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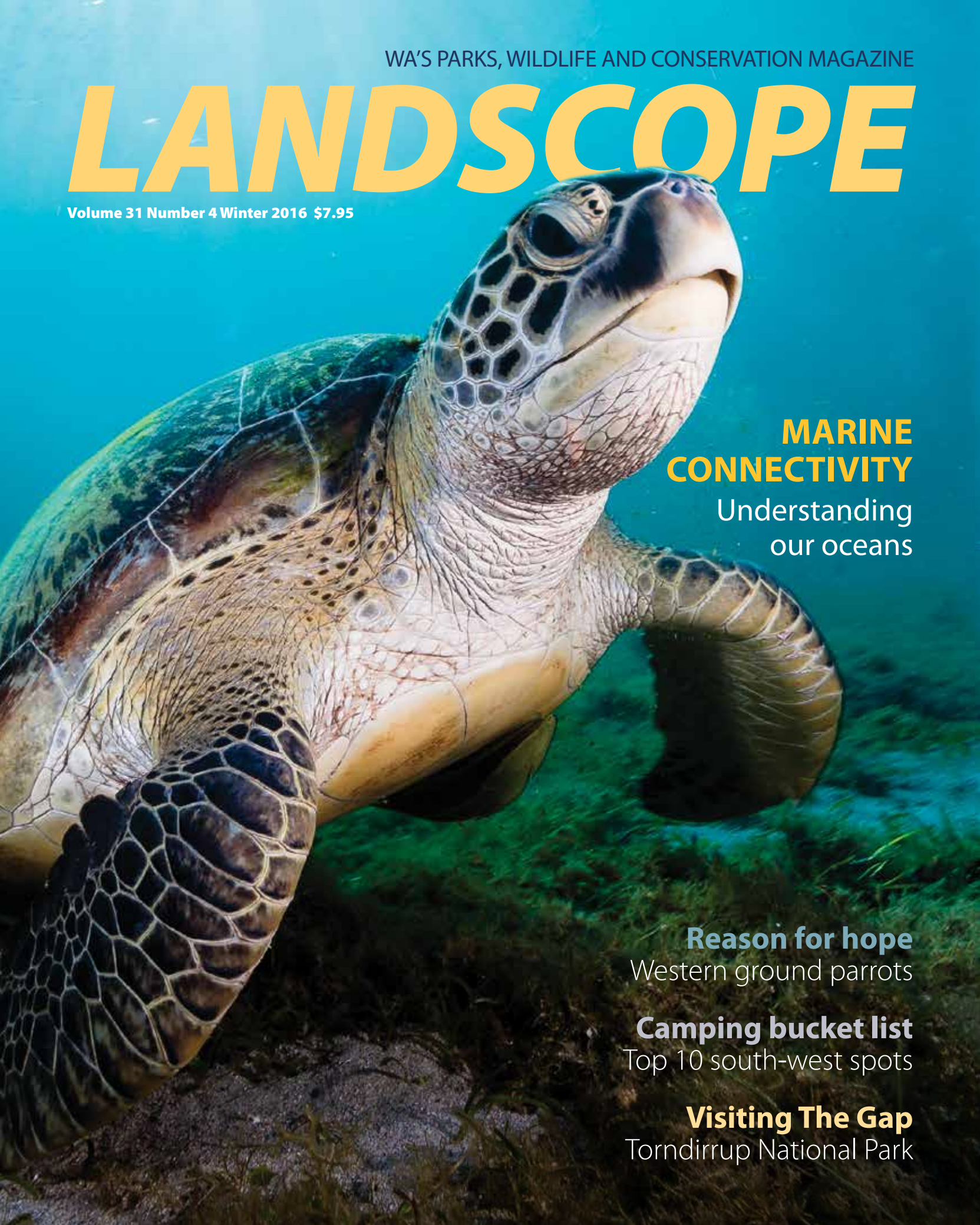

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ON THE COVER

Front cover Green turtles (*Chelonia mydas*) are often seen in the Dampier Archipelago. Visitors to the area may have the opportunity to watch female flatback, green and hawksbill turtles nesting on several beaches during summer. Adult green turtles grow up to 1.5 metres long and can weigh between 68 and 190 kilograms. The average carapace length is 78 to 112 centimetres. You can read about the Dampier Archipelago in 'Dampier Archipelago underwater: A diamond in the red rock' on page 16).

Back cover The stunning reefs of Ningaloo boast a wonderland of corals and fish. *Photos – Matt Kleczkowski*

Developments in our natural areas, like the new tourist precinct at Torndirrup National Park (see 'Mind The Gap' on page 28) which was made possible by a $6.1 million Royalties for Regions *Parks for People* investment, offer a range of benefits to the local communities that surround them and the visitors they attract. They provide safe and often spectacular infrastructure that supports visitors to explore the area as well as interpretation that helps them appreciate the environment. But even smaller-scale developments can have positive impacts on visitor experiences. The Shire of Manjimup and Parks and Wildlife have recently sealed a three-kilometre path that runs between Manjimup and the King Jarrah recreation site. This has become a popular walking trail and forest recreation experience for people looking for an easy walk to enjoy nature without having to travel too far out of town, such as families with prams and elderly people who use mobility aids. It has connected the forest with the town in a way that helps foster a sense of community ownership for the area. The town of Walpole has a similar facility that joins the town, Walpole-Nornalup National Park and Walpole-Nornalup Inlets Marine Park.

Developments in tourism infrastructure can have tremendous tangible economic benefits to regional areas too. During construction, Parks and Wildlife makes use of local contractors and suppliers and, when they're up and running, some facilities such as the Tree Top Walk in Walpole-Nornalup National Park provide employment and volunteering opportunities for local people. Parks and Wildlife is also embarking on a number of community partnerships where private businesses (many of them local) and tour operators offer experiences and services on lands and waters managed by the department. A number of these partnerships are being successfully run throughout the State with many more in the pipeline (see 'Adventure out: Canopy capers on page 46). And of course, when tourists spend time in WA's beautiful natural areas, they often spend time in regional towns and cities, contributing to the local economy through the purchase of food, accommodation, fuel and other goods and services.

You can read more about some of the magnificent places in our south-west in 'Southward bound: Top 10 camping spots' on page 23 for inspiration and ways to visit some of these amazing places.

Peter Keppel, ***Warren Region Manager***
Department of Parks and Wildlife

Contributing

Margie Mobring has been working with Parks and Wildlife for almost two years as a research scientist with the Marine Science Program. While she is based in Perth, her work focuses on long-term monitoring of marine communities in the Dampier Archipelago. Until this role, Margie's work concentrated on temperate waters, where she studied seaweed during her PhD with The University of Western Australia. She has found learning about tropical environments to be an exciting challenge.

Heather Quinlan is a communications officer working in Parks and Wildlife's Public Information and Corporate Affairs branch. A former sports journalist with *The Sydney Morning Herald* and event publicist for Fairfax Media, she has worked at Parks and Wildlife since 2012 specialising in media liaison, bushfire public information and preparation of department resources. Heather is a fitness and sports enthusiast, with a strong appreciation for the parks and natural environment of WA.

Richard Evans is a Parks and Wildlife marine senior scientist based in Perth. He started with the department in 2009 working on the Gorgon monitoring, evaluating and reporting program in the Montebello and Barrow Islands marine parks and management areas. He is now working on the Wheatstone Offset B project: Connectivity and recovery potential of Western Pilbara marine habitats and their associated taxa. Richard has more than 15 years' experience in coral reef ecology.

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This page *Diploastrea heliopora*.
Photo – Matt Kleczkowski

Department of Parks and Wildlife

PARKS FOR PEOPLE

READERS' PIC

Snap shot

Argyle cycad (*Cycas pruinosa*)

Words and photo by Don Stallard

"Argyle cycad (*Cycas pruinosa*) supposedly represents "the earliest form of plant life" on the Earth's surface.

This particular stand is a fine example of this species distributed throughout the central and north-east Kimberley. For me, the location of this stand thrives at the core of the Kimberley where the mighty King Leopold and Durack ranges meet. Where the higher peaks of Mt Wells, Bedford and King are concentrated. Where the source of the Ord and Fitzroy rivers rise and flow in opposite directions but are separated by few kilometres by what I call the Kimberley Divide. This divide continues north-west to further separate the sources of the Little Fitzroy River from the Durack and Chamberlain rivers. Adding to these attractions are the nearby Teronis Gorge, old Elgee Cliff's homestead and cave paintings, all of which highlight the importance of this location."

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

Camera watch program calls on volunteers

People all around the world now have the opportunity to take part in *Western Shield*, the biggest conservation project ever undertaken in Australia, with the launch of an online citizen science program.

Hosted on the collaborative volunteer research website Zooniverse, the *Western Shield Camera Watch* project draws on the help of more than two million volunteers to identify native and introduced animals captured by 90 remote cameras around Western Australia.

Volunteers don't need any scientific knowledge, just a keen eye and a willingness to learn. The website provides a step-by-step guide to correctly identifying the animal by shape, size, colour and markings.

The identifications received will help *Western Shield* scientists at the Department of Parks and Wildlife measure the success of its broadscale feral cat and fox baiting program.

More than 200,000 images are already loaded onto the site for identification. To get involved, visit www.zooniverse.org, register, and search for '*Western Shield Camera Watch*'.

Prawn project boasts 4.5 million milestone

A project to address the decline of western school prawns in the Swan and Canning rivers has seen more than 4.5 million prawns released back into the river system in the past three years.

The restocking project works with the community through the citizen science program *Prawn Watch*, to collect gravid (pregnant) female prawns from the river each year during the November–April breeding season. They are transferred to tanks and allowed to spawn naturally in a carefully controlled environment, where chances of the young's survival are much higher than in the river. The juvenile prawns are later released into the Swan Canning Riverpark, boosting the population and helping to reinstate prawning as a recreational activity for Perth families.

The historically popular activity of drag netting for prawns has all but disappeared as prawn numbers have declined since the 1950s.

Restocking began in 2013, using recreational fishing licence fees to partly fund the project. In March 2016, 674,000 juvenile prawns were released along the Como foreshore to bring the project's total above the 4.5 million mark.

The project is a joint effort between the Department of Parks and Wildlife, the Australian Centre for Applied Aquaculture Research, Murdoch University, Recfishwest, the Department of Fisheries, the WA Fish Foundation and the Fisheries Research and Development Corporation.

Below Prawning in the Swan River. *Photo – Stewart Allen*

Future mapped out for Esperance and Swan Coastal regions

The futures of two biologically important regions in WA have been secured with the release of 10-year plans for the Esperance and Recherche parks and reserves, and the southern part of the Swan Coastal Plain.

The plan for Esperance covers more than one million hectares and includes Stokes, Cape Le Grand and Cape Arid national parks, 62 nature reserves and an archipelago of 105 islands. The area contains two Ramsar-listed wetlands, stunning beaches, rich biodiversity and significant Aboriginal cultural heritage.

The plan covering the southern part of the Swan Coastal Plain from Perth to Dunsborough guides the management of 82 parks and reserves. It includes two Ramsar-listed wetlands – the Peel-Yalgorup and Vasse-Wonnerup systems – which provide habitat and breeding grounds for thousands of waterbirds. These and other wetlands make up 80 per cent of the area covered by the plan.

The plans detail strategies to protect the natural values of the areas including mitigating threats such as altered hydrology, weeds, introduced animals, disease and inappropriate fire regimes.

They also provide for recreation opportunities, maintaining natural experiences in the more remote parks and providing excellent facilities in others.

Many of the reserves have strong cultural heritage significance for Aboriginal people and other Australians, with the plans aiming to protect and conserve these values of the land with traditional owners.

For more information and to download the plans visit www.dpaw.wa.gov.au.

Above Members of BirdLife Australia netting for migratory birds on the Swan Coastal Plain.
Photo – Paul Tholen/Parks and Wildlife

Thank you to all our readers who took the time to complete our readers' survey. We strive to make *LANDSCOPE* magazine an interesting and engaging publication that informs our readers about the work being carried out by Parks and Wildlife and our partners, showcases our beautiful State and its plants and animals, and highlights ways to discover it. The information you provided through the survey will help us continue to improve *LANDSCOPE* and the way we deliver it.

Those who responded went into a draw to win a framed print of the stunning bobtail painted by Parks and Wildlife's Gooitzen van der Meer that was featured in the Autumn 2016 edition's Nature's pin-up.
Congratulations to Ian Smith of Wongan Hills who won.

Guest column

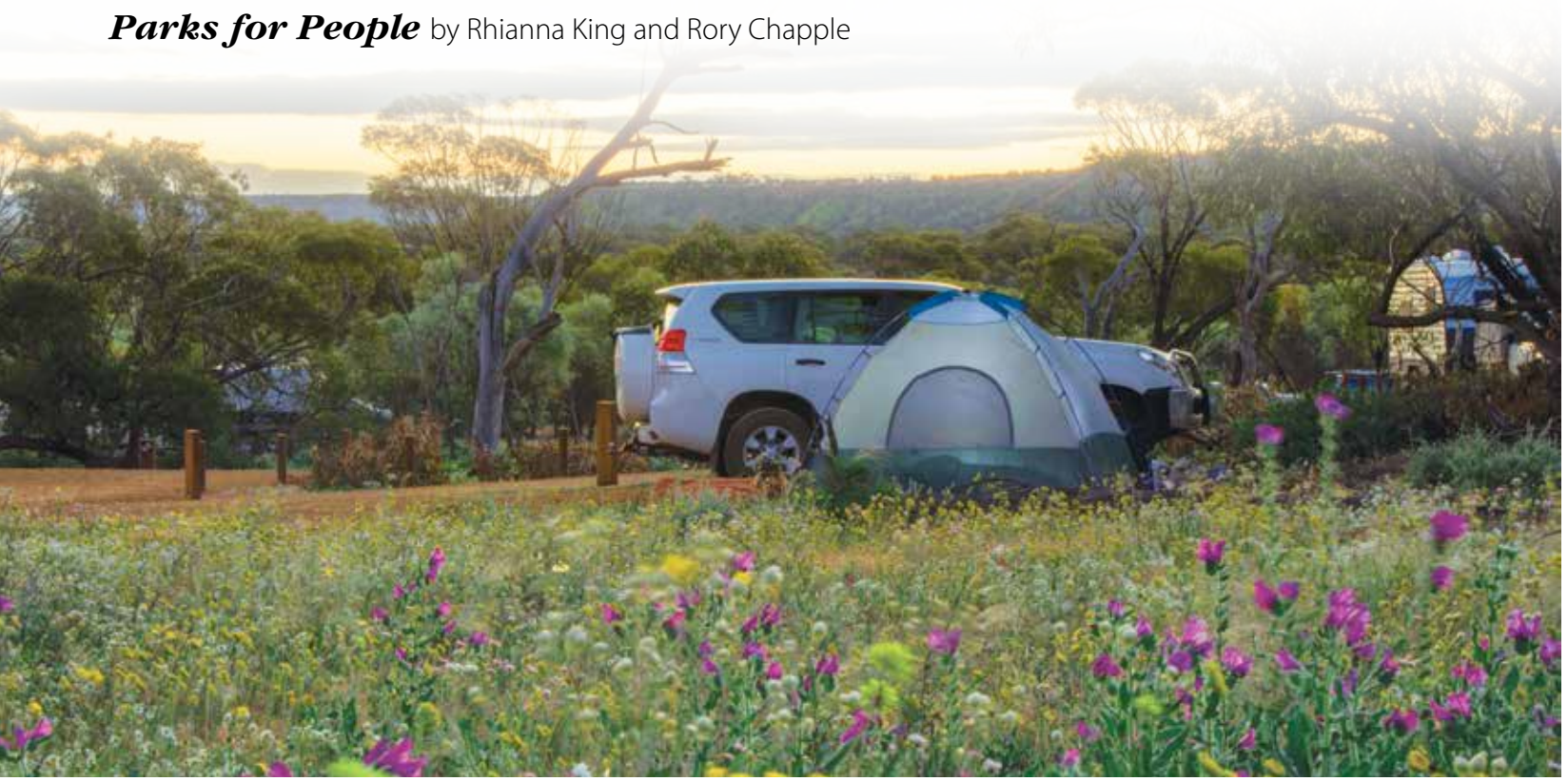
Ross Anderson
Assistant curator of maritime archaeology, WA Museum

Western Australia has a rich maritime history, with underwater archaeological heritage ranging from prehistoric Indigenous sites to World War II shipwrecks and aircraft. Underwater cultural heritage (UCH) sites provide habitat for marine life, and some lie within our beautiful marine parks. Occasionally shipwrecks once underwater are found buried in reclaimed land, such as the newly discovered North American whaling ship *Samuel Wright* (1840) in Koombana Bay. Sealers and whalers explored Western Australia's coast before British colonisation, and *Samuel Wright*'s mast, which was later used as a convenient trig point to map out Bunbury's town plan in 1841, is a unique example of this chronology (see 'The *Samuel Wright* story: digging for hidden treasure' on page 42).

It is hard to fully appreciate sunken or buried archaeological sites being 'out of sight out of mind', though Western Australians are proud of their maritime heritage. To protect archaeologically significant sites such as *Batavia* (1629) and *Samuel Wright*, the Western Australian Government enacted the pioneering *Maritime Archaeology Act 1973* – the first legislation in the world to specifically protect historic shipwrecks. Since then the WA Museum has built two maritime museums, conducted more than four decades of maritime archaeological and conservation research, conserved thousands of artefacts, contributed to international standards codified in the *2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage*, and trained hundreds of underwater archaeologists in Australia and abroad. The WA Museum's outreach work includes supporting public education, recreational diving and tourism through site interpretation, exhibitions, training courses, lectures, tours, shipwreck trails, books, maps and websites.

Think of Western Australia's 1600 shipwrecks as 'underwater museums', though only 350 of them have been located to date. Each of them is a unique and irreplaceable time capsule containing stories of our maritime past. Next time you leap into the ocean, keep an eye out – you might discover something special!

WESTERN AUSTRALIAN museum



Coalseam Conservation Park

Famed for its spectacular wildflower display, Coalseam Conservation Park – located in the heart of the Midwest – comes alive with colour in late winter. A redeveloped campground is catering to those keen to experience 'wildflower country' and discover all the other surprises this park has to offer.

