

WA'S PARKS, WILDLIFE AND CONSERVATION MAGAZINE

# LANDSCOPE

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**FROGS  
IN THE  
WHEATBELT**  
Spotted frogs  
defying the  
odds

**Feeding  
native birds**  
Understanding the rules

**Making maritime history**  
Explorers of WA's coastline

**Star Trek**  
Bibbulmun Track  
after dark

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Department of Biodiversity,  
 Conservation and Attractions



ON THE COVER

**Front cover** Western spotted frogs have the adaptive capacity required to survive in drying climates.

Photo – David Bettini

**Back cover** Ancient giant granite boulders reflected in the calm waters of a billabong on the Avon River in the Western Australian bush.

Photo – Richard McDowell/Alamy

Western Australia is home to some of the richest and most unique plants and animals on earth, with the south-west of the State known to be one of the world's 34 biodiversity hotspots.

The Department of Biodiversity, Conservation and Attractions (DBCA) plays a key role in protecting our native flora and fauna, and is constantly striving to enhance and conserve WA's landscape and natural values.

On 1 January 2019, the *Biodiversity Conservation Act 2016* and *Biodiversity Conservation Regulations 2018* were introduced to provide greater protection for biodiversity, particularly threatened species and threatened ecological communities. This modern legislation replaced the outdated *Wildlife Conservation Act 1950* and *Sandalwood Act 1929*.

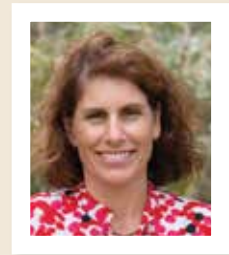
One of the ways the department is doing more to protect the State's threatened species and ecological communities, is by applying harsher penalties for illegal take. Under the *Biodiversity Conservation Act*, the maximum penalty for taking a threatened species is now \$500,000, a significant increase from \$10,000 under the *Wildlife Conservation Act*. There are also significantly higher penalties for unlawfully taking, selling or exporting sandalwood, a fragrant native timber that produces oil used in perfumes and other products. Preventing the illegal harvest of this species has been a challenge for many years and it is hoped that the new penalties will provide a strong deterrent.

As far as the *Biodiversity Conservation Regulations* go, we've modernised the licensing regime for flora and fauna, providing additional protection for native species. While all licences now have a fee to cover the department's costs of assessing, issuing and administering different licence types, fees can be reduced or waived in certain circumstances. Some fees have also been set at lower levels than previously, such as for people keeping reptiles as pets.

To strengthen biodiversity conservation, some new activities now require a licence. One of these is feeding wildlife. In this issue of *LANDSCOPE*, you can read about one way to reduce some of the negative impacts associated with feeding native birds (see page 20). While many of us grew up throwing bread or lunch scraps to the neighbourhood birds, these days we know in most cases, it's doing more harm than good.

While there are a lot of changes, these new laws are in place for good reasons – to help educate our community and safeguard the future of our native flora and fauna.

**Dr Fran Stanley, Executive Director, Conservation and Ecosystem Management**  
Department of Biodiversity, Conservation and Attractions



Contributing

**Claire Greenwell** is a marine ecologist and conservationist with a passion for terns. She is currently undertaking a PhD project exploring the life-history, behaviour and feeding ecology of fairy terns in south-western Australia and is the convenor of the Western Australian Fairy Tern Network, engaging directly with land managers, government and non-government organisations, and citizen scientists to improve outcomes for this threatened species.



**Dian Fogarty**, also known as the 'cane toad lady' has been with DBCA for three years in the role of cane toad education and communication. Based in Broome, she travels the Kimberley, visiting remote schools and communities to deliver information about cane toads and Kimberley-specific environmental education. Dian facilitates Indigenous ranger training workshops and school holiday programs across Kimberley national parks.



**Dr Robert Davis** is a fauna ecologist and a senior lecturer at Edith Cowan University. His passion for frogs was ignited during his honours year at Murdoch University and continued during a PhD at the University of Western Australia. He now heads a wildlife lab at ECU looking at the impacts of human disturbance on wildlife, especially birds, reptiles and frogs.



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

**This page** Fairy tern.

Photo – Claire Greenwell



Department of Biodiversity, Conservation and Attractions

## Features

- 8 **Parks for People: Leeuwin-Naturaliste National Park**  
WA's most popular national park.
- 12 **Phillip Parker King: Master mariner of the Australian coast**  
Maritime explorer who made history on WA's coastline.
- 20 **Taking heed of bird seed**  
Changes to laws protecting native birds.
- 24 **Travelling toad show**  
A toad busting trip through the Kimberley.
- 28 **Sea lions of the south coast**  
Recovering from extensive fur and oil hunting.
- 35 **Adventure out: Star Trek**  
Walking the world-famous Bibbulmun Track after dark.
- 38 **Stepping closer to 1616**  
Ecological restoration continues on Dirk Hartog Island.
- 42 **Spotted! Western spotted frogs in the Wheatbelt**  
A noisy little frog defying the odds.
- 48 **Jumping for joy**  
Boosting conservation efforts for the beloved fairy tern.

## Regulars

- 3 **From the desk of Dr Fran Stanley**  
A foreword from Executive Director, Conservation and Ecosystem Management.
- 6 **Bush Telegraph**  
Short stories from around the State, readers' pic and a guest word.
- 11 **In review**  
A collection of books and applications.
- 47 **Discovered**  
Tarin Rock banjine.
- 53 **Kaleidoscope**  
Connecting kids with nature.
- 54 **Nature's pin-up**  
Boab tree (*Adansonia gregorii*).



**Snap  
shot**



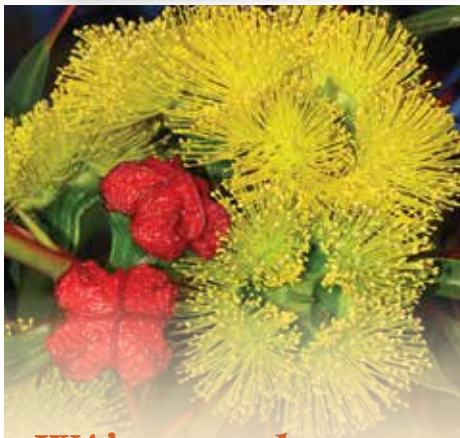
## READERS' PIC

### **Varied sittella**

Photo and words by Chris Tate

"Looking for grubs in the bark of a tree alongside the Tone River near Franklin the varied sittella with its black cap, slightly upturned beak and orange bar in its wing is quite distinctive when it flies from tree to tree. Found in various forested areas of southern WA they are often seen in small flocks walking up the sides of trees or even upside down on branches in pursuit of insects. I find them fascinating to observe."

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



## **WA's popular eucalypts**

It seems Western Australia's eucalypts are very much en vogue.

Gardening Australia recently featured WA's spectacular *Eucalyptus preissiana* (Myrtaceae), which is distributed along the southern coast and hinterland between Albany and Esperance.

On National Eucalypt Day 23 March, the beautiful WA native *Eucalyptus erythrocorys* (Illyarrie), also known as the red capped gum, was announced as Australia's 2020 Eucalypt of the Year! When other plants aren't flowering, this eucalypt provides nectar and pollen for our native wildlife.

Above *E. erythrocorys*.  
Photo – DBCA

## Thank you, Yanchep community!

In December 2019, a bushfire raged through Yanchep National Park triggering an outpouring of concern and support that united the community.

DBCA's volunteer coordinator Ciara McIluff, who coordinated the community response, explained that "within hours of the fire igniting we were inundated with offers of assistance, with countless locals asking what they could do to help."

In the wake of the fire, volunteers were anxiously waiting to be told it was safe to re-enter the park. The moment the park re-opened, a team of local wildlife carers and volunteers began searching for injured animals.

Northern Valley Wildlife Support tended to the abandoned or injured kangaroos and encouraged volunteers to build nesting boxes for bats, possums, Carnaby's cockatoos and other hollow-nesting birds.

Other teams began the momentous task of removing weeds that established after the fire and pose a threat to native flora, revegetating degraded areas and removing glass and other rubbish.

Volunteers continue to monitor wetland water quality for any adverse effects from the fire, photo monitor the post fire regeneration, keep an eye out for injured animals and educate tourists about the dangers of entering the burnt ground.

"It has become evident from the outpouring of support that Yanchep National Park holds a special place in the hearts of many and we would like to thank all of the staff, volunteers and community members who are helping this special place and its inhabitants rise from the ashes," said Ciara.



Left Wildlife carers search for injured wildlife at Yanchep National Park.  
Photo – DBCA

Guest column



Mural for Wellington Dam

In February, Premier of Western Australia Mark McGowan announced the plan to create a large-scale mural on the wall of Wellington Dam in Wellington National Park. The surface area of the wall is over 12,000 square metres. In order to get the wall ready for the artist to begin painting, workers will need to abseil across the face of the wall to be able to clean it! The artist could require a 250-tonne crane to create the piece.

A local community survey suggested that the artwork could honour the region's flora and fauna, the history of the area and its Noongar connection as part of a \$1.5 million mural trail project for Collie, with the State Government calling on artists to submit designs for selection.

The Premier said the artwork would turn the wall into a world-class attraction and a 'must-see' destination in WA.

"What we're going to do here is create one of Australia's biggest murals on Wellington Dam, if not the biggest mural in the entire world," Premier McGowan said.

"The idea behind it is it will attract tourists, locals, interstate and international people right down here to Collie to showcase the marvellous Wellington National Park, the extraordinary Wellington Dam and the beautiful community of Collie and the surrounding towns."



Above and right Wellington Dam.  
Photos – DBCA

*Addendum*

Last issue we brought you the story about improving accessibility in our national parks 'Access to more, for more', *LANDSCOPE* Autumn 2020. In it, we include a caption to a photo of a female competitor using an adaptive handcycle. The caption states she is on the Cape to Cape Track, but in fact she is in the Cape to Cape Mountain Bike Race, which is not on the track. Indeed, cycling is not allowed anywhere along the Cape to Cape Track. Thank you to Cape to Cape volunteer Nita Pratt for noticing the error and bringing it to our attention. *LANDSCOPE* apologises for this mistake.



**Tiffany Shellam**

*Associate Professor and History lecturer at Deakin University*

This year marks 200 years since Phillip Parker King's hydrographic survey charted the west and northern coast of Australia. While earlier histories of his voyages have honoured King as the captain and leader of the expedition, new stories from the archives and remnant natural history and ethnographic collections from these voyages in museums in WA and the UK reveal a cast of other characters and histories that warrant attention.

There is now recognition that Indigenous people were central figures on board maritime expeditions throughout the 18th and 19th centuries. Intermediaries navigated challenging encounters with Aboriginal strangers, and shaped or influenced the knowledge that the explorers generated about specimens and artefacts that went back to England, offering cultural and environmental knowledge. These individuals are belatedly receiving acknowledgement in commemorative events and histories.

Over the course of King's four-year expedition, two Indigenous intermediaries were part of his crew. Joining the expedition in Sydney, Boongaree, (known today as the iconic go-between, Bungaree), a Kuringgai man from Broken Bay, signed on to the expedition for the first voyage (December 1817 – July 1818); while Bundle, a Dharawal man from the Cowpastures area near Sydney, signed on for the final voyage in May 1821. These men were required to assist the explorers in their communication with Aboriginal people met along the coast, which they did many times.

The botanist, Allan Cunningham, appreciated Boongaree's attentiveness to his collecting needs during the voyage as he benefited from Boongaree's labour, presence and protection when botanising on shore. At Point Cunningham, Bundle helped the crew determine that some of the rocks in their geological collections were in fact core artefacts, used by Indigenous people 'to make hatchets'. Boongaree and Bundle's expert botanical knowledge assisted explorers' understanding of the west coast's natural history. It is important to commemorate their knowledge that was crucial to the assistance of Phillip Parker King's 'discoveries' 200 years ago (see page 12 'Phillip Parker King: Master mariner of the Australian coast').

*Tiffany's book Meeting the Waylo: Aboriginal encounters in the Archipelago (UWAP, 2019), highlighted the experience of Indigenous intermediaries on King's expeditions and is available at [uwap.uwa.edu.au/products/meeting-the-waylo](http://uwap.uwa.edu.au/products/meeting-the-waylo).*



## Leeuwin-Naturaliste National Park

*The remarkable Leeuwin-Naturaliste National Park stretches 120 kilometres between Cape Naturaliste and Cape Leeuwin with a diverse and captivating landscape of rugged coast, beaches, bushland, caves, forests and historic and archaeological sites.*

**W**ith its temperate climate of cool winters and mild, warm summers and a plethora of recreational activities on offer, the region has become a popular destination for city dwellers, interstate and overseas visitors who rest in nearby resorts, vineyards, farms and townships.

Recreational activities at the park include abseiling, rock climbing, riding and bushwalking. It's important to note that some activities can be dangerous such as

**Above** Canal Rocks.  
Photo – David Bettini

**Above top right** Purple-crowned lorikeet.  
Photo – Sallyanne Cousans

**Above right** Spider orchid.  
Photo – Ann Storrie

swimming and surfing due to the large swells, rips and difficult conditions. Abseiling and rock climbing can also be dangerous, especially near the popular Bob's Hollow.

### CULTURAL CONNECTION

It is of little surprise to the local Wadandi people that Leeuwin-Naturaliste is the most visited national park in the State. The Wadandi people, one of the fourteen Noongar tribes in the south-west of Western Australia, have an intimate knowledge of the land, its changing seasons and abundant natural foods.

The Leeuwin-Naturaliste Ridge is a major feature of the park running along the coast between Cape Naturaliste and Cape Leeuwin, nestled in the land of the Wadandi people.

Aboriginal occupation of the Leeuwin-Naturaliste area dates back at least 40,000

years and is reflected in the names of many nearby sites such as Yallingup, which means 'place of caves', Meekadarabee 'the moon's bathing place' and Boranup 'place of the male dingo'. Nearby Cowaramup is the place of the parrot (*cowra*) or purple-crowned lorikeet, which, according to Noongar lore, brought fire to Earth. Injidup comes from the Noongar word (*inji*) for the lovely red pea flower (*Templetonia retusa*), which grows along the limestone cliffs in winter. To Aboriginal people, this area was a land of plenty, providing local tribes with a rich variety of edible plants, wildlife and fish.

