

WA's conservation, parks and wildlife magazine

LANDSCOPE

Volume 29 Number 2
SUMMER 2013-14 \$6.95

Kimberley marine life

Race to save western
ground parrot

History of Pelican Point





Douglas Coughran



Joanna Adele

contributors

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Sue Graham-Taylor

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Sarah Comer

Guest columnist

This issue marks the end of an era for *LANDSCOPE*, and heralds exciting times ahead. The magazine started 28 years ago, as the journal of the then just-formed Department of Conservation and Land Management, and has a long tradition of delighting readers with engaging articles about science and conservation throughout beautiful Western Australia. Many talented scientists and researchers have contributed to the magazine, bringing you information about the department's work and the ways science has informed the management of our natural spaces across the state.

This issue is no exception. On page 40, you can find out about work to save the critically endangered western ground parrot on the state's south coast, part of a program to conserve a suite of mammals and birds. This ambitious landscape-scale program builds on the existing *Western Shield* fox baiting program, integrating trials of the feral cat bait Eradicat®, first to Fitzgerald River National Park and then to parts of Cape Arid National Park and Nuytsland Nature Reserve. While there are many challenges ahead, this multifaceted project—which also includes fire management, captive breeding and new monitoring methods—is a great example of the integration of scientific research and management actions.

Also explored in this issue is the somewhat-bizarre observation that a particular introduced plant creates a drug-induced stupor in cats, leading to an investigation into how the plant may be able to assist with cat control efforts (see 'Science, a weed and cat control', page 59). And, in the sheltered estuarine environments of Walpole and Nornalup Inlets Marine Park, research on benthic invertebrate communities may help future management decisions (see 'Cities in the sand', page 16). As the article explains, estuaries are highly susceptible to human impacts, in part because they are usually adjacent to areas of urban development. Changes are often subtle, occurring slowly over time, and in these cases variations in these tiny sediment-dwelling creatures can provide an early warning sign of potential issues requiring early intervention.

Science gives us a critical insight into the complex relationships of the natural environment in our parks and conservation areas, helping us conserve these natural spaces for the benefit of present and future generations. *LANDSCOPE* provides an excellent means of sharing science and conservation knowledge with all of you who share our passion for our parks and wildlife.

Next issue, *LANDSCOPE* will receive a makeover. A new contemporary design and some great new content that will make your magazine even more enjoyable to read. However, each quarterly issue will maintain its focus on scientifically based articles on conservation, parks and wildlife.

In the meantime, I hope you enjoy this issue. The editorial team looks forward to continuing the tradition of striving to entertain, delight and inform readers about parks, wildlife, science and nature conservation well into the future.

Dr Margaret Byrne
Director, Science and Conservation Division
Department of Parks and Wildlife

Letter to the editor

I read with interest the article by Ms Penniford titled 'Saving streams of the south-west forests' in the Spring 2013 issue of *LANDSCOPE*. The author states that remedial action is necessary, by "managing catchments and groundwater to ensure that streams keep flowing" but does not give any examples of how this can be done. For some years, I have been associated with the Water Corporation's Wungong catchment trial. As part of this trial we thinned the 350-hectare Cobiac catchment in summer and autumn 2008, removing an estimated 35 per cent of its capacity to transpire water. Over the next five years we observed rises in the shallow and deeper groundwater levels, as well as increases in soil moisture, in stream-flow and in the number of flow days.

This and other work show the many environmental benefits that could be achieved by reducing the forests' capacity to transpire water excessively. What is required from the forest manager (DPaW) is action to protect these vulnerable ecosystems. Such action is recognised as necessary in the proposed Forest Management Plan. Let's hope, for the sake of the environment, there is the will in the Conservation Commission and in DPaW to carry this out.

Yours sincerely,

Frank Batini

Features



Cover illustration by Gooitzen van der Meer
The tiny and endearing honey possum (*Tarsipes rostratus*) occurs in heath, shrubland and woodland in the state's south-west. About half the size of your average house mouse, honey possums weigh up to 16 grams. The possums use their long snouts and brush-tipped tongues to gather pollen and nectar from flowers. Joeys remain in their mothers' pouch for about nine weeks.
Illustration reference photo by Jiri Lochman

Back cover photo by Jiri Lochman
Karri forest, Shannon National Park

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Prepress and printing Advance Press, Western Australia.

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December 2013

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ISSN 0815-4465

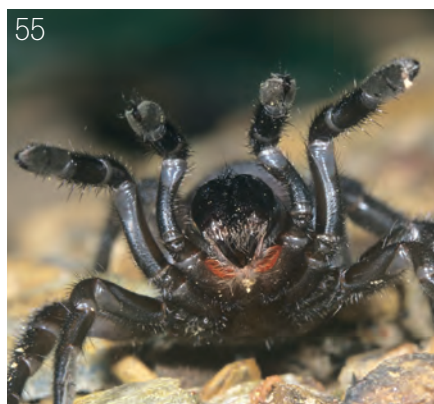
Please do not send unsolicited material, but feel free to contact the editors.

Published by the Department of Parks and Wildlife (DPaW), 17 Dick Perry Avenue, Kensington, Western Australia.

Visit DPaW online at www.dpaw.wa.gov.au.



Department of
Parks and Wildlife





Song of melaleuca

The melaleuca was here long before humans walked on this ancient continent, before Indigenous people stood on its soil, trekked across its plains, hunted in its woodlands, and explored its central deserts.

Being nomadic and expert at living in their environment, Australian Aboriginals quickly discovered the versatility and flexibility of the many different types of melaleuca. They would use its branches to build miamias to shelter from the sun, rain and wind, and its papery outer layers for wrapping food and cooking, plugging holes in canoes, and as clothing for

warmth and to keep out the rain. The flaky layers of melaleuca bark were perfect for soft inner linings for their coolamon cradles, carrying baskets, bandages and sleeping mats.

Aboriginal people also discovered the healing qualities of melaleuca. The leaves were used for medicinal purposes. Chewing the young shoots or young leaves could dull headaches and soothe ailments. The sweet berries and seeds were used as a condiment, and the oils for healing skin complaints. Fishing pots, similar to the craypots used today, were originally designed using melaleuca's thin, flexible branches.

Materials from different parts of the tree were easily accessible, disposable and completely biodegradable.

Names

Melaleuca is a Greek word—*melas* means black and *leukos* means white. In the Nyoongar language melaleuca has various names depending on the variety of plant and include mindiyet, booree and kwytat.

The melaleuca is from the myrtle family. The name myrtle refers to the white, scented flowers and the black berries which, in ancient Greek mythology, were sacred to the goddess



A nature-lover shares her wonder at the melaleuca tree, known for its toughness, medicinal qualities and for the way it 'sings' as wind passes through its needle-thin leaves in what is sometimes referred to as a healing song.

by Jan Ramage

Venus. The tree is sometimes called the paperbark, punk tree, honey myrtle or periwinkle plant.

Melaleuca is endemic to Australia, with more than 200 species of which about 150 can be found throughout Western Australia.

A tree of many uses

Today the melaleuca can be harvested to produce tea tree oil. The name 'tea tree' is taken from the brown colour the tree stains the water. As the melaleuca is often found along water courses, shedding leaves fall into the water below staining the waterways as they die and discolor.

Melaleuca alternifolia is notable for these essential oils. The oils are both anti-fungal and antibiotic, and can be safely used as topical preparations. Indigenous people used the oils for healing and today they are commercially produced for health industries. The terpenes in tea tree oil kill many types of bacteria. Tea tree oil is also used for the treatment of skin ailments such as acne, boils and yeast infections.

The oil is anti-inflammatory and therefore useful for arthritis, bunions and muscle pain. Like the closely related eucalyptus, tea tree oil can also help treat respiratory infections

Above Saltwater paperbarks (*Melaleuca cuticularis*) in Stokes National Park.
Photo – Sallyanne Cousans

when added to the bath or used in a vaporiser. It should never be ingested, however, as it can be highly toxic.

On a less scientific basis, the beautifully mottled grain of larger varieties of melaleuca makes them ideal for wood turning. Melaleuca plants are



Left Rottneest tea-tree (*Melaleuca lanceolata*).
Photo – Len Stewart/Lochman
Transparencies

Centre left *Melaleuca filifolia*.
Photo – Sallyanne Cousans

Bottom left Straw-necked ibis (*Threskiornis spinicollis*) perch on nests built in melaleuca shrubs.
Photo – Simon Cherriman

also perfect for bee keepers. Bees are attracted to the abundance of flowers and the strong scent from the pollen.

Recognising melaleuca

Melaleucas flower from March to July, with some species flowering up to five times a year. Because melaleucas flower at a different time to many other species, they provide food and nectar for native creatures when ‘stores’ may otherwise be scarce. The shape of the flowers often resembles those of a bottlebrush: fluffy and thick, with spikes. They come in a range of colours, from white to shades of red, orange, purple and yellow.

Seed capsules are often crowded together on the twig of a branch. They are broadly cylindrical, thick-walled and woody, and contain many tiny seeds.

Wildlife haven

Melaleuca trees provide a refuge for some of our native wildlife. Their thick bushy growth gives shelter to small birds and native marsupials. On close inspection, intricately built nests can be found nestled between the thin branches. Birds feed on nuts, seeds and the flowers’ sweet nectar. Insects attracted by the melaleuca provide food for many small birds such as miners, weebills, fantails and honeyeaters. Melaleuca wood and flowers both have a strong scent, which attracts a variety of insects that are extremely beneficial for our environment. Many of these insects also pollinate other native plants, as well as some commercial farm crops.

The threatened south-west brush-tailed phascogale (*Phascogale tapoatafa*)





Above Freshwater paperbark (*Melaleuca raphiophylla*).

Photo – Marie Lochman

Right Grey-bellied dunnart (*Sminthopsis griseoventer*).

Below right Freshwater paperbark (*Melaleuca raphiophylla*) has characteristic peeling bark.

Photos – Simon Cherriman



drinks the nectar from melaleuca flowers, and the tiny western pygmy possum (*Cercartetus concinnus*) feeds on their fruit, nectar and pollen. Echidnas (*Tachyglossus aculeatus*) can also be found in melaleuca habitat.

Due to its growth habit, melaleuca stands are often referred to as heaths. In Wheatbelt areas such as around Naremben, melaleuca heaths provide food and shelter for malleefowl (*Leipoa ocellata*). This bird is threatened due to disappearing habitat and the introduction of predators.

Farming our environment

Fragile soils can be held together by the fast-spreading root systems of melaleuca trees, often preventing or alleviating wind-borne soil erosion. The strong and resilient natural qualities of some species enables them to grow close to salt pans. When established in or near ‘saline seeps’, such species can also help lower the water table and slow the spread of salt pans.

Brushwood species of melaleuca are hardy enough to establish themselves

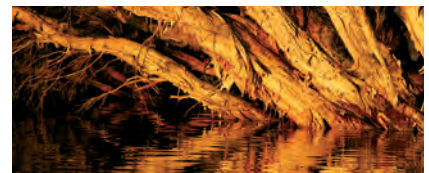
in small cracks in rocky hilltop areas, deep sloping sands and saline margins, as well as clay type soils. Soils can be quite low in many nutrients but still sustain melaleucas.

Melaleuca seedlings even survive in gravel-covered areas and paddocks prone to strong winds. Sometimes when winds pass through the small needle-shaped leaves, the trees appear to be ‘singing’; the beautiful melody is sometimes referred to as a healing song.

A versatile species

Many species of melaleuca trees and shrubs are suitable for planting in modern garden beds. As well as needing less water, they are fast growing and hardy, and attract native birds and insects that thrive on the abundant nectar, seeds, and nutritious soft new shoots. Native birds are always a welcome and beautiful addition to suburbs. Melaleucas are well adapted

to extreme weather conditions and can survive through our hot dry summers with little rain. They come in a wide variety of forms, colours and sizes and suit any garden or purpose.



Jan Ramage is a teacher and author of children’s books. She writes about Australian animals and our natural environment. Jan’s latest book, *Deepsea Whale Rescue*, won the 2013 zoological Whitely Award. Her other book published by the Department of Parks and Wildlife, *Tuart Dwellers*, won the 2009 Environment Award from The Wilderness Society and was also shortlisted for an Eve Pownall Award. She can be contacted by email (ramcom@westnet.com.au).



Pelican Point: a special place

Pelican Point in Crawley has been a treasured gathering place across the ages—for Nyoongar people living and hunting on their traditional lands, for European settlers, for today's local community, for tourists and those pursuing recreational activities, and for migratory birds travelling from far-flung corners of the globe.



by Sue Graham-Taylor

On 27 March 2013, 60 community members gathered on the Swan River foreshore in Crawley to mark the history of this very special place. The occasion chosen by the Swan Estuary Reserves Action Group (SERAG) was the 50th anniversary of a visit by HRH Prince Philip to Pelican Point in 1963.

The Swan River Estuary has changed extensively since European settlement in 1829. Three A-Class nature reserves—Milyu (South Perth), Alfred Cove and Pelican Point—contain most of the remnant salt marsh, sedge banks and fringing forest on the Swan River Estuary and together comprise the Swan Estuary Marine Park. Their sandbanks, mud flats and beaches provide the only remaining significant resting, feeding and nesting areas for birds, both local and migratory, on the estuary. SERAG, a voluntary community group, was formed in 2010 to work to protect these fragile environments.