Coalseam Conservation Park's annual wildflower display is quintessentially Western Australian, with the beautiful white, pink and yellow flowers of the everlasting daisies transforming the landscape after the winter rains. The papery flowers densely carpet the valley slopes and provide a visual feast for the thousands of people who come to the area each wildflower season to enjoy them. But there is a plethora of other species that occur in the park year round which contribute to it being one of the most botanically diverse areas in the region. There are also a number of birds – such as galahs, nankeen kestrels, black-faced woodswallows, black-faced cuckoo-shrikes, crested and common bronzewings, red-capped robins and Australian ringnecks – that occur in the area and add to the sounds of the bush.

Wedge-tailed eagles can also be spotted soaring in the skies above. Many of the area's mammals can be difficult to spot during the day as they are nocturnal. However, a search of the bush around the campground, particularly in the early morning or late afternoon, may reveal echidnas and western grey kangaroos.

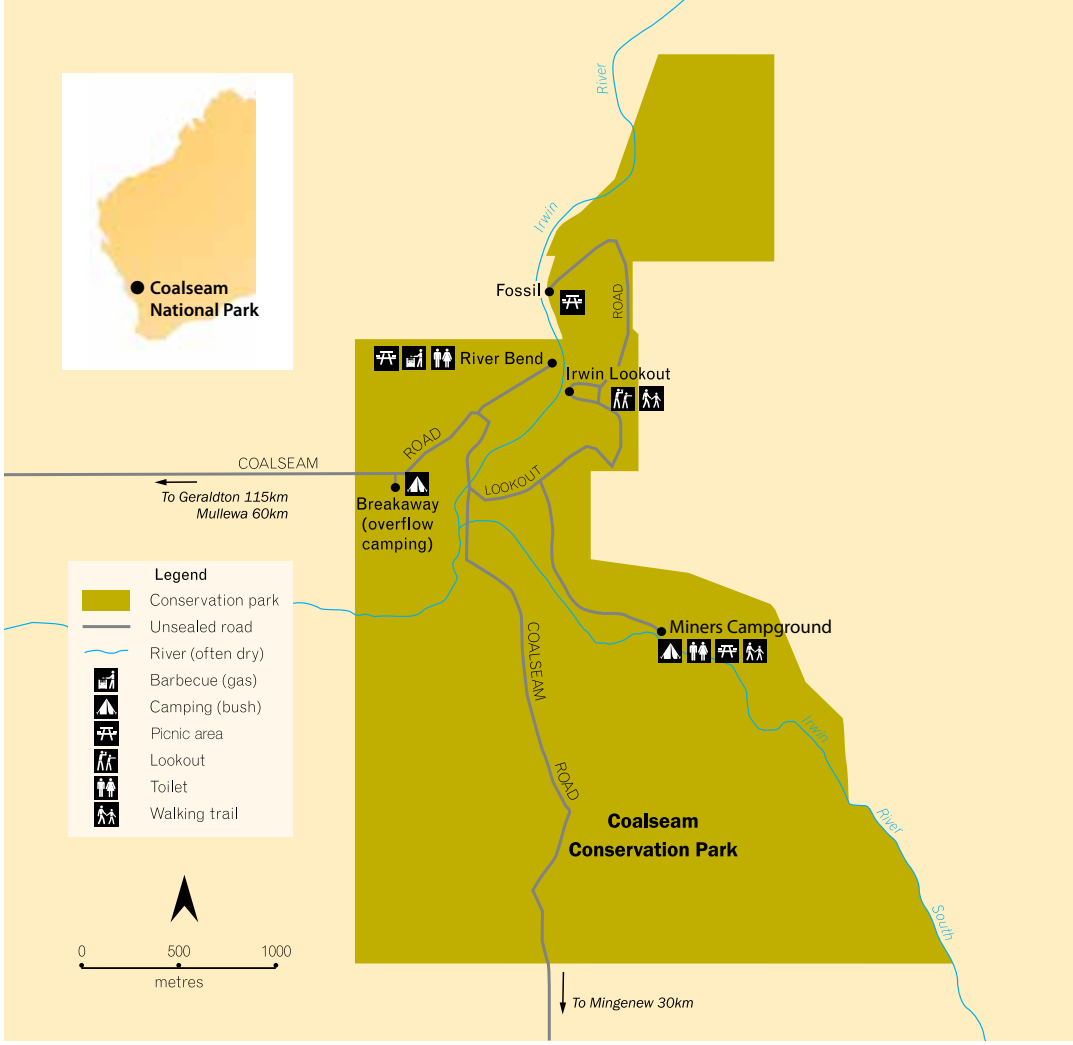
CAMPING

Coalseam Conservation Park has long been popular for campers – particularly during the wildflower season – however the existing campground lacked well-defined sites and only had 14 bays. Thanks to a $302,500 investment as part of the State Government's $21.05 million Royalties for Regions *Parks for People* initiative, a new campground is catering to more visitors and providing better facilities. Campground Host volunteers are on site from August to October to make your stay even more enjoyable.

Miners Campground now provides 25 full-size camping bays that cater for small to large vans and camper trailers. The spacious sites are designed so visitors can enjoy privacy but still have access to a communal fireplace where campers can enjoy a yarn and a cup of tea around the fire at night. Picnic tables are also provided. A new toilet features a privacy screen that is constructed out of anodised aluminium featuring cut-outs of flowers.

GO EXPLORING

Visitors to the area can use Miners Campground as a base from which to explore the park. The area is steeped in European history which began when three brothers and explorers – Augustus, Frank



and Henry Gregory – discovered exposed coal seams along the banks of the Irwin River in 1846. This was the first discovery of coal in WA and resulted in the area being declared as a reserve. A number of shafts were excavated and can be seen today from the Johnson Shaft Viewing Platform, which can be accessed on the 700-metre-return Miners walk trail. The walk takes about 30 minutes from Miners Campground. The Gregory brothers' exploration made way for pastoralists and farmers who cultivated the land for sheep and wheat farming, which now surrounds the park. The park itself was unsuitable for farming and became a refuge for native plants and animals, which led to it eventually being protected as a conservation park.

Another lookout can be accessed by a 560-metre-loop walk in the northern part of the park. This lookout provides views along a cliff edge above the Irwin River, where you'll enjoy dramatic views of the valley below and learn about the fascinating geology of the area.

During your journey around the park, you may see artefacts such as stone flakes, scar trees and grinding stones that give insight into the traditional uses of the area. The region is significant for a number of local Aboriginal groups and its plants and animals provide important sources for food and medicine.

Even more ancient are the marine fossils that can be seen on the edges of the Irwin River. The fossils have been exposed over time by erosion but you'll need a keen eye as many of them are quite small. That's the thing about exploring our natural areas – sometimes you've got to adjust your focus from the spectacular vistas of the stunning wildflower displays to also enjoy the hidden gems.

Opposite page Coalseam Conservation Park features a newly redeveloped campground. *Photo – Peter Nicholas/Parks and Wildlife*

Top left Everlasting daisies bloom in abundance during wildflower season.

Above left Irwin River Lookout. *Photos – Sally Bostwick/Parks and Wildlife*

Do it yourself

Where is it? 30 kilometres north of Mingenew and 115 kilometres east of Geraldton.

What to do: Camping, birdwatching, bushwalking, photography, wildflower appreciation, picnicking.

Facilities: Campground, toilets, short walking tracks, communal fireplace, gas barbecues.

Nearest Parks and Wildlife office: Midwest Regional Office, 201 Foreshore Drive, Geraldton, phone: (08) 9964 0901.

PARKS FOR PEOPLE

Discover more about Coalseam Conservation Park

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

Century-old seaweed resurfaces

More than 100 years ago, the Dutch embarked on what is justly recognised as one of the great voyages of discovery. The *Siboga* Oceanographic Expedition to what was then known as the Netherlands East Indies, now known as Indonesia, lasted for just short of a year, departing Surabaya on 7 March 1899, and formally ending on 27 February 1900, when it returned to the same port. In total 323 sites were visited, physical measurements were made at each, and numerous biological and geological specimens were collected.

While only four scientists took part in the expedition, the analysis of the samples involved scientists from 12 countries. The results were published in a series of more than 130 monographs that appeared between 1901 and 1982. Even to this day, the *Siboga* collections are being actively studied, and this remarkable cache of biological material continues to yield interesting new records and taxa.

The expedition did not enter Australian waters, but many species that were recorded are widespread in the tropical Indo-Pacific, including northern Australia. The monographs of the *Siboga* expedition are therefore of considerable importance in assessing and documenting the marine flora and fauna of tropical Australia, as they include the first descriptions of numerous new species.

On board the *Siboga* was seaweed biologist Anna Weber-van Bosse, who was the wife of the expedition leader Max Weber, professor of zoology at the University of Amsterdam. The participation of a woman in such an expedition was unheard of at the time, and Weber-van Bosse is justly regarded as a pioneer. In recognition of her achievements, Weber-van Bosse was awarded an honorary PhD from the University of Utrecht, the first Dutch woman to receive one.

One of the seaweeds collected during the expedition, a small, wrinkled, red blade dredged from 34 metres deep in Makassar Strait, was described by Weber-van Bosse as the new species *Kallymenia maculata*. This species has remained one of the *Siboga* expedition enigmas, as it has never been recollected. Until recently, that is, when I participated in a Western Australian Museum expedition to Ashmore Reef, some 350 kilometres north-west of the Australian mainland and about 1200 kilometres south-east of Makassar Strait, the locality where the species was collected originally

During a scuba dive on a reef drop-off, I spied an unusual looking seaweed, one that I was unfamiliar with despite many years of working on the tropical flora. This seaweed had a very corrugated blade, and luckily the plants were reproductive, which meant I was able to assess the correct taxonomic status of the species. The unusual shape of the plants also jogged my memory that I'd seen this before in Weber-van Bosse's 1928 account of the red algae collected on the *Siboga* expedition. Willem Prud'homme van Reine, a colleague at the Leiden herbarium where the *Siboga* algal collections are housed, sent photographs of the original material, and the match with the Ashmore Reef plants was enough to convince me that I had rediscovered the long-lost *Kallymenia*. However, the reproductive structures, although similar to those of *Kallymenia*, had a few subtle but important differences, which seeded a thought, was the species correctly placed in *Kallymenia*?

Answering this question drew in further colleagues, firstly the Canadian phycologist Gary Saunders, whose experience with using DNA sequencing in algal taxonomy is unparalleled. The sequences of the Ashmore Reef specimens demonstrated clearly that the species belonged to the family Kallymeniaceae, but also that it was only remotely related to the true *Kallymenia*, and did not align with any other known genera. As a result, the species was moved to a newly described genus, named *Rhytimemia*, or 'wrinkled blade', a very apt description of the plants. There the story might have ended, but, as often happens in taxonomy, further questions were raised regarding other Australian species of *Kallymenia*. In a seeming parallel to the international input to the original *Siboga* monographs, three more phycologists became involved: Line Le Gall (France), Alba Vergés (Spain) and Gerry Kraft (Australia), each with a strong interest in the taxonomy of the red algae. More specimens were collected and examined, and more species were sequenced, including authentic *Kallymenia* from the Mediterranean, and others from around Australia, South Africa and elsewhere. The results were surprising and an extensive revision of the family Kallymeniaceae is underway, which will include the recognition of at least six new genera. Thus the rediscovery of one rare species (no small achievement on its own) has led to an international collaboration generating results that will modify our understanding of red algal taxonomy worldwide.

FROM THE ASHES

Creating a future for western ground parrots

Already facing an uncertain future, the critically endangered western ground parrot suffered several blows in 2015 and early 2016. But, it's not all doom and gloom, there is some cause for optimism.

by Sarah Comer, Allan Burbidge, Dave Algar, Lucy Clausen, Abby Berryman, Jeff Pinder, Saul Cowen, Alan Danks, Jon Pridham and Steve Butler

It was late in the afternoon on 29 February 2016 when we spotted smoke on the horizon in Cape Arid National Park. Our hearts sank – the spectacular lightning we had been watching had started a fire in an area that we had planned to search for the elusive and critically endangered western ground parrot (*Pezoporus flaviventris*) or Kyloring as it's also known. We stopped to plot the location of the fire and then called Parks and Wildlife fire management staff in Esperance. When fire is threatening a species like the western ground parrot, rapid response times are crucial, as a single uncontrolled fire could spell the beginning of the end.

The sense of dread we felt was in stark contrast to the delight we had experienced on the previous morning when ground parrots were heard calling in the adjoining Nuytsland Nature Reserve – the first time in a decade. We speculated that these birds may have escaped from the devastating fires of last October and November but the new fire potentially could burn through this area where we had only just rediscovered the birds. What an emotional ecological roller coaster!

A PARROT IN PERIL... THE BACKGROUND

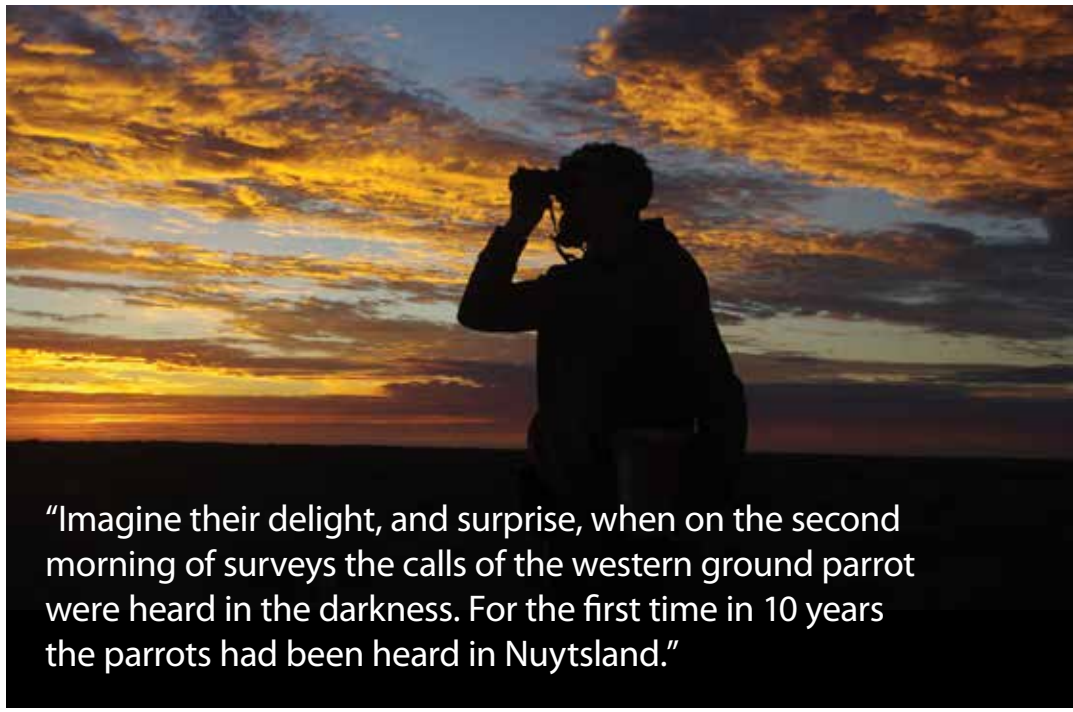
By 2004 it was clear that the western ground parrot was in a perilous state, with populations at Waychinicup National Park (near Albany) disappearing and at Fitzgerald River National Park declining dramatically. The species' stronghold was Cape Arid National Park, with estimates of population size by the South Coast Threatened Birds Recovery Team at less than 140 birds in the wild. In 2010, efforts to halt this decline were ramped up with an increased focus on managing fire and controlling introduced predators, in particular feral cats (*Felis catus*), in the remaining western ground parrot habitat (see 'Heeding Kyloring's warning: south coast species under threat', *LANDSCOPE*, Summer 2013). While the parrot was the flagship species for this work, it was expected that numerous other threatened and not-so-threatened species, such as the quenda (*Isoodon obesulus*) and dibbler (*Parantechinus apicalis*), would benefit from reduced feral cat populations and improved fire management in Cape Arid and Fitzgerald River national parks.

A small number of birds were also taken into captivity in 2009–10 by the then Department of Environment and Conservation to learn how they could best be kept in a captive situation, with the longer-term objective of establishing a captive breeding population for release back into the wild, once fire and introduced predators had been managed.

Previous page
Main top A lightning strike starts a fire in Cape Arid National Park.
Photo – Cameron Tiller/Parks and Wildlife
Main bottom Fire in Cape Arid National Park.
Photo – Saul Cowen/Parks and Wildlife
Inset top The western ground parrot or Kyloring as it is also known
Photo – Abby Berryman/Parks and Wildlife
Inset bottom Trapping for feral cats is an important component of protecting the western ground parrot.

Above The recently burnt Cape Arid National Park.
Photos – Sarah Comer/Parks and Wildlife

In 2014, these birds were transferred from the south coast to Perth Zoo, with the aim of developing such a breeding program. Perth Zoo staff have extensive and specialised experience in breeding difficult-to-breed species and in wildlife health.



"Imagine their delight, and surprise, when on the second morning of surveys the calls of the western ground parrot were heard in the darkness. For the first time in 10 years the parrots had been heard in Nuytsland."

Above *Xanthorrhoeas* flowering post-fire.

Above right A dedicated team is up before dawn looking and listening for signs of the western ground parrot.
Photos – Sarah Comer/Parks and Wildlife

They have also provided advice and assistance for the western ground parrot captive program since its inception.

Parks and Wildlife's Integrated Fauna Recovery Project (IFRP) team has continued to monitor ground parrots in Cape Arid National Park and has searched for birds in Fitzgerald River National Park. Numerous volunteers assisted the field team, showing remarkable enthusiasm for getting out of their tents to conduct surveys an hour before sunrise and after sunset each day. Many have been rewarded by hearing birds, and a few have even caught glimpses of this striking-looking parrot as it flushes from vegetation. The survey results from Cape Arid were encouraging, and in autumn 2015 the recovery team deemed that the status of the ground parrot population had stabilised to the point where more birds could be taken from the wild for captive breeding. Given there were only five birds at Perth Zoo, the recovery team was very aware that more birds were required to increase the chances of breeding the parrots. Plans to catch more birds were made with funding provided by Parks and Wildlife, South Coast Natural Resource Management and the Friends of the Western Ground Parrot to carry out this work.