### NATURAL WONDER

Leeuwin-Naturaliste National Park forms part of an internationally recognised biodiversity hotspot. Additionally, the densely vegetated thickets in rivers, streams and wetland systems of the



Discover more about  
Leeuwin-Naturaliste  
National Park

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



Left Boranup Forest.  
Photo – Marc Russo

Above Western ringtail possum.  
Photo – Suzanne Trigwell/DBCA

Leeuwin-Naturaliste Ridge provide refuge for several native fauna species including threatened mammals such as the western ringtail possum, chuditch and brush-tailed phascogale. Thanks to DBCA's *Western Shield* wildlife recovery program, populations of these species are being protected in the Leeuwin-Naturaliste National Park from the threat of foxes.

Western grey kangaroos are plentiful, and brushtail possums make regular visits to forest campsites, especially Point Road.

Fascinating spider orchids are one unusual group of plants in a huge diversity of plant and animal life in the park and the region boasts an incredible 7239 plant species, most of which are found nowhere else on Earth.

Boranup Forest between Caves Road and the coast is home to pale-barked karri trees that reach heights above 60 metres and is the furthest west you can find karri, the third tallest tree in the world. Boranup is a regrowth forest less than 140 years old, grown after timber tycoon Maurice Coleman Davies milled the trees in 1884. Trees from the timber yard were once used to build the iconic Hamelin Bay jetty that could once berth three ships at a time, and the mill itself has recently been developed

into a camping area called Jarrahdene. The campground has an enjoyable interpretative walk through old relics from the era when the mill was functioning (see *Step back in time: Jarrahdene, LANDSCOPE Summer 2019–20*).

## LIGHTHOUSES, SHIPWRECKS AND LEGENDS

The first European sailing ship to arrive in the area was the Dutch ship *Leeuwin* in 1622. Almost 180 years later, the famed naval navigator, chart maker and explorer Matthew Flinders sighted the same rocky headland and named it Cape Leeuwin in honour of the Dutch ship.

The next year, French explorer Nicolas Baudin made landfall at Geographe Bay, giving French names to many landmarks along the coast.

A small group of British settlers, including the Molloy, Bussel and Turner families, moved to Augusta in 1831 and set up timber, agriculture and dairy farming industries. The Bussels moved soon after and formed the town of Busselton.

The profitable jarrah and karri industry saw tonnes of wood shipped from Augusta and Hamelin Bay during the timber boom of the 1890s. However, the wild beauty

of the coast between the capes was treacherous for ships. At least 22 ships wrecked at Cape Leeuwin and 12 ships off the most westerly tip of Australia, Cape Naturaliste, before lighthouses were built in 1895 and 1903 respectively.

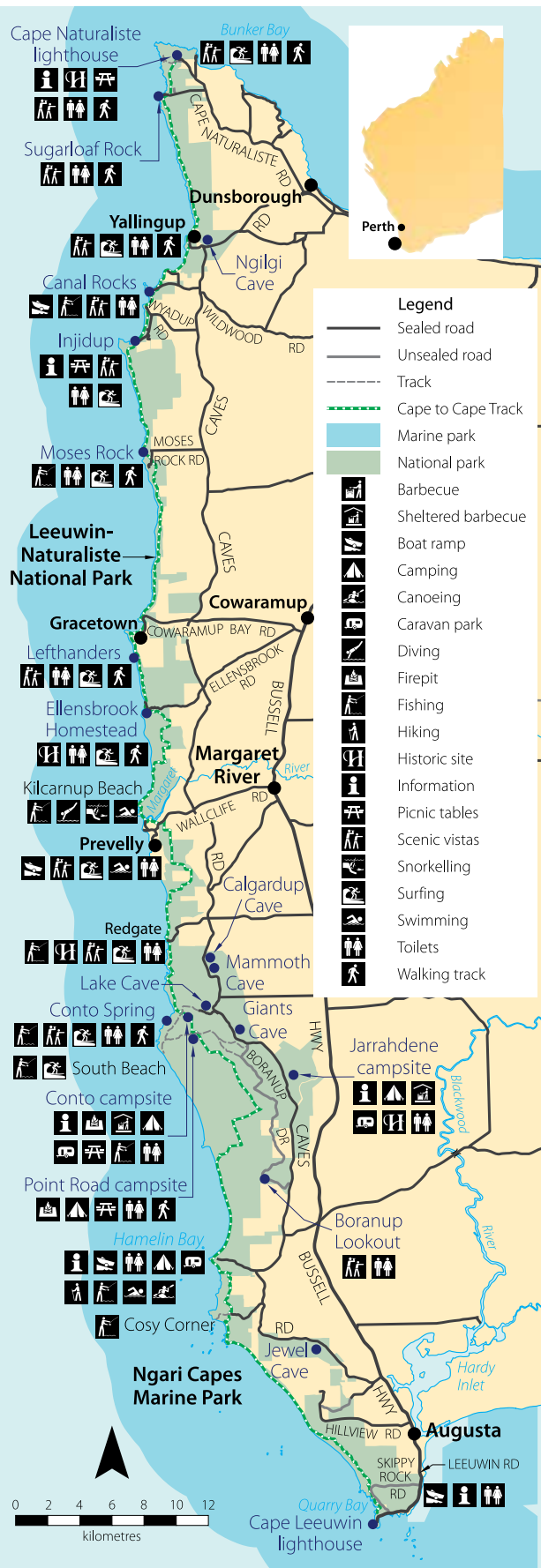
The lighthouses not only continue to provide safe passage for mariners but have become iconic landmarks of the area. Cape Leeuwin is an important collection site for meteorological data and boasts the longest unbroken record of weather data recording in the State since 1897.

## CAPE TO CAPE TRACK

The premier walk trail along the Leeuwin-Naturaliste coastline is the Cape to Cape Track, winding 130 kilometres from Cape Naturaliste to Cape Leeuwin.

The track takes five to seven days to walk and is one of only two long distance walk tracks in the south-west of WA. To the north, a 3.5-kilometre section of the track from Cape Naturaliste to Sugarloaf Rock has been developed to a higher standard to accommodate high visitor use including those with disability and the elderly, and is pram friendly. To the south, the track remains less developed to maintain a more remote experience.

# Parks for people Leeuwin-Naturaliste National Park



The Cape to Cape Track crosses the Margaret River where it meets the ocean and when the river mouth is open in winter and spring a track diversion is in place as it is difficult and dangerous to cross. The track is pleasantly challenging and takes walkers through breathtaking coastal scenery.

The rich sea life of the Cape to Cape coast is one of the great attractions of the track. From the track you can often see humpback and southern right whales migrating up and down the coast, bottlenose dolphins surfing along the beach, shorebirds such as the red-capped plover and sooty oystercatcher feeding in the shallows, and osprey circling overhead. An amble along the shoreline will reveal crabs, periwinkles and limpets clinging to the rocks with a variety of seagrasses and colourful seaweeds washed up on the beach.

For end-to-end walkers travelling north to south, Cape Naturaliste Lighthouse is an iconic departure point and Cape Leeuwin's tall visage, nestled out on the rocky south-west tip of WA, signals to walkers that they have reached their destination. Visit [trailswa.com.au](http://trailswa.com.au) for more information about walking the Cape to Cape Track.

## CAVES OF THE CAPE

The limestone of the Leeuwin-Naturaliste Ridge is home to caves, with a wide variety of caving experiences on offer, from self-guided, unlit Calgardup or more adventurous Giants Cave, to lit-up Mammoth Cave or guided tours such as Ngilgi, Lake and Jewel Caves.

Swamps and small streams supply water to some caves. Tree roots can make their way into these and form root

mats that in turn may harbour many communities of invertebrate life, some of which may not be found anywhere else in the world.

Fossils and archaeological specimens have been found in some cave deposits, including evidence of Noongar occupation and remains of extinct marsupials, reptiles and birds. The caves' constant temperature, humidity, alkalinity and protection from disturbance means that rich and diverse assemblages of fossil vertebrates have been well preserved and are some of the best examples of any Pleistocene deposits found in Australia.

Above left Cape to Cape Track, near the Wilyabrup Cliffs.

Above Ngilgi Cave.  
Photos – Tourism WA

## Do it yourself

**Where is it?** 92 kilometres south-west of Bunbury.

**Total area:** 19,000 hectares

**Facilities:** Information, toilets, picnic tables, gas barbecues, campgrounds, walk trails, bike trails, 4WD access, boat ramps, boat and canoe access, beach fishing

**Recreational activities:** Abseiling, camping, fishing, rock climbing, boating, bushwalking, surfing, swimming, wildlife viewing

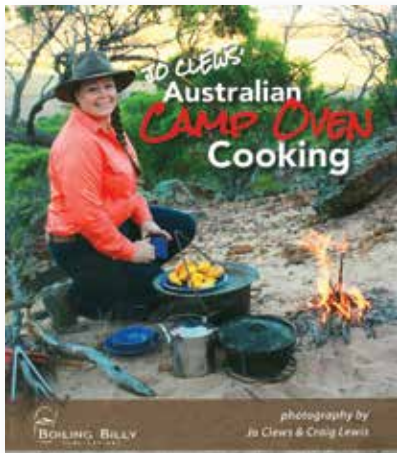
**Nearest Parks and Wildlife Service office:** Blackwood District, 14 Queen Street, Busselton WA  
Phone: (08) 9752 5555

Conto campground can be booked online at [parkstaybookings.dbca.wa.gov.au](http://parkstaybookings.dbca.wa.gov.au)

## BUTTERFLIES AUSTRALIA

Butterfly watchers around the country can leave their net at home because researchers at The Australian National University (ANU) have developed an innovative app to gather information about Australian butterflies. The app is part of the *Butterflies Australia* citizen science project that aims to 'get everybody looking at butterflies and recording their sightings'. Citizen scientists can send details of their butterfly sightings to ANU via the app to build data-driven range maps for butterfly species to assist with conservation. While the app takes a little while to load the field guide, images and maps, it is well worth the wait. If you spot a butterfly and are lucky enough to capture a photo, the app guides you through identifying the species, recording as much detail as possible and uploading the image. With regularly updated field guide content, a beautiful image gallery, species profiles and range maps, and the ability to not only record sightings but complete comprehensive surveys, the *Butterflies Australia* app is an asset to citizen science.

*Butterflies Australia* app is available for free, download from the AppStore and Google Play.



## JO CLEWS' AUSTRALIAN CAMP OVEN COOKING



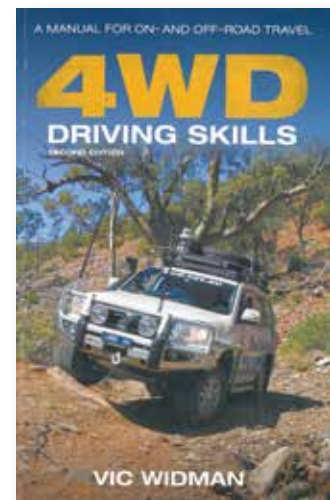
If you weren't hungry before you opened this beautifully presented cookbook, your appetite will most certainly be whetted after turning the pages. Author Jo Clews and fellow photographer Craig Lewis will have you salivating over the simple and delicious meals made lovingly over a camp stove. The introductory pages provide practical suggestions on how to plan and prepare the food such as 'tucker box essentials' and suggesting calling ahead to remote community stores along your trip. The well thought out guide leaves the door wide open for what seems like unlimited options. Couple that with careful details on the history, types and maintenance of camp ovens as well as different fuel sources, even a beginner cook will feel confident to give any of the recipes a go. In the interest of conscientiousness, I attempted the asparagus frittata and let's just say there wasn't much washing up to do after the plates were licked clean.

*Australian Camp Oven Cooking* is published by Woodslane Press and is available for \$35 from [woodslane.com.au](http://woodslane.com.au)


## 4WD DRIVING ESSENTIALS

Nothing teaches like experience, especially when it comes to four-wheel-driving that involves as much problem solving as it does actual driving. Even on sealed roads, four-wheel drive vehicles require a different set of driving skills, which adventurer and author Vic Widman learnt the hard way, so he decided to write a book about it. Vic now runs one of Australia's leading four-wheel drive training schools, tag-along tour companies and wrote '*4WD Driving Skills*'. First printed in 2001, the book has recently been updated and includes well explained, practical information about all things four-wheel drive; from mechanics, to trip planning, understanding regulations and how to drive on just about every surface including sealed roads, sand, mud, river crossing and even snow. Vic's humour is sprinkled throughout the book, which provides enough information so that beginners have everything they need and those with experience get a refresher or can skip to more advanced subject matter.

*4WD Driving Skills* is published by CSIRO and is available for \$39.99 from [publish.csiro.au](http://publish.csiro.au)







# Phillip Parker King

Master mariner of the  
Australian coast



By Kevin Kenneally and Cathie Clement

In 1820, Lieutenant Phillip Parker King's survey vessel, His Majesty's cutter *Mermaid*, careened in a sheltered bay on the north-west Kimberley coast and the ship's carpenter inscribed 'HMC MERMAID 1820' on a large boab tree. Two hundred years later, the significance of Careening Bay to Western Australia's science and conservation history and the role of Indigenous crew members, is being recognised and honoured.



In today's modern world, it is difficult to appreciate the courage, skill and ingenuity of maritime survey work in remote parts of the world. For some, the contribution to science and the significance of the charts achieved by these journeys have often been somewhat overlooked but today their discoveries are being recognised.

.....  
*Previous page*

**Main** A boab tree at Careening Bay inscribed 'HMC Mermaid 1820'.

*Photo – C. Done*

**Inset top right** Phillip Parker King's Chart of Camden Bay to Vansittart Bay.

*Image – Courtesy United Kingdom Hydrographic Office*

**Inset right** A sketch of HMC *Mermaid* under repair at Careening Bay by Phillip Parker King.  
*Image – Courtesy Mitchell Library, State Library of New South Wales*

**Above** A sketch of HMC *Mermaid* by Phillip Parker King.

*Image – Courtesy Mitchell Library, State Library of New South Wales*

**Above top** Boongaree Island, Prince Frederick Harbour.

*Photo – Robert Wyatt/Alamy*

**Above centre** Portrait of Boongaree by Phillip Parker King.

*Image – Courtesy Mitchell Library, State Library of New South Wales*

Phillip Parker King, at the age of 25, was appointed to complete the exploration of the 'Coast of New Holland' started by the famed Captain Matthew Flinders and create accurate charts to guide ships safely through the dangerous waters.

