geleznovia verrucosa</i>  |
| 2000 G. Paczkowska and A.R. Chapman     | <i>Geleznovia verrucosa</i> subsp. <i>verrucosa</i> ms and <i>Geleznovia verrucosa</i> subsp. <i>formosa</i> ms  |
| 2007 Western Australia Herbarium        | <i>Geleznovia verrucosa</i> subsp. <i>Kalbarri</i>   |
| 2013 Paul Wilson                        | <i>Geleznovia verrucosa</i>  |
| 2013 Western Australia Herbarium        | <i>Geleznovia</i> sp. <i>Binnu</i> , <i>Geleznovia verrucosa</i> , <i>Geleznovia</i> sp. <i>Marchagee</i> , and <i>Geleznovia</i> sp. <i>Red Bluff</i>   |
| Colloquial names assigned               | <b>Daffodil</b> , <b>White peak</b> , <b>Tinged</b> , <b>Broad's</b> , <b>Mini</b> , <b>Kalbarri</b>   |
| 2020 Kelly Shepherd and Andrew Crawford | <i>Geleznovia narcissoides</i> , <i>Geleznovia eximia</i> , <i>Geleznovia calycina</i> , <i>Geleznovia uberiflora</i> , <i>Geleznovia verrucosa</i> , <i>Geleznovia oculata</i> , and <i>Geleznovia amabilis</i> |
| 2023                                    | <i>Geleznovia narcissoides</i> , <i>Geleznovia eximia</i> , <i>Geleznovia calycina</i> , <i>Geleznovia uberiflora</i> , <i>Geleznovia verrucosa</i> , <i>Geleznovia oculata</i> , and <i>Geleznovia amabilis</i> |



Top *Geleznovia amabilis*.

Left *Geleznovia oculata*.

Inset from far left  
Tinged (*Geleznovia calycina*);  
White peak (*Geleznovia eximia*).  
Photos – Kelly Shepherd/DBCA

Tinged (*Geleznovia uberiflora*).  
Photo – Andrew Crawford/DBCA



Andrew Crawford, moved to a job based at the Western Australian Herbarium. He continued to collect specimens of *Geleznovia* and lodge them at the herbarium, adding to the knowledge about the distribution and variation of the species.

Subsequently, a thorough inspection of all the WA Herbarium collections of *Geleznovia* by resident taxonomist Kelly Shepherd led to three additional putative species being identified, which corresponded to some of the floricultural forms that had previously been identified. These were allocated the informal phrase names: *Geleznovia* sp. Binnu (K.A. Shepherd & J. Wege KS 1301), *Geleznovia* sp. Marchagee (A. Crawford ADC 1353) and *Geleznovia* sp. Red Bluff (A. Crawford ADC 597).

In 2020, *Geleznovia* sp. Red Bluff was formally named and described as *Geleznovia amabilis*. It was recognised as a species of conservation concern, as it is currently only known from a few populations around Kalbarri. The specific epithet (the second part of its binomial Latin name) means ‘worthy of love’, an appropriate choice given its striking flowers.

## EMPLOYING GENOMICS

Even though some progress had been made, it was clear that further help was needed to untangle the rest of this complex. The group was investigated as part of the national Genomics for Australian Plants conservation genomics project ([genomicsforaustralianplants.com/geleznovia-verrucosa-conservation](http://genomicsforaustralianplants.com/geleznovia-verrucosa-conservation)). In the spring of 2020, while the COVID-19 pandemic swept around the world and many were in lockdown, Kelly Shepherd and Carol Wilkins were able to undertake

fieldwork, sampling populations across the various forms previously recognised in *Geleznovia*. The samples were sequenced and then analysed by Ben Anderson and Rachel Binks using modern genomic techniques.

The molecular results corroborated initial ideas but also pointed to some unexpected relationships. So, after a long and complicated journey that started with a single species, a combination of traditional taxonomy and modern genetics has now resulted in the recognition of seven species in the genus. This includes *Geleznovia verrucosa*, *Geleznovia amabilis*, and four new species, as well as the reinstatement of *Geleznovia calycina*, a species previously described in 1855 by Harvey (under the genus *Sanfordia*). Two of the new species revealed by the genetic results, *Geleznovia occulta* and *Geleznovia eximia*, are very rare in the wild, with the latter currently only known from three plants within one population.

