

Australian GEOGRAPHIC

THE JOURNAL OF THE AUSTRALIAN GEOGRAPHIC SOCIETY



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Attack of the space bugs



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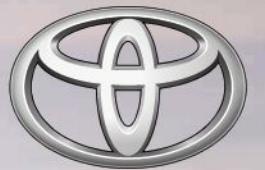
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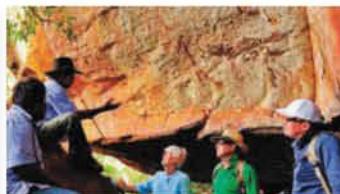
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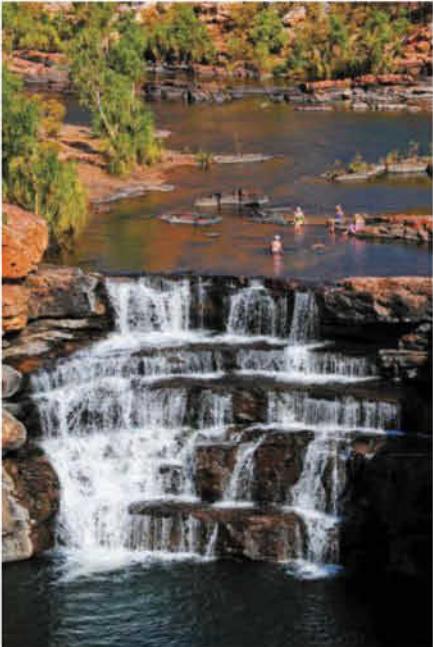
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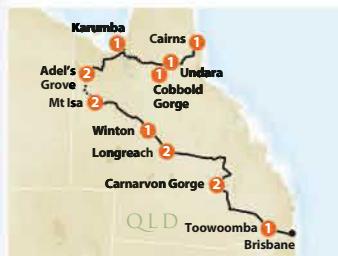
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Australia has about 70,000 dugongs, such as this one photographed by Douglas Seifert. Weighing up to 400kg, these mammals (*Dugong dugon*) often attract juvenile golden trevally (*Gnathanodon speciosus*), which follow in their wake for protection.



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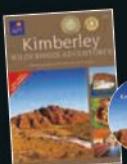


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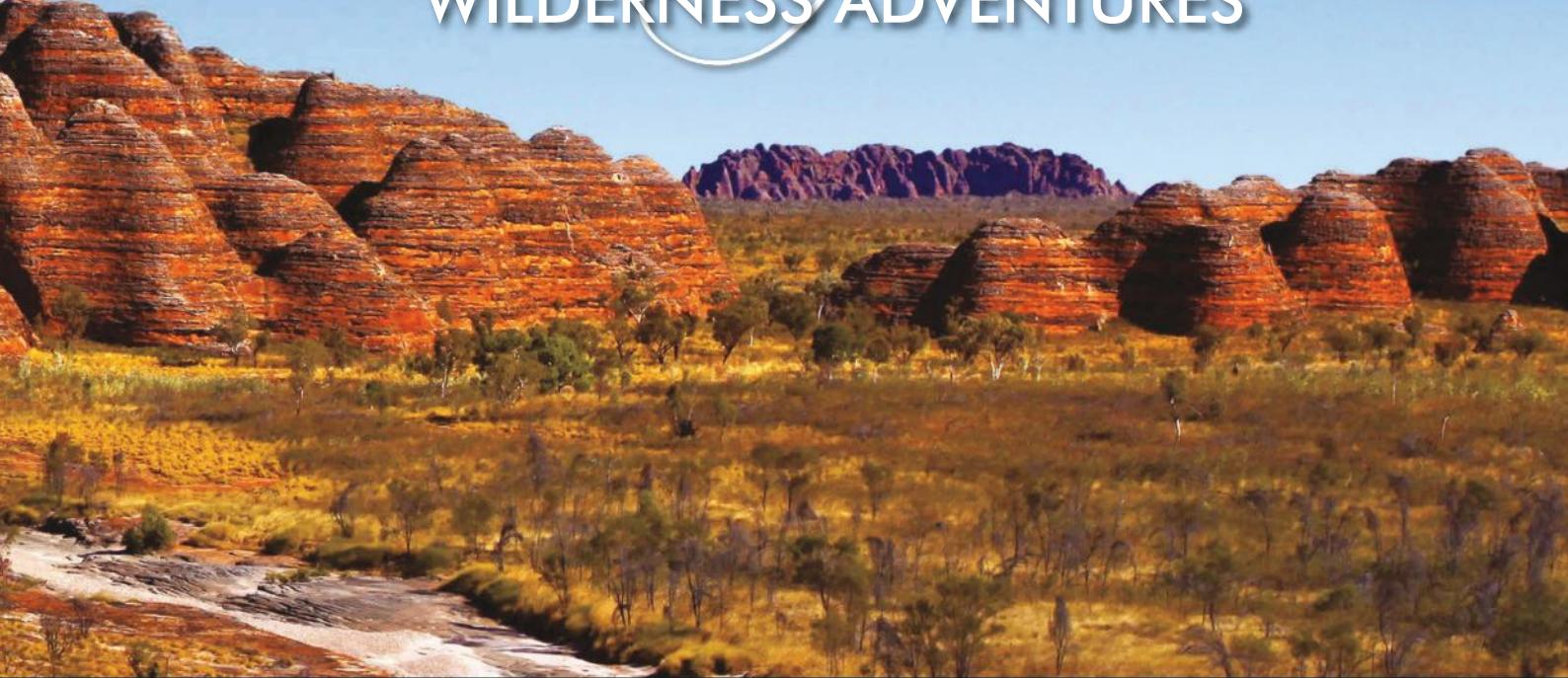
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Clear skies ahead

IT'S THAT TIME of year when, hopefully, the frenetic pace of Christmas slackens a little and gives way to languid days at the beach with family and friends – or maybe offers the chance to head off on an adventure to somewhere unexplored.

Wherever in Australia you find yourself this holiday period, take a little time to look up and contemplate the heavens on a clear night. One of the great pleasures of spending time in the great outdoors is the chance to end each day sitting out under a sky studded with stars. It's an experience not to be taken for granted: there are many parts of the globe where a starry night is a rare sight.

Nevertheless, Australia has yet to see the declaration of a designated International Dark Sky Reserve.

Our astronomy columnist Fred Watson and the Australian Astronomical Observatory are working towards having a reserve declared around our national observatory at Siding Spring, in northern NSW, and AUSTRALIAN GEOGRAPHIC will be lending support to the campaign. Read Fred's commentary to learn more (page 39), and we'll keep you updated on the campaign over the year.

For the past three years, the Australian Geographic Society (AGS) and its volunteers have supported research into the impact of cane toads on the ecology of the east Kimberley, and trial measures to keep toads out of pristine parts of areas of outstanding natural value. If you're a subscriber to AG (and therefore a member of the AGS) a proportion of your annual subscription cost goes towards

our support of remote-area field work undertaken by Australian scientists and conservationists. The Kimberley toad project is now the subject of our brand-new documentary, a DVD of which is provided free to subscribers with this issue. If you are inspired by the documentary, perhaps consider joining the team when they head back to the Kimberley in 2015 (more details on page 114).

Finally, we're delighted to welcome a new columnist into the AG fold in the colourful guise of Dr Karl Kruszelnicki; he will be a regular contributor from this issue. Dr Karl is one of the country's most effective science communicators and I'm certain you'll enjoy his entertaining and informative view of the world (page 124).

Wishing you all the best for 2014.

Chrissie Goldhawk

Contributors



Daniel Sheridan

is a freelance artist based in Perth. For six years he has combined his love of nature and the arts as a wildlife illustrator. Starting out as a signwriter and muralist, Dan created large photorealistic wall and ceiling murals, while dabbling in fine arts in his spare time. In 2010 he entered the Archibald Prize with his portrait of Schapelle Corby. Dan's dragonfly image is featured on the cover of *The Art of Australian Geographic Illustration*.

MERMAIDS OF MORETON BAY, PAGE 52



James McCormack

has always been attracted to adventure. He has skied, paddled, climbed, biked and hiked around the world, successfully turning the pursuit of wilderness into a career as a writer and photographer. The roots of this adventurous spirit are inherited; his father was Australia's first modern hot-air balloonist. "Researching his early exploits for this story was eye-opening," says James. "And in the process, I learnt not only about him, I learnt about myself."

LOFTY AMBITIONS, PAGE 66



Thomas Wielecki

became a professional photographer in 1998, entirely by chance. He studied journalism, but photography took over. Thomas's first commissioned shoot was of a car and, although since then he has often been labelled a car photographer, he is happiest when people open up and let him into their worlds. For his first AG assignment, *Pushing Time* (AG 68), he spent two and a half weeks on the road with long-haul truck drivers.

LAT/LONG, PAGE 108

Contributing editors: Joanna Egan and Karen McGhee **More contributors:** Fleur Bainger, Ian Brown, Peter Elfes, Andrew Gregory, Darren Jew, Ling Man, Alasdair McGregor, Brent Melton, Adam Morrissey, Mike Owen, Alex Palmer, Steve Passlow, Douglas Seifert, David Studham, Brendon Thorne, Fred Watson, Yu Yong.

BIG PICTURE

EAT YOUR GREENS

BY STEVE PASSLOW

The common garden katydid is native to Australia and New Zealand, and is found in the gardens of most of our cities. Adults such as this one are always green, but nymphs – which moult regularly and still have developing wings – take on the colour of whatever they have been eating: pink, for instance, if lunch was a hibiscus flower. This colour will last through several moults; it seems much safer, therefore, to have a taste for greens.



BIG PICTURE MINI ON A STICK BY PETER ELFES

Travelling across the Hay plains in south-western NSW – some of Australia's flattest country – landscape photographer Peter Elfes could see this humorous landmark for kilometres; its surrealism captivated him. The work of art on the Mid-Western Highway also has a practical purpose: it marks the Motorkhana ground, about 12km north-east of Hay, where an annual Mini rally is held on the June long weekend each year.





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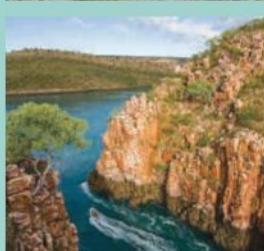
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Bat to basics

FOR MANY, the *thwack!* of a cricket bat connecting to a ball – and a commentator's laconic drawl – is the soundtrack to an Aussie summer. Leather on wood has echoed across ovals here since 1804, when a match was first reported as a highlight of a blistering January. Rivalry with the mother country began hotting-up in 1861, when England first toured Down Under. Apart from a few notable exceptions, bats were still largely British-made until the 1940s; English willow was the only wood considered tough enough for a bowling season. Commonwealth sister colony, India, chipped in with the rubber for grips from the late 1800s, but it wasn't until supplies dried up during World War II that we began making our own in earnest. Nowadays a number of companies manufacture bats here, but it's still bespoke craftsmen, or 'pod-shavers', that create century-makers for the pros.

2000s Twenty20 bats introduced

Now Modern-day bat

1600s The Cricket-staffe

The Cricket-staffe

In a 1611 dictionary, the meaning of the French noun 'crosse' refers to: "A Crosier or Bishop's staffe; also, a Cricket-staffe; or, the crooked staffe wherewit boyes play at cricket." The bat was a curved stick, shaped like a modern hockey stick, ideal for the underarm-bowling style.

Straighter shape

Cricket became more formalised with the introduction of laws, but there was no limit on bat size, length or weight. Although bats were becoming straighter, they were still slightly curved for the sweeping style of hitting suited to underarm bowling.

Maximum width of 4.25"

Bats were heavy and had begun to develop a 'swell' (hump or thickest part) on the lower back to add power to the swing. After



Thomas White of Ryegate "brought a bat to a match, which being the width of the stumps, effectively defended his wicket from the bowler", a law was passed limiting the width to 4.25" (10.8cm). This is still enforced today.

Length restricted to 38"

Bats were restricted to 38" (96.5cm) in total length, which remains the maximum allowed today. Round-arm bowling was legalised in the 1835 code, meaning there was more bounce in deliveries. Bats then became straight sided and lighter, with a higher swell for balance.

Cane splice-handles

Cane splice-handles were introduced from the early 1840s, replacing solid willow bats. The splice, originally ash or willow, assisted with shock absorption in the handle as bowling got faster and harder.

Development of shoulders

The laws were altered to allow overarm bowling. Bats became lighter again, and their sloped top developed shoulders to give more 'face' for higher bouncing deliveries – and to stop high nicks off the bat. Handles became intricate constructions and were nearly all made of cane with Indian-rubber grips.

Australia's aluminium bat controversy

The Laws of Cricket were amended to ensure that the blade of a cricket bat was made solely of wood. This was a direct reaction to Australian cricketer Dennis Lillee's use of an aluminium bat during a test match at the WACA ground in Perth in 1979.

Twenty20 bats introduced

The advent of the Twenty20 game led to a specific bat.

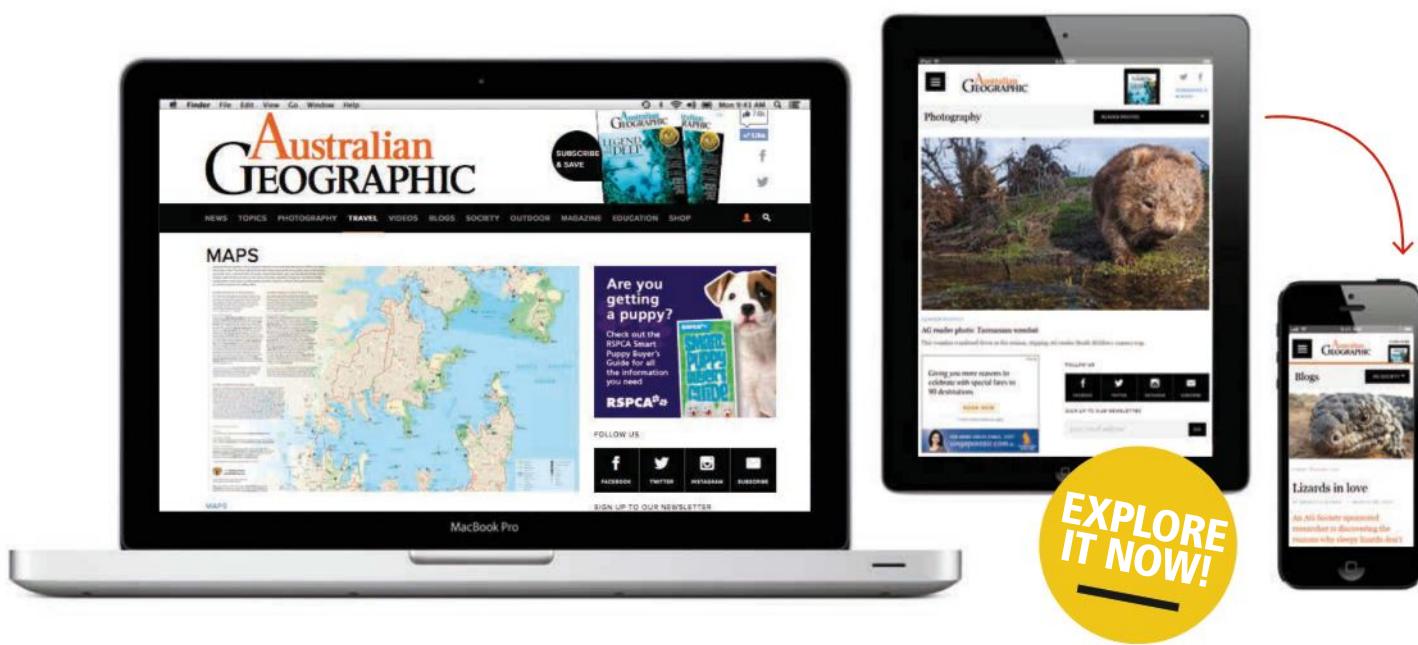
Developed in 2004, the T20 bats have elongated handles and shorter blades. By 2008 the T20 bats were 33 per cent shorter than conventional bats and had handles that were 43 per cent longer.

Modern-day bat

Modern bats must conform to the regulatory maximum width and length. However, they are now thicker and heavier – weight has been redistributed to increase the 'sweet spot' (where the ball should strike), and the swell reaches up to 8.5cm in some models. Bigger sweet spots, combined with boundary ropes set well inside arena fences, mean more sixes are being hit than ever before.

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Platypuses with bite

The discovery of a prehistoric, supersized, carnivorous platypus helps to fill in the family history of this unusual and iconic Aussie species.

WAS THIS ANIMAL for real? It sounded more like something from a poorly scripted, low-budget horror film. Could an ancient relative of everyone's favourite venomous, duck-billed, egg-laying mammal really have grown to epic proportions and had a taste for flesh? I could picture the scene through the Hollywood lens: maniacal monotremes marauding through the sewers of Sydney, ready to burst out of drains and clamp their bills around the ankles of unsuspecting pedestrians, dragging them to their untimely deaths.

Implausible as it all sounded, this prehistoric Platyzilla really did exist, even if descriptions of it were a little overblown in the press. Researchers led by Professors Mike Archer and Sue Hand, at the University of New South Wales (UNSW), announced late last year that they'd discovered remains of a metre-long species, which had powerful teeth for preying upon turtles, frogs and fish. *Obdurodon tharalkooschild* inhabited pools and rivers in the rainforests that covered Queensland's Riversleigh region 5–15 million years ago.