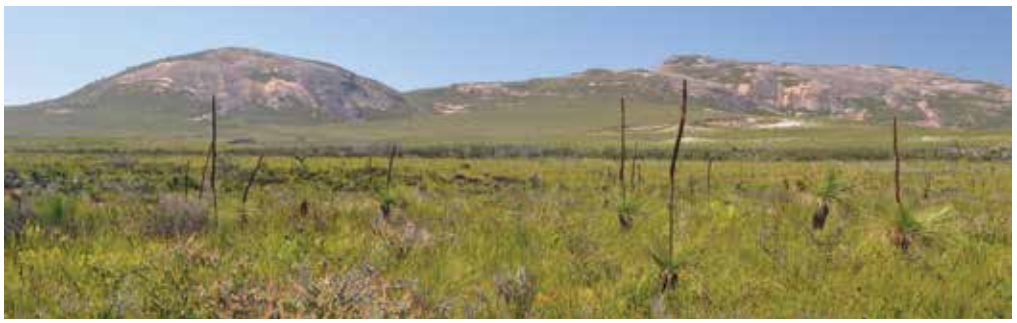
A FIERY TIME

Returning to present day, on 17 October 2015 a series of lightning strikes blanketed the south-west of the State resulting in the ignition of three fires in Cape Arid National Park. Unfortunately, two of these were in western ground parrot habitat and, despite the best efforts of firefighters and water bombers, the fires burnt through about 16,000 hectares including a significant proportion of the ground parrot habitat that had been occupied in autumn 2015. It was in these areas that the team had planned to catch birds for the captive breeding program. The recovery team discussed the impact of the fires at length and decided that the capture team would still head out to the park and conduct surveys, before deciding whether enough birds were left to justify taking more.

A small team of staff and volunteers started the survey work in the first week of November 2015, and were later joined by the rest of the team to survey unburnt vegetation in and around the burnt ground. After 10 days of intensive surveying, the team had found enough birds around the October fire edges, including young birds preferred for captures, to justify removing a small number of individuals. The capture work started on 12 November.

Recognising the importance of feral cat control immediately post-fire, the capture team also conducted extensive trapping and baiting for cats around the fire edge. Feral cats are known to travel extensive distances from their normal home range area to recently burnt ground, presumably to forage on high densities of prey that seek refuge in unburnt pockets. Seven feral cats were trapped and removed from the area surrounding the pocket of unburnt vegetation that contained a large number of the remaining parrots.

Strong winds hampered capture efforts, but the team managed to catch a young female and male parrot, that were suitable for the captive program. Both birds appeared to quickly settle into their new surroundings, showing ready acceptance of their new diet. At the same time, automated recording units (ARUs) were deployed to monitor the areas where birds had been heard and caught.



Right A western ground parrot being measured.
Photo – Alan Danks/Parks and Wildlife

Far right Releasing a male western ground parrot into an aviary.
Photo – Jennene Riggs/Riggs Australia

Below right Western ground parrot habitat.
Photo – Louisa Bell/Parks and Wildlife

Only days into the capture work, another band of storms struck Cape Arid igniting a number of fires, which resulted in the evacuation of the capture team. Despite the best efforts of firefighters, a further 17,000 hectares of ground parrot habitat was burnt, including areas that had been targeted for capturing birds just weeks earlier.

The impact of the combined October and November fires was devastating, with 25,000 hectares or an estimated 90 per cent of the known western ground parrot habitat burnt. And, as if this loss was not bad enough, the two young birds died at Perth Zoo several weeks later – a sobering disappointment for all involved as high hopes were held for these birds, which seemed to get along well together and were thought to have good potential for breeding. Unfortunately, they succumbed to unpredicted and rapid onset of Aspergillosis infections and did not respond to treatment, despite intensive efforts by Perth Zoo's highly experienced veterinary staff.

PICKING UP THE PIECES

The recovery team met to discuss the situation and agreed on emergency recovery actions to secure the remaining birds in the wild. The field team was hopeful that a small number of birds might remain in the two unburnt pockets of vegetation, and also recognised the need to conduct urgent feral cat control. Parks and Wildlife allocated some emergency post-fire funds to carry out feral cat baiting to protect the remaining birds, carry out more targeted feral cat removal, retrieve burnt ARUs and deploy additional units in unburnt habitat.

The first few months of 2016 saw the IFRP team focused on this work. In January they travelled to Cape Arid National Park, and surveyed the two small pockets of vegetation. Birds were heard calling and all of the team were lucky enough to see birds as they flushed. Targeted cat trapping was carried out and 10 feral cats were removed from the areas surrounding the remaining ground parrot habitat. ARUs were deployed around the fire edges where it is hoped they will detect parrots.

A trip in late February saw the Parks and Wildlife team and volunteers travel some three hours east of Esperance to look for parrots in Nuytsland Nature Reserve. Despite recent searches in this remote area, which abuts Cape Arid National Park, parrots had not been detected in surveys since 2006. Hopeful that some birds had managed to escape the fire, the survey team focused on areas of unburnt vegetation that might provide refuge for parrots. Imagine their delight, and surprise, when on the second morning of surveys the calls of the western ground parrot were heard in the darkness. For the first time in 10 years the parrots had been heard in Nuytsland. It is not known how long these birds had been in Nuytsland, but it is likely that they were birds that had moved away from the October–November fires.

Hopeful that more birds would be found, the Nuytsland survey team continued to target pockets of vegetation that looked promising for ground parrots. Only three days into this survey another series of thunderstorms treated the team to a spectacular lightning show and views of storms moving across the park. But the entertainment value of these storms faded quickly when smoke was spotted on the way to the evening listening session. Plotting the location of the fire, and realising that it had the potential to impact on the survey team's egress from the park, the decision was made to leave. Packing up in the dark and rain, with storms still raging, was a very unusual exit strategy but at least the team was leaving having had some success in finding parrots, even if they were now under threat from fire.

A helicopter survey the next day found that the fire had been extinguished by the heavy rains. Another two fires had ignited around western ground parrot habitat during these storms; one was also put out by rain and the other tackled by Parks and Wildlife crews and resulted in only a small area being burnt – a close call and yet another reminder of the inherent vulnerability of this landscape to fires brought about by thunderstorms.

Controlling the ferals

Feral cat baiting is underway on Western Australia's south coast conservation reserves, with 465,000 hectares baited for foxes three times a year as part of the successful *Western Shield* wildlife recovery program. Autumn baiting with *Eradicat*® has been trialled in key reserves through the Integrated Fauna Recovery Project since 2010 (see 'Heeding Kyloring's warning: south coast species under threat', *LANDSCOPE*, Summer 2013) and this has been incorporated into the *Western Shield* program.

Feral cats have been targeted with *Eradicat*® bait for the past five years to protect western ground parrot habitat in Cape Arid and Fitzgerald River national parks, Nuytsland Nature Reserve, Two Peoples Bay and Mount Manypeaks nature reserves, with increases in distribution and populations of native species including quenda and other native mammals seen since the trials began. In 2016, a further operational research trial of *Eradicat*® at Fitzgerald River National Park, funded by the Federal Government's Threatened Species Strategy, will help provide more information to determine the optimum timing of baiting at south coast sites. Remote cameras are used to track feral cat activity before and after baiting.

Right Feral cats present a formidable threat to native animals.
Photo – Jiri Lochman

Far right *Eradicat*® baits being prepared as part of the *Western Shield* wildlife recovery program.
Photo – Sarah Comer/Parks and Wildlife

THE FUTURE FOR KYLORING

Currently, a team of experts from a range of conservation disciplines is assisting the recovery team develop an emergency action plan for the species. The task of securing the future for ground parrots will require action on all fronts: feral cat control, fire management, genetic management and captive management. A workshop hosted by Parks and Wildlife in March and attended by leaders from a range of disciplines from across Australia and New Zealand has provided expert input to identify and prioritise emergency interventions for the species.

The recovery actions carried out in recent years have benefited not only ground parrots, but a suite of other native species that occur nowhere else in the world. It is essential that this work continues. The year 2015 was one of the most challenging years ever for the dedicated group trying to secure the future for the western ground parrot. This remarkable parrot may be rarely seen, but straining in the darkness to hear the extraordinary call in remote and beautiful areas of the south coast has inspired many people to work together to make sure we do not let the species disappear forever.

Below The team of volunteers and Parks and Wildlife staff surveying Nuytsland Nature Reserve.
Photo – Sarah Comer/Parks and Wildlife

Sarah Comer is Parks and Wildlife's South Coast Region regional ecologist based in Albany. She can be contacted on (08) 9842 4513 or by email (sarah.comer@dpaw.wa.gov.au).

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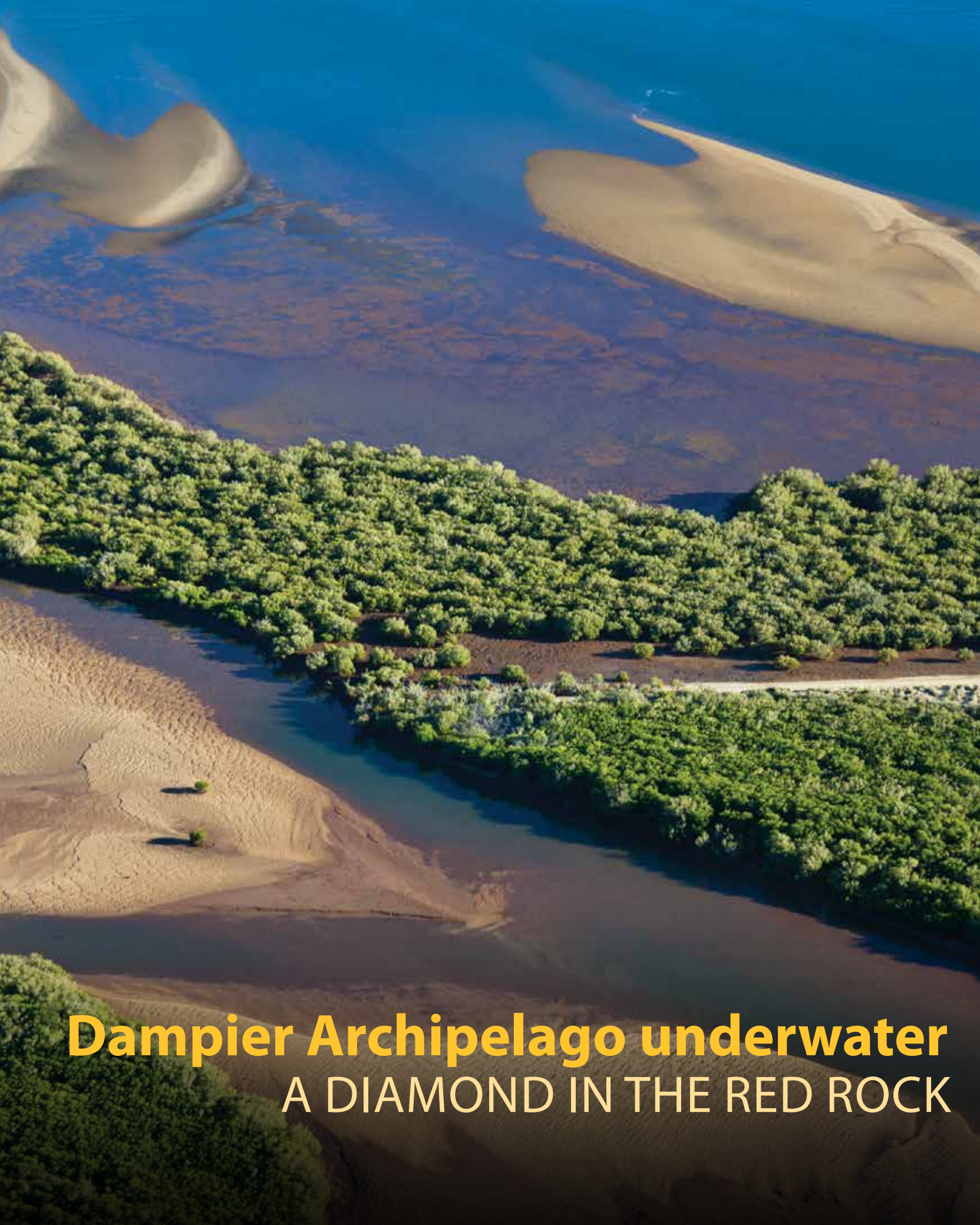
Lucy Causen, Abby Berryman, Jeff Pinder, Saul Cowen, Alan Danks and ***Jon Pridham*** work on the Integrated Fauna Recovery Project and are based on the south coast.

Steve Butler is the Esperance District nature conservation coordinator.

The funding for the implementation of work on western ground parrot recovery and Eradicat® trials has been provided by Biodiversity Fund, State NRM, South Coast NRM, the Friends of the Western Ground Parrot, the Commonwealth Government and Parks and Wildlife. Perth Zoo is supporting the captive management work. Numerous individuals have volunteered their time to assist with surveys and the Friends of the Western Ground Parrot support the implementation of the ground parrot recovery project.



Dampier Archipelago underwater

A DIAMOND IN THE RED ROCK

BY MARGIE MOHRING

When many people think of the towns of Dampier and Karratha, they think of red dirt and mining, but there's much more to this area than meets the eye. Just beneath the surface of the surrounding ocean you'll find a rich diversity of marine plants and animals.

The Dampier Archipelago is situated 1650 kilometres north of Perth, adjacent to the towns of Dampier and Karratha. When most people think of the area, they think of mining, busy ports, salt pans and red dust. Not many people have had the opportunity to explore the area's rich and diverse waters and experience first-hand its unique marine and coastal environment. Made up of 42 offshore islands, intertidal and subtidal coral reefs, mangroves, and macroalgal communities, the archipelago abounds with magnificent marine life.

It is also significant because it is the meeting point between a diverse marine environment and intensive human activities. As part of offset funding associated with the Pluto Liquefied Natural Gas development on the Burrup Peninsula, Parks and Wildlife marine scientists are establishing a marine monitoring program in the waters surrounding the Dampier Archipelago to help understand and manage the outstanding marine conservation values of this hidden gem into the future.

CAPTIVATING CORALS

Dramatic red granophyre rocks loom over contrasting blue water, which contains some of the most diverse coral habitats in Western Australia. More than 200 hard coral species from 57 genera have been identified and approximately 18,000 hectares of coral reef occur around the archipelago. In some areas the coral reef is bright and complex, with massive *Porites* bommies looming over branching *Acropora* beds. In other areas close to shore the water can be warmer and less clear, which gives rise to different, hardier and less spectacular communities. These include vase (*Turbinaria* spp.) and cactus (*Pavona* spp.) corals which are more common in silty environments, and even the uncommon giant star coral (*Moseleya* sp.), which is entirely restricted to murky, muddy waters. Other genera which survive well in muddy environments are the flowerpot corals (*Alveopora* spp. and *Goniopora* spp.) which can be observed extending their long tentacles into the water. These corals use their tentacles to catch food to supplement the energy provided by the microscopic algae (known as zooxanthellae) that live in coral tissue and provide corals with much of their colour.

SEAWEEDS AND SEAGRASS

Seaweeds and seagrass form dense beds among the coral reefs and provide food and shelter for fish and invertebrates. Seaweed beds are dominated by the genus *Sargassum*, and can be found throughout the waters of the Dampier Archipelago. These extensive algal beds are significant breeding, feeding and nursery habitats for species popular with fishers in the Pilbara. Each year the algal beds undergo major seasonal changes as *Sargassum* fronds break away from their holdfasts and form massive rafts. These rafts allow pieces of seaweed to be transported long distances and populate new areas, as well as carrying small critters like juvenile fish and crabs, which can be transported to widely separated habitats around the archipelago. Seagrass beds are found throughout Nickol Bay and around many of the islands. They are important habitats for swimmer crabs and prawns, while dugong feed on the small-leaved *Halophila* and *Halodule* seagrasses.

MANGROVE FORESTS

The area is considered to be internationally significant for mangrove communities. More than half of the mainland shore and many of the islands are lined with complex mangrove habitats, comprising six species. Species that occur in the area include the common grey mangrove (*Avicennia marina*) with its exposed breathing roots (pneumatophores) which help them survive in muddy sediments with low oxygen; and the stilt mangrove (*Rhizophora stylosa*) with its strong buttress roots that trap sediment and help stabilise the shoreline. Their complex root systems provide safe havens for many transient and resident animals, and provide important nursery habitat for juvenile fish, turtles and sharks. Mangroves also protect the shore from strong waves and cyclones, and shelter urban and industrial developments and infrastructure. A small mangrove creek on the southern side of Enderby Island serves as a secret hiding spot for countless creatures. The water here is often very clear and juvenile turtles, sharks and rays can readily be seen sheltering in the mangroves.