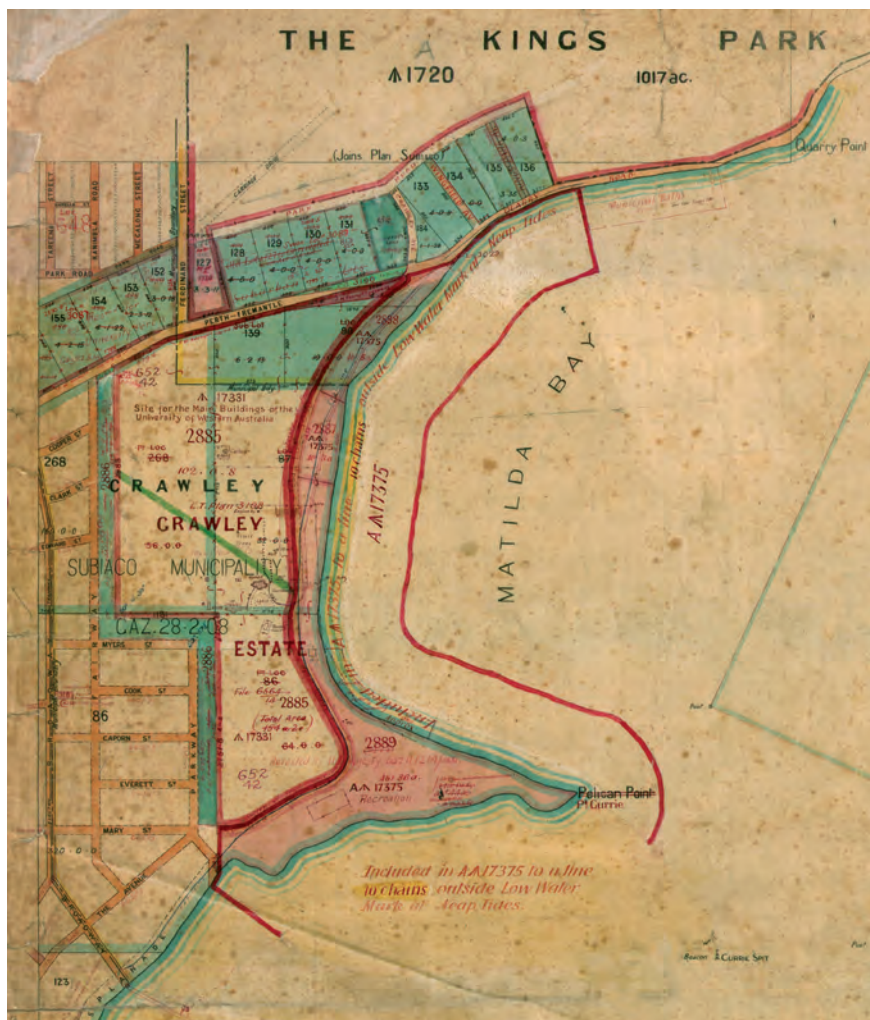
The early days

Pelican Point today remains a vital community asset. The lush country and the waters of the Swan River were home to Nyoongar people for more than 40,000 years before the arrival of Europeans. It was a traditional camping place with freshwater springs and a good source of food. Nyoongar people hunted and fished, moving within their lands according to the six seasons. As part of their spiritual beliefs, they saw themselves as responsible for the protection of the Swan River and its resources.

In 1827 Captain James Stirling and botanist Charles Fraser explored the Swan River to assess its suitability for settlement. Fraser described the abundant fish and the plentiful bird life of the river, commenting on the quantity of black swans, pelicans, ducks, and other aquatic birds. He wrote: “The country from Pelican Point to the entrance of the Moreau [Canning] is diversified into Hill and Dale, magnificently clothed with Trees of the richest green ... To a person accustomed to the Everbrown of the Woods of Port Jackson, the magnificent scene from Pelican Point would be considered a great treat.”

Pelican Point was part of what came to be called Crawley Swamp. The point itself was later called Point Currie after Captain Currie, the first harbourmaster at Fremantle who took up 32 acres (13 hectares) in the district in 1829. The land was acquired by the state in 1910 for recreation purposes.

From the early 1900s the foreshore around Matilda Bay to Pelican Point was a popular picnic spot. In 1920 it became an A-Class Reserve and a government-regulated camping site. Some people stayed for a few nights, others camped for the summer. Horse stalls, tea rooms and shade shelters were built, water was provided and food vendors visited. The many trees around the bay were gradually cut down and used for camp fires, bough shed shelters and cooking the plentiful fish catches. A sleeper track and shell path enabled people to walk to the point. Crawley Reserve was easily accessible by tram from the city and campers were joined by up to 20,000 people on a public holiday such as New Year’s Day.



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Main Little black cormorants (*Phalacrocorax sulcirostris*) at Pelican Point.

Photo – Tim Graham-Taylor

Inset left Aerial view of the Crawley reclamation work, 1930s.

Photo – State Library of WA 022868PD

Inset right Aboriginal camp, circa 1860.

Photo – Freshwater Bay Museum

Left Crawley plan, cancelled 1930.

Photo – SROWA



Above Eradicating mosquitoes along the Swan River with a kerosene knapsack spray.

Photo – *West Australian*, 23 Jan 1928

Above right A camp at Crawley Bay, 1912.

Photo – *State Library of WA 8282B*

Right Birdwatching knoll.

Photo – *Tim Graham-Taylor*



Recreational pursuits in Matilda Bay Reserve

Pelican Point is in Matilda Bay Reserve, an area of grassy parkland covering 20.6 hectares of riverside including a café, restaurant, offices, yacht and rowing clubs, and walk and cycle paths. The reserve is highly popular for recreational pursuits ranging from picnics and barbecues to jogging and cycling, while the waters are popular for sailing, kayaking and windsurfing.

Pelican Point and Crawley Reserve was also a significant flying boat base during World War II.

The winged torment

Mosquitoes were a traditional problem along the shores of the Swan and Canning rivers. Local councils blamed each other for the menace but were loath to work together on a solution. In the 1930s, the government took the lead and declared ‘war’ on mosquitoes. Pelican Point was affected, with the Subiaco Council’s chief health inspector declaring in 1934 that “enough mosquitoes are being bred there to torment the whole of the metropolitan area”. *The Sunday Times* proclaimed “Crawley visitors have come to the conclusion that the mosquitoes bred down there are the Amazons of the tribe”.

In the same year the commissioner for public health sent a circular to local governments suggesting that they stock swamps with small mosquito-larva-



eating fish called *Gambusia* to eradicate the mosquito problem. Kerosene was sprayed in vast quantities and *Gambusia* were introduced in their thousands. However, the ‘improvement’ of the area by dredging and reclamation of the samphire marshes was seen as the long-term solution. The Crawley Swamp or ‘quagmire’ with its extensive undergrowth was seen as a particular problem. In March 1936 the dredge

Stirling was called in and about 40 acres (16 hectares) of low-lying land to the west of Crawley Swamp were reclaimed.

A bird haven

In early 1936, the state branch of the Australasian Ornithologists’ Union called for a sanctuary at Pelican Point for rare migratory birds. It was claimed that the area “already formed



Above Red-kneed dotterel (*Erythrogonys cinctus*), Pelican Point.

Photo – Tim Graham-Taylor

Volunteers in action

The Swan Estuary Reserves Action Group (SERAG) was formed in 2010 to protect and restore the ecological health of the three Swan River Estuary reserves: Alfred Cove, Milyu and Pelican Point, which together form Swan Estuary Marine Park. Members of SERAG work closely with management authorities including the Department of Parks and Wildlife. Volunteers give their time and expertise for the benefit of native fauna and to ensure that these special places will survive for future generations. For more information visit the website www.swanestuaryreserves.org.au.

an attractive feeding ground for thousands of migrants, including many rare species”. The chairman of the State Gardens Board promised that if bird life was affected by the reclamation at Crawley Swamp, he would “certainly see to it” that a sanctuary was provided. He was forced to keep his promise. In late 1936 the end of the sand spit at Pelican Point was declared a bird sanctuary and the public was urged not to use this area and to keep their dogs away.

In 1938, naturalist Dom Serventy deplored the changes taking place around the Swan River. He described Pelican Point as “a noted haunt of waterbirds” and stated that such havens were “rapidly diminishing”. He claimed that the filling of a large part of the shallows bordering the marshes had impacted on bird life: “Although there is still an extensive shallow water area alongside the end of the sandspit ... the complete destruction of the samphire has left the birds no shelter, whilst the greater accessibility of the area to the public has resulted in many of the more shy birds either forsaking

the place entirely or becoming much scarcer than they were previously.”

Ten years later, Serventy commented that with the re-establishment of samphire marsh and tidal shallows the area “was reverting to the old conditions”. However, he added that “although waders and other waterbirds continue to frequent the locality, they apparently find it less attractive, and their numbers are decidedly fewer than before reclamation”.

Long-time birdwatcher and local resident Judy Moyes reflected on birdwatching at Pelican Point from the 1960s: “When you went down in mid season, the little migratory waders came in a mob—and when they turned it was like a sheet of silver—hundreds of them. A breathtaking sight!”

Pelican Point remained a haven for many thousands of birds, particularly wading birds. Birdwatchers from other Australian states and from overseas visited and envied their Western Australian colleagues. A Western Australian Naturalists’ Club excursion to the site in April 1939 recorded more

than 2,000 birds including 40 or 50 pelicans. Serventy identified more than 60 different species of both permanent and migratory birds in the sanctuary.

In 1962 landscape architect John Oldham prepared the Pelican Point Landscape Scheme. An essential part of the scheme, along with tree planting, was a ‘birdwatching knoll.’ This feature was supported by the then Tourist Development Authority, which saw the area becoming a key point on the tourist coach agenda—a place to see wading and migratory birds. In September 1962 a large mound of sand was constructed at the site and faced with limestone. A concrete cap was poured and a fence was erected in 1964 to protect the bird sanctuary.

A royal visitor

At 6am on 27 March 1963, HRH Prince Philip quietly left the royal yacht *Britannia* at Fremantle for a private visit to Pelican Point. An avid birdwatcher, he had been told that this site was the best spot for watching waders and other aquatic birds. For more than two hours he explored the area, taking photos and noting the birds he saw.

His list included Caspian terns, bar-tailed godwits, grey plovers, white-faced herons, many silver



Above A photo of birds at Pelican Point taken by avid birdwatcher the Duke of Edinburgh Prince Philip during a visit in 1963.

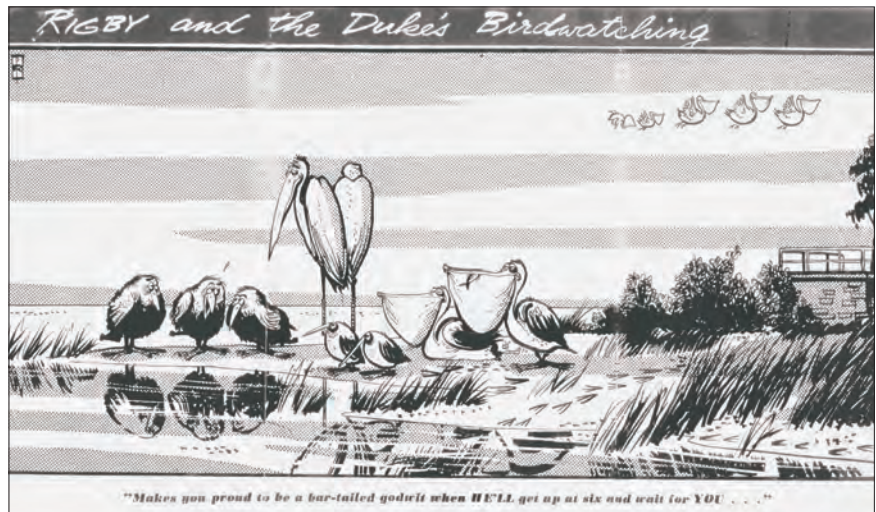
Photo – Buckingham Palace

Above right A cartoon from the *Daily News* commemorates the Duke's visit.

Illustration – Peter Rigby, Rigby Transmedia

Right Red-necked stints.

Photo – Tim Graham-Taylor



gulls and four of the five species of Australian cormorants feeding in the shallows. Greatly impressed, Prince Philip commented that he hoped that this and other suitable sites would be “preserved as permanent bird sanctuaries.” A plaque now marks his visit.

Fifty years later, SERAG wrote to Buckingham Palace to see if the Duke’s photographs still existed. The Duke of Edinburgh’s archivist replied and sent a number of photographs and a copy of the Paul Rigby cartoon reproduced here.

Since the Duke’s visit in 1963 bird numbers have generally declined. Weekly surveys since 1971 record fewer migratory waders at Pelican Point, indicating problems both outside and within Australia. Local wader numbers have changed little but non-waders—the great cormorant, grey teal, Caspian and crested terns—have declined. As our city grows and further developments take place around the river, areas such as Pelican Point become even more significant.

Our welcome visitors

It is early September 2013 and the little red-necked stint (*Calidris ruficollis*) has arrived at Pelican Point on the Swan River after a journey of about 25,000 kilometres from Siberia and western Alaska. It breeds in the northern summer and feeds in the southern summer when the north is frozen. It will stay until early March or April when it returns to Siberia to breed.

The tiny bird is a migratory wader measuring an average 14 centimetres and weighing about 25 grams. It forages in wet saltmarshes and intertidal mudflats, eating insects and small invertebrates both en-route and while it is here.

Numbers have decreased over recent years so it is all the more important to protect and treasure those areas such as Pelican Point that provide their essential habitat.

Dr Sue Graham-Taylor works as a professional historian and curator. She has researched and written on diverse aspects of Western Australian social, economic and environmental history. Sue has a particular interest in the history of the Swan and Canning rivers. She can be contacted by email (suegrahamtaylor@gmail.com).

Cities in the sand:

benthic invertebrates
of Walpole and
Nornalup Inlets
Marine Park





The estuaries of south-western Australia are unique aquatic environments that lie between the land and the sea. Geologically recent and highly dynamic, they change with the seasons as sandbars form and erode and freshwater from rivers mixes with seawater. Sheltered from Western Australia's rugged south coast, the estuarine Walpole and Nornalup Inlets Marine Park is a spectacular wildlife haven, where visitors can experience the wilderness, go birdwatching or fish for black bream. Department of Parks and Wildlife marine scientists and park managers have now begun studying the often-tiny creatures that inhabit the sediments of the inlets. Although rarely seen, this prolific invertebrate community forms an important part of the biodiversity and ecology of the marine park, and may even act as a sentinel that can warn of environmental change.

by Alan Kendrick, Michael Rule and John Huisman

Few visitors walking along the shore or boating in the Walpole and Nornalup inlets would pay much attention to the expanse of sand and oozing black mud that makes up the seabed of the marine park. This is understandable; after all, what could possibly be interesting about sand and mud? Taking a closer look, however, reveals that these seemingly barren sediments actually provide habitat for a largely hidden invertebrate community that represents a significant proportion of the biodiversity of the inlets. Often tiny and rarely seen, these animals are ecologically important, as they process nutrients and provide a vital food source for larger animals such as fish and birds. For these reasons, benthic (bottom-dwelling) invertebrates are recognised as a key value of the marine park, and ensuring this community remains healthy is an important aim of environmental management.



Department of Parks and Wildlife (DPaW) scientists are now undertaking a detailed study of how benthic invertebrates are distributed within the inlets and how this community varies over time, particularly in relation to the seasonal environmental changes that typically occur there. In each season over the past three years, numerous samples of sediment containing invertebrates were collected around the inlets, using a core sampler in shallow water and a grab sampler in deeper basins. The core sampler is a wide cylinder that is pushed into the substratum to extract a core, while the steel-jawed grab sampler is lowered to the seabed on a rope and takes a 'bite' of the seabed when triggered from above. Many hours were then spent in the laboratory, sorting the tiny animals from the sediment and identifying them. This research has



provided DPaW scientists with a new understanding of how these animals use the inlets, and builds upon earlier work undertaken by Western Australia's pioneering estuary researchers such as the late Ernest Hodgkin.