The description of this animal as "giant" in news reports conjured images of an animal the size of a small car, so I was disappointed to find it had been much smaller. Nevertheless, by monotreme standards this was huge. Today's platypus is about half a metre in length and, as an adult, doesn't have teeth, instead relying on horny pads in its bill to crunch up invertebrates. Although *O. tharalkooschild* was only twice as long as a modern platypus, it is likely to have been about four times the weight.

Former UNSW student Rebecca Pian, now at Columbia University in the USA, discovered a fossil tooth at the Riversleigh World Heritage Area in 2012. The size and eating habits of the new species were later determined from a detailed study of the size, shape and function of the tooth, which is yet to be dated definitively.

Fossil discoveries over the past 40 years have given us snippets of information about platypus evolution, and have shown that similar animals have been a part of the Australian

and distinguished this genus of prehistoric toothed platypuses from their modern descendants.

A second toothed platypus, *Obdurodon dicksoni*, was discovered by Mike Archer's group at Riversleigh in 1984 and dated to about 15 million years ago. Even more exciting was the discovery of the teeth of a 61-million-year-old South American relative in 1992. Hailing from Patagonia, *Monotrematum sudamericanum* demonstrated how widespread these early platypuses really were.

The newest species is significant because it is much larger than any of the other five known relatives, suggesting that the family tree is more complicated than we thought, with unexpected side branches. This hints that there may be other weird and fascinating platypus relatives waiting to be discovered in Riversleigh's rich fossil deposits.

The species descriptor *tharalkooschild* comes from an Aboriginal creation story about the platypus: Tharalkoo was a disobedient female duck who ignored her parents' warnings and swam downstream, where she was ravished by a water rat. Later, when she laid her eggs along with the other young ducks, she was horrified to discover it contained not a duckling but a platypus, with a mixture of rat and duck features.

This indigenous cautionary tale was then itself a horror story of sorts, one which had been told and retold over countless generations.



Platyzilla ambush. An ancient platypus from Riversleigh had a taste for flesh.

story for at least 110 million years. The most ancient platypuses were also found in Antarctica, South America and possibly Madagascar. By around 25 million years ago, they were left only in Australia, where up to three species shared the streams of the lush north and centre of the continent.

In 1975, the first known ancient platypus was described from fossilised teeth found in central Australia, by Mike Archer and US palaeontologists Michael Woodbourne and Richard Tedford. They named the 26-million-year-old species *Obdurodon insignis*. *Obdurodon* means "persisting tooth"

JOHN PICKRELL is the editor of AUSTRALIAN GEOGRAPHIC. Follow him on Twitter at: twitter.com/john_pickrell

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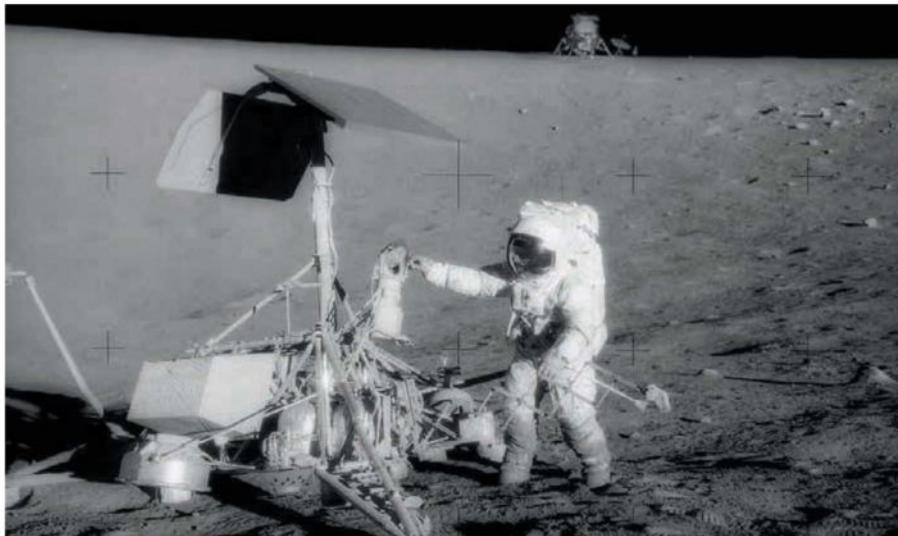
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Space bugs attack!

The transfer of microbes across space is a very real possibility, says FRED WATSON, but do we have anything to worry about?



IT'S ONE OF THE legendary tales of astrobiology. In November 1969, in the heyday of the Moon landings, *Apollo 12* visited the site of an earlier lunar landing by a robotic NASA probe called Surveyor 3. Astronauts Pete Conrad and Alan Bean landed within walking distance of Surveyor, which had been on the lunar surface for more than two and a half years. To investigate the long-term effects of the environment, they removed parts, including a TV camera, and brought them back to Earth.

To everyone's surprise, the camera harboured a common bacterium, *Streptococcus mitis*. Scientists concluded it was probably due to contamination before lift-off, perhaps by someone sneezing on it. Thus was born the claim that microbes can survive space, including a near-complete vacuum, a temperature range of almost 300°C, and irradiation by subatomic particles.

While the Surveyor evidence has since been disputed, the idea of space-hardy microbes has become part of planetary exploration. Experiments on the International Space Station have shown that bacteria can survive in the

Sneeze delivery. In 1969 Pete Conrad examines Moon probe Surveyor 3, which may have retained bacteria from Earth for more than two years.

vacuum of space for more than a year.

The possibility of microbial contamination in space was recognised as long ago as 1956, but it was 1967 before "planetary protection rules" were set out in the *UN Outer Space Treaty*. These seek to prevent both "forward contamination" (the transfer of organisms to another celestial object) and "back contamination" (the transfer of extraterrestrial organisms – if they exist – to Earth).

The protection rules are especially strict for potentially habitable worlds – Mars for instance. Sending a rover to Mars incurs not just the cost of build and delivery, but also rigorous decontamination, which can add up to \$100 million. The burden has led some to call for a relaxation of the rules, noting that microbes may already have travelled between planets as passengers on meteorites.

► **FRED WATSON** is Astronomer-in-charge of the Australian Astronomical Observatory.

Fred answers your questions

Does Earth show any gravitational hot spots when mapped from space? If so, will the removal of oil and minerals affect Earth's orbit?

Yvonne Sartori, Burwood East, VIC

Earth's gravity has been explored by the twin GRACE probes, operated by NASA and Germany's DLR. Among other things the gravitational effects of major earthquakes have been measured from space, but the changes in gravity due to mining activities are below the threshold of detectability, and have no influence on Earth's orbit.

If you have a space question for Fred, email it to editorial@ausgeo.com.au

Glenn Dawes looking up

x1  **NAKED EYE** Venus reappears in the morning sky, rising out of the eastern dawn glow in late January. It's at its brightest in February, when the goddess of love's beacon can't be missed below the teapot of Sagittarius.

x10  **BINOCULARS** Have you seen colours in the stars? Binoculars show this well. Orion in the northern evening sky is home to two excellent examples. Rigel is a blue star in contrast to distinctively red Betelgeuse.

x100  **SMALL TELESCOPE** Rising out of the south-east is the constellation of Vela, the sail. On its leading edge lies the brilliant multiple star, Gamma Velorum. Its four components are arranged in a Y shape.

Glenn Dawes is a co-author of *Astronomy Australia 2014* (Quasar Publishing).

**Competition opens
20 January 2014**

The 2013 People's Choice winner. Visitors to the ANZANG Exhibition at the South Australian Museum voted for their favourite photo. Last year's winner was *Little Egret, little fish*, by David Stowe of New South Wales.

Australian GEOGRAPHIC

ANZANG Nature Photographer of the Year

Could you be the next ANZANG Nature Photographer of the Year?

A USTRALIAN GEOGRAPHIC and the South Australian Museum are delighted to announce the opening date of the 2014 Australian Geographic ANZANG Nature Photographer of the Year; Australasia's most prestigious nature photography competition.

Our readers tell us that photography is one of their favourite activities – so why not share the best of your wildlife and landscape photos with the rest of the world?

The 2014 prize pool is valued at more than \$45,000 and we have introduced a new category – animals in their environment. We hope this and the other categories inspire you to participate in this globally recognised competition.

The 2014 competition opens on Monday 20 January 2014 and closes on

The Australian Geographic ANZANG Nature Photographer of the Year receives \$10,000 in cash plus a expedition cruise for two in the Kimberley. See opposite for details.

Friday 7 March 2014. A selection of short-listed photos will appear in the Sep–Oct 2014 issue of AUSTRALIAN GEOGRAPHIC and on our website. The winners will be announced at the South Australian Museum

on 9 October 2014. The overall winner will receive \$10,000 in cash, and a voyage for two aboard the *National Geographic Orion* along the Kimberley coast in 2015.

Visit our website for details of how to enter, conditions, rules and entry fees: www.australiageographic.com.au/ANZANG.

Entries can only be made through the website. Hard copy or emailed photographs cannot be accepted.

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For enquiries regarding the photo competition, please email the South Australian Museum at anzang@samuseum.sa.gov.au

Enter at www.australiageographic.com.au/ANZANG

King George Falls. Zodiacs allow expeditioners to get close to nature along the Kimberley coastline.



OVERALL WINNER RECEIVES \$28,000 IN PRIZES

The overall winner of the Australian Geographic ANZANG Nature Photographer of the Year competition will win an expedition for two to the Kimberley aboard the *National Geographic Orion*, valued at over \$18,000 plus \$10,000 in cash.

Photo opportunities abound

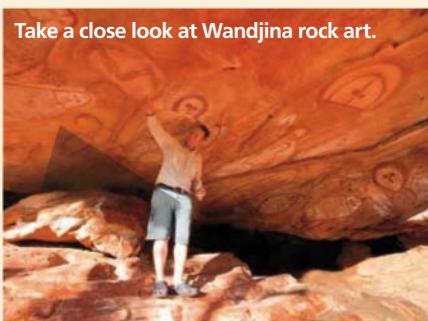
Underwater, wildlife, birds, dramatic scenery, indigenous rock art



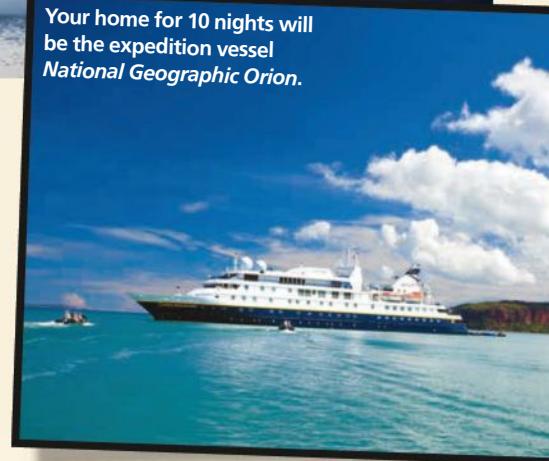
WIN AN unforgettable 10-night Kimberley expedition cruise for two aboard the magnificent *National Geographic Orion*. Valued at more than \$18,000, this prize is for a Category-A Stateroom and may be taken on any 2015 Kimberley Expedition, subject to availability.

From awe-inspiring waterfalls and gorges to ancient cultures and 40,000-year-old rock art, the Kimberley is a region most easily accessed from the sea. Your veteran expedition team will guide you past soaring red cliffs, through cool freshwater swimming pools, and across isolated islands, secluded beaches and river inlets – areas that are famous for an abundance of wildlife. *National Geographic Orion* makes the perfect base from which to see the best of the photographer's paradise that is the Kimberley coast wilderness.

Take a close look at Wandjina rock art.



Your home for 10 nights will be the expedition vessel *National Geographic Orion*.



EXPEDITION HIGHLIGHTS

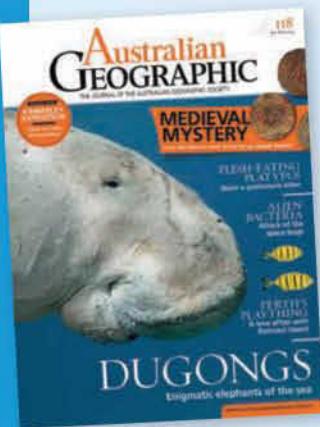
- **Zodiacs take you up the spectacular King George River, where you'll be dwarfed by the towering red-rock canyon walls, then cooled by the mist of King George Falls.**
- **View a spectacular Aboriginal rock-art gallery, portraying images of the Wandjina spirits.**
- **Take a scenic flight over the famous beehive formations in the Bungle Bungle Range, in World Heritage-listed Purnululu National Park.**
- **Visit Montgomery Reef, where the tide drops so rapidly that water trapped atop the reef creates a raging torrent as it escapes.**



Your Category-A Stateroom.

Terms and Conditions: Cruise may be taken on any 2015 Kimberley Expedition, subject to availability. Prize includes accommodation in a Category-A Stateroom, all meals onboard, entertainment and educational programs, use of ship's sporting equipment and facilities, Zodiac excursions, tender transfers, and professional services of the expedition team and crew; return flights to the voyage departure port from an Australian state capital (Sydney, Hobart, Melbourne, Perth, Adelaide or Brisbane); and scenic flight over the Bungle Bungles for two people. Prize cannot be redeemed for cash. Prize cannot be transferred to another destination. Prize winners and their companion must travel on the same itinerary. Please note this is an international voyage and you will be required to hold a passport that is valid for 6 months. Itineraries are subject to tides, weather and ice conditions, and may be changed without notice. You will be required to agree to Orion's Passage Terms and Conditions, which can be found at www.orionexpeditions.com. The terms and conditions under which the prize is offered can be found on the competition website.

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Australian Birds

illustrated by Ego Guiotto



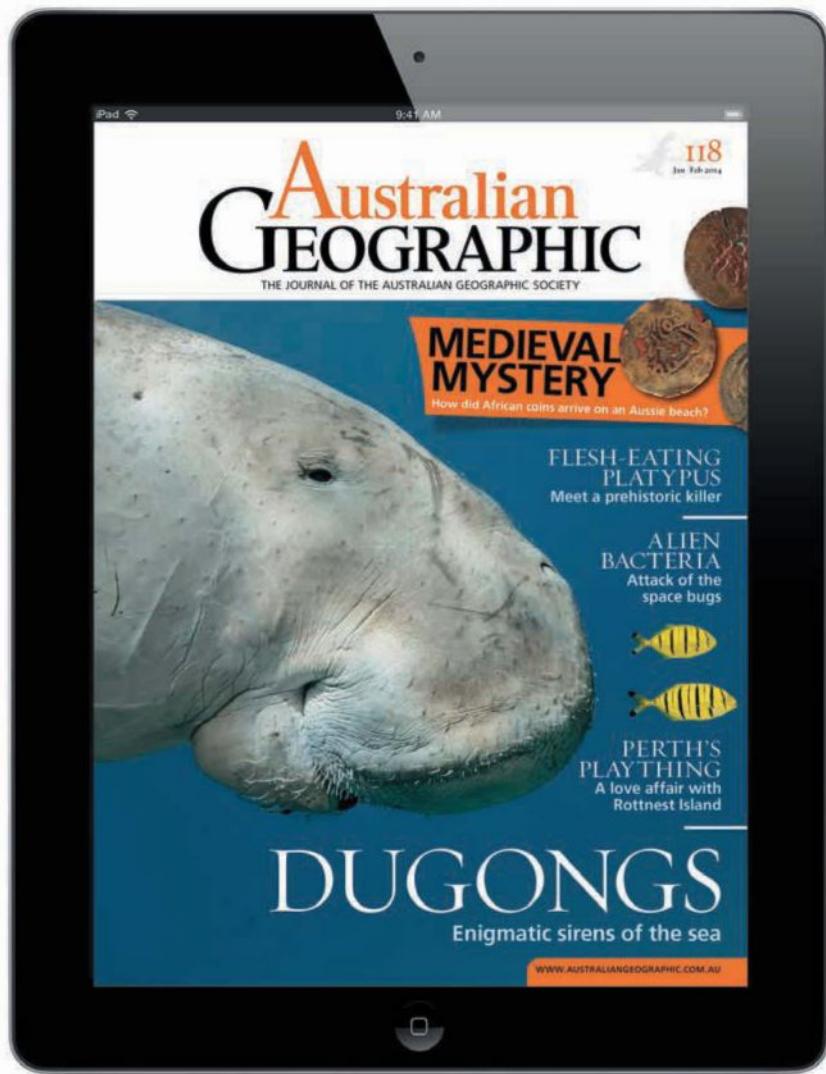
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FLOODPLAIN MAGIC

Wetlands no more

Five years on, we return to Naree station to find its ephemeral floodplains very thirsty indeed.



BACK IN 2008, AUSTRALIAN GEOGRAPHIC visited the Murray-Darling Basin to cover floods that were transforming the inland floodplains of NSW. On Naree station, 130km north-west of Bourke, photographer Andrew Gregory waded in to shoot a coolibah, its branches just clear of the water, and the resulting image was used on the cover of AG 91. Today, the trees here punctuate a dry, cracked mudflat.

During the summer of 2008, Andrew was able to kayak around most of the property, which sits at the head of the Paroo – the only free-flowing river in the Murray-Darling system. From the air he also captured the nearby Cuttaburra Creek floodplain, then a “vast greenery and maze of channels”.

More than 50,000 waterbirds were bustling in Yantabulla swamp on Naree’s south-western boundary.

Boom and bust. This coolibah (above) on Naree station, NSW, has seen more than a century of flood-driven bursts of life. In 2008 it sat on the same floodplain as the tree in AG 91's cover image (right).

