

WA'S PARKS, WILDLIFE AND CONSERVATION MAGAZINE

LANDSCOPE

Volume 39 Number 3 Autumn 2024 \$7.95

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South-west WA's
highest peak



**Sensed
phenomena**

Listening to the
seasons

Ray of white

Eagle rays in the Swan

Mysterious centipedes

Predatory arthropods

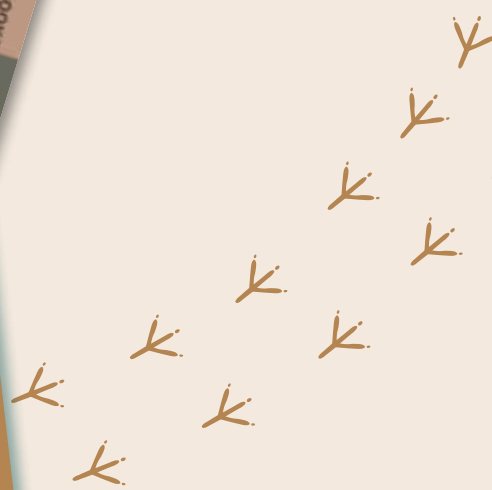


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ON THE COVER

Front cover Stirling Range National Park is home to the short-beaked echidna (*Tachyglossus aculeatus*).
Photo – David Bettini

Back cover The Noongar season of djeran is a time of red flowers, including the red flowering gum (*Corymbia ficifolia*).
Photo – Sophie Xiang

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.

An ecosystem is a partnership of all the biological elements in an interconnected system. This includes humans who are constantly trying to strike the right balance between sustainably using and protecting the natural environment.

This edition of *LANDSCOPE* takes readers onto Nharnuwangga Wajarri Ngarlawangga Country in the Pilbara (see 'New protection for ancient sites' on page 12), where a newly established joint management partnership enables Traditional Owners to work on Country, rediscover cultural sites and care for their ancestral land.

We also go back to childhood, where Nature Play WA partners with the City of Canning to deliver the Muddy Hands Festival (see 'Adventure out: Muddy hands, happy hearts' on page 17) and we see through the eyes of 10-year-old Olivia Thomas as she immerses herself in the pure joy of getting dirty in nature through unstructured play.

As the south-west of the State moves out from the hot and dry weather of the Noongar season of bunuru and into the cooler weather of djeran, we learn about the delicate partnership of all the nuanced and lived experiences that indicate the changes in seasons for Noongar Aboriginal peoples (see 'Listening to the seasons' on page 36).

A long-term partnership with Perth Zoo of more than 25 years has resulted in established populations of dibblers in the wild that have been so successful they have led to the completion of the breeding program (see 'Clear the tanks: dibbler breeding program a resounding success' on page 42).

When we work together, we can achieve great things and become greater than the sum of our parts. As we look forward towards the future, we can be proud of the long-standing partnerships that have grown from a shared vision.

Journey through the pages and discover the power and purpose of strategic conservation actions in WA's amazing ecosystems.

Morgan Marsh, A/Deputy Director General, Strategy and Governance
Department of Biodiversity, Conservation and Attractions



Contributing Allan Wills is a Senior Technical Officer based in Manjimup, engaged for more than 37 years in fire and invertebrate ecology in the forest. Allan explores how climatic seasonality interacts with fire, and changes in not only invertebrate populations but biotic phenomena generally. He also enjoys learning about Noongar

Aboriginal concepts of phenomenon-based seasonality.



Tiana Jones is a passionate conservationist and educator. She is based in Kalgoorlie working with multiple Traditional Owner groups to run flora and fauna projects. Her focus is on fauna research and closing knowledge gaps that exist in Western Australian deserts. She has also been building on her passion for kids' conservation education by running bush trips to monitor the environment in their local area.



Emily Taljaard is a passionate marine biologist with special interests in elasmobranchs and their interaction with commercial fisheries. While still new to the marine biology field, she has just completed her Master's degree exploring various biological characteristics, including age, reproduction and diets of the southern eagle rays (*Myliobatis tenuicaudatus*). She will soon be beginning a PhD with the Charles Darwin University looking at elasmobranch bycatch in commercial fisheries.



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This page Centipede (*Scolopendra laeta*).

Photo – Jiri Lochman



Department of Biodiversity, Conservation and Attractions

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Dibbler (*Parantechinus apicalis*)





READER'S PIC

Blue banded bee (*Amegilla cingulata*)

Photo and words by Nicole Ilich

"I was wandering around one of our local reserves in Kondinin taking photos of wildflowers, birds, lizards and pretty much anything that caught my eye, when I noticed these bees on the *Calothamnus quadrifidus*—one-sided bottlebrush.

They were continuously flying in and drinking the nectar from the flowers. This one kindly latched on for a few seconds to get this shot.

I have now noticed how many are around, even in my garden, and I am enjoying taking a lot of photos of them. I think I need to build a mud brick bee wall in the backyard!"

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

Take 4 for the shore

The students at Attadale Primary School were devastated to learn that some resident dolphins had died from being entangled in fishing line in the Swan River. They were so concerned about the amount of rubbish along the foreshore they created some fantastic posters to encourage people to pick up four pieces of rubbish when they visit the beautiful Swan River. A total of 11 different posters were designed with species that can be seen along the river with the phrase "Take 4 for the Shore!"



Langford Park upgrades to thrill adventure seekers

Visitors to Jarrahdale's popular Langford Park can now experience an upgraded mountain bike trail network and new day-use facilities.

Attracting 50,000 visits a year on average, the newly upgraded Langford Park is poised to be a haven for adventure seekers and a gathering place for families.

The trails are open for mountain bikers of all levels to appreciate the surrounding rehabilitated forests.

Improvements to existing trails including better drainage and trail re-surfacing, as well as new trails and enhanced features, will 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.

Improved signs will assist visitors to navigate the trails and appreciate the area's history, culture and nature.

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.

Above Enjoying the upgraded mountain bike trails.
Photo – DBCA

WA attractions feature in ABC TV travel show

Some of Western Australia's most popular natural tourist attractions and national parks have featured in a TV travel show *Bill Bailey's Wild West Australia*, which aired on the ABC in Australia and on the UK's Channel 4 in November and December 2023.

Comedian and TV personality Bill Bailey visited iconic areas including Valley of the Giants Tree Top Walk, the Pinnacles, Hamelin Pool, Shark Bay, Ningaloo and Cape Range.

After swimming with a whale shark on the Ningaloo coast, Bill met with Baiyungu Traditional Owner and DBCA cultural adviser Hazel Walgar to learn more about the region.

Hazel discussed the painful history of the stolen generations and the importance of practicing culture on Country.

Bill explored the nearby Cape Range National Park, describing its deep gorges and rugged limestone as "spectacular" and "awe-inspiring".

"It makes you stop and catch your breath. It's one of those days when it makes you think 'I'm glad to be on this earth, to see this,'" he said.



Above Bill Bailey with DBCA's Theres Morris in Hamelin Pool.
Photo – Bill Bailey

Discover the southern forests

A brand-new ropes course, Aerial Adventure Pemberton, has arrived at Gloucester National Park offering a multi-level treetop experience, including a 114-metre flying fox. Since opening on Boxing Day 2023, the new venture has lured in hundreds of visitors eager to experience the southern forests from up above.

D'Entrecasteaux, Greater Beedelup, Shannon and the Warren and Gloucester national parks are still open despite recent engineering assessments identifying structural issues with the steel platforms atop the nearby Gloucester Tree and Bicentennial Tree. Climbers are asked to keep off the trees while the issues are rectified.

However, there is plenty to enjoy in the area, from camping, four-wheel-driving, fishing, spectacular beaches, inlets, canoeing, walking trails, scenic drives and much more.

.....

Left Aerial Adventure ropes course.
Photo – Cecile Leclere



Guest column



Vanessa Kickett
CEO, South West Aboriginal Land and Sea Council

Noongar knowledge of caring for Country or boodja has been used for thousands of years. While our knowledge was largely overlooked during colonisation, we are now seeing an increasing interest in our traditional ways of land management.

On Noongar boodja—in Western Australia's south-west—there are six weather seasons, each with distinctive features. Learning about our seasons is key to understanding how we care for our Country (see 'Listening to the seasons' on page 36).

Unlike the European calendar, the change in Noongar seasons is determined by the environment for example, when the wildflowers start to flower, we know we're entering kamarang, and when the magpies are swooping, we are in djilba. The way Noongar lived, hunted, and cared for the land shifted with these seasons.

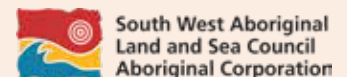
Noongars don't control the land—we are the custodians of it.

During birak and bunnuru, the two hottest seasons on Noongar boodja, Noongars traditionally used controlled 'mosaic' burns in the bush to reduce the undergrowth and encourage new grass and young plants to sprout. This made it easier for Noongars to move across the land and flushed animals out into the open for grazing—making them easier to hunt.

In modern Australia, the impacts of climate change and our urban landscapes create challenges in caring for boodja in the same ways that our ancestors did. But these challenges also provide opportunities.

Important partnerships such as the Metropolitan Noongar Ranger Program are a positive way to for local councils and governments to engage with our traditional knowledge and empower the Noongar community.

We all love this place and want to see our boodja flourish. By fostering mutually beneficial partnerships that connect modern science and ancient knowledge—we can work together in caring for this ancient, biodiverse, and life-sustaining boodja.





Stirling Range National Park

Around 80 kilometres north of Albany lies Stirling Range National Park, so named after the rugged peaks of the Stirling Range that mark the landscape with their impressive size and jagged edges.

The Aboriginal name for the range is Koi Kyenunu-ruff, which means ‘mist rolling around the mountains’; a frequent sight.

Many visitors flock to Stirling Range National Park for the challenge of climbing the highest peak in the south-west of Western Australia, Bluff Knoll, which rises 1095 metres above sea level creating a challenging and spectacular hiking experience. The surrounding range draws others to the brooding mountain landscape that comes alive in the spring with a stunning display of unique wildflowers.

Above Rainbow and mist at Bluff Knoll.
Photo – Alice McGlashan/Sallyanne Cousins Photography

The range stretches east-west for more than 65 kilometres and is characterised by stark cliff faces, magnificent views and abundant, vibrantly coloured flowering plants. At any time of year, there will always be some plants in bloom in the park and the Stirling Range is one of the few places in WA where snow occasionally falls.

CULTURAL HISTORY

The Mineng and Goreng Noongar Aboriginal peoples originally lived in and around the Stirling Range and surrounding Country. In cold weather, they built small, conical huts and wore kangaroo skin cloaks reaching nearly to the knee.

The lowlands surrounding the peaks were once important sources of food for Noongar peoples. Women gathered

roots, seeds and fruit while men hunted kangaroos, wallabies and other animals.

When European settlers arrived they took up land, created farms and raised livestock. The area was declared a national park in 1913, at a time when the dominant practice leaned towards clearing the bush and converting it to farmland.

Displaced from their traditional land, many Noongar people worked on farms and lived on settlements or in missions.

Depending on the intent of the speaker, Bluff Knoll is called Bular Mial (‘many eyes’) or Bala Mial (‘his eyes’) by Noongar people. This was because they believed the rocks on Bluff Knoll were shaped like faces.

The peak is often covered by mists, which curl around the mountain tops and float into the gullies. These constantly



Above far left Little Mondurup and Mondurup peaks.
Photo – DBCA

Above left The spikey flower head of *Andersonia* sp.
Photo – Anne Cochrane

Above Western whistler (*Pachycephala fuliginosa*).
Photo – Sallyanne Cousans

Far left Mardo or yellow-footed antechinus (*Antechinus flavipes*).
Photo – Jiri Lochman

Left Prickly Banksia (*Banksia aculeata*).
Photo – Rob Olver

changing mists were believed to be the only visible form of a spirit called Noatch, who had an evil reputation.

Bluff Knoll continues to be of great spiritual significance to Aboriginal peoples of the south-west as they believe it is home to a powerful ancestral being.

PLANT LIFE

The Stirling Range area is in the Southwest Australian Floristic Region that is internationally recognised as one of the world's top 35 hotspots for biodiversity, receiving Australia's highest heritage honour in 2006 when it was added to the National Heritage List.

The cloud-touched peaks, sheltered valleys, exposed rock faces, moist gullies, windswept lowlands and protected crevices of the range provide countless combinations of altitude, soil, rainfall, sunlight and exposure, enabling more than 1500 species of flowering plants to exist there.

More than eighty species of plants are endemic to the range and the park is particularly rich in banksias, eucalypts, orchids and verticordias (feather flowers).

The landscape displays a mosaic of thicket, mallee-heath, woodland and

wetland habitats plus a unique and threatened 'montane' plant community found only on the tops of the high peaks.

Among the most beautiful and iconic of the plants are the darwinias, or mountain bells. Nine species of mountain bell have been identified in the park and only one of these is found outside Stirling Range.

Phytophthora dieback is a major problem in the Stirling Range. Caused by a microscopic water mould that dwells in the soil, this plant pathogen kills plants by rotting their roots.

Dieback threatens biodiversity by not only killing plants but also by destroying wildlife habitat, placing the health and survival of whole ecosystems at risk.

ANIMAL LIFE

Nearly 150 bird species have been sighted in the park including the western rosella (*Platyercus icterotis*), red-capped parrot (*Purpureicephalus spurius*), western whistler (*Pachycephala pectoralis*), splendid fairy-wren (*Malurus splendens*), wedge-tailed eagle (*Aquila audax*) and western spinebill (*Acanthorhynchus superciliosus*).

The most commonly spotted native mammals are the western grey kangaroo

(*Macropus fuliginosus*) and western brush wallaby (*Notamacropus irma*). With luck, you may see a quokka (*Setonix brachyurus*) or a quenda (*Isodon fusciventer*).

Reptiles, amphibians and invertebrates are plentiful including endemic and threatened invertebrates. Spiders, snails and earthworms survive in cool moist refuges between the peaks. Venomous snakes such as tiger snakes (*Notechis scutatus*) and dugites (*Pseudonaja affinis*) are present but rarely seen.