Flinders had returned to London in 1810, having circumnavigated New Holland (Australia) on HMS *Investigator*, without fully exploring and surveying its coastline, in 1801–1803. Botanist Robert Brown had accompanied Flinders on that voyage and made extensive plant collections, most of which were new to science.

It was considered desirable for the continent to be circumnavigated by someone competent to complete the task and there was some urgency in getting King's expedition underway since France was showing renewed interest in the southern hemisphere.

King was a Lieutenant in England's Royal Navy and was well connected as the son of Philip Gidley King, third Governor of New South Wales, and the godson of Arthur Phillip, the first Governor.

## HISTORIC VOYAGES

The 84-ton cutter *Mermaid* was purchased for £2000. The vessel was small, built of teak, 56 feet (18 metres)

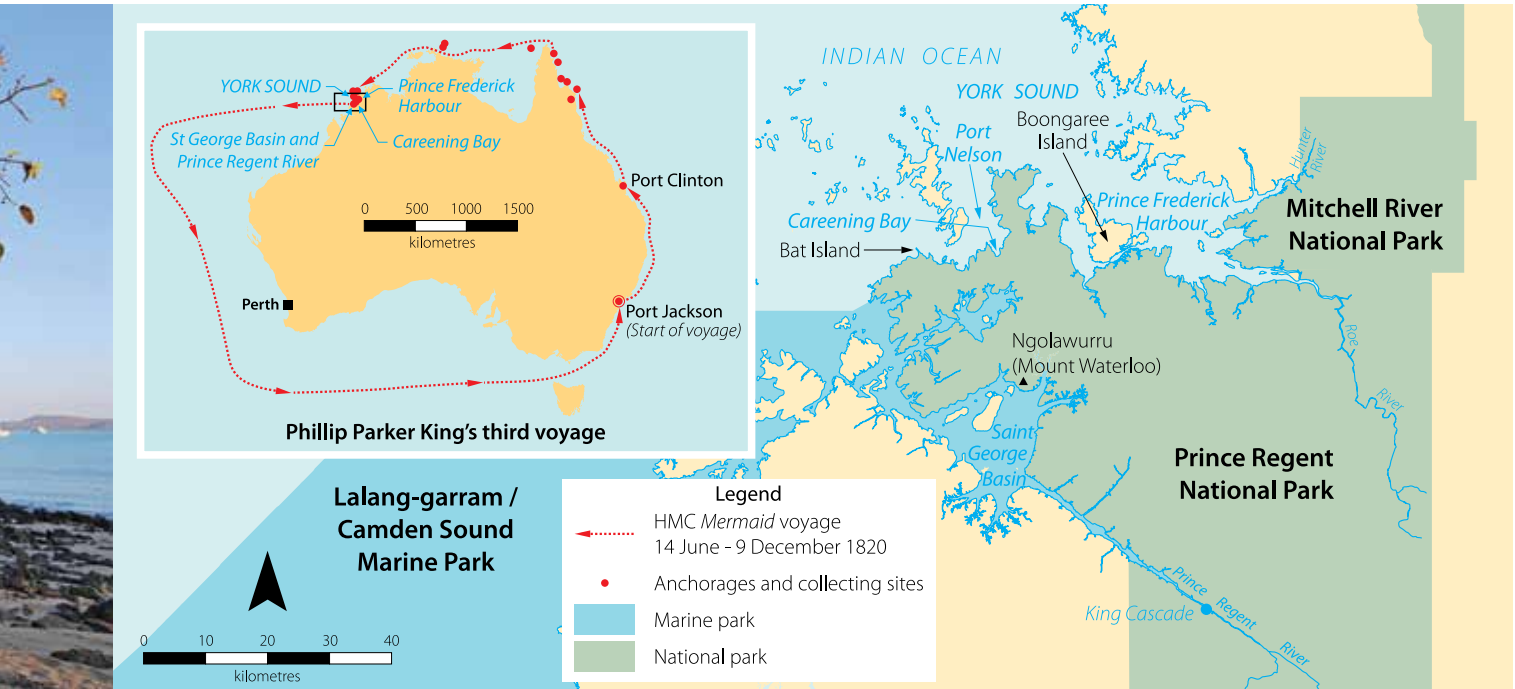
from stem to stern and a draught of 9 feet (3 metres). She had a large hold and King was confident that the vessel could carry stores for 20 men over a lengthy voyage. He remarked ruefully that there was barely room for the mess table in the only day cabin.

An Admiralty requirement was that King ascertain whether any river was 'likely to lead to an interior navigation into this great continent'. In addition, the Colonial Office had instructed him to collect information about climate, mountains, flora, fauna, timbers, minerals, the 'natives' and possible articles of trade.

King and his crew were to complete four voyages around Australia and one to Tasmania in HMC *Mermaid* and His Majesty's brig *Bathurst* between December 1817 and April 1822. These voyages were extremely hazardous with numerous groundings, near shipwrecks on reefs, raging tides, legendary whirlpools, a strange flora, encounters with wildlife, and numerous contacts with the Aboriginal and Torres Strait Islanders.

## INDIGENOUS KNOWLEDGE

In December 1817 King accepted the services offered by Boongaree, a member of the Eora tribe, whose territory surrounded Sydney Harbour. Boongaree was good company and,



having sailed with Flinders, he understood naval life. Flinders said he was a ‘worthy and brave fellow’ and extremely useful when making contact with other tribes. Boongaree’s knowledge of natural history and understanding of native foods, herbs, poisonous plants and other strange things likely to be encountered on a voyage also helped to ensure the survival of the ship’s crew.

In recognition of such services, King named Boongaree Island in his honour. The island is located in Prince Frederick Harbour on the Kimberley coast. Boongaree returned to his people at the conclusion of the second expedition.

## A MERMAID ASHORE

The officers and crew aboard the *Mermaid* for the third voyage (14 June to 9 December 1820) comprised King as captain, John Septimus Roe and Frederick

**Above left** Careening Bay.  
Photo – Carolyn Thomson-Dans/DBCA

**Above right** Portrait of Phillip Parker King.  
Image – Courtesy Mitchell Library, State Library of New South Wales

## Phillip Parker King (1791–1856)

King was born on Norfolk Island, educated privately in England and, in 1802, went to the Royal Naval Academy at Portsmouth. He was involved in the Napoleonic war against the French and was mentioned in dispatches for his navigation and hydrographic skills.

After his 1817–1822 exploration and surveys along the Australian coast, he returned to England and was employed on full pay at the Admiralty. King and John Septimus Roe completed a series of high-quality navigation charts of the Australian coast. King’s surveying and scientific contributions were recognised by his election to prestigious organisations. In London, he was made a Fellow of both the Royal Society and the Linnean Society.

Between 1826 and 1830 he took overall command of an expedition in *HMS Adventure*, sailing with *HMS Beagle* (whose company later included Charles Darwin) to chart the coasts of Patagonia, Chile and Peru. The Chilean Navy recognised King’s work, in 2008, with the erection of a memorial cairn. His work was said to be ‘worthy of the highest praise’ and his achievements were compared to navigators such as Ferdinand Magellan.

In 1832, after an absence of eight years, King returned to Australia. The King family owned New South Wales properties managed by his wife Harriett. Between 1839 and 1849, King was Commissioner of the Australian Agricultural Company. In 1850, he retired to Sydney, winning, for the second time, a seat in the Legislative Council. By 1854 he was in failing health. Still on the Royal Navy’s retired list, he was promoted in 1855 to the rank of Rear Admiral, the first Australian-born to achieve this rank.

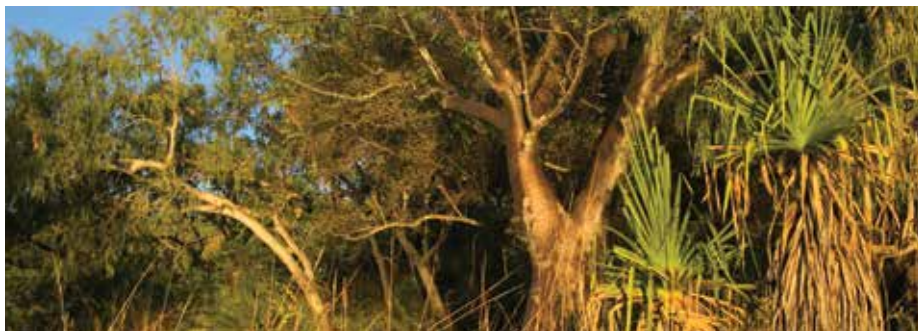
King died suddenly on 25 February 1856. He was given a State funeral on Sydney Harbour and buried in the family vault in the grounds of St Mary Magdalene church near his former home of Dunheved. He was survived by his wife and eight children whose descendants are now dispersed across Australia.



## Careening Bay is in Wunambal country

There is a growing body of information on the extensive interactions between Aboriginal people and Macassan fishermen. The Aboriginal Traditional Owners call Careening Bay 'Wunbung-gu'.

**Below** Sketch of Aboriginal huts at Careening Bay in 1820 from P.P. King's published account of the voyage.



### **John Septimus Roe (1797-1878)**

Roe was born in England and educated at Christ's Hospital School, London. He was appointed as a Midshipman in the Royal Navy in 1813 and, for the next four years, was seldom ashore. He joined HMC *Mermaid* as Master's Mate in 1817 under Phillip Parker King's command, and then HMB *Bathurst* in 1821, to conduct surveying expeditions of the Australian coast.

On his return to England in 1823 he was promoted to Lieutenant. Five years later, he was recuperating from a severe illness when offered the post of Surveyor General at the settlement to be established at Swan River (Western Australia). In

February 1829, newly married, he sailed from Portsmouth on the *Parmelia*.

In Western Australia, Roe was to serve the Crown with great distinction for 42 years. He served as Surveyor General until 1870, undertaking surveys and exploration, drawing up land regulations, and overseeing the management of the colony's Crown lands. In time, the navy promoted him to Commander, and he was made a Fellow of the Linnean Society of London.

While outliving King and Cunningham, Roe was dogged by ill health in his declining years. He died on 28 May 1878, aged 81, and was given a public funeral with full military honours. The citizens of Perth erected a monument in his honour in Kings Park in 1956 and, in 1991, a statue of him was unveiled on the corner of Adelaide Terrace and Victoria Avenue in the Perth CBD.



Bedwell as master's mates, James Hunter as ship's surgeon, Allan Cunningham as botanist, fourteen sailors and two boys. The men were young: King was 28 years old, and both Bedwell and Roe just 23; Cunningham was 28.

The *Mermaid*, having left Port Jackson on 14 June 1820, suffered storm damage, and returned to port. On 13 July they sailed again, heading north, but after a week ran aground on a sand bank at Port Clinton (north of Rockhampton). King heard a loud crash and suspected the stern post of the vessel had been damaged, but an inspection revealed nothing. He decided to sail on, unaware of serious damage that would eventually require the vessel to be repaired at Careening Bay.

After three months at sea, the *Mermaid* was leaking at an alarming rate. Crew had to leave other duties and man the pumps. As the ship sailed from Prince Frederick Harbour on the north Kimberley coast, King decided that urgent repairs were required. By noon, the *Mermaid* anchored in a sheltered embayment off a sandy beach and the crew unloaded the stores and equipment.

The ship's guns were set up on shore to provide a defence. More than fearing attacks by 'natives', King knew he must be wary of Macassan fishing fleets. Flinders had judged them 'piratical', and King was taking no chances.

### **GOING ASHORE**

On the afternoon of 21 September, as the crew unloaded the *Mermaid*, King and Cunningham went ashore and saw that the hills behind the beach had been 'recently fired by the natives, whose old, temporary huts were standing on the sands'.

**Above left** Boab tree and pandanus at Careening Bay.

Photo – Denis Crawford/Alamy

**Left** Portrait of John Septimus Roe.

Image – Courtesy State Library of Western Australia



“Hunter recorded that near the tents he tried to measure the temperature with his pocket thermometer, but when it reached 130 degrees, he abandoned the test for fear of bursting the tube.”

A search was made for what Cunningham described as ‘that most important article, water’. They were fortunate to discover a continuous supply of excellent fresh water at the base of one of the gullies. This was critical as they had discarded fresh water on board the *Mermaid* in order to lighten the vessel.

Tents were made using the ship’s sails. Hunter recorded that near the tents he tried to measure the temperature with his pocket thermometer, but when it reached 130 degrees, he abandoned the test for fear of bursting the tube.

Cunningham described the annoyance from sandflies ‘which crowded into the tents at dusk’ only to be replaced during

daylight by flies that ‘entered their eyes, nose and mouth!’ Next morning, with a flood tide, the vessel was careened as far up the beach as the water would allow.

When the tide receded, an inspection of the hull revealed the extent of the damage. King wrote that it was ‘greater even than our fears had anticipated’ and that, at first impression, ‘there was every reason to fear we could not remedy the defects sufficiently to ensure even an immediate return to Port Jackson’.

The hull was patched by the 30th but it was not until 5 October that the tide rose enough to float the cutter.

## TAKING NOTES

Their stay at Careening Bay provided ample opportunity to make observations and conduct scientific studies of the surrounding countryside. Cunningham collected and made notes on plants and natural history specimens. He preferred to botanise alone, avoiding the distractions of having to assist King or Roe with surveying requirements.

He recorded clumps of *Cycas*, or what he referred to as ‘Sago Palm’ (*Cycas*

*basaltica*), and noted that the fire-places near the ‘native’ huts were ‘strewed with the nuts of the sago palm, the fruit of which appears to be generally eaten by the natives of the north and north-west coasts’. The old people of the Traditional Owners’ Wunbung-gu and Gural families lived near the grove of Gun.gurru (cycads) at the south end of the beach.