The swamp is a “jewel” – one of 20 or so supporting 40 per cent of our waterbird population, says Professor Richard Kingsford, who completed a huge, first-of-its-kind, national survey of 4858 wetlands last year. “There aren’t many wetland areas quite like Naree, with large vegetation communities and [that are] so big.”

But recent pit-trap surveys completed by conservation group Bush Heritage Australia, which bought the cattle station in November 2012, captured just a few skinks and small arid-zone mammals, and most of



the swamp’s birds have dispersed.

Naree has been lucky, though; the good years kept coming after 2008 due to a rare combination of a La Niña event and warm Indian Ocean waters. The regular flooding meant ecologists could justify efforts to support these tricky inland ecosystems, which often compete with irrigators for water. For example, at the height of the Millennium Drought (2000–2009), concerns were raised about a waterbird population crisis at Narran Lake Nature Reserve, just 65km south of Naree.

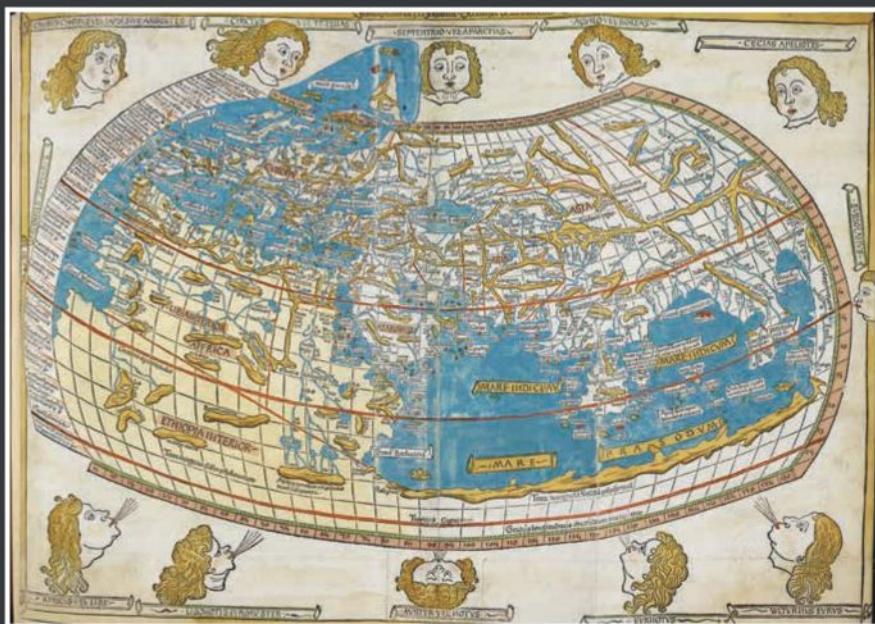
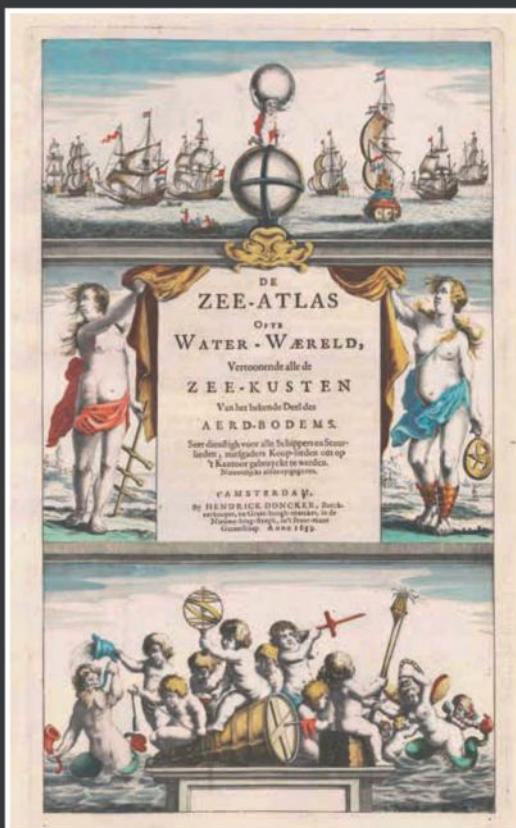
This led to a \$2 million water buyback by the government for the birds, which only breed successfully when water is plentiful; it’s estimated two-thirds of the area’s first chicks hatched in many years were saved from abandonment. As a result, 140,000 straw-necked ibises nested on Narran in 2012.

But the weather in 2013 underlined how fickle these ecosystems are. Heavy rains brought to Queensland by ex-tropical cyclone Oswald last January should have sent water barrelling down the Murray-Darling rivers to Naree. But, after the hottest January on record, the plains of north-western NSW sport typical outback attire: lignum shrubs cling to dust waiting for water that is likely 3–4 years away.

Naree timed its big bloom well. Its bustling life sustained the fundraising that allowed Bush Heritage to purchase the 14,900ha property when conservation-conscious cattle graziers decided to sell up. It may be 10–20 years until the good times come back.

NATSUMI PENBERTH

► **FIND** more images of Naree station in 2008 and now at: www.australiangeographic.com.au/journal/issue118.htm



Mind over mapping.

The Psalter world map c.1265 (centre right) is centred on Jerusalem and reflects religious views. On Fra Mauro's 1448–53 masterpiece (top right) Australia is missing, but an inscription notes: "Here commences the dark sea".

The *Ulm Ptolemy World Map* of 1482 (above) – based on information from the 2nd century – excludes Australia; in 2007 a rare stolen edition turned up in Sydney. A southern landmass named *Lave la Grande* (right) appeared c.1547, and the South Land showed up in the first successful commercial atlas of the world (top left) in 1659.



MAPPING THE ANTIPODES

WHAT LIES SOUTH?

A series of maps trace the unveiling of Australia, from the fantasies of second-century Egypt to Flinders' last work.

STORY BY ALASDAIR MCGREGOR



Good heavens. A 1602 globe by Willem Blaeu shows star groups useful for navigation, including the Southern Cross.

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COURTESY OF THE NLA

FROM ANCIENT imaginings of the medieval world – where Jerusalem lay at the centre of creation – to sumptuous wall charts proclaiming the might of European empires, a series of maps on display at the National Library of Australia (NLA) takes us through centuries of geographical speculation about the Southern Hemisphere.

With more than 130 maps, globes, manuscripts, paintings and objects – many of them on loan from the great libraries of Europe – the *Mapping Our World: Terra Incognita to Australia* exhibit tracks the unveiling of the Great South Land as it moved from abstract conjecture to familiar outline.

But, if you thought all medieval Europeans believed the Earth was

flat, think again. The idea of a flat Earth is actually a misconception of recent popular culture, and the early documents show how sophisticated the era's geographical knowledge was.

Based on the rediscovered work of the influential second-century Alexandrian astronomer and geographer Claudius Ptolemy, the *Ulm Ptolemy World Map* of 1482 pieces together more than 8000 coordinates first noted up to a millennium earlier.

"Such a wonderful thing that this information could find its way into print. It was all based on the idea from the ancient world that you can calculate your position from the stars," says Martin Woods, curator of maps at the NLA. And there along the bottom of Ptolemy's map is the

Original outline. Blaeu's *Archipelagus* (1659-63) – the basis for many New Holland maps – was carefully restored at the National Library.

earliest hint of a southern land.

From the mid-15th century, the hand-painted *Fra Mauro Map of the World* displays a vast amount of knowledge of coastal navigation, accumulated since Roman times.

As the colonial and trading reach of Europe extended into the previously unknown Southern Hemisphere, geographical knowledge of it became a commercially valuable commodity. So sensitive was this information that the Dutch East India Company had a secret atlas documenting its discoveries in the Indian Ocean and South-East Asia. ▶

Name games. Flinders' *General Chart* was also a political statement. After it was published, New Holland became Britain's "Australia".



NLA

However, other large-scale and ornately decorated maps, such as *Archipelagus Orientalis, sive Asiaticus* (1659–63) by master cartographer Joan Blaeu, were intended for public display. The Blaeu map – recently acquired by the NLA – was the first large-scale map of New Holland published, and was “made very much as an illustration of wealth and political power”, Martin says.

Most recently, Matthew Flinders’ *General Chart of Terra Australis* brings us to the shores with which we are all familiar. Near the end of an all-too-brief life full of accomplishment, Flinders was imprisoned by the French from 1804 to 1810 on the island of Mauritius, where he laboured on his chart.

As Martin explains, it was a “frustrating finale” to the remarkable career of the first explorer to

Australia, a continent named before a single European was known to have set foot on it.

circumnavigate Australia. “Flinders desperately hoped to return and finish the job,” Martin says. “Having spent months and months on small sections of the east coast, he wanted to bring the same accuracy to the west and north. In the end, though, he was forced to rely on the charts of the Dutch explorers, [Abel] Tasman and [Willem] de Vlamingh, to complete his work.”

Famously, Flinders used the name “Australia”, supplanting the Dutch name of New Holland. “It was as much a geopolitical statement as a geographical one,” Martin says. The Portuguese, Dutch, Spanish and French had been eclipsed in

discoveries about and, ultimately, claims on the Great South Land, which Flinders’ chart made manifest.

Intriguingly, Flinders was not the first to use “Australia” in print. On a page from *Astronomica: Teutsch Astronomie* – an astronomical treatise published in Frankfurt in 1545 by Cyriaco Jacob zum Barth – there is a map no bigger than a 50-cent piece. Clearly discernable on this tiny representation of a sphere is “Australia”, a continent named before a single European was ever known to have set foot on it. **AG**

⌚ *Mapping Our World* runs until 10 March. See more images at: www.australiageographic.com.au/journal/issue118.htm

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FRED WATSON

Taking back the night sky

Fred Watson explains why Australia needs at least one internationally recognised Dark Sky Reserve.

IT TAKES ABOUT 20 minutes – longer if you've just left the glare of fluorescent lights, but rather less if it was only the glow of a desk lamp. Either way, the result is the same. Your exposure to complete darkness triggers a sequence of biochemical processes in your eyes, rendering them a million times more sensitive than they were in daylight. You have become dark-adapted.

Your abilities in this condition might surprise you. If the sky is clear, the light from the stars alone is sufficient to illuminate your path. There's no need for moonlight. And, on the ground, you might even be able to see your shadow, silhouetted by the gossamer band of the Milky Way. But this remarkable response to darkness is denied to most of us by our high-intensity nightscape. Even when we sleep, we're seldom in a completely light-free environment. So why should we cherish a primitive faculty that has been made largely redundant by the dazzling lifestyle of the 21st century?

The answer is that our wellbeing depends on it. The loss of darkness inhibits the secretion of melatonin, the sleep-inducing hormone, and shift workers are well aware of the detrimental effects of trying to sleep at the wrong time and in the wrong environment. But there's a more subtle consequence of our enforced detachment from darkness. Before the growth of big cities, the stars were the evening's entertainment. That connection brought with it a solid foundation for life's trials and tribulations, a tangible assurance that in the heavens, at least, all was well. For most of us – irrespective of our cultural background – that bastion has gone.

Can we regain this lost Eden? I believe we can – particularly here in



Australia. Our nation is better off than most. Although the continent is ringed with cities, it boasts stunning expanses of emptiness. Often those havens of darkness are within reach. Moreover, there's a growing awareness that light can harm the environment, particularly nocturnal and migrating species. And that wasted light has a greenhouse footprint.

The reason cities are so bright is that they evolved largely without rules. Until a few decades ago, if you wanted to install a row of street lamps, you paid little heed to where the light went. The fact that some radiated uselessly into the sky was of no consequence if the street was adequately illuminated. The same was true of sportsgrounds, industrial complexes and coalmines. So the glow of light pollution grew inexorably with development. And, thanks to the light-transmitting properties of the atmosphere, its insidious fingers extended tens of kilometres beyond city boundaries.

Although that legacy remains, designs and regulations have improved. Newer fittings direct the light exactly where it's needed, with not a skerrick leaking upwards. I am

hopeful that this will begin to reduce the damaging spill of light, particularly with the advent of light-emitting diodes (LEDs). A recent meeting of lighting designers at Sydney Observatory sent a clear message – to make a city beautiful, and safe, you don't need to light absolutely everything.

Not surprisingly, it is observatories that have led the crusade against light pollution. The peak advocacy body for good outdoor lighting – the International Dark Sky Association (IDA) – had its origins in the 1980s, when astronomers at major US observatories became alarmed by night-sky degradation. Large telescopes are major investments and need complete freedom from light pollution. That advocacy is alive and well in Australia, too, where Sydney lighting consultant Reginald Wilson represents the IDA.

But the best bit is that the IDA is not just for astronomers – it's for everyone. And so, the association has launched its International Dark Sky Places program, which recognises the planet's accessible, pristine skies. A handful have qualified worldwide. The IDA also acknowledges communities with "exceptional dedication to the preservation of the night sky".

Our national observatory is located at Siding Spring, near Coonabarabran, NSW. Close to the beautiful Warrumbungle National Park (AG 112), it is already a dark site, protected by state legislation, and an obvious candidate for our first IDA-recognised place. With support from AUSTRALIAN GEOGRAPHIC, the observatory is working towards that recognition.

► PROFESSOR FRED WATSON, AM is Astronomer-in-charge of the Australian Astronomical Observatory in Coonabarabran. Find out about the IDA at www.darksky.org.

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STORY BY FLEUR BAINGER PHOTOGRAPHY BY ANDREW GREGORY

THE GOOD LIFE

History, nature and tourism collide on unique Rottnest Island, a long-time favourite with West Australian holidaymakers.





Shallow shore. Close to the beach, The Basin's water is only knee- to waist-deep. Walk further out to the edge of the reef and dive into deep water for great snorkelling.



IT'S 3:30PM ON ROTTNEST ISLAND and rush hour is in full swing. Like a river running downhill, hoards of daytrippers wheel their bikes towards the last ferry, backpacks slung over skin smeared with sunscreen, their hair encrusted with salt and their thongs scuffing the jetty.

With a loud rev the boat is away, leaving a frothy trail behind as it starts the 90-minute journey back to Perth via Fremantle. Calm immediately blankets the island and those left behind bask in the fading light. People cluster on the sand, clinking glasses, erupting into laughter; teens play cards on picnic tables as wallaby-like quokkas sniff at their feet; couples gaze over their books at the metropolis on the horizon; sea lions roll on the sand and ospreys glide into their giant nests.

With no cars to be heard or seen, the scene is reminiscent of another era and its charm has stolen West Australian hearts for generations. Rottnest Island is a place where past and present

overlap, where nature and people coexist. Known to locals as 'Rotto', the former labour camp for Aboriginals, boys' reformatory and prisoner-of-war camp is as much a part of WA's cultural history as mines, colourful entrepreneurs and untouched beaches. Its strange name – translated to mean rat's nest – can be attributed to 17th-century Dutch explorers, who mistook the native quokkas for cat-sized rats.

Today, some carefully preserved, treasured buildings, which date back to the 1840s, are in everyday use, and Rottnest's wildlife is so well protected that even wedding bouquets have to be approved. Such strict measures are in place to prevent pests being introduced into the precious ecosystem.

"Rottnest is a good blast from the past," says Peter 'Pedro' Minekus, one of the few people permitted to live on the island, a privilege extended only to certain employees by the Rottnest Island Authority, a statutory body that manages the island and



Peak hour at daytripper heaven. Thomson Bay's main jetty (above) is where mainland ferries arrive and depart. The island is so close to the mainland that it's a popular daytrip for visitors who want a taste of a way of life that harks back to the mid-20th century.

reports to WA's minister for tourism. Private land ownership has been prohibited on Rottnest since 1839 and the resident population fluctuates from 150 to 200. Having spent 33 of his 50 years deliberately marooned here, Pedro, who works at the general store, is its longest-serving inhabitant. "There's nowhere like Rottnest; it's really unique," he says. "I meet people from all around the world and they're just gobsmacked."

Pedro's home is a small, heritage-listed shack and he says Rottnest's "back to basics" style is what makes it special. "It's the simple life; kids can walk around freely," he says. "The super-

Lazy days. Mia Hessels (below, at left) and Charlotte Saunders enjoy the crystal-clear waters in front of their holiday villa at Geordie Bay. Cruise company Charter 1's Sarah Ellis-Stott (bottom, at left) with husband Matthew Oakley aboard her 41-foot catamaran *Capella*, which can sleep 10.



market still does home delivery and we'll even put your groceries in the fridge."

Boat skipper Sarah Ellis-Stott has a name for residents such as Pedro and herself. "We call the long-timers 'the abalone': they get stuck on the rock," she says, smiling. Thirty-something Sarah has lived and worked here on and off since she was 18: first, she was at the bakery, then with the ranger's team; now she runs her own canary-yellow charter boat. A devoted water lover, Sarah takes snorkellers to frolic with playful sea lions in transparent waters during the sunny tourist season, from September to November. "Rotto is my favourite place in the world," she says, enthusiastically. "I'm amazed that such a special natural place can exist so close to WA's capital city."

Rottnest has been referred to as "the brick on Fremantle's doorstep", thanks to the number of ships wrecked on its reefs. But so many sandgropers have passed carefree childhood holidays ▶



Repairing earlier damage.
The manager of Rottnest Island Authority's marine and terrestrial reserve, Roland Mau, inspects new plantings of trees and bushes at Parker Point.