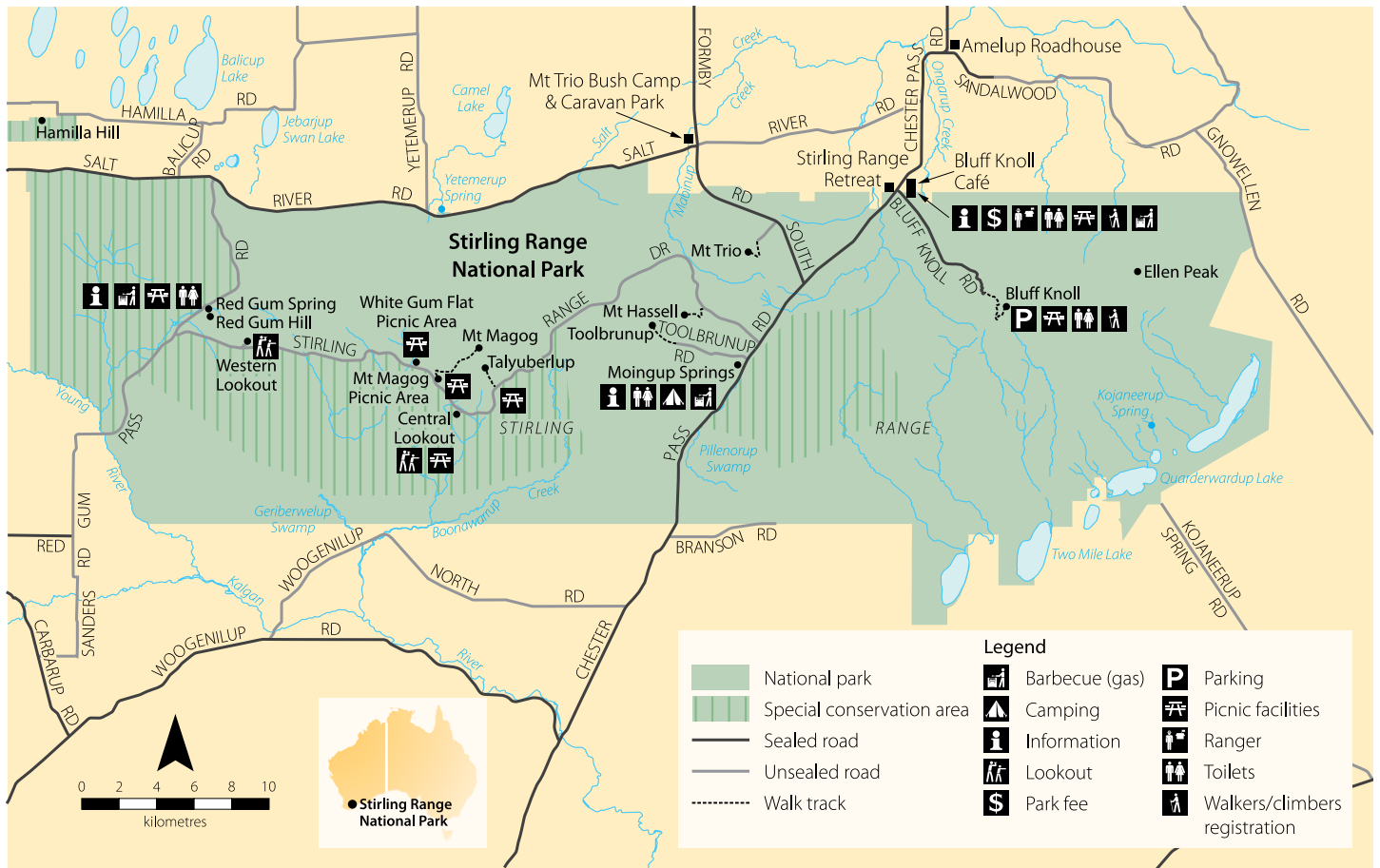
GEOLOGY

More than a billion years ago, a shallow sea covered the area. Minerals, soil, sand and the bones of tiny sea creatures slowly drifted down through the water to form

Discover more about
Stirling Range National
Park

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

Parks for people Stirling Range National Park



layer upon layer of sediment, transformed into layers of rock by the pressure created from their own weight. Ripple marks can still be seen on exposed rock layers on the peaks showing compacted layers of sediment.

Massive forces created by the Australian continent colliding with other continents

eventually caused the rocks to buckle and rise. Chester Pass and Red Gum Pass show the course of rivers that flowed south during the early stages of the range's formation.

The weathering forces of wind, rain, heat and cold steadily worked to erode the range into the jagged shape visitors can see today.

Do it yourself

Where is it? 80 kilometres north of Albany or 400 kilometres south-east of Perth.

Total area 115,920 hectares

Best time to visit Late spring and early summer (October to December) when the days become warmer, and wildflowers are at their peak. Winter (June to August) is often cold and wet but can also offer crisp sunny days.

Things to do Camping, bushwalking and adventure activities.

Staying safe in the park Prepare for all weather as conditions may change unexpectedly. Carry and drink plenty of water—one litre per person per hour per day. Wear boots or other sturdy footwear and take extra care near rock edges.

Nearest Parks and Wildlife Service office
120 Albany Highway, Albany, (08) 9842 4500.



Left Trail climbing up to Bluff Knoll.
Photo – Ann Storr

CORAL REEFS OF AUSTRALIA: PERSPECTIVES FROM BEYOND THE WATER'S EDGE



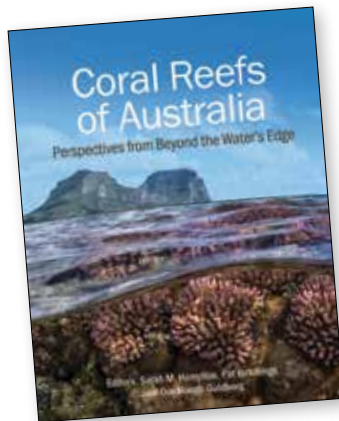
Coral Reefs of Australia is part history book, part scientific analysis, part geology lesson, part management guide and part love story between Australia's remarkable and diverse coral reefs and the many people fighting to protect them.

Published to mark the hundredth anniversary of the Australian Coral Reef Society in 2022, the editors state in the preface that they sought to include as many different perspectives as possible.

They definitely succeeded as the book has more than 90 contributors including scientists, historians, researchers, artists, economists and passionate marine lovers, many of whom are affiliated with universities, scientific organisations and research institutions from across Australia and even some internationally.

The balance between conserving biodiversity, managing tourism expectations and the economic considerations of industry is examined, as is the complex process of declaring and managing a marine park.

The comprehensive and engaging narrative is supplemented by maps, diagrams and many beautiful photographs of marine life and coastal landscapes, as well as historically significant events.



Coral Reefs of Australia can be purchased from CSIRO Publishing for \$99.99. It is also available as an eBook.

RECYCLE MATE



It may just be me, but taking out the rubbish each week elicits minor anxiety that I may have accidentally placed something in the wrong bin and therefore inadvertently contaminate the entire suburb's recycling.

Knowing what you can and can't recycle, and how and where to appropriately dispose of items in an environmentally appropriate way can be hard. Each local government area has different rules and 'where can I dispose of batteries?' is a very common question in my community Facebook group.

The *Recycle Mate* app is the app I've needed my entire adult life! Based on my location and confirming a few details, it tells me which item can be placed in which of my council rubbish bins, and where I can take items that can't go in my council bins for responsible disposal nearby.

You can search for items by name or upload a photograph and, for most common items, confirm their identity with a few clicks. The app then advises you how to correctly dispose of them.

There also appears to be barcode scanning capability coming soon, which will only make the process smoother.



Recycle Mate is free to download from the App Store and Google Play.

MARINE PLANTS OF AUSTRALIA (REVISED AND UPDATED EDITION)

WA Herbarium Curator, research scientist, and *LANDSCOPE* technical adviser John Huisman has published the third edition of his popular book *Marine Plants of Australia*.

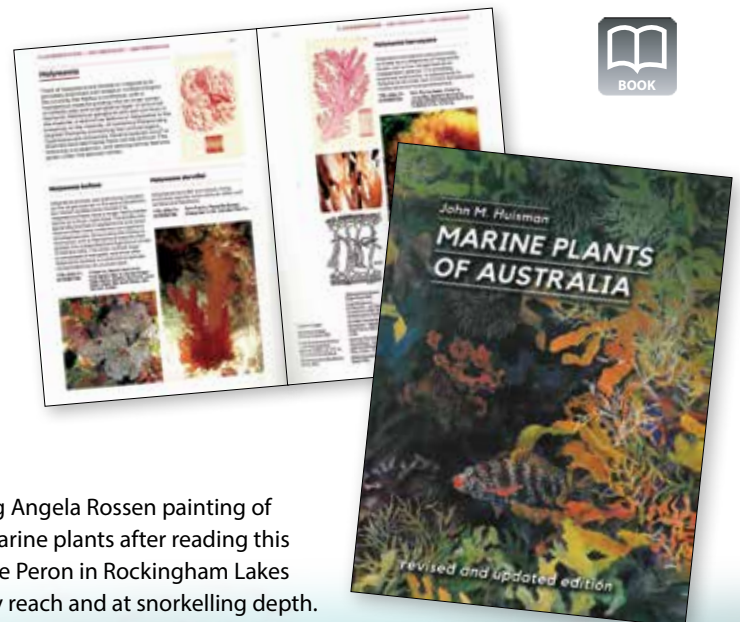
Originally written as a labour of love and published in 2000 with 300 species profiled, a revised edition featuring 600 species and stunning new underwater photography was published in 2019.

When the popularity of the 2019 edition meant a new print run was required, Huisman decided to further revise the book, adding yet more species of marine plants and making some taxonomic revisions.

This third edition is smaller in physical size than the previous two, but packs in more information with 645 species featured, including 12 new genera included in the book for the first time.

The cover artwork is once again taken from 'Elizabeth Reef', a stunning Angela Rossen painting of marine habitat. Good news for those developing a new-found love for marine plants after reading this book—one of Huisman's favourite places to explore marine plants is Cape Peron in Rockingham Lakes Regional Park just south of Perth, which has a diversity of habitats in easy reach and at snorkelling depth.

Marine Plants of Australia can be purchased from UWA Publishing (uwap.uwa.edu.au) for \$45.







New protection for **ANCIENT SITES**

A new joint management agreement is enabling Nharluwanga Wajarri Ngarlawangga people to work on Country, rediscover long-forgotten cultural sites and care for the land of their ancestors in Collier Range National Park (proposed Gulali National Park) and the soon to be created national park at the former Waldburg Station (proposed Jilgu National Park).

by Samille Mitchell



Nharnuwangga Wajarri Ngarlawangga man Stuart Robinson's boots crunch across the red dirt as he wanders across the land of his ancestors.

He knows this semi-arid countryside nurtured his people for millennia. But in more recent times, much of his people's Country has been under pastoral lease, and his people had not found it easy to visit.

Now, thanks to a new joint management agreement between the Jidi Jidi Aboriginal Corporation and the State Government, Mr Robinson and other Nharnuwangga Wajarri Ngarlawangga people are back on Country working as rangers.

Mr Robinson's footsteps slow as he notices a large slab of rock in the dirt. Squatting beside it, he runs his hand over the smooth indentation. A rounded rock lies nearby.

"A grinding stone," he announces.

He grasps the stone with reverence, and wonders who last used this stone, how long ago they were here?

The artefacts are just several of dozens Mr Robinson has found scattered across the area.

Much of the park remains inaccessible, but Mr Robinson is here with staff from the Department of Biodiversity, Conservation and Attractions (DBCA) on an exploratory journey to visit sites of cultural significance.



They stumble upon tree-lined waterholes hidden among red dirt and scrubby bush. These waterholes once sustained Nharnuwangga Wajarri Ngarlawangga people and served as meeting and camping sites. Arrow heads and grinding stones bear testimony to their former presence.

Today, the waterholes also delight DBCA scientists who observe frogs, shrimp and turtles in this otherwise arid landscape.

Just outside the park boundaries, another waterhole contains rock art and has long been treasured as a family camping spot. Here, Mr Robinson instructs the DBCA team on how to throw sand into the water to announce our presence and show respect to The Dreaming serpent that resides here.

Who knows what other cultural sites and biological treasures lie, long-forgotten or undiscovered, within the park's furthest reaches?

NEW BEGINNINGS

Collier Range National Park was declared in 1978, covering 240,000 hectares of hills, ridges and sand dunes, cloaked in mulga and spinifex growth.

The park offered natural protection amid great swathes of pastoral country, about 170 kilometres from Newman in WA's Pilbara.

The Collier Range snakes through the park's interior featuring cliffs and ridges that stand sentinel across the surrounding plains.



Previous page

Main Collier Range National Park is cloaked in a mantle of spinifex and mulga scrublands.

Top right Jidi Jidi Ranger Lylia Flowers treasures the opportunity to care for Country.

Inset left Tranquil scenes at a waterhole just outside the park boundaries.

