WA's conservation, parks and wildlife magazine

#### Greater protection for Ningaloo

Volume 20 Number 3 AUTUMN 2005 \$6.95

Oasis in the Gascoyne

## Making a world of difference with LANDSCOPE Expeditions



Expeditioners in a grove of desert grass trees (Xanthorrhoea thorntonii) at Lake Mason in September 2004, where they celebrated the 200th anniversary of ornithologist John Gould's birthday. CALM Goldfields ecologist Mark Cowan is holding a large specimen of Gould's goanna (Varanus gouldii). Photo – Kevin Kenneally

#### Join our scientists in the cause of conservation and discover the secrets of the Australian outback

#### Loggerhead Turtles of Dirk Hartog Island, Shark Bay (a) January 10–17; (b) January 17–24, 2005

The sandy beaches of Turtle Bay, at the northern end of Dirk Hartog Island, are among the few key nesting sites in Western Australia for the loggerhead turtle (*Caretta caretta*). The species is considered the most endangered turtle that nests in the Australian region. Expedition members will have the opportunity to help tag female loggerheads that nest at night on Dirk Hartog Island at the peak of the summer season.

#### Houtman Abrolhos Archipelago—A Voyage of Discovery February 26–March 2, 2005

Voyage to the Abrolhos Islands in the Indian Ocean off Geraldton with ornithologist and naturalist Kevin Coate, and Churchill Fellow and marine wildlife specialist Doug Coughran. Doug will lead a study of the islands' Australian sea lion colonies and, from Kevin, you will learn about the islands' importance for seabird breeding.

#### Macassans, the Mermaid and Marigui—First Encounters on the Kimberley Coast

#### May 30-June 12, 2005

Explore the untamed land and seascapes of the Kimberley coast. On this voyage of scientific exploration from Broome to Wyndham, you will visit some of the most isolated and scenic places in Australia with the expeditions Scientific Coordinator Kevin Kenneally and ornithologist and naturalist Kevin Coate. Journey back in time and discover the colourful history of first contacts, and their impact on the conservation biology of the Kimberley coastline and its myriad near-shore islands.

#### A Brush with Nature—the Art of the Flower Hunters August 22–31, 2005

On this historic journey to Doolgunna Station in the Murchison a rare opportunity is yours – not only that of assisting with an inaugural botanical survey of the former pastoral lease with botanist Daphne Edinger, but also that of observing the tradition of botanical illustration as it continues into the twenty first century with artist Philippa Nikulinsky. Based at the station for the duration of the expedition, you will have plenty of opportunities to try your hand at wildflower painting under the expert tutelage of Philippa.

#### Prospecting for Wildlife—Discovering the Biological Riches of Lake Mason

#### September 12-21, 2005

The former pastoral leases at Lake Mason and Black Range are particularly rich in wildlife and are home to the long-tailed and hairy-footed dunnart, and the rarely seen kultarr and mulgara. Travel with us through historic gold rush country, renowned for its carpets of spectacular everlasting wildflowers and scenic breakaways and assist scientists from CALM and the WA Museum with this important biological survey.

#### Conserving the Cape—Wildlife of Cape Arid November 13–20, 2005

Superb white beaches, rocky headlands and clear blue seas provide a stunning visual backdrop to granite hills, dense coastal heaths and the open woodlands of Cape Arid National Park. The principal focus of this year's expedition will be a survey of the eastern region of the park in search of the threatened western ground parrot. The park is also home to the elusive heath mouse, the Cape Barren goose, dunnarts, and pygmy and honey possums. You will have the chance to assist with a range of trapping and census methods to collect much needed information on the plants and animals found in the park.

#### Send for your LANDSCOPE Expeditions 2005 brochure now.

Call (08) 6488 2433, fax (08) 6488 1066 email: extension@uwa.edu.au or write to: *LANDSCOPE* Expeditions UWA Extension The University of Western Australia 35 Stirling Highway, Crawley Western Australia 6009 or visit www.naturebase.net



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#### Peter Kendrick trained as a zoologist and later began working on the Kimberley Rainforest Survey Program in 1987 and, since then, has developed a love for the weather and the big skies of the Pilbara. He has worked in CALM's Karratha office as a regional ecologist since 1989, and his awareness of the date palm problem at Millstream was sparked by his close

involvement with the management of the Millstream environment as part of the west Pilbara water supply scheme.

Ashley Tate Townsend completed a three-month graduate internship with CALM's Strategic Development and Corporate Affairs Division in 2004. During her internship, Ashley wrote

#### editor's letter

Given that the word 'biodiversity' has only been in use for about 20 years, it's not surprising that it still means different things to different people. After all, the prefix 'bio' has some very different associations, from biodegradable washing powders to biological warfare.

The National Strategy for the Conservation of Australia's Biological Diversity, published in 1996, defined biodiversity as the variety of all life forms-the different plants, animals, fungi and microorganisms, the genes they contain and the ecosystems of which they form a part. Biological diversity is considered at three levels: genetic, species and ecosystem diversity.

The Western Australian Government is a signatory to the national strategy and has also begun the process of developing a State biodiversity conservation strategy. A discussion paper, Towards a biodiversity conservation strategy for Western Australia, was released in December 2004 as the start of a consultative process to produce a strategy.

The pressing need for a Western Australian biodiversity conservation strategy is explained in Embracing diversity, the spice of life, by Keith Claymore. Our State is recognised internationally for the richness of its biodiversity-we have one of only 25 world biodiversity hotspots for example-but this tremendous asset is facing continual decline.

About two per cent (or 547) of described species are listed as threatened at a State level, and 33 species have become extinct. There are 66 threatened ecological communities and another three are presumed destroyed. Significant levels of human-induced extinctions are likely in the South West of the State, northern rangelands and in the more settled coastal areas unless conservation action is increased. It's estimated that about 400 animal species, including aquatic invertebrates, and 450 plant species are threatened by rising salinity, and 40 per cent of the 5710 described plants in the South West Botanical Province are susceptible or highly susceptible to Phytophthora dieback. Further threats come from altered fire and grazing regimes, habitat removal or modification, introduced plants and animals and climate change.

This issue of LANDSCOPE also highlights some of the activities that are underway to halt and even reverse biodiversity loss. These range from extending our conservation reserve system (Ningaloo, reef of gold by Carolyn Thomson-Dans, and Wanna know a secret? by Samille Mitchell and Brett Fitzgerald) and recovery work in an existing reserve ('Feral' palms by Peter Kendrick) to conservation work at the species level (Rock-wallables rediscovered at Kokerbin Nature Reserve by Christine Freegard and Peter Orell, The feather-leaved banksia by Anne Cochrane, Sarah Barrett and Sandra Gilfillan and Wondering about wandoo by Peter White and Liz Manning).

In fact, all of our stories have a common theme: to promote awareness, appreciation and support for biodiversity conservation.

Caine Bailey

Caris Bailey **Executive Editor** 

## contributors

several articles for LANDSCOPE and Conservation News, CALM's monthly newsletter, and also made valuable contributions to many other CALM corporate affairs activities. Her internship was a component of her studies at the Virginia Commonwealth University in Richmond, Virginia, USA, in which she focused on environmental studies and communications. She completed a Bachelor in Environmental Studies in 2001.

Brett Fitzgerald joined CALM in 1995 in the first intake of CALM's graduate recruit program, after completing a Bachelor of Science degree at Curtin University. Since then, he has worked in CALM's Blackwood and Shark Bay districts and is now based in the Midwest region working from the department's Carnarvon office, primarily on rangelands management. Brett is also responsible for the management of the Kennedy Range and Mount Augustus national parks. Brett continues a long family tradition of working for the Forests Department and CALM, which was started by his grandfather who began work as a forestry cadet at Ludlow in 1925.

Liz Manning has been the Executive Officer for the Wandoo Recovery Group since its inception in 2003. Her interest in the environment has spanned 18 years, during which time she has been an active member of numerous local and regional committees involved in natural resource management. Before moving to York, Liz lived in Arnhemland, where she studied the rehabilitation of eucalypt forest ecosystems after mining and the effects of wildfires. Her passions for travelling, working in remote cross-cultural societies and caring for the environment have contributed to her appreciation for life and its huge diversity. She also studies environmental science externally on a part-time basis at Murdoch University.

also contributing . . .

Samille Mitchell, Carolyn Thomson-Dans, Anne Cochrane, Sarah Barrett, Sandra Gilfillan, Peter White, Keith Claymore, Margitta Docters van Leeuwen, Christine Freegard, Peter Orell, Verna Costello, David Gough, John Hunter, John Blyth and Kirsten Pearce.







#### Cover illustration by Martin Thompson

The lionfish is a member of the scorpionfish family, but while other members of this family often use camouflage for protection, it swims freely around coral reefs, relying on its venomous spines to deter predators. These brightly-coloured fish, also known as firefish, grow up to 30 centimetres long and are predominantly found in tropical and subtropical waters. They are nocturnal, becoming active when the sun sets.

#### Back cover photo by Glen Cowans

Despite their plant-like appearance, sea anemones are animals related to corals. They have no skeleton and attach themselves to rocks or other underwater surfaces. They feed on a variety of animals, including worms, crustaceans and fish, which they trap in their tentacles.

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## rediscovered at Kokerbin Nature Reserve

Rock-wallabies

Black-flanked rockwallabies had not been seen at Kokerbin Nature Reserve for more than 30 years, but a spotlighting expedition in 2003 cast some light on the extraordinary ability of these special native mammals to recolonise areas against all the odds.



#### by Christine Freegard and Peter Orell

ntil 1967-1970, the Kokerbin Nature Reserve, in the Shire of Bruce Rock in the Wheatbelt region, was inhabited by a population of blackflanked rock-wallabies. It has been used as a control research site since 1979 and was left unbaited during a study by CALM scientist Jack Kinnear on the impact of fox predation on rockwallaby populations in the area. This was a ground-breaking study (see 'Outfoxing the fox', LANDSCOPE, Summer 1988/89) as, prior to Kinnear's research, most scientists did not believe that fox predation could lead to native species becoming extinct. The research eventually led to the original proposal for Operation Foxglove, the precursor to Western Shield (Western Australia's feral animal baiting program). However, rock-wallabies disappeared from Kokerbin after being eaten by foxes.

In 2002, Howard Robinson from CALM's Narrogin district office found fresh rock-wallaby scats among boulders at the reserve, so the area was investigated further. Spotlighting in June 2003 confirmed the presence of rock-wallabies, with the sighting of a single individual. However, it took until March 2004 to actually trap rockwallabies at the reserve. Three animals were caught, one male and two females, both of which were carrying pouch young. Ear tissue samples were taken from these animals and sent to Mark Eldridge at the Macquarie University in New South Wales for DNA analysis to determine the origin of the population.

Had these animals travelled five kilometres across open farmland from the nearest population at Nangeen Hill Nature Reserve? Or had they always remained present at Kokerbin Nature Reserve but eluded detection for more than 30 years? Both alternatives seemed unlikely, but surprising DNA results showed that the DNA of Kokerbin rock-wallabies closely matched that of rock-wallabies from Facing page Black-flanked rock-wallaby. Photo – Jiri Lochman

Above View of Nangeen Nature Reserve from Kokerbin Nature Reserve. Photo – Christine Freegard

Gundaring Nature Reserve (also known as Tutakin). This indicated that they had most likely travelled about eight kilometres across farmland to recolonise the vacant habitat at Kokerbin. These far-wandering animals probably used roadside vegetation for shelter during their journey across land, largely cleared for crop production and sheep grazing. The DNA also showed that the animals were closely related, suggesting that the population may have established from a single female carrying a male pouch young or a small group of related individuals.

A similar event was recorded in 1995, when a population of rock-





Above Black-flanked rock-wallaby.

Above right Black-flanked rock-wallabies on Querekin Rock.

**Right** Black-flanked rock-wallaby joey. *Photos – Christine Freegard* 

wallabies was discovered at a rocky outcrop on private property. DNA analysis of samples taken from the six known individuals in the population showed that the likely source of the population was the eastern end of Mount Caroline Nature Reserve, about eight kilometres away. Fox baiting at the outcrop since the population's discovery has resulted in an increase in the population size and the population has now persisted for almost 10 years.

These recorded dispersal events are encouraging for the long-term survival of rock-wallabies on outcrops isolated by farmland, because it indicates that occasional exchange of individuals between outcrops is possible. It also means that release sites chosen for translocations of rock-wallabies will hopefully form nucleus colonies from which animals will disperse to colonise other areas. This is already happening in the Avon Valley and in Cape Le Grand National Park. Founder animals from the release of rock-wallabies at Cape Le Grand National Park, for example, have been found more than eight kilometres from the release site in less than two years.

Kokerbin Nature Reserve, characterised by a giant boulder often referred to as 'the rock', provides excellent habitat for rock-wallabies. The complex rocky outcrop provides both shelter and vantage points from which curious rock-wallabies can observe the world.

Managing the population at Kokerbin is going to be challenging, given the close proximity of a very popular camping area to the rock. Kokerbin Nature Reserve is currently not baited to control foxes. Options for managing the population are being considered. The 1st Pingelly Scout Group is helping by removing rubbish and broken glass from the reserve.

While the future of these blackflanked rock-wallabies might contain challenges, their ability to recolonise areas and their adaptability has scientists viewing the success of this population with optimism.





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Peter Orell is the *Western Shield* zoologist also based at CALM's Wildlife Branch in Kensington. He can be contacted on (08) 9334 0454 or by email (petero@calm.wa.gov.au).

# bookmarks by Verna Costello

Gone to Rottnest

Author: Trea Wiltshire 98 pages, colour paperback Publisher: UWA Press ISBN: 1 920694 28 5 RRP: \$24.95.

The unspoilt simplicity and relaxed atmosphere of Rottnest Island has long lured Western Australians, and Trea Wiltshire delights her readers by tracing its transformation from a place of imprisonment to a favourite holiday destination.