"West Australians are very attached to Rottnest. That's why every time the RIA wants to develop something, people are against it."

combing its 63 sandy beaches – or pedal-pushing along scrubby, limestone ridges – that it's held in great affection. So keen are people to maintain Rottnest's simplicity that saltwater showers in the visitor accommodation were only upgraded to freshwater in the 1990s and televisions weren't introduced to rooms until 2007. About 500,000 people visit each year and nearly half of those have been to Rottnest 10 or more times.

"West Australians are very attached to Rottnest," says Dirk Hessel. "That's why every time [the authority] wants to develop something, people are against it. They want to leave it as is."

Dirk, 83, has visited Rottnest every year since 1951, when he first started diving and fishing in its waters. "If you don't like swimming and fishing, Rottnest isn't the island for you. There's no nightclub," he says. "When I was younger, we'd see millions of crayfish in very shallow water. We'd put heaps of them in the boat, and we'd spear kingfish, grouper and snapper."

The warm (23°C in summer, 19°C in winter) Leeuwin Current, which flows south around Rottnest, means diverse coral gardens and more than 130 tropical fish species can survive in this southern reach of the Indian Ocean. In contrast, the wider region's coastal waters only support 11 tropical fish species. In deeper waters, crayfish thrive in an undersea trench known as

the Perth Canyon, a place where blue whales come to feed on shrimp and humpbacks pass by on their annual migration. Closer to Rottnest's shores, large seagrass meadows provide habitat for hundreds of other species. Seven marine sanctuary zones have been set up to protect them and form part of the island's 3800ha of marine reserve.

The island was proclaimed an A-class reserve in 1917 and the RIA is "committed to striving to achieve sustainability in line with its vision that Rottnest Island is a model of ethical tourism based on financial, environmental and social sustainability".

Roland Mau took over the management of the island's land and ocean life a decade ago, the same year he proposed to his wife at one of Rottnest's secluded bays. Employed by the RIA, Roland manages the island's marine and terrestrial reserves. He and his staff walk the tightrope between protecting the environment and allowing visitors to enjoy it. "I've found you can strike a balance," he says. "It's the playground of people in Perth but they've got a really strong sense of ownership over it."

Aside from introducing environmentally friendly boat moorings, overseeing forest revegetation and building eco boardwalks that make coastal rehabilitation possible, Roland's current projects include the Coastal Walk Trail. *Continued page 46 ▶*

ROTTNEST ISLAND



KOWN AS Wadjemup, or "place across the water", by the Noongar people, Rottnest Island is low-lying – its highest point is just 46m above sea level. The island has a permanent population of 150–200, but up to 15,000 people may be visiting at any one time during the summer season. Visitors can join a guided nature tour to learn more about Rottnest's plant, animal and marine life. After dark, the night song of the moaning frog, the western green tree frog and the sandplain froglet can be heard at various points on the island.

Rottnest Island

AVERAGE DAILY TEMP. RANGE (°C)



MEAN RAINFALL (mm)



- Tourist information
 - ▲ Lookout
 - Rocks
 - ▲ Airport
 - Lighthouse
 - Road
 - Cycleway
 - - Track
 - Foot track
 - Rail line
- 0 1 2 km
- AG CARTOGRAPHIC DIVISION

TOTAL AREA

1900ha

NUMBER OF
ENDEMIC TREES: 3

LENGTH
10.5km

LAKES OCCUPY
200ha

NUMBER OF
QUOKKAS:
8000–
12,000







Why go elsewhere? An RIA survey suggested there were about 46,000 boat visits to the island in 2009–10. Parker Point is one of the most popular locations for boats to Rottnest, and the survey found most complaints about crowding were in relation to this area and Longreach Bay.



Perth's backyard. The RIA runs visitor accommodation at Geordie Bay. Western Australia's Minister for Tourism, Liza Harvey, has said the government puts additional funds into Rottnest "from time to time".

Hundreds died and were buried here and it's thought that Rottnest accounts for more Aboriginal deaths in custody than any other site in Australia.

Work on this \$8 million, 50km track began in July 2013 and, when finished, it will circumnavigate the island via numerous points of historical and ecological interest. Part of its purpose is to conserve native habitat by keeping walkers to designated areas. "We're hoping it'll become a world-renowned walking trail," Roland says. "It will combine inland trails and historical sites, and link up old farms and culturally significant Aboriginal sites."

ROTTNEST HAS NO SHORTAGE of significant sites. The island was part of the WA mainland 7500 years ago, during the most recent Ice Age, and artefacts discovered suggest Aboriginal people could walk back and forth across a land bridge before sea levels rose about 7000 years ago.

Harriet Wyatt, the RIA's manager of cultural heritage services, says that a chert-flake cutting tool found here is 27,000 years old. "It's significant because there's no chert deposit on the island. It had to be brought from elsewhere," she adds.

European settlement began in 1829. Rottnest was used to farm everything from livestock and grains to tobacco and fruit, and salt was harvested from its saline lakes. A decade later, it was transformed into an Aboriginal penal colony, where some 3700 men and boys were imprisoned during the century that followed.

Harriet believes the prisoners were chosen by the authorities

with the aim of destroying indigenous communities. "There's historical evidence that the men brought here were leaders – medicine men and law men," she says. Prisoners were forced into hard labour, quarrying stone and constructing most of the colonial buildings found in Thomson Bay. Hundreds died and were buried here and it's thought that Rottnest accounts for more Aboriginal deaths in custody than any other site in Australia.

Towards the end of the 19th century, the Rottnest Island Reformatory for boys was opened next to the prison. The prison was closed in 1904, although prisoners were used to build roads and other projects until 1931.

After the last inmates moved off the island in the 1930s, it started to become a leisure destination. The change in purpose was signified by the painting over of the blindingly white lime wash on the buildings with the peach-ochre hue that's now synonymous with Rottnest's historical buildings.

During both world wars, the island was commandeered by Australian defence forces; in World War I it was used as an internment camp; in World War II it was developed as a fortress to protect Fremantle until the focus of defence activities moved north – the remnant cannons and barracks are now tourist attractions. All recreational activity was suspended in 1940 until 1945.

After the war, the military units were disbanded and, by ▶

Mini-macropod haven.

Although there are a few tiny mainland populations, quokkas have survived better on Rottnest and Bald islands, which are free of cats and foxes.



SEE quokkas close-up.
Download the free **viewa** app
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THE SECRET LIFE OF QUOKKAS

DESPITE THE fascination for Rottnest's iconic furry marsupial, there's been no significant research on the quokka in the past 20 years. But a four-year study launched this year is analysing the ocean-locked population. It's believed there are 8000 to 12,000 quokkas on Rottnest and the study aims to gather an accurate population count of the vulnerable species.

Helen Shortland-Jones, coordinator of the RIA's research program, says animals trapped quarterly will give a picture of the

quokka's genetic viability. Why numbers fluctuate seasonally will also be investigated.

"As with most island populations, there's no inflow of genetic material. They've been separated from the mainland for 7000 years, so that gives you an idea of the level of inbreeding," she says. "We'll take information such as gender, age, and any pouch young. Then we'll assess [their] general condition, microchip and ear tag them, and take a genetic sample from the ear skin."

The information, collected in partnership

with the University of Western Australia and the Department of Parks and Wildlife, will be used to inform future environmental management decisions on the islands, particularly where revegetation of native woodlands is concerned.

Helen says quokkas have a healthy appetite for young seedlings. Seed guards and quokka-proof fencing have been implemented, and the census results will help to focus the island's woodland restoration strategy.

THE ROTTNEST CHANNEL SWIM

ACH YEAR, MORE than 2000 swimmers plunge into the Indian Ocean at Cottesloe Beach, freestyle determinedly towards Rottnest Island in one of the world's largest open-water swimming events. The Rottnest Channel Swim is an epic challenge – not least due to Western Australia's reputation as the shark capital of Australia – and competitors take from four to 10 hours to complete the swim. Supporters cheer on the competitors as they trudge up the beach at Thomson Bay, with a confetti of yachts and dinghies in their wake.

But the pain is worth it, according to Michael Leith, 28, who spent last summer working as a lifesaver at Rottnest. "There are so many people in the water, there's so much excitement and adrenaline," says the Queenslander, who completed the 19.7km swim in seven hours and 37 seconds. "It's long... You start singing songs in your head. You get bored. You just do anything to keep your mind off the pain in your arms." Now in its 23rd year, the event will next be held on 22 February 2014.

Fit for anything. Lifesavers, such as Michael Leith, patrol Rottnest's busy beaches – sharks are seen regularly beyond the reef.



April 1945, all Thomson Bay buildings had been vacated by the military except the bakehouse and garage. About 200 Italian internees were sent to the island for four months to carry out repairs and renovations. In 1967, the army returned most of its landholdings on Rottnest to the WA government.

The boys' reformatory was converted to accommodation and the governor's summer residence became a pub. The prisoners' quarters, known as The Quod, are used as holiday accommodation, but, before 2018, the RIA will take them back for historical preservation. Despite Rottnest's difficult history, Harriet believes the merging of past and present is an asset. "It's not like a museum where things are all shut up. The history is accessible and open."

HISTORY'S OTHER LEGACY is Rottnest's environmental degradation. Native woodlands were cleared and, in order to revegetate, the RIA now runs a nursery, manned by volunteers, where thousands of seedlings are being grown for restoration of the dunes and woodlands.

In another case of past and present intermingling, inmates from Bunbury Prison propagate woodland seeds collected on the island. In 2013, 20,000 trees were planted. Ironically, the quokka, another island icon, is often responsible for eating seedlings – posing a threat while simultaneously being protected because of its "vulnerable" status. After cats were eradicated in 2000, numbers have recovered. But they still fluctuate, so studies are under way to find out more about the animal (see "The secret life of quokkas", previous page).

Meanwhile, other research studies are probing topics as diverse as visitor interaction with seal colonies, the island's osprey nests (the RIA says one at Salmon Point is about 70 years old), rock lobster movements and the visitation of wedge-tailed shearwaters, or mutton-birds, which breed in a colony of burrows on the island's windy western tip. "We have to manage this place for recreation and conservation," Roland says. "So we ask, 'To what degree can you do that without impacting on the environment?'

Much of the environmental monitoring is conducted by



Popular with feathered tourists, too. A bridled tern (above) comes in to land; they breed in colonies, often on rocky islands. The red-necked stint (below) breeds in Siberia and Alaska. It follows the east Asian-Australasian flyway to spend the summer months in Australia.



volunteers and their goodwill extends to the preservation of Rottnest's culture. Wearing their signature yellow T-shirts, guides take the ferry across the channel each day to give free tours of the points of interest.

Richard Fox, 70, helped start the Volunteer Guides Association in 1986. Today it has 300 members. "It's just another way of sharing in the island, it's a privilege to do that," Richard says. His father worked variously as Rottnest's relief lighthouse keeper, postmaster and island manager. Richard has observed many changes over the decades but most alarming to him was former WA premier Brian Burke's desire to "turn Rottnest into a Club Med-style place".

Rallying against the plans, Richard's resolve to continue running the free tours was cemented. "One way of protecting the place is to show people what's there," he says. "If people know birds fly in from Siberia to be here, they're more likely to want to keep it how it is."

Some of Rottnest's charm lies in the fact that it is virtually car

free; other than a few island staff, people use bikes to get around. Jody McDonald manages the island's bike hire, a business that operates out of a tin shed. In peak season, about 700 of the 1300 bikes are used daily – including tandems and child trailers that parents attach to the rear of their cycles. Jody moved from what she now calls "the big island" to Rottnest more than two years ago, when she made a spartan WWII-era cottage her home. "[The island] teaches you how nice it is to live so simply," she says, adding that her commute to work takes just one minute. "It's about being in a pristine environment and not having a care in the world."

Her father, Des Dans, was a former tourism minister, so her childhood was filled with regular visits to Rottnest, a custom that Jody continued with her own children. "We're happy it hasn't been totally commercialised," she says. "There are no high-rise buildings. You don't have to have a lot of money to come here... Just 25 minutes [from Fremantle] and you're in a different world." ▶

BIRD SURVEYS: THE TWITTERING MASSES

FOR THE PAST five years, Suzanne Mather and Lorraine Marshall have been counting birds on Rottnest Island, most recently contributing their statistics to the Shorebird 2020 Program, a national monitoring initiative. Passionate twitchers, the pair head up BirdLife Australia's WA branch and coordinate some 1200 members.

Rottnest is an important bird area, supporting a number of threatened species and hosting trans-equatorial migratory birds that travel from as far away as Siberia. "The red-necked stint comes here," says Lorraine, a medical scientist. "It only weighs 50g and these ones spend the first year of their lives on Rottnest. The brine shrimps in the salt lakes are a good food source."

She's also fond of fairy terns, which breed on the island, and banded stilts, which congregate in their thousands. While monitoring revegetation sites, volunteers keep an eye on bush birds, such as the golden whistler and the red-capped robin; they are no longer found on the mainland but numbers are increasing on Rottnest.



Car no-go zone. Charlie Hessels, left, Mia Hessels and Charlotte Saunders ride their bikes along one of Rottnest's quiet streets. Quokkas, rather than cars, are hazards they must be mindful of.

"You feel a million miles away from home, but you're not. It's like a jewel: it's multifaceted and, no matter which way you turn it, there's more to see."

The cost of holidaying on Rottnest is a hotly debated issue and West Australians claim it is moving beyond their reach. Ferry tickets for a day trip cost \$75 for a standard adult pass. Built into that is a \$16.50 contribution to the RIA – more for extended stays – to cover the expense of running an island independently of the mainland. Electricity, water and sewage are all handled on site, largely using eco-friendly strategies, such as a wind turbine and desalination plant. Only rubbish is shipped off the island, much of it for recycling.

Paolo Amaranti, the RIA's chief executive, is accustomed to – and perhaps a little tired of – defending the price of a Rottnest holiday. Maintaining the island's strict environmental standards while developing tourism is undoubtedly a key driver of prices. The state government provides \$3 million each year, which Paolo says all goes to Roland's environment team. Funding for the island's utilities and 50km of roads has to be raised through other means. It's a non-negotiable reality, he says.

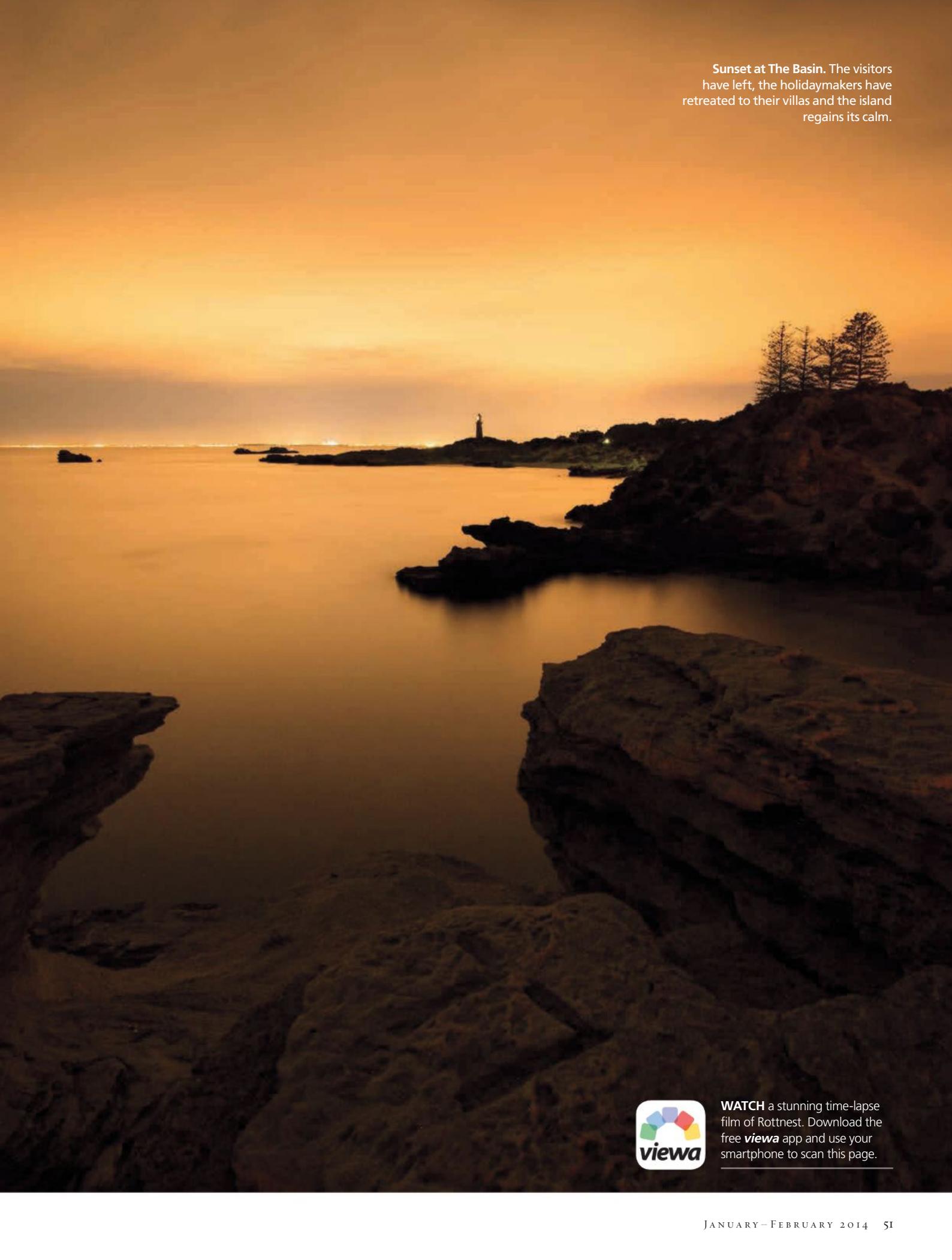
Efforts have been made to provide visitors with better value for money – accommodation and campsite upgrades are ongoing, new events are being added to the calendar and, this year, free wi-fi has been introduced. Public signage is planned to thank people for their contribution to the running of the island and

to explain where the money goes. However, in mid-October, the RIA board proposed that the authority withdraw from all commercial operations on the island, a suggestion backed by the WA Tourism Council. The government is yet to respond and the board will make its plan available for public comment before there are any changes.