RICH COASTLINE

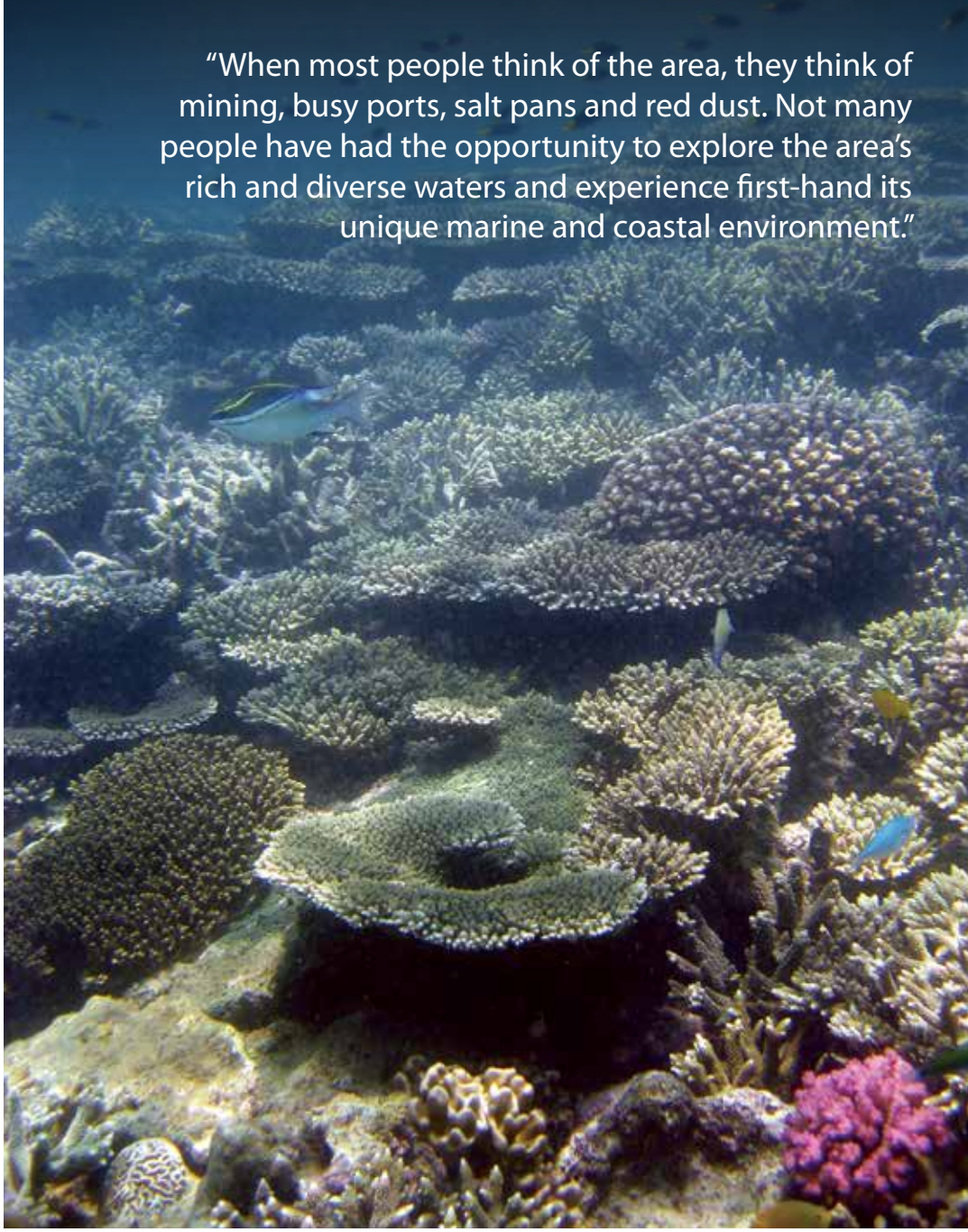
There are beautiful beaches all over the Dampier Archipelago, where the red rocks contrast with the white sand and yours are often the only footprints. There are lots of small and unusual

Previous page
Main Stunning mangroves at south west Regnard Marine Management Area.
Photo – Cliff Winfield
Inset from top A fiery-looking Aeolid nudibranch.
Photo – Margie Mohring/Parks and Wildlife
A striking sixbar angelfish.
Photo – Shannon Armstrong/Parks and Wildlife
A colony of delicate stalked ascidians.
Photo – John Huisman/Parks and Wildlife

Above Lush mangroves fringe Murujuga National Park.
Photo – Sallyanne Cousans

Right Mangroves provide shelter for a range of organisms.
Photo – Marissa Spiers/Parks and Wildlife

Far right A magnificent *Acropora* bed sighted in 2007. Return trips to the area have failed to find the reef.
Photo – Shannon Armstrong/Parks and Wildlife



"When most people think of the area, they think of mining, busy ports, salt pans and red dust. Not many people have had the opportunity to explore the area's rich and diverse waters and experience first-hand its unique marine and coastal environment."

invertebrates to observe, and beautiful shells accumulate on the tide line. Many species of sea birds visit, feed and nest along the Dampier coastline, some forming large nesting colonies. Birds of prey, including ospreys and sea eagles, are common and can be seen leaving their nests on the islands to go hunting, occasionally resting on the bow of vessels. Other birds can be spotted along the shore, such as the shy beach stone-curlew with its distinct warning call, or the more common cormorants which are a pleasure to watch diving deep in search of fish. The coastline of the Dampier Archipelago is also rich in culture, with the history of Indigenous people extending back at least 30,000 years. The area is Murujuga land and contains some of Australia's earliest art and cultural sites. The interests of the Aboriginal people are represented through the Murujuga Aboriginal Corporation, and the cultural heritage of the land is managed by the Murujuga Land and Sea Unit. The team carry out regular patrols to observe and report on plants and animals, as well as the condition of heritage sites.

SCHOOLS OF FISH

The Dampier Archipelago is a popular spot for anglers to wet a line and catch a fish, but there are hundreds of species on reefs that fishers are unlikely to see unless they venture under the water. A total of 650 species of fish have been identified, including many interesting and exciting species. These include some targeted by fishers like golden trevally, mangrove jack and coral trout. Other reef fish, like angel and butterfly fish, colourful wrasse, and tiny damsel fish dart in and out of branching corals, which provide shelter, and in some cases food, for these stunning species. Some of the fish observed are important for maintaining a healthy reef system. Surgeonfish and rabbitfish are typically herbivorous and feed on

Left A pin-cushion star, resting in a gap between the coral bommies.
Photo – Parks and Wildlife

Below far left Dense drifts of pink jellyfish off the northern tip of Legendre Island.
Photo – Melanie Trapon/Parks and Wildlife

Below left A moray eel peers out of a rock crevice.
Photo – Margie Mohring/Parks and Wildlife

filamentous and juvenile algae, preventing it from growing into fleshy macroalgae that competes with corals for light and space.

INVERTEBRATES

The waters of the archipelago are home to hundreds of species of molluscs, echinoderms, crustaceans and sponges. There are some amazing molluscs in the area, including the massive Australian trumpet (*Syrinx aruanus*). This trumpet shell is the world's largest living gastropod, and can grow to almost a metre in length and weigh more than 18 kilograms. These big shells can often be seen on the intertidal mudflats around the Dampier and Regnard area. Although often highly visible, they are an important part of the ecosystem and should not be disturbed. On the hard reefs it is also common to see giant clams, and big baler shells (*Melo amphora*) as they crawl across the interspersed sandy patches. Painted crayfish hide under ledges or in crevasses, and on the steep offshore walls they are often in high numbers and share these refuges with black urchins (*Diadema* spp.) and octopuses. A popular crustacean among fishers is the mud crab (*Scylla serrata*), which is common among the muddy shoreline mangroves. Recently there have been many reports of crown-of-thorns seastars around Mermaid Sound. Although these large seastars feed on live coral and have caused large-scale coral declines on other reefs, they occur naturally across this region. Dense drifts of pink jellyfish have been observed caught in a tide eddy off the northern tip of Legendre Island. Amongst this swarm of jellyfish, a large mantra ray was seen feeding amid the activity.

MARINE GIANTS

The waters of the Dampier Archipelago are important breeding, feeding and migration grounds for dugongs, whales, dolphins and turtles. Two dolphin species are relatively common: the more abundant bottlenose dolphin (*Tursiops aduncus*) and the Australian humpback dolphin (*Sousa sahulensis*) that is endemic to northern Australia. The cryptic Australian snubfin dolphin (*Orcaella heinsohni*), also found only in northern Australia, is occasionally sighted in Pilbara coastal waters but there are no known resident populations and these are presumably only occasional visitors to the Dampier area. Nickol Bay is an important staging area for migrating humpback whales, and dugongs are frequently seen foraging on seagrass in the area. Four species of turtles use the Dampier Archipelago – flatback, hawksbill, green and loggerhead. Every year hundreds of hawksbill turtles come ashore to nest at Rosemary Island, where scientists tag and monitor them (see also 'Tracking tides of turtles', *LANDSCOPE*, Autumn 2016). Other important turtle rookeries are found around Cape Lambert, Delambre Island and Legendre Island, where flatback turtles, which are endemic to Australia, are predominantly known to nest.

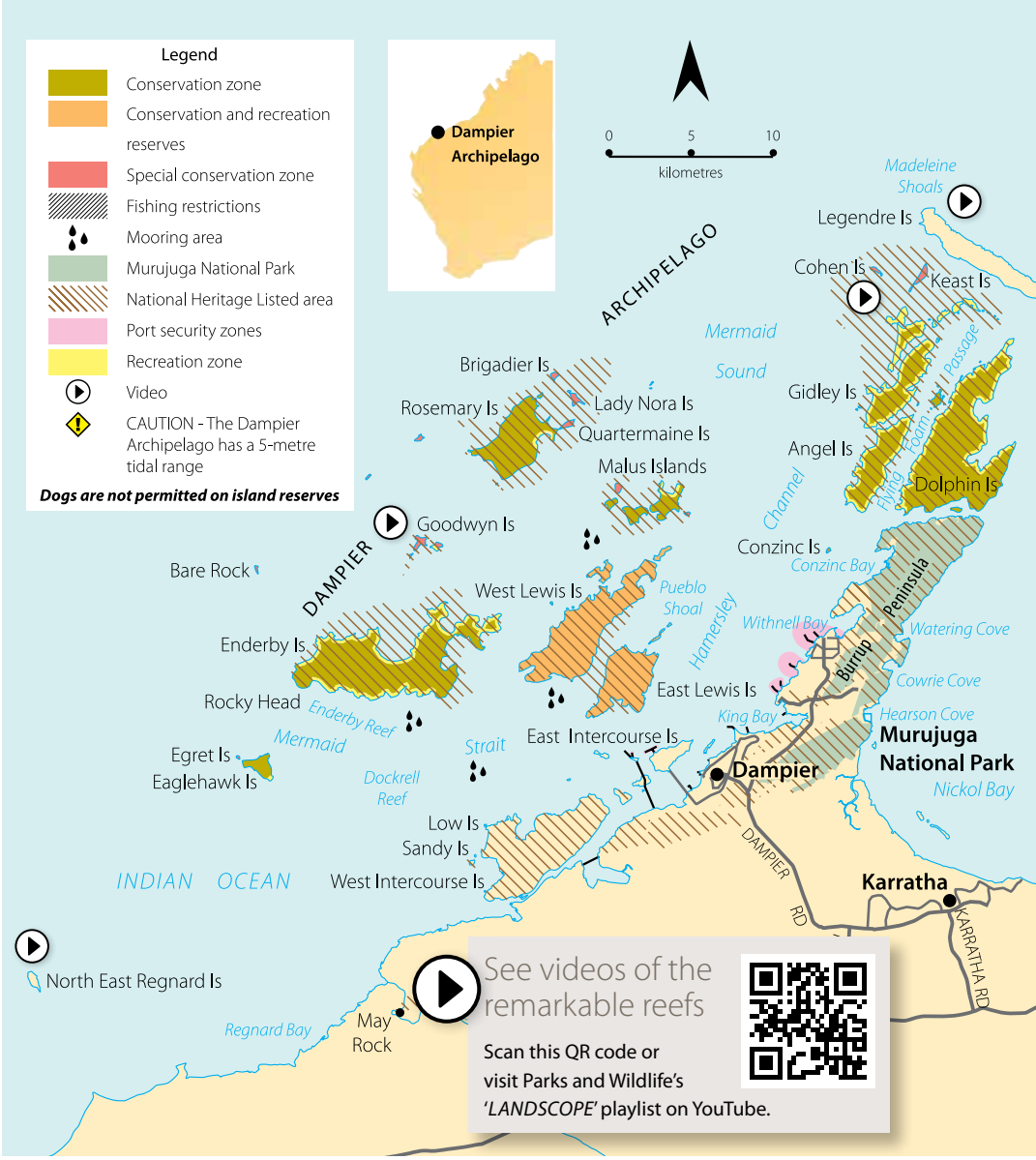
SCIENCE FOR CONSERVATION AND MANAGEMENT

The ocean and coast of the Dampier Archipelago and Cape Preston region are the focus of significant industrial

development and human activity. These create challenges in managing and conserving the environment so that this outstanding area remains for future generations to enjoy. For this reason, the Murujuga National Park and 25 island nature reserves have been created to protect the exceptional natural beauty and outstanding conservation and heritage values of this region. Several of the islands are either completely or partially closed to visitors to protect sensitive turtle and bird nesting habitats.

The monitoring program currently being implemented by Parks and Wildlife marine scientists will assist in the conservation of the largely unseen but spectacular underwater habitats and species that surround the Dampier Archipelago. This program will provide valuable baseline information on the health of this marine environment. It will initially investigate the condition of coral reefs and associated fish and invertebrate species, but will also examine mangroves, algae and seagrasses over time. These surveys will also help to identify areas where future research is needed.

Parks and Wildlife also monitors turtle nesting throughout the Dampier Archipelago and surrounds, recording hawksbill, flatback, green and loggerhead turtles at key nesting beaches on the islands. Remarkably, the nesting of hawksbill turtles on Rosemary Island has now been monitored for 28 years and is the longest running program of its kind in WA. Aerial and boat-based surveys are also being used to investigate the abundance, distribution and habitat use of dolphins. Finally, Parks and Wildlife is carrying out a large-scale project looking at how benthic habitats and their inhabitants are connected by ocean circulation and the movement of larvae and propagules throughout Pilbara marine waters, including the Dampier region. This will improve our understanding of how corals and seagrass might recover following environmental disturbances and identify areas that are especially important for maintaining healthy coral reefs and seagrass meadows.



Above left Beach stone-curlew are found in the area.
Photo – Jiri Lochman

Right Parks and Wildlife scientists researching the reefs.
Photo – Margie Mohring/Parks and Wildlife

Margie Mohring is a Parks and Wildlife Marine Science Program research scientist. She can be contacted on (08) 9219 9756 or by email (margaret.mohring@dpaw.wa.gov.au).

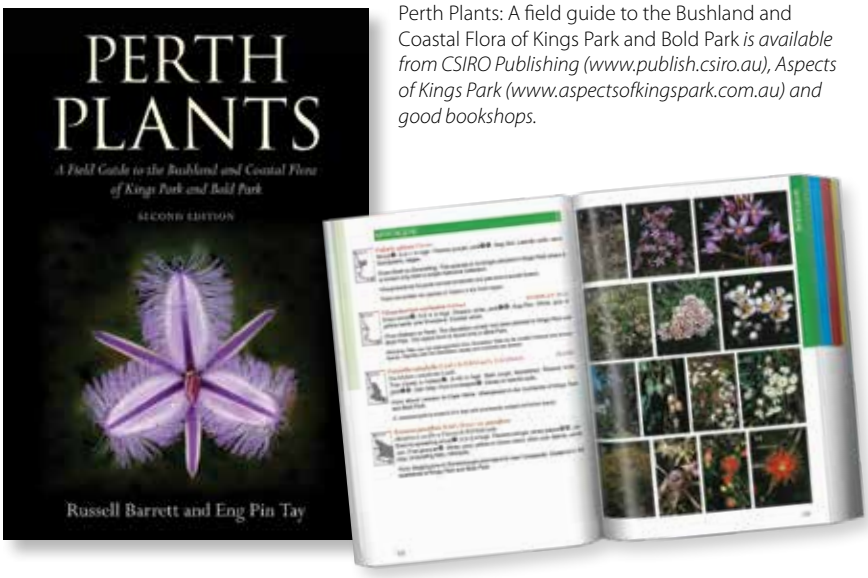
PERTH PLANTS: A FIELD GUIDE TO THE BUSHLAND AND COASTAL FLORA OF KINGS PARK AND BOLD PARK (second edition)

BOOK

This extremely comprehensive reference guide provides insight into the plants that occur in two of Perth's best-loved areas – Kings Park and Bold Park. The book includes information about 778 species (about a quarter of all those plants known to occur in the Perth region), which highlights the remarkable richness of these inner-city locations. A strength of the book is that it includes native and introduced plants and weeds – making it a useful and informative guide.

In most cases each plant has several associated photos to help with identification as well as information about its distribution, flowering times and conservation status. There is also a section that provides information about the traditional Aboriginal uses of some of the plants as well as a reference to the six Nyoongar seasons.

This second edition contains 22 additional species and updated photography from the first edition published in 2005.



Perth Plants: A field guide to the Bushland and Coastal Flora of Kings Park and Bold Park *is available from CSIRO Publishing (www.publish.csiro.au), Aspects of Kings Park (www.aspectsofkingspark.com.au) and good bookshops.*

SKINKS OF THE PERTH REGION

APP

As its name indicates, *Skinks of the Perth Region* provides a quick-reference guide to skinks that occur in the Perth region. Download this free app and you'll have access to profiles of 29 species including information about their appearance, life cycle, habitat, eating habits and distribution.

This app is handy for those with herpetophobia to confirm that the scaly creature they've come across is not a baby snake. It can also be used in connection with the WA Museum's WA Snakes app for absolute confirmation! Or, for those less wary, it's a handy reference for when you're out and about to easily discover more about a species you might have spotted – even when you're out of mobile range.

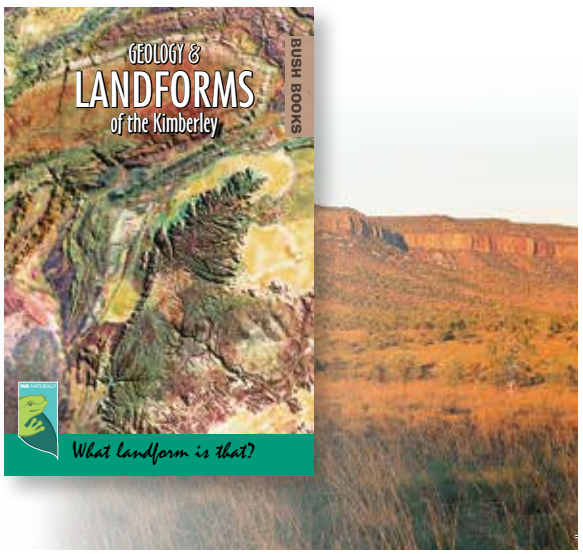
Skinks of the Perth Region *can be downloaded for free from the 'App' store.*

GEOLOGY AND LANDFORMS OF THE KIMBERLEY (revised edition)

BOOK

One of Parks and Wildlife's popular Bush Books – *Geology and Landforms of the Kimberley* – is back in print. The pocket-sized guide provides a detailed, yet digestible history and overview of the geological history of the magnificent Kimberley region. Written by geologist Ian Tyler from the Geological Survey of Western Australia, this book uses photographs and diagrams to support the technically accurate geological information, resulting in a book that anyone can understand. Discover how the King Leopold Ranges were made, what caused the Wolfe Creek Crater and the processes that created the Bungle Bungle Range, among many other fascinating features. This is definitely a staple for the glove box of anyone who is travelling to the Kimberley and wants to unearth the secrets of the landscape.