Unique estuarine environment

Estuaries are typically highly variable environments that form where a river meets the sea and creates a brackish water body. The environment that exists within an individual estuary depends on various factors, such as the underlying geology and climate of the region, and the tides and waves of the adjacent ocean. Estuarine water is typically marine-like in the lower reaches and becomes increasingly fresh as you move away from the ocean. These gradients, however, can change dramatically if large volumes of freshwater enter the estuary from surrounding catchments, or if they undergo extended periods without rain. In the absence of freshwater flows, many estuaries on exposed coasts are periodically closed from the sea by sandbars formed by wave action. These closures can lead to hypersaline conditions forming in the estuary until rainfall or human intervention again enables a connection to the sea. While providing attractive sheltered

Previous page

Main Walpole and Nornalup Inlets Marine Park.

Photo – Brett Dennis/Lochman Transparencies

Below 'Grab' sampling in deeper waters in the marine park.

Photo – Michael Rule/DPaW





Above Vegetation meets the water at Walpole and Nornalup Inlets Marine Park.
 Photo – Michael Rule/DPaW

Right Conducting research in the marine park.
 Photo – Alan Kendrick/DPaW

habitats for many organisms, few aquatic species can consistently tolerate the environmental gradients and seasonal changes that typically occur in estuaries. Mobile species often move in and out of the systems as conditions change, while fast-growing sedentary species may die and only re-colonise the estuary when suitable conditions return. For this reason, estuaries are typically dominated by high numbers of relatively few species compared to the adjacent ocean.

The Walpole and Nornalup inlets differ from most estuaries in Australia's south-west because they are not closed by a seasonal wave-formed sandbar and are therefore permanently open to the sea. This is probably due to the high rainfall in this part of WA and the presence of a large rocky headland adjacent to the ocean entrance that limits the influence



of waves on the inlet entrance. The estuary comprises two connected basin inlets—the smaller Walpole and the larger Nornalup, which is connected to the sea by a narrow channel. The Frankland and Deep rivers discharge into the Nornalup Inlet, while the smaller Walpole River flows into the Walpole Inlet. The bottom of the shallow Walpole Inlet and the deeper basin of the Nornalup Inlet consist

of fine, organically rich black silt that has accumulated in the inlets over many centuries. In stark contrast, the entrance channel and the large, shallow margins of the Nornalup Inlet consist of clean white sands. This study has found that, like many other estuaries, the benthic invertebrate community of the Walpole and Nornalup inlets is dominated by molluscs, crustaceans and polychaete worms.



Left Sandy Beach, Nornalup Inlet.
 Photo – Len Stewart/Lochman
 Transparencies

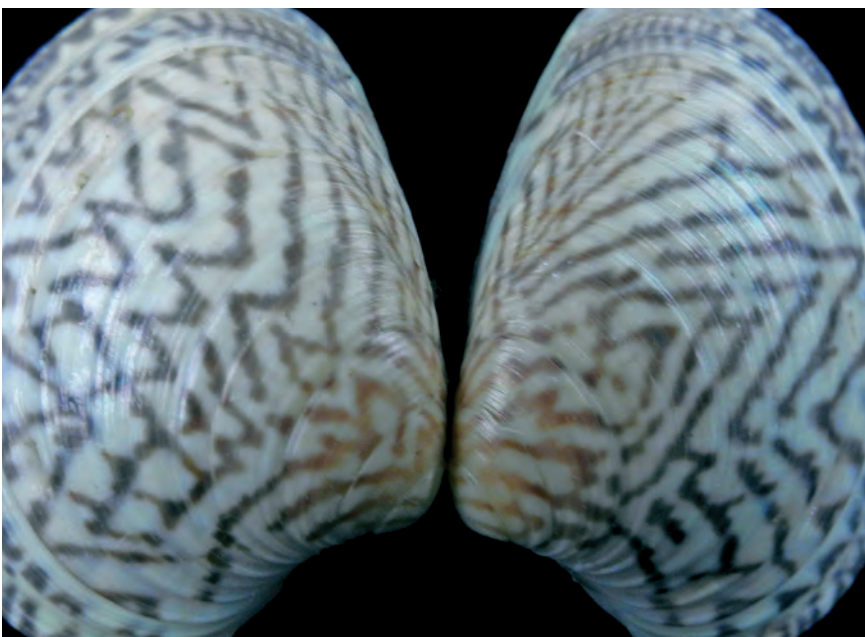
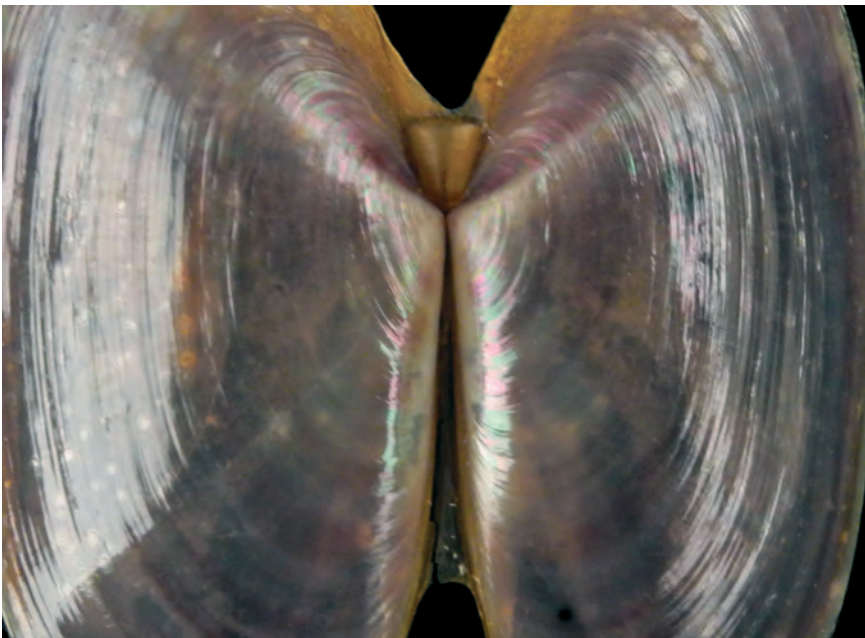
Centre left The bivalve *Soletellina alba*.

Bottom left The bivalve *Katelysia scalarina*.
 Photos – John Huisman/DPaW

Molluscs

More than 20 species of molluscs were found in the inlets during this study, the most abundant of which were bivalves that burrow into the soft sand or mud sediments. Here they remain hidden from predators, often feeding on organic detritus drawn into an inconspicuous siphon that protrudes up into the water column. The most common of these was the four to five centimetre long sunset shell (*Soletellina alba*), so named because of the pale ray-like stripes on the shell. While *S. alba* was commonly found burrowing into the clean shallow sands around the Nornalup Inlet and in the entrance channel, other relatively common bivalve species occupied different habitats. The round white lucinid bivalve *Wallucina assimilis* was mostly found buried among the rhizomes of the ephemeral seagrass *Zostera polychlamys* in or near the entrance channel, while the translucent and fragile *Theora lubrica* was found only in the silty mud of the deeper inlet basin. Originally confined to shallow muddy habitats across eastern Asia, *Theora* is thought to have reached Australia and other locations around the world in ballast water or on fouled vessel hulls.

More visible than the burrowing bivalves and quite common in the inlets is the dog whelk *Nassarius burchardi*, which grows to about one centimetre long and lives on the sand surface. These scavengers can often be seen aggregating near potential food such as dead fish. A more unusual mollusc is the sea slug *Philine angasi*, which is five to six centimetres long with pale fleshy lobes on its body and a delicate internal shell that is not visible. *Philine* was most common in the deeper silty habitats of the inlets, where it preys on other molluscs.



Right Blue swimmer crab.
Photo – Alex Steffe/Lochman
Transparencies

Below right A polychaete worm.
Photo – John Huisman/DPaW

Crustaceans

While the large blue swimmer crab (*Portunus pelagicus*) may be the most visible crustacean in the inlets, by far the most common are tiny species such as amphipods, isopods, copepods and mysids that rarely exceed five millimetres in length. What they lack in size, these tiny crustaceans make up in numbers and they can occur in very high densities in some habitats. Benthic-dwelling species, such as the common estuarine amphipods *Melita* and *Corophium*, anthurid isopods and harpacticoid copepods, may live in sediments or among the shelter provided by algae fronds or seagrass leaves. Other small crustaceans, such as the shrimp-like mysids, swarm in the water just above the seabed.

Polychaete worms

Polychaetes are very diverse and often highly specialised worms that can inhabit estuarine and marine sediments in very high numbers. Although related to humble terrestrial earthworms, the segmented bodies of polychaetes can be elaborately adorned with bristles, tentacles and lobe-like appendages called parapodia. Polychaetes can be either errant (free moving) or sedentary, in which case they often live within a secreted tube buried in the sediment. Some polychaetes are predatory carnivores with powerful jaws, while others digest organic material from ingested mud and sand, or filter organic particles from the water with complex frond-like mouthparts.

The two most abundant polychaete worms in the Walpole and Nornalup inlets are relatively nondescript species that are common in estuarine sediments. The earthworm-like capitellid *Heteromastus* is most abundant in the organically enriched muddy basins,



while the orbiniid *Scoloplos normalis* is more commonly associated with sandy sediments. Other polychaetes that occur in sandy habitats of the inlets are the opheliid *Armandia*, the spionid *Pseudopolydora kemp* and the nereidid *Simplisetia aequisetis*, which was particularly common at some locations within the Walpole Inlet.

More unusual residents

Less common members of the benthic invertebrate community of the inlets include sediment-dwelling worms with evocatively descriptive names

such as peanut worms (sipunculids), ribbon worms (nemertean), round worms (nematodes) and flatworms (platyhelminths). These small worms are not segmented like polychaetes, and some have an amorphous, blob-like appearance. Interestingly, some insect larvae also occur in the inlet waters, and the most abundant of these are chironomid midges, which can be common among algae and seagrass. As adults, these midges swarm near the water and lay their eggs on vegetation at the water surface.



Above Tranquil scenes in Walpole and Nornalup Inlets Marine Park.
Photo – Michael Rule/DPaW



Far left An amphipod.
Photo – John Huisman/DPaW



Left King George whiting.
Photo – Eva Boogaard/Lochman
Transparencies

Research informs management

This study has markedly increased knowledge of the benthic invertebrate community in the marine park. While dominated by about 20 very abundant species, more than 100 different invertebrate species have been identified so far. This is a higher diversity than had previously been recorded in the inlets, which may simply reflect the fact that more sampling was conducted in this study. The large number of invertebrate species in the inlets is probably due to the strong marine influence caused by the permanently open entrance to the sea. This oceanic influence may also explain why some species that are common in nearby estuaries, such as the small bivalve *Arthritica semen*, appear to be far less abundant in this estuary.

Understanding the ecological significance of this community is

just as important as documenting its composition. Many small invertebrates feed on organic material derived from decomposing algae, seagrass and other animals, which they collect by foraging within the sediment, on the seabed, or by filtering particles of food from the water. In this manner, small invertebrates recycle nutrients before they, in turn, become prey for the larger animals that inhabit the estuary. Benthic invertebrates are an important food source for many fish that inhabit the inlets, such as black bream (*Acanthopagrus butcheri*) and King George whiting (*Sillaginodes punctata*). Many fish begin eating small prey, such as amphipods and polychaetes, when they are juveniles, before progressing to larger prey items such as bivalves and shrimps as they grow. The numerous stingrays that live in the Walpole and Nornalup inlets

leave characteristic circular pits in the sediment where they have foraged for benthic invertebrates. At low tide, pied oystercatchers (*Haematopus longirostris*) can be seen on exposed sand banks using their long beaks to probe for bivalves.

Importantly for management, benthic invertebrate communities can be sensitive indicators of environmental change. As outlined above, estuaries vary naturally, and part of this research has been devoted to identifying how these invertebrates respond to the changes in salinity and temperature that may occur seasonally, depending on when river flow is greatest. Understanding such natural variation is important in relation to recognising possible additional changes caused by human impacts. Estuaries are extremely susceptible to human impacts, such as pollution and elevated nutrient levels,

Right Pelicans in Walpole and Nornalup Inlets Marine Park.
Photo – Michael Rule/DPaW

Centre right Pied oystercatcher.
Photo – Alan Kendrick/DPaW

Bottom right Walpole and Nornalup Inlets Marine Park is known for its scenic beauty.
Photo – Michael Rule/DPaW

because they are often a focus for urban development and are influenced by run-off from surrounding catchments. While some of WA's temperate estuaries exhibit obvious impacts of this kind, such changes can also be quite subtle and occur slowly over time. In these instances, variations in the benthic invertebrate community can alert managers that changes are taking place. For example, some species, such as the capitellid polychaete *Capitella capitata*, respond quickly to nutrient enrichment and can be very abundant in eutrophic (nutrient-rich) environments.

Following this research, DPaW scientists and local marine park staff will implement a long-term program to periodically monitor benthic invertebrates and other key values of the marine park. It is anticipated that community volunteers will have the opportunity to take part in this work. This monitoring will enable managers to assess the condition of the marine park and the way it varies over time, to determine if changes need to be made in how the park is managed. The Walpole and Nornalup inlets comprise one of south-west WA's most intact estuarine systems, and their high ecological and social values led to the estuary becoming a marine park in 2009. This and other research being undertaken by DPaW marine scientists and management staff is helping to better understand the hidden occupants of the inlets' cities in the sand. Research and monitoring play a key role in building our understanding of the ecology of WA's diverse system of marine parks and reserves, and ensures that management continues to be guided by sound scientific knowledge.

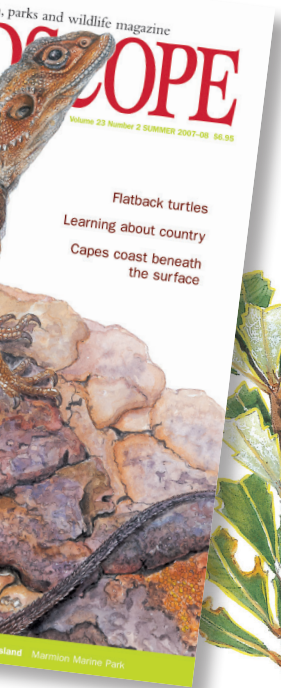


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Michael Rule is a research scientist in DPaW's Marine Science Program. He can be contacted on (08) 9219 9800 or by email (michael.rule@dpaw.wa.gov.au).

John Huisman is the author of *Marine Plants of Australia* and is an algal taxonomist at the WA Herbarium and research fellow at Murdoch University. He can be contacted by email (john.huisman@dpaw.wa.gov.au).