Paolo believes visitor numbers, which have varied from 450,000 to 550,000 a year in the past decade, will grow as more accommodation, a new camping ground, marina and golf course are developed. "The aim is to increase visitor numbers by 20,000 per year, but not in peak periods," he says, adding that Rottnest's major asset is its peace and quiet, and the way it combines a major tourist attraction with a nature reserve.

And he's not wrong. The deep affection that the island inspires is perhaps best summed up by UK expat Harriet. "Rottnest offers so many different things to so many different people," she says. "You feel a million miles away from home, but you're not. It's like a jewel: it's multifaceted, and no matter which way you turn it, there's more to see." **AG**

SEE more of Andrew Gregory's images of Rottnest Island online at: www.australiageographic.com.au/journal/issue118.htm



Sunset at The Basin. The visitors have left, the holidaymakers have retreated to their villas and the island regains its calm.



WATCH a stunning time-lapse film of Rottnest. Download the free **viewa** app and use your smartphone to scan this page.



WATCH footage of dugongs feeding. Download the free **viewa** app and use your smartphone to scan this page.



THE MERMAIDS of MORETON BAY

Flirtations with the mariners of bygone eras made dugongs the stuff of romantic legends. Today, Australian scientists are uncovering the truth about these mysterious creatures.

STORY BY KAREN McGHEE
(PHOTOGRAPHY BY DARREN JEW)

Bottom grazing. Using enlarged flattened snouts, dugongs – such as this animal in the Red Sea – feed on seagrass meadows in tropical waters from Africa to the Pacific.

IT'S AN IDYLLIC spring morning on Moreton Bay, southern Queensland, and the clear skies make for perfect conditions for finding mermaids. Flocks of shearwaters bob on a glassy sea. Green turtles break the surface at regular intervals for noisy breaths between dives to graze on seagrass meadows. Pied cormorants pop up periodically, their long necks like periscopes on mini-submarines. Sleek-swimming pods of inquisitive bottlenose dolphins steer towards our boat.

Photographer Darren Jew and I are not, of course, expecting to find mermaids, but instead the creatures that are believed to have sparked the legends. And soon enough a perfect ocean-going tail – shaped like a dolphin's, but at least a metre wide at its trailing edge – breaks the water. It waves briefly, Brisbane's distant skyline glistening behind it in the early light.

It's easy to understand how lonely sailors from a bygone era might have imagined this could signal a creature of submerged beauty. But minutes later we see a face that's more Dr Seuss than nereid. Clearly, those old mariners liked spinning tales, or were heavily influenced by rum and extreme isolation.

The exquisite tail and contrastingly comical face belong to one of the estimated 800–1000 dugongs in Moreton Bay, which is adjacent to one of Australia's most rapidly developing regions. The creature's odd-looking head

emerges just long enough to retract the valves that keep the water from its nostrils while submerged; with a snort like a snorkelling human, it sucks in a breath of fresh air before quickly disappearing, either too shy or uninterested to remain above water long enough to look around.

Limited surface time is a trademark of dugongs. As well as their tendency to stick to murky, or turbid, water, it's one of the main reasons they're so elusive – and why few Australians have ever seen one. Yet they're the most common marine mammals in northern Australia's coastal waters – outnumbering seals, whales and even dolphins. They're also surprisingly big, with adults reaching lengths of about 3m and weights of 400–600kg.

DUGONGS OCCUR wherever there are seagrass meadows, in the tropical and subtropical waters of about 40 countries across the Indo-Pacific. Australia is the stronghold for the species: a significant chunk of the world's population – an estimated 70,000 – cruise about in the shallows of at least 10 different locations along the 25,000km of our northern coastline, stretching from Shark Bay, Western Australia, to Moreton Bay.

Torres Strait has the biggest population: recent figures suggest there are at least 15,000 of these enigmatic marine mammals.

Mostly, their diet consists *Continued page 58 ▶*



Shy disposition. Despite being air-breathers, dugongs spend as little time at the surface as possible, preferring instead to remain in the obscurity of murky waters.



Tracking mermaids. University of Queensland researchers restrain an adult at the the water's surface so that it can be measured and tagged.

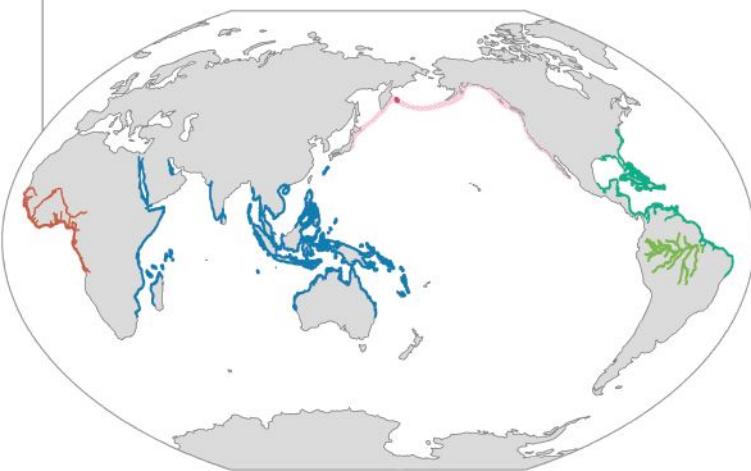
SIRENIANS *of* THE WORLD

Although you could be forgiven for thinking these ‘sirens’ are closely related to whales, this order of marine creatures actually has closer ties to the largest land mammal, the elephant.

THE DUGONG IS the only surviving species in the family Dugongidae. There was one other modern member – Steller’s sea cow; a huge, slow-swimming northern Pacific mammal that ate seaweed and may have reached weights of up to 10 tonnes. Sadly, the species is now best known as a cautionary conservation tale: it was discovered and hunted to extinction in three decades during the 18th century.

Dugongs belong to the order Sirenia (the sirens), the name being a nod to mermaid mythology. The other living members are three species of manatee, all found in coastal areas and rivers of the Caribbean Sea and Gulf of Mexico, the Amazon Basin and West Africa. There are similarities between the two groups, particularly their size, appearance and histories: they are both long-lived, slow breeders that spend much of their time grazing on aquatic plants. But, in the evolutionary sense, they’ve been separated for a long time and there are significant differences. Manatees have a broader diet, consuming a wider range of plant material, including mangrove leaves and fish. Dugongs are strictly marine creatures, but manatees also inhabit estuarine and freshwater habitats.

Sirenians have a similar shape to whales, dolphins or seals, but are not closely related. They have a clearer evolutionary connection to elephants and small rodent-like animals called hyraxes, found in Africa and the Middle East.



AG CARTOGRAPHIC DIVISION

West Indian manatee

Trichechus manatus

An estimated 10,000 animals in two subspecies of West Indian manatee survive in waters off Florida, USA, the Caribbean Sea and Gulf of Mexico. Unlike their close relatives, dugongs, manatees can tolerate a wide range of salinities and will move easily between freshwater rivers and the sea.



Amazonian manatee

Trichechus inunguis

This dark-skinned mammal, described as looking like both a seal and a hippopotamus, is the smallest of the manatees and the only one to be restricted to fresh water. It occurs only in the Amazon River and its tributaries, and is believed to be critically endangered.

- Dugong
- Amazonian manatee
- West Indian manatee
- African manatee
- Steller's sea cow
- - historic distribution
- - prehistoric distribution

Dugong

Dugong dugon

Dugongs are born with smooth pale skin but all eventually develop scars – the result of the tusks of adult males. Because they often fight each other, male dugongs have scarring from the middle of their back down to their tails. Males also use their tusks for leverage during mating, so females become more marked around the head and neck.

African manatee

Trichechus senegalensis

This is the least studied of all the sirenians. It's found in marine and freshwater habitats in equatorial waters along the west coast of Africa. Similar to other manatees, it's known to eat a wide variety of aquatic vegetation and is even able to eat the tough waxy leaves of mangroves.

Steller's sea cow

Hydrodamalis gigas

Unlike its surviving relatives, the manatees and dugong, this slow-moving herbivorous mammal was not a tropical species but a cold- and temperate-water specialist. Hunted to extinction in the 1700s, it was by far the biggest of the sirenians, possibly reaching lengths of more than 8m.

Size
matters



entirely of seagrass, and adults can consume more than 25kg a day. Because of this and their cumbersome, barrel-like body shape, dugongs are commonly known as sea cows. But Dave Holley, Shark Bay Marine Park coordinator, who's worked with WA's dugong populations since 2000, suggests they'd be better described as sea pigs. That's because they prefer to dig up the rhizomes and roots of seagrass, rather than graze on its leaves. It's a habit that creates tell-tale feeding trails of disturbed marine sediment.

Similar to many herbivores, dugongs cope with this difficult-to-digest plant matter with a very long (30m or more), bacteria-filled intestine. Their oddly shaped and proportioned face is also an adaptation to their seagrass-chomping lifestyle. They have a distended, trunk-like upper lip that angles sharply downward, and is covered in very sensitive bristles that help locate and manipulate seagrass in murky habitats.

There's a common assumption that dugongs are strict vegetarians. But Professor Helene Marsh – international doyenne of dugongs

were suffering significant declines. Over the years, the biggest threats to dugongs have been identified as seagrass habitat destruction, boat strikes, net entanglements and pollution. All of these factors were taking their toll in the increasingly busy waterways of Moreton Bay and Hervey Bay, just 300km to the north.

Moreton Bay's wild dugong population was accessible enough to be closely monitored. At that stage, much of the information on the species had been gathered from aerial surveys and autopsies on animals drowned in fishing nets or struck by boats.

"No-one had done much hands-on work with dugongs and we had little understanding of population biology and life history parameters from wild populations," Janet explains. "We also had a limited understanding of their behaviour and social interactions."

Her idea was to study the physiology and behavior of the Moreton Bay population by capturing, marking and recapturing. But there was evidence that handling dugongs could be

Their oddly shaped face is also an adaptation to their seagrass-chomping lifestyle.

who's been working on the species for four decades – says that's not entirely correct. Recent research has documented these mammals at the southern extremes of their distribution eating invertebrates from the ocean floor, including worms and crustaceans.

"It looks like it's important during winter in places like Shark Bay and Moreton Bay, although we don't yet know just how important," explains Helene, who's based at James Cook University, Townsville. It might be that these dietary supplements are a vital protein source in waters where temperatures dip to about 18°C – the lower limit tolerated by the species.

THE MERMAIDS OF Moreton Bay are at the south-easterly limit of the dugong's distribution. Under the direction of Dr Janet Lanyon, a marine zoologist at the University of Queensland, during the past two decades this population has become the best studied in the world.

When Janet began her work off Brisbane in the early '90s, she was motivated by aerial survey evidence that suggested dugong populations along Queensland's most urbanised coastline

dangerous for the animals. Work by Janet's mentor Helene Marsh and others suggested dugongs could experience a stress-prompted physiological phenomenon called "capture myopathy" – a muscle-wasting condition that can lead to death.

It took several years, but Janet and her colleagues got around the problem by modifying a form of rodeo-style capture developed for sea turtles. It meant the animals didn't need to be pulled from the water, no nets were involved and tagging could be performed in a rapid sequence at the water's surface.

For the past 14 summers, Janet's team has been carrying out a mark-and-recapture program with huge success. "We've now tagged close to 800 different animals, including some we've recaptured seven or eight times over the years, and we're getting some really good information about how these animals grow and mature, and their social dynamics."

Significant findings include the revelation that dugongs do not appear to aggregate and travel together in stable family groups, as some other marine mammals do. The large groups that form in Moreton Bay *Continued page 62 ▶*



Air supply. The valves that keep dugong nostrils clear of water while they are submerged retract fully when the animals surface to breathe.



Snug fit. During short shallow-water dives to feed, nose valves form a tight seal at the entrance to the dugong's airways.



Sea cowboys. Wearing protective helmets, Merrick Ekins, left, and Ben Schemel from the Queensland University dugong research team prepare to capture a dugong using a rodeo-style technique they pioneered.



– which can include up to 100 or more animals at a time – appear to be merely feeding aggregations within which mating occurs randomly. In essence, they function like big herds of cattle.

There is also evidence that, even though there is some limited movement of animals between Moreton Bay and Hervey Bay, the two populations are genetically distinct. Research elsewhere also suggests that various local dugong populations around the country are genetically separate, and this could have major implications for the species' long-term management.

Recently, Janet's team has begun to investigate dugong communication. Above water, you won't detect much noise from them. But if you put your head under water near a group of dugongs you're likely to hear chirping. "They sound like little tweeting birds and we've found that the animals here [in Moreton Bay] sound different from the animals in Hervey Bay: they vocalise at different frequencies," says Janet.

Research has also shown that the chirping rises exponentially with the increase in group size. It's not just more individuals chattering, but more 'conversations' occurring as a group grows bigger. "It suggests there is some sort of social behaviour going on in the herds," Janet says. There's anecdotal evidence that animals released at a distance from their herd will find their way straight back, and that a frightened herd will move together.

It's not clear, however, whether group movements involve 'chatter', or some sort of tactile pressure-sensitive sense, such as the 'lateral line' electro-sensory system that provides fish with information about their surroundings. Dugong skin is not smooth like a dolphin's. Surprisingly, it's covered in sparse hairs spaced a centimetre or two apart. There's a theory that these could function as pressure sensors that detect vibrations and movements in the surrounding water, but that will take more research to prove.

Janet's team has also been conducting annual health assessments of the Moreton Bay and Hervey Bay populations for the past seven years, taking blood samples and recording aspects of body condition. There are indications that what happens on land can affect dugong health.

After the Brisbane floods in 2011, significant rises in heavy metals were seen in the blood of Moreton Bay dugongs, a likely consequence of the influx of coastal run-off into the bay. About nine months later, researchers documented a drop in body condition of the animals, and they suspect there is a link between the two.

ALTHOUGH DUGONGS are a rare sight for much of Australia's population dwelling on the temperate east coast, the animals are an intrinsic part of the culture of northern coastline communities. Their significance is indicated by the fact that many Aboriginal and Torres



Dugong delicacy. Seagrass meadows stabilise marine sediments and provide food and habitat for a range of animals in tropical and temperate waters.



HEAR the sounds that dugongs make. Download the free **viewa** app and use your smartphone to scan this page.



Practical research. To aid out-of-water breathing and reduce stress for the animal during medical examination, Janet Lanyon douses a captured dugong's head with water.

Strait Islander languages have several names for dugongs at various stages of development. On Mabuiag Island in Torres Strait, for example, there are at least 17 different terms to describe them, including garkadanbgal (male dugong), ipikadangal (female dugong), kazilaig (pregnant dugong) andgilab (large old dugong).

"Indigenous people have always had a very close relationship with dugongs; historically and traditionally treating them, as well as other forms of mega marine life like turtles, as kin – as one of their own," explains Joe Morrison, CEO of the North Australian Indigenous Land and

science can learn from indigenous culture when it comes to dugongs. In late 2012, Bardi Jawa rangers, one of 14 such groups within the Kimberley Land Council, travelled to Abu Dhabi to share their skills at catching and tagging dugongs. This is where the biggest population outside of Australia survives and the exercise saw satellite tags successfully fitted to three dugongs so their movements in the Persian Gulf could be tracked by conservation scientists.

More recently the Torres Strait Regional Authority's Land and Sea Management Unit took out the 2013 Banksia Gold Award for

"It's indigenous people that have the most to lose if culturally significant species go extinct."

Sea Management Alliance, based in Darwin, Northern Territory.

This cultural connection is linked to the fact that dugong has long been a food for many northern communities. There is evidence, for example from the Torres Strait, that dugongs have been harvested for at least 4000 years. Dugong meat is still an important protein source for many remote communities near northern Australian waters. These animals continue to be hunted legally for non-commercial purposes in these areas by indigenous Australians using traditional methods, under state and federal native title legislation.

It's been a controversial practice over recent years and one that periodically receives media attention in response to concerns raised by animal rights and welfare activists. In 2004 Helene lent her voice, co-authoring two papers that suggested the Torres Strait dugong catch was not sustainable. Her position has since shifted. "I've changed my mind," she says. "We've got new data now: Torres Strait has very significant numbers and a significant harvest is probably sustainable."

Nevertheless, the mid-2000s controversy helped generate some positive outcomes across northern indigenous communities, spurring many to step up monitoring and management of dugongs and other marine resources in their jurisdictions. "We've always taken the view that, at the end of the day, it's indigenous people that have the most to lose if species that are culturally significant for people go extinct," says Joe.

It's becoming clear that modern conservation

sustainable environmental programs, largely based on its approach to dugong management that embraces a traditional indigenous harvest.

THESE DAYS a growing body of evidence suggests dugongs are most at risk from the threats that come with living near the country's busiest urban coastal areas. Here, as Janet's research is beginning to show, it's likely dugongs are affected by pollution run-off from the land, and the creatures' slow-swimming ways place them at risk from deadly strikes by boats. But, as is the case for most vulnerable species, habitat loss is the most enduring story for the seagrass-specialist mammals.