Photos – Samille Mitchell/DBCA

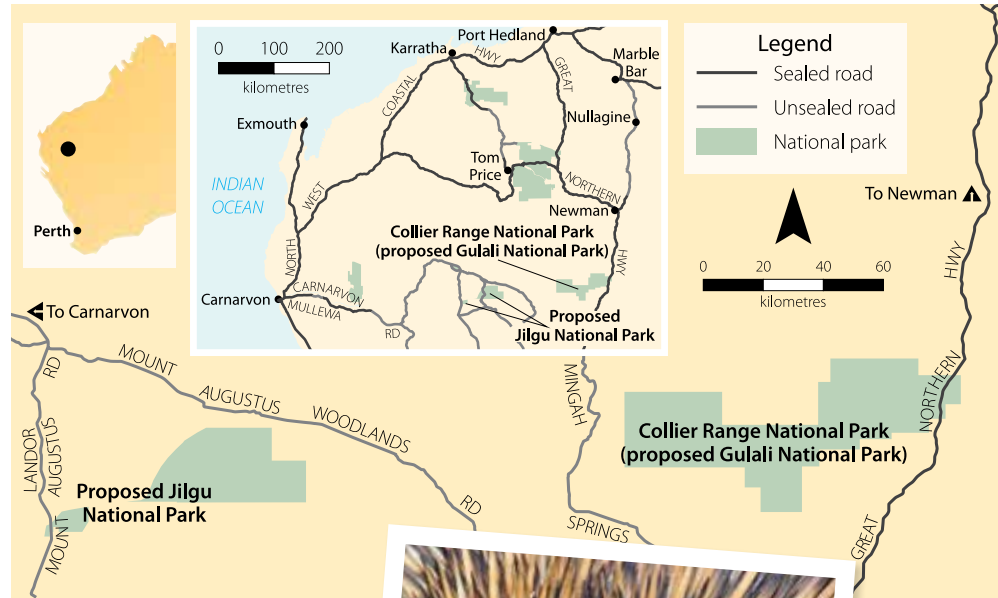
Inset right Perentie (*Varanus giganteus*).

Photo – Ann Storr

Above Spinifex grasslands glow gold in the setting sun at Collier Range National Park.

Left An old grinding stone bears testimony to the presence of Aboriginal ancestors.

Photos – Samille Mitchell/DBCA



“They stumble upon tree-lined waterholes hidden among red dirt and scrubby bush. These waterholes once sustained Nharnuwangga Wajarri Ngarlawangga people and served as meeting and camping sites.”

While the Great Northern Highway transects the far east of the park, most of the park’s interior is inaccessible.

Now, as part of the State Government’s Plan for our Parks initiative to add five million hectares to the conservation estate and jointly manage lands with Traditional Owners, there are aspirations for the park to be renamed Gulali National Park.

As part of the agreement with the Jidi Jidi Aboriginal Corporation, a portion of the ex-Waldburg pastoral station will also become national park.

Like Gulali National Park, Jilgu National Park is also dotted with cultural sites, rock art and traces of rare animals.

JOBS ON COUNTRY

The joint management agreement has paved the way for DBCA to employ five new Jidi Jidi positions, including a clerical officer, ranger and three ranger assistants.

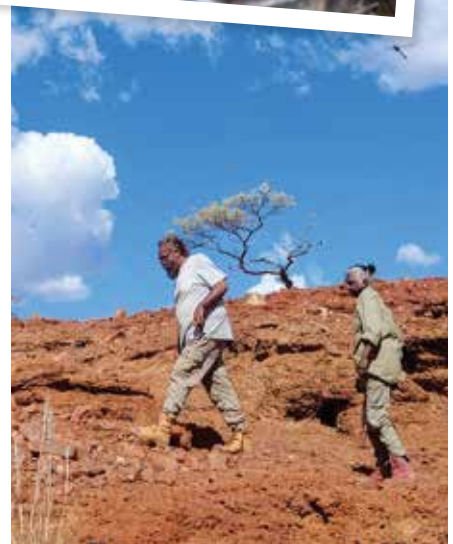
These staff will help establish a works centre from which to base themselves as they return to Country to manage the jointly-managed national parks.

Mr Robinson and his partner Lylia Flowers are among the new employees. They couldn’t be happier.

“It makes me feel happy, it makes me feel proud to do this kind of work,” Mr Robinson said.

“It’s good to come up into the Country that we have never been into and exploring it, to see what’s there and find sites there that we didn’t know about before.”

Ms Flowers believes the old people would approve.



Above Collier Range National Park’s semi-arid interior is dotted with waterholes offering oases amid the red dirt.

Right Jidi Jidi Ranger Stuart Robinson and assistant ranger Lylia Flowers traverse the park’s rugged environs.

Photos – Samille Mitchell/DBCA

Inset right Short-beaked echidna (*Tachyglossus aculeatus*).

Photo – Ann Storrie



Discover more about Nharnuwangga Wajarri Ngarlawangga peoples’ work on Country

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





“You get like that in the bush, you know you’ve got the old people looking after you, and the ancestors,” she said.

“They’re probably looking after us doing this work, they’d be happy.”

The younger generation at Yulga Jinna Aboriginal community also relishes the prospect of work opportunities.

“[There will be] a lot more opportunities for work and stuff and might be a bit of a brighter future for us and the DBCA guys as well,” 25-year old Jack McPhee said.

“The work is a pretty important thing to do—keeping it clean and make sure all the animals and plants are alright.”

PROTECTING COUNTRY

While the parks have been largely inaccessible, they have succumbed to the same threats as the rest of the rangelands—weeds and feral animals.

Cats have been sighted, as well as donkeys and cattle.

As part of their work, the new rangers will work to minimise these threats, work out what native animals remain and establish plans to further their protection.

The exploratory journey has already found indications that this area may once have sustained the western pebble-mound mouse (*Pseudomys chapmani*), which

Nharnuwangga Wajarri Ngarlawangga people call windalya.

These tiny critters construct mounds of pebbles of up to 10 square metres atop their burrows—the mounds remaining in place long after the mice have become extinct from a landscape.

It’s thought the pebbles may better protect the mice from predators. Though the IUCN lists the mice as of ‘least concern’ they are known to have disappeared from some areas in the rangelands due to feral cat predation.

In addition to offering conservation activities, the Jidi Jidi rangers will also be in a position to protect the cultural sites and places of importance to their ancestors.

Mr Robinson believes his ancestors would support their work.

“I always feel good when I’m in the bush, with the old people,” he said.

“When you’re out here you feel that they’re still around.”

As Mr Robinson replaces the grinding stone where he found it, the sun peeks through the clouds and a gentle breeze stirs the treetops. The pleasant conditions in this harsh land make it seem as if the ancestors are indeed blessing the return of the Nharnuwangga Wajarri Ngarlawangga people and their work to restore this Country.

Above left Joint management is a two-way learning experience in which western science and traditional knowledge are shared.

Photo – Samille Mitchell/DBCA

Top Western pebble-mound mouse (*Pseudomys chapmani*).

Photo – Jiri Lochman

Above *Halgania* sp. flowers in vibrant colour.

Photo – Eddy Wajon/Sallyanne Cousins

Photography

Below Jidi Jidi Rangers Jack McPhee, Stuart Robinson and Lylia Flowers have each gained work looking after Country thanks to the new joint management agreement.

Photo – Samille Mitchell/DBCA



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

Special thanks to DBCA Gascoyne Joint Management Coordinator Josh Woods, Joint Management Operations Officer Ashley Cull, the Nharnuwangga Wajarri Ngarlawangga Rangers and the Jidi Jidi Aboriginal Corporation for their assistance with this article.

Ten-year-old Olivia Thomas enjoyed some unstructured play time at Kent Street Weir with her friend Edith as part of the Muddy Hands Festival. Each year, the City of Canning runs the festival, and Nature Play WA brings the muddy fun to help encourage children and families to enjoy playing outdoors and being in nature.

by Olivia Thomas

On Saturday 18th November I went to the Muddy Hands Festival at Kent Street Weir with my friend, Edith. I knew the festival involved getting messy in nature, but I didn't know what to expect.

When we got there, we first went to the Nature Play WA stand, and we chose a conversation card. The card asked, "What do you do to de-stress?" So, Edith, my mum and I talked about our answers—I like to colour in, and Edith likes to play with her dog.

The Eco Faeries were at the festival, which made sense because they are all about bringing nature to children through the magic of fairies. At their tent we made a boat with bark from a tree, a skewer stick, a piece of fabric for the flag and some plasticine to hold the flag in place.

We tested our boats in some water. Mine floated, but Edith's sunk because her bark had a crack in it. At the bottom of the water there were insects and stones to touch.

We also made some fairy potions. Each colour had a different meaning, but we used all the colours and mixed them around. When we were finished, we had our photo taken with one of the Eco Faeries.

.....
Above Splashing, having fun in the mud pit.

Below Getting muddy in a puddle.
Photos – Claire Thomas



MUDDY HANDS

happy hearts



GETTING HANDS ON

We walked over to where we saw lots of different shelters. We decided to make one ourselves using nine wooden sticks, rope and three bamboo sticks for the roof. Some of the wooden sticks kept falling because they weren't evenly in place.

We worked together to tighten the knots in the rope and after we fixed the problems, we got some fabric and pegs. There was a lot of fabric to choose from, but we finally came to a decision—we used a tarpaulin for the roof because it kept the sun out. When the cubby was finished, we sat in it, and it looked really cool!

Over at the wildlife tent, we first looked at some animal poo in jars and

.....
Above The festival sign is a big drawcard for photo opportunities.

Photo – City of Canning

learned that wombat poo is shaped in a cube, similar to kangaroo poo. We touched some very long snakeskin, which felt rough and scaly. There were some Australian animal finger puppets and I played with the kangaroo, wombat and koala.

We used all our senses and a magnifying glass to explore some seeds that were in a basket. I smelled one of the seeds, but it didn't have a smell. There were some pinecones, some that looked like corn, seed pots and a bull banksia (*Banksia grandis*).

It was finally our turn to touch the animals. First, we touched a non-venomous snake called Ninja, which I thought would feel rough but was very smooth. After that, we stroked a sleeping koala with the back of our hands.

Next were the western blue tongue lizards (*Tiliqua occipitalis*) and bobtails (*Tiliqua rugosa*). They were very hard and scaly and looked really cool. One of

them kept sticking out its tongue. Last, we touched another snake that was curled around a post, and we couldn't find its head. My favourite animal to touch was definitely the koala.

At the City of Canning tent there was kinetic sand to touch and create sculptures using the molds. There were also some bubbles, and I used a love-heart shaped bubble wand. We spun a wheel and won a prize. We both chose a blue sensory ball.

TIME TO GET MESSY

Finally, it was mud pit time. Edith and I splashed around in the puddles of mud and got filthy! We sat in the mud, putting dirt on our arms and legs. It was so sloppy! Some other kids were throwing mud all over each other. I loved putting my hands in the mud, lifting them up and watching the gooey mud drip down all over my legs. We got sprayed off with water but still had mud all over us. It was so fun getting covered in mud!



Messy fun

Muddy Hands Festival invites children and families to revel in the joy of unbridled, messy outdoor play. This unique event celebrates the myriad benefits of letting kids get their hands dirty, like fostering a deeper connection with the environment, encouraging a sense of creativity and adventure, and building resilience.



Do it yourself

Where is it? Muddy Hands Festival is held at the Kent Street Weir in Canning River Regional Park.

When is it? The festival is held in November each year, visit canning.wa.org.au for specific details.

Things to do Mud kitchens, mud pits, mud sculpting, ochre face painting with Educated by Nature, loose parts play, cubby building, high ropes course, sporting activities and workshops, recycling and sustainability education, craft workshops, plant giveaways, stage shows and roving entertainment.



Olivia Thomas is ten years old and lives in the Perth Hills where her home and school are surrounded by bush. She is a talented cross country runner and loves spending time in nature with her family and friends.

It was a hot day, so we sat in the shade and created a sculpture out of clay. Edith and I decided to make turtles. Edith's was very skinny, so I called hers the baby and mine was much bigger, so I called it the mummy. After I made my sculpture, I painted it with grey clay. I had clay all over my hands, so I washed them off in a bucket of water. Down at the bottom there was so much sloppy clay and it felt nice and calming to touch.

After all the fun we had, we were so hungry. We walked to the food vans to get lunch. We sat in the shade to eat and watched an ant carry a crumb twice its size. After lunch we wanted to run on the bike track. We ran the red track twice, which was super challenging. We then ran the blue track, which was much easier.

Finally, we took a photo of us all muddy in front of the Muddy Hands Festival sign. It was the best day because I got to spend time in nature with my

friend. We took our time and enjoyed each activity without having to rush.

I loved using all my senses to create a boat, shelter, clay sculpture, fairy potion and most of all, play in the mud! I will definitely go back again and next time I will take my whole family.

Top left Finding joy in getting messy.
Photo – City of Canning

Top right Olivia and Edith with one of the Eco Faeries.

Above left Learning about snakes.

Above middle Making turtle sculptures out of clay.

Above right Up close observing native plants and introduced pines.
Photos – Claire Thomas

DENMARK

GIVING THE **WOW** FACTOR

The Wilderness Ocean Walk (WOW) Trail near Denmark has recently been extended, linking up with the Bibbulmun Track, Munda Biddi Trail and iconic Waterfall Beach to Elephant Rocks Trail, to create a 15-kilometre coastal adventure that takes full advantage of the picturesque landscape.

by Bron Anderson





The 6.2-kilometre WOW Trail was first opened in 2017, taking visitors from Lights Beach to Denmark Community Windfarm. The second stage of the trail adds a further 3.2 kilometres of dual-use coastal trail all the way to Sinker Bay.

Denmark, in the south-west of Western Australia, is known for its amazing beaches. The area the WOW Trail passes through, Pooryungup, is part of a wider cultural landscape that provided local Noongar Aboriginal peoples with everything they needed for their way of life.

Iconic attractions including Waterfall Beach and Elephant Rocks are now all connected as the WOW Trail links with the Bibbulmun Track and Munda Biddi Trail and the Waterfall Beach to Elephant Rocks Trail, creating a 15-kilometre coastal trail between Sinker Bay and Greens Pool in William Bay National Park.

The trail passes through dense coastal heath that comes to life with colour in the wildflower season, and lookout points provide convenient rest stops with stunning vistas over the coastline.

Looking east on a clear day, the coastal views extend from Wilson Inlet and Ocean Beach along the cliffs to Knapp Head and all the way to West Cape Howe, the southernmost point of Western Australia.



Not to be outdone, the view to the west boasts a star-studded lineup of some of the best beaches in south-west WA—Back Beach, Lights Beach, Waterfall Beach, Madfish Bay and the wide sweep of Mazzoletti Beach leading to Parry Beach. Tucked just out of view are the famous Elephant Rocks and Greens Pool of William Bay National Park.