LANDSCOPE

through the years

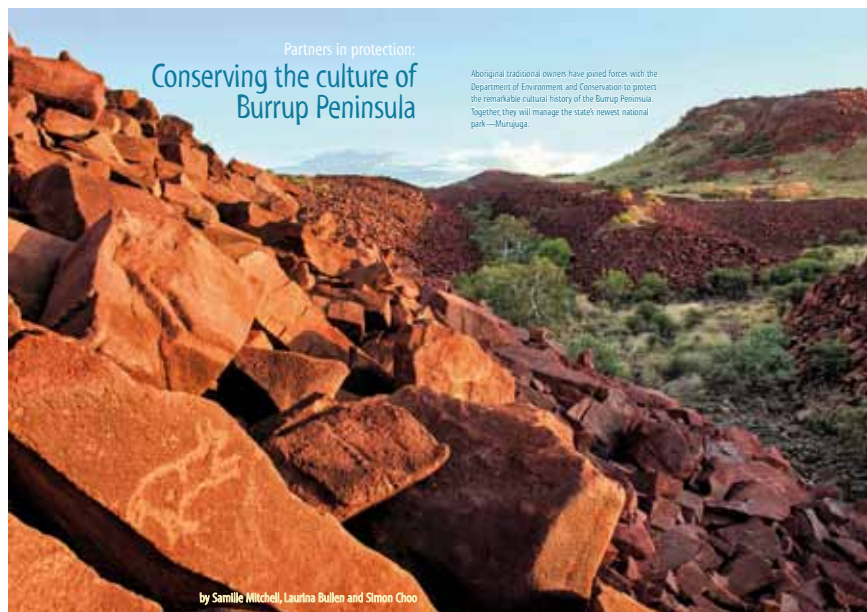
In anticipation of the exciting redesign planned for *LANDSCOPE*, we take a look back into the magazine's history.

by Joanna Adele

LANDSCOPE magazine was launched in June 1985 as the journal of the Western Australian Department of Conservation and Land Management (CALM). Over the past 28 years it has documented and celebrated the natural spaces of this amazing state, and the diverse and significant flora, fauna and landscapes found here. It has delighted and informed thousands of readers, many of whom have been subscribing for numerous years. Production of the magazine has been passed through several departments as they have changed through the years—from CALM to the Department of Environment and Conservation (DEC) in 2006 to the newly formed Department of Parks and Wildlife (DPaW) established in July 2013.

Readers of *LANDSCOPE* have a deep interest in the natural environment and, while often well-informed and interested in science, do not necessarily have a scientific background. Therefore the magazine is more than a scientific journal—it aims to provide information about scientific research, conservation activities and recreation opportunities to a wider audience, and present this information in an engaging way, accompanied by stunning photography.

Most articles in *LANDSCOPE* are contributed by departmental staff—scientists, technical officers and a range of other employees, right up to the head of the agency—and there are also articles from members of associated



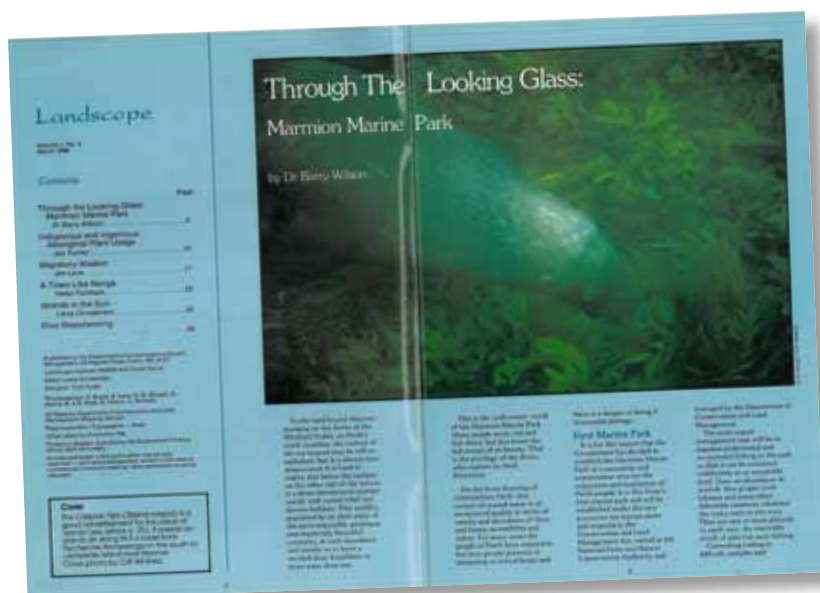
organisations and institutions including universities, volunteer and not-for-profit environmental groups, and freelance writers. The richness of the magazine's content is a reflection of the many talented contributing authors.

Landscape is renowned for its photography, and has drawn on the work of many exceptional Western Australian photographers over the years. Contributing authors often have excellent photography skills as well, providing shots of rarely visited places or unusual or interesting species they study. Their photos, beautifully presented by the magazine's graphic design team, have become a hallmark of the magazine.

Looking back

Flicking through the 1985 launch edition—which included an article about Lane Poole Jarrah Reserve (now Lane Poole Reserve) and a photographic essay on Hamersley Range National Park (now Karijini National Park)—it's amazing to see how much has changed, but also how things have remained the same. Throughout the past three decades *LANDSCOPE*'s aim has always been to educate and inspire our readers about the natural environment.

The creation of the state's first marine park, Marmion, was celebrated by the magazine in March 1986, in a feature article about the natural values and challenges in managing these popular waters just off Perth,



Previous page

Main A collection of *LANDSCOPE* covers over time, illustrated by Philippa Nikulinsky, Ian Dickinson, Martin Thompson and Gooitzen van der Meer. **Inset illustration** Front cover illustration of cut-leaf banksia, *LANDSCOPE* Autumn 2009.

Illustration – Philippa Nikulinsky

Above The Winter 2013 issue describes the state's 100th national park, Murujuga.

Left This article from March 1986, in the fourth issue of *LANDSCOPE*, discusses the first Western Australian marine park, Marmion.

Fast forward 27 years to 2013, and the magazine is featuring Murujuga National Park, the state's 100th national park, which will be managed with the traditional owners.

The 1986 winter edition also saw the first article authored by Keiran McNamara, at the time director of Nature Conservation and later CALM's executive director and DEC's director general. This article, was entitled 'Managing kangaroos—striking a balance'. Keiran also wrote a feature about the highly successful rescue of killer whales at Augusta in July 1986, which ran in the issue released in Summer 1986–87.

The first 'Urban antics' graced *LANDSCOPE*'s pages in the same summer edition. While this piece was not written by John Hunter, he quickly took the reins—his first 'antics' ran in the Summer 1988–89 issue, entitled 'Reptilian escapades', and he's done every one since. His entertaining and engaging colloquial 'stories of an urban naturalist' quickly became popular. As a kid, my reading of *LANDSCOPE* was focused almost entirely on that back inside story. I loved the tree-climbing adventures, backyard discoveries and short, interesting facts.

The magazine has frequently explored the topic of land management planning. For example, in the Winter 1987 issue, then executive director Syd Shea and general manager Roger Underwood wrote about the management plans that would take the south-west environment into the 21st century in their article 'Blueprints for the future'. The article discussed the challenges facing the then new CALM, and its commitment to 'the progressive philosophy of public participation in land management'.



Above right *LANDSCOPE* cover illustration of a prickly honey-suckle from Spring 2010. Illustration – Philippa Nikulinsky

Behind the scenes

Paradoxically, a magazine ages by not changing. What once may have been fresh, exhilarating and delightful 10 years ago can seem dated today.

During my association with *LANDSCOPE* we gave the magazine a major cover-to-cover examination and rethink in the early 1990s and again in 2003. Our aim was to try and keep it a 'must read' concerning conservation, parks and wildlife in Western Australia.

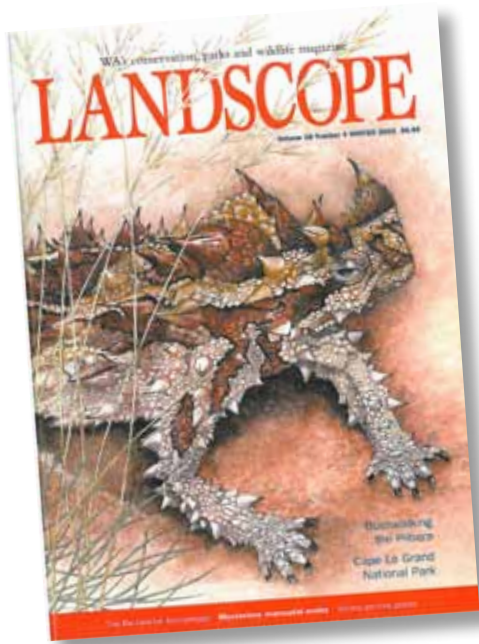
The magazine developed a reputation for excellence in nature and science journalism, photography and graphic design and it was great fun and hugely rewarding to be associated with that.

The broad goal of *LANDSCOPE* since its inception has been to increase community awareness, understanding and support for Western Australia's nature conservation and land and marine management programs, and to promote wider community involvement in the prevention and solution of problems in our natural environment.

We tried to accomplish this by having each edition of the magazine bring readers fresh perspectives on WA and fascinating insights into our native plants, animals, and special places. With easy-to-read articles that are scientifically accurate, and accompanied by stunning pictures, *LANDSCOPE* has aimed to not only inform and educate, but also to delight.

A significant feature of *LANDSCOPE* over the years, and a highlight for me, was the botanical and wildlife art of Philippa Nikulinsky that appeared on many covers of the magazine. Philippa is one of the most celebrated botanical artists in Australia, and her particular specialty is recording the phenomenal natural resource of wildflowers found in WA.

Contributed by former director of Strategic Development and Corporate Affairs, and long-time the department's LANDSCOPE executive editor, Ron Kawailak.



Above LANDSCOPE cover Winter 2003.
Illustration – Philippa Nikulinsky

In the Winter 1993 edition, Syd joined forces with the manager of CALM's Policy and Extension Branch Jim Sharp, now DPaW's acting director general, to author the article 'Our natural advantage'. This piece explored the significant nature-based tourism opportunities available in Western Australia. Over the years, many departmental staff contributed to the magazine, both as authors and in scientific and technical review—a significant commitment of time and expertise.

A new look in 2003

The magazine was redesigned in 2003, launching a number of new features with which you've become familiar, including 'Bookmarks', mini feature articles (which replaced 'Bush Telegraph'), a contributors' page and the double-page 'Feature park'. Then Executive Editor Ron Kawalilak—who took responsibility for the magazine in November 1989 and helped guide it for 22 years—admitted in his opening editor's letter to be delighted and nervous upon inviting readers to explore the new-look format.

Filling a niche

As well as informing the public about the work the department does, *LANDSCOPE* has played an important role in showcasing the efforts of conservationists, naturalists, scientists, historians and volunteers. Many of these people really value the opportunity to get their message heard. The magazine fills a niche, and there's nothing else like it.

Many scientists credit the magazine with increasing the profile of their research programs and the causes they champion, possibly leading to increased support from community groups and other agencies. Principal research scientist Tony Friend—who co-authored an article about numbats for the second issue of the magazine, in September 1985, and has penned many since—says the magazine has certainly been a great way for him to acknowledge the support of community groups. He says it's been a good medium for communicating his research, particularly as the magazine's style enables a more anecdotal approach than traditional 'heavy' science publications, which are less accessible to most people. This is supported by the fact that *LANDSCOPE* is very visual, featuring high quality photography, broadening its appeal.

One of *LANDSCOPE*'s scientific checkers senior principal research scientist Keith Morris, said articles in the magazine played an important role in promoting outcomes of research and raising awareness about conservation issues.

Senior research scientist Anne Cochrane contributed her first article to *LANDSCOPE* in 1995 and has

authored or co-authored many articles since—about high priority conservation areas, flora translocation programs, and the collection and storage of seeds as an insurance policy for rare and vulnerable species. Anne says she's enjoyed writing for the magazine, and getting conservation messages to readers subscribers and also to people within the department. Particularly pleasing, Anne says, have been responses from the public—she's received some delightful letters and emails, often from people who are keen to get involved and support a conservation cause, such as offering their property as the site for a translocation project.

For some contributors, an article published in *LANDSCOPE* was their first ever in print, or the first to appear in a 'real' magazine. The magazine has also provided the opportunity for a number of work experience or professional placement students from universities to have their work published. Many will testify to that particular buzz that comes from seeing one's name in print.

LANDSCOPE into the future

The magazine's Autumn 2014 issue will see a new contemporary design, with some great additional content. The focus on scientifically accurate articles will remain, with continued focus on animals, plants, ecosystems, environmental science and nature conservation and the people who make it all happen. This will be coupled with new features on exploring ways you can enjoy spending time in national parks and marine parks, encouraging you to get out and experience nature. We look forward to you joining us on the continuing journey.

Joanna Adele was a Department of Parks and Wildlife publishing officer and *LANDSCOPE* editor at the time of writing this article.

The department would like to acknowledge the many people who have made LANDSCOPE magazine possible, from contributors, photographers, editors and graphic designers, to the scientific and technical advice panel, print houses, and sales and distribution team. Most importantly, the department would like to thank the magazine's readers and subscribers, long-term and new, for their support. As a thank you, a special 20 per cent discount on all WA Naturally publications is available to existing subscribers. Check out the inside back cover to view a selection, or visit the department's online shop at shop.dpaw.wa.gov.au to view the entire range.



Shannon National Park

Part of the Walpole Wilderness, this beautiful national park is a great spot to camp, experience nature and learn about the history of the south-west.

Above Karri forest.

Above right top Honey possums live in Shannon National Park.

Photos – Marie Lochman/Lochman Transparencies

Above right The South West Highway travels through Shannon National Park.
Photo – Cliff Winfield

Far right Western grey kangaroos are among the most commonly sighted animals in the park.
Photo – Jiri Lochman

Located in the midst of karri country between Manjimup and Walpole, Shannon National Park was once the site of a timber mill and forestry settlement. Today it is an important conservation reserve known for its natural, Indigenous and recreational values such as bushwalking and camping.

History

Aboriginal people have a significant connection to all the land in and around what is now Shannon National Park, with Shannon River being a significant feature. During their travels from inland to the coast in the warmer seasons, Aboriginal people used the river to source food and as a place of shelter.

In the 1940s, the area was the location of a small but vibrant settlement known as Shannon, established by the Forests Department in response to a timber shortage after World War II. Shannon had a number of facilities including 90 houses, a sawmill, forestry headquarters, hall, church, golf course and oval. In 1968

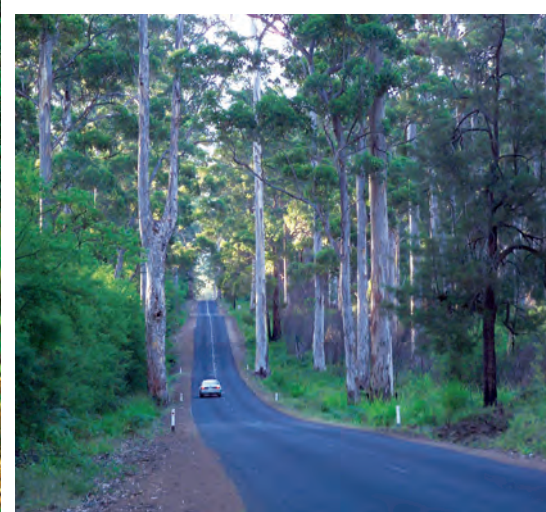
the mill closed, and in the coming years the settlement's buildings were dismantled and removed.