Geology and Landforms of the Kimberley *is available for $6.95 from Parks and Wildlife's online shop (shop.dpaw.wa.gov.au), from* WA Naturally *Publications ((08) 9219 9071) or from good bookshops, regional and visitor centres.*



Southward bound: TOP 10 camping spots

Western Australians and visitors to the State are spoilt for choice when camping in the south-west. Here are 10 top spots between Perth and Esperance to put on the camping 'bucket list'.

by Steve Crawford

Above Relaxing at Cape Le Grand National Park.
Photo – Jiri Lochman

Research tells us that spending time in nature is good for general health and wellbeing. But anyone who has pitched a tent, or set up a caravan or camper trailer and camped can tell you that, no doubt with a raft of anecdotal tales. If you take the time to tune in your senses to the sights, sounds, smells, textures and even tastes (if you have a palate for bush tucker) then you feel more connected to the natural environment and (hopefully) more connected to the people you're with. For some, it's a nice change to look over the camp fire and talk to friends and family, rather than connecting through text messaging, social media and emails. While for others it's quiet time alone and away from the hustle and bustle of everyday life. And spending time in nature offers kids a chance to make those all-important childhood memories, and get their hands and feet dirty while learning about the natural world – a much-needed contrast to the increasingly computer-driven world in which many of us live.

When it comes to natural places to explore, Western Australians and our visitors are spoilt for choice. The Department of Parks and Wildlife manages more than 265 campgrounds throughout WA with more than 2900 campsites to choose from. Thanks to the State Government's *Parks for People* initiative, $21.05 million has been provided through the Royalties for Regions program to improve camping options and park facilities. Some of these are in far-flung parts of the State in locations only sought after by those with a penchant for adventure, while others are a short drive from Perth – perfect for a weekend getaway.

DOWN SOUTH

Western Australia's south-west is a botanical biodiversity hotspot and an important environment for a number of native animals. It has stunning ocean vistas, fascinating geology, awe-inspiring forests as well as a range of opportunities for bushwalking, bike riding, swimming, surfing, diving, snorkelling, kayaking, canoeing and rock climbing, to name a few! Here is a list of top 10 camping spots down south that are suitable for two-wheel-drive vehicle getaways.

1 BEELU NATIONAL PARK

Just 40 kilometres east of Perth, Beelu National Park is a terrific spot if you are new to camping and want the bush experience but prefer creature comforts such as hot showers and flushing toilets. The Perth Hills Discovery Centre campground, which is suited to tents only, is fitted with a camp kitchen with fridge, electric barbecues, power, a sink and a fire ring. Parks and Wildlife's *Nearer to Nature* program, which is based at the centre provides a raft of engaging activities for people of all ages, including through the school holidays.

2 YALGORUP NATIONAL PARK

A short drive from Perth, Yalgorup National Park boasts the newly redeveloped Martins Tank Lake campground. This is a perfect location for families with young kids who want a taste of camping but don't want to stray too far from home. Here you'll find eight new tent camp sites, four larger group camp sites, a camp kitchen, two communal fire pits and two toilets. While there, you can try your luck night-spotting for possums, view wading birds on the lake, swim at nearby Preston Beach, view thrombolites from a boardwalk or take the six-kilometre Lake Pollard Trail that takes in the bird hide where you can view the wildlife in their natural environment without disturbing them (see also 'Parks for People: Yalgorup National Park', *LANDSCOPE*, Summer 2014 –15).

3 LANE POOLE RESERVE

Just 9.5 kilometres from Dwellingup, Lane Poole Reserve has long been a popular camping destination, and now improved facilities at Baden Powell campground as well as redeveloped picnic areas have upped the appeal. Nanga Brook campground is a newly redeveloped site which provides camp sites for campervans, caravans, camper trailers and tents. These facilities provide a base for visitors to spend time bike riding, bushwalking, swimming, fishing, canoeing and kayaking on the Murray River. If you are feeling adventurous, try the newly opened Trees Adventure rope course (see 'Adventure out: Canopy capers' on page 46).

4 DRYANDRA WOODLAND

Less than two hours' drive from Perth, Dryandra Woodland is one of the prime places in the south-west for viewing native wildlife. Congelin and Gnaala Mia campgrounds both provide a spot to camp, where you're nestled among the magnificent woodlands and spectacular wildflowers in spring. They provide 17 caravan sites, 12 tent sites, four toilets and two camp kitchens (see also, 'Parks for People: Dryandra Woodland', *LANDSCOPE*, Winter 2015).

If you are into hiking there are a number of walking trails where you can explore the surrounding forest. You might even spot some native wildlife in their natural habitat. Or, for an up-close look at some of WA's most precious animals, you can visit Barna Mia and take a guided nocturnal tour in a tranquil sanctuary.

Take a journey to some of these beautiful spots

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

5 WELLINGTON NATIONAL PARK

The stunning Honeypool Pool and Potters Gorge campgrounds offer picturesque camping and picnic sites within Wellington National Park. Potters Gorge is set on the banks of the Wellington Dam in a shady jarrah and marri forest setting. Here you can experience breathtaking views across the calm waters and try fishing or catching marron in season (with a permit). This is also a great place to take the family canoeing, swimming or kayaking.

Honeymoon Pool is a very popular campground shaded by peppermint trees on the banks of the Collie River. There is easy access to the river for swimming and water activities when the weather is fine. It's also a perfect spot to toast marshmallows on the campfire during the cooler months.

6 LEEUWIN-NATURALISTE NATIONAL PARK

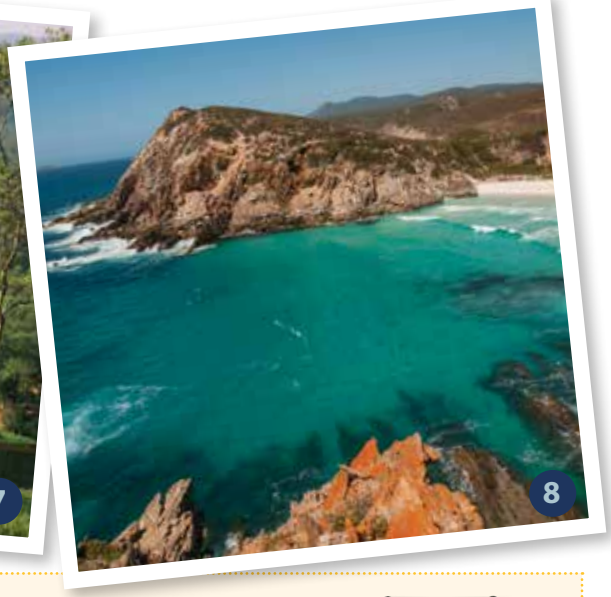
One of WA's most popular and beloved national parks, Leeuwin-Naturaliste National Park provides access to the Cape to Cape Track and an opportunity to explore caves, go surfing, swimming, snorkelling, rock climbing and bike riding, or visit nearby wineries, fine food outlets and galleries.

Close to the beach is Contos campground with 116 camp sites nestled among the coastal peppermint woodland. The campground has a range of site types catering for tents through to sites suitable for large caravans and camper trailers. Inland, and a little more secluded, is the small Boranup campground, close to the magnificent towering karris, which accommodates just seven tents and small campervans (see also 'Our south-west escape: the Leeuwin-Naturaliste capes', *LANDSCOPE*, Summer 2014–15).

Previous page
Main Thrombolites can be viewed from the boardwalk at Lake Clifton, Yalgorup National Park.
1 A misty morning at Beelu National Park.
Photos – Sallyanne Cousans
3 Camping at Lane Poole Reserve.
Photo – Tourism WA
4 Dryandra Woodland.
Photo – Sallyanne Cousans
5 Little Rock at Wellington National Park.
Photo – Ann Storrie
6 Injidup Point, Leeuwin-Naturaliste National Park.
Photo – Andrew McInnes

Take a journey to some of these beautiful spots

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



7 WARREN NATIONAL PARK

Glamorous camping, or 'glamping' is becoming increasingly popular among those who don't own a tent, camp bedding or cooking equipment or who simply want to experience being in nature but still have access to some of life's luxuries (and have someone else look after them for you). WA Wilderness Glamping operated by Pemberton Discovery Tours provides fully equipped camp sites at Drafty's campground. From here, in easy reach, you can enjoy the tall timbers of the southern forests, go bushwalking, freshwater fishing, cycling, canoeing or climbing one of the three fire lookout trees for a view over the forest.

8 FITZGERALD RIVER NATIONAL PARK

Fitzgerald River National Park boasts a number of new facilities that cater to visitors who are camping or just passing through thanks to a $40 million investment by the State and Federal governments. Several picnic areas and viewing facilities provide places to enjoy the magnificent scenery (and an opportunity for whale watching between July and October), while two campgrounds have been revamped. The Four Mile Beach campground is set into the bush to maximise privacy and provide protection from the wind, while the newly developed Hamersley Inlet visitor precinct provides 14 camp 'pods', toilets and a camp kitchen.

7 Warren River Lookout.

8 Quoin Head, Fitzgerald River National Park.
Photos – Jiri Lochman

FOR MORE INFORMATION

***CampingMate* app** has been designed to help people get on the road easier. The app has a comprehensive list of pre-loaded items that you can add to and share with others and save for next time. The app also has handy information about where to camp and how to book, and details about some of WA's tracks, trails and partner organisations.

CampingMate can be downloaded free from the 'App Store' and Google Play.

ParkFinder WA is a free one-stop shop for information about the 150 parks and reserves in WA including information about what sites you'll find in the parks and reserves, whether entry fees apply and how to get there. The app is kept up-to-date with information about fires and park alerts.

ParkFinder WA can be downloaded for free from the 'App Store'.

Exploring Western Australia's natural wonders: national, marine and regional parks is a 327-page region-by-region guide to 64 of WA's stunning parks and reserves. It contains fascinating and helpful information about how to explore the park, its history and natural attractions. There is also information on a range of activities available for visitors such as bushwalking, camping and mountain biking. *Exploring Western Australia's natural wonders: national, marine and regional parks* can be purchased for $39.95 from good bookshops and Parks and Wildlife (shop.dpaw.wa.gov.au) or see page 34.

Park Stay WA (parkstay.dpaw.wa.gov. au) is a convenient website where you can search for campgrounds and their facilities, compare them, create a shortlist of alternatives and even book some online.

9 STOKES NATIONAL PARK

Stokes Inlet is one of the most picturesque and interesting estuaries along WA's southern coast. The Benwenerup campground is nestled on the banks of the inlet surrounded by paperbark trees. It is a perfect spot to unwind and take part in activities such as kayaking and bushwalking where you'll discover an abundance of bird life on the inlet and lakes. Fishing is popular and you can launch small boats from the camp sites in the hope of catching some of the area's black bream, Australian salmon, King George whiting and mullet, all found within the area. Normal fisheries regulations apply in national parks.

Thanks to a $3 million upgrade, visitors can camp at Benwenerup campground with 14 sites of various sizes, all suitable for caravans.

10 CAPE LE GRAND NATIONAL PARK

The white sand and turquoise waters of the stunning Lucky Bay make this area akin to paradise. The sand is so fine it squeaks under foot and kangaroos can be spotted sunbathing on the beach. The park features sweeping heathlands and rugged coastal peaks to explore. In season, the wildflowers in the area are spectacular.

A campground expansion and upgrade at Lucky Bay provides campers with a camp kitchen, gas barbecues, picnic tables, toilets and water.

9 A narrow beach along Stokes Inlet meanders through an avenue of paperbark trees.
Photo – Sallyanne Cousans

10 and right Lucky Bay, Cape Le Grand National Park.
Photos – Andrew McInnes

Steve Crawford is Parks and Wildlife's visitor communication manager. He can be contacted on (08) 9334 0214 or by email (steve.crawford@dpaw.wa.gov.au).

Explore Parks WA *Quicklinks*

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parks.dpaw.wa.gov.au

Park Stay WA Find details about campgrounds. Some sites can be booked in advance.
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MIND THE GAP

by Lorna Charlton, Jeremy Flynn and Rhianna King

A new improvement program at Torndirrup National Park is celebrating and showcasing The Gap and its spectacular surrounding environment, while providing safe state-of-the-art visitor facilities.

Previous page
Main The Natural Bridge at Torndirrup National Park, Albany.
Inset The platform lookout over The Gap.

Above Enjoying views across the Southern Ocean and to the waves crashing nearly 40 metres below.
Photos – Damon Annison

Located just 10 kilometres from the centre of Albany, Torndirrup National Park is one of the area's most beloved parks. Boasting a breathtaking coastline where windswept coastal heaths give way to massive granite outcrops, sheer cliffs and steep sandy slopes and dunes, the area is home to a range of vegetation types including peppermint and karri trees and the rare blue tinsel lily. And native animals that are found here include the endangered western ringtail possum, western pygmy possum, western grey kangaroo, quenda and bush rat as well as carpet pythons, tiger snakes, dugites and the rare Main's assassin spider. At the right time of year, spectacular views across the Southern Ocean, which extends as far south as the shores of Antarctica, also reveal whales and seals that sometimes visit the coast.

But the story behind this spectacular coastline is more complex than what meets the eye. It's the ancient processes that have worked over millions of years that have created the geological legacies that people flock to see. About 1350 million years ago Antarctica and Australia collided and stayed joined for about 1300 million years. During this time rocks called granodiorite and gneiss formed many kilometres below the surface under extreme temperatures and pressure. Antarctica and Australia eventually rifted apart and then waves, saltwater spray, rain and groundwater slowly sculpted the exposed coastline, including the Natural Bridge and The Gap that is there today.

OVERWHELMED WITH LOVE

A popular day trip from Albany, The Gap and Natural Bridge attract about 240,000 visitors each year. This popularity has seen the visitor area struggle to meet demand with only a three-metre-wide platform at The Gap, while the Natural Bridge was one of the several geohazards identified in the area at risk of collapse or subject to rockfall.

Between 2011 and 2015, the State Government committed $6.1 million through the $21.05 million *Parks for People* Royalties for Regions initiative towards a new development to improve visitor safety and deliver state-of-the-art facilities to enhance visitor experiences at the park. The area now boasts new accessible viewing structures at The Gap and Natural Bridge, paths, a picnic area, visitor information and parking capacity for 27 cars, two ACROD vehicles, four motorcycles and two long vehicles.

A DESIGN CHALLENGE

Designing visitor facilities for Western Australia's national parks presents a range of opportunities and challenges. Often it is the irregular and rugged nature of the features that are destined to be showcased, that require landscape architects and contractors to be innovative and creative with their designs. There are also times when crews on the ground need to overcome a number of logistical challenges.

The development at Torndirrup National Park was no exception.

In 2011, the ambitious objective was set: to create an aesthetically pleasing facility that provides safe access for all to experience nature at its breathtaking best, while preserving and enhancing the exhilaration of the iconic Gap and Natural Bridge. In response, Parks and Wildlife landscape architects and architectual designers designed a structure, which was engineered by GHD Pty Ltd, enabling visitors to safely venture over a precipice to stand on a platform nearly 40 metres above the crashing ocean below as part of a complex of facilities. Designers and builders faced a number of challenges including site access, rock instability and selecting materials that could withstand harsh marine and weather conditions. These were overcome with a high level of planning and attention to detail.

SOLID ROCK

The most important factor in the lookout's design was the rock foundation. The gneiss beneath the lookout is incredibly strong but the rock contains natural faults and joints near the cliff face. Behind this unstable area is solid, stable rock that provided the perfect foundation for the lookout. A 3D laser site survey studied the rock joints and overhangs. This data was used to design the trajectory for five stainless steel beams that were created to follow the natural surface and extend up to four metres from the edge. These beams support a lookout platform that is more than eight metres wide with a 1.2-metre-high railing that gives visitors a thrilling view of the rocks and crashing waves below. These beams are secured by 30-millimetre-diameter stainless steel rock anchors fixed up to nine metres deep into stable intact rock. The anchors were tested to 1.5 times their design load of 170kN (which is equal to hanging about 10 family-sized cars from each anchor).

Sourcing the appropriate materials to withstand the harsh conditions was an important part of the process. The beams are made from Duplex 2205 stainless steel and offer a higher strength than conventional stainless steel with higher resistance to staining, corrosion and cracking. Fibre-reinforced grated panels

Welcome to Torgadirrup

The Mirnang people are descendants of an ancient culture in which storytelling is used to convey important knowledge, values and beliefs. These stories explain how the spirits of the ancestors were passed on to their descendants and confirm the deep spiritual connection our people have to this land and sea.

"Two Mirnang brothers had their differences and were fighting over a young woman. The elders became tired of their squabbling and sent them to a place near The Gap.

They made one stand on one side of The Gap and one on the other side. One brother was good at throwing spears, while the other was good at throwing boomerangs. As the first brother threw a boomerang, the second threw his spear.

The first brother was struck by the spear. The other brother was struck in the back by a boomerang and turned into a shark. The fin on the shark is the boomerang. The brother who was hit by the spear turned into a stingray."

This story was made available by the sons of Norngen. Torgadirrup is the local Aboriginal name for Torndirrup.

Top left The magnificent structure offers a safe but exhilarating experience.
Photo – Peter Nicholas/Parks and Wildlife

Top centre Western pygmy possums are found in the park.
Photo – Jiri Lochman

Above left The revitalised facilities at the park include accessible walkways.

Above The facilities are well suited to visitors of all ages.
Photos – Damon Annison

provide a lightweight but strong nonslip surface making the structure safe for use year-round.