Owners, the Shire of Denmark and the Department of Biodiversity, Conservation and Attractions (DBCA) as most of the new section of the trail is on land managed by the Shire of Denmark, including Pooryungup/Ocean Beach Reserve with a small portion of the trail aligned through the Denmark Community Windfarm.

“We are really pleased that this project has produced such a quality outcome, through a partnership with the Shire of Denmark,” DBCA’s Assistant Director, Parks and Visitor Services, Rod Annear said.

GETTING CONNECTED

The creation of the new trail was a true partnership between Traditional

.....
Previous page

Main Start of the WOW trail near Lights Beach.

Photo – Cliff Winfield

Inset left Looking out over Ratcliffe Bay.

Photo – Benji Anderson

Top inset Southern right whale (*Eubalaena australis*).

Photo – John Anderson

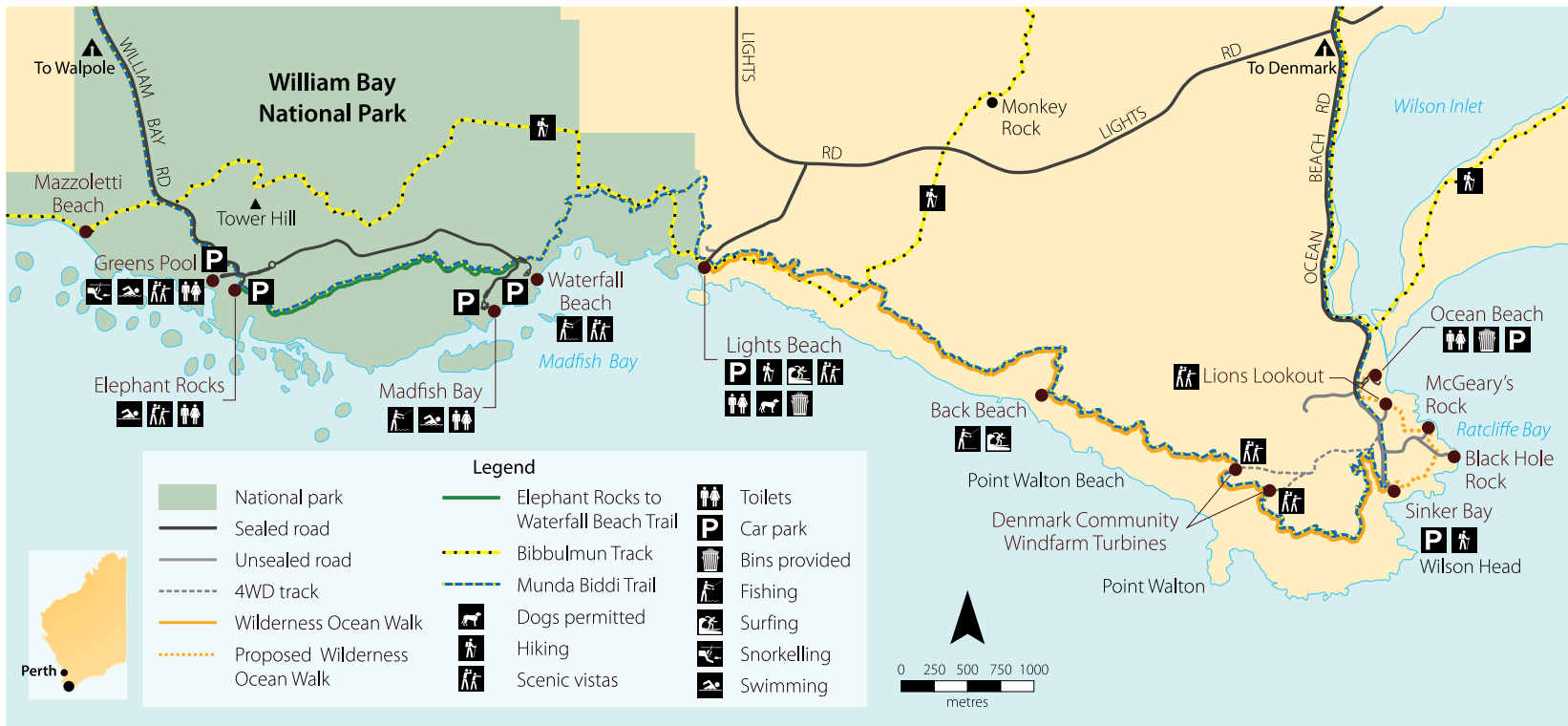
Inset right Shining fanflower (*Scaevola nitida*).

Above Cycling near Sinker Bay.

Right Traditional Owners, community and project team members work together on Country.

Photos – Bron Anderson





“This is a great community resource that will benefit the locals and tourists for years to come”.

Along with *Phytophthora* dieback mapping of the area as well as flora and fauna surveys, there has been extensive consultation with the Traditional Owners with several on-site visits prior to the start of construction. An archaeological survey was undertaken to ensure there were no impacts on Aboriginal cultural heritage, which informed the trail alignment.

Traditional Owners undertook green card training and were on-site during construction to ensure that any earth disturbance was kept to a minimum and if any artefacts were turned up, work ceased to allow a closer examination.

Interpretive signage at various lookout points is being developed after

Above right White-bellied sea-eagle (*Haliaeetus leucogaster*).
Photo – John Anderson

Right Bull Banksia (*Banksia grandis*), one of the plants growing along the track.
Photo – Bron Anderson

a consultation session with Traditional Owners to develop the themes that will focus on the indigenous and natural values of the area.

“This is a great community resource that will benefit the locals and tourists for years to come,” Rod said.

For those who are more technologically minded, the two 50-metre turbines of Denmark Community Windfarm are standout features along the trail. The windfarm is owned by a public company whose 120 shareholders are mainly local residents. Commencing commercial generation of renewable energy in 2013, the Denmark Community Windfarm supplies 50 per cent of Denmark’s annual power demand.

NATURAL VALUES

Many of the plants growing along the trail have cultural significance such as the wonil (peppermint). The leaves of this tree can be crushed, and the vapour inhaled to relieve congestion.

Discover more about the WOW Trail

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





Fan flowers, pimelias and hibbertias add to the rainbow of colour. Shady peppermint groves offer cool relief from the sun and Banksia and Hakea thickets provide a food source for Carnaby's and Baudin's black cockatoos.

Denmark local and convenor of the Denmark Bird Group, Kirsty Anderson, is a regular user of the WOW Trail.

"There are a good variety of birds including shining bronze and fantail cuckoos, Carnaby's and Baudin's black cockatoos, and on the parrot bush, scrubwrens, fairy wrens, red-eared firetails and currawongs," Kirsty said.

"We have seen many different species of seabirds including yellow-nosed and black-browed albatross, gannets, shearwaters and we occasionally see the white-bellied sea-eagle skirting along the cliff edge."

From June to November, humpback (*Megaptera novaeangliae*) and southern right whales (*Eubalaena australis*) are regular visitors to the sheltered waters of Ratcliffe Bay. Humpback whales leave their feeding grounds in Antarctic waters in late autumn as the temperature drops and head north to breed in the warmer waters off the west coast of Australia. From the lookouts, whales can be seen breaching and slapping their tail flukes and fins on the water.

Locals of the more dangerous variety are at home in the thick coastal heath at Pooryungup. Dugites (*Pseudonaja affinis*) and tiger snakes (*Notechis scutatus*) can sometimes be seen sunning themselves along the trail or moving quickly out of the way.

LOVED BY LOCALS

Local resident and cyclist, Jane, thinks it's a great trail that is perfect for the whole family, including dogs in some sections.

"To have nine kilometres of trail that winds around the coastal cliffs and dunes to Lights Beach is amazing," Jane said.

"The views along the whole trail—the Wilson Inlet, the cliffs and ocean and Mt Hallowell—are just so picturesque."

Former Denmark Shire President, Ceinwen Gearon, said the extended WOW Trail is already a treasured community asset, despite its short life.

"I'm delighted that after working together with DBCA and thanks to detailed and appropriate consultation with Traditional Owners, we now have a continuation of this popular trail. It means we can all enjoy even more of WA's stunning coastline by foot or bicycle," Dr Gearon said.

Planning is underway for the last section of the WOW Trail between Sinker Bay and Ocean Beach.

Above Looking west from one of the lookouts on the trail.

Photo – Bron Anderson

Below Red-eared firetails (*Stagonopleura oculata*) have been spotted on the trail by Denmark Bird Group.

Photo – Jiri Lochman

It is envisaged that long-distance Munda Biddi Trail riders and Bibbulmun Track walkers will also take advantage of the new alignment and use the specially hardened trail surface to travel closer to the coast for the spectacular views over the Southern Ocean.



Bron Anderson is a Visitor Services and Interpretation Officer with DBCA's Parks and Wildlife Service based in Manjimup. She can be contacted at bron.anderson@dbca.wa.gov.au



Ray of white

by Dr Kerry Trayler,
Emily Taljaard, Charles Maus,
Dr Alan Cottingham,
Dr Danielle Johnston
and Dr James Tweedley

After a year of sampling the species in the Swan-Canning Estuary, it was an exciting moment for Masters student Emily Taljaard to see an albino southern eagle ray (*Myliobatis tenuicaudatus*) in the Swan Estuary Marine Park at Alfred Cove.

There are more than 200 fish species that utilise the Swan-Canning Estuary and many are well-known, but others are more cryptic and often evade observation from scientists. This was the case for the southern eagle ray (*Myliobatis tenuicaudatus*), a well-camouflaged, bottom-dwelling, cartilaginous fish, that is olive green with pale grey-blue markings, and occurs in coastal waters and estuaries across southern Australia to south-east Queensland, Norfolk Island and New Zealand.

First recorded in the Swan-Canning Estuary in the 1970s, the southern eagle ray is one of many species that may be responding to the increasing marinisation of the estuary, steadily driven by increasing tidal height and reduced riverine flows. These rays are now one of the most abundant larger species recorded in the deeper waters of the lower estuary as part of the Department of Biodiversity, Conservation and Attractions' (DBCA) annual fish community monitoring conducted with Murdoch University.

In the decade from 2012 (to 2022) since this regular monitoring began, the annual number of southern eagle rays recorded has increased tenfold, from 15 to 153.

In December 2023, DBCA scientists monitoring the estuary spotted a juvenile albino southern eagle ray gliding in the shallows along the Attadale foreshore. Southern eagle rays are also increasingly common in the bycatch of commercial crab fishers operating under license in the Swan-Canning Estuary, triggering interest in their commercial value, and prompting



Watch an albino southern eagle ray

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



questions over sustainability. With limited information available on this species, a collaboration was established between the Department of Primary Industries and Regional Development (DPIRD), who conducted the sampling, Murdoch University and DBCA to investigate the biology and ecology of this little-known species in the estuary.

POTENTIAL ESTUARINE NURSERY

In the broader metropolitan region of Western Australia, southern eagle rays are not limited to the Swan-Canning Estuary, with local populations in Cockburn Sound, and the Peel-Harvey Estuary and marine waters. There is also some evidence that these nearshore areas may be local nursery areas for this species. In the

Swan-Canning Estuary, Emily found pups and pregnant females in most months of the year. The gestation period is not known but females have two functional uteri and give birth to live young. In keeping with other eagle ray species, it may be between nine and 12 months but it is unclear whether this includes a diapause (suspended development) period.

Emily's work showed that the females produced a comparatively small litter for an eagle ray species with just one to three young, and were not sexually mature until they were around nine years of age. At this time, females were approximately 83 centimetres wide (across the wings). The males were almost six years old and approximately 60 centimetres when they reached maturity. Peak birthing periods

were in summer and there was evidence that the males and females would mate at around the same age. Southern eagle rays live to at least 16 years of age and, outside of the Swan-Canning Estuary, are known to reach 1.6 metres in width and up to 38 kilograms.

GENERALIST FEEDER

Rather than pointy teeth, the jaws of eagle rays contain tooth plates helping them to crush their prey. Southern eagle rays are generalist bottom feeders and adapt their diet to the environment in which they occur. Broadly, these rays are known to consume polychaete worms, bivalve and gastropod molluscs, crustaceans (e.g. crabs and prawns), echinoderms (e.g. sea urchins) and bony fishes (teleosts).

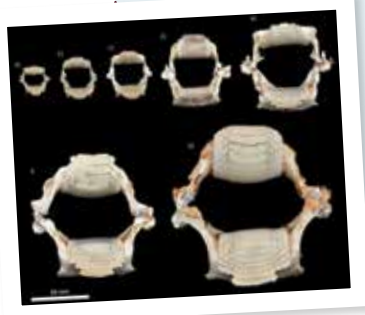
In the less marine environment of the Swan-Canning Estuary, Emily's research showed their diet was more tailored, with prawns, polychaete worms, gastropods and crabs being the main prey consumed. Prawns were the most common prey species eaten by 50 per cent of the rays, but their proportional contribution to their diet increased in

Not like other rays

Stingrays are cartilaginous fishes characterised by their flattened bodies, pectoral fins fused to the head, and ventrally located gill slits. Stingrays are differentiated from other ray groups (e.g. skates, electric rays, and shark-like rays) by the presence of one to several serrated spines on their tails, which includes true stingrays, stingarees, devil rays, and eagle rays.

The flattened body plan of stingrays makes them well adapted to shallow-water areas, which they use for foraging and protection from predators. Many stingrays feed on invertebrates buried in the sand and mud. They use a combination of pectoral fin flapping, suction, and water jetting from their mouths to uncover and consume buried prey. The larger, open-ocean species like manta rays use their large mouths and gill rakers to filter plankton and small fish from the water column.

Western Australian waters are home to approximately 40 species of stingray. The highest diversity is found in tropical latitudes; however, there are a few species common in the southwest, with the smooth stingray (*Bathytoshia brevicaudata*) and the southern eagle ray (*Myliobatis tenuicaudatus*) being the most easily recognisable and most likely to be encountered.



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Main Southern eagle ray (*Myliobatis tenuicaudatus*).

Photo – Alex Hoschke

Above A juvenile albino southern eagle ray observed gliding in shallows of the Swan-Canning Estuary.

Photo – DBCA

Inset left Jaw morphology of different-sized southern eagle rays.