She also celebrates the natural history and simple pleasures of the island, among them cycling, snorkelling, diving and birdwatching. She introduces readers to the birds that will share their stretch of beach, the vegetation they will cycle through when exploring the island, the fish they may catch, and the migrating whales and playful dolphins of the Indian Ocean.

Gone to Rottnest will also raise awareness of its fragile environment and, hopefully, will stiffen the resolve of its loyal supporters to nurture and restore it.

#### A Home for Bilby

Author: Joanne Crawford Illustrator: Grace Fielding 28 pages, full-colour paperback Publisher: Magabala Books Aboriginal Corporation ISBN: 1 875641 91 2 RRP: \$18.95

Bilby, who has lost his family and is homeless, meets five different Australian native animals. They each have a home but can't or won't share it with Bilby. Eventually, they help Bilby and become his friends.

The author is a primary schoolteacher who has developed resources to provide teachers and students with a better understanding of Aboriginal culture.

Grace Fielding is well known for her unique illustrations that combine traditional dot art with contemporary images.

She has illustrated two other children's books, one of which,



*Bip the Snapping Bungaroo*, won the Chrichton Award for Illustration in 1991.

A budding expert on children's books is six-year-old Eleni Tsaknis of Cottesloe, who said "I enjoyed this book a lot 'cause it's about our wild animals, and I just love them".

#### Geology of Western Australia's National Parks: geology for everyone

Author: Peter Lane 101 pages, full-colour paperback Publisher: Self-published ISBN: 0 646 43995 2 RRP: \$29.95

Author Peter Lane has taken a 'helicopter view' of Western Australia's national parks in order to give the reader a greater appreciation of the global forces that have formed these areas.

The aim of his book is not only to describe the geology, but also to explain in simple terms how it came about and to encourage the reader to look at our land and ask "How did that get there?" To achieve this, Peter's text is generously supported with photographs, detailed diagrams and maps.

Peter is heavily committed to environmental issues and has worked as a geologist in the oil exploration industry in Papua New Guinea, Canada and Australia.



#### Geology of Western Australia's National Parks





# Wanna know a secret?



On the very northern edge of the Gascoyne lies a wonderfully kept secret. Where flat, barren landscape is the norm, this secret is an oasis of life. Stunning ranges sweep through its boundaries, rivers and creeklines meander throughout and giant gums line waterways harbouring a spectacular profusion of bird life.

#### by Samille Mitchell and Brett Fitzgerald

picturesque area that was previously part of Wanna Station is hidden in the remote landscape of the Gascovne region. Using Commonwealth government Natural Heritage Trust funding, the Department of Conservation and Land Management (CALM) bought 288,808 hectares of the station in June 2003 as part of its Rangelands Pastoral Land Acquisition Program aimed at better preserving natural habitats in the Gascoyne and Murchison regions. The remainder of Wanna Station has been amalgamated with the adjoining Gifford Creek Station and the resultant property has retained the name Wanna.

To avoid confusion, the section of Wanna purchased by CALM will



require a distinctive name, worthy of the remarkable country it contains. It is hoped that an appropriate name will be determined during the management planning process for this area.

Before the inception of the land acquisition program, just 1.4 million hectares—representing about 2.4 per cent of the Gascoyne and Murchison



regions—were protected in conservation reserves. Following the purchase of 3,914,691 hectares of land under the program, that figure has leapt to 5.4 million hectares—nine per cent of the region.

#### Wildflowers

Situated at the northern end of the Gascoyne region boundary, the area includes a diverse range of habitats, ranging from mulga and snakewood shrublands to low woodlands and spinifex hummock grasslands.

The Irregully, Muntharra and Wandarry creeks run through the property before joining the Ashburton River and flowing into the Indian Ocean at Onslow. Draining in a southerly direction is the Frederick River, which joins the Lyons River and then the Gascoyne River to finally discharge into the waters of Shark Bay at Carnarvon. Thus, run-off from the same rainfall event on this property could eventually discharge into the Indian Ocean at two locations 400 kilometres apart.

Though it has not been comprehensively surveyed, the property contains examples of both Gascoyne and Pilbara flora. Of the six vegetation types known to occur on Wanna, five are considered to be inadequately represented in existing conservation reserves. One vegetation type—lobed spinifex (Triodia basedowii) hummock grassland-was virtually unrepresented in any conservation reserve, and only poorly represented in other land managed by CALM. The acquisition of this area has added an

Previous page Main Early morning at Strama Pool on Irregully Creek. Photo – Iain Copp Insets from left Little corellas; Rothschild's rock-wallaby; zebra finch. Photos – Lochman Transparencies Textures and colours from Wanna. Photos – Samille Mitchell

Left Crimson peaflowers (Sphaerolobium) at Wanna. Photo – Iain Copp



additional 500 hectares of this vegetation type to the conservation reserve system.

Another two vegetation types mulga (Acacia aneura) and snakewood (Acacia eremaea) shrubland, and low woodland of Acacia victorae and snakewood—had less than five per cent of their original ranges within conservation reserves. One of these systems, mulga and snakewood shrubland, comprises most of the area. With the purchase of this property, the area of this vegetation system in reserves has increased from four per cent to 15.5 per cent, and it is now considered adequately represented.

Thanks in part to the relatively inaccessible nature of the area, and to conservative practices of previous pastoral managers, the vegetation has been maintained in good condition.

#### Wildlife

The area is also home to a range of native animals. While no comprehensive wildlife surveys have yet been conducted, initial property inspections indicated that animals found there are predominantly species typical of the Pilbara.

CALM staff have reported sightings of the uncommon Rothschild's rockwallaby and have been told of sightings of the northern quoll. The threatened Pilbara olive python has been found there too, confirming pastoralists' reports that this magnificent python species the largest snake in WA, with lengths of up to 4.5 metres (see 'Giant pythons of the Pilbara', *LANDSCOPE*, Spring 2003)—was frequently encountered while working across the property. In fact, the land remains in such good condition, compared to its heavilygrazed surrounds, that CALM staff hope monitoring will reveal a relatively unspoilt array of native mammals and reptiles.

CALM intends to begin fauna monitoring in the near future. Information gleaned from the monitoring will serve as a benchmark from which the station's biological diversity can be judged in the future. And, of course, there's always the hope of discovering species outside their known range. The area's topography has made it difficult to develop and this means the land is still in good shape. Because of this, finding rare or uncommon animals is a distinct possibility.

Containing the headwaters of the spectacular Irregully and Muntharra creek systems, the area is rarely without numerous river pools, which provide important refuges for a variety of wildlife species through times of drought. The presence of permanent water in river pools and springs on the Above Part of the land formerly in Wanna Station, that has been acquired for conservation. Photo – Samille Mitchell

station means that it harbours birds by the thousand. Representatives from Birds Australia have been invited to visit next year to start developing a database of the station's spectacular feathered inhabitants.

Walk along a riverbank and you'll see the trees and an explosion of colour and sound, as zebra finches and diamond doves erupt from the branches. The chitter-chatter of budgerigars is also commonplace, along with the raucous calls of galahs and little corellas. Visitors will also be sure to spot the exquisite spinifex pigeon and the Australian bustard. Even pelicans, so far from their coastal homes, soar the thermals in stark contrast to their rust red surrounds.

#### Wanna-ful landscape

The Wanna countryside is renowned as some of the most spectacular in the region, with giant ranges sweeping through the property. The Godfrey Range forms the southern boundary of the CALMmanaged area. This spectacular range is broken in only three places along the





32-kilometre boundary. Vehicle access is possible through only one of these gaps.

The magnificent entrance to the CALM-managed portion of the station is itself enough to grace a postcard. Called Coodardo's Gap, the entrance is framed by two battlements of the Godfrey Range plunging abruptly down to a magnificent creek system lined with river gums.

The river meanders towards two waterholes—Faithful Pool and Pretty Pool. As the name suggests, Pretty Pool is particularly scenic. The slate rock that dominates so much of the landscape forms building blocks on a cliff face overlooking the pool. Reflected in the pool's waters, the cliff face's regular square blocks look particularly striking.

But it is Gregory's Gap that most impresses with its magnificence. The gap is part of the Godfrey Ranges—a virtually impregnable landscape of sheer cliff faces, tabletop hills and rugged red rock. The gap itself is heralded by two giant rounded hills. Clamber to the top of them and the river that runs at their feet diminishes in size and the ethereal form of Mount Augustus shimmers on the distant horizon.

When viewed from this vantage point, the comprehensiveness of the

**Top** Folded beds of sandstone and siltstone of the Minnierra Range.

**Centre left** Spring time in the Minnierra Range. *Photos – Iain Copp* 

Left Pretty Pool. Photo – Samille Mitchell properties acquired through the Gascoyne Murchison Strategy is brought into perspective. Behind the viewer, the 288,808-hectare expanse acquired from Wanna stretches north towards the Ashburton River. In front of the viewer, the iconic Mount Augustus within the Mount Augustus National Park looms on the horizon. To the west of Mount Augustus, the Centipede Range on the CALMacquired Cobra Station snakes across the landscape.

#### **Aboriginal history**

All of these landmarks were significant to the area's original inhabitants, and Wanna itself was important because of the permanent water sources. A rock painting of a giant olive python is testimony to Aboriginal use of the area and their intimate knowledge of the area's biodiversity.

Even the station's name arose from the Aboriginal-named Wanna Hill. Several explanations for the name exist. One theory is that the name arose from the Payungu word 'wana mulu', meaning 'shag' or 'cormorant'. Another says it comes from the Yingarrda word for 'little black cormorant'. And yet another explanation says it comes from 'wangana'-the Jiwardi word for 'grey duck'. Or perhaps the name arose from the word 'wanna', meaning womens' digging stick. Aboriginal legend had it that any Aboriginal person to go through the gap or walk in the shadow of its walls would die.

Ingarda elder Ron Crowe is chairman of the Gnulli Native Title claim over the area and says the area has been highly important to Aboriginal people. He points to the carvings, art and shield trees as evidence of early Aboriginal occupation. Ron was born in the region and spent many years mustering at Wanna Station in the 1960s and 1970s. He believes there is something extra special about the area's landscape-it becomes a part of you, he says. And he confirms that the area harbours rare and uncommon wildlife like Rothschild's rock-wallabies, olive pythons and quolls. Ron is glad to see the area protected under CALM management. He says it's vital to preserve such a special piece of bush and the animals it shelters.



#### **Station history**

The first European to venture into the area was Francis T Gregory. In 1858, Gregory explored extensive areas of the Gascoyne region, travelling from near the present-day site of Kalbarri, along the Murchison, Gascoyne and Lyons rivers. During this expedition, he climbed and named the nearby Mount Augustus and visited the area at the mouth of the Gascoyne River where the town of Carnarvon is now located.

Three years later, in 1861, Gregory sailed to Nickol Bay and, over the course of the next six months, explored extensive areas of the Pilbara. During June 1861, Gregory explored the Wanna area. On 25 June, Gregory sighted Mount Augustus from the Kenneth Range and, later that day, passed through the gorge now named Gregorys Gap, in the Godfrey Range. Gregory's journal recorded:

'from the summit of this pass the course of the stream could be traced across the fertile flats of the Lyons until it was lost in the numerous channels of the river and I was able to obtain bearings to many well

Above Lee Steere Pool. Photo – Samille Mitchell

remembered objects noticed on my former visit to this part of the country'.

On 26 June, Gregory blazed several large trees on the northern side of the gorge. Some of these trees are still standing with the axe marks clearly visible.

Within 60 years, pastoralists began taking up leases in the area. A team of three men—Donald Ryan, Alexander Grant and David Grant—established Wanna, calling it Elliot Creek Station. In 1923, Ernest Lee Steere and Henry Percy Sprigg took on the property and introduced cattle there. They employed Angus Paterson to manage the station, and he and his wife Josephine set about better establishing the property and its homestead.

It must have been a trying life for this pioneering young couple and their eldest two daughters in this rugged, remote stretch of countryside.







Communication with the outside world was difficult, as there was no telephone line, but they could rely on a pedal radio to reach the Royal Flying Doctor base in Meekatharra. Times became even tougher in the mid–1930s when drought began to grip the land. By 1938, the couple had left. The station was then managed by a string of others, before Ernest Lee Steere returned from the war to take on the property once more.

In the early 1960s, the Adams family purchased the lease and changed the station's name to Wanna. They too eventually moved on and Rudy and Shirley Van Dogen assumed management of the property in 1984. By 1989, Bill and Nina Radford began managing the property.

It was Bill and Nina who encouraged the owners to negotiate with CALM in a bid to preserve the land. Bill says Wanna's northern end remains a pristine piece of country, worthy of preservation. He applauds the efforts of CALM rangelands conservation coordinator Tony Brandis for his work on the land acquisition program. Today, Bill's son Bruce continues to manage the section of Wanna not purchased by CALM, and helps CALM with necessary operations on the acquired area.

#### Wanna's future

CALM has started a management planning process for the area. An important part of the planning process will be liaison with all stakeholders to determine necessary and appropriate management actions needed to preserve the area's unique features. An important component of the management plan will be consideration of the area's suitability as a wilderness area. Remoteness, lack of infrastructure and low levels of impact by feral animals all contribute to the wilderness quality of the area. After suitable assessment, some areas of the old Wanna lease may be declared wilderness areas.

To preserve the wilderness values, and because of concerns about visitor safety, visitation is currently discouraged. Steep gorges mean a Above Looking out towards Muntharra Tabletop rising above Irregully Creek. Photo – Iain Copp

Far left Remnants of an old cattle yard on the part of the property now managed for conservation.

Left Trees blazed by F T Gregory in 1861 still have clearly visible axe marks. Photos – Samille Mitchell

single serious rainfall event could cut all access north of the Godfrey Range, with serious consequences for anyone stranded in the area.

The need to establish biological baseline data for the area makes it an excellent location to conduct a LANDSCOPE Expedition, and plans for such a survey are being made for 2006. Flora and fauna surveys conducted by expedition members would help CALM management planning for the area. LANDSCOPE Expeditions would also allow participants to experience this rare and relatively pristine area of WA's outback. With uncommon and rare wildlife present on Wanna, participants may be involved in the discovery of some very special animal and plant species. Why not join us!