King and his crew spent 18 days (21 September to 9 October 1820) at the site he named Careening Bay, now located within the Prince Regent National Park. One day was spent investigating nearby Cliff Island (now Bat Island) where Cunningham collected many new plant specimens and entered a cave full of bats.

He also ‘secured a curious lizard, of extraordinary appearance which had perched itself on the stem of a decayed tree’. This was something of a major coup for the voyage’s natural history collections. He described it as having a ‘curious crenated membrane, like a ruff or tipper around its neck and covering its shoulders’. This was the first collection of the frill-necked lizard. In 1825, Edward Gray, keeper of zoology at the British Museum,

.....  
**Above** *Cycas basaltica* referred to by Cunningham as ‘Sago Palm’, although this is a misnomer as cycads are not palms. The seeds are highly toxic unless treated.  
 Photo – Kevin Kenneally

**Above right** Frill-necked lizard.  
 Photo – K. Coate

## Allan Cunningham (1791-1839)

In 1814, at the urging of William Aiton, the Superintendent of the Royal Botanic Gardens, Kew in London, Sir Joseph Banks advocated the appointment of two botanical collectors to work in the southern hemisphere. At his recommendation, Allan Cunningham received one of those appointments. Despite his fragile appearance, Cunningham was both energetic and assiduous. He left England in 1814 and spent two years collecting plants in Brazil.

By 1817, he was in New South Wales collecting seeds and other propagating material of Australian plants for Kew Gardens — His Majesty the King of England's private garden. Soon after that, in London, Lord Bathurst advised Phillip Parker King that Banks had ordered Cunningham to join the expedition and be given 'every facility to botanise'. After the cycle of maritime surveys was completed in April 1822, Cunningham embarked on nine gruelling years of both botanical and geographic discovery. In July 1831, exhausted and ill, he returned to England.

When his brother Richard, the New South Wales Colonial Botanist, was murdered in 1835 on Major Mitchell's exploring expedition, Cunningham agreed to return to Australia as his replacement. An 1838 New Zealand collecting trip, conducted in heavy rain and cold, finally destroyed his health. He returned to Australia and nine months later was moved from his lodgings to his old official cottage in the Sydney Botanic Gardens for a change of air. He died there a few days later.

Cunningham and King had remained life-long friends and King wrote 'Alas, poor Allan he was a rare specimen ... an enthusiast of Australian geography; devoted to his own science.' Cunningham was buried in the Devonshire Street Cemetery. In 1901 his remains were removed and placed within an obelisk in a pond in the Royal Botanic Gardens, Sydney and his tombstone mounted on the wall of the National Herbarium of New South Wales. Botanist and author Dr Tony Orchard described him as 'one of the most important and prolific collectors of Australian plants in the late 18th and early 19th century, although until now he has been somewhat overlooked, overshadowed by Joseph Banks and Robert Brown.' 'However', he continued, 'his collections are better documented than either of these two famous botanists, and form the basis for many hundreds of Australian species.'



Left Portrait of Allan Cunningham by Phillip Parker King.

Image – Courtesy Mitchell Library, State Library of New South Wales

Below left *Bauhinia cunninghamii* pressed specimens collected at Careening Bay by Cunningham and described by botanist George Bentham as a new species.

Image – Reproduced with the consent of the Royal Botanic Gardens, Kew

Below Seed pods of the Kimberley Bauhinia (*Bauhinia cunninghamii*).

Photo – Kevin Kenneally

named it *Chlamydosaurus kingii* in tribute to King.

Cunningham was the first European to collect botanical specimens of the Kimberley boab, although he had observed 'several large gouty-trees' on King's second voyage in 1819. Cunningham noted the tree's resemblance to the baobabs of West Africa but believed, in the absence of flowers and based on the structure of the fruit, that it was a member of the caper family and applied the name *Capparis gibbosa* in his journal.

## MAKING BOTANIC HISTORY

On 7 October, Cunningham packed up his plant collections. At the end of the voyage, his dried and pressed plants would be sent back to William Aiton and Sir Joseph Banks at the Royal Botanic Gardens. His herbarium specimens, numbering several thousand, became the vouchers for the naming of hundreds of new plants. Many of these were published by George Bentham, one of Britain's most influential botanists, in his classic seven volume work *Flora Australiensis: a description of the plants of the Australian Territory*, between 1863 and 1878.

In shady spots near the fresh water, Cunningham had planted seeds of lemons, oranges, Indian corn and some eyes of potatoes that he hoped would become established – for the benefit of future Europeans or even the Australian 'natives'. Admiralty instructions stipulated



## Botanising the boab

Botanist Allan Cunningham did not include a description of the boab tree in King's published account of the voyages, *Narrative of a survey of the intertropical and western coasts of Australia performed between the years 1818 and 1822*. Cunningham clearly believed that his name *Capparis gibbosa* should be published, however, his premature death in 1839 resulted in his discovery going unacknowledged. Subsequently, Victorian Government botanist Ferdinand Mueller described the Australian boab in 1857 as *Adansonia gregorii* and this became the accepted name for the species.

that such things must be 'within the observation and reach of succeeding navigators'.

## THE MERMAID TREE

Cunningham also wrote: 'The name of His Majesty's Cutter was deeply carved upon the stem of the largest tree on the shores of Careening Bay, Port Nelson, with certain initials and the date of the year of our visitation'. This was no random act of vandalism by the crew. King was following Colonial Office instructions to 'take care to leave some evidence which cannot be mistaken of your having landed'.

In addition, the name of the vessel was punched on a sheet of copper and fastened to the stem of a *Hibiscus tiliaceus* growing on the beach. When King returned to Careening Bay ten months later in the *Bathurst*, the copper sheet was missing but he remarked that the boab lettering was likely to last 'longer than any other memento we had left'. In 1893, Aeneas Gunn, the cousin of pioneer pastoralist Joseph Bradshaw, sketched the

'Mermaid Tree' when visiting Careening Bay from their pastoral lease 'Marigui' on the lower slopes of Mount Waterloo on the Prince Regent River.

## SETTING SAIL

By 8 October, King had prepared to depart Careening Bay. After leaving, he wrote: 'Our people were now all laid up with sores upon their feet and legs, from cuts and bruises received in scrambling over the rocks; and several were affected by ophthalmia'. He then made the decision that, as the wet season was rapidly approaching and the *Mermaid* was still leaking badly, it was time to quit the Kimberley coast and return to Port Jackson.

As the sun set on 9 December 1820 the *Mermaid* entered the Heads of Port Jackson, and King secured his vessel at the King's moorings in Sydney Cove, having successfully completed his third surveying expedition. He wrote that the voyage from Careening Bay had been undertaken within the 'pale of danger', for death had been their constant companion.

**Above** Mermaid Tree.  
Photo – C. Done

**Below** Aeneas Gunn's 1893 sketch of the Mermaid Tree.  
Image – Courtesy Mitchell Library, State Library of New South Wales

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# *Taking heed of bird seed*

Feeding native animals is now an offence under the *Biodiversity Conservation Act 2016*. It can alter natural behaviours, aid in the proliferation of pest species and, in some cases, cause animals to become aggressive towards people. However, there are circumstances where feeding native birds is necessary for conservation. Feeding off-the-shelf bird seed, which is often sourced from non-native plants, has the potential to disperse weeds, so a study was conducted to find ways to help prevent it impacting on our natural environment.

by Mark Blythman





In the past it has been commonplace for Western Australians to feed birds that visit our yards. Most of us know at least one house in the neighbourhood that many different types of birds visit for a feed, or have been to a lake or riverside and witnessed a bag of crusts being shared among the local waterbirds. There have long been health-related council by-laws that prohibit people from feeding wild birds, but, until recently, it has not been an offence to feed native birds in Western Australia for biodiversity conservation reasons.

### IN THE HANDS OF THE LAW

New laws to prevent some of the negative impacts associated with feeding native birds have recently come into effect, and a licence is now required from DBCA to feed native fauna. Section 155 of the *Biodiversity Conservation Act 2016* has made feeding native wildlife, including birds, without authority an offence (this does not include native species that are held legally in captivity).

These laws have been introduced to protect the health and welfare of native

.....  
*Previous page*

**Main left** Western rosella eating seed provided.  
*Photo – Marc Russo*

**Main right** Port Lincoln parrot *Barnardius zonarius zonarius* eating seed in natural environment.

*Photo – Sallyanne Cousans*

**Below** Hand feeding native wildlife is now an offence.

*Photo – Ann Storrie*



species; native birds are often fed food, such as bread, that is not suited to their physiology. This practice can also create an unhealthy dependence on humans, discourage natural behaviours and draw native animals to areas where they may be more susceptible to predation. And, feed sites can often be exploited by introduced or problem species, such as corellas, which can lead to their proliferation.

There are some situations when feeding wild native birds can be an important tool for research, conservation or land management. But, this is carried out only in extenuating circumstances, under controlled conditions and with necessary licences (see 'Focused feeding' below).

## POTENTIAL FOR WEED INTRODUCTIONS FROM FEEDING BIRDS

When it is necessary to feed native birds, it is important for researchers and land managers to take steps to minimise the risk of spreading weeds, as most commercially available bird seed contains viable seeds unless indicated. There are commercially available bird seed mixes that have already been devitalised, but these may be a blend of seeds that are not suitable for the target species.

Many plants have evolved to make use of birds to transport their seeds; some are totally reliant on this method to complete their life cycle. While birds such as parrots

will generally de-husk seeds with their beaks, which renders them unviable, birds such as pigeons and doves that rely on their gizzard for mechanical digestion, can pass undigested and viable seeds some distance from where they were consumed.

A study recently published in Australian Field Ornithology demonstrated that seeds from a commercially available bird seed mix could be successfully devitalised (made unviable) by placing them in a microwave oven at a high setting for 2.5 minutes, or in a preheated electric oven at 180 degrees Celsius for 2.5 minutes. The viability of the treated seeds was tested by attempting to germinate them, and comparing their

### ***Focused feeding***

Supplementary feeding may be used to provide additional food for birds during times of shortage or when translocated or captive birds are 'soft released' into the wild.

In 2011 in Queensland, Cyclone Yasi damaged large areas of cassowary (*Casuarus casuaris*) habitat, stripping fruit from branches and ripping fruiting trees from the ground. To prevent the birds starving or leaving the safety of the rainforest to search for food, the Cassowary Recovery Team deployed more than 100 feed stations, which they stocked with fruit, throughout the devastated area.

Monitoring and trapping sites often use food to encourage birds to a focal point where they can be trapped or monitored for research.

Seabirds such as albatross are easily captured by hand at breeding colonies, but when they need to be captured at sea to apply satellite trackers, chum (bait usually made up of made up of fish offal) is used to attract them close to the boat where hoop or pole nets are used catch them.

Rehabilitated, captive bred or translocated birds require feeding to ensure they are in good condition before release.

Rescued black cockatoos that have endured a lengthy rehabilitation period at Kaarakin Black Cockatoo Conservation Centre are switched from their regular captive diet to one that has a higher nutrient content in the weeks prior to release.

Diversionsary feeding is sometimes used by farmers and orchardists who provide a sacrificial crop that birds are free to eat to divert damage away from their production crops.

A winery in Margaret River planted crops of sunflowers next to their vines to provide an alternative food source for Australian ringnecks (*Barnardius zonarius*) at a time when the grapes are most susceptible to parrot damage.



**Above** A juvenile southern cassowary.  
*Photo –Stan Breeden/Lochman Transparencies*

Medicated feed can be provided to wild bird populations that require treatment or management.

An oral contraceptive that can be added to food and presented to wild birds at feed sites has been used to help manage feral pigeon populations. Limiting the pigeons ability to reproduce is a long-term management strategy as the treated birds remain alive and continue to be a problem.

Treated feed can be used to help track and monitor individual birds.

A luminescent food additive was added to grain to help eradicate feral chickens on Northwest Island, Queensland. Both the bodies and the dung glowed under UV light, which helped to locate roosting birds at night time and to determine which birds were attending feed sites.

success to untreated seeds. The study does not suggest that all bird seed can be devitalised using these methods, but it describes a simple method that can be used to determine if the seed has the potential to germinate. It may be the case that certain species of seeds require a longer period of heat treatment or some other form of treatment such as cracking to render them unviable.

Due to the potential for increased or decreased nutrition of heat-treated seeds, it is not recommended that heat-treated seeds are used for captive birds, unless directed by a veterinarian. However, if viable seeds are spilling out of an aviary and are being eaten by wild birds, practices should be put in place prevent this.

**Right** Red-eared firetail at a garden water source.

Photo – Cliff Winfield

**Below left** Planting date palms should be avoided.

**Below right** Twenty-eight parrot (*Barnardius zonarius semitorquatus*) eating seed.

Photos – Jiri Lochman



### Gardening for wildlife

Rather than actively feeding native birds, landholders can play a role in ensuring native species have access to their natural food sources. Maintaining existing native trees and shrubs and, where possible, establishing new native plants, can provide food and other resources for local fauna. Perth Zoo provides information about how to create a bird-friendly garden (see [perthzoo.wa.gov.au/get-involved/do-your-part/bird-friendly-garden](http://perthzoo.wa.gov.au/get-involved/do-your-part/bird-friendly-garden)) and the 'plants for Carnaby's search tool' can be used to find the most suitable plants for your garden, though these should not be planted in high traffic areas, such as road verges, to reduce the chance of vehicle strike (see [dpaw.wa.gov.au/images/documents/plants-animals/animals/p4c\\_plantlist\\_20110415.pdf](http://dpaw.wa.gov.au/images/documents/plants-animals/animals/p4c_plantlist_20110415.pdf)). Perth residents can also play a role in providing habitat for quenda and butterflies by planting native species.

Species such as olives (*Olea europaea*) and coastal sheoak (*Casuarina equisetifolia*), which attract corellas, and coral trees (*Erythrina* sp.) and date palms, which provide food and nesting habitat for introduced rainbow lorikeets, should be avoided.

It's a good idea to leave water out for native animals, particularly during the hot, summer months. However, it should be kept clean and, if possible, surrounded by spiky/prickly native plants to keep cats away and provide somewhere for the birds to flee if they feel threatened. Rocks or branches should also be placed in the water, so animals can climb out if they fall in.