While large parts of the construction were undertaken by local BGC Construction contractors, high quality stainless steel components were fabricated individually in Sweden and transported to Albany for installation. Extensive measures were undertaken to minimise environmental impact during construction. Existing path alignments and degraded areas were chosen to minimise disturbance, old paths not in use were removed and areas rehabilitated. Vehicle and machinery access was limited to a temporary access track to preserve both the natural rock surface and remnant vegetation. Almost all rock removed for the construction of paths and lookouts was re-used for landscape works within the site. Any vegetation that needed to be removed was retained for rehabilitation. Juvenile plant specimens were stored in a protected area and used in revegetation.

AND THE VERDICT

Opened in April, the facility is already proving very popular with locals who are coming to check out the newest attraction in their neighbourhood, and among visitors to the area. The experiences people have at the site changes with the weather – from enjoying the gentle and mesmerising heaving of calm seas to the adrenaline rush of buffeting wind and spray of winter storms from underfoot. The solid pathway and viewing area of the Natural Bridge provide a less confronting but still impressive window to one of Australia's most exposed coasts. Interpretive signage gives an insight into the cultural and geological history of the area and the design of the new viewing facilities.

The improvement project has not only supported local business through the construction phase with many local contractors engaged to undertake works, it will continue to generate social and economic benefits in the long term as a major tourism drawcard for the Albany region.

The Gap and Natural Bridge join the Granite Skywalk in Porongurup National Park, the Tree Top Walk at the Valley of the Giants in Walpole-Nornalup National Park and the Wilderness View Lookout in Mount Frankland National Park in offering outstanding views and nature experiences for visitors to Western Australia's national parks.

See remarkable vision of the new facilities at Torndirrup National Park

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

Do it yourself

Where is it? 10 kilometres south of Albany across Princess Royal Harbour. There is well-signposted road access via Frenchman Bay Road. Sealed roads lead to all major features.

Total area: 3936 hectares.

What to do: Walking, sightseeing, photography, fishing, rock climbing (for experienced rock climbers with proper equipment), abseiling, whale watching. A whaling museum at Discovery Bay makes a fascinating visit.

Facilities: Toilets, information, interpretive signage, car parks. A recreation camp at Quaranup is run by the Department of Sport and Recreation. Contact the department for more information and bookings.

Nearest Parks and Wildlife office: South Coast Regional Office, 120 Albany Highway, Albany, phone: (08) 9842 4500.

Below The huge stainless steel beams that form the base of the lookout.
Photo – Mike Shephard/Parks and Wildlife

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Wildlife NEEDING AID

Every year, thousands of injured and ill native animals are cared for and rehabilitated by a number of generous and unselfish volunteers. And, with a few behaviour changes, we can all do our part to help protect our precious native wildlife.

by Ann Storrie

Over the past 100 years, more mammal species have become extinct in Australia than anywhere else in the world. A range of factors have played a role with some of the main culprits being introduced predators such as foxes and feral cats. Another significant factor has been loss and degradation of habitat due to increasing human population. And, sadly, sometimes native animals fall victim to vehicles on our roads and tracks and occasionally cruelty through misguided or even malicious actions of people. Although this situation is overwhelming, work is being carried out by Parks and Wildlife through its *Western Shield* program to protect native animals by reducing predation by foxes and feral cats. And, there is a network of dedicated and special people who in their own private, unselfish way, support the tenuous existence of our precious native animals.

UNITED FRONT

Around Western Australia there are about 20 major rehabilitation centres, and almost 200 approved registered rehabilitators who work alongside 2000 volunteer rehabilitators. Parks and Wildlife works with the community to provide guidance on standards for wildlife rehabilitation in Western Australia and offers courses and support for wildlife rehabilitators on an on-going basis.

Much of the work done by Parks and Wildlife in conserving the large and unique array of native animals could not be achieved without the involvement of the community and the partnerships created throughout the State with wildlife carers and Friends groups.

One group which is making a difference in the Busselton and Margaret River area is Fostering and Assistance for Wildlife Needing Aid (FAWNA) – a not-for-profit, government approved, wildlife rescue and rehabilitation organisation for sick, injured and orphaned native fauna. Based in Busselton, the group was formed more than 30 years ago and is managed entirely by volunteers who run several emergency care centres throughout the area.

Rehabilitators treat and shelter injured and orphaned wildlife until they are able to be released back to the wild. Many volunteers also build and supply the necessary equipment for the rehabilitation and release of animals, some work on committees; others conduct educational programs (especially for schools), while others raise funds to implement the aims of FAWNA.

As well as caring for wildlife, FAWNA aims to provide support for other wildlife rehabilitators, form associations with groups with similar aims and encourage appreciation and respect in the minds of others for our native animals. FAWNA works alongside Parks and Wildlife, facilitating training for rehabilitators and keeping people informed of the latest wildlife issues.

In 2011, FAWNA was one of the key volunteer groups searching, rescuing and rehabilitating wildlife after the Margaret River fires. Following that effort, FAWNA successfully applied to Parks and Wildlife, plus sought community donations, to purchase an emergency response van. The van is equipped with medical supplies, cages, capturing equipment and information and is used around the south-west to facilitate emergency treatment of injured wildlife. During the fires near Harvey in early 2016, the van was used as a base from where FAWNA and other groups such as the National Animal Rescue Group operated.

RESCUE, REHABILITATE AND RELEASE

Three 'R's' are paramount in FAWNA's aims: to rescue, rehabilitate and release

Previous page
Main and inset Ill and injured native animals, such as chuditch and woylies, are often provided care and rehabilitation by volunteers.
Photos – Parks and Wildlife

Above Members of FAWNA and NARGA with the emergency response van attending a bushfire.

Left A tiny juvenile western ringtail possum.
Photos – Ann Storrie

Far left Participant Sue Morrison at a Parks and Wildlife training program learning to stomach tube a reptile.

Left Jeff Falconer securing a ringtail possum release basket into a peppermint tree.
Photos – Ann Storrie

native fauna. This can involve a degree of risk to the volunteers and bites and scratches are an everyday occurrence! It is therefore imperative that all FAWNA members are registered volunteers with Parks and Wildlife to enable cover to be provided for some medical expenses should injuries be sustained while undertaking wildlife rescue and rehabilitating activities.

Volunteers are also obliged to adhere to relevant Acts and Regulations pertaining to either animal welfare or wildlife at all times. Parks and Wildlife runs regular courses in basic wildlife rehabilitation for interested members of the public. Online modules plus two-day seminars are conducted with information presented by some of WA's most experienced wildlife rehabilitators. They share their expertise in their specialist fields such as the rehabilitation of marsupials, reptiles and birds (including raptors). FAWNA also informs members of any other relevant programs and workshops that are organised by groups such as the Possum Centre Busselton, Geo Catch and the South West Catchments Council, to name a few.

RESPONSIBLE REHABILITATORS

Many species of animal that come into the care of FAWNA members are threatened and listed as 'vulnerable', 'endangered', or 'critically endangered' on the threatened species list. Minimum standards for transportation, rehabilitation facilities (such as cage sizes and disease control), release procedures and record keeping are outlined and should be adhered to. There is a maximum fine of $10,000 for intentionally killing a specially protected animal and a $4000 maximum fine for wounding, hunting or capturing protected fauna under the Wildlife Conservation Act. These are set to rise following the introduction of the new Biodiversity Bill into State Parliament late last year, which when passed will see significant new penalities, with offences for harming critically endangered species and ecological communities, attracting a maximum penalty for an individual of $500,000. Hefty fines can also be imposed if habitat is unlawfully removed or degraded and for harassing an animal.

FAWNA rehabilitators are committed to responsibly feed, nurture, clean, monitor, record, and gradually rehabilitate their charges. This process can be immensely time-consuming. Two especially dedicated volunteers are Jeff and Linda Falconer from Busselton. Jeff has been President of FAWNA for more than six years and has manned its emergency phone helpline almost full-time for this period. Often taking up to 12 calls a day, Jeff and Linda give advice to all callers, attend call-outs to rescue wildlife (some in very difficult situations) and organise and mentor possum rehabilitators throughout the south-west. As retired teachers, they are also ideal people to educate young and old on the responsibilities to our wildlife.

THE WESTERN RINGTAIL POSSUM

One of the most common native species to come into care in the Busselton region is the western ringtail possum (*Pseudocheirus occidentalis*). Its threat level was upgraded in 2015 from 'vulnerable' to 'endangered'. Ninety per cent of the ringtails' diet consists of leaves from the peppermint tree (*Agonis flexuosa*), which has been severely depleted due to clearing for housing developments in recent years. It is estimated that there are fewer than 8000 western ringtail possums in the wild and it's possible this number is decreasing.

In 2015, Jeff and Linda took in 52 young ringtail possums. Many of these were possum joeys, orphaned or abandoned when their mothers were attacked and injured or killed by domestic pets, or disturbed by people, others were survivors of vehicle accidents, while some adults and their young had to be taken into care after having jumped onto hot barbecue plates. Many were dehydrated and weakened in the heat of summer.

Emergency calls are not only received from people who find these injured or abandoned animals, but from the veterinary clinics in the area. Most veterinary hospitals in Busselton, Dunsborough and Margaret River will treat native fauna, free of charge and will contact rehabilitators when necessary, often via the FAWNA helpline. FAWNA has developed good relationships with local vets by providing each veterinary

Above FAWNA was on hand to help rescue native animals fleeing from the fires that devastated Waroona and surrounding areas. *Photo – Ann Storrie*

practice with a hospital box to be used for wildlife only, as well as $500 for medications. FAWNA contributes to the payment of X-rays and works with the vets and Perth Zoo to establish plans for operations. If you find an injured or abandoned animal, your nearest veterinary hospital may be able to help.

WHAT CAN YOU DO FOR WILDLIFE?

There are many things we can do to help our native species, even in our own home and backyards. You do not have to devote your life to caring for possums, but you can appreciate and accept the existence of them and other native animals. Make your garden fauna friendly. Plant local trees and shrubs to attract native birds and animals. Quendas like scrubby ground cover surrounding patches of lawn – yes, they love digging up those pesky lawn beetles and the small holes they make are easily filled in. Put boxes and hollow logs into trees as nesting places for birds, possums and other arboreal animals such as phascogales. Wildlife stacks are a wonderful way of getting rid of rubbish and to keep the children (and adults) amused. Made of old timber, building rubble, pipes, metal sheeting and just about anything that is littering the yard, they can be piled up in tiers that provide nesting sites and shelter for insects, frogs and other animals. However, be mindful that piles of material can provide shelter for venomous snakes, so be sure to keep them away from buildings and suburban backyards and check them for snakes before children and pets use them. Place water containers in trees for birds and possums and on the ground for reptiles and ground-dwelling native mammals and install bird baths and ponds surrounded by native vegetation. Develop a compost heap at the back of the garden to attract insects that will in turn attract animals, and put in solar lights to attract insects at night for the frogs.

It is also important to minimise the use of fertilisers and poisons in your home and garden. Look up alternatives to your long-lasting surface sprays and weed killers. It may take a little more effort and time, but the rewards far outweigh the inconvenience and are often cheaper. Use rat and mice traps in their nesting areas rather than poison. Even if you don't kill the native animals directly, rats and mice that have ingested poison can be eaten by raptors and are a large concern for the declining hawks, falcons and eagles in rural areas. Avoid using snail pellets that may be eaten by native wildlife and, instead, use a shallow dish filled with beer to kill snails, and encourage the bobtails in the yard as snails are part of their normal diet (though perhaps without the beer!).

Encourage native birds and other animals to feed only on their natural foods. Ringtail possums in care, for example, if reared on their specific marsupial milk and peppermint leaves with a few native flowers for treats, will not be interested in eating the neighbours' fruit and vegetables when released. And never allow wild animals to become reliant on humans for their main source of food.

Learn about the native species in your area and always keep cats and dogs in at night. Never allow your pets to harass or kill wildlife.

WHY CARE?

You don't need to have rehabilitated an injured ringtail possum joey to understand the importance of our wildlife. We all have a role to play in providing the best environment we can for these animals to ensure they persist in the wild for years to come and fulfil their unique and important roles in the ecosystem.

Contacts

If you find an injured or orphaned native animal you can:

- contact your nearest Veterinary hospital
- ring Parks and Wildlife's Wildcare helpline on (08) 9474 9055.

If you are within the south-west region of Western Australia, ring the FAWNA number on 0438 526 660.

If you would like information on the Basic Course for Wildlife Rehabilitation contact the Parks and Wildlife's Community Involvement Unit on (08) 9334 0251 or visit www.dpaw.wa.gov.au/get-involved/wildlife-rehabilitation-and-courses.

Anne Storrie is a regular contributor to *LANDSCOPE* magazine and a registered wildlife carer. She can be contacted by email (naturescapes.au@hotmail.com).

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Department of Parks and Wildlife

SURVEYING MIRIMA:
Capturing change

Main Mirima National Park's geology is very similar to that of the Bungle Bungle Range. **Above** A prescribed burn at one of the Mirima survey sites in early 2010.
Photos – Ian Radford/Parks and Wildlife

A research project started in 2008 to document the impact of fire on native plants and animals at Mirima National Park has also provided some interesting information about the impact of cane toads.

by Ian Radford and Richard Fairman

Mirima National Park is like a mini version of Purnululu National Park with its interesting rock formations and pretty hidden valleys. It is home to a few small and medium-sized mammals, including a number of native mouse and rat species as well as several types of bats. But what makes this park particularly special is its interesting array of reptiles, amphibians and invertebrates.

In 2008, Parks and Wildlife's predecessor, the Department of Environment and Conservation, began research into the impact of fire on native plants and animals in the park, concentrating on the pindan sandy woodlands surrounding the rocky areas. Four surveys were carried out between 2008 and 2011 providing important data about the area's plants and animals. An additional four surveys have been carried out in the years since offering a useful comparison for land managers.

FIERY IMPACT

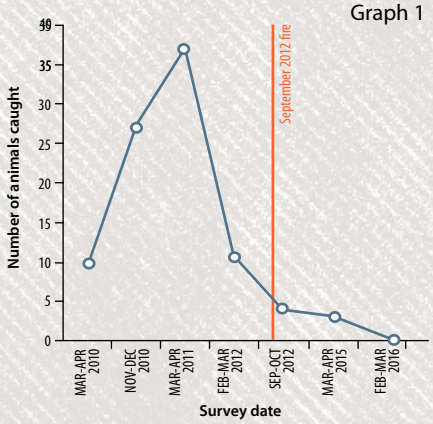
In September 2012, a deliberately lit high-intensity fire burnt through almost all of Mirima National Park. The most obvious impact of this fire, and successive fires in 2013 and 2014, was the loss of the pindan wattle (*Acacia tumida*) in many areas of the park and surrounds (including three of our 10 survey sites). A dominant tree, this loss has effectively transformed the pindan vegetation structure from relatively dense woodland of about 20 to 35 per cent canopy cover, to an open savanna of around only five per cent canopy cover. Some seeding trees and shrubs such as pindan wattle require sufficient time between fires to enable seedlings to mature and produce their own seeds before the occurance of any future fires.

On the other hand, much of the wildlife that occurs in Mirima National Park appears to be resilient to the effects of most fires. Fire has increased captures of many species of dragon lizards (*Diporiphora magna* and *D. pindan*), skinks and invertebrates, probably due to reduced shelter and fewer ground-based obstacles leading to increased trapping. Very large *Ctenotus* skinks (more than 20 centimetres long) become scarce after fire probably because they are highly visible in a burnt landscape with no cover and get eaten by birds of prey.

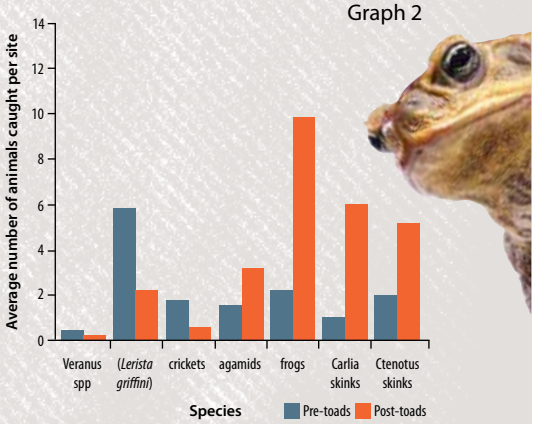
Small mammals are seriously affected by the impacts of fire as revealed in 2016 surveys. In Mirima these include rodents like the western chestnut mouse (*Pseudomys nanus*) and the pale field rat (*Rattus tunneyi*), and small dasyurids including planigales. When the numbers of mammals captured in the surveys before 2012 are compared to the numbers of the three surveys carried out since, it is clear that mammals have declined after this single September fire. Despite four years of vegetation recovery in some areas, mammal numbers have remained very low (zero to four in every 720 traps), compared to between 10 and 32 (in 720 traps) before September 2012. The pale field rat has not been recorded since this fire. Mammals caught in Mirima have fallen below one in every 100 traps, similar to the level now seen in post-mammal collapse Kakadu survey sites.

"Goannas are adversely affected by cane toads through poisoning, and in 2015 at Mirima they were less than half as abundant as they were before toads."

Graph 1



Graph 2



Above left *Ctenotus robustus*.
Photo – Kathryn Radford/Parks and Wildlife

Above right and above centre A comparison of the survey sites in 2009 and 2015 show the change from high pindan wattle canopy cover to an almost complete removal of the species by fire between 2012 and 2015.
Photos – Ian Radford/Parks and Wildlife

Above Response of species to cane toad arrival.

RECOMMENDATIONS FOR FIRE REGIMES IN MIRIMA

Since the large September 2012 fire, the lack of older cured grass fuel early in the dry season has hampered attempts to reintroduce early season prescribed burning to mitigate further wildfire impacts. Consequently, large fires burnt much of Mirima National Park again in 2013 and 2014. However, the opportunity to reintroduce prescribed burning arose by early 2016 because little was burnt in Mirima National Park in 2015 (probably due to low grass growth with a below average wet season in 2014–15). Burning strips of vegetation in a grid pattern has provided the best chance of breaking up

grass fuels early in 2016 to reduce larger and more intense fires from occurring later in the year. Early results of this work have been promising.