Some of these species corresponded to the horticultural forms or phrase named species that had previously been identified. For example, *Geleznovia* sp. Binnu (the ‘daffodil form’) was named *Geleznovia narcissoides*; a name based on the daffodil genus *Narcissus* with the addition of *-oides* meaning “like”, alluding to this species having showy flowers that are reminiscent of a double-headed daffodil.

To further complicate matters, when scanned images became available of the holotype of *Geleznovia verrucosa* held in the National Herbarium of Ukraine, it became clear that the phrase-named *Geleznovia* sp. Marchagee represented true *Geleznovia verrucosa*, while most specimens named as *verrucosa* were either

*Geleznovia calycina* or the new species *Geleznovia uberiflora*.

Over the long and complicated history since yellow bells were first described, the number of names and concepts have varied (see timeline on page 46). This may also not be the final word, as there may yet be more diversity to be discovered. The UWA horticultural study mentioned another unrecognised ‘form 5’ that has not been seen in the wild since then, and no specimens are available for study. While we have come a long way in clarifying what names go with which species and how they are related to each other, there may yet be another chapter to be written about these stunning plants.

.....  
**Top left** Card showing dissected fresh flowers of *Geleznovia amabilis*.

Photo – Kelly Shepherd/DBCA

**Above** Kelly Shepherd providing updated determinations to *Geleznovia* specimens.

Photo – Andrew Crawford/DBCA

**Dr Andrew Crawford** is a Research Scientist in DBCA’s Biodiversity and Conservation Science and manager of the Western Australian Seed Centre at Kensington. He can be contacted at [andrew.crawford@dbca.wa.gov.au](mailto:andrew.crawford@dbca.wa.gov.au)

**Dr Kelly Shepherd** is a Senior Research Scientist (taxonomy) in DBCA’s Biodiversity and Conservation Science based at the Western Australian Herbarium. She can be contacted at [kelly.shepherd@dbca.wa.gov.au](mailto:kelly.shepherd@dbca.wa.gov.au)

**Dr Ben Anderson** is a Research Scientist (Plant Systematics) in DBCA’s Biodiversity and Conservation Science based at the Western Australian Herbarium. He can be contacted at [benjamin.anderson@dbca.wa.gov.au](mailto:benjamin.anderson@dbca.wa.gov.au)

# Langford Park

*Milling, mining and mountain biking*

by Lauren Cabrera





Once the site of Alcoa's first bauxite mine in the 1960s, Langford Park is today a popular trail network where hikers and mountain bikers can weave their way through the rehabilitated forest. Recent trail and facility upgrades mean the park is providing an enriched experience for visitors.

**L**angford Park near Jarrahdale was once the site of Alcoa's first bauxite mine in Western Australia where shallow surface mining occurred between 1963 and 1998. The park opened in February 1975 and has been progressively rehabilitated since the closure of the mine.

The park is home to a popular mountain bike trail network that attracts more than 50,000 visitors each year. The trails have recently been upgraded, drawing mountain bikers of all levels, and also serves as a gathering place for families to appreciate the surrounding rehabilitated forests.

## ANCIENT LANDS

The Jarrahdale area is the traditional lands and waters of the Whadjuk Noongar peoples. Their leader at the time of European settlement was known as Munday and his lands were the Beelo, which include the area known today as the Shire of Serpentine Jarrahdale.

The Whadjuk Noongar peoples wandered over their lands during the six



.....  
Previous page

**Main** The Fox mountain bike trail.

Photo – DBCA

**Right** Silvereye (*Zosterops lateralis*).

Photo – Georgina Steytler

**Top right** Cyclists gather before hitting the trails.

Photo – Paul Chauvel/DBCA

**Above right** Bauxite is a type of rock found along the Darling Range.

Photo – Shutterstock

**Above far right** A plaque honouring the park's history as a former bauxite mine.

Photo – DBCA

seasons—visiting, hunting and gathering, attending ceremonies, trading and exchanging according to the lore and customs within their family structure.