In the early 1980s, the government announced the creation of the national park. Logging in the proposed park ceased immediately, and planning and construction of visitor facilities began. Shannon National Park was formally proclaimed in December 1988.

The site of the former settlement, located just south of South Western Highway, is now a campground for park visitors. A number of reminders about the area's past can be found there, such as fruit trees and signs featuring historical photos, as well as building foundations that have proved useful for campers with caravans. Old tramways and railway lines have been transformed into walk trails.

Visiting the park

It is not difficult to see why Shannon National Park is so popular with visitors. The 80-metre-tall karri trees with their straight, smooth trunks, interspersed with jarrah, marri,

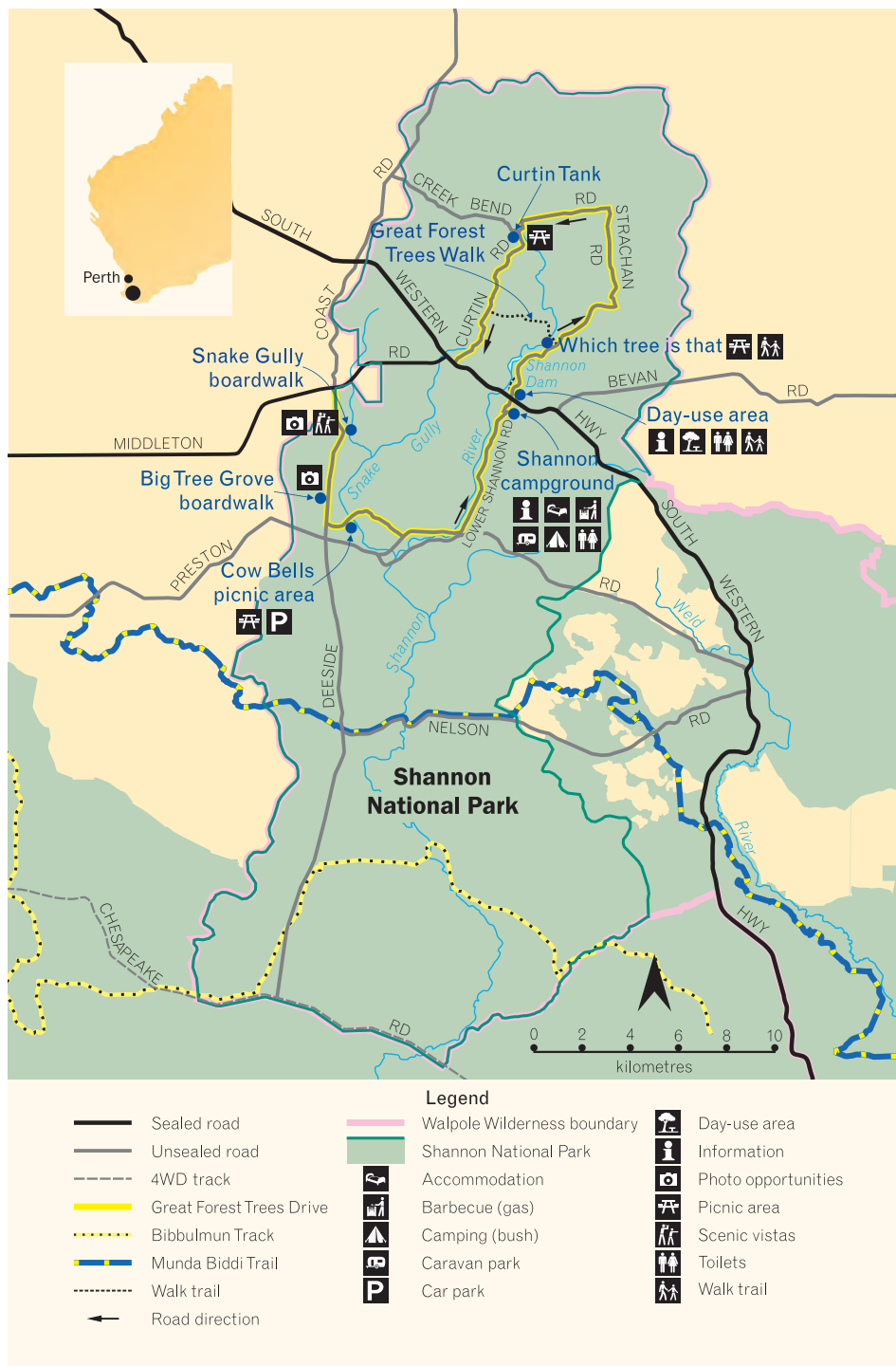


bullich and blackbutt trees, make for an impressive and tranquil nature-appreciation experience. In addition, the park's high-quality camping facilities and easy accessibility via South Western Highway make it an ideal spot for a weekend getaway or day visit.

Shannon campground has 23 single and group camp sites. Two rustic weatherboard huts remain from when the Bibbulmun Track ran through this section of the park and can be used as accommodation. The nearby Shannon Lodge is also available for visitors to hire, sleeping up to six people. Shannon National Park is one of the few parks in the state that offers showers with hot running water—a drawcard for many campers.

One of the park's most-used features is the 48-kilometre scenic Great Forest Trees Drive, which winds its way through towering karri trees, with opportunities to stop at picnic areas and lookout points. The self-guided trail has a dedicated radio channel that people can tune into to learn interesting facts about the area, including information about the cattle drives that once ran through the forest.

There are several options for those wishing to explore the park on foot.



The Shannon Dam Walk Trail is 3.5 kilometres long and links the day-use area to Shannon Dam via the banks of the Shannon River. The eight-kilometre Great Forest Trees Walk runs through dense karri forest in the northern section of the park, while the moderately hard 5.5-kilometre Rocks Walk Trail can be walked from the day-use area to Mokare's Rock, a granite outcrop with views of the Shannon River valley.

Mountain bike riders can also enjoy the park, following the opening of the world's longest off-road cycling trail, the Munda Biddi Trail, in early 2013. The trail runs through the park to the south of the campground.

park facts

Where is it? 33 kilometres east of Northcliffe, 53 kilometres south of Manjimup and 65 kilometres north of Walpole.

Total area: 52,598 hectares.

What to do: Camping, bushwalking, cycling, visiting historic sites and exploring the scenic drive.

Facilities: Campground, picnic benches, covered picnic and barbecue facilities, hut accommodation, toilets, showers.

Park fees: Entry and camping fees apply.

Nearest DPaW office: Donnelly District Office, Kennedy Street, Pemberton, phone (08) 9776 1207.



Saltwater country: Kimberley coast



The Kimberley region of Western Australia is one of the world's last great wilderness areas. The Kimberley Science and Conservation Strategy—a bold plan to conserve the region's natural and cultural values—was released in June 2011, and is facilitating Aboriginal involvement and employment in land management. The centrepiece of this strategy is the creation of the state's largest interconnected system of marine and terrestrial parks covering five million hectares. This photo essay highlights some of the many marine and coastal values that the strategy seeks to protect.









Previous page

Main Brown boobies in flight over Montgomery Reef. Montgomery Reef in Lalang-garram / Camden Sound Marine Park is a particularly outstanding, biologically diverse coral reef covering an amazing 300 square kilometres. When the tide goes out, water gushes from the narrow channels and off the edges of the enormous reef in powerful torrents, like fast-flowing rivers, until the reef emerges to stand metres above the surrounding sea at low tide. At high tide, the reef once again disappears beneath the sea.

Opposite page

Far left Sea turtles are visible and abundant wherever you go in marine waters of the Kimberley, with six of the world's seven species of turtle found in Kimberley waters, all of which are listed as threatened. Western Australia has the only large population of the hawksbill turtle remaining in the Indian Ocean. Green, loggerhead, flatback, olive ridley and leatherback turtles also occur in the region. Turtles may travel for thousands of kilometres between their foraging and breeding areas. They are long-lived and take decades to reach breeding age.

Photos – David Bettini



Top left Between June and September each year, humpback whales arrive in very significant numbers to breed, calve, and nurse their young in the warm tropical waters and protected embayments of the Kimberley coast and islands, after migrating north from their feeding grounds in the sub-Antarctic. The Lalang-garram / Camden Sound Marine Park is the biggest calving area for humpback whales in the southern hemisphere. It provides an ideal area in which calves can build up the blubber they need for the return journey and where they can hide from predators.

Centre left Looking somewhat like Medusa are these mating Stokes' sea snakes. Stokes' sea snakes feed at Montgomery Reef, in Lalang-garram / Camden Sound Marine Park, in high numbers and are frequently visible there at low tide. During mating season, several males may compete for the attentions of a female.

Photos – Tim Willing



Left Raft Point is home to the powerful stylised Wandjina art—a major attraction for the Kimberley coastal cruise industry. Kimberley rock art is a cultural treasure of international significance and scale. It is critically important to traditional owners that their spiritual significance is respected by visitors and the rock art remains in excellent condition.

Photo – Carolyn Thomson-Dans/DPaW



Above Sir Graham Moore Island, a large island at the entrance to Napier Broome Bay, has a World War II heritage site and is an important cultural site for the Balanggarra people, but a number of weeds are present. A weed survey by Department of Parks and Wildlife staff and Balanggarra rangers is planned for 2014 and weed control will start in the following wet season.

Photo – Carolyn Thomson-Dans/DPaW

Left This strange-looking dolphin, with a short stubby dorsal fin and a round melon-like head, was only recognised as a new species in 2005 and is endemic to northern Australian waters including the Kimberley. Previously thought to be the Irrawaddy dolphin (*Orcaella brevirostris*), DNA profiles and skull measurements by scientists showed conclusively that the Australian snubfin dolphin (*Orcaella heinsohnii*) was distinct. It occurs in rivers, estuaries and coastal waters, and is common in Roebuck Bay.

Photo – Deb Thiele

Right The proposed Horizontal Falls national park and marine park will protect an internationally renowned tourist attraction. Massive tides in the Kimberley of up to 11 metres have created the Horizontal Falls in Talbot Bay. When the tide turns, the water has to drain out of a wide inlet through a narrow gap between high sandstone walls. The tide falls faster than the water can escape, producing a 'horizontal' waterfall. By low tide the inlet has emptied, but with the turn of the tide it fills again, resulting in a waterfall in the reverse direction. Visitors get an adrenaline rush by powering over the falls in fast tour boats.

Photo - Alice Ralston

Below Roebuck Bay is an amazing marine area on the doorstep of Broome where millions of birds congregate. It is one of only a handful of areas in the world with huge intertidal flats rich in shorebirds. The dense mangroves that grow around the bay are habitat for hundreds of species of mollusc, crab and fish that are food for the shorebirds (or waders). Large flocks of waders stop here during annual migrations from as far away as northern Siberia. The state government is working with the Yawuru traditional owners to establish a marine park in Roebuck Bay that will be jointly managed by the Yawuru.

Photo - Bill Belson/Lochman Transparencies







Opposite page

Top Only a few decades ago, saltwater or estuarine crocodiles had been hunted to virtual extinction in the Kimberley. Today they have made a resurgence and are ever-present in Kimberley waters, although usually lurking out of sight or lying in disguise camouflaged as a floating log. They have become an attraction for visitors, although you would be wise not to fish too close to the water's edge or go swimming in the sea or in major rivers.

Photo - Tim Willing



Opposite page

Bottom Some of the largest patches of mangrove in Australia occur along the Kimberley coast. They have a total area of approximately 140,000 hectares and are considered to be among the most pristine mangrove forests in the world. Up to 18 tree species of mangrove are found in the Kimberley and the fauna they support is rich and distinctive. Mangroves are important nursery areas for fish and other marine species and are important in stabilising coastlines.

Photo - Carolyn Thomson-Dans/DPaW



Above Prince Regent National Park is one of Australia's most remote and beautiful places. Spectacular features include Kings Cascades, Mount Trafalgar and Prince Regent River, which runs almost straight for most of its length, often between near-vertical cliffs. The waters of the river are marine and form part of the Lalang-garram / Camden Sound Marine Park Marine Park.

Above left Low Rocks Nature Reserve is a small island in the northern waters of the Admiralty Gulf. This remote, scenic spot is an important breeding area for the pied cormorant, bridled tern and crested tern.

Left The Kimberley region is one of the most pristine areas remaining in the world, and the state government has established new marine parks there at Camden Sound and Eighty Mile Beach, with commitments to establish three more marine parks at Horizontal Falls, North Kimberley and Roebuck Bay. The majority of the parks will remain open for fishing, with the lure of big barramundi one of the area's big attractions.

Photos - Carolyn Thomson-Dans/DPaW



Kyloring, cats and conservation: the race to save the western ground parrot

Dramatic declines in populations of the critically endangered western ground parrot, known as kyloring to the Aboriginal people of the area, have sparked a race to save the species from extinction. Cat control, captive breeding and fire management are each playing a role in bringing the species back from the brink.

by Sarah Comer, Allan Burbidge, Dave Algar, Abby Berryman and Anne Bondin



Alarm bells were ringing with the Department of Parks and Wildlife's (DPaW's) South Coast Threatened Birds Recovery Team, which is responsible for the management of recovery programs for a suite of birds endemic to the south-west, including the noisy scrub-bird (*Atrichornis clamosus*), western bristlebird (*Dasyornis longirostris*) and western whipbird (*Psophodes nigrogularis*). The recovery team believed that the decline in ground parrots could indicate that other species could also be at risk. Lack of conservation action could result in not only the loss of ground parrots but possible declines in other threatened species as well. The cause of the declines was at first unclear, but further investigation concluded that predation by feral cats was the most likely reason.

At about the same time the declines were realised, genetic studies showed that the western ground parrot was distinct from the eastern ground parrot, and warranted being treated as a separate species from its eastern cousin. The rate of decline of the western birds meant that, if nothing was done, this enigmatic species could be lost forever. With this realisation, the recovery team, in collaboration with the Friends of the Western Ground Parrot, submitted a nomination to the federal government to have the western ground parrot declared as critically endangered under the Environment Protection and Biodiversity Conservation Act. This was endorsed in 2013.

Since 2010, the combined efforts of departmental staff, Friends of the Western Ground Parrot and community volunteers have seen this ambitious recovery project progress to the point where a landscape-based trial for cat control is now in place—along with associated monitoring of this predator and selected potential prey species including ground parrots. Although it is still early days, the future for the ground parrot is much more promising than it was three years ago.

Controlling cats

The South Coast Threatened Birds Recovery Team launched an ambitious landscape-scale project integrating trials of the feral cat bait Eradecat®



Main left A western ground parrot foraging for seed.

Photo – Brent Barrett/DPaW

Inset DPaW technical officer Louisa Bell collaring a feral cat.

Photo – Cam Tiller

Above DPaW staff and volunteers trapping native animals in Cape Arid National Park.