TREACHEROUS TOADS

Goannas are adversely affected by cane toads through poisoning after consumption, and in 2015 at Mirima National Park they were less than half as abundant as they were before toads (see Graph 2). Crickets also declined along with one species of burrowing skink – the stout sandslider (*Lerista griffini*). However, the cane toad invasion also resulted in increases in frogs, dragon lizards and a number of other skinks (Graph 2), perhaps due to fewer goannas as top predators. This phenomenon has been observed in some other studies. It's possible that increased competition for resources above ground, or increased predation by large skinks, has also led to the decreases in the stout sandslider at Mirima sites (Graph 2). These animals are probably not directly predated by cane toads as they are small and spend most of their time below ground in the sand.

It appears from these studies that indirect impacts of cane toad invasion results in changes in abundance, rather than total disappearances of species. But one thing is for sure, collecting short- and long-term data is imperative so we can build a profile of our environment from species to landscape-scale. By building a picture of the present, we can observe changes that occur in the short and long-term, which is extremely helpful to land managers who are faced with complex variables such as fire and invasive pests.

Top left Ornate burrowing frog.
Photo – David Bettini

Top Spiny-tailed gecko.

Above Cane toad.
Photos – Kathryn Radford/Parks and Wildlife

Above centre Rock pool in Mirima National Park.
Photo – Andrew McInnes

Above left Pindan wattle.
Photo – Jiri Lochman

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The *Samuel Wright* story

DIGGING FOR HIDDEN TREASURE

Buried deep below Koombana Bay lies the historic *Samuel Wright,* a whaling ship which was wrecked off the coast of WA in 1840. A recent development provided an exciting opportunity to explore the wreck and uncover a treasure-trove of artefacts that have miraculously survived amidst an urban and mining centre.

by Heather Quinlan

During the 19th century, hundreds of North American whaling ships sailed 10,000 nautical miles south to a place they knew as 'New Holland Ground' off Western Australia's coast, hunting whales for their valuable blubber and oil. Some of the ships were wrecked in northerly gales and washed ashore at the small settlement of Koombana Bay.

Fast forward 176 years in the bustling city of Bunbury, on a patch of Koombana Bay foreshore land destined to become the site of the new Department of Parks and Wildlife headquarters, and archaeological excavations are underway to discover the hidden treasures of one of these wrecks.

It is thought the 34-metre wooden hull of the Salem-based whaling ship *Samuel Wright*, which was wrecked on 8 July 1840, lies up to six metres underground, buried in sand below the watertable.

Locals and maritime archaeologists from the Western Australian Museum have known for many years – since sand mining operations were conducted on the Bunbury coastline in the 1960s, temporarily exposing a number of buried shipwrecks – that some of WA's richest maritime heritage could be found beneath the Koombana Bay foreshore.

This coastline and further south around to King George Sound and the western Great Australian Bight area used to be a rich hunting ground for international and colonial whalers.

At a time before petroleum and electricity, when whale oil was used worldwide for street lamps, candles, soap and many other industrial and domestic products, visiting whaling ships provided small coastal settlements with crucial trade opportunities in exchange for fresh provisions such as vegetables and kangaroo meat.

But hazardous conditions in little-known seas blew many ships ashore.

BUNBURY SHIPWRECKS

The *Samuel Wright*, one of 13 recorded shipwrecks in the Bunbury area, was buffeted high up onto the beach in a massive northerly storm. It gradually became covered by sand in the early 1900s, after construction of rock breakwaters to make Koombana Bay safer for shipping caused sediment to build up inside the port. It is considered the most important and historically significant of the local wrecks.

One of the earliest American whaling ships to visit WA's south-west corner, its mast was used as a reference point in Government Surveyor Henry Ommaney's work pegging out the new town of Bunbury in 1841–42, making it the only city in Australia to have its town plan based on a shipwreck. The wreck was also used as a storehouse, making the *Samuel Wright* one of Bunbury's first buildings.

Excavations to determine which ship lay under the Parks and Wildlife site began in February 2016, after months of planning and environmental investigations including geophysical and water probe surveys.

Previous page
Excavating the front section of the *Samuel Wright* shipwreck.
Photo – Jennifer Eliot/Parks and Wildlife
Inset top North American whaling ships sailed to the coast of Western Australia to hunt whales.
Inset bottom Article from the *Perth Gazette*, August 1840 detailing the sale of whaler ships, including the *Samuel Wright*.

Above The excavation site at Koombana Bay.
Photo – Jennifer Eliot/Parks and Wildlife

Left A leather shoe and try-works bricks – used to build furnaces to help process whale blubber – were uncovered during the excavation.
Photos – Deb Shelf/WA Museum

"The *Samuel Wright* is one of the most historic and best-preserved shipwrecks we have in Western Australia, and indeed Australia."

Coordinated by Ross Anderson, the assistant curator of maritime archaeology at the Western Australian Museum, the dig began with heavy machinery removing accumulated beach sand and mine tailings overlying the hull structure, and continued with an expert team carefully uncovering the ship's features and artefacts with trowels, spades, buckets and brushes. Highly accurate surveying technology including 3D photogrammetry and laser scanning was used to record the site.

Three North American whaling ships had been wrecked at Koombana Bay, but based on historical records and water probe surveys, Ross was quietly confident the structure would be confirmed as the *Samuel Wright*.

DIGGING REVEALS ARTEFACTS

Days of digging and scientific analysis of timber hull samples and metal fastenings proved he was right – the large shipwreck was indeed the *Samuel Wright*. Built in 1831, the old whaler revealed a swathe of treasures for museum archaeologists.

Uncovered were 219 items including chopped firewood, wooden casks, leather shoes, clay pipes and numerous red, hand-made bricks from whaling vessel 'try-works', the furnaces used to render whale blubber into oil.

Analysis of samples showed the ship's hull was made of white oak and North American yellow pine and its construction, typical of early 19th century shipbuilding, used predominantly wooden materials, including fastening pins known as 'treenails'.

Seven copper fastenings recovered from the wreck were found to have arsenic added to the metal to make them more resistant to erosion, a strategy often employed prior to the introduction of copper alloys with greater percentages of zinc and tin.

The findings from the excavation have provided insights into Indian Ocean whaling, North American shipbuilding, WA's early colonial economy and development, and the State's maritime history.

"The *Samuel Wright* is one of the most historic and best-preserved shipwrecks we have in Western Australia, and indeed Australia," Ross said.

"To have it so close to an urban centre and to have survived amidst industrial sand mining activities is a miracle.

"Archaeological sites are often hard for people to appreciate because they are buried 'out of sight out of mind', so we have recorded the site in great detail so that we can use all of the artefacts, images and 3D digital reconstructions to interpret the site for many years to come."

And what will become of the *Samuel Wright*? Now fully reburied, it will continue to occupy its sandy subterranean grave, preserved beautifully below the water table for hundreds more years.

Visitors to the Parks and Wildlife precinct in future years will be able to connect with the ship's amazing history through cultural interpretation and landscape elements overlaying the wreck site.

Above left Measuring the remains of the bow structure.

Above One of the ship's hand-made iron nails.
Photos – Jennifer Eliot/Parks and Wildlife

See video animation of the *Samuel Wright* shipwreck site

Scan this QR code or visit
museum.wa.gov.au/research/departments/maritime-archaeology/samuel-wright

Heather Quinlan is a Parks and Wildlife communications officer. She can be contacted on (08) 9219 9909 or by email (heather.quinlan@dpaw.wa.gov.au).

See Ross Anderson's guest column on page 7.

Canopy capers

by Lauren Emmerson

An exciting new experience at Lane Poole Reserve is offering thrillseekers of all ages a completely different perspective of the forest. And a whole lot of fun.

It had been years since I'd worn a harness (flashback to abseiling at school camp) and as I put my legs through the sturdy fabric loops, tightening at the thighs in a triumph of safety over beauty, I was ready to channel that inner child. We were about to endeavor navigation of the high ropes course known as Trees Adventure – a matrix of zip-lines, suspended bridges, cargo nets and other challenges, high in the canopy of hundreds of pine and jarrah trees, 16 metres above Lane Poole Reserve.

I listened as intently as possible to the safety briefing, blaming any lapses in concentration on forgetting to pack a pillow when we camped at nearby Nanga Mill the night before, but excited about spending a two-hour session in the trees.

My respect for the Swiss family Robinson grew as we walked towards 'Home Tree' – a thick-trunked mother tree skirted by a complex system of handcrafted platforms and ladders.

Trees Adventure's Liam Hicks explained that Home Tree was the base from which each colour-coded ropes course begun. I suppressed my childlike urge to hug Home Tree like she was a secret-keeping aunt as Liam showed us the locking system that would keep us safe.

The level of thought that has gone into balancing safety with fun became increasingly obvious as we looked up to the elevated playground and the long, steel cable running throughout.

"The best thing about our system is that once you lock on to the cable, you're 100 per cent safe and you don't need to have one of us looking over you the whole time," Liam said.

"We're down on the ground, we're always there to help, but you get to have your own unique experience."

"Each colour represents a different degree of difficulty. Start with the green course, then work your way up to blue, red, black then extreme black if you feel up to it."

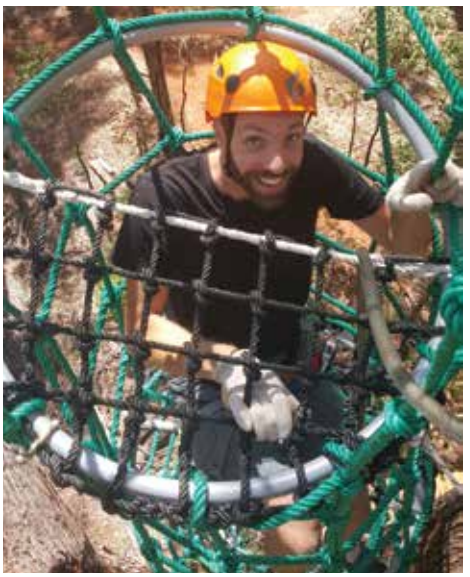
In a moment of unjustified confidence we chose to skip the green level and go straight to blue, and spent the next few hours going from tree to tree through a range of obstacles that challenged our bodies and our problem-solving skills.

We wobbled our way over suspended wooden bridges, gave Miley Cyrus a run for her money with the wrecking ball, tried to look as cool as possible on the mid-air skateboard, gave a pretty good impression of a spider trying to crawl across the cargo net, zip-lined up to 100 metres and hoped nobody noticed the slight shake in our knees just before the freefall jump.

Exciting. Heart pumping. Challenging. Completely addictive.

Trees Adventure in Lane Poole Reserve opened to the public in mid-December 2015 and is the newest course in Australia, with three other high ropes parks operating in New South Wales and Victoria. Liam helped establish the Victorian incarnation of Trees Adventure and journeyed across the Nullabor in a truck loaded with a specific type of wood fit for purpose, to build the course in Western Australia.

"I love the outdoors, I love climbing and that's all culminated in me being over here in WA helping to set up this park," Liam said.



"We spent two and a half months in the trees, getting covered in soot, slogging it up here with the flies building this beautiful course and it's pretty awesome to see it full of people."

There is even a children's course, which is a mini version of the adults playground where kids can navigate their way through the obstacles and zip-lines two metres above the ground using a simplified safety system.

Given it's only an hour from Perth, you can visit Trees Adventure and be home in time for lunch, or incorporate it as part of a road trip, camping adventure or weekend getaway.

Trees Adventure is managed under a lease by Parks and Wildlife and is open year-round from Tuesday to Sunday, including public holidays and school holidays.

Do it yourself

Where is it? Lane Poole Reserve, Nanga Road, Dwellingup WA (100 kilometres from Perth) (08) 9463 4063

Facilities: Day-use and camping areas, toilets, barbecues, tables.

Camping: You can camp at one of several campgrounds. Fees apply.

For more information: about the Trees Adventure visit www.treesadventure.com.au/lane-poole-park

Nearest Parks and Wildlife office: Dwellingup office, Banksiadale Road, Dwellingup, phone (08) 9538 1078 or Perth Hills District Office, 275 Allen Road, Mundaring, phone (08) 9290 6100.

Above left The course offers challenges for people of all ages, skills and abilities. *Photo – Trees Adventure Park*

Left Zip-lining between trees.

Above and top The course incorporates a range of climbing and balancing challenges. *Photos – Lauren Emmerson/Parks and Wildlife*

Get a tree swinger's view of the Trees Adventure

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

Lauren Emmerson is Parks and Wildlife's editorial project officer. She can be contacted on (08) 9219 9814 or by email (lauren.emmerson@dpaw.wa.gov.au).

Understanding marine ‘connectivity’

At first glance all the oceans of the world are connected as myriad organisms swim or drift in the same watery medium. In reality however marine waters move in a complex way caused by currents, winds and tides, and the distributions of marine plants and animals are much more complex. Parks and Wildlife marine scientists are carrying out a collaborative study focused on the Pilbara and with links to the wider WA coast, that will provide information to help understand how populations of marine organisms are isolated or connected, and what this means for managing our unique marine environment.

by Richard Evans

On a recent trip to Ningaloo, I came across a fisherman who had obviously seen the 'research' sign on my boat and asked "What ya researching?".

"I am doing a study to understand how all the different marine regions of the Pilbara are connected," I replied.

To which he quickly turned with a confused look on his face and bluntly said "They're all connected mate".

"Yes… and… no, at varying levels" I replied, thinking "I wish it was that easy". The fisherman's response had startled me in its simplicity, but he was right: all the oceans are connected to some extent. However, the complexities of oceanography mean that marine waters often do not mix as well as some might think and this affects how populations of animals or plants are genetically similar or different in what may look like entirely uniform coastal waters.

The presence or absence of such connectivity could help to explain how some marine taxa survive or recover from disturbances or environmental influences that occur over short or long time spans. This fisherman's comment prompted me to write this article to explain what scientists mean when they refer to 'connectivity'. While the *Merriam Webster Dictionary* definition of the word connectivity is "the quality, state, or capability of being connective or connected", connectivity from an ecological perspective means the relevant exchange of individuals which impacts the survival of a species in a local population.

INFLUENCING CONNECTIVITY

Marine organisms that live as adults on or near habitats like coral or rocky reefs, seagrass or macroalgal fields typically have a remarkably different early life. They spend their early life stages as tiny eggs and larvae floating or swimming as plankton in the currents of the open sea. Currents may either transport them to other reefs or keep them in the vicinity of reefs in the area in which they were born. After a period of time and as they grow, these larvae have the ability to settle from the water column into suitable habitats to begin their life on or near their habitat of choice. The average time spent in the water column, known as the 'pelagic larval duration', varies between species and can range from seven to 10 days for coral larvae and 10 to 80 days for larval fish. For many species, this pelagic larval stage is when they disperse widely. Dispersion may also occur as adults, however many species are either attached to the seabed or have relatively restricted home ranges or territories that may be only tens or hundreds of metres in size. Obviously this varies widely and some mobile fish have the ability to swim kilometres by the time they reach adulthood.

Until recent decades, scientists believed marine organisms existed in open populations, with the ability to disperse thousands of kilometres ("They're all connected mate!"). More recently however, research has shown that most marine organisms disperse over relatively smaller distances of up to about 15 kilometres in a single generation. Yet, if their inter-generational movement is so limited, why do many species exist across entire oceans?

Opposite page
Main Anemone fish.
Photo – Richard Evans/Parks and Wildlife
Inset Loggerhead turtle hatchling.
Photo – Jiri Lochman
Background Healthy hard coral from the family Faviidae.
Photo – Matt Kleczkowski

Above left Fish in seagrass.

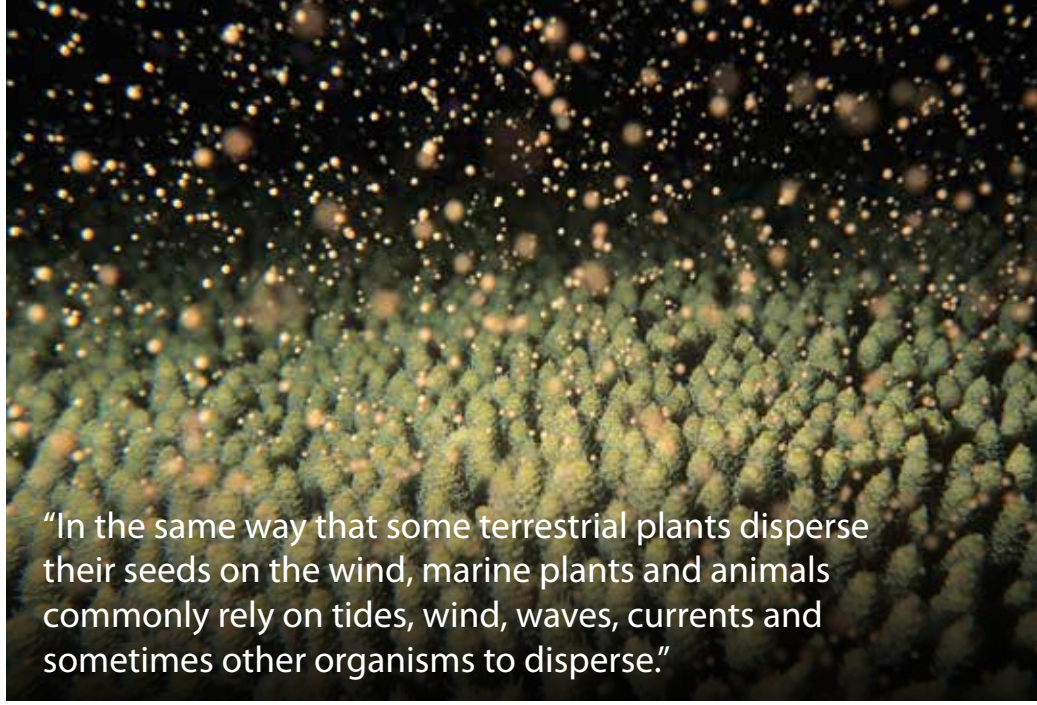
Above Christmas tree worm.
Photos – Richard Evans/Parks and Wildlife

The answer lies in the benefit of time, with species using a series of generational stepping stones to cross large distances. In some instances, larvae can travel hundreds of kilometres in a single generational event under the influence of unusual conditions like cyclones or strong ocean warming events which can carry larvae well beyond their normal dispersive range.