Over in the country's west, it appears that a new chapter of this story is being written. In the Shark Bay World Heritage Area, it's long been thought that the world's second-largest dugong population, 10,000-strong, was secure. But alarm bells have been sounding since the 2010–11 summer, when heatwave conditions saw west coast water temperatures rise to unprecedented levels.

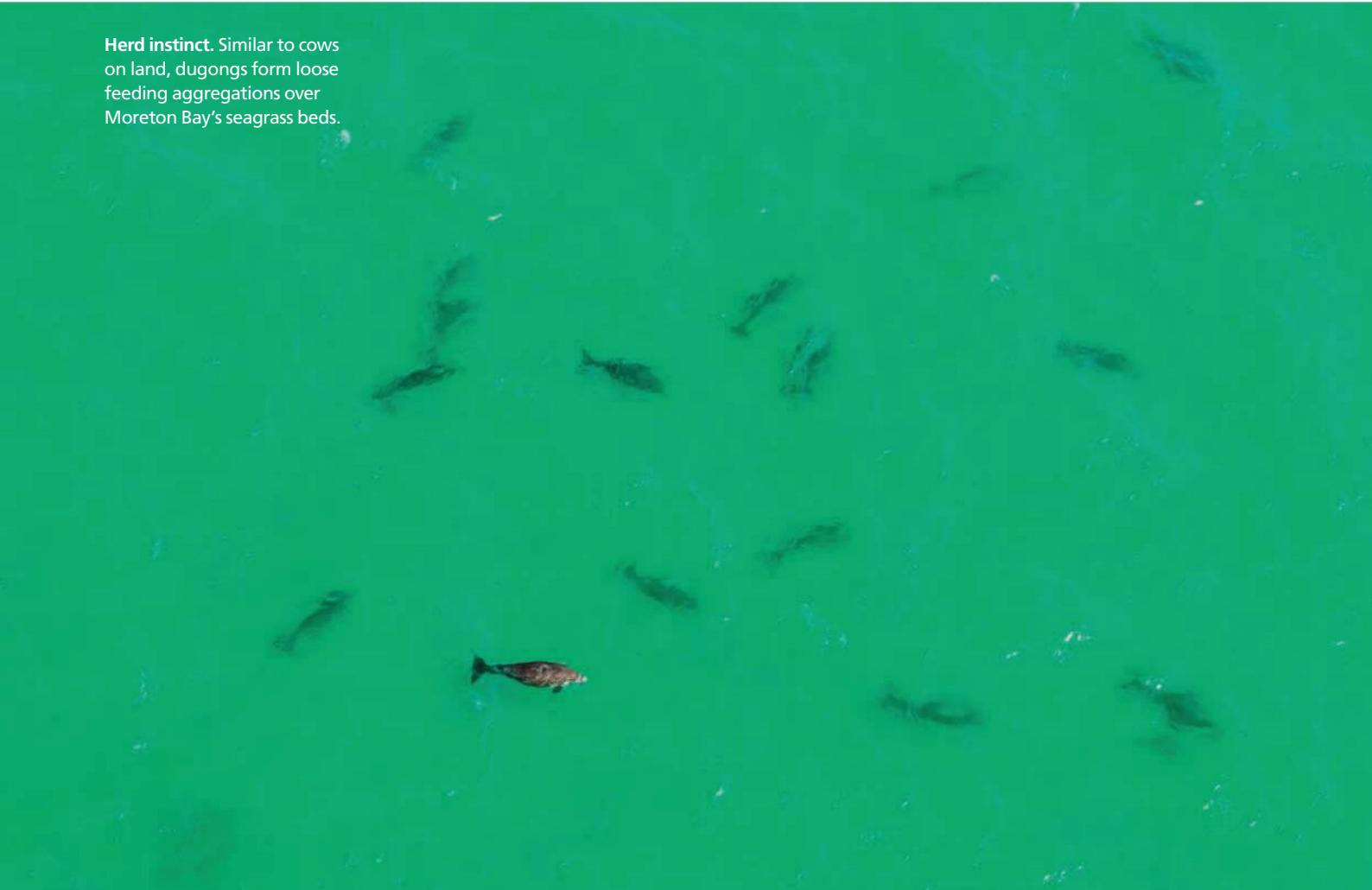
"It hit some of the seagrass pretty hard," says Dave Holley. "We're now keeping a watching brief [for the consequences]." If such events recur, as they're predicted to do as a result of climate change, the long-term impacts could be devastating for Australia's dugong populations. **AG**

SEE more dugong images at: www.australiangeographic.com.au/journal/issue118.htm

An aerial photograph showing a long line of shipwrecks resting on the ocean floor in Moreton Bay. The wrecks are scattered across a turquoise-colored sea. In the upper left corner, a sandy beach with some buildings and small boats is visible. The water transitions from a bright turquoise near the shore to a darker teal further out.

Tangalooma Wrecks.

Dugong herds in popular coastal areas such as Moreton Bay face multiple threats, including pollution from runoff and boat strikes.

An aerial photograph showing a large school of fish swimming in the clear, turquoise waters of Moreton Bay. The fish are scattered across the frame, appearing as dark silhouettes against the bright water. The water has a distinct greenish tint characteristic of seagrass beds.

Herd instinct. Similar to cows on land, dugongs form loose feeding aggregations over Moreton Bay's seagrass beds.

LOON VENTURE

flight across Aust.

will try to cross Australia within the month by balloon.

ir route



must be observed including the carrying of a flight navigator, survival radio beacon and a fully charged telephone. Every man must have a parachute harness at all times during flight and paracutines must be stowed so that they can be fastened within seconds. Although the gas balloon will be constructed as a hot-air balloon, it will be made as lighter-than-air gas. This is the reason why we will take gas from Gin Gin in Western Australia. Gin Gin has one of the few natural gas fields in Australia which supply sufficient gas to inflate the envelope which will contain 100,000 cubic feet of gas in a short period.

Fully inflated, the hot-air balloon will lift up in a second, once pressurised.



AUG 1966



Lofty ambitions

James McCormack embarks on a personal crusade to better understand his father who, 50 years ago, completed Australia's first modern hot-air balloon flight.

STORY BY JAMES MCCORMACK

Lost balloon

NICE and aviation authorities were last night to keep a missing 65ft

Police said the students had made one successful flight with the unmanned balloon and were recovering it when a guy rope snapped.



Up, up and away. Terry McCormack (centre) clutches *Archimedes* (also above). The Aerostat Society's first balloon, it didn't have a basket. Their second balloon, *Tejin* (opposite), had an aluminium gondola.

ON 4 JULY 1964,

a group of young engineering students and recent graduates gathered around a shapeless object in a paddock near Parkes, in central-western New South Wales. They looked like members of an esoteric sect, clad identically in simple white overalls and performing curious rituals, the function of which few onlookers could have guessed.

At the centre of their attention was 150sq.m of Mylar film. It was just one-fiftieth of a millimetre thick. During the days to come, the Mylar's aluminium coating would shimmer silver, mirroring bright cobalt skies and brown, hard-baked fields. On these days, there would be no spectators and their strange activities would go unwatched. The fourth of July, however, was different. Thousands of onlookers had gathered, braving mid-winter's grasping dawn chill, because the young engineers were attempting the country's first manned balloon flight in nearly half a century.

Unlike previous balloons, *Archimedes*, as they had named their craft, was equipped with an onboard burner. This was Australia's first modern hot-air balloon and tiny by today's standards. Balloons now average a volume of 2500cu.m; *Archimedes* was one-fifth that size. Nor was there was a passenger basket. There was just an open platform, large enough to carry one gas cylinder, a single passenger and no more.

The group had built *Archimedes* themselves. In a cafeteria at The University of Sydney, they had cut out 28 sections of Mylar (a form of plastic polymer officially known as polyethylene terephthalate) and taped them together to form the envelope. When *Archimedes* was complete, they performed an unmanned trial on a football field in Sydney, with the balloon tethered by ropes. Their next step was to remove its constraints – they wanted *Archimedes* to fly free. So they headed to Parkes, where they could run their trials outside restricted airspace.

On the day of the attempt, a light breeze blew. The students struggled to steady the inflating balloon. Eventually they were ready for take-off. The president of their ballooning club, the Aerostat Society, stood on the platform. His added weight was too much for the tiny, rudimentary burner, which lacked the power to sufficiently heat the air within *Archimedes* for lift-off. But it was close. All they needed was to lighten the load. Then the pilot removed his parachute and *Archimedes* began to float. Within minutes, it was half a kilometre up. By the time it landed, a quarter of an hour later, it had travelled 5km. History had been made.



Treasure chest. While sifting through one of his mother's cupboards, James found a box of his Dad's photos, clippings, slides, brochures, film and hundreds of pages of hand-written calculations.

However, no-one had considered the dynamics of the landing. When *Archimedes* touched down, for an instant the weight of the pilot, the platform, the burner and the gas bottle were no longer supported by the balloon, but by the ground. Relieved of this encumbrance, *Archimedes* shot skywards. The pilot lost his footing and was left dangling from the platform some 30m in the air, before the balloon descended again. When spectators arrived, they were relieved to find him uninjured.

Eleven years later, he would not be so lucky. In another Australian ballooning first, he would die in an accident, closing a pioneering chapter of the sport. For me, too, just 8 years old at the time, the world of ballooning ended. That was because the pilot, Terry McCormack, was my father, and for the next 35 years I didn't think about hot-air ballooning at all.

FOR YEARS I HAD known of a box my mother kept. It smelt musty and, although I'd never rummaged through it, I knew roughly its contents: yellowed newspaper clippings; black-and-white photos; hand-drawn designs on paper browned at the edges; and the odd silverfish, squished and dried between promotional brochures.

I'd never closely examined this evidence of my father's ballooning endeavours, nor spoken with any of his friends from those times. I'd never even really asked anyone about him or what he was like. However, because several of Dad's friends had recently died, in 2012 I decided that if I was ever going to learn more about him, or the contents of that box, now was the time to start.

As a form of transport, ballooning predates cars, bicycles, and even steam locomotives. It seems at odds with the fast pace of modern life. A flight in a balloon is a languid affair, floating through the skies, drifting over the landscape in slow, meandering lines. Yet nostalgia was not what attracted the Aerostat Society members to ballooning. Precisely the opposite; it was innovation, research, adventure. And, at least according to ▶



The A-team. Brian McGee (top, from left), Peter McGee, Terry McCormack, Zenon Kocuimbas, Stan Grincevicius and Mopsy Mauragis pore over plans for *Archimedes* at St John's College, before launching at Parkes (above).



WATCH historic footage of ballooning in Australia. Download the free **viewa** app and use your smartphone to scan this page.

History made. The moment of *Archimedes'* lift-off. Newspaper reports at the time estimated a crowd of 3000 had gathered to brave a cold winter's morning and witness the flight.

one clipping I found in the box, humour, because it all began with an idea for a stunt.

In July 1962, as is the wont of students, Dad and others gathered at The University of Sydney's St John's College devising mischief. Dad suggested a party, one that couldn't be stopped. "Imagine it," he said. "The Poms are playing at the SCG. You float over in a balloon, singing and dancing at 100ft [30m] and nobody can get you. The cops are bristling with rage and frustration, the fire brigade is called in with ladders and the air force with rockets."

Stan Grincevicius, who later became my godfather, was there. "It was just students sitting around in – pardon the French – a bullshit session, everyone going off on tangents with big ideas. But every once in a while somebody grabs the idea and runs with it. In this case, it was Terry," Stan says.

"It was first principles. There were no do-it-yourself manuals or texts to follow."

I hadn't seen Stan since my father's funeral. But he was possibly my father's closest friend, so I travelled to Melbourne to pay him a visit. He showed me hundreds upon hundreds of pages Dad had sent him: drawings and sketches; designs and costings; calculations of payloads, lift factors, gas densities, vapour pressures, BTUs (British thermal units), spring-loadings, fuel consumption, drag coefficients and temperature differentials. Done in the pre-computer, pre-calculator age, every equation was handwritten – scrawled lines of calculus, of derivatives and integrals, of sines and cosines.

"He was an engineer," Stan says. "He liked working things out and researching. And he was very, very intelligent. For every three hours [of study] we had to put in, he only had to put in one."

The joy of research seemed to be at the project's heart. This didn't surprise me; the original Aerostats were, essentially, all math and science geeks. There was Dad and his brother Laurie, brothers Peter and Brian McGee, Stan, Zenon Kocuimbas, Mopsy Mauragis and Terry Golding. And they had to start from scratch. There were no books for guidance, no hobbyist magazines, and no ready flow of information to Australia about international ballooning developments. American Ed Yost had made the first modern hot-air balloon flight just a few years earlier; no-one in England would do so for years. ▶





COURTESY CHERRY MCCORMACK



Windows to the past.
Photographer Michael Small, who flew with Terry McCormack on the day of his accident, goes through old slides from his ballooning days at his Blue Mountains studio.

"It was really first principles," Terry Golding says. "There were no do-it-yourself manuals or texts to follow at all. There was a piece of paper and a Biro."

By all accounts, Dad drove the research. "It was absolutely [his] show," Terry says. "Without him, this thing wouldn't have got off first base. It was his idea, his initiative, his enthusiasm, his research. It was his baby. And the remaining members of the Aerostat Society, including myself, were just there for the ride."

THE SIGNIFICANCE OF this first flight of *Archimedes* in July 1964 still surprises me. Newspapers ran it on front pages and it was covered on television. Buoyed by this, within 12 months the society had embarked on a bigger project: building the largest balloon in the world. Reaching 75ft (23m) in height and 60ft in diameter, it would hold six times the volume of *Archimedes*. The goal was to fly it across Australia.

But the equipment they needed was expensive and much of their energy was spent chasing sponsorship. "It was always a hard sell, trying to get support," Stan says. "There was little to offer in terms of publicity."

Yet receive they did. Ropes. Propane gas. Toyota sponsored them with a truck. Sydney's now-defunct *Daily Mirror* newspaper contributed \$1000. Australian sewing machine supplier Capron Carter donated an industrial sewing machine and arranged a seamstress to sew together the balloon. An electric blanket

To my father, these mishaps meant little. His optimism was, it seemed, irrepressible.

company made two blanket suits to protect the balloonists from the cold at altitude. And then there was the sponsorship from Teijin. "That was big," Stan says. "Big. Big. Big." Dad had become convinced that, for a larger balloon, a fabric that resisted rips was needed. His research led him to Teijin, a Japanese company that produced Terylene, known today as Dacron. Dad sent a request to Teijin, asking for a donation of tens of thousands of dollars' worth of Terylene. In gratitude for the gift of the fabric, the Aerostats named the world's biggest balloon after the company.

By October 1965, *Teijin* was ready. They decided to test it with a tethered flight at St John's Oval in the grounds of The University of Sydney. The inflation progressed smoothly, but *Teijin* was so big that Terry Golding was genuinely worried it might lift the truck to which it was secured. Dad and Peter McGee ascended first, followed by Terry. On the descent, with *Teijin* still floating 5m in the air, a bystander pulled on one of the ropes. (The rope led to an innovation they were trialling:



Lift-off. *Teijin* (left) is launched at Cargo in April 1966. Ken Bath (below, at left) and Terry McCormack fiddle with *Teijin's* burner. Made of cast iron, steel piping and brass, and with an asbestos cover to protect the pilots, it was more like an industrial burner for a furnace, says fellow Aerostat Grahame Wilson.



a zipper running the balloon's length — in essence splitting it open — to allow rapid deflation.) *Teijin* collapsed instantly. It crashed down on Dad and broke his leg, and Terry Golding's clothes were set on fire when molten fabric fell on him.

Terry's burns, thankfully, were minor, requiring just a single night in hospital, but sponsors became wary and the balloon was badly damaged. Yet Terry doesn't believe the incident dampened Dad's enthusiasm, even if he did soon relinquish the idea of flying across Australia.

"I think he realised it was a much more ambitious program than he'd originally envisaged," Terry says. "It would have required massive resources that he simply didn't have access to."

Other mishaps followed. In July 1966 (after a successful flight where my mother Cherry became Australia's first modern-day female hot-air balloonist) Dad and some others flew *Teijin* at Canowindra, a sleepy central-western NSW town, now known as the balloon capital of Australia. They were testing a new deflation system when a 270kg rope snapped, freeing the unmanned craft. *Teijin* floated away and radiant heat from the sun provided the balloon with enough warmth to stay afloat. It was last seen 140km to the south-east, near Crookwell.

With mounting debts and no balloon, the Aerostat Society seemed doomed. Two months later, though, a pilot spotted *Teijin* in thick bushland and the society recovered it. But a year later, *Teijin's* envelope ripped apart mid-flight — perhaps because

ultraviolet rays had weakened its fabric during all those months it lay in the bush. Stan and fellow pilot Don Joergens were forced to make emergency jumps, the first time either had parachuted.

It seemed to me the Aerostats lurched from near disaster to near disaster. But that was perhaps unfair, because not only were there many successful flights, it was also quite clearly a period of trial and error. "Uninformed is a good word to use," says Phil Kavanagh, who joined the society in 1968 and went on to found Australia's only commercial balloon manufacturing company, which he manages to this day. "We just didn't have a clue. We were really lucky to survive," he says. "Especially with the things we flew in."

BUT TO MY FATHER, these small mishaps meant little. His optimism was, it seemed, irrepressible. It was also, however, his undoing. That, and sheer rotten luck.