**Mark Blythman** is a DBCA Biodiversity and Conservation Science technical officer. He can be contacted by email ([mark.blythman@dbca.wa.gov.au](mailto:mark.blythman@dbca.wa.gov.au)).

For more information about the study, please refer to: Blythman, M. and Sansom, J. (2019). Devitalising bird-seed to prevent dispersal of weeds by birds. *Australian Field Ornithology* 36, 31-33.

For more information about the Biodiversity Conservation Act, living with wildlife, gardening for wildlife and butterflies, and wildlife licensing visit [dbca.wa.gov.au](http://dbca.wa.gov.au).

# Travelling toad show



On a mission to prevent more endangered northern quoll populations from being impacted by poisonous cane toads, a convoy of 14 people embarked on a toad busting road trip through the Kimberley. Dian Fogarty shares how the trip captivated the attention and enthusiasm of every community it passed through.

**by Dian Fogarty**



In the sticky heat of the Kimberley's wet season when the temperature doesn't drop below 35 degrees Celsius overnight, a dedicated team challenged themselves to collect 4000 cane toads, over four nights in four locations. The aim was to drive across the Kimberley and ask people in communities along the way to use their local knowledge to locate and collect as many cane toads as they could so the leg meat could be minced into sausage baits as part of the taste aversion program to deter northern quolls (*Dasyurus hallucatus*) from eating the toads.

## ON A MISSION

The only thing holding us back from attempting to prevent more endangered northern quolls in the Kimberley being impacted by cane toads was how many toad legs we could get to make the sausages. It takes approximately three toads to make one sausage, which weighs about 14g, and we needed thousands of live toads.

The taste aversion program involves taking the cane toad leg meat, mincing it into sausages and lacing the sausages with a mild nausea-inducing chemical before dropping them into known habitats of northern quolls.

The quolls eat the sausage meat and feel slightly sick, creating a bad memory associated with anything that smells



or tastes like cane toads. The baits are dropped just before cane toads are predicted to arrive in the area to train the quolls to avoid eating them.

Smaller toad busting events have been held around Kununurra and in small communities like Frog Hollow and Muludja but since thousands of toads were needed to make the sausages in time for when the quolls were teaching their young how to forage, we needed to think bigger.

We stirred up some interest with posters on community noticeboards, on social media and participated in an ABC radio interview.

## HITTING THE ROAD

In late January, the Parks and Wildlife Service team from Broome and Kununurra met with a group of Dambimangari Rangers from Derby, local Bunuba Rangers and Jardine MacDonald from Rangelands Natural Resource Management in Fitzroy Crossing.

The original plan was to travel via the Gibb River Road, but a decent amount of rain changed that plan and the team decided to stick to the bitumen and go to Fitzroy Crossing, Warmun, Wyndham and Kununurra.

The six-vehicle convoy was loaded with education materials, gloves, bags and everything they needed to set up an information stall in each town and create an area to process the meat. Behind them



they towed a portable cool room to keep the toad meat fresh from the wet season heat.

It was the first time we had attempted a travelling road show, and finding the toads was harder than we anticipated.

The plan was to catch the toads during the night when they are active and bring them back to 'toad base' for processing. The leg meat would then be packed into foam boxes and frozen, ready to be sent to the bait factory to be made into sausages.

## THE MOMENTUM BUILDS

On the first night in Fitzroy Crossing, the stall was inundated with kids wanting to help and more than 70 people came to the stall to see what was happening and get involved.

The team set up an information stall at 'toad base' where we explained how to identify cane toads correctly, how to catch them and handle them and answered questions about the conditioned taste aversion project and sausage making.

It was a great start; the enthusiasm was infectious. We handed out gloves and bags and everyone went off looking for cane toads.

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Previous page

**Main** A dedicated team challenge themselves to collect 4000 cane toads across four nights in the Kimberley.

**Inset** Cane toad (*Rhinella marina*)

**Top right** Information stalls at the four locations help educate locals in identifying and capturing cane toads correctly and provide further information about the baiting and taste aversion project.

Photos – Dian Fogarty/DBCA

**Above right** A closer look at the toxins released by poison glands on a cane toad.

Photo – Jiri Lochman



“The quolls eat the sausage meat and feel slightly sick, creating a bad memory associated with anything that smells or tastes like cane toads. The baits are then dropped just before cane toads are predicted to arrive in the area to train the quolls to avoid eating them.”

Fitzroy Crossing is at the front line of the spread of cane toads, so it was unknown whether the toads had reached large numbers as they had only started appearing in town the previous year.

Throughout the course of the night, only seven cane toads were found in Fitzroy Crossing, which is good news for the resident goannas that are one of the most significantly affected species of cane toad invasion, but bad news for filling the 4000-toad quota.

Despite the low numbers, the local Bunuba Rangers had so much fun they ended up joining the team for the rest of the week.

The second night led us to Warmun where we set up our ‘toad base’ and information stall next to the local basketball courts where a lively game was happening under the lights.

The team’s youth coordinator rounded up some kids to help and before long, it seemed like half the community was looking for cane toads.

The local police were very supportive, taking carloads of kids out to catch toads

and people who had never touched a cane toad before got involved filling up bags.

Despite the enthusiasm, the relatively cool weather and low rainfall leading up to the muster resulted in only 37 toads being found in and around Warmun.

### RALLYING THE TROOPS

Starting to feel the pressure to get another 3956 cane toads, the team continued to Wyndham the following night, but when we arrived, there was a Blue Light Disco in town and all the kids were dancing up a storm! The team’s experienced toad busters set about looking for cane toads around town at sundown but without the kids’ local knowledge, we didn’t find any toads.

After an hour or so without any luck, we decided to pack up and head back to Kununurra, collecting toads on the way. This turned out to be a good idea as there were we found a couple of good spots on the side of the road and netted around 800 toads.

On the final night, the team set up ‘toad base’ in the middle of Kununurra



town centre and attracted the attention of passing motorists and plenty of locals stopped by and picked up a set of gloves and bags to catch cane toads around their properties and places they know.

It was great to see so many toads coming back to us in bags. All in all, we didn’t reach our target of 4000, it was more like 2000, but the community engagement was incredible, and I think there is a lot to be said for that.

The muster collected enough leg meat to produce around 500 sausages, which

**Top left** Northern quolls are now being trained to avoid eating cane toads through a taste aversion baiting program.

*Photo – Jiri Lochman*

**Top** Leg meat is packed, frozen and sent to the bait factory to be made into sausages.

**Above** Collection of cane toads at night by an enthusiastic community.

*Photos – Dian Fogarty/DBCA*



Above Cane toad processing at 'toad base'

Below A cane toad collection box is located outside the Parks and Wildlife Service office in Kununurra.

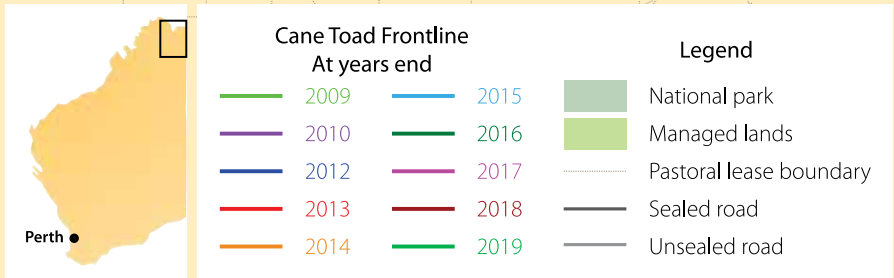
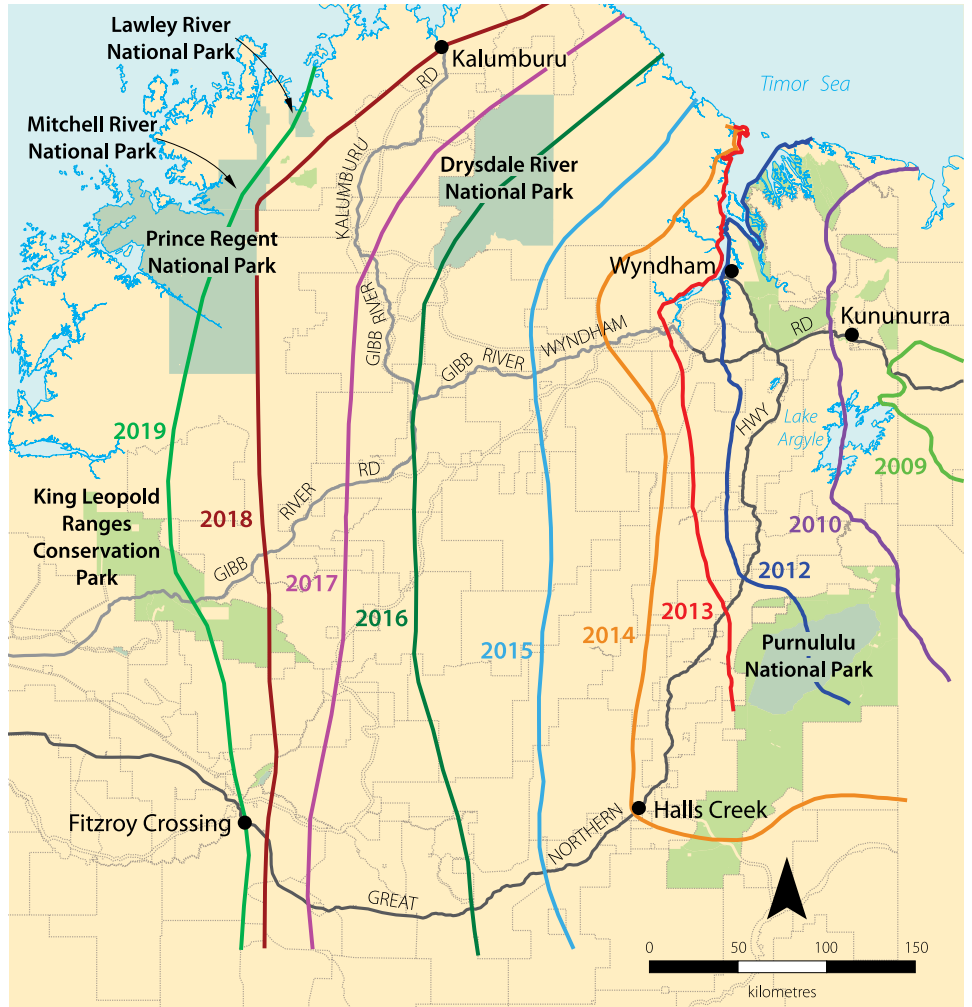
Photos – Dian Fogarty/DBCA

will be sent to the Harvey bait factory and then dropped from helicopters into known quoll habitats just in front of the cane toad invasion front line near Silent Grove, Mount Hart and Prince Regent Nature Reserve.

## WHAT YOU CAN DO

Anyone can get involved in toad busting by contacting Dian for advice and guidance. Gloves and bags are available for toad busting in your own backyard and if you spot a toad, you can drop it off to the live toad collection box out the front of the Parks and Wildlife Service office on Ivanhoe Road. The team are also happy to take frozen toads, provided they have been killed humanely using the cooling and freezing method.

**Dian Fogarty** is a project officer - education and community for the *Invasive Animals Program* based in Broome. She can be contacted at [dian.fogarty@dbca.wa.gov.au](mailto:dian.fogarty@dbca.wa.gov.au) or 0432 563 373



An underwater photograph of two Australian sea lions swimming in clear turquoise water. The sea lions are seen from the side, with their bodies and flippers visible. The water is bright and clear, with some bubbles and light reflections. The sea lions appear to be moving towards the left of the frame.

# Sea lions of the south coast

by Richard Campbell and  
Jonathan Pridham

In almost inaccessible island locations, fiercely guarded by protective females, Australian sea lions are being closely monitored and the commercial fishing industry is responding to ensure populations can recover from the extensive fur and oil hunting of previous centuries.



**T**he Australian sea lion (*Neophoca cinerea*) is the only pinniped species endemic to Australia.

The word pinniped means fin or flipper-footed and refers to the marine mammals that have front and rear flippers such as true seals, fur seals and sea lions.

Australian sea lions live in small breeding colonies on offshore islands dotted around the coast between the Houtman Abrolhos Islands off Western Australia and The Pages Islands in South Australia. Their range in Western Australia overlaps considerably with the long-nosed fur seal (*Arctocephalus forsteri* also known as the New Zealand fur seal).

Island populations in Western Australia include Investigator, Red, and West islands and Haul Off Rock near Albany and a number of islands within the Recherché Archipelago near Esperance including Little Island and Cooper Island.

While Australian sea lions breed in colonies in both South and Western Australia, they have an unusual breeding cycle of 17-18 months, as opposed to the usual 12-month cycle of all other pinnipeds. Not only do they breed at a slower rate, but individual colonies breed at different times across their distribution. This is the only pinniped species in the world that displays this unusual behaviour.

## FACING THREATS

Today, they face pressures of fishing and aquaculture, deliberate killing, habitat degradation, pollution, disease and changes in prey distribution. There is also the emerging issue of climate change and the warming of oceanic waters impacting on the ecosystem that supports these top-order predators.



*Previous page*

**Main** Australian sea lions at Jurien Bay.

*Photo – Matt Kleczkowski*

**Above** Australian sea lions at Abrolhos Islands.

*Photo – David Bettini*

**Right** Sea lions have remarkable restorative abilities to heal from wounds.

*Photo – Jon Pridham/DBCA*



And like all other species of seals and sea lions, they were hunted extensively for their skins and oil throughout the 18th and 19th centuries, but have recovered over the following hundred years or so (see 'A Tale of Two Seals', *LANDSCOPE*, Summer 1999–2000).

It is thought that some Western Australian sea lion colonies may be decreasing, and while the species is currently listed as a nationally threatened species (Vulnerable category), it may soon be uplisted to Endangered because of similar concerns held for the mainstay of the sea lion population in South Australia.