Photo – Abby Berryman/DPaW

into DPaW's existing *Western Shield* fox baiting program. The first delivery of the Eradecat baits to Fitzgerald River National Park occurred in March 2010, and in subsequent years this program has extended to include 145,000 hectares of Cape Arid National Park and Nuytsland Nature Reserve. This extension was particularly important as the southern heathlands of Cape Arid are home to more than 95 per cent of the remaining ground parrots.

This project, called the Integrated Fauna Recovery Program (IFRP), has western ground parrot conservation at its heart but is also aimed at conserving a suite of other threatened or conservation-dependent mammals and birds.

While DPaW has made significant advances in the control of feral cats

In 2009 an ambitious project to reverse a dramatic decline of the critically endangered western ground parrot (*Pezoporus flaviventris*) started on the south coast (see 'Heeding kyloring's warning: south coast species under threat', *LANDSCOPE*, Spring 2010). This secretive parrot, at the time believed to be a subspecies of the eastern ground parrot, was relatively easy to find in a number of locations along the south coast in the late 1990s, but by 2004 it had disappeared from Waychinicup National Park, near Albany. The once robust population in Fitzgerald River National Park had also declined dramatically.



Above Although their diet is mainly seeds, western ground parrots have also been observed eating flowers, in this case *Grevillea tripartita*.

Photo – Brent Barrett/DPaW



Left One of the IFRP team’s remote cameras captured this image of a feral cat with a bandicoot in Cape Arid National Park.

Photo – IFRP team/DPaW



Below left Attaching a GPS radio collar to a feral cat in Cape Arid National Park.

Photo – Sarah Comer/DPaW

in arid and semi-arid areas, the IFRP project was designed to research appropriate baiting regimes for the wetter southern region of the state (see ‘Controlling cats: the work continues’, *LANDSCOPE*, Autumn 2013). In the past few years the team has been monitoring direct uptake of baits by attaching GPS radio-collars to feral cats caught prior to baiting. Collar data not only provides a direct indication of bait-related mortality, but also gives the team invaluable information on habitat use, movement patterns and home range size of individual cats.

Initially, the team also monitored feral cat activity by recording tracks on sand pads before and after baiting. However, this method was not suited

Right Captive western ground parrots are fed a range of native plants. This male is eating curry bush, one of the plants found throughout ground parrot habitat.

Photo – Abby Berryman/DPaW

Below right The dibbler (*Parantechinus apicalis*) is one of the suite of native species that the project team hopes will benefit from feral cat control in Fitzgerald River National Park.

Photo – Allan Burbidge/DPaW



to south coast reserves due to disease hygiene restrictions limiting access to sites after rain, and persistent rain washing tracks away. In 2011 remote cameras were trialled and are now being used to support the bait uptake trials by detecting feral cats before and after baiting programs. The cameras have also assisted with monitoring other native species at risk of predation such as the quenda (*Isodon obesulus*) and western brush wallaby (*Macropus irma*).

Native fauna in the target areas are also being monitored through standardised *Western Shield* trapping transects, and, where not already existing, new transects were established in the first year of the project. Although it is early days, there are some encouraging signs that cat baiting may be benefiting native species. For example, on one of the sites in Cape Arid National Park the number of quenda trapped has increased significantly in the three years since baiting started.

The project has also used automated recording units (ARUs) that are programmed to record all bird calls in an area at specific times of the day. Western ground parrot calls are easily identified from the visual sonogram that is generated from these recordings. While volunteer listening surveys are still very important, the use of ARUs is giving the team the ability to survey more historical habitat and monitor known populations in a systematic manner.



Captives

While conservation of the ground parrot in the wild is the focus of the IFRP, the recovery team is also aware of the risks associated with a single strategy to manage the remaining wild population. In the case that cats are not the cause of the dramatic declines, or we are not able to limit the threat in time, then the western ground parrot could conceivably disappear forever. After much debate, a number of birds were placed in captivity, with the long-term aim of establishing a captive breeding program to provide birds for eventual release into the wild when introduced predators are controlled, or when other causes for the birds' decline are overcome. Such a population of birds would also provide an insurance policy if

bushfire in Cape Arid National Park seriously decimated the remaining population. However, this path also came with risks—for example, there was no way of being sure what impact removing some birds would have on the dwindling wild population. In addition, no-one had kept or bred western ground parrots before. Nevertheless, this avenue needed to be attempted.

Seven ground parrots have now been successfully 'maintained' in captivity for several years, and one of the pairs has made two attempts to breed. The captive program has created an excellent opportunity to learn about the husbandry required to keep ground parrots, and provides a good chance that they will breed in captivity.



Left Alan Danks setting up an automated recording unit. These are now being used to help with surveys for ground parrots in remote areas.

Photo – Allan Burbidge/DPaW

Below left Technical officer Louisa Bell radio tracking a feral cat in Fitzgerald River National Park.

Photo – Jeff Pinder/DPaW

Managing fire

As well as introduced predators, fire is also a threat to ground parrots. DPaW manages the threat of intense bushfire as part of park management, for this and other fire-sensitive species. In Cape Arid and Fitzgerald River national parks, detailed planning has centred on protection of remaining habitat of the western ground parrot. In January 2010, a bushfire burnt 1,200 hectares of habitat in one of the two strongholds of birds in Cape Arid National Park, including a long-unburnt area where it was believed that birds had been nesting. Firefighting efforts resulted in the fire being kept to a relatively small area and a small number of birds was observed on the fire perimeter immediately afterwards. Further monitoring in 2013 revealed more birds, some of which were feeding in the burnt area.

Work will continue to improve bushfire suppression. For example, an upgrade to the airstrip adjacent to Cape Arid National Park will improve the efficiency of fire-fighting efforts by enabling waterbombers to be based closer to remaining habitat should a bushfire threaten these areas. Esperance-based DPaW staff also received support from the department's remote regions program to upgrade some of the strategic fire access tracks in the park, which will also aid firefighting efforts.

A collaborative effort

Friends of the Western Ground Parrot also have been working hard to assist with the recovery project, collecting donations for the Western



Right Deanna Rasmussen and Mark Cowan setting automated recording units in the Fitzgerald River National Park to survey historical ground parrot habitat.

Below right A common brushtail possum (*Trichosurus vulpecula*) in Fitzgerald River National Park.

Photos – Sarah Comer/DPaW

Ground Parrot Rescue Fund and providing assistance to volunteers who wish to be involved in the field program. Volunteers take part in a range of activities including field surveys for ground parrots, and monitoring other native species and feral cats—collecting important information which assists the recovery team in its evaluation of the success of predator control.

The future

In 2014 DPaW will start a feral cat control program in the Two Peoples Bay–Manypeaks area, a site from which the western ground parrot disappeared 10 years ago. This area is extremely important for fauna conservation, being home to the only mainland populations of the critically endangered Gilbert’s potoroo (*Potorous gilbertii*) and endangered noisy scrub-bird, and significant populations of other species including the western ringtail possum (*Pseudocheirus occidentalis*), quokka (*Setonix brachyurus*), Australasian bittern (*Botaurus poiciloptilus*) and western bristlebird. Should the captive breeding and predator control programs succeed, this will be one of the areas to be considered for ground parrot translocations.

The future of the western ground parrot is still tenuous, with its conservation in the wild reliant on effective management of threats including both introduced predators and bushfire. While the work of DPaW, and particularly the IFRP team, is promising in terms of controlling predators, there are still many challenges in developing the most efficient techniques for successful uptake of cat baits.



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Abby Berryman is a conservation officer for the captive western ground parrot project, based at DPaW Albany.

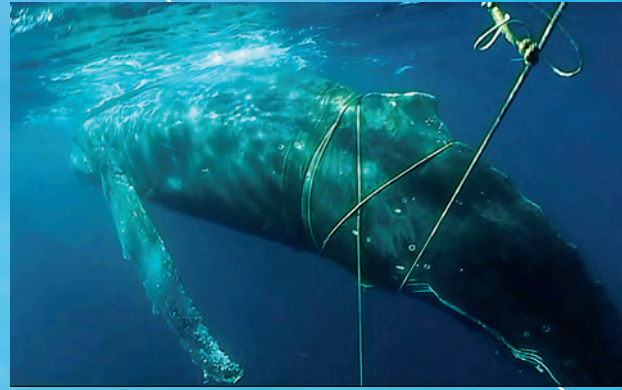
Anne Bondin is on the committee of the Friends of the Western Ground Parrot.

This project is a collaboration between a large number of individuals from DPaW’s South Coast Region, Science and Conservation Division and Western Shield program, as well as the Friends of the Western Ground Parrot, Perth Zoo, The University of Western Australia and the local community. It has been supported by a number of funding bodies including the state government via DPaW, Caring for our Country, Biodiversity Fund, State Natural Resource Management (NRM), Exetel and South Coast NRM.

Entangled
whales:
not your typical gentle giants



Staff with the Department of Parks and Wildlife have become known worldwide as one of the most experienced teams in the field of disentangling whales that have become entrapped in fishing gear.



by Douglas Coughran

Since 1990, 128 large whales have been recorded as becoming entangled in fishing gear or other marine debris while migrating along the Western Australian coast. In such cases, staff from the Department of Parks and Wildlife (DPaW), often supported by the Department of Fisheries, are quickly on the scene in an attempt to free the entangled animal. But dealing with animals weighing up to 45 tonnes, who are often tightly entangled in gear, while being tossed by the wind and waves in a small rescue vessel, is a risky business for disentanglement teams. Whale disentanglement experts need solid knowledge, management planning and infrastructure in place if they are to successfully disentangle the whale, while also ensuring their safety.

The key is to maintain a healthy respect for working around wild, large and powerful animals, while having a fundamental understanding of their survival strategies and survival behaviour to perceived threats. We need to understand the chance of a whale selecting a flight or fight



response, to read its body language, to be aware of its likelihood to travel in a certain direction, to understand the threat of any nearby whales and to know which position to be in to avoid a potentially lethal tail slap.

After about 20 years of working to disentangle whales off the WA coast we have built such a repository of knowledge that so far all of the department's attempted whale disentanglements have been successful. The department is now regarded as a world leader in whale disentanglements, its staff sometimes travelling to far-

flung corners of the globe to share knowledge with others. But every case is different, every case poses its own risks. So just how does whale disentanglement work?

Not for the faint hearted

Disentangling whales is a very dangerous task that should not be undertaken without appropriate training, equipment, incident management structures and resources. Even with appropriate precautions, dealing with large dangerous animals is never easy, especially when you consider variables such as how tightly they're entangled, the sea, tides and weather.

Whales are large and capable of inflicting injury or death, particularly if harassed or distressed. All precautions must be taken to protect the public and staff when responding to large whale entanglement incidents. And, contrary to popular belief, whales do not understand that we're trying to help them and behave accordingly. Rather, they will do whatever they can to minimise their exposure to a perceived danger—the disentanglement team.

Fight or flight

One of the strongest driving forces in animal evolution is adaptation to reducing the probability of detection and capture by a predator. This dynamic—called predator-prey interaction—determines much about



Previous page

Main A humpback whale clears the water in just three tail beats.

Photo – Oceanwide Images

Inset A humpback struggles to breathe with multiple rope wraps around its body.

Photo – Douglas Coughran/Sea Dog Films

Above An aggressive humpback makes a huge surface splash as it re-enters the water after breaching in front of the rescue team.

Photo – DPaW

Left The disentanglement team makes the final cut to free a humpback off the Abrolhos Islands.

Photo – Sea Dog Films



Above A humpback whale displays an extremely aggressive behaviour as its tail slaps the surface of the water.

Photo – Oceanwide Images

how animals react under threat or pressure. Regardless of the physical size of whales—one of the most charismatic megafauna admired by humans—the forces of survival drive how they will react to any perceived or real threat.

Even the largest animal to have ever lived on Earth, the blue whale (*Balaenoptera musculus*), is subject to predation by killer whales (*Orcinus orca*) and sharks. As such, they have developed responses to such threats. These responses are very much in a mix of complex driving forces that need to be well understood when determining what can or cannot be done safely in close proximity to a compromised whale. Scientific literature describes two distinct categories of survival strategy that animals make in response to predatory advances—fight or flight.

As the word suggests, the fight strategy is an active physical response to a survival threat. This may be attack, the best form of defence by an individual, or defence. It may include an all-out attack by a mother in an effort to protect her calf, or could also be a ‘group stand and defend’ as has been well documented in herd animals, including cetacean species such as humpback (*Megaptera novaeangliae*) and sperm whales (*Physeter macrocephalus*).

Unless desperate, most predators will avoid being injured by a species that is inclined to attack for fear of their own chances of survival diminishing through injury.

The second strategy is flight—to out-run or, in the case of whales, out-swim a predator. And, as noted in countless observations and detailed study, once a flight animal is caught, it offers little or no fight. On the other hand, an animal that prefers the fight strategy will attempt to out-run a predator, but when pressed, they will stand and put up a fight. The energy budget is equally demanding but, depending on the morphology of specific species, one strategy will benefit over the other.

There are two main whale species likely to have contact with human-related obstacles causing entanglement, such as fishing line, as they migrate along the WA coast. These are the humpback whale and southern right whale (*Eubalaena australis*). Of the 128 large whale entanglements recorded in WA waters from 1990 to 2012, about 91 per cent were humpback and about seven per cent southern right whales—both of which are fight-strategy species. The balance is made up by Bryde’s whale (*Balaenoptera edeni*)

and Minke whale (*B. acutorostrata*), at about one per cent each—both flight-strategy species.

Obviously, understanding that some 98 per cent of entangled whales are going to ‘stand’ and fight a response team demands strict risk management techniques. But the complexity of the challenges doesn’t only involve considering whether a whale is going to fight or flee—a complex mix of other factors also needs consideration.

Assessing the risk

Each year, between May and December, humpback whales make a 13,000-kilometre round trip from Antarctica to the breeding grounds in warmer waters in WA’s north and back again to the feeding grounds in Antarctica. This is one of the longest migrations of any mammal on the globe. Like many other global populations of great whales, the population of humpback whales that aggregate to



breed along the coast of WA was severely depleted through commercial whaling.

The west coast humpback whale population is now estimated to be more than 30,000. This is a significant recovery; when commercial humpback whaling ended in 1963 the population was less than 500. The population that migrates along our coast is now the largest humpback whale stock in the southern hemisphere, and it is predicted that by 2020 the population will be fully recovered to pre-whaling levels.

Most whale entanglements are experienced on the northbound migration. This means a breeding -status humpback will be in peak condition and average between 40 and 45 tonnes. An animal in peak condition compromised by a rope entanglement will often be dragging the entanglement gear, which may include floats and possibly pot-traps, and will be driven by an overwhelming urge to reach the breeding grounds. If the entangled whale is pregnant, the stakes will be even higher as the animal rushes to the warmer waters to give birth. This urgency increases the likelihood of a fight response. If the entangled animal is a male, the motivation to breed will heighten its urge to fight. If either are entangled but anchored by the entangling lines, they will be compromised even further by the probability of sharks taking advantage of a trapped animal, and attempting to feed on it.