Photo – Daniel Cox



Casper the albino stingray

Originally named Luka (Latin for 'light'), an albino smooth stingray (*Bathytoshia brevicaudata*) is known locally as Casper. While marine rangers are unsure of Casper's gender, the ray is a fully grown adult, believed to have lived in the Walpole-Nornalup Inlets Marine Park for around 15 to 20 years. The smooth stingray is a protected species and visitors to the Rest Point Caravan Park and The Channels can sometimes see the albino stingray when they are cleaning their fish as Casper often comes to enjoy the spoils.

summer as prawn abundance in the system changed over time.

Southern eagle rays are less than 30 centimetres wide when born and increase markedly in size during their lifetime. Increased jaw size (gape and width) gives their tooth plates more crushing power, allowing them to eat hard-bodied prey. As such, their diet shifts over their lifetime, with small juveniles limited to a diet of softer-bodied prey (for example, polychaete worms), whereas very large individuals, wider than one metre, were found to include crabs in their diet.

SUSTAINABLE FISHING

Emily's study showed that only very large southern eagle rays consumed crabs and given the relatively small number of individuals of this size in the estuary, it is unlikely that commercial or recreational crab fisheries in the estuary would be affecting their food resources. Information on their reproduction, seasonality and distribution will contribute to the knowledge base of DPIRD's ecosystem-based fisheries management program.

Top left Gillnetting for eagle rays.
Photo – Charlie Maus/DBCA

Above left Evaluating reproductive biology.
Photo – Kerry Trayler/DBCA

Above Casper, the albino smooth stingray (*Bathytoshia brevicaudata*).
Photo – Peter Moore/DBCA

Inset above Casper spotted at The Channels near Walpole.
Photo – Tiffany Taylor

Below left Juvenile southern eagle ray.
Photo – Emily Taljaard



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Mysterious **centipedes**

Photos and words
by Jiri Lochman





After photographing Australian wildlife for more than 40 years, Jiri Lochman has had more interesting encounters than you can imagine. He is fascinated by the living natural world and has had the rare opportunity to view the incredible world of centipedes up close.



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Main Little long-tailed dunnart (*Sminthopsis dolichura*) battling a large scolopendrid centipede.

Above Oscar Range, Wunaamin Conservation Park.

Inset top Centipede consuming a trapdoor spider (*Idiopidae* sp.).

Inset above Jiri Lochman taking macro photography

Photo – Marie Lochman

Of all the land-based creatures, only snakes and spiders are likely to cause more havoc in the human psyche than centipedes. There is even a technical term for the pathological fear of centipedes—scolopendrophobia.

Sufferers of scolopendrophobia usually give one of two reasons for their affliction. One is the same as in the case of snakes and spiders—fear of the venom. The second one is a less rational one; it is the large number of legs centipedes have that make people cringe and apparently even faint. But try to explain to a scolopendrophobe that the affliction is irrational; after all, all phobias are, aren't they? But is it justified in the case of centipedes?

It is and it isn't. All centipedes possess venom delivering organs. Whilst all other legs are used for locomotion, the first pair of legs has been modified for the purpose of envenomation. They have enlarged, and became equipped with sharp, hollow spurs at the tips that are connected to the venom glands inside the swollen segments of the modified legs.

These false fangs, if you like, are used for injecting venom and thus dispatching the prey. But, more often than not, the prey is a fellow arthropod, or other invertebrate, not a human. On the other hand, I have personally experienced a centipede bite so I recommend avoidance and can confirm that the bite of a large

centipede is unpleasantly painful. On the bright side, the pain usually subsides relatively quickly. Still, there are very few reports of centipede bite fatalities globally and none from Australia. So, don't unduly fear a centipede, but don't provoke it either as its bite might ruin your day.

CURIOUSER AND CURIOUSER

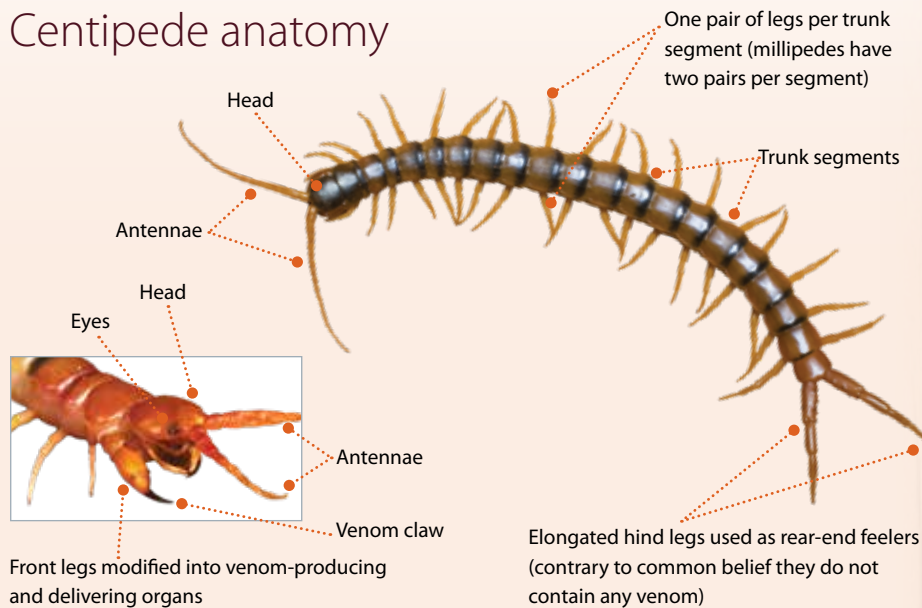
We can outweigh our disappointment from not encountering a monster by looking at the real centipedes, what they do and how they live, because it is here where the real excitement of the discovery resides.

The most readily encountered are the scolopendrid, also known as the giant, or desert, centipedes. There are 28 described species of these 42-legged centipedes known to occur in Western Australia.

These are also my favourites, not only because they are big and often quite colourful and hence photogenic, but because of their interesting behaviours like their maternal care. Scolopendrid centipedes guard and otherwise take care of their eggs with some species taking care even of the newly hatched offspring. They are also the fiercest predators of all centipedes. Simply put, scolopendrid centipedes are quite astonishing.

The world's largest centipede, the over 30-centimetre long Amazon giant centipede (*Scolopendra gigantea*) from Central and South America, belongs

Centipede anatomy



here. It is known to catch bats in flight by hanging by its hind legs, upside down, from a ceiling at the cave entrance and grabbing by its front legs the bats flying in or out of the cave. If this is not an amazing feat conceived by an invertebrate brain, then nothing is.

The largest Australian centipede, at about half of the *gigantea* size, is still a sizable creature, as there are not many 16-centimetre-long terrestrial invertebrates one can readily encounter in the Australian bush.

EAT AND BE EATEN

All centipedes are predatory flesh eaters consuming primarily invertebrates, but reptiles, frogs, birds and small mammals are all known to feature on the scolopendrid centipede menu.

It is not a one-way road though; it is a two-way exchange of proteins. As much as other critters are on the centipede menu, centipedes are on the menu of many animals large and small. Fish, reptiles, frogs, birds and mammals are all known to consume centipedes, as are the ground beetles, ants, spiders, and scorpions.

One group of arthropods also known to consume centipedes are the centipedes themselves. It can be between different species, or cannibalistic and can happen even among the closest of relatives.

But to return to the centipede diet. During the 40 years I have been photographing Australian wildlife I have made two exceptionally interesting observations of scolopendrid centipedes in action. The first one I regrettably can

only describe, but not illustrate. But the second one, which is significantly more remarkable, I fortunately can, as without photographic evidence no chilopodologist (zoologist specializing in centipedes) would ever believe it.

IN FLAGRANTE

While searching for nocturnal creatures in the Kimberley, I came to an overhang under which lay a large, but quite emaciated King Brown (*Pseudechis australis*) snake. I started photographing it without at first noticing that the snake was being simultaneously attacked by a large, though miniature in comparison, centipede. The centipede was actually in the process of ringbarking the snake's tail on which it was hanging. When I noticed this behaviour, I immediately realised that



“...there are not many 16-centimetre-long terrestrial invertebrates one can readily encounter in the Australian bush.”

Above Centipede consuming a moth in the safety of a fissure in a dead tree.

Left Centipede overpowering a thick-tailed gecko (*Diplodactylus conspicillatus*).



it was vastly more interesting than the pictures of the snake itself.

Although the centipede was doggedly performing its daredevil's act, I could not get close enough to the snake's tail, as I did not want to be bitten even by a wasted King Brown. And the snake was reluctant to move, likely being too weak and finding 'safety' under the overhang irresistible. The photographic proof I have is unfortunately unpublishable, so, I have to be satisfied with a picture of the scolopendrid centipede overpowering a gecko, which I took near Sandfire Roadhouse. It is worthwhile noting that in both instances the centipedes were biting and injecting their venom into the reptiles' tails.

The second occasion when I caught a centipede so to say *in flagrante*, or according to our textbooks behaving in an un-centipede-like manner, was when I was looking for nocturnal creatures in a flowering coastal heath east of Albany. While photographing some pollinating moths I spotted something that made me absolutely baffled—a centipede feasting on a eucalyptus flower.

This was a true discovery, a behaviour that had never before been observed. There are in the technical literature few notes about centipedes consuming foodstuffs other than flesh, such as fruits, butter, or coconut, but these observations were of captive centipedes. It means that these food items were presented to the

centipede by people. After all, how else would a wild centipede get an opportunity for consuming butter?

It is a well-known fact to every zookeeper that you can entice captive animals to eat something they would not readily consume under natural conditions. You leave it in the cage long enough for a bored, captive animal to play with and it will eventually try to eat it.

Mine was a completely different story. This was a wild centipede, photographed in the wild, feasting on flower nectar. I took a series of similar pictures of this centipede poking its head into eucalypt flower nectaries. Under no circumstances did I want to disturb it, so I waited to find out what its next move would be.

After some time, it quite abruptly withdrew its head and then climbed rapidly to another flower where it resumed its feeding. I could not photograph it there, as that particular flower was partly obscured by the foliage. So, I waited and hoped that it would pick, for me, a more accessible flower. But as it

was visiting flower after flower it instead retreated further and further away from me; shine of my headlamp being the likely culprit.

I suspect that this centipede was not just a nectar thief, but that it actually might have been a pollinator. It must have picked up a lot of pollen on its many legs and the underbelly, as it crawled on the anthers, which it then fairly likely deposited on the stigma, as it slid over it in its search for more nectar. Nectar thief or pollinator, it doesn't really matter; this was the most incredible encounter with a centipede I have ever had.

.....
Above left Female centipede guarding her eggs.

Above Centipede feeding on the nectar of a eucalyptus flower.

Below *Scolopendra morsitans*, known as the Tanzanian blue ringleg or red-headed centipede.



Jiri Lochman is a renowned Australian wildlife photographer together with his wife Marie. He is a co-recipient of the coveted Australian Geographic Award for Excellence in Photography and an author, or co-author of seven books. Jiri's photographs have featured in all but three *LANDSCOPE* magazines ever published. He can be contacted at lochman@iinet.net.au

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Western Australia is world renowned for its extraordinary plant species diversity. Well over 11,500 native plant species have been recorded in the State, and this number continues to increase as more species are found and named every year.

Sometimes this happens when an already described species is split into several new species. This can occur when new specimens are discovered with morphological variation, or powerful new genetic tools reveal patterns of variation previously unknown. Combining genetic data with traditional morphological studies is increasingly resulting in new species being named.

In Western Australia, species completely new to science are still being found, even in places that are highly visited and plant diversity well documented. Sometimes a 'discovery' takes the right person to notice a plant looks different or is well outside its typical area of occurrence.

One such example is a plant previously unknown to science, but long known to the local farming family as 'penny bush' because of its small coin shaped leaves. In February 2020, Parks and Wildlife Service Conservation Officer Andrew Webb was surveying typical Jarrah bushland to the south-east of Collie when he found a small tree previously only known from hundreds of kilometres away, near Augusta and Mount Barker—*Lambertia orbifolia*. The species has orange-red tubular shaped flowers that give the species the common name of 'honeysuckle'. Taxonomic work in the late 1990s noted small morphological and significant genetic differences between the geographically isolated Augusta and Mt Barker populations and consequently recognised two informal subspecies—subsp. Scott River Plains (a.k.a. Scott River honeysuckle) at Augusta and subsp. *orbifolia* (a.k.a. round-leaf honeysuckle) at Mt Barker. Both subspecies had small plant numbers and were under threat from *Phytophthora*



Penny-leaved honeysuckle (*Lambertia orbifolia* subsp. *pecuniosa*)

dieback, so were subsequently conservation listed as threatened.

The new plants near Collie had features that were intermediate to both subspecies. This led to studies that combined morphological and genetic assessments to determine which subspecies the new Collie plants should be assigned to, whilst at the same time formally naming the known subspecies. A genetic study used microsatellite markers to look for patterns in genetic diversity between plants at the different locations. Simultaneously, flower, leaf and branch features were assessed for morphological features that differentiated the subspecies.

The team from the WA Herbarium, led by taxonomist Juliet Wege, found differences in the curvature of flower bracts, and number and length of hairs on the flowers and branchlets that differentiated the plants from the three different locations. The genetic data showed the same pattern of clear

differentiation between the three locations. The study confirmed the Collie plants were actually a new subspecies and it was named *Lambertia orbifolia* subsp. *pecuniosa*, with its scientific name (meaning moneyed, rich, wealthy) referencing the common name, penny bush, used by the local farmers. The subspecies near Augusta was also formally named as *Lambertia orbifolia* subsp. *vespera* (which references its location as the westernmost subspecies).

The discovery of *Lambertia orbifolia* near Collie was significant, as it considerably increased understanding of the species' distribution, prompted a finalisation of the species taxonomy and showed that even in well surveyed areas, small trees previously unknown to science can still be found.