## WHAT'S BEING DONE

DBCA staff and other researchers are monitoring populations primarily through pup counts although other methods are being trialled including the use of remote cameras and drones to minimise the need to land on the island colonies. The south coast islands are often problematic to access from a boat; large swells and winds

and sparse beaches make it difficult to land and visits often require researchers to swim ashore. Other research has focused on foraging behaviour by using satellite tags attached to the animals, identification of individuals by facial whisker spot patterns and genetic studies. For these projects, animals must be captured and temporarily restrained or closely approached, which leads to another suite of challenges.

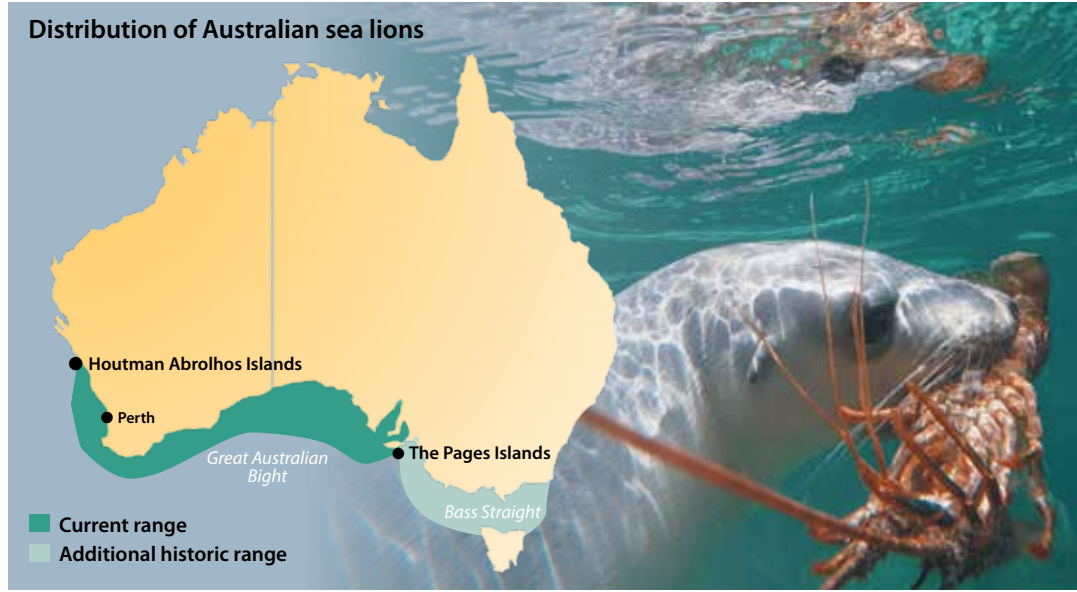
Sea lions hunt for food across a wide area of the continental shelf, diving repeatedly to the sea floor, to depths of more than 100 metres, looking for a range of prey including octopus, cuttlefish, crustaceans, skates and rays. This activity sometimes brings them into contact with commercial fishing operations.

Significant long-term conservation management measures continue to be implemented to mitigate some of the threatening processes in WA. In 2005, the Western Rock Lobster Fishery (WRLF) was the first to address concerns over reports of the incidental capture of small

 Discover more about Australian sea lions

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





sea lion pups in the pots of the fishery. The resulting mandatory changes to fishing gear have mitigated this concern and the conservation measures were extended from the WRLF into the South Australian rock lobster fishery.

More recent conservation measures have been implemented throughout the commercial demersal gillnet fisheries in both South and Western Australia due to concerns over the incidental drowning of sea lions in the bottom set nets.

A number of breeding colonies and some foraging areas are also protected within the bounds of State and Commonwealth marine parks. Whilst these measures are undoubtedly playing a part in mitigating some of the causes of incidental mortality and giving the sea lion a chance of recovery, it is important that the response of these breeding colonies

continues to be monitored to assess the conservation outcomes of these measures.

A range of programs have attempted to monitor sea lion population abundance and trends in abundance over time, however the sheer number of individual colonies (28 in WA and 48 in SA) make it difficult to monitor them all. In addition, the different timing in breeding seasons, remoteness and accessibility as well as the concerns of repeated disturbance of breeding colonies by researchers has presented challenges in this regard over the years and has limited consistent monitoring effort at many colonies.

### DON'T MESS WITH THE LADIES

At certain times of the year, especially when pupping, the females become quite protective of their turf and will 'chase' researchers as perceived threats. Because

they are usually all related, this protective behaviour can also involve 'sisters' and 'aunts' joining in the pursuits, so it is not unusual to have two or three females doggedly following the researchers sometimes for quite a long distance.

A recent program run by the Fisheries Division of the Department of Primary Industries and Regional Development (DPIRD), funded through the Fisheries Research Development Corporation (FRDC), and working closely with the Department of Biodiversity, Conservation and Attractions, has looked at using remote HD cameras to monitor the breeding performance of a number of colonies to look for a solution to this issue.

The program has uncovered some interesting behaviours and confirmed aspects of breeding season timing but has

**Above** A pup on Red Island died after becoming tangled in a fishing net.  
*Photo – Jon Pridham/DBCA*

**Above right** Australian sea lions eat a range of prey including lobsters.  
*Photo – Marc Russo*

**Right** Researchers at Investigator Island placing satellite tracking recorders on anaesthetised Australian sea lion cow.  
*Photo – Jon Pridham/DBCA*



## Have you seen a seal you think needs help?

1. Do not approach the animal, it will cause stress and could become aggressive
2. Take a photograph of the animal and surroundings
3. Do not try and feed the animal
4. Call the Wildcare Helpline on (08) 9474 9055 or nearest Parks and Wildlife Service office



### Advise staff of the following:

- location (as specific as possible including any unique identifiers)
- species (or description if not known)
- age (pup, juvenile or adult)
- size
- condition (poor or healthy)
- injuries or entanglements
- stationary or moving



“We are also looking at using drone technology to fly surveys over breeding islands... reduce risks in accessing the islands, and visitation pressures to both sea lions and researchers...”

also discovered that there are limits to the performance of remote camera systems in the harsh environments of the south coast of WA.

“We are also looking at using drone technology to fly surveys over breeding islands and so reduce risks in accessing the islands, and visitation pressures to both sea lions and researchers on the islands,” said DBCA’s Parks and Wildlife Service regional wildlife officer Jonathan Pridham.

“Relatively low pup counts at some colonies over the past five years has raised some concerns for individual colonies (i.e. Red Islet and Haul Off Rock on the south coast of WA), while others in the Jurien Bay Marine Park seem to sustain pup numbers if not showing some signs of recovery.”

### STILL A LOT TO LEARN

A number of studies using satellite tagging technology over the past decade have highlighted the extensive foraging

range of the sea lion, and contributed to the design of some of the commonwealth marine parks across the south-west of WA and in South Australian waters.

“However, we are still unable to understand exactly why the limited population recovery of sea lions differs so much to the recent exponential rise in fur seal numbers over the past 20-30 years,” said Jonathan.

“It is interesting to note that the recovery of fur seal populations here in Australia and overseas did not occur immediately after the ending of commercial hunting but after a considerable lag period of more than 70 years.

“The concern is that the recovery trajectory for the Australian sea lion is being impacted by the myriad of different biological and environmental factors as well as some of the human pressures, which in combination are precluding the species from making a recovery to their previous abundance.”



Top Bull and cow on Haul Off Rock.

Above Fauna conservation officer Tim Button operating a drone to monitor sea lions on Haul Off Rock.

Photos – Jon Pridham/DBCA

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*Adventure out*

# Star Trek

As the rest of the world began winding down after a long day, a group of hikers put on their backpacks and ventured across the Darling Scarp, undeterred by the looming clouds, as the sun began to set over the Bibbulmun Track.

by Katie Stevens



**D**espite having ventured to the east side of the Darling Scarp many times, I am always astounded by how beautiful it is over the 'other side'. The bush out there seems almost unpretentious, in contrast to the majestic karri forests in the south. It's jam-packed with jarrah trees and the forest floor is lined with zamia palms and grass trees threatening to spike you at any second.

I am en route to a section of the Bibbulmun Track that crosses the Brookton Highway just south-east of the outer Perth suburb of Karragullen. *Star Trek* is my first ever Bibbulmun Track event and I am excited to get back out on track, even if it's only for an evening.

As I drive along the highway, hoping I have read the directions correctly, I am greeted with signs marking the event that have been set up by the forward-thinking event guides. As I drive in, I see people checking and re-checking their packs, tapping their pockets and performing the general body language sequence of "do I have everything I need?" I exit my car and perform the identical ritual.

As a group we gather to listen to the introductions from our guides about the walk. The *Star Trek* is a night walk, starting near sunset and finishing in the dark where we practice using night vision and take in the stunning star-filled sky away from the

**"Continuing along the Track we come to the side of a ridge providing sweeping views of the back of the scarp."**



Hear more about walking the Bibbulmun Track

Scan this QR code or visit the Great Walks of the World playlist on YouTube.



*Previous page*

**Main** Climbing up Abyssinia Rock.

*Photo – Katie Stevens*

**Top** Night sky over the Darling Scarp.

*Photo – Roger Groom*

**Above** Taking in the view.

*Photo – Katie Stevens*



light pollution of the city. Alas, it's very overcast with the threat of rain closing in fast. Our guide, Steve, apologises for his inability to control the weather, and despite the name of the event, it's obvious that we are unlikely to see a single star tonight!

## OFF WE TREK

We head south along the Bibbulmun Track, in very humid conditions. The bush seems to be creaking all around us with the anticipation of rain. We stop a few times as our all-knowing guide feeds us little factoids of the flora and fauna around us. A few bushfires have ravaged this area over the years, with the most recent about three years ago. New growth has established as time has gone by.

The eerie call of red-tailed black cockatoos and the shriek of corellas can be heard overhead as they feast on the surrounding bush. Steve explains how we can spot the difference between the male and female red-tailed black cockatoos – the scarlet flashes on the tail feathers are the males, while the females have orange

and black bands and a duller plumage. I think to myself, amused, how the males are prettier in the animal world.

Continuing along the track we come to the side of a ridge providing sweeping views of the back of the scarp. Steve points out the various mounts and landmarks including an old fire lookout that, although we cannot see it with the human eye, we are assured is there. As we make our way downhill, we begin to approach Abyssinia Rock, a huge granite rock peaking at about a whopping 335 metres above sea level.

Dusk is beginning to set in as we climb the rock and take a break at the top joined by some friendly raindrops. All around me, organised hikers are beginning to pull out cheese, crackers, cold meats and wine. We stay here for a while as Steve tells us a wonderful story (which I'll keep a secret), looking up at the sky now blanketed in clouds, darkening quickly and showing no sign of letting a single star shine through. Wait, is that a star!? Nope, headlights from a vehicle on a distant hill.



## NIGHT MOVES

After the break, lubricated with a little wine, the vibe is generally jovial. We make our way down the rock and split into two groups to test our night vision skills. The first group (who wish to use their head lamps) moves on while the rest of us stand in the dark, waiting for our eyes to start adjusting to the dark. Silence and the inability to see one another results in many humorous remarks and giggles. We begin to walk slowly, following the sound of each other's footsteps and voices, learning to make out various features of our gear through the dark. And it's dark, very dark, the moon isn't up, and the starlight isn't quite making it through the clouds. The unease about what may be beneath our feet starts to set in. Tread lightly, concentrate, listen.

Eventually we rejoin the other group and are relieved to be able to turn our head torches on and bathe in the safety of light. At this point, it's really raining so we head back to the cars with one final

stop to farewell everyone before reaching the carpark. As we reach the carpark the group scatters to their respective cars to make the journey home to a hot shower and bed no doubt!

*Star Trek* was fantastic; being in the bush in the cooling weather and rain experiencing a section of Perth rarely visited was wonderful. No, we didn't see stars, but there were plenty of other things to learn, experience and amuse us along the way, and there's nothing better than being in the bush.

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**Top left** A male red-tailed black cockatoo.  
*Photo – Jiri Lochman*

**Top right** Cheers on Abyssinia Rock.

**Above** Waugal directional marker.

**Right** Off and away.  
*Photos – Katie Stevens*

## Do it yourself

**Where is it?** On the Bibbulmun Track, where it crosses Brookton Highway, about 21 kilometres south-east from Karragullen. From Perth, about 1-hour drive.

**Facilities:** Walk trail, parking.

**Tours:** Bibbulmun Track Foundation, visit [www.bibbulmuntrack.org.au/walk-the-track/events-calendar/](http://www.bibbulmuntrack.org.au/walk-the-track/events-calendar/)



**Katie Stevens** is a tourism and marketing assistant with the Bibbulmun Track Foundation and can be contacted at [tourism@bibbulmuntrack.org.au](mailto:tourism@bibbulmuntrack.org.au) or (08) 9481 0551.



# STEPPING CLOSER TO **1616**:

## MORE MAMMALS RETURN TO DIRK HARTOG ISLAND

The ecological restoration project for Western Australia's largest island, Dirk Hartog Island National Park ('Wirruwana' to the Malgana people of Shark Bay), continues apace.

by **Saul Cowen, Colleen Sims, Cathy Lambert and Tony Friend**





Following the successful eradication of sheep, goats and cats, 'Return to 1616' restoration project at Dirk Hartog Island is now well into the planned program of fauna translocations, aiming to restore 13 native species to the island.

## WINNING WALLABIES

The first two species to be released were the banded hare-wallaby (*Lagostrophus fasciatus*) and rufous hare-wallaby (*Lagorchestes hirsutus*), which were brought over from nearby Bernier and Dorre islands nature reserves. After a successful trial translocation of 12 of each species in 2017 (see 'Welcoming wallabies to Wirruwana', *LANDSCOPE*, Winter 2018), a full-scale release took place in 2018 of 90 banded and 50 rufous hare-wallabies. In 2019, another 50 rufous hare-wallabies were released to ensure an adequate founder population of both species.

The rufous hare-wallabies have wasted no time in establishing themselves in their new home and post-release monitoring of both species has shown they are surviving, breeding and generally thriving. However, neither species of hare-wallaby has shown an inclination to enter live-capture traps and while camera traps have proved useful in tracking their occupation of the island, this method is potentially tricky for estimating population sizes.