Such an event occurred off the coast of Western Australia during 2010 when an exceptionally strong Leeuwin current transported hot tropical water all the way down past Perth, carrying with it the larvae of many tropical marine species. Unfortunately, many of these did not survive the onset of winter, or were not able to successfully breed if they did survive. Remarkably, marine scientists now believe that some vagrant species from tropical waters are now surviving in temperate waters as they are now slowly migrating south. But this is another story.

DIFFERENT DISPERSAL METHODS

The fluid nature of the marine environment enables organisms to disperse differently to terrestrial organisms. In the same way that some terrestrial plants disperse their seeds on the wind, marine plants and animals commonly rely on tides, wind, waves, currents and sometimes other organisms to disperse. Dugong, for example, disperse seagrass seeds in their faeces, often after travelling some distance from where they may have foraged.

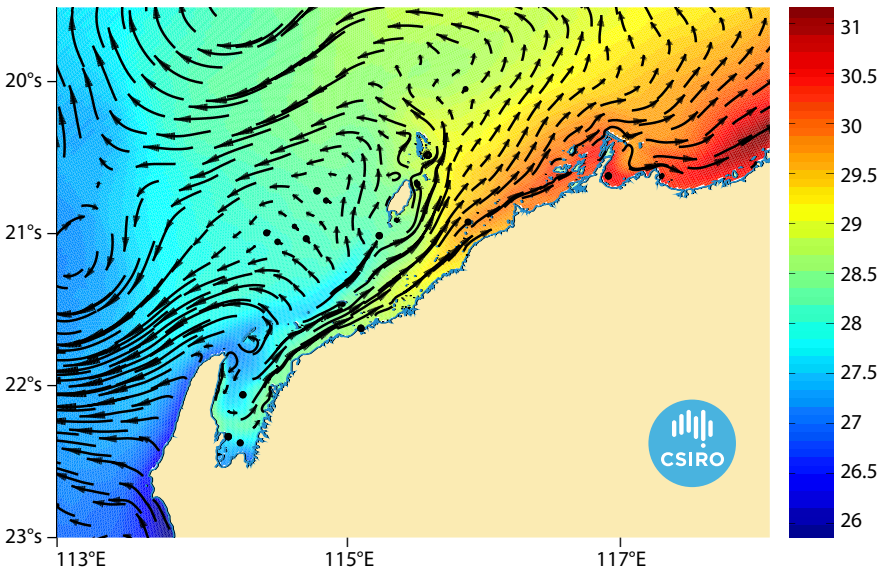


"In the same way that some terrestrial plants disperse their seeds on the wind, marine plants and animals commonly rely on tides, wind, waves, currents and sometimes other organisms to disperse."

The young of some organisms develop within their parents or on the substrate where their eggs were laid, which is known as 'direct development'. These organisms typically have limited dispersal from their parents. Sessile organisms (attached to the sea floor) may only disperse a matter of metres. While fish may hatch from eggs and disperse up to several kilometres through active swimming with local currents.

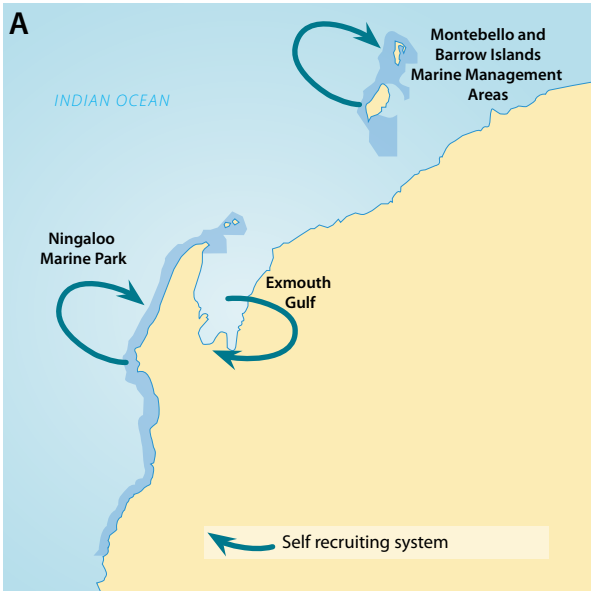
Plants or animals without the ability to control their horizontal or vertical movement – such as some species of seagrasses and mangroves – are referred to as 'passive' dispersers. Dispersal of these organisms relies solely on the environmental conditions to distribute their reproductive outputs (propagules). Some organisms may delay settlement to the benthic environment to enhance their chance of finding suitable habitats.

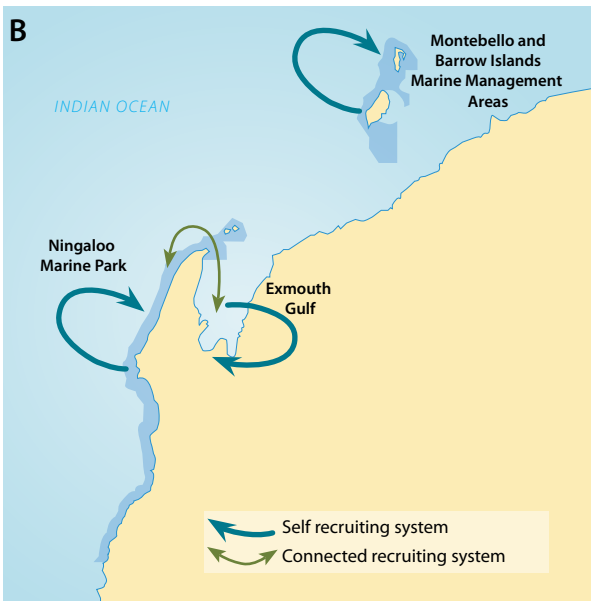
Animals such as corals can control their vertical position in the water column and are understood to have 'passive movement with vertical migration'. The water column does not always move as one body of water, at times there are eddies, and temperature and salinity variations which allow different sections of the water to move in different directions. Organisms with vertical migration mobility

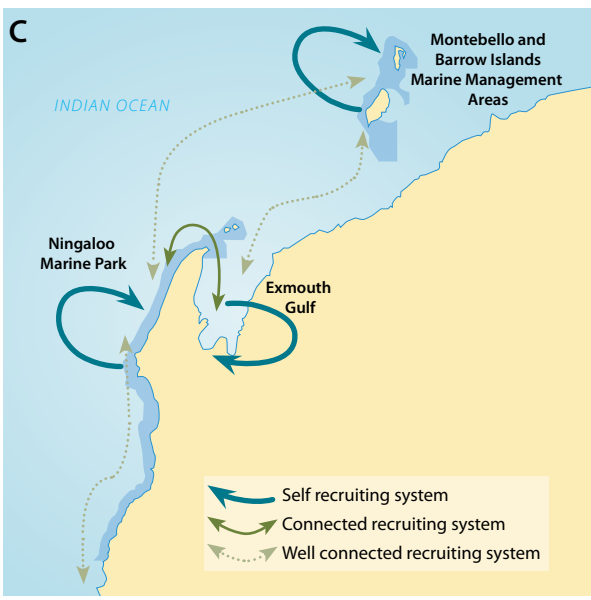


Above Coral spawning.
Photo – Geoff Taylor/Lochman Transparencies

Left A model of average water movement (arrows) and temperature (colour) in the top five metres of water during January from 2003 to 2010. The size of the arrows indicates relative speed of the currents. Note how the water moves in different directions at various parts of the coast.
Data – Provided from the Pilbara Marine Conservation Program (PMCP) ROMS model on a nominal 1km grid developed and provided by PMCP at CSIRO.







Above Dugong feeding on *Cymodocea serrulata*.
Photo – Kelvin Aitken/Marinethemes.com

Right
A) An example of three self-recruiting systems, suggesting low resilience to natural or anthropogenic disturbance.
B) An example where Montebello/Barrow Islands are self-recruiting, but Exmouth Gulf and Ningaloo are well connected so have greater recovery potential in the face of disturbance than perhaps Montebello/Barrow Island.
C) All three locations are connected in a well-connected system that would have the greatest ability to recovery from external impacts.

can move up or down to take advantage or avoid certain bodies of water to enhance or impede their dispersal.

Meanwhile, juvenile fish, less than a centimetre long, can swim quite strongly against or with currents to impede or aid dispersal, in a strategy known as 'active dispersal'. This is quite amazing given their tiny size as not all vertebrates have active dispersal; for example hatchling turtles are not strong enough to control their dispersal and are sometimes dragged by currents from the tropics all the way south past Perth. Interestingly, water carries chemicals and sounds great distances through the ocean, and juvenile fish use their sense of smell and hearing to locate reefs from up to several kilometres away.

TEMPORAL SCALES OF CONNECTIVITY

We can measure connectivity on varying spatial scales ranging from individual movements, to intergenerational movements all the way up to geological timescales of connectivity. Individual movements are typically measured using parentage or assignment tests. Comparing the babies' DNA to that of a number of potential parents, similar to what we do in humans to confirm paternity. These are direct measures of connectivity. Intergenerational movement studies focus on how related a number of populations from different locations are to each other to confirm a relative amount of connectivity. That is populations from location X and Z have more genetic similarities than location X and Y, therefore there is more transfer of genetic material (babies) between X and Z than X and Y. Studies on geological timescales are used to reconstruct lineages and understand where species have come from, and to infer how and where they may have survived during long periods of disturbance, such as ice ages where the seas were reduced dramatically compared to present sea levels. While these questions are important, managers, tour operators and the general public are more likely to be interested in questions of smaller time scales such as: "If the coral

in my local reef or marine park bleaches and dies, how long will it take to recover to its original state, and where will it come from?" Genetic techniques have only recently become affordable to conduct such short time-scale projects (years to decades), which are important for short-term management issues. So now is the ideal time to start searching for answers to such questions on the Western Australian coastline. While science is interested in all scales of connectivity, most projects are carried out over two to five years, which focuses on short-range data collection.

LEVELS OF CONNECTIVITY REFLECT RESILIENCE

Interconnectedness provides a challenge for the agencies and groups managing WA's marine environment. To understand the recovery potential of any location in the event of disturbance, marine park or otherwise, we need to study the connection within and between marine parks, as well as to and from areas surrounding each park, and determine which areas are more or less susceptible.

Some areas rely on what we call 'self-recruitment' – that is, all the new offspring arriving in that area actually come from that area. Only recently was evidence shown to support this phenomenon in the Great Barrier Reef, Hawaii and the Caribbean, and it is now believed to be quite common in the marine environment. However, a self-recruiting system is the least resilient to disturbance. Let's use WA's Ningaloo Marine Park as a hypothetical example: if species within Ningaloo Marine Park were totally self-recruiting and the area was adversely impacted, the park has less chance of recovering to its original state. Or, if all the offspring came from only one other area, and both areas were impacted, then Ningaloo reef would also have a lower chance of recovery. This scenario offers more resilience than the self-recruiting park, but in a world where heatwaves and large cyclones are forecast to increase in frequency, this model may still be susceptible due to the regional scale of these impacts.

The best-case scenario would be a network of several source populations interconnected to and from Ningaloo, including self-recruitment, to ensure the greatest resilience in our management. These are the types of questions we hope to answer in a current Parks and Wildlife study funded by the Chevron-operated Wheatstone project.

FOCUSING ON THE PILBARA

Parks and Wildlife is carrying out the Wheatstone Connectivity Offset project in the Pilbara – a region with increasing natural and man-made impacts – with the aim of understanding the connectivity of benthic habitats and the animals that use them (see also 'Dampier Achipelago underwater: A diamond in the red rock' on page 16). Using a new population genomic technique, department scientists, along with collaborators from the Department of Fisheries, Edith Cowan University, CSIRO, The University of Western Australia, Western Australia Museum and Curtin University, is studying marine life with different dispersal and reproductive characteristics to test for similarities or differences in population connectivity between key taxa, including corals, seagrass, mangroves and fish, over varying spatial scales, from the Kimberley to Bunbury. This information is critically important for managing this precious environment, as it provides background for planning marine protected areas, assists management of fisheries and nursery stocks, and enables industry to plan projects in a way that will minimise impacts on sensitive areas. Field work for the project has finished and the lab work has begun. Research outputs are expected to begin in the next year or so. And, while we process the data, and learn more about these magnificent ecosystems, we will happily engage with people of all walks of life who want to learn more about what we're doing. Who knows, they might even encourage us to view things in a different way or remind us that "they're all connected mate" in one way or another.

Above left Collecting seagrass.

Above A cleaner shrimp.
Photos – Richard Evans/Parks and Wildlife

Richard Evans is a Parks and Wildlife senior research scientist in the Marine Science Program. He can be contacted on (08) 9219 9098 or by email (richard.evans@dpaw.wa.gov.au).

by Lauren Emmerson

kaleidoscope
kids exploring nature

Fire **and Feathers**

Ardross Primary School *River Rangers* recently held a 'Fire and Feathers' dress-up day at their school which raised more than $400 for black cockatoo rehabilitation.

River Rangers Arthur Bradley and Joseph Kelly came up with the idea to raise the money, which went to Kaarakin Black Cockatoo Conservation Centre.

"Everyone should notice and think about black cockatoos or the next generation won't be able to see these beautiful things again," Arthur said.

"Being in a *River Rangers* Cadets Unit helps us to achieve many sustainability goals," Deputy Principal Catherine Bishop said.

"When someone asks our students where they come from they say, 'We're from Ardross Primary – the Environmental School'."

"Being in a River Ranger Cadets Unit helps us to achieve many sustainability goals. When someone asks our students where they come from they say, 'We're from Ardross Primary – The Environmental School'."
Catherine Bishop, Deputy Principal

River Rangers is a primary school cadet program for students in Years 5 and 6 which seeks to engage and educate the next generation of children to help us protect our local rivers. It aims to empower students to make positive change to their local communities and waterways and ultimately, their local river park. *River Rangers* allows students to actively investigate local issues and design, evaluate and share the results of their projects with other schools and the wider community.

Conservation projects undertaken by *River Rangers* include tree planting, litter pick-ups, bird and bat box building, biodiversity surveys, water quality testing and building native gardens.

For more information, visit www.dpaw.wa.gov.au/get-involved/nearer-to-nature/river-rangers

Right Joseph and Arthur with some of their feather collection.
Photo – Parks and Wildlife
Above Carnaby's cockatoo.
Photo – Rick Dawson/Parks and Wildlife

Ranger cadet leaders converge

Bush Rangers and *River Rangers* offer students in Years 5 to 12 the chance to experience nature through fun and educational activities such as camping, hiking, biking or canoeing. Students develop leadership and teamwork skills while contributing to conservation projects.

Bush Rangers is WA's most successful cadets program with more 60 schools participating. The Cadets program is supported by the Department of Local Government and Communities.

For more information, visit www.dpaw.wa.gov.au/get-involved/nearer-to-nature/bush-rangers

Ever wondered what teachers look like when they're pitching a tent blindfolded? This and many other fun and educational activities filled a two-day conference held earlier in the year for 90 *Bush Rangers* and *River Rangers* teachers.

Cadets will benefit from their teachers' experiences and opportunities to share ideas, learn from their colleagues and take part in hands-on workshops and presentations, including a visit from Perth Zoo staff who introduced them to some wildlife, and a workshop on Aboriginal acknowledgement by Parks and Wildlife's Aboriginal Heritage Unit officer Belinda Cox.

Left *Bush Ranger* and *River Ranger* unit leaders put up tents blindfolded – a team-building exercise.
Photo – Parks and Wildlife

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

Western ground parrot *(Pezoporus flaviventris)*

Western ground parrots, also known as Kyloring, are found in only a few pockets on the south coast (see also 'From the ashes: creating a future for western ground parrots' on page 11). One of only five parrots world-wide that nest on the ground, they are a medium-sized parrot characterised by their bright-green feathers with yellow and black flecks, as well as the red band that occurs above their beaks. As their name suggests, they spend much of their time on the ground feeding on seeds, flowers, fruits and leaves and where they also nest during spring.

Illustration by Gooitzen van der Meer

Reference photo by Brent Barret

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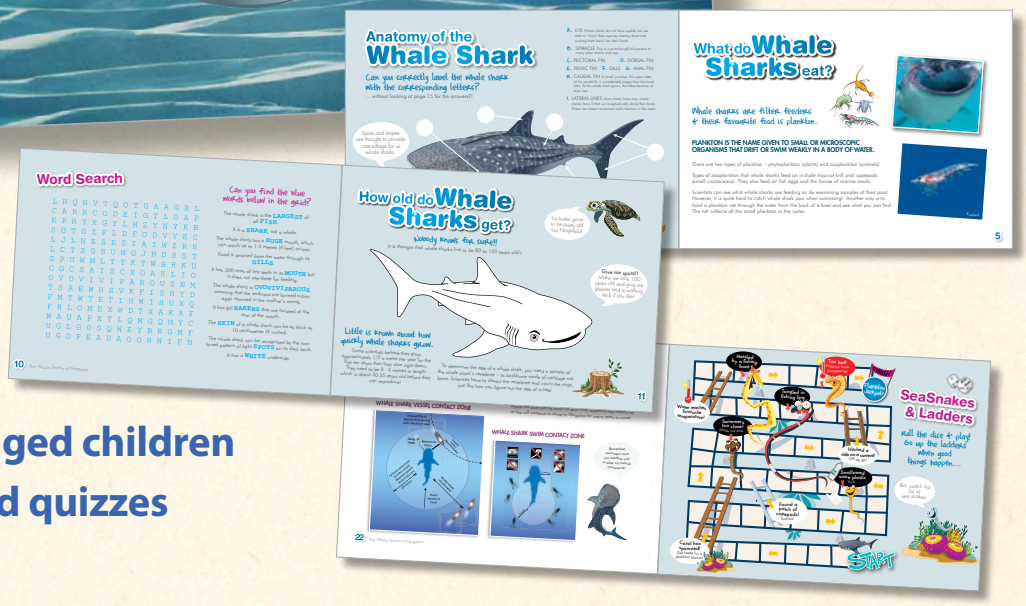

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