Above Penny-leaved honeysuckle
(*Lambertia orbifolia* subsp. *pecuniosa*).
Photo – Leonie Monks/DBCA



Listening to the seasons

by Allan Wills

The concept of seasons and how they are defined in western culture includes indicators such as air temperature, rainfall or soil dryness. For Noongar Aboriginal peoples, it is a more nuanced and a more lived experience, noticing instead the movement and behaviours of animals or the reproduction of plants. These sensed phenomena play a key part in the seasonality of cultural burning practices.



Several concepts of season have been used or proposed in south-western Australia, and these connect differently to fire seasonality, cultural history, biological features and climate patterns.

European colonisers of Australia brought with them the concept of four seasons linked to the Gregorian calendar. These seasons continue to be a broad descriptive framework used by the Australian Bureau of Meteorology, with spring falling in September to November; summer in December to February; autumn in March to May; winter in June to August.

In south-western Australia the Noongar Aboriginal peoples retain a complex concept of seasons with a six-season calendar recognising climate, resources, and biological phenomena as seasonal cues.

THE CONCEPT OF BOODJAR

Central to the Noongar six season calendar is a representation of boodjar; a concept that does not translate easily to English as it is an encompassing concept of location as a lived experience including landscape and place as astronomical, climatic, biological, and geographical phenomenon and custodianship through cultural beliefs, lore and knowledge.

It can be interpreted that, above all, boodjar is the phenomena of place as a lived experience relayed in stories, songs and dance that connect across time.

Conceptually, the seasons are experienced cyclically as part of boodjar in a multitude of sensations.

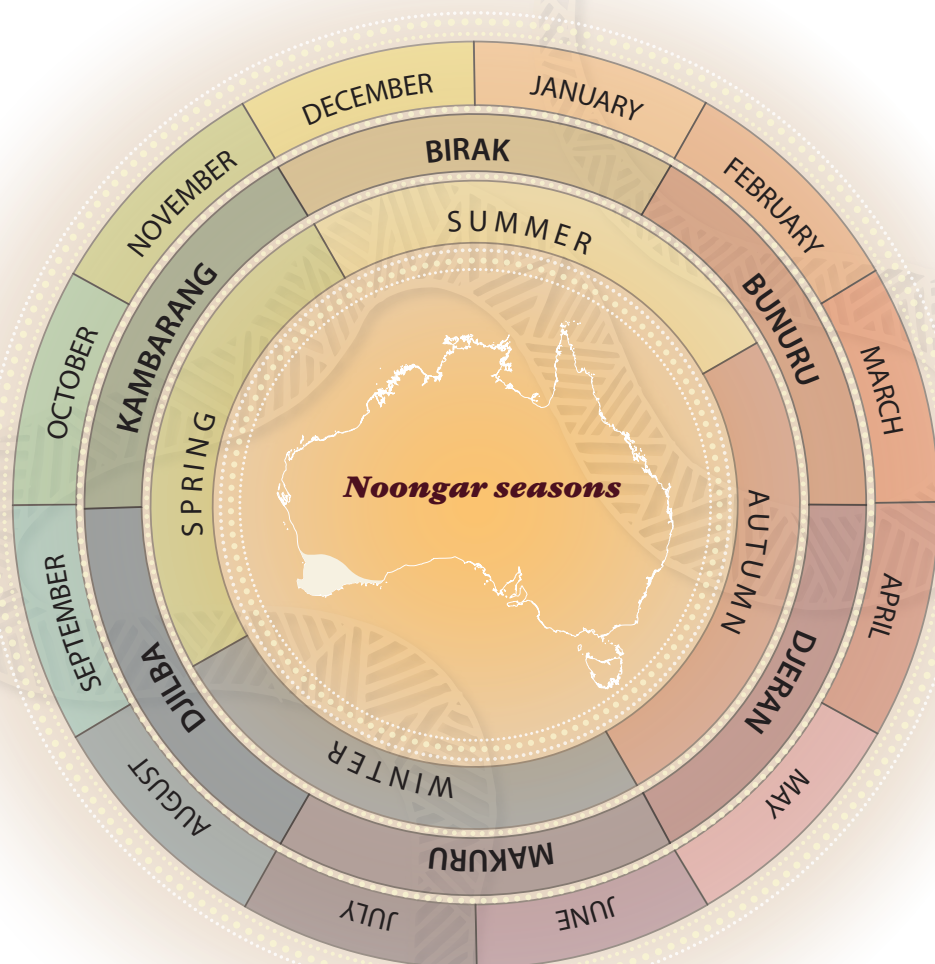
“The six seasons are made palpable through the presencing of different natural things... registered by sight, touch, taste, smell, and sound,” John Charles Ryan wrote in his paper *Toward a*



phen(omen)ology of the seasons: The emergence of the Indigenous Weather Knowledge Project in 2013.

SEASONAL INDICATORS

Seasonal phenomena are recognised by many Australian Aboriginal cultures; for example, there are plant species that reliably flower in line with discrete Noongar seasons. Not altogether



Previous page

Main Fire has shaped Australian landscapes over thousands of years.

Photo – DBCA

Right Throughout Australia, Aboriginal peoples used fire for many reasons.

Artwork – Joseph Lycett 1817/National Library of Australia

Inset left to right Reptiles shed their old skin during birak. *Photo – Tourism WA*; Huge cones emerge from the female zamia (*Macrozamia riedlei*) during bunuru. *Photo – Jean and Fred Hort*; djeran is a time of red flowers, especially the red flowering gum (*Corymbia ficifolia*).

Photo – Mark Brundrett; Makuru brings water flowing to rivers and waterways. *Photo – Andy Milner/DBCA*; Koolbardi or magpie (*Gymnorhina tibicen*) swoop to protect their nests during djilba. *Photo – Simon Cherriman*; Flowers of the moojar, or Australian Christmas tree (*Nuytsia floribunda*), signal heat is on its way during kambarang. *Photo – Tourism WA*

Above Bunuru is a time of lots of white flowering gums (*Eucalyptus* sp.) in full bloom. *Photo – Mark Brundrett*

Left Noongar seasons with map indicating traditional lands of Noongar peoples.



surprising given the richness and diverse origins of the flora of south-western Australia.

Using phenomena as a basis for assigning time to the Noongar seasons means that the timing of each season is flexible, and that allocation of Gregorian months to the seasonal calendar can only be approximate as the timing of phenomena is variable from year to year.

A way to describe this from a wadjela (white person) perspective is that measurable events, such as flowering plants and temperature, trigger sensed occurrences, and these sensed occurrences collectively mark the transition of the Noongar seasons.

As an illustration, a limited set of phenomena, expressed in terms of western standards, might encompass monthly rainfall, monthly maximum and minimum temperature with preceding maximum temperature, day length and soil dryness index (SDI).

Variations in temperature, rainfall and SDI affect and reflect where the water is in the landscape, impacting the movement and migration of animals and the reproductive processes of plants.

The movement and behaviours of animals and the reproduction of plants contribute to the presence of a Noongar season. Of course, humans have a presence in the landscape too—cultural practices, the use of fire, hunting of animals, and the harvesting of plants feed back to the reproduction of plants and animals.

Traditional burning

The sketch below by Charles-Alexandre Lesueur of Wardandi Noongar people in the coastal lagoon country of Geographe Bay dating from 1824 allows a glimpse into the traditional Aboriginal way of life.

We can see Wardandi men on the right driving swans towards an ambush hunter concealed in the sedges on the left. A Wardandi woman (bending figure) is perhaps tending a fish trap, though this is not clear. On the left bank of the lagoon is a woodland with an open understorey.

On the distant dune on the right bank is a much lower and more open woodland. The right middle ground has discrete patches of sedges interspersed with open ground. The centre of the image is dominated by the mia mia (shelters) with sparse small trees and sparse shrubs. The fire history is evident from the limited skirts on the balga and their flower spikes indicating that there was a fire in this landscape about one year prior.

The openness of the vegetation, the very open woodland on the right, implies a reasonably frequent burning of the landscape at low risk to the inhabitants. In overview, where the water was in the landscape determined when and where food (in this case aggregations of maali (swans)), natural resources, people and cultural activities were in the landscape, and hence when and where fire was, and to some extent the flammability and predictability of fire behaviour in the landscape.



“Central to the Noongar six season calendar is a representation of boodjar.... boodjar is the phenomenon of place as a lived experience relayed in stories, songs and dance that connect across time.”

Modern-day human influences on climate globally also affect climate and weather as it is experienced on boodjar.

SEASONALITY AND FIRE

Burning regimes across millennia have been determined by the cultural practices of the first human inhabitants of south-western Australia, and the frequency of lightning ignitions.

The use of fire by Noongar peoples was highly seasonal according to records from pre- and early colonial times. However, there are limitations to pre-colonial and early colonial accounts such as very little detail on

the cultural subtleties of Aboriginal burning.

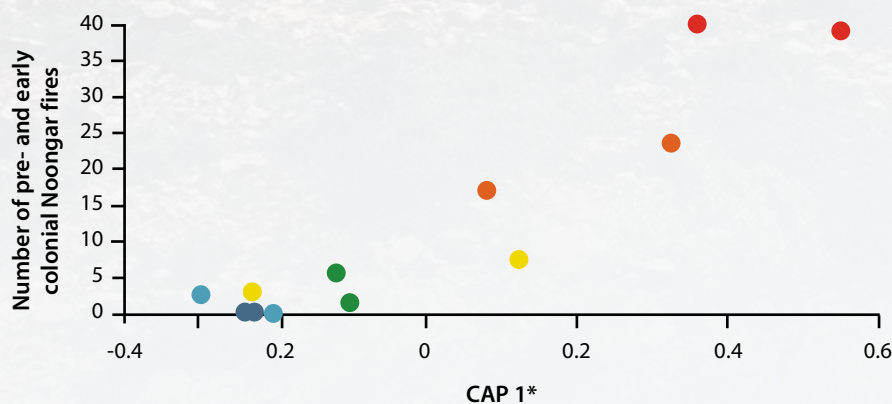
Early colonists recorded that Noongar peoples carried firebrands in all seasons and so are likely to have set fires in all seasons. Another possible limitation of

.....
Above left Snow on the peaks of the Stirling Range can be seen during makuru.
Photo – Ann Storrie

Above Nouvelle-Hollande: Terre de Leuwin.
Artwork – Charles-Alexandre Lesueur 1824/ State Art Collection, Art Gallery of Western Australia



Pre- and early colonial Noongar fires



Key to graph

- Birak
- Bunuru
- Djeran
- Makuru
- Djilba
- Kamarang

*CAP correlating climatic variables via the CAP1 axis with number of pre and early colonial Noongar fires (Data of Abbott 2003).

pre- and early colonial observations is that fires of different purposes had different visibility, as well as the differences in visibility of fires across the seasons.

Use of fire was likely to be partitioned according to gender, leading to differences in locations burned and types of fire techniques. Fires observed in pre-colonial and early colonial records are known from the Noongar season djilba (equivalent to August and September, or early to mid-spring in the southern hemisphere) and greatest during the season birak (equivalent to December and January, or mid to late summer in the southern hemisphere).

However, consideration of only the timing of fire misses cultural considerations of both the purpose and location of fires in the landscape, and the motivations for the timing of fire.

THE FLAMMABILITY PARADOX

If the Noongar peoples burned the land at times when conditions were hot and dry, and the landscape was most flammable, why was the result not large, uncontrollable fires?

We can hypothesise that the answer lies in fuel availability and discontinuity—burning of relatively young and light fuels to larger mosaic of fuel ages, and the locations that were burned at particular times.

It is understood that Noongar peoples moved about the landscape according to the availability of food and water, and for cultural considerations. Particular parts of the landscape would have been burned for purposes such as flushing vertebrate game by men, or promoting productivity of vegetation, food and materials by both men and women.

Above far left Lightning over the Swan River. Photo – Peter Nicholas

Above left Baby frogs complete their transformation into adulthood during birak. Photo – Jari Cornelis

Left A prescribed burn helped to clear vegetation in order to identify and protect cultural assets. Photo – Murujuga Aboriginal Corporation



The mosaic could have been created by a combination of fires from burning practises of Noongar peoples and by inevitable lightning ignitions. Indeed, that such a mosaic is possible has been demonstrated in modern times by Department of Biodiversity, Conservation and Attractions fire managers using aerial ignition to introduce fire into London forest block near Walpole at intervals of one to three years between 2002 and 2011. The outcome was a fine grain mosaic of discontinuous patches of different fuel ages with different abilities to carry fire.

WATER, FOOD AND CERTAINTY

It is believed that Noongar seasons are cued by adaptive responses and, in turn, cue human adaptive responses. Knowledge of what the animals, plants and spirits are doing within the Noongar seasons, and their place within boodjar, allows an understanding of conditions for, and outcomes of, cultural burning. The scale of cultural burning is much finer compared with the variability of modern burning.

Different phenomena are timed according to ecological relationships with several factors, including but not limited to the availability of water.

The cycle of water availability through the landscape has consequences for landscape flammability, the timing of recurring biological events like flowering plants and animal reproduction, and human behaviour, and the Noongar calendar is dynamic and responsive to that cycle.

The areas of landscape available to Noongar peoples varied seasonally with the presence of drinking water, as well as water available to culturally important plant species, and Noongar peoples moved through the landscape accordingly.

Thus, Noongar burning of the landscape hinged on the moisture cycle in (at least) three ways—its effect on where people were in the landscape, why they were there, and which parts of the landscape were deliberately burnt; its effect on fuel flammability and fire characteristics; and its effect on plants and animals as they affected food and resources.

Noongar peoples understood the complex relationships between fire, water, and biological productivity—as is implicit in the six season Noongar calendar.