The use of DNA derived from faecal pellets (scats) has proved valuable in calculating estimates of populations of bilbies (*Macrotis lagotis*) (see 'DNA: unlocking secrets', *LANDSCOPE* Summer 2016–17) and in 2018, trials to assess the utility of this technique for hare-wallabies was tested in collaboration with the Australian Wildlife Conservancy.

Moisture and ultra-violet rays are the enemies of DNA and the mix of moist Indian Ocean air and Shark Bay sun means there is no shortage of either on Dirk Hartog Island. Fortunately, despite these obstacles, this technique shows real promise and in 2019 a trial monitoring program was rolled out to develop a survey method that relies on poo not traps!



## THE RETURN OF LITTLE MARL

Next to join the hare-wallabies, was that diminutive denizen of Bernier and Dorre islands, the Shark Bay bandicoot (*Perameles bougainville*). After a recent taxonomic revision, the species has cast off its moniker of 'western barred bandicoot', but the smallest member of this tribe also goes by the handle of 'little marl'.

This was the first true 'reintroduction' to Dirk Hartog Island, and it was with considerable excitement that 72 animals were released there in spring 2019. It became rapidly apparent that the new arrivals were very much at home and within weeks, their release sites were peppered with tracks and diggings.

The foraging behaviour of bandicoots means that they can turn over vast



Previous page

**Main** Dibbler and bandicoot release on Dirk Hartog Island.

**Above left** Dibbler ready for release.

Photos – K Rayner/DBCA

**Above right** Releasing a Shark Bay bandicoot.

**Above left** Rufous hare-wallaby first released on the island in 2017.

Photos – T Duselli/DBCA

**Above** Helicopter lifting off from Bernier Island with bandicoots bound for Dirk Hartog Island.

Photo – Colleen Sims/DBCA

quantities of soil and leaf-litter and returning these little diggers to the island could have a dramatic effect on the island's ecosystems. Radio tracking of 12 bandicoots over the first month or so after the release found some were ranging widely (more than 4km from their release site) but finding food was clearly not an issue based on some of the weight gains over this period (up 20 per cent of their original capture weight!).

However, despite their cute appearance, little marls have an ugly secret. The Bernier Island population harbours an unusual disease caused by Bandicoot Papillomatosis Carcinomatosis Virus 1, which causes cancerous warts and lesions that may ultimately prove fatal.

Transmission of the virus to Dirk Hartog was the biggest fear of this



translocation, but to ensure the new population had the best possible genetics, it was vital that some Bernier stock was included. Quarantining the bandicoots would be both costly and stressful, so all animals (including from Dorre) were thoroughly checked for any symptoms of the virus before release.

## DIBBLER CASTAWAYS

Joining the bandicoots in spring 2019 was another charming small marsupial, the iconic dibbler. Once thought extinct, this small but feisty dasyurid, related to quolls and Tasmanian devils, persists in populations scattered across the southern coast of WA (in part thanks to releases of captive-bred stock) as well as on three small islands off Jurien Bay. The latter location was chosen as the source for Dirk Hartog Island, partly to help preserve the genetics of these highly threatened populations.

The very small islands of Boullanger, Whitlock and Escape hold tiny numbers of dibblers, and removing enough animals to establish another population would all but wipe them out. Instead, a total of 10 pairs of were taken from Whitlock and Escape islands in 2018 (Boullanger's population was too small at the time to take any animals at all) and transferred to the Native Species Breeding Program facility at Perth Zoo.

The zoo has extensive experience in breeding dibblers, but the new arrivals weren't quite as productive as hoped. By October 2019, just 26 adults and juveniles were available for release on Dirk Hartog, but the breeding program will continue, boosting the numbers released on the island over the coming years. As can be typical for dibblers, the new arrivals promptly disappeared but trapping a month later found an adult female in good health, indicating they (like the bandicoots) weren't having any trouble finding food.

Monitoring with traps and cameras will continue for both bandicoots and dibblers and as they settle into their new, much larger, island home, it is hoped their numbers will swell and they are encountered more frequently.

## PLANNING FOR THE FUTURE

Planning such a large reintroduction program is complex and requires careful consideration of a multitude of factors.

DBCA's decision scientist, Dr Megan Barnes, has recently facilitated a process to better understand the possible implications of various interactions between species. Modelling experts at the Queensland University of Technology have applied an innovative scientific approach that will allow researchers to have confidence in our decisions both now and into the future.

**Above left** Shark Bay bandicoot being processed prior to release.

**Above** Searching for radio collared Shark Bay bandicoots on Dirk Hartog Island.  
Photos – *T Duselli/DBCA*

**Below** Shark Bay bandicoot tracks.  
Photo – *Saul Cowen/DBCA*



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Western spotted  
*frogs*  
in the  
Wheatbelt





In the wheat and sheep farming country of WA's  
Wheatbelt, a noisy little frog is defying the odds and  
providing a soundtrack to the night from small, isolated  
temporary ponds made possible by autumn rains.

by Robert Davis and Cheryl Lohr



If you're lucky enough to find yourself in the semi-arid parts of WA's south-west from March to April and there's been some rain, you should go out at night and listen carefully. If you're even luckier, you may hear a shrill 'whoop, whoop' call that doesn't stop all night. If you brave the darkness and track down the source of this strange call, you'll likely end up at a dry small wetland, roadside ditch, dam, salinity drain or old quarry.

Looking around on the ground may reveal a large mound of freshly turned up sand with no obvious entrance hole. The calling has probably stopped by now, so stand still, turn off your torch and look at the stunning southern skies and enjoy the stars and soon enough, the calls will start up again, one at first and then one by one,

adding to a symphony until the air around you is pulsing. Congratulations, you have found yourself a thriving breeding population of western spotted frogs!

### GOOD CALL

This species has a unique breeding biology. Males arrive shortly after the first autumn rains between March and May. They excavate a burrow in a sandy depression and begin calling. If successful in attracting a mate, a foamy egg mass is deposited in the base of the burrow in the moist soil.

At this stage, the frogs leave the burrow. The eggs develop to some degree within the protection of the jelly-like foam surrounding the eggs. If all goes well, the season breaks, and rains fill the breeding sites with water. The flooded burrows collapse, the eggs hatch and complete their development as free-swimming tadpoles.

### THE FIGHT FOR SURVIVAL

The western spotted frog is distributed widely throughout the semi-arid region of Western Australia from near Kalbarri in the north-west to Esperance in the south-east. Much of this distribution coincides with the wheat-sheep farming region of Western Australia, and accordingly, much of the range of this species has been subject to habitat loss, fragmentation and salinisation as European settlers cleared 140,000 square kilometres in less than 150 years.

In most areas of the Wheatbelt, less than 10 per cent of the native vegetation now remains, mostly as small, isolated remnants. The value of the approximately 1000 small nature reserves, parks, reserves and private property bush cannot be underestimated as they provide valuable protection for animals like frogs and areas from which they can recolonise when conditions are favourable. Such rapid and widespread landscape change has had a significant impact on local fauna and flora.

Amphibians are the world's most threatened class of vertebrate and there has been great concern about both the cause and scale of declines of amphibians globally. The most significant causes of decline are the chytrid fungus, climate change and habitat loss. Habitat loss is the leading cause for the decline of Australian frogs, yet we have a very limited understanding of how frogs persist in fragmented landscapes, or even if they do.

### PREDICTING THE FUTURE

To understand the impact of a drying climate and habitat loss, a comprehensive dataset is needed that can be used to model population processes and predict the future survival of frogs on a landscape scale. Over six years, starting during his PhD at the University of Western Australia in 1999, Robert Davis studied 30 populations of the western spotted frog *Heleioporus albopunctatus* in the Central Wheatbelt region of WA near Kellerberrin.

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*Previous page*

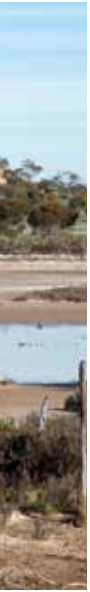
**Main** Western spotted frogs.

*Photo – Jiri Lochman*

**Above** Western spotted frog emerge to forage on warm wet nights outside the breeding season.

**Above right** A granite outcrop breeding site near Kellerberrin. The larger salt river in the foreground separates this site from populations in the north.

*Photos – Robert Davis*



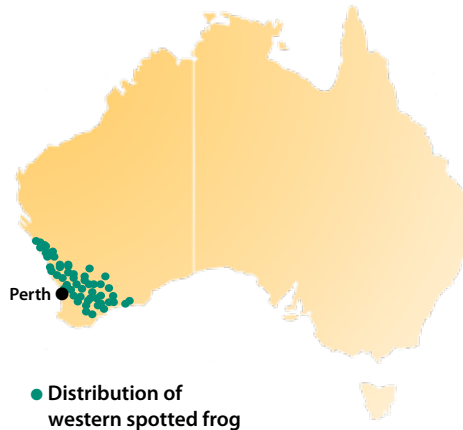
He installed pitfall traps to capture migrating adults during the autumn breeding season. Adults were marked so he knew which adults survived from year to year. Egg clutches were collected, and the number of eggs counted. He followed the metamorphosis of tadpoles into frogs from May to September.

While the western spotted frog may appear to be widespread and secure, Rob's detailed studies of genetics and adult, tadpole and egg survival, suggest that western spotted frog populations are small and isolated, with low tadpole and juvenile frog survival.

So, he teamed up with research scientist Cheryl Lohr from DBCA to predict the probability of persistence for this species.

"We used population viability analysis (PVA) to model the sensitivity of populations to a decline in breeding-season rainfall and the length of time that breeding ponds held water," said Rob. "We wanted to predict the likely persistence of this species in a highly modified agricultural landscape that still has opportunities for successful breeding."

The analysis showed the western spotted frog still occurs across all of its known range and uses a wide range of water bodies such as livestock dams for breeding. Regular dispersal among small breeding populations (metapopulations)



increased the probability of persistence for this species.

That is to say that populations that became extinct or were declining could be saved by new individuals moving in. Several similar studies on frogs and other animals have come to the same conclusion. In Rob and Cheryl's study, the metapopulation facilitated population persistence, despite increases in the frequency of drought.

### A DRYING CLIMATE

Atmospheric research predicts a drying climate for the south-west of WA. But western spotted frogs are a long-lived dryland frog that may be resilient to some dry years because they don't try to breed every year.

**Top left** Western spotted frog burrow.

**Top** Western spotted frog tadpole.

**Above** Western spotted frog.  
*Photos – Jiri Lochman*

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**" ...western spotted frog still occurs across all its known range and uses a wide range of water bodies for breeding such as livestock dams."**



“Consequently, we assumed drought did not have a catastrophic effect on juvenile frog survival,” said Rob.

However, as the drying climate worsens, the reduction in rainfall and runoff will further reduce the size and duration of temporary ponds which may result in widespread failure of recruitment (the successful development of tadpoles into juvenile frogs), which requires the pond to be full of water for at least six weeks.

If this happens, the maintenance of a well-connected metapopulation may be even more critical to the species viability. Another major finding was that the survival rate of juvenile frogs was a key to populations persisting in the long-term. If there was an increased death rate of juvenile frogs e.g. by predation or car strike, then the model suggested that populations would be driven to extinction sooner. To increase the accuracy and resolution of future models, more research on the survival of juveniles is required.

## LOCATION, LOCATION

“A fascinating observation during our work is the attraction of breeding adults to sub-surface water and sandy substrates

such as in salinity interceptor banks and small pastoral soaks,” said Rob.

“Some frogs are choosing breeding sites based on cues such as soil moisture or the presence of a depression, but these sites do not tend to hold water long enough for tadpoles to develop and breeding attempts fail when sites do not fill with water during winter.

“In the future, consideration may need to be given to designing breeding wetlands to ensure the presence of core breeding sites that continually succeed, even in a series of low rainfall years.”

## WHAT’S NEXT

Juvenile and adult survival is critical to the long-term persistence of western spotted frogs and this may be the case for many amphibians with similar life histories. Finding that a metapopulation with as few as five sub-populations reduced the extinction risk for western spotted frogs gives cause for hope that WA’s frogs may have the adaptive capacity required to survive drying climates, particularly if connectivity is maintained or enhanced.

“Our work highlights the importance of furthering our fundamental knowledge of amphibian species. While recent efforts

have focused considerable resources on understanding and preventing the spread of chytrid fungus and determining the impact of climate change on amphibians, sound baseline population demographic data is essential to inform the complex models required to understand these threats. With baseline life history data lacking for most species of amphibian, it is critical that such studies are resourced and continued,” said Rob.

.....  
**Above left** Western spotted frog habitat, Eagle Rock.

**Top** Western spotted frog.  
*Photos – Ann Storr*

**Above** A newly metamorphosed western spotted frog emerges from a breeding pond. Its tail will be slowly reabsorbed.  
*Photo – Robert Davis*

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It's not uncommon for there to be a time lag between the first collection of a new species and its scientific publication. Some undescribed species are collected, misclassified and filed away in the specimen vaults at DBCA's Western Australian Herbarium where they await botanical discovery. Others, like *Pimelea* sp. Tarin Rock, are known to us but cannot be scientifically named and described until high-quality collections and additional data are obtained and their taxonomic distinctness confirmed. With this in mind, my colleague Kelly Shepherd and I decided to detour to Tarin Rock on the last day of a broad-ranging field expedition in order to search for the *Pimelea*, which had been collected more than 30 years ago by citizen scientist Eileen Croxford.

We weren't optimistic that our plant hunt would be successful. There wasn't much location information associated with Eileen's collection and we had insufficient time to fully explore the large areas of bushland in the region. However, by querying the Herbarium's specimen database to see what other collections Eileen had made the day she found the *Pimelea*, I was able to build a better picture of her travels and narrow our search area. After several hours of searching, and not before feeling like we were hunting for a needle in a haystack, we spotted a showy *Pimelea* that had large, drooping heads of white flowers and contrasting orange anthers. Although it was unlike any other *Pimelea* we had seen that day, we were uncertain as to whether we had found what we were looking for. We took photographs, made a lovely pressed collection, and popped some fresh flowers in the car fridge before hightailing it back to the Herbarium, eager for our resident *Pimelea* expert Barbara Rye to examine the material. Delight was evident on Barbara's face as she not only confirmed that our collection matched Eileen's but that the species was truly new to science.