Top left A humpback mother and calf. Whalers used to call humpback mothers 'devil fish' due to their tenacious defence of their calves.
Photo - Oceanwide Images

Centre left A humpback whale comes eye to eye with the disentanglement team.
Photo - Geoff Taylor/Lochman Transparencies

Left A male suitor tail-sails alongside the rescue team, displaying its displeasure as they work to free a female, heavily entangled in ropes.
Photo - DPaW

Right A male suitor launches itself into the air, engorging its mouth with water and air to appear more menacing to the rescue team.

Photo – DPaW

Reading whale warnings

Every response effort must consider all aspects of risk and determine whether the incident can be managed to achieve a positive safe outcome. The response team may decide not to attempt the disentanglement if they determine that the whale will free itself, or if an attempted disentanglement is too dangerous. They follow a ‘decision tree’ in the risk management process, and then put in place procedures and techniques that have been developed over time, locally, nationally and internationally.

All animals give warnings to a potential threat. This may be in the form of posturing, vocalisation, subtle body language and breathing rates. It is through understanding these warnings and signs that a disentanglement response team makes critical decisions on when to continue and when to back away.

The tail of any cetacean is its primary weapon to deter or repel a threat, but the head and pectoral fins are also used. The potential reach of the tail, head and pectoral fins is used to identify a hypothetical line; outside this line is deemed the ‘safe zone’ but inside is the ‘kill zone’—a zone in which time spent is crucially limited, or totally avoided. All techniques deployed by the response team are based around this knowledge.

Extended pectoral fins are a sure sign of the whale stabilising to throw a tail slap in the direction of the perceived threat which, in the case of a whale disentanglement, is the response crew in a small boat. Conversely, finding a humpback arching over with head, tail and pectoral fins hanging vertical in the water column is a sign of fatigue and means the whale is less likely to react as aggressively, at least initially. Elevating the peduncle and

tail flukes into the air will be followed by tail slapping onto the water surface or more directly at and on the threat. Both humpback and southern right whales take up an aggressive ‘S’ posture, somewhat like a wound-up spring ready to release, meaning they are ready to strike. A highly distressed whale will head charge at a boat or predator. Over many years of studying whale behaviour, it has been noted that many whales, particularly humpback whales, will move into shallow water when their survival is compromised, to gain a defensive advantage. Shallow water enables a whale to protect itself from a ventral attack from deep water so the whale needs only to defend laterally, forward or from the rear. They are extremely sensitive to any approach but a rear approach is likely to afford better control for a response team. Additionally, a high percentage of entangled whales will turn back southward if entangled on the northbound migration and towards shallow water.

Though quite dramatic, any tail slapping can be avoided by staying out of the reach of the tail. Positions forward of the tail are extremely dangerous as the whale can adjust its strike distance and they are very accurate with attempts to hit a target. They will quite often attempt to get below a boat to lift it on its back and up-turn the vessel. Right whales will lift the head high, roll over then tail slash, a predictable sequence once it commences but one that can occur lightning fast.

Much can be achieved in disentanglement attempts in the initial stages of contact. The objective is to assess the situation correctly and act in a way that will not pressure the animal into taking flight or fight. However, this is stated with caution, as each case is unique and should never be underestimated. But if a response team fusses around the entangled whale for too long without taking action, the whale may quickly decide that it can attack the response team without risking itself, and launch an attack.





Above A southern right whale approaches. Note the white callosities on its head, thought to be an adaptation for fighting. Photo – Oceanwide Images

Working around whales with vessel motors causing any level of noise quickly agitates the whales and may inadvertently simulate predatory behaviour. The presence of a second nearby vessel can also cause whales to panic as they may mistake the vessel for another predator, such as a killer whale. Killer whales hunt cooperatively and one routine strategy deployed is the flanking of the victim with pressure applied from both sides and simultaneously from behind the whale. The killer whale's strategy to work its whale prey is aimed at fatiguing the victim so a 'rider' can swim up onto the blowhole to accelerate exhaustion, depleting the whale of energy and rendering the victim incapable of fight. Therefore, for an entangled humpback, any second vessel in close proximity can cause alarm as it fears a group attack, and may cause the whale to panic, therefore heightening the risk to disentanglement response teams.

Attending whales pose threats

The entangled whale is not always the most dangerous whale on site. The most dangerous of all entanglement incidents is when a calf is entangled with its mother, and sometimes an escort, in attendance. These situations are of very high risk and only an extremely experienced crew should attempt an assessment and action

plan. The behaviour of the mother will be the focus of very high-risk management.

Second only to a mother-calf pair in terms of risk is the involvement of a breeding-status female entangled with male suitors in attendance. In all of the years of experience undertaking disentanglement response operations in both the southern and northern hemispheres, a case in late 2012 was one of the most difficult and challenging. A breeding-status female humpback whale was badly entangled around her tail and peduncle, and was anchored. Normally an anchored whale is under relative control, but she had three male suitors in close attendance. The male behaviour observed was truly frightening. There was always a large male in close proximity, often crisscrossing each side of the rescue vessel, tail sailing and breaching in aggressive posturing. These males, mostly the dominant escort, rewrote the book of experience for the crew.

The case was further complicated by the female whale's efforts to remain deep underwater, out of reach of the cutting pole which is used to sever entangled ropes. However, the female was buoyed to near the surface and eventually cut free. All our cases have been different and challenging—none could be described as easy operations. But they have all been learning experiences to pass onto colleagues here in WA, across the country and overseas. Such culminated experience helps us to manage the risks of very challenging incidents so a positive outcome can be achieved for the compromised whale, and so all crew make it safely back home.

Douglas Coughran AM is a senior wildlife officer with the Department of Parks and Wildlife's Marine Wildlife section. He has led the whale disentanglement response team since its inception in 1995. His work becomes busier each whale migration as whale numbers continue to increase. Douglas is a member of the International Whaling Commission's Large Whale Disentanglement Response Committee and advises internationally. He can be contacted on (08) 9219 9849 or by email (douglas.coughran@d paw.wa.gov.au).

endangered

by Andrew Brown



Milky emu bush

Milky emu bush (*Eremophila lactea*) is a member of the Scrophulariaceae family. It is a spindly shrub that grows to 3.5 metres tall with pale brown, more or less smooth bark and smooth, sessile, often-overlapping leaves 10 to 30 millimetres long by two to six millimetres wide. The tubular flowers are cream to pale lilac on the outside while inside they are deeper lilac with purple spots. Both the scientific and common names are derived from the milky substance which often appears on the leaves and branches. Flowering occurs between September and November.

Milky emu bush is similar to smooth-sepaled eremophila (*Eremophila psilocalyx*) but has broader leaves and smaller, glandular flowers with smaller sepals.

The first known collection of the species was made in 1967. Further collections were made in 1978 from the same general area. Despite being searched for over several seasons no new populations were found until 1997. Seven additional populations have since been located.

Milky emu bush is endemic to the Esperance–Salmon Gums area of Western Australia, where it grows in sandy-loam soils in *Eucalyptus* woodland with earth-loving eremophila (*Eremophila chamaephila*), stiff westringia (*Westringia rigida*) and red plume grevillea (*Grevillea plurijuga*).

Much remains unknown about the biology and ecology of milky emu bush; however, it does appear to be a disturbance opportunist as all known populations are in disturbed sites. Fire and mechanical disturbance trials aimed at stimulating the germination of soil-stored seed have shown positive responses, with around 400 seedlings appearing following trials in May 2007.

Under the WA *Wildlife Conservation Act 1950* the species is declared as rare flora and ranked as critically endangered due to the fragmented nature of populations and a continuing decline of mature individual plants. It is listed as endangered under the federal *Environment Protection and Biodiversity Conservation Act 1999*. The species is probably naturally rare, as it has only ever been recorded from a very small area of distribution. Only eight populations

are currently known, all of which are threatened by further clearing of remaining habitat. A lack of fire has resulted in little or no recruitment in most populations, as the species requires fire to germinate soil-stored seed.

The Department of Parks and Wildlife's (DPaW's) Esperance District Threatened Flora Recovery Team is overseeing the implementation of protective measures to ensure the long-term conservation of the species. An interim recovery plan has been prepared and recovery actions underway include fencing, further surveys, monitoring, fire and disturbance trials, seed collection and liaison with landowners and land managers.

It is possible that there are more populations of milky emu bush. If you think that you have found this species, please advise DPaW's Esperance District or Species and Communities Branch on (08) 9083 2100 or (08) 9334 055 respectively.

Photos by Emma Adams (main) and Andrew Brown (inset)

bookmarks by Catherine Jack

Common Trees of the South-West Forests

Author: Judy Wheeler
Publisher: Department of Parks and Wildlife
www.dpaw.wa.gov.au
72 pages, soft cover, colour photographs
ISBN: 978 19 2170 314 0
RRP: \$6.95

There is something satisfying about being able to spot and identify the species of trees around you. Having knowledge about and being able to recognise organisms and their communities enhances your awareness of the natural environment.

Common Trees of the South-West Forests is part of the Department of Parks and Wildlife's Bush Book range, and provides an easy-to-read, pocked-sized field guide with colour photos and descriptive text to help you identify the most prevalent species.

The book covers the most common trees found from Bunbury to Denmark, including marri, karri, tingle and jarrah among others, and includes a section to write down your own sightings.

A Natural History of Australian Bats: Working the Night Shift

Authors: Greg Richards and Les Hall
Publisher: CSIRO Publishing
www.publish.csiro.au
192 pages, hard cover, colour photographs throughout
ISBN: 978 06 4310 374 0
RRP: \$79.95

Colleagues Greg Richards and Les Hall have shared a love of bats for more than 40 years and together they have an extensive knowledge of Australia's bat species. Through their anecdotes from the field, they shed light on the world of Australian bats, and bat enthusiasts.

Colour images show Hall exploring tight cave 'squeeze holes', guided by his sense of hearing and smell to track and record bat species.



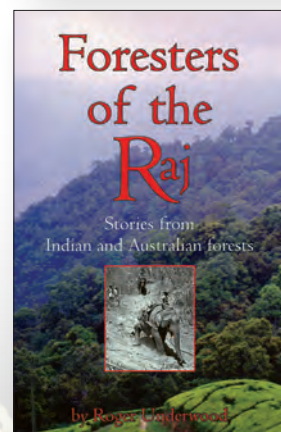
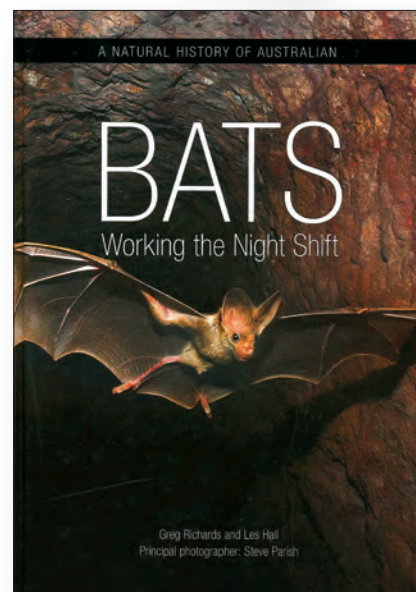
Richards and Hall have an obvious passion that they are keen to ignite in others. *A Natural History of Australian Bats* is an entertaining record of Australia's bat species with detailed close-up colour images and information on species' locations, anatomy and ecology.

Foresters of the Raj
Author: Roger Underwood
Publisher: York Gum Publishing
308 pages, soft cover, black and white photographs and illustrations
ISBN: 978 06 4659 505 4
RRP: \$40

After picking up a copy of *The Indian Forester* journal in the library of the then Forests Department in Western Australia, Roger Underwood discovered pages of fascinating stories and pioneering forestry management practices. *Foresters of the Raj* is a collection of stand-alone stories based on the articles and anecdotes found in *The Indian Forester*.

Stories dating from 1875 are interspersed with Underwood's commentary of his own experiences to create humorous and informative narratives on trees, forests, wildlife, adventures and Indian characters.

This would be an ideal gift for anyone who has enjoyed a career on the land and has a love of animals and forest management.





People in profile

by Samille Mitchell

Barbara York Main



This senior scientist is a force to be reckoned with in her field of study trapdoor spiders. She has uncovered dozens of new species and brought about a whole new understanding of their ecological traits during her lifetime's work.

Barbara York Main rushes through the corridors of The University of Western Australia (UWA), where she's based as adjunct professor in the School of Animal Biology. Colleagues call out friendly welcomes as she passes but she can't stop to chat today—there's a mountain of things to be achieved. Digging into her pockets she pulls out sets of keys to unlock the office doors and, although she's in an extreme hurry, there is one thing that serves to stop this slightly built 84-year-old in her tracks—spiders.

But far from shriek with fright, Barbara stops to show off these specimens with a sense of sheer delight.

Previous page

Main Barbara at work in the field circa 1953.

Photo – Albert Main

Inset Barbara, 2013.

Photo – Samille Mitchell/DPaW

Inset background A *Nemisiid* trapdoor spider.

Photo – Jiri Lochman

Above right Barbara discovering a wombat hole in 1955.

Photo – Albert Main

Below A trapdoor spider burrow entrance.

Photo – Jiri Lochman



These particular species are Barbara's passion and are the subject of her lifetime's work. For here in a couple of flower pots, with the words 'live spiders' scrawled in pen on a note tacked to the side of one, are two unnamed species of *Gaius* spiders, commonly called trapdoor spiders.

Barbara crouches down and points out one of the spiders' burrows—sturdily built, web-lined chambers leading down into the earth. At the entrance of one she indicates the stick lines the spider has attached—a guise to encourage prey to travel down the sticks to where the spider waits at the entrance to its lair to seize its victim. Barbara has tended to these spiders for the six years since she found them and discovered that they were new to science.

They are almost as precious as the spider population she has studied for 40 years in the Wheatbelt. Long-time associate Mark Harvey, Head of Terrestrial Zoology at the WA Museum, remembers visiting this population of spiders with Barbara as an astounding experience.

"It was just staggering to walk around with Barbara and witness the dedication she had towards her subject," Mark says.

"It was a life-changing event for me to witness the level of patience she demonstrated to study one population of spiders for so long.

"We even had to take off our boots and walk around in our socks so we didn't trample any of the spiders.

"The experience just highlighted to me the love and passion she has for her subject—not only spiders but everything else in the landscape."

A passion is born

Barbara has certainly more than achieved the dream she first conjured as a child growing up on a farm near the small Wheatbelt township of Tammin. Barbara decided early on in life to devote her career to the smaller creatures that most kids her age overlooked in favour of cute and furry animals, or charismatic snakes and other reptiles.

The second youngest of five siblings, the others all boys, Barbara looks back on her childhood with fond memories of adventures in the bush uncovering all sorts of fascinating miniature creatures.