Top left Swans become flightless during djiilba, using their flight feathers to build nests.
Photo – Rick Dawson/DBCA

Above far left Freshwater food and seafood made up major parts of the Noongar peoples diet during bunuru.
Photo – Matt Kleczkowski

Above left Foods during djeran included zamia seeds which were treated before eating.
Photo – Jean and Fred Hort

Above Aboriginal personnel involved in contemporary burning practices.
Photo – DBCA

Allan Wills is a Senior Technical Officer based in Manjimup with DBCA's Biodiversity and Conservation Science. He can be contacted at (08) 9771 7976 or allan.wills@dbca.wa.gov.au





CLEAR THE TANKS

*Dibbler breeding program
a resounding success*

*by Harriet Mills, Lisa Mantellato
and Cathy Lambert*

If you were lucky enough to visit Perth Zoo's breed-for-release facility over the last few years, you probably saw many dibblers (*Parantechinus apicalis*) scurrying around in their leaf-litter filled enclosures. These energetic bundles of grey fur have been a favourite of the staff in Perth Zoo's Science team, who have been breeding the small marsupials for release to the wild. The tanks are now empty, and for a good reason—the success of the breeding program over more than a quarter of a century has resulted in the establishment of at least three new dibbler populations in the wild, leading to the completion of the breeding program at Perth Zoo.



Hear more about breeding programs at Perth Zoo

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



Dibblers were first described by Europeans in 1842 after a specimen was collected from 'King Georges Sound' near Albany. From those early reports and the fossil record, it seems they had a distribution stretching from Shark Bay in Western Australia to the Eyre Peninsula in South Australia, being found predominantly in heaths and shrublands.

Their mainly insectivorous diet meant food was probably more plentiful in areas of deep leaf litter, with dense vegetation also protecting them from natural predators such as snakes, large lizards and raptors.

European settlement in south-western Australia saw the rapid clearing of natural vegetation, followed closely by the introduction of new predators in the form of feral cats and foxes. This was catastrophic for dibblers and there were no reports of the species for more than sixty years between 1904 and 1967.

.....
Previous page

Main Dibbler at Perth Zoo searching for food hidden in a pine cone.

Photo – Perth Zoo

Background Perth Zoo dibbler research facility in 1998.

Photo – Marie Lochman

Above Juvenile dibbler climbing.

Photo – Alex Asbury

Dibblers are one of a handful of 'Lazarus' species that were thought to be extinct before being miraculously rediscovered. Excitingly, in 1967, wildlife photographer Michael Morcombe inadvertently captured two dibblers while trying to photograph honey possums (*Tarsipes rostratus*) on Banksia flowers at Cheynes Beach, east of Albany.

Once identified by staff from the Western Australian Museum, there was a concerted effort to survey the area, but no more dibblers were found. In subsequent years, dibblers popped up again at Cheynes Beach, Jerdacuttup and Torndirrup National Park, but only one or two animals were recorded at a time. Finally, after much searching, a larger population was found in the Fitzgerald River National Park.

Rather surprisingly, in 1985 dibblers were also found on two small islands in Jurien Bay Marine Park, some 500 kilometres north of their mainland counterparts. Although confined to only a few hectares, these island populations boosted the known number of dibblers overnight from a handful of animals to dozens. Even so, dibblers were still an endangered species and their persistence in the wild remained precarious.

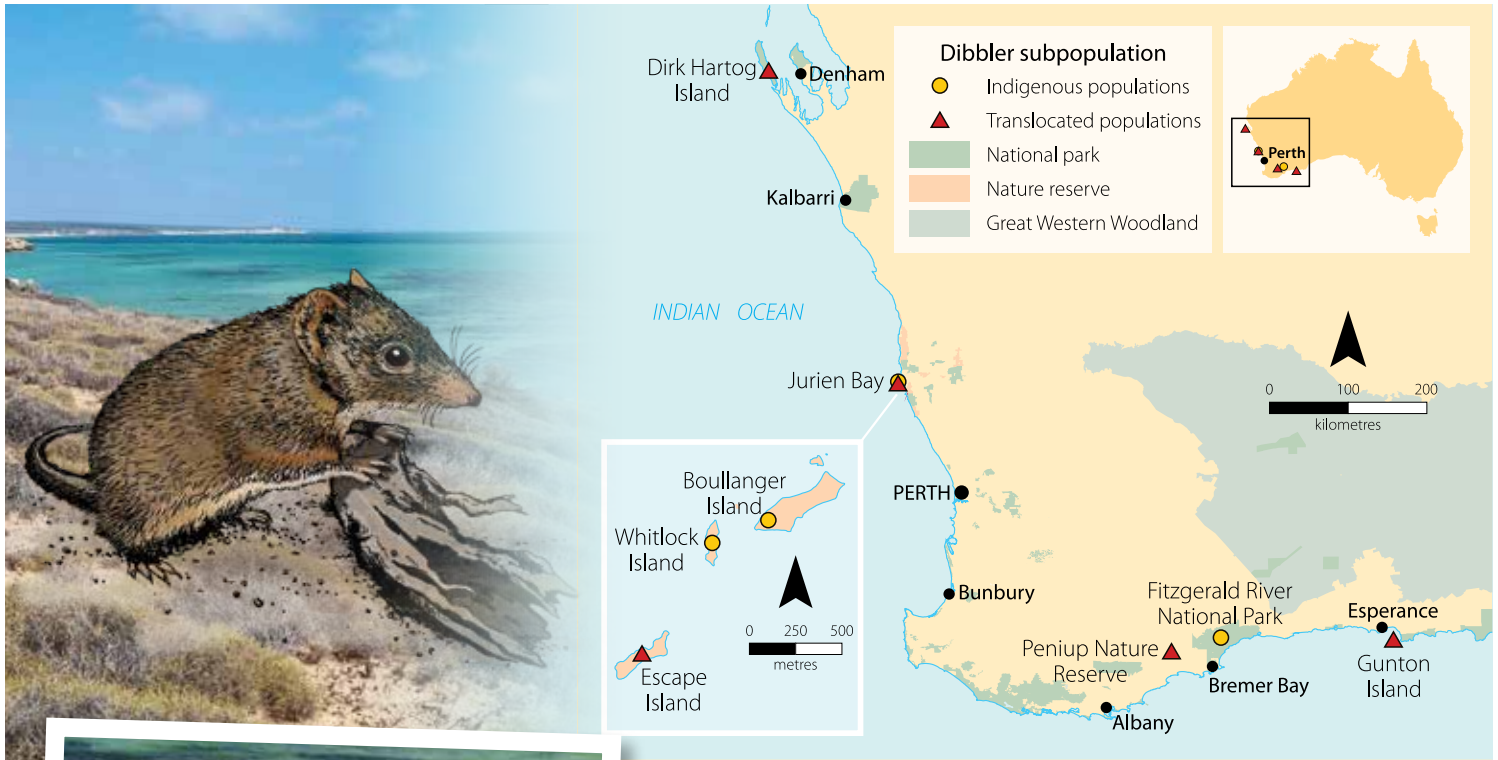
In 1996, there was a gathering of experts including scientists and field staff from the then Department of

Conservation and Land Management, university researchers and local community representatives, and a fledgling Dibbler Recovery Team was formed. Since that time, the Dibbler Recovery Team has worked collaboratively to identify the main threats to the species and propose actions to improve the conservation status of the species. One proposal was to attempt captive breeding at Perth Zoo.

WHY ZOO BREEDING?

Breed for release programs in zoos do come with risks and challenges, which means each program needs to be carefully designed. With the right circumstances, it can be the most effective method to increase the numbers of animals available to create new populations.

For dibblers, the wild populations were small and the impact of removing enough animals for a 'wild to wild' translocation was too great. Females produce a litter of up to eight young each year, and while only a small number would survive to adulthood in the wild, at Perth Zoo almost all the young survive, so numbers can quickly increase. As part of the recovery plan, in March 1997 four pairs were transported to Perth Zoo from Boullanger and Whitlock islands in Jurien Bay Marine Park, in the hope they would produce enough offspring to start a breeding program. From those first four pairs, three



Top Dabbler illustration.
Illustration – Kristy Day/DBCA

Top background Dirk Hartog Island.

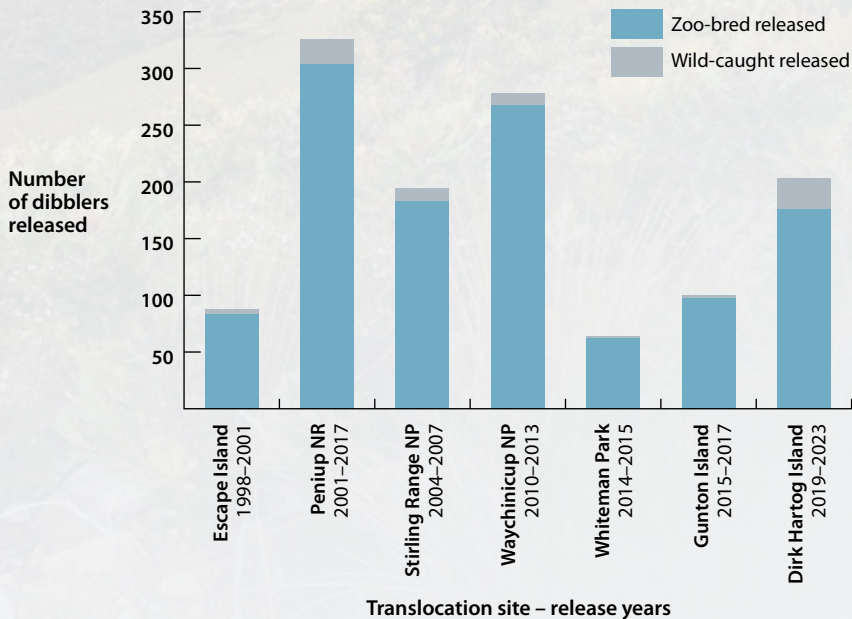
Above Transfer of precious cargo from dinghy to Escape Island.
Photos – Harriet Mills

Above right Measuring growth of young dabbblers.

Right Zookeeper Cathy Lambert and PhD student Harriet Mills in 1998 at Perth Zoo Dabbler Research Facility.
Photos – Jiri Lochman



Dibbler translocations



Summary of dibbler translocations established from the Perth Zoo breeding program (updated from Northover et al. 2022).



Top View from West Mt. Barren, Fitzgerald River National Park.
Photo – Marie Lochman

Above Dibbler in habitat.
Illustration – Kristy Day/DBCA

females produced litters and 19 young were raised to independence. This was a promising start.

QUESTIONS AND ANSWERS

Prior to 1997, dibblers had not been bred in zoos, and there was much to learn about their husbandry requirements and the timing of their reproductive cycles. As well as breeding for release, the animals housed at Perth Zoo provided an opportunity to learn more about dibbler biology, so several research projects were undertaken in collaboration with academics and students at the University of Western Australia and later with other universities.

Early areas of interest were the genetics of island versus mainland populations, the length of the oestrus cycle and gestation, the rate of growth and development of the young, reproductive behaviour, and mate choice. Over the years, there have been several postgraduate student projects studying dibblers at Perth Zoo, either directly using the zoo animals, or indirectly through research on the translocated populations. At last count, dibblers have been the focus of two Graduate Diplomas, eight Honours

projects, one Masters and six PhDs.

Much has been learned and scientists now understand there are genetic, morphological and behavioural differences between the dibblers from the mainland and the islands. The mainland dibblers are around 30 per cent larger and they have a gestation period of around 45 days—a week longer than island females (38 days). The breeding season for dibblers originating from mainland populations is also earlier than for island animals.

Genetic variation is higher in the mainland population, which is not surprising considering that the islands have had small, isolated populations for many generations.

The first dibblers arriving at Perth Zoo came from the Jurien Bay Marine Park islands, as numbers there were higher than in Fitzgerald River National Park, and there were large enough numbers to select pairs for breeding.

In 2000, Perth Zoo switched to breeding dibblers from Fitzgerald River National Park. This was mainly because of their greater genetic diversity, but also because the next proposed release sites were on the south coast, and therefore Fitzgerald River dibblers were likely to



be better adapted to the cooler, wetter conditions than those from the Jurien Bay islands.

Fortunately, after some concentrated fieldwork, departmental staff had also identified areas where dibblers could be found in good numbers on the south coast, allowing regular additions to the Perth Zoo colony to maintain genetic variability.

In 2019, Perth Zoo switched back to breeding dibblers from the Jurien Bay islands for release to Dirk Hartog Island, as the habitats were more similar, and it was decided those island animals may be better adapted to the drier conditions they would encounter on Dirk Hartog Island.

All this research contributed to improved outcomes in the health of the Zoo colony and in breeding success, as well as for the broader management of the species in the wild.

This is not to say there weren't challenges, particularly in the early stages of the breeding program. There were issues of mate incompatibility between breeding pairs, maternal aggression towards their young and mastitis in females during the weaning process. Importantly, the program was well-funded and well-managed, with staff having

the time and resources to make detailed observations and maintain excellent records. The team could then problem solve and quickly make informed decisions to modify techniques and overcome these issues.

Research on mate selection showed that pairing females with larger males eliminated most of the mate incompatibility issues. Providing more space, decreasing disturbance, reducing noise levels and making closures more complex dealt with the maternal aggression issues, and modifying the weaning process removed the mastitis issue completely.

WHERE ARE WE NOW?

From humble beginnings, the dibbler breeding program has made a significant contribution to the recovery of the species. While still listed in Western Australia as Endangered, dibblers are now more secure than when the breeding program began in 1997.

From one mainland population and two island populations in 1997, there are now an additional two populations on islands—Escape Island in Jurien Bay and Gunton Island on the South Coast.

“From humble beginnings, the dibbler breeding program has made a significant contribution to the recovery of the species. While still listed in Western Australia as Endangered, dibblers are more secure than when the breeding program began in 1997...”

Top left Cathy Lambert releasing another dibbler on Escape Island.

Photo – Harriet Mills

Above left The translocation team on Dirk Hartog Island.

Photo – Samantha Webb

Above Dibbler stack.

Photo – Perth Zoo



A third population on Dirk Hartog Island is not yet fully established, but there are positive signs for success, with an island-born dibbler with pouch young recorded in May 2023, and increased detections of dibblers on remote camera traps.

Translocation of dibblers to Dirk Hartog Island, known to the Malgana peoples as Wirruwana, is part of the ambitious *Return to 1616* project that aims to restore the ecosystem to a similar condition to when the first European visitors saw it more than 400 years ago.