Adults were lifelong custodians and interpreters of the land, ensuring information and responsibility was passed on to the younger generations through song, story, dance, and ritual.

## ON YOUR BIKE

The mountain bike trail network at Langford Park is popular due to its proximity to Perth, located only 50 minutes' drive south-east of the city, as well as being a recreation site and picnic area for families.

There are 11 signposted trails to choose from, varying in length from 700 metres to 5.1 kilometres, weaving through the rehabilitated bauxite mine and the surrounding jarrah and marri forest.

The trails are rated easy (green) to moderate (blue) and are suitable for beginner and intermediate riders who like riding 'old school' natural flowy cross-country trails. Riders can expect a mix of

easy climbs, fast descents, tight technical stretches, and long-flowing loops.

The park's trail network was designated as a priority location for regional development in the 2017 Peel Regional Trails Strategy and in the 2018 Perth and Peel Mountain Bike Master Plan.

Improvements include better drainage, trail re-surfacing, new trails and enhanced features to ensure a more sustainable network and an enriched rider experience.

It also includes a dual-use link from Langford Park to Jarrahdale, improving access to Langford Park from the townsite.

New signs and upgraded day-use facilities, such as picnic and barbecue areas, are designed to bring friends, families and the community together, to safely navigate the trails and appreciate the area's rich history, culture and nature.

"We were thrilled to contribute to the upgrade of the trails and facilities at Langford Park, which was a prime example of valuable post-mining land use," Alcoa Australia President Matt Reed said.

"The park, which opened in 1975, is named after our first manager of mines, James N Langford, and we are delighted



Discover more about  
Langford Park

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





that today it is a valued attraction for locals and visitors alike.”

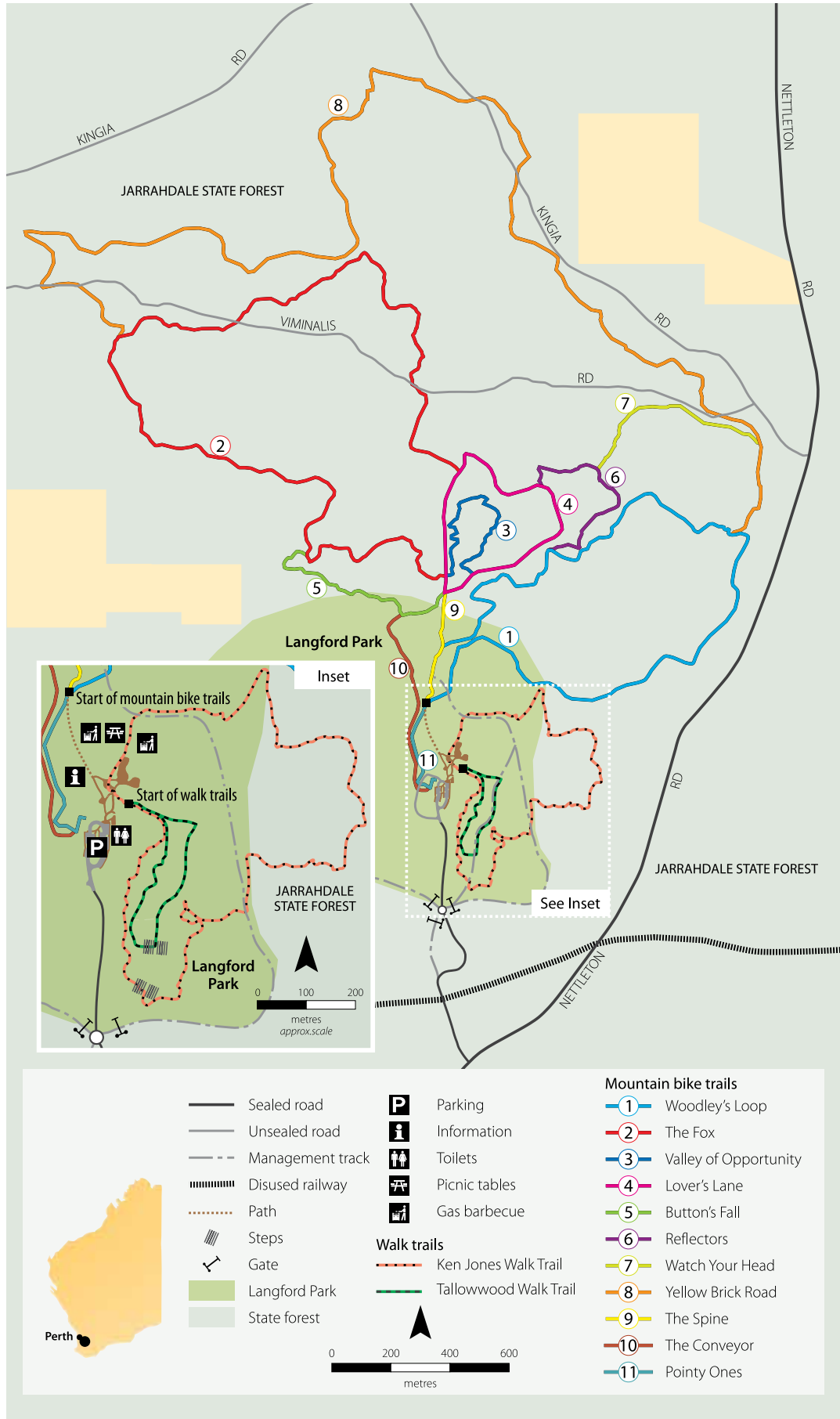
The upgrades to Langford Park are thanks to a \$400,000 investment from Alcoa Australia to mark the aluminium producer’s 60th year of Australian operations,” Mr Reed said.