Until this year, when I chatted with Michael Small, who witnessed Dad's fatal flight, I had never spoken to anyone — not even my mother — about the circumstances of his death. I had never read the newspaper accounts, nor the Australian Department of Transport's accident report.

In November 1975, Dad went to Wagga Wagga, 160km west of Canberra, to fly with Michael and Tony Hayes. It was a warm day and Michael says the morning flight with Dad in the *James Cook* was memorable. "It was the highest I'd ever flown in a balloon. We got up to 10,000ft [3048m]. I was wondering if that was [Mt] Kosciuszko I could see."

Tony then swapped with Michael and he and Dad took off at 12.20pm. Phil Kavanagh was upset when he heard they'd set out so late. He'd become suspicious of afternoon flights as, once temperatures rise, thermals start popping. This is why ballooning is an early morning activity. Phil even talked about it with Dad.

"But Terry had such huge optimism he thought he could overcome any obstacle," he says. Yet it was becoming apparent, at least in Phil's mind, this would not be the *Continued page 76* ▶

The good ol' days. The Aerostat Society relied on sponsorship: Toyota supplied a truck (right), and Archimedes' Mylar panels were joined by donated Sellotape. Teijin's zipper deflation system (below centre) at work. Rosemary Johnson (opposite top, at centre) works the sewing machine on a balloon with Mopsy Mauragis, left, and Terry McCormack.

RODUCING
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TIMELINE: HOT-AIR BALLOONING DEVELOPMENTS

→ **1709** Bartolomeu de Gusmão, a Brazilian priest, reportedly gave an indoor demonstration of a model balloon within the palace of King John V in Lisbon, Portugal, taking it 4m off the floor. Some claim, controversially, that Gusmão actually ascended with the balloon. That same year he published a treatise: *Short manifesto for those who are unaware that is possible to sail through the element air*.

→ **1783** The first manned hot-air balloon free flight. Piloted by Jean-François Pilâtre de Rozier and François d'Arlandes, it was designed by paper manufacturers Joseph-Michel and Jacques-Étienne Montgolfier, who had noticed ashes from burning paper rising into the air.



→ **1858** Joseph Dean completed the first balloon flight in Australia. Dean's muslin balloon, *Australasian*, launched from Melbourne's Cremorne Gardens.

→ **1960** Launching from Nebraska, USA, Ed Yost made the first flight in a modern hot-air balloon. Earlier versions of hot-air balloons did not use onboard propane burners.

→ **1963** Ed Yost and Don Piccard made the first hot-air balloon flight across the English Channel, earning international notoriety.

↓ **1964** Terry McCormack completes first Australian hot-air balloon flight in *Archimedes*.





→ **1967** First UK manned free flight. Piloted by Gerry Turnbull, it was meant to be a tethered, demo flight, but *Bristol Belle* broke free and made history.

→ **1987** Richard Branson and Per Lindstrand made the first hot-air balloon trans-Atlantic crossing in the *Virgin Atlantic Flyer*. Controversy arose when they landed just off the coast of Rathlin Island in the Irish Sea. The pair were separated

and Lindstrand swam for hours in frigid waters before being rescued.



→ **1993** AG founder Dick Smith and balloonist John Wallington made the first non-stop balloon crossing of the Australian continent in the *Australian Geographic Flyer*.

→ **1994** Australian designer Phil Kavanagh made his first flight in a D77 hot-air balloon, *Red Tape*. It was fitted with the first Smart Vent deflation system, which could open and close on demand.



→ **2005** Vijaypat Singhania set a new record, reaching more than 69,000ft (21,000m) on a flight from Mumbai, India, but missed a target of 70,000ft.



Full of hot air. Silhouetted by the dawn sun, Jan Kerr is dwarfed by her balloon *Hippy* while it inflates in Canowindra, Australia's balloon capital.



case with thermals. "We would just have to learn to avoid them."

When Dad and Tony departed, Michael and a few others followed by car. "They weren't flying as high as we had in the morning," Michael says. "I remember losing sight of the balloon, quite often behind hills. But coming around a corner, [we saw] smoke maybe one or 2km away. We prayed they were okay."

Newspapers say Dad and Tony were at an altitude of about 100m, and chatting with onlookers below them, when a willy-willy moved through. The basket began swinging violently and, in all the movement, the cable leading to the chimney's release pin was pulled. Chimneys were large vents in balloon envelopes that could be used to rapidly release air upon landing. But the deflations they induced were termed 'catastrophic', in that they were irreversible. The *James Cook* plummeted. Tony jumped, but his parachute had insufficient time to deploy. Dad stayed with the balloon. Neither had a hope of survival.

IF I WAS TO UNDERSTAND the attraction of ballooning for Dad, I had to fly again. It seemed fitting it should be with Phil Kavanagh and that it should be in Canowindra. Not only had Dad been influential in the town becoming Australia's ballooning capital, but also some of my earliest memories are from time spent there with him.

For me, a kid from the city, Canowindra had seemed exotically

bushy. I remember the land appeared hard and leached, the gum trees veneered with dust. I remember fields of Paterson's curse and thistles as high as my chest. I remember learning to negotiate barbed wire to reach paddocks where the balloon had landed.

Returning to Canowindra in November 2012, it seemed virtually nothing had changed. That was not the case, however, with modern balloons. Dad's accident cemented in people's minds the danger of afternoon flights and chimneys were banned. Skirts, too, were added to balloon bases to allow safer ascents in higher winds. Inflation fans are quieter and burners infinitely more powerful. Most importantly, deflation vents can now be opened and closed on demand.

Phil demonstrated the vent in the moments before we ascended. Unlike the swatch-patterned colours of so many modern balloons, Phil's was almost wholly a single hue; a lustrous teal blue to match the rich depths of the dawn above. Then, with a couple of blasts of the burner, we were off.

The lift was so gentle it could barely be felt, and we rose in near silence over the dawn-kissed fields. The land seemed soft and slow, as if waking drowsily from sleep. Soon we were high enough to no longer hear the calls of livestock or songs of birds. We took in aerial views revealing the patterns of the landscape: the spidery webs of sheep tracks near dams; the rows of vineyards; the angularities of fence lines; the crooked haphazardness



Past revisited. With Phil Kavanagh in *The Captain*, James makes his first flight since before his father's death.

They are the ones that move us forward, the ones that achieve significant greatness.

of creeks; and the contours of gentle hills ringing the valley.

But I preferred those times we dipped low. Nearing Canowindra itself, we swung down to the paddocks. Up high I had felt suspended, as if held by a giant crane. Close to the ground, however, where the rough imperfections of the earth itself were apparent, the sense of being air-cushioned, of truly floating, was heightened. And after rising in a graceful arc over the buildings, we dropped again, this time so low the basket brushed the whispering heads of wheat.

Nearing touchdown, Phil feathered the vent and we landed with a surprising gentleness. I came away with an overwhelming feeling of calm, but I still couldn't understand what had compelled Dad to devote his life to ballooning. There were, of course, aspects Dad relished that I couldn't even begin to appreciate after just one flight, because largely they had little to do with flying. Terry had hinted at them the day before my

flight, when he said that if Dad hadn't died so young, he could have achieved significant greatness. "He was just that sort of a man," Terry said. "Your father would never buy a lottery ticket; if he won it, he said, the whole challenge in life would disappear."

There are very few of us – and I'm not one of them – who don't want to win the lottery, metaphorically speaking. For those rare few, the very marrow of life lies neither in mere survival nor comfort, but rather in confronting both. I actually believe there is a biological necessity for this. Not just for the pioneers, explorers, adventurers and risk-takers involved, but for us as a species to have such people – they are the ones that move us forward, the ones that achieve significant greatness.

After returning home to Sydney, I discovered my attitude towards my father had shifted. When I began researching his balloon exploits, I believed the respect I had for him was no different from that of most sons towards their fathers – especially sons with dead fathers.

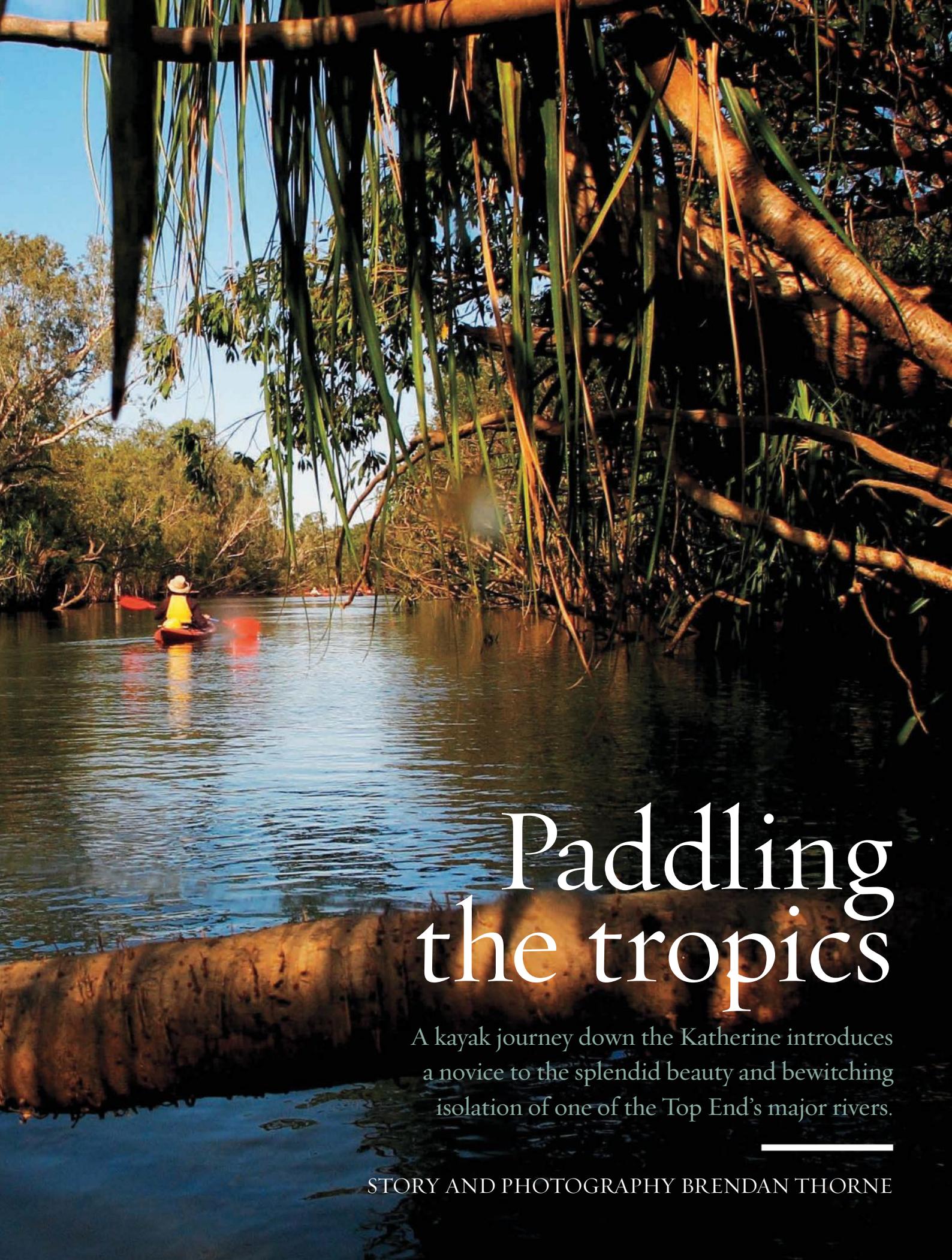
But for years, I have been passing a sign near my apartment quoting Ralph Waldo Emerson: "Do not go where the path may lead," it reads. "Go instead where there is no path and leave a trail." It is, of course, a beautiful sentiment. Yet I've always considered it unattainably lofty; who have I ever met, I've thought, who's truly had the courage to do so?

I look at the sign now and realise I know a man who did. AG



Just us five and the river.

Dave Cauldwell savours the stillness
as he lags behind the other paddlers
on the Katherine River.

A photograph capturing a person in a kayak from behind, paddling away on a calm river. The kayak is a vibrant orange-red color. The person is wearing a yellow life vest and a white hat. The river is bordered by dense tropical vegetation, including palm trees and various leafy plants. The lighting suggests it's either early morning or late afternoon, with long shadows and a warm glow.

Paddling the tropics

A kayak journey down the Katherine introduces a novice to the splendid beauty and bewitching isolation of one of the Top End's major rivers.

STORY AND PHOTOGRAPHY BRENDAN THORNE

AS I SIP ON MY morning coffee and pore over the day's headlines, a menacing photograph grabs my eye. A large saltwater croc is lunging from the cover of the *NT News*. Its enormous mouth is open wide, revealing sharp teeth that hint at the crushing power of mighty jaws. Alongside the image, the Darwin-based newspaper's cover line reads: "Kids use live dogs for croc bait". I suddenly feel a bit sick. I'm about to embark on a three-day kayaking trip down the Katherine River: was this a sensible decision?

Under normal circumstances, such an image would send me packing. Instead, I rationalise that the Katherine is a freshwater river so there won't be any salties lurking in its depths. Right? I tell myself this again, later in the morning, as I board a coach headed for a popular kayaking spot on the outskirts of Katherine township, about 320km south-east of Darwin.

Three and a half hours later, after a drive through the lush savannah woodlands of the Top End, I'm met by tour guide Collin Jerram. Clad in shorts and a shirt that match the colour of the outback dirt, and with thick tufts of white hair poking out from under his Akubra, Collin seems very much at ease in his environment. In fact, he looks like a man who could

through the protocol we'll need to follow for the next three days as we journey 50km along the Katherine River. Most visitors to the region travel the river in Katherine Gorge, in Nitmiluk National Park, but our tour heads in the opposite direction, downriver, for a quieter, more isolated paddle. We launch from Manbulloo homestead, 13km west of Katherine township.

The Katherine River is a mighty 328km stretch of fresh water that runs south-west from Nitmiluk NP, through Katherine – where some 10,000 residents tap its water – to merge with the Flora River, at the eastern tip of Flora River Nature Park. The two rivers form a major tributary of the Daly River, whose system is the longest in the NT and is kilometres wide when it reaches the sea south-west of Darwin. During the dry season (May–October), the Katherine River is spring fed by the Tindall limestone aquifer in the Katherine region and the Oolloo Dolostone aquifer of the Daly River basin. During the wet season (November–April) monsoon rains fill the river and supply the aquifers.

This whole area is the Jawoyn's beat; they are the custodians of the Katherine region. Their traditional lands, which sprawl across about 50,000sq. km, include Nitmiluk NP, southern parts of Kakadu NP and western Arnhem Land. In 1978 the Jawoyn people lodged a claim under the *Aboriginal Land Rights*

I rationalise that the Katherine is a freshwater river so there won't be any salties lurking in its depths.

run from Darwin to Alice Springs without breaking a sweat. He has a warm smile, a firm handshake and he speaks openly. I am compelled to ask him the question that had been eating away at me during the long bus journey. "There are no saltwater crocodiles in the Katherine River, are there?" I inquire, nervously. "Oh, yes," Collin says brightly, breaking into a broad smile. "My word, there'll be plenty of salties in the river!"

I STAND BESIDE the faded ocean kayaks that will be our life rafts for the next three days. At their bows, just above what looks to be a series of scratches left by crocodile claws, are their names: BamBam, Melon, Bom Shiva and Tree Hugger. "Tree Hugger. That'll be my ticket," I say, looking around at the other three members of my group: Nat Bradford, a publicist from Adelaide; Dave Cauldwell, a journalist from Melbourne; and Jesse Trushenski, a fisheries and aquaculture professor from the US state of Illinois. Our kayaking guide Matt Leigh runs

(NT) Act 1976 over lands including Katherine Gorge National Park (proclaimed in 1962), but it wasn't until 1989 that ownership of Nitmiluk was returned to the elders. The Jawoyn Association Aboriginal Corporation was established in 1985 as the representative body for the traditional owners and jointly manages Nitmiluk NP with the NT government.

The Jawoyn have lived with the river for some 70,000 years. They recognise two distinct social groupings, or moieties – Duwa (or Dhuwa, Dua) and Yirritja – which were created during the Buwurr (Burr), or Dreaming. Each of the two groups is divided into four skin groups and every person, animal, plant and place belongs to one of the two groups. Moiety is an important part of Jawoyn, balancing the natural and cultural worlds.

Balance can be thought of as the act of weighing factors, one against the other. And indeed, as I cast off from the bank of the Katherine River, I'm weighing up whether to abandon the kayak *Continued page 84 ▶*



Laid-back tempo.
Nat Bradford (above and far right) a publicist from Adelaide, walks his kayak through a side channel to avoid rapids before negotiating the fairly swift current at a spot where the river narrows. After diving for food, little black cormorants (right) must dry off their plumage before they can fly.

A long way from home. Kayaking guide Matt Leigh (above, at left) chats to Jesse Trushenski during a lunch break. Maintaining energy levels and staying hydrated is imperative on any Top End adventure.





Species to spot



Dusky leaf-nosed bats 1 (*Hipposideros ater*) are tiny, growing only up to 6.5cm and 11g. They go in search of food after sunset and are recognised by their large, rounded ears.

Sooty grunters (*Hephaestus fuliginosus*) are also known as black bream; they are grey-black or golden brown with dark blotches on rear fins. Growing up to 50cm and 4kg, they are found in streams with sandy or rock bottoms.

Saltwater crocodiles 2 (*Crocodylus porosus*) have been known to venture upriver during the wet season. But the rangers search for them before opening the river to canoeing and swimming, and any found are captured and removed.