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## Wondering about Wandoo

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Wandoo, or white gum, is one of Western Australia's most significant woodland species. Wandoo has made a considerable economic contribution to the State's development, while conferring invaluable environmental benefits. However, in recent times, the species appears to have suffered from severe crown decline. Why is wandoo in decline, and what can be done to conserve our delightful and unique wandoo woodlands?

by Peter White and Liz Manning

andoo is a species that can strongly influence the character of the landscape. The observer's eye is drawn to the whiteness of the trunk. This, crowned by dull bluish-grey foliage, tends to stand out in the reddish-orange soils. The absence of a middle storey vegetation layer helps to accentuate its appearance.

#### **Natural beauties**

Wandoo (Eucalyptus wandoo subsp. wandoo) is commonly confused with many other species. Many have similar white bark, such as butter gum (E. laeliae) or salmon white gum (E. lane-poolei). However, wandoo has many distinguishing features, which, if viewed correctly, make it easy to identify. Its closest relative is the subspecies pulverea, which, due to its restricted northerly distribution, is rarely encountered. Another close relative is the widespread inland wandoo (E. capillosa subsp. capillosa), which has different bark colouration, seedling leaf characteristics and landscape positioning. Although the common name seems to suggest otherwise, wandoo is not closely related to powderbark or 'powderbark wandoo' (*E. accedens*), which has glossy leaves and rounded bud caps.

Wandoo can grow to 30 metres high, with a trunk girth up to three metres (one giant has been measured at more than five metres in girth at chest height). The largest trees are found in the highest rainfall areas, with the species being reduced to almost a mallee form in drier zones. Mature trees have a strong branching growth habit from the main trunk. Like most forest eucalypts, wandoo trees are estimated to live somewhere between 250 and 350 years.

#### Previous page

Main Wandoo stands out with its white, mottled bark. Photo – Robert Powell

**Below** Wandoo tree and Bluff Knoll in the Stirling Range. *Photo – Rob Olver* 

#### Distribution

Wandoo is found across much of south-western Australia. It has an unusual distribution in comparison with other eucalypts such as marri or jarrah. It is distributed partially along the base of the Darling Scarp, grows as a component of the jarrah forest in some of the medium rainfall areas, then south and eastwards into the Wheatbelt region. It is absent from the high rainfall areas between these regions. Within this distribution, it can span the topographic sequence, from some of the highest parts of the landscape to some of the lowest.

Clearing for agricultural activities has dramatically altered the occurrence of wandoo across its former distribution. While it remains intact in many parts of State forest, in agricultural areas wandoo is reduced to a component of roadside vegetation, paddock trees, isolated farmland remnants or conservation reserves.

#### Woodland structure

Wandoo may grow in pure stands or with other species. In the more







Above left Tree martins in a wandoo nesting hollow. Photo – Sallyanne Cousans

**Top** An echidna in wandoo woodland at Boyagin Nature Reserve. *Photo – Mike Griffiths/WWF* 

Above Blossoms and the narrow, pointed bud caps of wandoo. Photo – Tom Chojka

#### **Commercial use**

Wandoo is a first class structural timber, used for flooring (especially in areas subject to heavy wear), joinery, beams, girders and joists, and was once regarded as Australia's best wooden railway sleeper timber. The timber has been widely used for heavy construction purposes such as poles, bridges and wharfs and for warehouse flooring. In the early days, it was sought after by wheelwrights to make wooden implements. It is still in demand for heavy use such as stockyard construction, and is highly prized as feature flooring.

Wandoo timber has been much sought after, and some sawmills such as Boyup Brook and Narrogin were almost entirely dependent on its supply. However, availability of wandoo timber for commercial use is now extremely limited.

westerly areas, it frequently occurs with marri (Corymbia calophylla), jarrah (E. marginata) and flooded gum (E. rudis). Across the easterly part of its range, this mix changes to include York gum (E. loxophleba), salmon gum (E. salmonophloia), red morrel (E. longicornis), numerous mallee species and, occasionally, brown mallet (E. astringens). At the eastern edge of its range, it grows in conjunction with inland wandoo.

The understorey of wandoo woodland varies greatly across its distribution. A grassy or low shrub understorey can be common in some areas, but poison plants (*Gastrolobium* spp.), wattles (*Acacia* spp.) and sheoaks (*Allocasuarina* spp.) are prevalent in others.

Wandoo regenerates readily from seed, with most seedling recruitment occurring on ashbeds after a bushfire. It can also resprout from a lignotuber, cut stump or from dormant shoots along the trunk.

#### Wildlife haven

Wandoo is one of the most important trees for wildlife in WA, with many animal species using the hollows in the tree itself, as well as the shed branches on the ground for habitat. The dead wood is dense and durable, and is less affected by termites than that of other eucalypts, hence standing dead trees and the shed branches can remain intact for many years.

Animals such as the brush-tailed wambenger (or phascogale), several bat species and a variety of birdsincluding the rufous treecreeper, regent parrot and barn owl-will inhabit hollows in standing trees. Hollow logs on the ground provide homes for wambengers, immature rufous treecreepers. brushtail possums. numbats, chuditch and echidnas, as well as carpet pythons, Gould's monitors, western bearded dragons and other reptiles.

The foliage and bark support a myriad of spiders, beetles, thrips, native cockroaches, flies and other insects, making it a good habitat for insectivorous birds. Flowers produce abundant nectar in most years and provide a good source of food for birds and insects. The insects are important in recycling plant matter and nutrients, dispersing seeds and pollinating many plants, and form an integral part of the ecological food web.

Wandoo trees are often parasitised by the mistletoe (*Amyema miquelii*), which is the favoured food plant of the amaryllis azure butterfly (*Ogyris amaryllis*) and the wood white butterfly (*Delias aganippe*).





Left Wandoo in decline at Mount Observation, near York. Photo – Duncan Steed

Above Dead clusters of leaves in wandoo crowns are termed 'flagging'. These occur early in the onset of wandoo decline, as well as later when the decline is strongly evident. Photo – Paul Brown

decline is widespread through many parts of the natural range of wandoo, being observed in woodlands, along road verges and in paddock situations.

Crown decline is characterised by an initial browning off and death of the upper and outer twigs, a symptom known as 'flagging'. Epicormic shoots sprout along the lower limbs to replace dead twigs. Usually, these the eventually die, resulting in the progressive downward movement of the tree crown and redistribution of the canopy, as the tree attempts to recover but cannot. Over a period of three to five years, the decline process transforms the tree from a condition of apparent health to advanced decline and sometimes death. However, the decline process can eventually stabilise and the tree may recover as epicormic growth replaces the lost canopy.

#### Wandoo Recovery Group

In response to increasing community concern over the failing health of

Wandoo trees do not flower regularly, but in a good year for blossom they produce fine honey with a characteristic light colour and mild flavour. Wandoo honey has long been the mainstay of the apicultural industry in the South West of WA. However, the wandoo forest these days is most highly valued for watershed protection and recreation. Most of the eastern-or high-salinity-risk-areas of Perth's forested water supply catchments are dominated by wandoo. In addition, wandoo still maintains considerable popularity in landcare plantings, and is attracting some interest for timber production, as a farm forestry species in the medium rainfall areas.

#### Wandoo in decline

Like several other woodland species, wandoo has suffered greatly from the effects of land clearing. Many of the soil types on which wandoo grows were taken up for agriculture, and the tree's range has thus been severely fragmented. Many stands of trees are isolated (either as paddock or road verge trees) and the effects of isolation are often compounded by factors such as waterlogging, salinity and—often more insidiously—old age.

Though the stature of the wandoo tree, along with its distribution and persistence in the landscape, may give the impression of amazing toughness, this notion has been challenged in recent times by the onset of a severe decline in the canopy of many trees.

The history of the wandoo crown decline is quite complex. There are some anecdotal references to it in the mid-1960s. In the late 1970s and early 1980s, symptoms were observed throughout many parts of the range of the wandoo, and this resulted in a research station being set up at Narrogin to study the decline. There was a period after this when the symptoms abated and tree crowns recovered. Symptoms recurred in the late 1980s early 1990s, however, the presence and severity of symptoms varied throughout the wandoo's distribution-and from year to year. It had been observed in the Brookton, Pingelly and Narrogin areas through most of this period, but also from areas such as Kojonup and Cranbrook. Crown



Above Wandoo Recovery Group member Roger Underwood explains aspects of wandoo decline within the Helena catchment to community members.

Above right A healthy wandoo growing beside York Road. Photos – Liz Manning

wandoo, the Wandoo Recovery Group was formed in February 2003 to investigate the causes of wandoo crown decline and devise appropriate strategies and actions. The group aims to raise the profile of tree decline, to build partnerships with stakeholders and communities and to coordinate the development of government and community-based action.

The recovery group includes York representatives from and Cranbrook Land Conservation District Committees, the Department of Conservation and Land Management (CALM), the Department of Environment, Greening Australia WA, the Water Corporation, World Wide Fund for Nature (Woodland Watch), The University of Western Australia, the Forest Products Commission, Western Power, Beverley Naturalists Club and community interest groups.

One of the group's key objectives is to promote, support and coordinate research into wandoo decline and recovery. Scientific investigations into possible causes of decline are now underway. This important work will provide the basis for understanding the relationships between climate, tree physiology and possible disease factors that could be contributing to wandoo decline. Knowledge gained through this research will be used to influence future research directions and to ensure that wandoo woodlands are properly conserved and managed.

Another important task is to accurately assess the extent and health of wandoo ecosystems through a coordinated vegetation mapping survey. CALM is taking a lead role in this project, utilising Landsat imagery and on-ground truthing to develop an invaluable tool to guide future management decisions.

The Wandoo Recovery Group has disseminated a series of news bulletins to local authorities, government agencies and community groups with an interest in natural resource management. These explain the nature of the decline and outline the progress of current research and the activities of the Wandoo Recovery Group. A recent bus trip to view wandoo decline within the Helena Catchment gave a large group of community participants the chance to learn more about the issues of decline and discuss research



investigations with scientists from The University of Western Australia.

#### How you can help

The Wandoo Recovery Group is currently developing a simple, illustrative guide to assessing the sequence of decline of wandoo crowns. Training and assistance will be given to community groups who would like to help map decline in their local area.

The recovery group also seeks local knowledge that will help to build an accurate historical account of previous decline events. For more information on the activities of the group—and how you can help—contact the Wandoo Recovery Group's Executive Officer Liz Manning (see below) or Chairman Alan Sands on (08) 9368 4399.



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# The feather-leaved banksia

Disease, fire and a long juvenile period have brought this striking species close to the brink of extinction

by Anne Cochrane, Sarah Barrett and Sandra Gilfillan

S outh-western Australia has a remarkably rich flora, even by world standards. More than 70 per cent of its plants are endemic to Western Australia. *Banksia*, in the family Proteaceae, is a well-known and important genus of the South West, and is conspicuous in heath and woodland. There are more than 60 banksia species in south-western Australia and the feather-leaved banksia (*Banksia brownii*) is perhaps one of the most endangered of these.

#### From the mountains to the sea

Feather-leaved banksias occur in a number of small, isolated populations over a range of about 90 kilometres from the Stirling Range south to Cheyne Beach. Plants grow in a variety of habitats from Stirling Range mountain tops and slopes, in mallee thicket on rocky sandstone soils, to mallee heath and woodland communities on lateritic ridges or granite slopes in southern populations near Albany. In the Stirling Range, the plants form low spreading shrubs. In more sheltered coastal sites, plants may form an openly-branched small tree to six metres. The associated vegetation is rich in proteaceous (*Banksia, Dryandra, Lambertia, Isopogon, Hakea, Adenanthos*) and myrtaceous (*Eucalyptus, Agonis, Kunzea, Beaufortia*) species.

The bark of the feather-leaved banksia is smooth and greyish-brown and its leaves have an almost featherlike appearance, giving rise to the common name. The flowering candles consist of a dense spiral of hundreds of individual flowers. Parts of the flower are pale brown and cream and the metallic red styles have a cream tip, but the overall appearance of the flowering spike is reddish. Many follicles, or



valves, are fused together to form the woody fruit, and this species is one of only a few banksias to produce only one seed per follicle. A papery black wing on the seed assists with wind dispersal. The number of flowering spikes that set fruit—and the proportion of flowers that develop into follicles—is low in feather-leaved banksia, a characteristic of most hermaphroditic plants.

Two forms of feather-leaved banksia are recognised. A northern form confined to the Stirling Range has short, thin, hard leaves and a southern form, with long, wide, soft leaves, occurs in the Albany-Cheyne Beach area. Genetic testing planned for the future should be able to settle whether these constitute separate subspecies. The feather-leaved banksia is closely related to the swamp banksia (*Banksia occidentalis*), which has smaller, deep red flowers and narrow, sparselytoothed leaves.

The first specimen of featherleaved banksia was collected from near Albany by William Baxter in 1829. Baxter was collecting seeds and roots of Australian plants on behalf of the Sydney Botanic Gardens. In a letter from King George Sound on 25 March 1829 to Mr Fraser, Colonial Botanist, Baxter reported:

'I have sent you a few of some [*Banksias*] I collected a good distance inland, but not having near enough to eat I am not able to carry but a small quantity of each sort... I mean to collect *Banksias* and other large seeds in large quantities on my return'.

It is possible that Baxter was collecting from the Stirling Range. The species was named after botanist

Previous page Main Late afternoon view of Pyungoorup Peak and The Arrows. Photo – Rob Olver Inset Feather-leaved banksia growing on mountain slopes in the Stirling Range National Park. Photo – Sarah Barrett/CALM

Left Feather-leaved banksia. Photo – Rob Olver



Above Bush rats are believed to pollinate the feather-leaved banksia.

**Right** New Holland honeyeaters are among the main pollinators of the plant. *Photos – Jiri Lochman* 



Robert Brown, who accompanied Matthew Flinders to Australia on a voyage of discovery in 1801.