Mainland populations have been harder to establish and there were failed attempts at Waychinicup, Stirling Range

National Park and Whiteman Park, but several translocations to Peniup Nature Reserve between 2001 and 2017 have resulted in dibblers persisting at that location.

END OF AN ERA

Since 1997, staff from the Perth Zoo Science team have successfully bred 1253 dibblers for release to the wild—1080 zoo-bred adults and 93 pouch young that were released with their mothers, along with 80 wild caught animals.

The success of the program is certainly cause for celebration, but it is slightly bittersweet for the staff at Perth Zoo who have now said goodbye to the last group of these furry favourites.

Above Dirk Hartog Island.
Photo – Harriet Mills

Inset left Lisa Mantellato on Dirk Hartog Island.
Photo – Lesley Shaw

Inset right Dibbler being examined.
Photo – Perth Zoo

Below Dibbler.
Photo – Alex Asbury



Harriet Mills completed her PhD on dibblers and is now the Perth Zoo Science Program Leader within DBCA's Biodiversity and Conservation Science. She can be contacted at harriet.mills@dbca.wa.gov.au

Lisa Mantellato is a Senior Technical Officer at Perth Zoo working in DBCA's Perth Zoo Science Program and can be contacted at lisa.mantellato@dbca.wa.gov.au

Cathy Lambert was previously the Supervisor, Perth Zoo Science, overseeing the dibbler breeding program and is now retired.

A program that runs for 26 years involves too many people to name individually, but the authors would like to acknowledge the important contributions of Dr Tony Start, Dr Tony Friend, Dr Lesley Gibson, Tim Button, A/Prof Roberta Bencini, Dr Mark Bradley, Dr Helen Robertson, Dr Terry Fletcher, Dr Peter Mawson, Caroline Lawrence, Perth Zoo Veterinary staff and Perth Zoo Science staff.

Down the garden path



Josh Byrne grew up on the south coast of Western Australia, immersed in the stunning coastal landscapes, which carved a deep love and fascination with the natural environment. As his skills and knowledge grew, so did his sense of responsibility for our shared future, and he now spends his days sharing his love and passion for sustainability.

by Lauren Cabrera



Touched by nature

A childhood spent immersed in nature had a deep impact on a young Josh Byrne. Growing up by the magnificent coast and hinterland near Esperance, Josh was fascinated by nature, which developed into a deep respect and a strong desire to take care of the natural environment.

His father was a keen sailor, so many days were spent out on the picturesque waters of the south coast of Western Australia visiting islands and being immersed in the outdoors.

In between childhood and his early teen years, his love for nature developed into an interest in how things grow. After moving to the suburbs of Perth, he was lucky enough to be surrounded by large backyards and has fond memories of helping his father look after their garden and herb collection.

SETTING UP ROOTS

What is an arguably uncommon pastime for a teenager, Josh would spend much of his spare time in his backyard growing and propagating plants.

“It was part of my list of chores to look after the herbs and I quickly became riveted by the process of watching them grow and keeping them flourishing,” Josh said.

“I started my own vegetable garden at age 14 and after a few years it had taken over the backyard.”

Josh’s father was a keen book collector and Josh pored over the pages of

.....
Previous page

Main Sustainable gardening is Josh’s passion.

Photo – Rob Firth

Below Spectacular wildflowers on display as part of the Everlasting Kings Park Festival.

Photo – Tourism WA

Inset Josh is a seasoned TV presenter.

Top right The Josh’s House project uses best practice sustainable design.

Photo – Rob Firth

Above right Volunteering on a permaculture project in Malawi.

Above far right Josh in his student permaculture garden.

Photos – Josh Byrne & Associates



“I started my own vegetable garden at age 14 and after a few years it had taken over the backyard.”

Australian literature about permaculture and gardening, reading the books cover to cover and putting into practice what he’d learned.

All the while, as he learned more and more, he was constantly thinking ‘how can we do things better?’, ‘how can our homes and gardens be less wasteful?’.

His brain was well and truly switched on to the notion of sustainability, which led him to enrol in an Environmental Science course at Murdoch University.

While studying, Josh rented a rundown quarter-acre block in Dalkeith with a wonderful old garden.

“I chose the house because of the garden, and over the next six years I fixed it up and restored the old fruit trees and hen sheds,” Josh said.

“We had chickens, pigeons and quail, as well as frog ponds. Essentially creating our own little ecosystem, all on a student budget.”

“It was self-led apprenticeship in gardening and permaculture, and I started studying short courses in horticulture and permaculture to learn as much as I could.”

Parties would end up back at the house and revelers would be fascinated by the extensive garden and Josh found himself conducting late night garden tours past the bathtub ponds and thriving vegetation.

“The whole place was alive with sounds and smells, and the entire property became a well-managed permaculture project, with native gardens out the front and food growing out the back.

“It was all made out of salvaged materials, but it had a good aesthetic and was very functional. It was a little bit wild but very, very special.”

It was a deep immersion for Josh, and he was fortunate to meet a keen group of researchers at university who were involved in setting up a demonstration site on campus called the Environmental Technology Centre.

The group looked at environmental technology for remote communities, including things like composting toilets, small scale renewable energy systems and sustainable building materials.

“It was an opportunity for someone with a background in gardening and



permaculture to look at how it all fits together.

“I found myself with a part-time job while studying and maintaining my home garden.”

PAVING THE PATH

Word soon got out about the group of bachelor students with the amazing permaculture garden. A small article in the local paper turned into the story being picked up by The West Australian newspaper and an interview with Channel 7’s Today Tonight.

“I couldn’t believe I had Monika Koss from Today Tonight in my backyard at one point,” Josh said. “Then Neville Passmore from ABC did a two-part story, which led to a job offer on ABC TV’s Gardening Australia at age 25!”

Above The ABC TV Gardening Australia Team.
Photo – Australian Broadcasting Corporation

Above right Bountiful sustainable garden produce.
Photo – Rob Firth

Right Colourful characters at the Everlasting Kings Park Festival.
Photo – Josh Byrne & Associates

As excited as he was for a job with the ABC, Josh chose to finish his undergraduate degree and do volunteer work on a permaculture demonstration farm in Malawi. He then went on to a kibbutz in Israel to learn about efficient irrigation and wastewater re-use before he accepted the job while finishing his PhD.

The approach for Josh’s part in Gardening Australia played directly to his strengths. He would set up a series of gardens in rental properties, drawing from his own first-hand experience.

Amongst all this, he always made sure he took time out to spend in nature. Reconnecting with the natural world reminded him why it is so important to protect our natural systems.

BRANCHING OUT

Josh’s passion only intensified as the years passed, as did his interest in aesthetic landscape design that mixes function and beauty.

“I find a lot of positivity and creativity through gardening and landscaping. It helps





balance out the frustrations by creating something beautiful and functional.”

Josh established his own company in 2005 and today provides consulting and design services to commercial, civic and community projects. He takes an integrated approach to landscape architecture and urban design, drawing on all those years of experience and an unwavering desire to create sustainable living spaces.

On a community level, Josh has been running Riverwise Garden workshops since 2016 directly to keen, or often frustrated, gardeners who are trying to do the right thing when it comes to their gardens.

The workshops are run as part of the Department of Biodiversity, Conservation and Attractions’ River Guardians program and are all about helping the community to support the health of the Swan-Canning river system.

“For those who live close to the river, fertiliser runoff can get into stormwater drains and then directly into the Swan-Canning river system,” Josh said.

“For those further from the river, over fertilising on sandy soils can also have an impact, with nutrients leaching past the root zone and into the groundwater, then into waterways.”

“I explain how to improve soil to hold onto nutrients, encourage the use of

river-friendly fertilisers and demonstrate ways to be water efficient and improve biodiversity. It’s about taking a balanced approach so you can have the garden you want and still support the health of our waterways.”

ENCOURAGING POSITIVE CHANGE

The course of Josh’s life is testament to the well-documented notion that a childhood spent immersed in nature and developing a connection to the natural world is deeply impactful on behaviour, health and wellbeing.

“My great love of nature keeps me motivated and constantly seeing the potential for positive change,” Josh said.

Josh finds opportunities for positive change in all aspects of his work—from Gardening Australia to his professorial role at Curtin University as the Dean of Sustainable Futures, to delivering community education programs, and his consulting and design practice.

“The penny has dropped. We don’t need to spend so much time convincing people about the challenges facing the environment and most people want to know what they can do, in their own small way, to help.

“The challenge is to help people connect with what that is, even if it’s as

Get involved

For information on how to attend Josh’s next community workshop, visit riverguardians.com.au

Above left Participants of a Riverwise Gardening workshop.

Photo – Josh Byrne & Associates

Top Talking to visitors at the Everlasting Kings Park Festival.

Above Presenting to a large audience at a Riverwise Gardening workshop.

Photos – Jason Menzies/DBCA

simple as being more mindful of how you fertilise to support a healthy river system. These small things add up and make a real difference.”

Lauren Cabrera is a *LANDSCOPE* editor and a very amateur gardener. 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



Living things vs non-living things

Out in the forest, in your backyard or at your school there are a mixture of living (biotic) and non-living (abiotic) things! Biotic things include animals, plants and bugs. Abiotic things include water, rocks and the sun. Living things cannot survive in the bush without non-living things, they are all connected.

Head out into your backyard or local bushland to see how many biotic and abiotic things you can spot! Bring this page with you to then play the *Is It Living?* game.



Is it living?

Instructions

You will need: **dice** and **counters**.



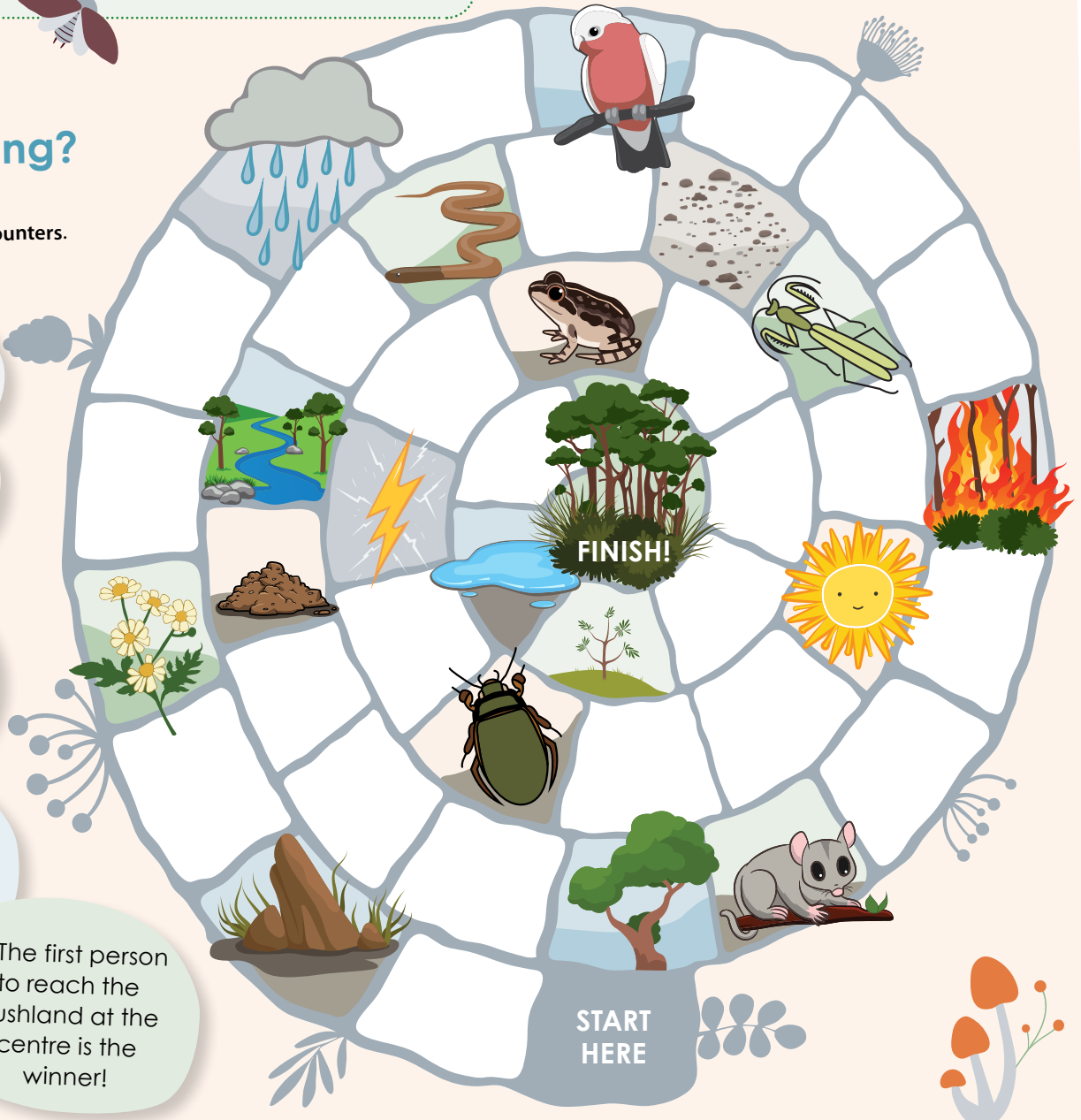
1. Take turns to roll the dice.

2. Move counter forward as per the number shown on the dice.

3. If you land on something living (biotic), go forward two spaces.

4. If you land on something not alive (abiotic) go back two spaces.

5. The first person to reach the bushland at the centre is the winner!





Dibbler (*Parantechinus apicalis*)

The dibbler is a small marsupial with coarse brownish grey fur, speckled with white. It has distinctive white eye-rings and a tapering hairy tail. Dibblers are carnivores and feed mostly on ground-dwelling insects and other invertebrates but also eat small lizards, birds and mammals. They are crepuscular, which means they are most active at dawn and dusk, and live in areas with lots of leaf litter. This provides them with their food supply of invertebrates and provides cover from predators.

Illustration by Gooitzen van der Meer

Reference photo by Perth Zoo.

Nature's pin-ups

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