### MILLING AND MINING

Jarrahdale has a strong timber milling history dating back to the 1830s. Roads were created to facilitate the movement of timber through Kelmscott, Pinjarra and Bunbury that are now known as Albany Highway and South West Highway.

Alcoa’s Jarrahdale bauxite mine operated for 35 years from 1963. Bauxite is a type of rock formed from the weathering of ancient granite bedrock and is found along the Darling Range. It is often located as a loose layer just beneath the soil and is used in producing

**Above** Enjoying the new mountain bike trails.  
Photo – Shem Bisluk/DBCA





“New signs and upgraded day-use facilities, such as picnic and barbecue areas, are designed to bring friends, families and the community together, to safely navigate the trails and appreciate the area’s rich history, culture and nature.”

aluminium, a recyclable metal used in products we use every day.

Progressive rehabilitation occurred from 1966 to 2001 based on the State’s rehabilitation requirements of the day.

In the early days, various species from the eastern states of Australia, such as tallowwoods, sugar gum (*Eucalyptus cladocalyx*), spotted gum (*Corymbia maculata*), and Tasmanian blue gum (*Eucalyptus globulus*), as well as pine, were commonly used. The trees were planted as quick-growing alternatives to the jarrah tree because they were mostly native Australian hardwoods, dieback resistant and produced quality timber. The trees, along with thousands of other seedlings, were grown in Alcoa’s nursery and were planted in the park in the late 1960s and early 1970s.

The earliest approach to rehabilitation involved planting these trees in neat rows. However, this did not result in a natural-looking forest. In later years, this was solved by seeding rather than planting.

While walking or riding the trails, visitors may pass by she-oaks (*Allocasuarina*), jarrah, spotted gums, blue gums and some snottygobble trees

(*Persoonia longifolia*). This bush tucker plant has a weeping foliage and flaky bark with long, slender sickle-shaped leaves.

Sugar gums can also be seen with their mottled yellow to orange bark and smooth grey old bark that sheds in irregular patches and have creamy white flowers in summer.

Later rehabilitation efforts supported a more diverse understorey of native plants and offer a wider range of habitats and food sources. Birds and insects are the most commonly heard and seen wildlife in the park including Australian magpie (*Gymnorhina tibicen*), common bronzewing (*Phaps chalcoptera*), silvereye (*Zosterops lateralis*), western whistler (*Pachycephala fuliginosa*), splendid fairy-wren (*Malurus splendens*), and black-faced cuckoo-shrike (*Coracina novaehollandiae*).

By observing the arrangement of trees and the diversity of the understorey, you can piece together the rehabilitation history of the park.