Feather-leaved banksia has been declared as rare flora since 1980 under the Wildlife Conservation Act, and is currently ranked critically endangered. The species was previously considered to be endangered, but was upgraded because of recent population extinctions and a projected decline in population size of more than 80 per cent over the next three generations.

### Furred and feathered pollinators

Like many other Australian members of the Proteaceae family, feather-leaved banksia flowers for many months, with freshly-opened flowering spikes most abundant during winter. Flowering has been recorded from March to August. The major pollinators are honeyeaters, such as New Holland honeyeaters and red wattlebirds, and small nocturnal mammals, such as the bush rat (*Rattus fuscipes*) and the honey possum (*Tarsipes rostratus*). Nectar from this species may provide an important food source for some or all of these pollinators.

#### **Fire adaptation**

Feather-leaved banksia is killed by fire and does not resprout, relying entirely on seed for regeneration. It holds its fruits in the canopy of the plant, with seed reserves accumulated in woody fruits that release en masse when the parent is burnt. The fruit is a woody cone-like structure containing numerous follicles. The average number of seeds per fruit varies between plants, and between





**Above** Only two feather-leaved banksia seedlings survive in a population southeast of Ellen Peak in the Stirling Range in 2003, after fires in close succession in 1991 and 2000. Although 270 young plants had regenerated in 1995 after the 1991 fire, the combined effects of frequent fire and *Phytophthora cinnamomi* brought this population to the verge of extinction.

Left Feather-leaved banksia plants dying from aerial canker at Vancouver Peninsula near Albany. Pholos – Sarah Barrell/CALM

populations, and is directly related to the size of the fruit and indirectly to soil nutrition, moisture and the amount of time that has elapsed since the last fire. Levels of seed predation can also vary, with boring insects often destroying more than 50 per cent of the seed crop in some fruits.

In the climate of south-western Australia, hard woody fruits may be an adaptation to high intensity fires. These protective coverings, and the outer fruits, are often very large in relation to the small seed held within them. Fruits of feather-leaved banksia may take up to a year to mature. The seed is little affected by the passage of fire because the dense woody material protects it from the extreme heat. Limited seedling recruitment can occur between fires, but fire is necessary to trigger mass seed release.

Botanists collecting seeds to ensure the long-term survival of the species first need to lightly burn the fruits so that the follicles open. They then alternately wet and dry the fruits to accelerate the seed release. Fresh seed is highly viable and no treatment is required to aid germination.

#### **Tenuous existence**

A population of feather-leaved banksia exists only as seeds immediately after a fire, and virtually no seeds are stored in the soil until the next fire. If seedlings fail to establish, the population may become locally extinct.

Like many long-lived woody perennials, this banksia takes a long

time to flower and produce fruit. Differences in aspect and topography, soil depth, moisture and nutrient status can affect flowering and fruiting success. Plants in southern populations may reach reproductive maturity after five to six years, but those in mountain populations take much longer. In one upland population, only three plants out of 20 had commenced flowering eight years after a fire, and no plants had yet produced fruits. The fire regime is therefore very important in conservation management of this fire-sensitive species. Scientists have suggested fire frequencies of at least 18 years or more are required for adequate seed banks to accumulate in upland populations of feather-leaved banksia.



#### The killer disease

Feather-leaved banksia is highly susceptible to dieback, a disease caused by the soil-borne water mould, Phytophthora cinnamomi, with more than 80 per cent of plants dying after being artificially inoculated with the disease in the greenhouse. In fact, it is one of the most highly susceptible plant species in Western Australia. People, vehicles, and even native and feral animals act as vectors of Phytophthora, aiding the wide and rapid spread of the pathogen through transport of infected soil, particularly when tracks and roads are wet and muddy. The pathogen also spreads directly through root-to-root contact with infested plants, and as a result of movement of spores in water flow. Another disease caused by the aerial canker fungus (Zythiostroma) causes banksia deaths in some populations, and this spreads through windblown spores.

The fungicide phosphite is the only treatment currently available to control *Phytophthora* in native vegetation. The fungicide does not eradicate the disease, but is thought to enhance the plant's defence responses, as well as having a direct fungicidal effect. The Department of Conservation and Land Management (CALM) has directed considerable resources into applying phosphite to threatened flora and monitoring the resultant effects on plant survival. This includes aerial spraying trials and hand application of the fungicide. In the case of featherleaved banksia, aerial phosphite spraying has significantly enhanced the survival of plants in certain populations and reduced the ongoing spread of the pathogen throughout the population. However, at other sites, the pathogen continues to spread relentlessly, particularly in hillside situations, where Phytophthora spores may be readily carried down slopes during rainfall events. Unfortunately, phosphite remains the only tool available to slow the rate of population extinction in this susceptible extremely species. Hopefully, ongoing research may improve phosphite application techniques and produce alternative control methods.

No formal research has been done on the relationship between fire and disease in feather-leaved banksia Above Phytophthora cinnamomi is killing susceptible species in a population of feather-leaved banksias on the south-east ridge of Yungermere Peak. Small 'spot' infestations rapidly spread and coalesce to cover entire mountain slopes. Photo – Sarah Barrett ICALM

habitat, but field observations suggest that the impact of the disease is exacerbated after fire, due to altered hydrology and increased surface runoff. Changes in vegetation structure and floristics caused by the dieback pathogen will also affect the numbers of vertebrate pollinators in these plant communities through loss of food sources and habitat. Other impacts may include changes in invertebrate fauna, loss of wildlife habitat in the form of thick vegetation cover and increased predation risk. Julie Whelan, a PhD student at Murdoch University, conducted a study in coastal heath near Albany and found significantly higher bush rat abundance in healthy sites



compared with infested sites. Bush rats are known pollinators of feather-leaved banksia, so an indirect impact of the disease on the plant species through loss of pollinators is highly likely.

#### On the brink

There are currently 17 known populations of feather-leaved banksia, comprising about 12,000 mature plants. This may seem like a large number of plants, but another 10 populations have been proclaimed locally extinct in recent times because of dieback. Within the Stirling Range National Park, eight of 13 populations were burnt in hot fires in both 1991 and in 2000, an interval of only nine years. Of these, five are considered to be either extinct or close to extinction. Of the remaining coastal populations, three are close to extinction, with less than 15 mature plants per population. Only five of the 17 current living populations contain more than 200 plants. The viability of very small fragmented populations is unclear, as the genetic diversity in the gene pool declines, while inbreeding may potentially reduce plant reproduction. All surviving populations are threatened by dieback.

Feather-leaved banksia is just one of many species perched on the brink of extinction due to threatening processes. The continued loss of local populations—and the potential loss of the entire species—is not only a tragedy in itself but may have unforeseen, and potentially disastrous, consequences for the functioning of the vegetation communities of which feather-leaved banksia is an integral part. Several south coast flora species that are declining due to frequent fire and dieback are food sources for mammals, birds and insects. As these plants form a vital part of the structural habitat, their loss from an ecosystem may have profound effects on countless numbers of other animals and plants within that community.

#### Strategy for survival

Tackling a killer disease and the vagaries of wildfire are two major hurdles to overcome in conserving feather-leaved banksia for future generations. To ensure the species survives in the wild we must continue to spray plants with phosphite, while monitoring the disease's rate of spread and the subsequent survival of the plants. Practising good hygiene is essential to reduce the spread of the pathogen, and visitors should always be mindful of the irreparable damage they can do when moving soil around on muddy boots or vehicles in wet conditions. Implementing an appropriate fire management plan is vital to protect areas from too-frequent fires and to ensure that seedlings can develop to maturity and produce



Above The passage of fire triggers seed release from the woody fruits of featherleaved banksia. Photo – Ellen Hickman

Above left Swamp banksia is a close relative of the feather-leaved banksia, but has smaller deep red flowers. Photo – Marie Lochman

adequate seed for regeneration. Seed collection and conservation is a vital link in this integrated conservation strategy. Stored seed is the genetic resource of the species, and can be used to recreate and augment wild populations. If we continue to do these tasks well, then there is hope for the survival of the species.



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# Not your typical whale tale

by Ashley Tate Townsend

Gazing over Geographe Bay from the rocks at Cape Naturaliste, one would not expect to see blue whales, the largest living animals on earth, swimming in shallow water just 100 metres from the shore. This opportunity to view these otherwise rarely-seen whales so near the mainland may help us find out more about this mysterious oceanic species.

In 1994, Chris Burton—who operates Western Whale Research and monitors whales for industries with seismic operations—teamed with Steve Mitchell, owner and operator of Naturaliste Charters, to monitor whales in Geographe Bay during whale watching cruises. The charters take tourists close to humpback whales so that they can view their behaviour and record data on the whales. When a different species of whale emerged from the water on one trip, they weren't sure what they had witnessed.

Chris later confirmed that they had sighted and photographed four blue whales. He assumed they were the subspecies known as pygmy blue whales. Even more amazing, was how close the whales were to the shore. Blue whales are mostly animals of the open ocean that feed on krill. But, in this case, they were coming as close as 100 metres to the Geographe Bay shore. More than 200 sightings of pygmy blue whales were recorded from 1994 to 2002, and the numbers sighted have steadily increased each year.

Part of Geographe Bay is a proposed marine conservation reserve (see 'The Capes Coast: a diverse coastal and marine environment', *LANDSCOPE*, Summer 2002-03). The bay's sheltered shores are populated with a wealth of colourful marine plants and animals with both temperate and tropical distributions. Many of these species are only found locally. The presence of blue whales in the area adds to the importance of this biodiverse ecosystem



and further highlights the need to protect it. The ever increasing popularity of the region means it is under increasing human pressure and there may be a need for special management of blue whales.

Two subspecies of blue whales are found in the southern hemisphere: 'true' blue whales (Balaenoptera musculus intermedia), which inhabit cold southern waters of the Antarctic in summer, and 'pygmy' blue whales (Balaenoptera musculus brevicauda). True blue whales grow to an average length of 25 to 26 metres and weigh 100 to 200 tonnes. The largest female recorded was measured at 31 metres. Pygmy blue whales are smaller, but no means miniature versions of the 'real' thing, as the names 'true' and 'pygmy' might suggest. Although pygmy blue whales average 20 to 22 metres in length, they may reach a maximum size of 24 metres.

#### Whaling

Observing a marine animal of that size made it difficult for Chris to determine whether he was watching true or pygmy blue whales. Japanese and Soviet whaling fleets targeted pygmy blue whales in the late 1950s and early 1960s, and their observations of a smaller body, baleen and part of the tail distinguished the subspecies from true blue whales.

Whaling records indicate that pygmy blue whales primarily inhabit the Indian Ocean—along the east coast of Africa, the Western Australian coast and east along Australia's southern coast to New Zealand. Based on this information, Chris recorded his sightings as pygmy blue whales, but he has no definitive confirmation of the subspecies he sighted.

The migratory patterns of true blue whales are more mysterious—they migrate between the warm waters of low latitudes to breed and cold waters of high latitudes to feed. They occur off the coast of southern Australia, but a specimen in the WA Museum—the skeleton of an immature true blue whale that stranded near Busselton in 1898—suggests that true blue whales visit WA's western coast as well.

#### Research

Western Whale Research received federal funding from the Department of Environment and Heritage to study the abundance and distribution of blue whales in Geographe Bay from October to December 2003. Chris recorded 121 presumed pygmy blue whale sightings during the migratory season.

Naturaliste Charters played a crucial role during the project, providing daily cruises, during which Chris observed 11 calves, three subadults and 61 adult blue whales in 41 pods from Naturaliste Charters vessels. The enthusiasm and skill of the crew also enabled important photoidentification of these huge whales to be carried out. Additional aerial surveys



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Main Granitic coastline near Castle Rock, Geographe Bay. Photo – Brett Dennis/Lochman Transparencies Inset Blue whale. Illustration – L Broomhal (courtesy WA Museum)

Left The blue whale skeleton held in the WA Museum. Photo – Soula Vouyoucalos (courtesy WA Museum)



Above Two blue whales in a breathing sequence. Photo – Doug Coughran/Lochman Transparencies

Right Steve Mitchell on a whale-watching charter in Geographe Bay. Photo – Rhianna Mooney/CALM

resulted in 12 sightings, and indicated the spatial distribution of the whales extended north from Cape Naturaliste to Bunbury. Land-based surveys from a rocky headland, five metres above sea level on the cape, produced 34 sightings of blue whales moving west close to the land in early morning and late evening. Chris photographed several pods as they passed very close to the shore in 10 to 30 metres of water.

Chris collaborated with Rob McCauley from Curtin University, Curt and Michelene Jenner from the Centre for Whale Research and John Bannister from the WA Museum. Since 1999, Rob has coordinated a continuing study of presumed pygmy blue whales in the Perth Canyon—deep water west of Rottnest Island—where these baleen whales feed on krill. They plan to compare Chris's photographs with those taken for the Perth Canyon project, as any positive matches of images would indicate that some blue whales move between the two areas.

Chris also hopes to compare his databased collection of blue whales photographed off the WA coast to those taken from the south-east of Victoria by Pete Gill. If any of the



whales photographed off the WA and Victorian coasts are the same animals, it might provide clues as to where they go for the six or so months of the year that they are unaccounted for. As they can cover distances of up to 100 kilometres per day, perhaps they travel back and forth between these two important feeding grounds off Victoria and Rottnest Island.

#### **Future research**

With continued research, Chris hopes to determine why these gigantic whales enter Geographe Bay, where the water is relatively shallow and where there is no food for them. Are they just passing through, with the Cape forming an obstacle around which they must move, or is this an important resting stop on some long migration route? With further funding from the Department of Environment and Heritage, Chris will continue his work through 2005, which will include a larger aerial survey and provide more data on abundance, distribution and residence times of the blue whales in and around Geographe Bay. He also hopes to satellite track whales using tags fitted to the back of up to 10 whales.

This work is slowly, but surely, unlocking the secrets of the world's largest living creatures.