Tarin Rock banjine (*Pimelea crucis*) was recently named and described as part of this year's golden anniversary edition of the Herbarium's journal *Nuytsia*.



## Tarin Rock banjine



Since its launch on 10 December 1970, *Nuytsia* has supported five extraordinary decades of botanical discovery during which the number of native plants species formally recorded in Western Australia has increased from 5802 to more than 10,450. Many people have contributed to this extraordinary growth in botanical knowledge by writing, reviewing and editing journal manuscripts, collecting, processing, databasing and curating herbarium specimens, and of course discovering new species. To celebrate this collective effort, 50 new Western Australian species from 50 genera are being published online in *Nuytsia* over 50 separate days this year, each with a corresponding story on the Herbarium's Facebook page.

The golden anniversary edition features botanical novelties from a wide range of habitats across the State and has a strong conservation focus. Most of the included species are threatened or poorly known, with several known only from a single collection or population, or fewer than 50 individuals. Giving names to these species and providing descriptions to aid their identification is a vital scientific step that is likely to stimulate survey and lead to positive conservation outcomes, such as the discovery of more plants in the wild.

**Above** *Pimelea*.

**Inset** Western Australian Herbarium journal *Nuytsia*.

The Tarin Rock banjine is a case in point. Only four plants of this apparent rarity were observed when it was relocated in 2017. Descriptive information and photographs were subsequently sent to citizen scientist Jolanda Keeble, who was known to be actively botanising in the area. Last year Jolanda managed to locate another four plants at a different site following a persistent and extensive survey effort. There are indications that this species is a disturbance opportunist, which will make determining its precise conservation status challenging, but at least good taxonomic information is now available to inform the search for more.

Information on the Tarin Rock banjine and the other species featured in this year's golden anniversary edition of *Nuytsia* (Volume 31) is freely available at [florabase.dbca.wa.gov.au/nuytsia/current](http://florabase.dbca.wa.gov.au/nuytsia/current)

Follow the Herbarium on Facebook for more golden stories of discovery [www.facebook.com/WesternAustralianHerbarium](http://www.facebook.com/WesternAustralianHerbarium)

# Jumping for joy

A busy fairy tern nesting season along Western Australia's coastline has been a delight for bird watchers and researchers alike. And, with the help of dedicated citizen scientists, it's hoped new conservation efforts will boost numbers.

*by Claire Greenwell and Kendall O'Connor*





**D**espite being one of Australia's smallest and rarest seabirds, weighing in at around 70 grams (about one and a half golf balls) and measuring less than 250 millimetres from their bill to tail-tip, the much-loved fairy tern bursts with personality. The tiny bird features a trademark dark black head cap, and bright orange bill and legs.

Each year in late spring, up to one third of Australia's fairy tern population migrates to the south-west of Western Australia, seeking suitable sites to lay eggs and raise chicks. Like most seabirds, fairy terns nest in groups or colonies, which can have up to several hundred breeding pairs.

Their preferred habitats are sand spits and wide, sandy beaches in sheltered lagoons, near estuary mouths and on shallow continental islands. Colony sites are surrounded by clear, productive waters, where small baitfish are abundant. Their nest consists of a simple scrape in the sand, 20 to 30 millimetres deep, and small stones and shells are often incorporated to increase cryptis.

The eggs and chicks of fairy terns are mottled in appearance, which allows them to blend in with their surroundings and reduce detection by predators. However, their precarious beach-nesting lifestyle, combined with a range of human-induced pressures, has negatively impacted breeding success.

Expanding coastal development has reduced habitat availability, and many historically important sites are now too heavily disturbed to support breeding. Cats and foxes pose a significant threat to colonies on the mainland, while unnaturally high numbers of silver gulls



and Australian ravens can threaten birds nesting on nearshore islands.

## CITIZEN SCIENTISTS BANDING TOGETHER

In 2016, the Western Australian Fairy Tern Network (WAFTN) was established to facilitate a holistic approach to conservation of the species and a citizen science program was launched. WAFTN provides a platform for communication and the coordination of conservation actions among researchers, land and wildlife managers, non-government organisations and citizen scientists.

Fairy terns have a wide distribution that spans across 2500 kilometres of coastline managed by multiple stakeholder groups. This presents a number of challenges for conservation but thanks to adaptive management, education and strong, proactive community support the number of chicks hatched at known breeding sites is on the rise.

As part of the WAFTN citizen science program, the birds are given a unique eight-digit metal band, which they carry for life. Adults are also colour banded, with each colour designating a different breeding location.

Over the past few years, citizen scientists have been resighting and reporting banded birds, and gathering

important data about the fairy tern population. The banding project has revealed a wealth of new information about how fairy terns utilise the coastline and their population demographics. In November 2019, a bird almost 23 years of age set a new longevity record when it was sighted on Garden Island.

## A GREAT TERN OUT

Claire Greenwell, a PhD candidate from Murdoch University and convener of the WAFTN, is investigating the lives, behaviour and foraging ecology of fairy terns in south-western Australia. This research is being used to inform management and guide future conservation efforts for this threatened species.

Over the 2019–20 summer, Claire investigated the diet of fairy terns breeding at Point Walter in the Swan-Canning Estuary and on Penguin

.....  
*Previous page*

**Main** Fairy terns now have a bright future thanks to citizen scientists and dedicated conservation strategies.

**Above** Australia's rarest and smallest seabird bursts with personality.  
*Photos – Claire Greenwell*



Hear more about the fairy terns

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



## Distribution of fairy terns



“Fairy terns have a wide distribution that spans across 2500 kilometres of coastline... thanks to adaptive management, education and strong, proactive community support the number of chicks hatched at known breeding sites is on the rise.”

Island, a nearshore coastal system. This work is expected to reveal important new information into the use of food resources within these productive ecosystems and the potential for fairy terns to adapt their diet to a warming ocean.

Over the same period, DBCA's Parks and Wildlife Service staff from the Frankland District, South West Region, Metropolitan Marine and Riverparks Unit, Moora District and Exmouth District as well as Rottnest Island worked hard to record population numbers of breeding

.....  
**Above** Every year fairy terns migrate to the south-west of WA, seeking suitable sites to lay eggs and hatch their chicks.

**Right and above right** WA Fairy Tern Network investigates lives, behaviour and ecology of these birds.

*Photos – Simon Blears*

colonies and number of chicks hatched and fledged along the WA coast.

The largest colony was recorded at Green Islets on the mid-west coast with approximately 250 pairs estimated. In the metropolitan area, successful colonies included Carnac, Penguin, Garden and Rottnest islands. At Point Walter, the number of nests doubled from around 70 pairs in 2018–19 to 135 pairs in 2019–20 and a record number of chicks fledged.

### PROTECTING BREEDING GROUNDS

To provide fairy terns the best protection from threats and minimise disturbance, potential breeding sites are identified, and temporary fencing is erected to protect the colony from human encroachment.

Identifying the sites can be a challenge because the birds do not tend to commit to one site year-in-year-out, but they do offer some hints when they are deciding where to settle. During the day, the birds





**Above** An unnaturally high number of silver gulls can pose a threat to the nesting of fairy terns on nearby onshore islands.

*Photo – Jiri Lochman*

**Right** The eggs and chicks of the fairy tern are mottled in appearance, allowing them to blend in with their environment and not be detected easily by their predators.

*Photo – Claire Greenwell*

form ‘clubs’ where they fly and hover over potential nesting spots. They also undertake courtship displays to attract potential mates, which involves the carrying of prized fish by male suitors.

Once nesting sites are found or the birds are seen to be engaged in nesting activity, conservation officers only have a small window of time to set up the fence in order to minimise disturbance to the birds.

Temporary signage is used when nesting is taking place to alert beach goers to keep clear of certain areas and the site is routinely monitored.

Fairy terns are extremely sensitive to disturbance but by working together there’s hope that the seabirds can have a bright future.

### *How you can help*

Unfortunately, several small colonies on the mid-west coast of WA appear to have been disrupted by foxes and a colony of around 180 pairs in Bunbury failed in December, likely due to cat or fox predation.

Members of the public can help protect beach-nesting birds like fairy terns by taking a few simple steps while utilising the coastline.

- Share the space and be respectful of signage and fencing. These temporary measures are deployed to give the birds a chance of success and they only need the area for a little while.
- Keep dogs leashed and away from known breeding areas to help protect small chicks that cannot easily escape and keep cats indoors.
- If a bird nesting on the beach is spotted, report it to the Parks and Wildlife Service or local rangers and maintain your distance.



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# BE CROCWISE



Above Estuarine (saltwater) crocodile.  
Photo – DBCA

## Be crocwise in croc country!

Two crocodile species occur in Australia and both are found in the north of Western Australia. They are the estuarine (saltwater) crocodile (*Crocodylus porosus*) and the Johnston’s freshwater crocodile (*Crocodylus johnstoni*).

Estuarine (saltwater) crocodiles are found throughout the Kimberley in salt and freshwater systems including; rivers, estuaries, billabongs, floodplains and in the open ocean. They are the most deadly of the species and have been known to grow up to 7 metres in length. Unlike the estuarine (saltwater) crocodiles, freshwater crocodiles can only survive in freshwater rivers, creeks and lakes. They are rarely longer than 3 metres but can still be dangerous if touched or disturbed.

### HOW TO BE CROCWISE WHEN:

#### Fishing from the shore

- Only fish where there is an area of shallow water in front of you and stand at least 5 metres back from the water’s edge.
- Don’t stand on logs overhanging the water while fishing or attempting to retrieve lures.
- Be careful when fishing alone or where a crocodile can approach you from behind.

#### Recreating and camping

- Read and obey warning signs. Some locations where crocodiles live may have warning signs, but most do not, therefore don’t assume the absence of signs means that it is safe to enter the water.
- Always keep a lookout for crocodiles. Be aware that crocodiles can remain hidden underwater for long periods.
- Camp at least 5 metres above the high-water mark and at least 50 metres away from the water’s edge.



Top and above Parks and Wildlife Service incursion at St Mary’s Primary School in Broome. Estuarine (saltwater) crocodile yearlings borrowed from Malcolm Douglas Crocodile Park.  
Photos – St Mary’s Primary School



## Boab tree (*Adansonia gregorii*)

The boab tree occurs mostly in the Kimberley region of Western Australia. It is outstanding for its huge bottleshaped trunk that is filled with soft fibrous wood, enabling it to store water. A deciduous tree, it loses leaves in the winter months in the tropics when it is dormant. The boab can live for hundreds of years and grows slowly to a height of 5–15 metres and has a trunk circumference of up to 20 metres. The fruits are large, brown and oval-shaped, up to 18 centimetres long with a woody and hairy exterior. They contain numerous seeds and a white pithy substance.

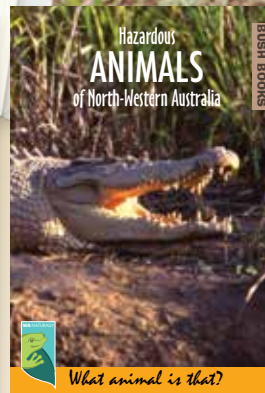
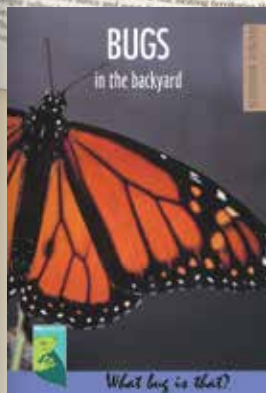
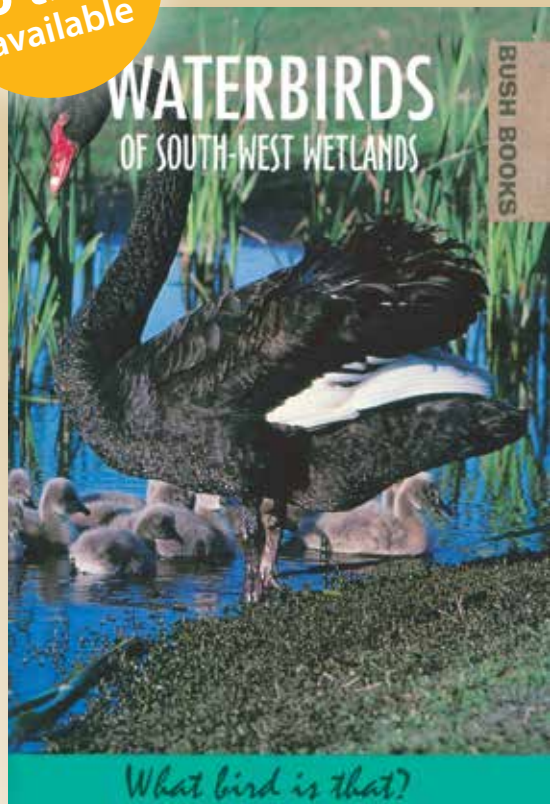
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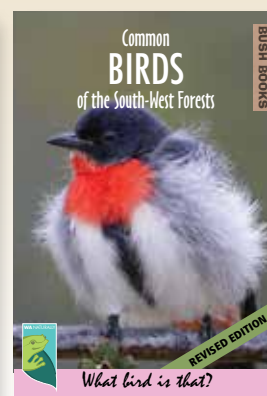
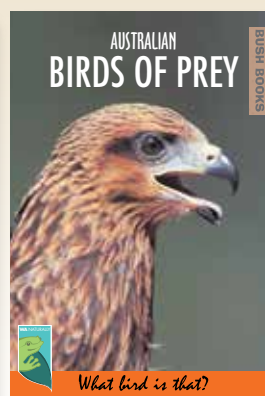
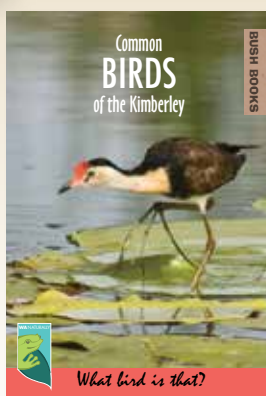


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