"As kids we had a lot of freedom to roam around, particularly myself," she says.

"I spent a lot of time in the bush and found myself not so much into bigger animals but insects.

"I'd collect them and put them in



Right A typical defence pose of a Mygalomorph trapdoor spider.
Photo – Jiri Lochman

Below right Barbara and her husband Bert in 1990.
Photo – George O'Neill

shoeboxes, feed caterpillars—that was great fun—and dry specimens and pin them with my mother’s sewing pins.”

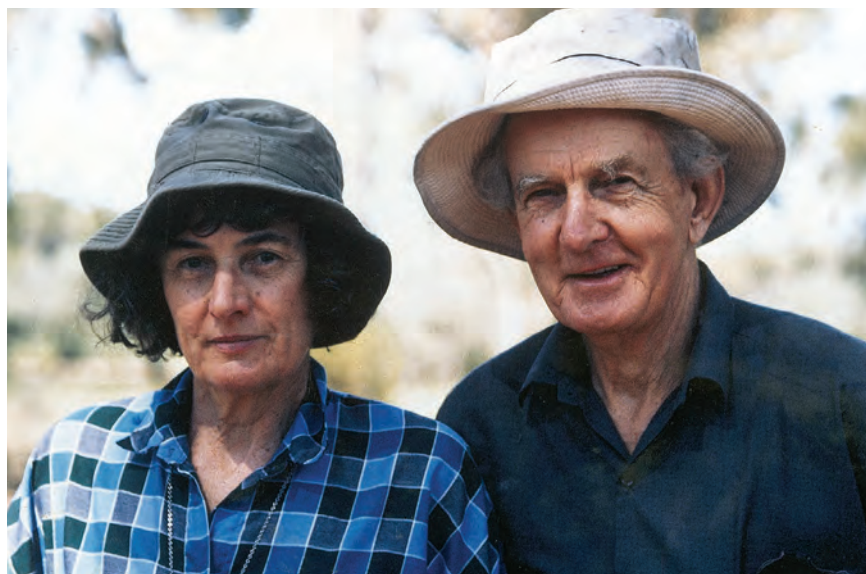
Her family was bemused by Barbara’s passion, and tolerated it. “I don’t think they’d seen anyone so dedicated before,” she says.

Barbara’s other passions were reading and writing. As a correspondence student she was required to pen fortnightly letters to her teacher, in which she poured out tales of her adventures, her discoveries in the world beyond the classroom. The teacher encouraged her interest, sending her natural history books to further fire her imagination.

Barbara remembers one book from her household shelves—a children’s natural history book by Gladys Froggatt, *The World of Little Lives*—that really captured her attention. She pored through the pages, enchanted by the illustrations, fascinated at the life histories of these tiny creatures. Here was a world of infinite wonder, of bizarrely fashioned creatures with all sorts of fantastical traits. Barbara couldn’t get enough of them.

A career begins

When Barbara reached her teenage years she moved to Northam where she boarded with a local woman while attending high school. It wasn’t long before the landlady recognised the depths of Barbara’s passion for nature and the miniature world of insects, and put her in touch with someone who shared her love—the local train driver Chris Jessup. Barbara has fond memories of weekends spent with the Jessup family, having picnics in the bush and discovering more about the natural world around her. She also felt immense satisfaction at the recognition of her interest as something to be supported, rather than merely tolerated.



And it wasn’t long before Barbara had decided to dedicate her career to the study of nature’s smaller creatures.

Barbara embarked on a science degree with UWA, eventually completing an Honours degree in zoology, working as an entomologist with the Department of Agriculture during holidays, and completing a thesis on the crustaceans that inhabit ephemeral ponds. Following her studies she was appointed as an assistant lecturer at the University of Otago in Dunedin, New Zealand. While she relished this opportunity there was a certain ex-serviceman she’d attended university with that lured her back home—her future husband Albert, or Bert Main.

Together Barbara and Bert became a formidable team in the Western Australian world of natural history studies. They travelled together for work—to the east coast, America and Great Britain. Barbara remembers weeks spent in the field, Bert working on frogs while she concentrated on what was increasingly becoming her area of expertise—trapdoor spiders (suborder Mygalomorphae).

“They were really terrific days,” she says. “I loved being in the bush, the camping, but also having the work we were doing being appreciated,” she says.

Mark Harvey also has fond memories of life in the field with Barbara. “I was always amazed by what



Above Barbara York Main.
Photo – Marie Lochman

Below right Barbara in Wongan Hills
around 1975.
Photo – Barbara York Main collection

she could see, and how she could find the trapdoor burrows,” he recalls.

“I remember being on a field trip with her and being challenged to see if I could see the burrows she had already spotted.

“And I remember she’d always stop for morning tea. No matter what we were doing she’d pull out the thermos and the camp table and we’d stop for a cuppa, which suited me perfectly.”

Barbara soon authored several books—the pocket guide *Spiders*, published in 1964, the natural history book on the Wheatbelt *Between Wodjil and Tor* in 1967, a book on people and their response to the landscape *Twice Trodden Ground* in 1971, and the reference book *Spiders* published in 1976. These were written in addition to the countless papers she has penned over the years.

In between research, field trips, overseas work and book production Barbara also found the time to rear three children. Her first, Rebecca, spent her second year in the UK while Barbara completed a fellowship from the Federation of University Women. Her second child Gilbert, and third Monica, were raised back in Australia, Barbara working from home

and storing her growing collection of specimens in the old zoology rooms of UWA—a pioneer of the modern-day juggling act of balancing work and parenthood. When all three children were at school, Barbara was back in the lab at UWA, where she continues to work today as an adjunct professor.

World of infinite wonder

After decades of work in the field, Barbara never tires of her subject. She says the extent of biological surveys being conducted these days continues to unearth new species of trapdoor, and reveal new information about the creatures that have her so fascinated.

“Trapdoors have become something of a target species in the biological surveys—they are ground dwelling, sedentary and they don’t disperse like other spiders so they have a very narrow distribution. If you damage a trapdoor spider habitat you could lose an entire species,” she says.

“And there are lots that are still to be named. When I started even some genera were unnamed.”

Barbara herself has discovered so many new species of trapdoor spider that she can’t remember how many she has made new to science.

And for many years her work as a consultant meant she was the person to go to when spiders discovered during biological surveys needed identification. She also has acted as a mentor to countless students.

Future

While Barbara now rarely does consultancy work, she certainly hasn’t stopped working. Her role as an adjunct professor with UWA’s School of Animal Biology ensures she is often at her desk, writing up taxonomic notes on years of past studies.

“I’m also writing a paper on a population of *Gaius villosus* in the Wheatbelt,” she says.

“I had only planned on studying them for 20 years but some of the cohorts I’d pegged went on well past this timeframe—there’s one spider still going that will be 40 years old this year.”

It was this study that so impressed Mark Harvey when he visited the Wheatbelt with Barbara years ago.

“She really is a lovely lady—very knowledgeable, very forthright, and knows an incredible amount about spiders, as well as the WA landscape as a whole. Her knowledge of the whole landscape was something that really amazed me.”

And you can bet we will continue to be amazed as Barbara works on publishing still more scientific papers. For, as long as Barbara is still working, you can rest assured that we’ll learn a lot more about the world of the trapdoor spider.



Samille Mitchell is a Department of Parks and Wildlife feature writer and *LANDSCOPE* editor. She can be contacted on 0407 998 721 or by email (samille.mitchell@dpaw.wa.gov.au).

Science, a weed and cat control

A plant that attracts cats to chew the roots and then roll about in an apparent drug-induced stupor? Could this be true? Department of Parks and Wildlife scientists set out to investigate and determine if such a plant can aid cat control efforts.



by Dave Algar, Neil Hamilton, Don Nickels and Gavin Flematti

While conducting research into feral cat control on Christmas Island, several local residents told us of a plant on the island that had a peculiar effect on cats. The behaviour was particularly noticeable when people weeded their gardens and exposed the roots of the plant. Pet cats and strays—and there were many before the start of a cat control campaign—would wander into the gardens and pick this plant out of the weed heap. They would chew the roots and then roll in them in what appeared to be a drug-induced stupor. If the plant was taken away from the cat it became aggressive and attempted to regain the material.

We followed up on these reports and found that the plant was a species called *Acalypha indica* and did indeed induce this behaviour in cats. *Acalypha indica* belongs to the family Euphorbiaceae and is also known by the common names Indian acalypha, Indian nettle and three-seeded mercury. The species occurs throughout tropical Africa and South Africa, in India and Sri Lanka, as



well as in Yemen and Pakistan and was probably introduced to Christmas Island where it has become a weed. The plant grows up to 75 centimetres tall and has ovate leaves and green flowers. A literature search revealed that, where the plant grows, it is widely known for its effect on domestic cats, which respond very tenaciously to the root of the plant.

The plant also has medicinal properties and has been used to cure ringworm, rheumatoid arthritis, scabies-infected wounds and more. It

is also browsed by cattle, but whether it produces the same narcotic behaviour is not documented.

Enticing cats

Could this plant be used to improve our cat control techniques as an addition to the bait medium, or be used as a lure to survey cat numbers? Pilot trials conducted on Christmas Island showed that the roots lost their impact on cats after being exposed to the atmosphere for a number of days; so we could not grind up root material and use that. It was therefore important to determine which chemicals in the plant's root affected the cats, whether they could be manufactured synthetically, and whether loss of volatility could be prevented.

Initially, a number of plants were brought to the mainland, under Australian Quarantine and Inspection Service permits, to provide fresh root material for chemical analysis. Following fumigation and the regulatory quarantine period, roots were removed and analysed but unfortunately the chemicals could



Previous page

Main *Acalypha indica*.

Inset left A cat in an apparent drug-induced stupor after chewing roots of *Acalypha*.

Inset right Gavin Flematti at work in the School of Chemistry and Biochemistry laboratory at UWA.

Above *Acalypha indica* growing on a roadside verge.

Left A cat rolling in plant roots.

Photos – Neil Hamilton/DPaW



not be identified. We then contacted the School of Chemistry and Biochemistry at The University of Western Australia (UWA) for advice and decided a collaboration between the two organisations would be the best way forward. We conducted chemical extractions on fresh root material at Christmas Island and provided these extracts to UWA for chemical analyses. Vacuum absorption traps were also used to trap volatile compounds emitted from fresh root material.

A compound combination

Chemical analyses of the extracts, and in particular the absorption traps, revealed the presence of two compounds known to cause behavioural responses in cats. The occurrence of these two compounds, not normally found in the same plant, is suspected to have a synergistic effect and therefore be responsible for the elevated reaction in cats. The two compounds are now being prepared synthetically at UWA and, following further testing, this may lead to them being incorporated into baits and lures.

Top A cat chewing plant roots.

Above right Don Nickels (foreground) and Keith Hywood (background) performing chemical extractions on root material on Christmas Island.

Photos – Neil Hamilton/DPaW



Dave Algar is a senior research scientist at the Department of Parks and Wildlife's (DPaW's) Science and Conservation Division at Woodvale. He has worked throughout Western Australia conducting research on feral cat control for the past 20 years. He can be contacted by email (dave.algar@dpaw.wa.gov.au).

Neil Hamilton is a senior technical officer at the DPaW Science and Conservation Division at Woodvale. He has worked on feral cat research under the fauna conservation program for the past 10 years. He can be contacted by email (neil.hamilton@dpaw.wa.gov.au).

Don Nickels is a registered veterinary surgeon with 45 years' experience working with cats and now consulting with DPaW on cat management and control. He can be contacted by email (nickelsd@bigpond.net.au).

Gavin Flematti is a researcher in the School of Chemistry and Biochemistry at The University of Western Australia. His work involves identifying naturally derived compounds that have some form of biological activity. He is currently funded through the Australian Research Council's Future Fellowship scheme. He can be contacted by email (gavin.flematti@uwa.edu.au).

urban antics by John Hunter



Swan song

The black swan (*Cygnus atratus*) is so taken for granted by today's urbanites of the Perth region that it barely raises an eyebrow when viewed on the wetlands and waterways of the city. While common among the ducks and waterfowl throughout the continent, it is acceptable to say that it is uncommon only in central and northern Australia.

While the local Aboriginal people of south-west Australia had lived in concert with black swans for thousands of years, Dutch explorer Willem de Vlamingh surveyed what is now the Swan River in 1696 and named it after the majestic birds' presence.

Again in 1827, two years before European settlement,

botanist Charles Fraser with Captain James Stirling aboard the HMS *Success* further described for the rest of the world that: "The quantity of black swans, ducks, pelicans and aquatic birds seen on the river was truly astonishing. Without any exaggeration, I have seen a number of black swans, which could not be estimated at less than five hundred rise at once, exhibiting a spectacle which, if the size and colour of the bird be taken into account and the noise and rushing occasioned by the flapping of their wings, previous to their rising, is quite unique in its kind. We frequently had twelve to fifteen of them in the boats, and the crews thought nothing of devouring eight roasted swans in a day."

By 1870 it was quite noticeable that the settlers of the new colony had decimated the stocks of black swans on and around the Swan River and so legislation was enacted to ban the shooting of birds and animals indigenous to the Swan River Colony.

Since early times, the black swan has endeared itself deep into Western Australia's culture with the people of the state fully supporting the protection of this magnificent icon. The black swan was a literary or artistic image long before European settlement and its Australian heraldic role both today and in early colonial history is well documented. The contrast of this antipodean identity to the white swan of Europe has given us a unique icon of 'Australianness'

which features on our flag and coat of arms, as our bird and state emblem, and on the iconography of WA's institutions and commercial industry.

The Swan River Estuary, like the bird and marine life it supports, is not quite as pristine as it once was. Today it labours to cater for some two million people who live in and use the wider Swan-Canning catchment. At times, the sparkling waterway is also under stress from nutrient and marine water intrusion, lack of flushing from low winter rainfall, altered river flow from past dredging and the loss of fringing riverine vegetation. Past river management has been largely shaped by a variety of interests and goals, but it is hoped that with hindsight and understanding, the people of Perth will make more informed decisions for the future of the river and its dependants.

To me, the bugling and hissing of a rampart black swan protecting its fluffy grey cygnets has always been the epitome of extreme character and strength, whether it be on the Swan Estuary, beyond the breakers at Scarborough Beach or in the seclusions of Herdsman Lake.

Some 70 years ago and head-high to a small boy at Matilda Bay, Crawley, an angry swan was as tremendous as the take-off roar of nearby catalina flying boats ... and I can still hear the distant swan song from my workplace at the same location today.

DID YOU KNOW?

- A black swan stands at about 130 centimetres with a wingspan of almost two metres.
- Swans are known to live for up to about 40 years, are monogamous, but have about a seven per cent divorce rate.
- Swans feed primarily on aquatic plants but inland they forage on grain, grasses and crop foods.



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ISSN 0815-4465



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Print Post Approved pp665002/00004