Ashley Tate Townsend completed an internship with CALM's Strategic Development and Corporate Affairs Division as part of her environmental and communications studies at Virginia Commonwealth University in Virginia, USA.

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# Ningaloo reef of gold

Mention the word 'reef' in Western Australia, and most people immediately think of Ningaloo. Yet when the Ningaloo Marine Park was first declared in April 1987, few people had heard of it. Now, protection for this cherished marine icon is even better, with the marine park boundaries being extended to protect Ningaloo's entire 300-kilometre length. A new marine management area has also been established at the Muiron and Sunday islands, one of the region's most beautiful and biodiverse underwater wilderness areas.

he conservation significance of Ningaloo Reef-the largest fringing coral reef in Australia-was recognised in the 1960s by the Western Australian branch of the Australian Marine Sciences Association. Despite concern from the local communities at Exmouth and Coral Bay, who felt that it would affect the local economy and their lifestyles by restricting fishing and other activities, the State waters of Ningaloo (and a 40-metre strip along the shore) were finally declared a marine park by the Western Australian Government in April 1987. The park included about 90 per cent of the reef, and extended about 260 kilometres from North West Cape to Amherst Point.

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Main Ningaloo Reef and Sandy and Osprey bays, Ningaloo Marine Park. Photo – David Bettini Inset Lionfish. Photo – Peter and Margy Nicholas/ Lochman Transparencies

**Below** Anemone and fish on reef. *Photo – Glen Cowans* 



#### Living colour

Today, more than 200,000 people visit Ningaloo Marine Park every year to dive, fish, surf or just soak up the remote landscapes and winter sun. However, the park is important to most Western Australians, as Ningaloo Reef has become a symbol of all that is special and pristine about Western Australia's marine environment.

People who have dived or snorkelled at Ningaloo understand this only too well. Many have had the privilege of swimming alongside massive whale sharks, up to 12 metres long, as they cruise the waters of Ningaloo, sucking in tiny prey. Dugongs are frequently seen in the shallow



Above left A blennie peers from its home.

Above A feather star extends its arms to feed. Photos – Glen Cowans

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lagoons. There are also big numbers of large marine animals such as manta rays, marine turtles and humpback whales. Every year on certain nights, mainly following the full moons in March and April, divers gather to witness the mass spawning of coral, when billions of pink eggs and sperm burst from their parents in a synchronised display.

In many of the sheltered lagoons between the reef and the beach, staghorn and other corals grow in dense colourful gardens populated by tropical fish of all





Above The feather-like tentacles of a tubeworm. Photo – Glen Cowans

shapes and sizes. Such is the area's biodiversity that there are more than 200 species of corals, 600 species of shellfish and other molluscs, and 500 species of fish in the park. The Muiron and Sunday islands contribute further to this amazing biodiversity. The foreshores and nearshore reefs of the Ningaloo coast and the Muiron and Sunday islands are also important aggregation and nesting areas for loggerhead, green and hawksbill turtles, all of which are threatened.

Of course, Ningaloo is much more than just the sum of its parts. You really have to go there to fully appreciate the wild nature of the land and seascapes that is such a huge part of the area's appeal.

#### Having a whale of a time

As well as the intrinsic benefits of conserving the park's biodiversity, and the pleasure that people gain from experiencing the area, Ningaloo Marine Park is producing major economic benefits. The whale shark industry alone brings \$12 million in revenue into the local economy every year. A study on the economic effects of tourism on Exmouth, recently carried out by Professor David Wood from Curtin University, illustrated the value of the Ningaloo Marine Park to the local economy. Ningaloo Marine Park was considered by visitors to be the most important tourist attraction in the Exmouth area. More than 83 per cent of all respondents considered the Ningaloo Marine Park to be a reason for visiting Exmouth.

A major pastime for visitors was snorkelling, with 75.6 per cent of WA



visitors, 67.9 per cent of interstate visitors and 71.4 per cent of overseas visitors undertaking this activity. Recreational fishing is another major activity in the marine park. Other activities that were extremely popular were swimming with whale sharks, coral viewing and sightseeing. It is estimated that about \$127 million a year of the total spent by visitors to the Exmouth area is directly attributable to the Ningaloo Marine Park and the adjoining Cape Range National Park.

#### Plan for greater protection

With all this recreational activity in Ningaloo Marine Park, which is set to increase further with new developments planned near Exmouth, it is vital to provide even greater protection to the reef. The original boundaries of Ningaloo Marine Park did not protect the entire Ningaloo Reef ecosystem. In the reef's south its structure changes from a fringing barrier reef to a true fringing reef environment, supporting a diversity of reef communities with a distinctly temperate influence. Many southern temperate species that are found only along the west coast of Western Australia do not extend to the northern end of the park. For example, the western rock lobster (Panulirus cygnus) occurs in relatively small numbers at the southern end of Ningaloo Reef but is less common





north of Coral Bay. The endemic west coast shellfish *Turbo pulcher* is abundant as far north as about Gnarraloo Bay but is replaced by *Turbo argyrostuomus* further north on the Ningaloo Reef. Scientific understanding of the ecological values of the Ningaloo Reef has also increased significantly since the marine park was established.

Hence, a new draft management plan (to replace the original 10-year management plan) was released for public consultation in July 2004, along with an indicative management plan for a proposed southern extension to the park to Red Bluff (covering a further 38,000 hectares) to include the entire 300-kilometre length of Ningaloo Reef in the park.

The draft plan also included an indicative management plan for a proposed 28,000-hectare marine management area at the Muiron and Sunday islands, 15 kilometres north of North West Cape. One of the most magnificent dives in the Exmouth area is the 'cod spot', which is offshore at

Above A diver looks at a giant clam at Ningaloo Reef.

**Top left** Swimming with a whale shark is the experience of a lifetime. *Photos – Alex Steffe/Lochman Transparencies* 

**Centre left** Massive potato cods are also among the larger inhabitants of Ningaloo Marine Park. *Photo – Geoff Taylor/Lochman Transparencies* 

Left Staghorn coral garden at Ningaloo Marine Park. Photo – Clay Bryce/Lochman Transparencies



Above A manta ray sweeps over the reef. Photo – Eva Boogaard/Lochman Transparencies

**Right** Aerial view of the Muiron Islands. *Photo – Wade Hughes/Lochman Transparencies* 

the Muiron Islands. At this reef feeding station the limestone reef, in deep water, is covered in thousands of golden cardinalfish. Large cod are also frequently seen in the area. Many other smaller cod and emperor species gather around divers. At another spot known as 'The Spit', which has numerous swimthroughs along its edge, divers are enveloped by hundreds of tiny baitfish and may discover a grey nurse shark or turtle sleeping peacefully under a ledge. Large manta rays are also common.

Following the public consultation period, the State government formally extended Ningaloo Marine Park and established the new marine management area in November 2004. These initiatives seek to conserve marine biodiversity in this area and to ensure opportunities for nature appreciation, recreation (including fishing), tourism, research and education are maintained and managed within an ecologically sustainable framework.

In announcing these measures, the government committed an extra \$8.5 million over the next four years for the management of the expanded marine



park, through the Department of Conservation and Land Management and the Department of Fisheries. This funding was in addition to \$5 million already committed over the same four year period for scientific research and monitoring of the reef and its ecosystems.

The draft plan had proposed to increase the existing sanctuary zones at Ningaloo from 10 per cent to 28 per cent of the total area of the State waters of the park and its proposed extension. However—in response to both public submissions and to independent scientific advice—the government decided to increase the area in sanctuary zones to around 34 per cent, although it made some changes to sanctuary zone boundaries to reduce the impact of these changes on recreational fishers.

Most of the extensions to the

existing sanctuary zones are to the seaward side of the reef and in many instances the landward boundaries have been placed 100 metres offshore, so that line fishing from the shore can continue along 70 per cent of the park's coastline. Sixty-six per cent of Ningaloo Marine Park will still be available for fishing (multiple use areas).

#### Finding sanctuary

Sanctuary zones are one of the most effective ways of protecting the nature conservation values within marine parks and this is their primary purpose. Sanctuary zones of the right size in the right areas can also increase fish populations outside the zones, as adult fish move out of the 'no take' zones into adjoining areas, thereby providing additional secondary benefits to fishers. Fertilised eggs and larvae also drift out of sanctuary zones to settle in





Above The southern end of Ningaloo Reef, near Gnarraloo Bay, is now included in the marine park. Photo – David Bettini

Above right People may fish in 66 per cent of Ningaloo Marine Park. Photo – Brett Dennis/Lochman Transparencies

Left Tourists at Turquoise Bay. Photo – Bill Belson/Lochman Transparencies

other areas. For example, research by Dr Mark Westera of Edith Cowan University at Ningaloo Marine Park has shown that there are twice as many emperors in sanctuary zones than in the neighbouring general use zones, where fishing is allowed.

Elsewhere in Western Australia, early results of some research by Dr Russ Babcock from CSIRO on a sanctuary zone at Rottnest Island Marine Reserve show that rock lobsters are appreciably larger and considerably more abundant within the sanctuary zone. The same research has shown similar results for some fish species commonly targeted by recreational fishers.

A recent survey of 80 'no take' zones around the world found that the number of fish in the 'no take' zones increased by 192 per cent; the total weight of fish was higher than in adjacent fished areas; and average fish size was 20 to 30 per cent higher than in adjacent fished areas. In Florida, very large game fish are almost seven times more common in areas next to a notake reserve than in fishing areas where no reserve exists. A similar pattern has been recorded for sharks in a tropical 'no take' area off Western Australia, where they are larger and more common than in comparable fished areas.

All of the significant different habitats within the Ningaloo Marine Park are now included in sanctuary areas (the original sanctuary zones were all close to the coast and did not afford any protection to deep water habitats). For similar reasons, sanctuary zones in the Great Barrier Reef Marine Park were recently increased from 4.5 per cent to 33 per cent.

While some recreational fishers have been quite vocal in their opposition to sanctuary zone extensions, many conservation-minded fishers and local business people support the increases to sanctuary zones at Ningaloo. Peter Shaw, a



commercial fisher and charter operator at Coral Bay, while not necessarily agreeing with all areas suggested in the draft plan, supports the concept of increasing sanctuary zones in the Ningaloo Marine Park.

"There is definitely a need for more sanctuary zones in the marine park. You need areas for replenishment of fish stocks. Also, not all people who come to Ningaloo come here to fish. A lot of people go snorkelling and there will be more marine life for them to see in areas that can't be fished."

#### **New developments**

The economic return from tourism is now expected to grow even further, because of an increased public profile for Ningaloo as a result of the marine park extensions, and as developments such as the Exmouth Boat Harbour Resort and Residential Development are completed. However, as use of the area increases through such developments, it is going to be even more vital to protect the attractions that people go to Ningaloo to see. Hence, Ningaloo's new management plan and extended boundaries, and the new marine management area at the Muiron and Sunday islands, will be vital to protect the area's natural marine values and ensure that visitors are able to keep enjoying its natural beauty.



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## endangered by John Blyth and Kirsten Pearce



#### **Ningbing land snails**

The family Camaenidae is widespread and is the dominant family of land snails in all but the wetter south-east and south-west of Australia. However, many species are very restricted in range. For example, 23 species and two subspecies of camaenid snails are found only in the Devonian limestone of the Ningbing Range and Jeremiah Hills, north of Kununurra. Here, 25 threatened Camaenid species are known to occur in an area of about 115 square kilometres.

The three genera that these species belong to are also restricted to the same small area. None of the threatened species has a range greater than 5.6 square kilometres, and one is known only from about 100 square metres! Such small living areas make them very susceptible to threatening processes, and 19 are critically endangered, four are endangered and two vulnerable.

These large attractive snails, up to 30 millimetres in diameter, have a flattened shell and varying degrees of ornamentation. They prefer areas

within open deciduous vine thickets on rugged limestone, incorporating unstable boulders and rocky slopes. They typically occur in shaded limestone crevices, under rocks or in leaf litter, and feed on decaying leaves and grass. Even a few tens of metres of unsuitable habitat appears to be sufficient to prevent movement away from favoured areas, and to separate different species.

Each known population faces various threats, particularly inappropriate fire regimes, cattle grazing and trampling, and introduced weeds. Some areas with extensive rugged limestone outcrops are naturally protected from the primary threats of cattle and fire. Sites on less challenging landscapes, with cattle often grazing and sheltering in and around the vine thickets, appear to be under significant threat.

A draft interim recovery plan has been written for the 25 known threatened snails of the Ningbing Range and Jeremiah Hills. The recovery plan aims to conserve all known existing populations in the two ranges, based on a whole-oflandscape approach, in preference to managing individual species.

It also aims to ensure the traditional owners and pastoral managers are supportive of and, where possible, actively involved in management decisions and onground actions. Appropriate fire regimes around limestone areas are needed, so controlled, slow burns will be carried out in the late wet/early dry season. The plan also indicates that areas vulnerable to the effects of cattle grazing will be fenced where possible. Work will also be done to maintain the health of vegetation associated with the snail's limestone habitat, particularly monsoon vine thickets.

Many areas within these limestone ranges have not been surveyed and many additional species of endemic snails may remain to be discovered. It is recommended that conservation measures are taken to protect entire occurrences of limestone-associated habitat, to conserve both known and yet to be found species of these remarkable snails.

Photo by Norm McKenzle Illustration by Linnea Lahlum, from Solem (1984), *Records of WA* Museum (17).



## Yalgorup National Park coastal escape

The air is thick with a mixture of ocean breeze and peppermint scent. A rich environment of woodlands and wetlands teeming with wildlife and wildflowers, Yalgorup National Park is the perfect setting for an exchange with nature.

by Margitta Docters van Leeuwen

estled between a frequently travelled highway and the Indian Ocean, just south of Mandurah, lies a series of lakes and reserves that together make up the largest national park on the Swan Coastal Plain.

Yalgorup National Park stretches from just south of Mandurah to north of Myalup and covers an area of 12,888 hectares, including ten magnificent lakes. It protects a wetland system that has achieved international recognition as an important area for migratory waterbirds, and it supports several threatened plant and animal species. But its crowning glories are the microscopic communities that reside in Lake Clifton and form thrombolites. This is one of few places in Western Australia where these communities survive.