The upgrades to Langford Park are timely as Jarrahdale evolves into a flourishing recreation and trails destination.

**Top left** Western whistler (*Pachycephala fuliginosa*).

Photo – Adobe Stock

**Above left** Celebrating the opening of new trails.

Photo – Peter Nicholas/DBCA

**Above** Visitors are immersed in the forest along the trails.

Photo – DBCA

**Below** Fruit of the snottygobble (*Persoonia longifolia*), a shrub or small tree.

Photo – Bron Anderson/DBCA



**Lauren Cabrera** is a LANDSCOPE editor. She loves trail running in the hills around Perth, where she lives. She can be contacted at (08) 9219 9903 or [lauren.cabrera@dbca.wa.gov.au](mailto:lauren.cabrera@dbca.wa.gov.au)

For more information about Langford Park’s trail network visit [exploreparks.dbca.wa.gov.au](http://exploreparks.dbca.wa.gov.au)

## Ribbiting sounds

In the south-west of Western Australia, we are lucky to have a diverse range of frog species, all which have a unique call to help identify them with.







Use the table below to identify which frogs are calling near Perth, at different times of the year.



Scanning the QR code will take you to the WA Museum website to listen to the different calls WA frogs make.

| JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|     |     |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |     |     |     |     |

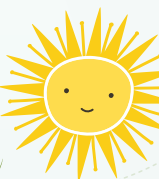
  

|  |  |  |   |  |  |
|--|--|--|---|--|--|
|  |  |  |  |  |  |
| Moaning frog   | Motorbike frog   | Quacking frog  | Slender tree frog   | Squelching froglet   | Western banjo frog   |

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | F | H | W | I | Q | L | W | E | A | H | G | W | N |
| B | N | G | L | Y | A | D | E | Q | S | G | B | E | E |
| V | A | V | P | A | A | L | D | E | D | E | D | S | A |
| F | N | Q | J | M | O | A | N | I | N | G | A | L | R |
| M | D | D | G | D | F | L | B | T | J | L | C | E | F |
| W | S | Q | U | E | L | C | H | I | N | G | T | N | T |
| B | G | G | U | G | J | I | B | T | K | Q | E | D | S |
| A | H | H | J | A | K | J | A | T | L | W | S | E | A |
| N | J | U | L | K | C | H | N | O | O | E | D | R | G |
| J | O | P | P | H | L | K | P | M | F | R | G | T | B |
| O | M | O | T | O | R | B | I | K | E | R | U | R | U |
| F | S | Q | Q | N | M | C | M | N | Y | B | L | E | I |
| L | H | D | D | G | P | X | O | S | G | B | K | E | O |
| A | M | J | S | F | L | A | T | G | T | N | J | U | L |

### Can you find these frog names?

- Motorbike
- Slendertree
- Moaning
- Banjo
- Quacking
- Squelching



Photos – 1, 5 & 6. Babs & Bert Wells/DBCA; 2. anjahrenn/Adobe Stock; 3 & 4. Mark Cowan.





## Freckled hawkfish (*Paracirrhites forsteri*)

The freckled hawkfish, also known as Forster's hawkfish or blackside hawkfish, is a species of marine ray-finned fish belonging to the family Cirrhitidae with a deep, stout body and high-set eyes, typical of the hawkfishes. Adult freckled hawkfish reach a maximum total length of about 22 centimetres and undergo colour changes several times during their lifetime. As a juvenile, it is burgundy with a yellow tail. As an adult, it may be pink, brown, or an olive colour. The black or red freckles on the face are constant throughout its lifetime.

Illustration by Gooitzen van der Meer

Reference photo by Alex Steffe/Lochman Transparencies

# Scope & explore



@waparkswildlife



## How to subscribe



**PRINT edition**  
iSubscribe.com  
shop.dbca.wa.gov.au



**DIGITAL edition**  
zinio.com  
shop.dbca.wa.gov.au/landscape-extras\*  
\*(online subscribers only)



**PODCAST**  
Search 'Western Australia  
by nature' wherever you  
get your podcasts





ISSN 0815-4465



2023/692

[shop.dbca.wa.gov.au](http://shop.dbca.wa.gov.au)

**wa naturally**