#### **Microscopic masterbuilders**

Yalgorup National Park protects a natural marvel. Lake Clifton, which is furthest from the coast, contains rocklike structures known as thrombolites on its edges. They also occur in Lake Richmond, near Rockingham. Like the famous stromatolites of Hamelin Pool, in Shark Bay (see 'Lilliput's Castles', *LANDSCOPE*, Summer 1991–92), the thrombolites are built by micro-organisms.

From the outside, there is no real difference between the two types of structure. Only when they are excavated can you see what distinguishes them. A stromatolite (which is only formed in marine environments) has a distinctive layered structure, whereas a thrombolite (formed in fresh water) has a disrupted internal construction—a kind of clotted, or messy, look.

The most striking things about the thrombolites are their limestone colour and rounded shape. Visitors could be forgiven for mistaking them for fossils or boulders placed there in earlier times. Lieutenants Collie and Preston certainly did in 1829. They recorded what they thought they saw in their journal.

'The rising ground on the bank [of Lake Clifton] is formed of sand and calcareous petrifactions of trees.'

The thrombolite-building microorganisms are too small for the human



eye to see and resemble the earliest forms of life on Earth. The discovery of modern examples helped scientists to understand the significance of microorganisms in the environment and unravel the long history of life on Earth. These organisms were the only known form of life on Earth from 3500 million to 650 million years ago. The formations that they construct grow at an incredibly slow rate. When the stromatolite or thrombolite reaches a metre high, it is estimated to be approximately 2000 years old and is filled with living communities of diverse inhabitants with population densities of 3000 per square metre.

Scientists know little about the thrombolites and why they form at Lake Clifton, but one theory is that they form because the lake is associated with upwellings of fresh groundwater that is high in calcium carbonate. The micro-organisms living in this environment are able to precipitate calcium carbonate from the waters as they photosynthesise, forming the mineralised structure that is the thrombolite.

Lake Clifton's thrombolites are very

Main Boardwalk over thrombolites at Lake Clifton Photo – Sallyanne Cousans Bottom Thrombolites. Photo – David Bettini

**Above** Thrombolites at Lake Clifton. *Photo – Alex Bond* 

fragile, so an observation walkway has been built for visitors to enjoy these incredible formations while protecting them from damage.

#### Aboriginal heritage

The Swan Coastal Plain, which stretches between Moore River and Busselton, has been the traditional home of the Nyoongar Aboriginal people for thousands of years. The Aboriginal people who lived in this part of the State were fortunate, as the South West provided plenty of fresh water and rich hunting and foraging grounds.

The name Yalgorup is derived from two Nyoongar words, 'yalgor', which **Right** Bird hide at Lake Pollard. *Photo – Marie Lochman* 

means 'lake or swamp', and 'up', which is a suffix for 'a place'. Discoveries of stone artefacts within the park have led to seven occupation sites being identified. As well as these, there are two significant sites located close to the park. One is a cave east of the park and the other is a ceremonial site just north of the park. Despite the area's obvious importance to Aboriginal culture, little is known about the significance of the park itself and, as yet, there have been no recognised sites listed.

#### **European discovery**

Lieutenant Surgeon Alexander Collie and Lieutenant William Preston were the first Europeans to discover Lake Preston and Lake Clifton, while exploring the coastline from Cockburn Sound to Cape Naturaliste in November 1829. When they came across the lake now known as Lake Clifton, they believed that the body of water could be a section of the Murray River. Only on the following day did they discover that the 'river' was a lake.

After Collie and Preston returned from their expedition, Thomas Peel built a settlement in the area now known as Mandurah. In those days, to reach the settlement meant a day's journey by sea, followed by a second day of travel with horse and cart over some very rough terrain. It wasn't until 1842 that the Old Coast Road, along which the park is situated, was built. Convict road gangs rebuilt it in the 1850s to connect Mandurah with Perth, effectively putting an end to the settlement's isolation. The remains of some of the wells built by the road gangs can still be found in the park, near Whittakers Mill picnic site.

The 10th Light Horse Brigade used areas now in Yalgorup National Park for training and patrol during the Second World War. There are remains of a horse yard in the middle of Duck Pond, and, at the north end of Lake Clifton, is Greenwood Cottage, whose facilities were used by the unit. The OCEAN

Yalgorup

National

Park

Mandurah

Pinjarra



kilometres

Mvalup

ORESTRY

cottage is known today as the Herron Homestead and still has historic family links to the area.

Early last century, the area was briefly exploited for its resources. The WA Cement Company built lime kilns on the eastern side of Lake Clifton in 1921. The supporting settlement that developed at the lake included a bakery, school, shop, postal receiving point, houses and a boarding school. The lime operation turned out to be uneconomic and closed after only a few years. The foundations of the lime kilns can still be seen in the park. It was fortunate that the lime kiln venture wasn't a success, because it might have destroyed the natural wonders that live in the lake.

Yalgorup was established as a national park during the early 1970s and is governed by a management plan prepared by the Department of Conservation and Land Management (CALM) that has been in operation for the past nine years. The shires of Mandurah, Harvey and Waroona maintain the beach areas.



#### Wildlife and wildflowers

Yalgorup National Park is a place teeming with birds. At last count, more than 134 species had been recorded in the park. The sheer number of species makes the park a haven for bird lovers. The 10 lakes play a large part in attracting such a huge number of birds, and have collectively been recognised by the Ramsar Convention as being internationally significant. They provide important habitat for waterbirds such as Australian shelducks, musk ducks and black swans. Waders include bar-tailed godwits, red-necked stints. greenshanks, red knots, whimbrels and three species of sandpipers. A variety of other waterbirds also use the lakes, including banded and black-winged stilts, rednecked avocets, red-capped plovers, Australian pelicans and coots.

The incredible number of bird species found in Yalgorup National Park makes it perfect for birdwatching. CALM has built a bird hide on the edges of Lake Pollard that gives a perfect vantage point from which to observe most species. But if sitting in a bird hide doesn't appeal, many birds can still be seen from other recreational areas in the park. There is a population of bold little wrens that scrutinise visitors at the boardwalk leading to the thrombolites and confident ducks abound around Lake Hayward and at the adjacent picnic site.

Yalgorup National Park contains one of the few surviving populations of chuditch on the Swan Coastal Plain. The park has been the recipient of southern brown bandicoot (*Isoodon obesulus*) and western ringtail possum (*Pseudocheirus occidentalis*) translocations since 2000. The populations of bandicoots were moved from other areas near Mandurah and the threatened western ringtail possums, also known by their Nyoongar name of

Above left Lake Preston. Photo – David Bettini

Left Australian pelican. Photo – Rob Olver **Right** Campsite beneath peppermint trees. *Photo – Rob Olver* 

Below right Swamp donkey orchid (*Diuris* micrantha). Photo – Andrew Brown/CALM

'ngwayir', were sourced from the Leschenault Peninsula, near Bunbury.

The introduced European fox threatens native animals in the park, including chuditch, possums and bandicoots. To give native animals a fighting chance in their natural habitat, CALM established Western Shield-the largest conservation program ever undertaken in Australia-in 1996. The program aims to bring at least 13 native species back from the brink of extinction by controlling predation by foxes and feral cats. The key weapon in this fight is baiting, using the naturally occurring poison 1080. The 1080 poison is found in native plants called gastrolobiums or 'poison peas'. Native animals have evolved to be able to resist this plant, but introduced species haven't, making 1080 the perfect choice for safe predator control (see 'Western Shield', LANDSCOPE, Winter 1996).

The park also has the perfect habitat to support a threatened flora species, the swamp donkey orchid (*Diuris micrantha*). This orchid only grows in swampy ground or shallow water such as that found around the lakes. The tiny plant doesn't grow taller than half a metre, and produces a delicate yellow and brown flower from September to October.

#### Peppermint sanctuary

Yalgorup National Park is known for its peppermint (*Agonis flexuosa*) and tuart (*Eucalyptus gomphocephala*) woodlands, although the tuart has suffered noticeable decline—of undetermined causes—in recent years. The peppermint can reach up to 10 metres and is covered in elegant white flowers with a wine red heart, from July to December.

The park's only campsite is situated in a cleared area among the



peppermints, on the banks of Martins Tank Lake. The dappled shade thrown by the beautiful trees makes this an ideal place to relax and enjoy the area's natural splendour. The site has basic facilities, including toilets, barbecues and tables, but is the perfect setting for a weekend escape from the hustle and bustle of the city. Brushing the foliage of the trees releases a strong peppermint scent that infuses the entire campsite, enhancing the peaceful experience.

The park puts on a magnificent show for the visitor, particularly in spring and autumn, making it the perfect time for some exploring. The sheer size of the park allows for some extended bushwalking. For the less dedicated, there are nature walks at Lake Pollard and Lake Preston, both of which can be strolled at a leisurely pace before indulging in a well-earned barbecue or picnic. Nearby, Hayward Lake picnic site and Martins Tank campsite have barbecue facilities and picnic tables.

With so much to see and do in Yalgorup National Park it is hard to believe that it does not have much higher visitation, especially as it is located along the busy Old Coast Road. The park is less than an hour's drive from Perth, it's close to the beach and it offers a wealth of wildlife and wildflowers, the rare thrombolites and the option to escape from the city. Why not consider the park for some weekend explorations?



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Margitta used the Yalgorup National Park Management Plan 1995–2005 for research and help with writing this article.

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# Feral palms

In the remote Millstream-Chichester National Park, conservation managers have declared war on 'ferals' of a different kind. These are not predatory animals, but highly invasive date palms that have had a severe impact on the area's unique natural vegetation and wildlife.

ike so many of the exotic plants that have arrived in Australia since European settlement two centuries ago, date palms (Phoenix dactylifera) are both handsome and useful. In cultivation they are popular for both shade and fruit, and thrive in the hot arid conditions of the north. Indeed, in the early days of the colony, government agencies provided parties of explorers, prospectors and pastoralists with packets of date palm seeds, with instructions to plant them in suitable locations. These were invariably springs, soaks and other wetlands-the legacy of this well-intentioned policy can still be seen today.

### Millstream—the heart of the west Pilbara

The Millstream wetlands, in the Millstream-Chichester National Park, form one of the jewels of the Pilbara. Lying about 100 kilometres south of Karratha, the permanent pools and springs of Millstream are fed from spring outflows from a large calcrete aquifer, the remnants of an ancient lake system lying in the Fortescue River valley. These springs flow through permanent pools (some more than two kilometres long and 15 metres deep) and streams for more than 30 kilometres along the Fortescue River. The Millstream 'delta', close to the homestead, is an area of approximately 250-hectares of streams and swamps, fed by springs within Chinderwarriner



Pool. The canopy of river gums (*Eucalyptus camaldulensis*) and cadjeputs (*Melaleuca leucadendra*), and the dense stands of Millstream fan palms (*Livistona alfredii*), sedges, reeds and dragon trees (*Sesbania formosa*) along the pools and streams are a striking contrast with the spinifex and snappy gum (*Eucalyptus leucophloia*) grasslands of the surrounding hills and plains.

For many thousands of years, this huge wetland has been the heart of the tribal lands and lore of the Yindjibarndi people. The river provided more than just the resources they needed—many places along the river and streams remain sacred to the traditional custodians of the country.

The permanent streams and pools of Millstream are of great biological

interest because they are so large, and for the unique plants and wildlife they support. The native Millstream fan palm grows in large numbers around the springs and in the Fortescue River bed near Millstream. The streams and pools are also home to Nososticta pilbara, a tiny beautiful black-and-gold damselfly known only from the Millstream area. It is one of 33 species of dragonfly and damselfly found at Millstream (see 'Dragonflies - Desert Jewels', LANDSCOPE, Summer 1986-87). The groundwater of the Millstream aquifer and the springs that flow from it support a wide variety of stygofauna-aquatic animals that live below the ground surface. These secretive creatures are currently being investigated by Department of Conservation and Land Management (CALM) scientists as part of a massive biological survey of the Pilbara.

In the early 1860s, an exploration party led by Francis T Gregory passed by the springs at Millstream, describing the stream as 'running strong enough to power a large mill'. His reports of

Previous page Main Millstream-Chichester National Park. Photo – David Bettini Background Date palms.

Above Black-and-gold damselfly (Nososticta pilbara).

Left A proliferation of date palms chocking Millstream in 1989. Photos – Jiri Lochman pastoral lands in the interior of the Pilbara led to rapid settlement of the area by Europeans, mainly for pastoralism.

During the early 1890s, the settlement at Millstream Station resembled a small town. Station staff, workers and their dependents were fed from stores imported from the coast via wagon from Cossack, and from produce grown locally. Many pastoral stations supported as many as 200 people or more, and the springs and wetlands near the Millstream homestead irrigated large kitchen gardens and grazing.

#### Mixed up mess

Inevitably, weeds became established in the rich, damp soils near the homestead. By 1990, after part of the Millstream pastoral lease had been acquired for conversion to a national park, at least ten major weed species had become naturalised in the delta area (date palms, cotton palms, parkinsonia, giant bamboo, oleander, Indian water fern, water lily morning glory, khaki weed and Galland's curse).

Date palms were estimated to have totally destroyed about 30 hectares of native vegetation, mostly within the Millstream delta. Another 250 hectares were heavily infested, particularly along watercourses, but the palms had not yet destroyed the natural canopy of river gums and paperbarks. A further 1000 hectares were more lightly infested. In all, many millions of date palms were thriving in the Fortescue River valley and in nearby springs. The other weed species were mixed up in this as well.

#### Alien invaders

Date palms are one of the most serious environmental weeds affecting wetland areas in the Pilbara. While they do not invade large areas of the Pilbara landscape, they very efficiently overrun wetlands, totally destroying the native species.

Individual date palms are either male or female. Mature female date palms can produce many thousands of large, heavy seeds each year. Seed production can thus be controlled by removing females. The seeds usually fall near the parent tree and germinate in dense stands, sometimes resulting in



Photo – Jiri Lochman

**Right** Millstream homestead. *Photo – David Bettini* 

thousands of seedlings per square metre. Seeds are spread by floods and animals such as emus, dingoes and possibly flying-foxes.

The seedlings rapidly grow into dense, impenetrable thickets, which overwhelm other plants. The understorey plants cannot persist within these thickets as the date palms grow taller and denser. The palms grow so thick that they cut off most of the light. Because they use large quantities of water, the soil becomes strongly saline over time. The final phase of the invasion occurs when the date palms gradually kill off the mature trees-the river gums and cadjeputs-which once formed the natural canopy of the wetland.



Date palms thrive on fire, and in a relatively short time can create vast quantities of fuel from fallen fronds. Even the green fronds are highly flammable, being well aerated, light and covered in a waxy coating. Repeated high-intensity fires, blazing from ground level right up into the canopy, eventually kill even the largest of the native trees, leaving the dates in sole possession.

The palms have also affected the

hydrology of Millstream. The stiff, dense root mats of the palm trees rapidly invaded streams in the delta, blocking them up and altering water flow patterns. The date palm root mats are very different to the softer and less invasive roots of the native cadjeputs and river gums, and may affect aquatic invertebrates. The palms also cut off all light for long distances of stream channel, suppressing or killing off all the aquatic plants as well.

This complete cycle, from initial invasion of a few palms to total replacement of native species can occur quite rapidly. Photographs of Chinderwarriner Pool taken in 1957 clearly show that the date palms were just beginning to invade the area. In less than 30 years, massive damage had been done. The same view, taken in the late 1980s, shows almost total domination of date palms in this area.

This is also seen in aerial photographs. In 1964 aerial photos, the distribution of date palms was relatively small, with the main infestation occurring close to the homestead (a small number are apparent in the Fortescue River at that time). In 1964, there were still a large number of natural canopy trees surrounding Chinderwarriner Pool. By the mid-1970s, although the overall distribution of the palms had not greatly increased, they were clearly dominant in upper parts of the delta and around Chinderwarriner Pool. By





the late 1980s, dates were dominant throughout the delta and had spread into the river en masse.

#### War on palms

In 1986, a small number of mature palms were removed from Chinderwarriner Pool for landscaping projects in Karratha, When Perth-based horticultural operators became interested in sourcing date palms for major projects in Perth during the early 1990s, hundreds of mature and mid-sized palms were removed from Millstream and transported alive to Perth (some of them can be seen in North Fremantle). Ironically for the date palms, the revenue raised from selling these palms was used to fund larger-scale control operations.

In 1990, staff from CALM's Pilbara regional office decided to try to remove date palms from the Millstream area. The discovery of an effective herbicide treatment, applied to the crown of the palm, turned the tide. Following a devastating fire in 1991, which burnt the entire Millstream

**Left** Chinderwarriner Pool in 1989 with dense date palms overgrowing the top of the pool.

**Below left** Chinderwarriner Pool in 2004 with all date palms removed and rehabilitation plantings established.

**Below** Chinderwarriner Pool after a fire in 1991. *Photos – Peter Kendrick* 





wetland area, momentum for the program accelerated. An intensive campaign, which resulted in some 7000 mature palms being felled in a four-week period, was followed by mechanical removal of dense thickets. Stragglers and juvenile palms were poisoned wherever they occurred.

The date palm removal program

**Above** Chinderwarriner Pool. *Photo – Jiri Lochman* 

**Below** The native Millstream fan palm. Photo – Dennis Sarson/Lochman Transparencies



involved CALM staff and trainees, contractors and volunteer groups, as well as several groups of Green Corps trainees. In 2001, the WA Department of Justice established a work camp at Millstream. Work camp personnel have been major contributors to the control program.

Because seeds are produced only on female date palms, it has been possible to retain a stand of male palms in the Homestead walktrail area for their historic interest—without jeopardising the natural vegetation. Several hundred male palms have been kept as a reminder of their link to the pastoral days.

#### Taking back control

Removing the palms was just the first step in bringing the Millstream wetlands back to health. Early on in the program, a nursery was developed at Millstream, growing plants from local seed for use in areas where the palms had destroyed all native vegetation. Michael Hughes, a Karratha-based CALM horticulturalist, and national park rangers based at Millstream took on this project, and produced many thousands of seedlings. These were planted into the most damaged areas, and established using drip irrigation. Compacted, salinised soils often made this very difficult. Where canopy species had not yet been totally destroyed by palms, there was no need to undertake plantingsthose areas quickly rehabilitated using natural seed fall. Many thousands of

seeds were also directly sown into areas after palms had been removed.

Once established, most plantings thrived. Areas that were once nothing but date palms, and then bare ground following their removal, now support healthy riverine vegetation.

#### The future

Date palms are not the only weeds at Millstream. Significant effort is also being put into controlling parkinsonia (Parkinsonia aculeata) and Indian water fern (Ceratopteris thalictroides), as well as several other weed species. Weed control remains a major part of the daily works program in the national park. CALM staff, volunteers and work camp personnel are continually sweeping through areas where date palms have been removed, poisoning small date palms as they emerge. This task will go on for at least another five years. However, those areas once lost to a voracious environmental weed are now well on the way to recovery.

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## Shoalwater Islands Marine Park

Only a short distance south of Perth is an easily accessible marine environment, where penguins, sea lions, dolphins, seagrass and shipwrecks converge.

Above Jagged limestone along the western side of Penguin Island. The adjacent waters are in the Shoalwater Islands Marine Park. *Photo – Alex Bond* 

#### Facing page

Top Australian sea lion. Photo – Alex Steffe/Lochman Transparencies Above Silver gull. Photo – Jiri Lochman Far right Bryozoan and sea star. Photo – Ann Storrie

icturesque submerged reefs inhabited by diverse plant and animal life in the Rockingham area form a remarkable ecosystem. Much of the underwater environment is protected in the Shoalwater Islands Marine Park. As well as having an incredibly rich and diverse marine environment. the marine park surrounds a chain of limestone islands such as Penguin Island, less than 700 metres offshore. These island nature reserves are significant in the ecology of a number of bird species. The park encompasses Shoalwater Bay, Warnbro Sound and the waters off Cape Peron.

Ferry tours operate from Mersey Point from mid–September to early June and feature a cruise around the waters and islands of Shoalwater Bay, with an opportunity to view the sea lions lazing on Seal Island, and to stroll around Penguin Island's network of boardwalks and walkways.

#### Seabird haven

The islands of Shoalwater Bay abound with seabirds, many of which are

seldom seen on the mainland. They are important seabird breeding sites. At least 14 species of seabirds use the marine park and adjacent nature reserves as foraging and nesting areas. Within the marine park there are breeding colonies of silver gulls, pied cormorants, fairy terns, bridled terns and Caspian terns. Crested terns are commonly seen, but don't usually breed on the islands.

The penguins that nest on Penguin Island feed in the adjacent marine park. The scientific name of the little penguin (*Eudyptula minor*) means 'good little diver' and these birds are adept in the water. The little penguin is the smallest of the world's 17 penguin species. Adults stand about 40 centimetres tall and weigh about a kilogram, but birds in the Shoalwater area are larger than those elsewhere in Australia.

The reef areas support a variety of temperate and subtropical invertebrates, including sea stars, urchins and shellfish, as well as numerous fish species. Bottlenose dolphins are extremely common in the park's waters.





#### Sea lions and seagrass

A colony of male Australian sea lions hauls out on Seal Island for most of the year (only leaving every 18 months to breed further north). These animals often fish and swim in nearby waters. This species is one of the rarest sea lions in the world and is given special protection under State legislation. Although they are one of our most attractive and interesting sea creatures, sea lions can deliver a nasty bite if aggravated. They are curious and may approach boats. To avoid disturbing the animals, which are territorial, visitors are asked not to land on the island.

Extensive areas of the sea floor are dominated by seagrass. These are important areas, since they provide nursery habitat for juvenile fish and help to stabilise the sandy floor.

#### Snorkelling and diving

The cavernous reefs surrounding the islands provide good snorkelling and diving. Just south of Penguin Island, for example, there is a shallow and very sheltered area that is an ideal place to



explore interesting underwater ledges and overhangs, lumps, low broken reef and seagrass areas. It is a good area for novice snorkellers, as it is only two to five metres deep and fairly protected.

The Sisters, a series of limestone reefs at the southern end of the Shoalwater Islands Marine Park, offer snorkellers and scuba divers an excellent opportunity to experience an area rich in marine life and First Rock, the first large rock to the south of Penguin Island, is almost completely surrounded by reef, which is undercut by ledges and caves. You should only dive these sites in good weather conditions. There are also a number of good snorkelling spots or shore dives around Cape Peron, in three to seven metres of water.

For further information on these and other dive sites in the marine park see the CALM publication *Dive and Snorkel Sites in Western Australia*.

#### park facts

Where is it? 50 kilometres south of Perth Total area About 6545 hectares. What to do Boating, commercial boat tours, fishing, swimming, windsurfing, diving, picnicking, surfing. Spear guns and hand spears (gidgees) are not permitted on Penguin Island. Must see sites At the Penguin Experience Discovery Centre commentated feeding of little penguins occurs daily at 10.30 am, 12.30 pm and 2.30 pm. Entry to the centre is included in the cost of the ferry ride or tour, which leaves regularly from the mainland. Naming When John Septimus Roe surveyed and charted the coast and offshore islands of what is now Rockingham in 1839 he called the bay south of Cape Peron 'Shoal Water (a shoal is an area of shallow water). Nearest CALM office CALM rangers are stationed on Penguin Island and at Mersey Point in Rockingham, from which the ferry leaves.



# Embracing diversity the spice of life

Western Australia has an extremely rich and unique biodiversity that is nationally and internationally recognised. However, loss of biodiversity is a major issue facing the State.



by Keith Claymore

he quality of life of all Western Australians depends on having a rich and healthy biodiversity. All of us depend on the products and ecosystem services that biodiversity provides, in order to maintain the lifestyle we all enjoy and take for granted. Living things provide food, clothes, building materials and medicines. They also help to regulate and maintain our environment, by providing clean water and air, maintaining the quality of the atmosphere. controlling climate. providing fresh water, protecting soil by preventing erosion, controlling pests and diseases, and pollinating crops. Hence, all Western Australians share a responsibility to conserve biodiversity and to ensure that the use of our natural resources is ecologically sustainable.

#### **Biodiversity values**

Western Australia is in the enviable position of having Australia's only internationally recognised terrestrial biodiversity hotspot (the South West Botanical Province), one of the world's 18 tropical marine hotspots and eight of the 15 national biodiversity hotspots. While these hotspots reflect an extremely high level of endemism and biodiversity richness, the terrestrial hotspots are subject to a high degree of threatening processes, such as: the effects of secondary salinisation and waterlogging on native habitat in the South West; altered fire regimes; inappropriate grazing; introduced



plants, animals and pathogens such as Phytophthora cinnamomi (see 'Alien Invaders' in LANDSCOPE, Summer 04-05); and direct habitat loss through clearing of native vegetation for infrastructure, agriculture and other developments.

The impending effects of climate change-and associated processes such as sea level rise-and increases in carbon dioxide will also significantly threaten biodiversity in both terrestrial and marine areas (for instance, through coral bleaching) over the next few decades.

At least 547 species, subspecies and varieties of plants and animals are now threatened with extinction in WA, while at least 18 animal species, 15 plant species and three ecological communities have been lost forever. Secondary salinisation and waterlogging in the agricultural zone of the South West may cause a further 450 plants and 400 animals, including aquatic invertebrates, to become extinct. It has also been estimated that 14 per cent of plant species in the South West Botanical Province are susceptible to dieback disease caused by Phytophthora cinnamomi infestation and a further 26 per cent are susceptible.

#### Devising a strategy

The State has been recognised internationally and nationally as being at the forefront of biodiversity conservation through programs such as the wildlife recovery program Western Shield. However, while there has been considerable progress in biodiversity conservation in WA, there is need for accelerated conservation action in a coordinated and targeted fashion, to halt and reverse the decline in biodiversity. A piecemeal and uncoordinated approach will fail.

WA is therefore developing a State biodiversity conservation strategy to provide an overarching framework to guide decisions, identify and clarify responsibilities, provide a coordinated and targeted approach to conservation requirements, outline institutional reforms, establish a common vision and goals for the next 25 years (phase 1 of a proposed 100-year strategy), and meet WA's national and international obligations.



#### Previous page

Main Wattle and black-eyed susan on a hillside. The South West of Western Australia is Australia's only internationally recognised terrestrial biodiversity hotspot. Photo - Bill Belson/Lochman Transparencies Inset Green tree frogs. Photo - Ken Stepnell/CALM

Above The Queen of Sheba orchid (Thelymitra variegata) has a great deal of variability in its flower colour, indicating genetic diversity. Photo - Babs and Bert Wells/CALM

Left Hummock grasslands dominate much of the semi-arid and arid areas of WA and provide a rich assemblage of plants and animals and diversity of habitats. Photo – Keith Claymore

#### What is biodiversity?

The term 'biodiversity' was coined in the mid-1980s. Western Australia is a signatory to the National Strategy for the Conservation of Australia's Biological Diversity, which defines 'biodiversity' as 'the variety of all life forms—the different plants, animals, fungi and micro-organisms, the genes they contain, and the ecosystems of which they form a part'. Biological diversity is considered at three levels.

- Genetic diversity is the variety of genetic information contained in all of the individual plants, animals, fungi and microorganisms that inhabit the earth. Genetic diversity occurs within and between the populations of organisms that comprise individual species, as well as among species.
- Species diversity refers to the variety of species on the earth.
- Ecosystem diversity is the variety of habitats, biological communities and ecological processes.

A recent discussion paper, released by the Department of Conservation and Land Management (CALM) to commence the development of a State biodiversity conservation strategy, puts forward four primary areas that need to be considered in a biodiversity conservation strategy for WA: research into biodiversity; engaging the public; integration and coordination; and direct management. It also proposes nine key strategic directions.

#### **Understanding biodiversity**

There are significant gaps in knowledge about the State's biodiversity-and of threatening processes—so improving this knowledge is critical. In particular, much more work is required to describe invertebrates, non-flowering plants (like ferns, lichens and fungi), micro-organisms (such as cryptogams and bacteria), and marine and subterranean organisms.

Systematic biological surveys are needed to identify and document



biodiversity patterns and components, and to establish the conservation status of species, subspecies and varieties of plants and animals, and of ecological communities. A comprehensive biological survey is now underway in the Pilbara region across a range of plant and animal groups. However, around 70 per cent of WA has not been comprehensively surveyed. Hence, we need to expand the State's biological survey program to complete these gaps in coverage, and to map ecosystems at a finer scale. The information that is collected will help to determine priorities for establishing a conservation reserve system that is comprehensive, adequate and representative, and assist in planning for integrated natural resource management.

Monitoring the health of biodiversity and trends in threats is essential. It will allow us to determine whether conservation management is effective, to establish relationships between cause and effect, and to **Top** Prince Regent Nature Reserve in the Kimberley is one of two areas in WA classified as a world biosphere reserve (the other is Fitzgerald River National Park on the south coast). *Photos – Babs and Bert Wells/CALM* 

Above Ningaloo Marine Park is the largest fringing reef in Australia. The temperate and tropical currents that converge in this region result in highly diverse marine life. Photo – Clay Bryce/Lochman Transparencies

distinguish between human-induced changes and those brought about by natural disturbance. A Biodiversity Audit for Western Australia was undertaken in 2002, and provides information on terrestrial biodiversity values, threats and appropriate actions at a bioregional scale.

It will also be important to develop readily accessible databases that organise and link data from a variety



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Above Taxonomic work is needed to help complete gaps in our biodiversity knowledge. Photo – Community Newspapers

of sources and provide relevant information for biodiversity planning and on-ground conservation.

The potential impact of climate change is increasingly being recognised as posing a major threat to biodiversity. Further knowledge on the likely effects is needed, so we can develop effective response strategies, and identify biodiversity assets particularly at risk. Impacts from other impending threatening processes, such as the imminent arrival of the cane toad in the Kimberley, will also need to be examined and understood.

#### Engaging the public

If we are to bring about greater support for biodiversity conservation initiatives, the wider Western Australian public will need to recognise the environmental, social and economic consequences of biodiversity loss, and impacts on their wellbeing and livelihoods. This will require education and awareness-including the development of formal educational curricula at all levels-on the benefits of biodiversity, to achieve greater empathy with our natural heritage and appreciation of its values, and recognition of conservation needs.

Involvement of people in the enjoyment of biodiversity will assist in maintaining social health and help them gain an understanding of



biological values. Involving people directly in conservation initiatives will help to address biodiversity threats and bring about long-term support for conservation programs. These strategies will also help to establish biodiversity conservation decision-making in mainstream businesses and government processes. All levels of government, non-government organisations, industry and the general public can help to achieve these outcomes.

#### Integration and coordination

A plethora of existing strategies, plans and legislation deal in some manner with biodiversity conservation. Opportunities exist to strengthen some of these mechanisms to accelerate and better coordinate and integrate biodiversity conservation initiatives.

A Biodiversity Conservation Act is proposed for WA. It is intended that the Act will provide a regulatory framework for the protection, restoration and sustainable use of biodiversity, and that it will also formally recognise conservation activities by a range of stakeholders through accredited bioregional plans, and help to broaden and strengthen protection for all species and their habitats.

Local government action plans for biodiversity, and community-based regional natural resource management strategies and investment plans, will help to better integrate and coordinate biodiversity conservation initiatives. Guidance to local government authorities for incorporating biodiversity conservation considerations into their town planning schemes will help to minimise the impact of development and urban expansion, along with environmental impact assessments under the Environmental Protection Act.



Natural resource management sectors are increasingly adopting sustainability principles in plans and guidelines, and providing for biodiversity conservation. There are also many commercial opportunities to establish industries based on native species, such as oil mallees, to provide alternatives to traditional practices while at the same time providing conservation benefits.

#### Managing for biodiversity

Establishing and managing conservation reserves-national parks, nature reserves, marine parks and equivalent areas-is vital to help conserve biodiversity, and is a central strategy to maintaining and reversing biodiversity decline. It provides longterm protection of representative ecosystems, and establishes management protocols and standards for those areas. As well as providing the basis for conserving biodiversity, the conservation reserve system also plays an important role in the State's economy and social wellbeing by providing opportunities for sustainable nature-based tourism and recreationincreasingly being seen as vital by many regional communities.

While there have been significant additions to both the terrestrial and marine conservation reserve systems over the past few years, there is some way to go to reach the benchmark of at least 15 per cent of terrestrial ecosystems being reserved. Of the 54 terrestrial subregions in WA, only ten currently have 15 per cent or more of their area reserved (see map on page 59). Of the 18 marine bioregions, 10 have no marine reserves. There is therefore an urgent need to add additional areas to the conservation reserve system, particularly in the rangelands, and for the Kimberley and WA South Coast marine bioregions (see 'Vision Splendid', *LANDSCOPE*, Spring 2003). Nevertheless, three new marine parks, two new marine management areas and extensions to Ningaloo Marine Park and Rowley Shoals Marine Park, and 29 new national parks have been created since August 2004.

Recovery of species and ecological communities on the edge of extinction is another primary conservation strategy needed to prevent further biodiversity loss, along with special attention being given to areas of high conservation values such as wetlands and naturally restricted ecosystems and habitats.

The need for landscape-scale conservation has highlighted the important role of conservation outside reserves to complement the goals of the formal conservation reserve system, and to address threatening processes at an appropriate scale. Over the past decade, a wide range of mechanisms and programs have been developed to provide incentives for private and leasehold landholders to manage native vegetation and other habitat for conservation purposes.

Programs such as Urban Nature and Land for Wildlife provide technical advice on conservation management to private landholders. Innovative initiatives, such as market-based instruments that provide or increase financial rewards for conservation, are currently being trialed. The Bushland Benefits scheme encourages landholders to apply for funds for conservation through a tendering system, and awards funds on the basis of Above Codes of practice and management guidelines help ensure activities such as swimming with whale sharks in Ningaloo Marine Park are sustainable. Photo – Western Australian Tourism Commission

cost effectiveness and the best possible biodiversity conservation outcomes. Through the Biodiversity Adjustment Scheme the State government is buying high-value biodiversity conservation land and providing assistance to landholders where land should never be cleared.

These and other programs are being complemented by other voluntary conservation approaches, direct financial assistance schemes and industry-driven approaches such as environmental management systems. The expansion of these types of initiatives and advisory services will be needed to achieve effective biodiversity conservation on private and leasehold lands.



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CALM has released a discussion paper *Towards a Biodiversity Conservation Strategy for Western Australia.* Downloadable copies of the paper are available from http://www.naturebase.net/have yoursay or on request from CALM at its main office at 17 Dick Perry Ave. Kensington, phone (08) 9334 0333.

# sight & sound by David Gough

#### Busselton Jetty (DVD) and Naturally Ningaloo (DVD or CD-ROM)

Busselton Jetty DVD PAL only, TV format 4x3 RRP: \$39.95 Naturally Ningaloo DVD PAL only, TV format 4x3 RRP: \$39.95 Naturally Ningaloo CD-ROM RRP: \$25.00

Filmed by Paul 'Wags' Waghorn and narrated by Kelly Richie, *Busselton Jetty* DVD takes you on a 30-minute journey outside the Busselton Underwater Observatory and beneath the jetty itself. With the aid of Wags's camera, you follow Kelly through shoals of fish and coral gardens to view an amazing and colourful marine world.

This modern-day diving duo can be likened to famous German naturalists and divers Hans and Lottie Hass of the 1950s. Wags's cinematography is stunning and Kelly's commentaries are enthusiastic, educational and highly enjoyable.

The Naturally Ningaloo DVD, also by Wags and Kelly, is a 65minute underwater extravaganza that takes you on an extraordinary adventure along Ningaloo Reef, off WA's North West Cape, and introduces you to the area's marvellous marine life. You can choose from three audio tracks on the DVDs-music only. narration only, or a mixed track of both. The Naturally Ningaloo CD-ROM (Windows only) contains a video of the movie, a 115-image slideshow, 115 printable images and four screensavers.

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#### Wild Encounters – Shark Bay DVD PAL and NTSC (double-sided), widescreen letterbox format 16x9 RRP: \$34.95

Shark Bay has one of the most fascinating ecosystems in the world, and in this DVD WA wildlife filmmaker Leighton De Barros takes viewers on almost an hour's exciting adventure into this World Heritage Area, as he documents the work of marine scientist Lars Bejar and researcher Aaron Wirsing.

Take a trip to Cape Peron to see majestic birds of prey and

Wags's Kelly's NATURALLY NING

BUSSELTON JETTY

Wags & Kelly's

dolphins speeding through the shallows to catch fish. Move on to the waters off Monkey Mia to witness more fascinating dolphin behaviour and come face-to-face with a tiger shark. Back on land, you will see the release of bilbies into the wild on Peron Peninsula.

# Ningaloo – where the desert meets the sea DVD

#### PAL only, widescreen format RRP: \$32.95

This DVD by Emmy Awardwinning filmmaker David Hannan runs for 72 minutes. Bonus features include 40 downloadable prints, a narrated environmental program, educational fact files, maps and four mini programs. Like the Naturally Ningaloo DVD, it explores the incredible marine life of Ningaloo Reef-gardens of corals, moray eels, clouds of pink and green parrotfish, curious cuttlefish, crabs and sea stars, manta rays, whale sharks and the annual coral spawning.

However, while this visual feast is set to a sumptuous soundtrack, it lacks any form of narration, and, for me, that's a setback. Nevertheless, it is another view of the largest and most pristine western fringing reef in the world.



I m

## urban antics by John Hunter

#### A few dollars a day

In the summers of the early 'fifties' we used to camp among the Rottnest cypress (Callitris preissii) at Coogee Beach. It was heaven. In the distance, a fun fair merry-go-round continuously pumped out hit songs like 'I want a hippopotamus for Christmas' as the afternoon sea breeze raged melodic through guy ropes, pine, sheoak and saltbush. Mornings always seemed the reverse, however. The still, quiet, protected waters of Owen Anchorage were glasslike, as an easterly wind wafted wearily toward Carnac and Garden islands.

Morning swims in the clear stillness of the lagoon-like ocean between Woodman Point and Coogee were soooo... good. Here, young children on car tyre tubes would bob around staring wideeyed through facemasks at an underwater world of amazing and diverse marine life at arm's reach.

Snorkelling at Perth's beaches is a great recreation. Today, it is likely that those now 'big kids' are still hooked on observing a myriad of strange and fascinating sea creatures.

One such group of marine animals that provided hours of fun was made up of the sea stars (starfish) and sea urchins. It was one thing to see them alive if you ventured out to the seagrass beds or snorkelled along the Woodman Point groyne. But many a good time was had searching the sandy shallows, or combing the beach, to collect the hard test, or skeleton, of an urchin called the sand dollar.

The stars and urchins are part of the phylum of animals referred to as echinoderms. These are made up of thousands of species, including brittle stars, sea cucumbers and sea lilies. Although some echinoderms resemble tiny hedgehogs with large spines and pencils, others, like the sea stars and sand dollars, appear smooth or, at most, rough- skinned. If viewed with a magnifying glass, however, it is easy to see the tiny but similar tube feet and stalked, chalky, pincer-like structures (pedicellariae).

Live sand dollars burrow in the sea floor, where, as scavengers, they consume sand and silt, to extract plant and animal material. If you look hard, sometimes you can see the disc outline of the animals as they lie just under the sand surface of the sea floor. A gentle wafting of water over the outline usually uncovers the attractive fivepointed star-shaped petals on the spiny, orange or pink skin of the animal.

In those early days of simple entertainment-and I'm sure it is still the same for some today-the collection of the flat tests of dead sand dollars added fun to summer holidavs. While the size of the dead shells varied, the popular size sought were those slightly bigger than the then current two-shilling piece. One can only surmise that the attractive petal-like design and the smooth coinsized shell resembled a foreign dollar piece, or perhaps a brooch to be painted for mum. Or were they simply a perfect object to see who could skim them out the furthest into the bay? | forget.

Whatever it was, it was fun and freedom, a time of childhood discovery at a somewhat remote place, and all for a few dollars a day.

#### **DID YOU KNOW?**

- Locally found tests of Lesueur's sand dollar (*Peronella lesueuri*) may reach 12 centimetres across while the shells of Peron's sand dollar (*Peronella peroni*), found on the south coast, reach about five centimetres.
- The vital organs are enclosed inside each test. From the mouth on the underside of the animal five white teeth protrude, a part of the elaborate chewing mechanism called Aristotle's lantern because of its oil lantern-like shape.

## A book worth shelling out for....

# ... when wildlife and conservation is your concern.

At least 185 species of animals are threatened in Western Australia, from weird and wonderful marsupial-moles to spectacular 150-tonne blue whales; and from the mysterious night parrot, which has not been seen alive since the 1930s, to the rarely-seen graceful sunmoth. A further 18 species are either extinct or extinct in the wild. How have they managed to cling to survival and what can be done to secure their future?

An important 208-page full-colour book, *Threatened animals* of *Western Australia*, by eminent naturalist and scientist Andrew Burbidge documents the current state of research into and management of threatened animals in Western Australia, looks at the factors that led to their decline and presents a vision of what needs to be done to conserve WA's amazing biodiversity.

RRP \$32.95

WA Naturally Publications Department of Conservation and Land Management Locked Bag 29, Bentley Delivery Centre, WA 6983 Tel: (08) 9334 0333. Fax: (08) 9334 0498. TTY (hearing impaired) facility available: (08) 9334 0546 Order online at our award-winning NatureBase website, www.naturebase.net



Threatened animals