Freshwater crocodiles (*Crocodylus johnstoni*) are far less sure of themselves, to the point of shyness. But be careful you don't intrude near a nesting site as they will defend with a snap.

White bush apple 3 (*Syzygium forte* ssp. *potamophilum*) grows to 30m. Its bark is papery, flaky and reddish and the dark leathery leaves can be bluish; it has white flowers and cream-white apple-like fruit, a food for the Jawoyn and fish and turtles.

Darters (*Anhinga melanogaster*), or snake birds, dive from the air to capture their prey in dagger-like bills. They can remain underwater for up to a minute; their plumage is not waterproof and they have to dry off before flying.

Northern snake-necked 4 (*Chelodina rugosa*) and **short-necked turtles** (*Emydura victoriae*). Together, the head and extended neck of the northern snake-necked are longer than its body; the short-necked has pale salmon stripes on the side of its head. You can see them sunning on rock ledges near the water.

Little pied cormorants (*Phalacrocorax melanoleucos*), with dull yellow bills and pale under-plumage, and little black cormorants (*Phalacrocorax sulcirostris*) duck-dive for their prey. They too must dry off before flying.

Barramundi 5 (*Lates calcarifer*) can grow to more than 1.5m and 60kg; the minimum legal size for catching them is 55cm. Silvery, with a pointed head and protruding lower jaw, nearly all are born male, changing sex to become female after about five years.

Freshwater mangroves (*Barringtonia acutangula*) grow to about 8m and are deciduous. Their red flowers have long stems and their unusual fruit is four sided. The tree is regarded as poisonous and the bark is pounded to use as a fish poison by the Jawoyn.

Fairy martins 6 (*Hirundo ariel*) migrate to breed at Katherine Gorge every year. They feed on insects, look similar to small swallows, and build bottle-shaped mud nests in rock overhangs and caves.

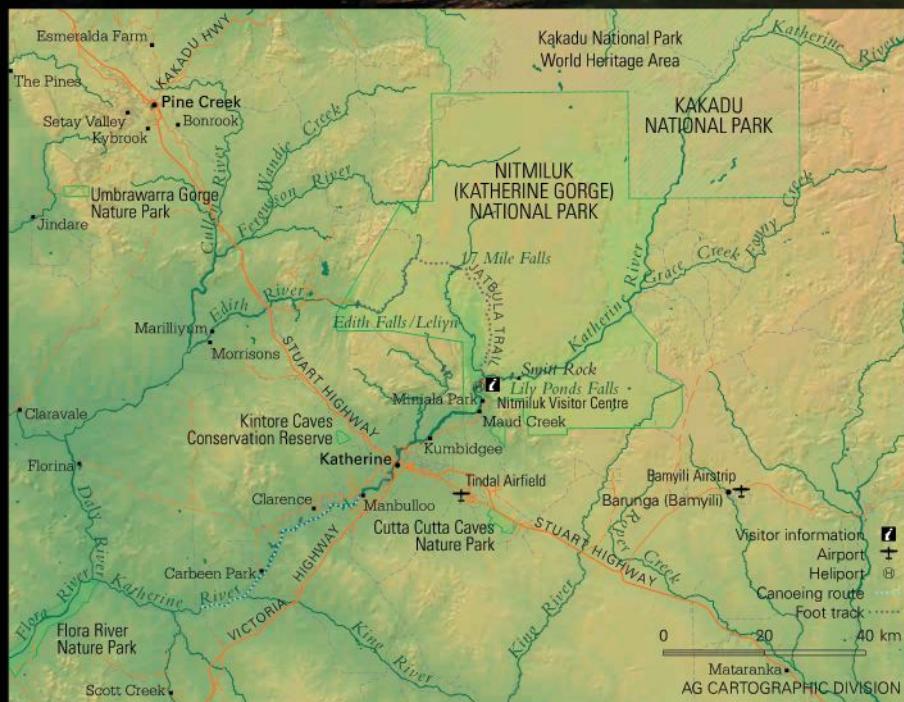
River pandanus (*Pandanus aquaticus*) grow up to 4m in clumps with prickly elongated leaves and are always associated with freshwater streams. Its globular, green fruit turn orange when ripe and the inner flesh is eaten by the Jawoyn, who use the leaves to make string.

Mertens' water monitors 7 (*Varanus mertensi*) are strong swimmers and can stay submerged for long periods. They grow up to 1m and have distinct, light-cream to yellow spots and narrow cross-band markings. They, too, like to sun themselves.

Down 'pandanus alley'.

Nat, left, and Matt head into the gloom: a stretch where trees meet overhead to form a natural ceiling.

KATHERINE RIVER



Visiting Katherine

The river is a three-hour drive from Darwin; a group will do best by renting a car. Individuals can catch a Greyhound bus from Darwin, with tickets starting at \$65.

LENGTH

328km

RIVERS/CREEKS THAT JOIN IT: **15**

SIZE OF NITMILUK NATIONAL PARK:
2920sq.km

NUMBER OF GORGES: **13**

NUMBER OF BIRD SPECIES: **170**

NUMBER OF REPTILE SPECIES: **78**

ESSENTIALS

IT CAN BE extremely hot from October to May and severe sunburn, heat stress and dehydration are risks – visitors from cooler climates need to be extra cautious. Drink water regularly and wear loose, light-coloured clothing and a wide-brimmed hat; water-resistant 30+ sunscreen is a must.

Saltwater crocodiles have been known to venture upriver during the wet season but Nitmiluk NP rangers search for them before opening the river to canoeing and swimming – any found are captured and removed.

Outside Nitmiluk NP, similar patrolling occurs near Katherine; visitors to the town have claimed to have spotted some sunning on the riverbank.

Who to go with: Gecko Canoeing Katherine River trips are only April–October. But in the Wet, Gecko Canoeing offers trips on the Ord River, near Kununurra in the Kimberley. Three-day Katherine River Safari \$810; Six-day Katherine, Flora, Daly rivers \$1399; eight-day Katherine River Discovery \$2390. Nitmiluk Tours, run by the Jawoyn Association, also operate several guided Katherine trips, including boat cruises and canoe and helicopter tours.

More information: www.parksandwildlife.nt.gov.au, www.geckocanoeing.com.au, www.nitmiluktours.com.au/tours/

and head back to shore or to continue with my fellow paddlers and avoid the humiliation of looking like a mountain goat trying to stay upright on a pair of water skis during a heavy swell.

The river is moving swiftly now. Matt senses the need to calm my jangled nerves. "I wouldn't worry so much," he says. "The salties that we get down here are mainly smaller males, under 3m, that make the 300km trip from the coast to fatten up before heading back to breed and compete with the larger males." He tells me that the Parks and Wildlife Commission NT trap a few larger rogue salties every dry season but this year has been quiet. "You're viewed more as a large 15ft [4.6m] object that's too big to compete with than as food in a kayak," he reassures me.

Feeling a little less like a kangaroo in headlights, I paddle into the first set of rapids we'll cross. The Katherine River is intersected by rock bars and the elevation drops by up to 2m between each bar, causing a very manageable, yet exciting, whitewater experience. I realise that the scratches on the sides of our kayaks aren't claw marks after all but evidence that newbies, such as myself, have been unable to zigzag around the exposed rocks and submerged eucalypts without damaging the kayak. The twisted trunks play an important role in supporting the river's large and

up smouldering wood from the edge of a bushfire and drop it into a separate part of the bush to start another fire and flush out prey," he says. He names blue-faced honeyeaters and rainbow bee-eaters as they flit into view. We see a great-billed heron, an elusive native wading bird, as well as pied cormorants, royal spoonbills and raja shelducks.

Early each morning, the landscape is transformed as an eerie mist cloaks the river. Over the mist, sunlight streams through the silver-leaved and weeping paperbarks. Freshwater mangroves and palm-like pandanus crowd the bank. One narrow, fast-moving stretch of the Katherine, dubbed "pandanus alley", is covered by a canopy of leaves stitched together by the webs of Saint Andrew's Cross spiders.

As the river cuts its way through the landscape and I am carried further from mobile-phone reception, I begin to feel at home. I'm about to relax and pull out a fishing rod when Matt points out a freshwater crocodile sunning itself on the sandy bank to my left. Freshies are far smaller than their saltwater cousins; they can grow up to about 3m but more commonly only reach about 2m. They are not as territorial as salties – which can grow to 7m – and are less aggressive. They eat small prey, such as fish and cherabin (freshwater prawns). It's my first up-close encounter

By our second day on the river my haze has lifted; I am no longer numb with fear.

varied aquatic ecosystem; 38 species of fish are found in the Katherine. The fish include barramundi, sooty grunter, and freshwater long toms, which have long arrow-shaped bodies and jaws like miniature billfish.

As we paddle along, we see archerfish knocking prey insects into the river from overhanging plants by exposing their lips just above the surface and spitting a jet of water. Yellow-faced and northern snake-necked turtles are also common in these stretches.

BY OUR SECOND DAY on the river, my haze has lifted; I am no longer numb with fear and my balance in the cigar-shaped kayak has improved. It's the dry season. The days are long and hot and blue skies. A flock of exuberant red-tailed black cockatoos flies overhead, screeching and flapping.

Matt is quick to list the impressive diversity of birds that live along the river. "You have your apex birds like the white-bellied sea eagle and whistling and black kites – they've been known to pick

with a crocodile; all the other freshies sighted have darted from the bank into the river's depths before we could get within cooee of them.

After three days, as we pull into the pick-up point, about 50km down river, Collin greets us with cold drinks and chocolate. I wonder whether I should paddle in with the others or make a mad dash and continue on. Like the Katherine River itself, which transforms as it meanders through the landscape, I have undergone a great change. Climbing out onto the bank I know I have been bewitched by the natural delights of this remote pocket of the Top End and suspect I'll be back to sample them again – hopefully in the not too distant future. 

► **AUSTRALIAN GEOGRAPHIC** thanks Gecko Canoeing and Trekking and Tourism NT for their help with this story.

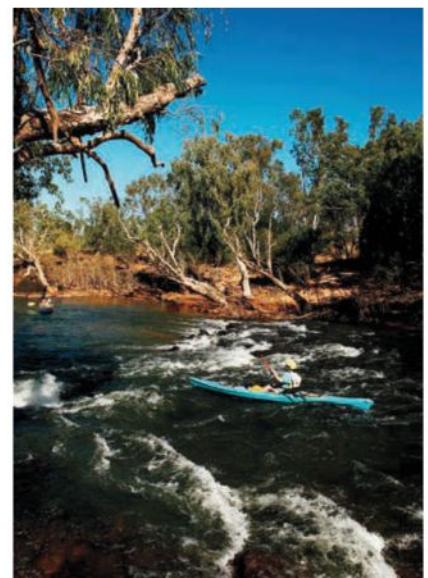
► **FIND** more images of the Katherine online at: www.australiageographic.com.au/journal/issue118.htm



More likely to run for it.
A freshwater crocodile (above) suns itself on the bank; far more cautious than salties, these crocs can become aggressive if their nests are threatened. Matt (right) keeps an eye out for a suitable place to stop. He says even salties are unlikely to take on a kayak – it's too big.



Big country. A spectacular sunset (above) paints the campsite mauve and pink at dusk. Jesse (below) tackles a small set of rapids formed by one of the many rock bars; helmets and life jackets are standard issue.



The curious five.

Kilwa sultanate coins were minted between the 10th and 14th centuries; copper ones such as these are most common, but a few examples of bronze, gold and silver coins have been found.



Trade winds

An AG Society-sponsored expedition set out in July 2013 to solve the mystery of 12th-century African coins found off Arnhem Land in 1944.

STORY BY MIKE OWEN



MYSTERY AND MAGIC still inhabit the wild places. Few are wilder than the Northern Territory's Wessel Islands, which arch out into the Arafura Sea like a reaper's scythe, harvesting flotsam from Indonesia's fabled Maluku, or 'Spice', Islands, just a few days' sail to the north-west. And no mystery is more beguiling than the 900-year-old coins from a medieval African sultanate, found on one of the archipelago's beaches during WWII by RAAF serviceman Morry Isenberg.

By far the oldest foreign artefacts ever found in Australia, the Kilwa sultanate coins are now held at the Powerhouse Museum in Sydney. Only twice before have Kilwa coins been found outside Tanzania; once in Zimbabwe and once in Oman. Australia is a great deal further for them to have travelled – more than 8000km. Perhaps their discovery in the Wessels tells of ancient disaster, shipwreck and castaways, or they may merely have been left by ocean-going traders at ease in the safe anchorage beside a freshwater lagoon on Marchinbar Island.

Were Yolngu Aboriginal people trading comforts and necessities for iron tools centuries before they were first thought to have bartered them for grog and tobacco with Macassan fleets from Sulawesi in the 1700s? Perhaps the Yolngu played a small, and previously unknown, part in the ancient maritime trade network that stretched from Mozambique on east Africa's Swahili coast, across the Indian Ocean to the Spice Islands and China.

The island of Kilwa Kisiwani, off the south coast of Tanzania, was once a thriving seaport. From the 11th century, the sultans of Kilwa grew rich controlling the gold, ivory and slave trade, and presided over a vast empire that included Zanzibar and the Comoros archipelago. Could it be that other Europeans connected to this trading network had contact with Australia before the well-documented arrival of Dutch explorer Willem Janssoon in 1606? The Yolngu tell of white men emerging from the sea dressed in "mirror" (armour), and beating stones to make metal on the beach. The rock art in caves on Marchinbar features passing ships and European-looking sailors.

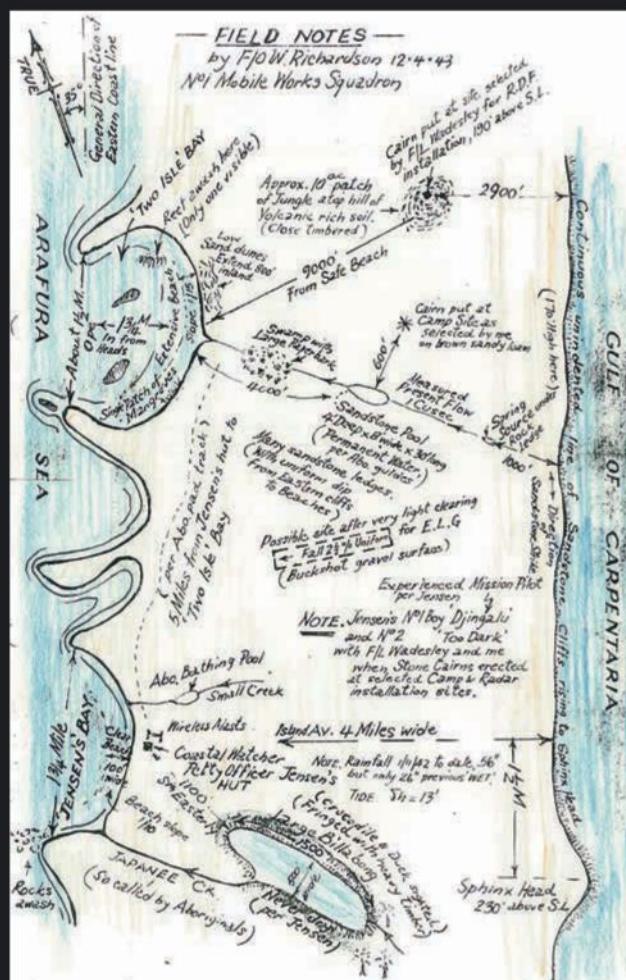
These ideas and questions had long been on my mind. So in July 2013, Australian anthropologist Dr Ian McIntosh, based at Indiana University-Purdue University Indianapolis (IUPUI) in the USA, and I led the "Past Masters", a team of five archaeologists and heritage experts, to the Wessel Islands. Our ultimate objective was to answer how these 12th century coins ended up on a beach at Marchinbar Island, the largest in the archipelago. But our week-long expedition in 2013 was more specifically aimed at locating and mapping key sites of interest and finding enough evidence to justify a much bigger scientific study of ▶



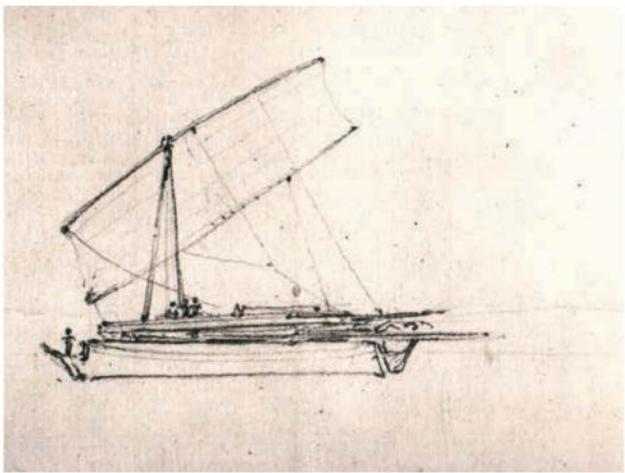
MIKE OWEN (left) is a heritage consultant based in Darwin, NT. Expedition co-leader Professor Ian McIntosh is an Australian anthropologist at Indiana University-Purdue University, in Indianapolis, USA. He is an adopted member of Arnhem Land's Wanguri-Mandjikay clan.



Trading powerhouse. From the 11th to 15th centuries, Kilwa Kisiwani (above), home of the Swahili sultans, was the epicentre of Indian Ocean trade in African gold, iron, ivory and slaves. It was famed for its beauty.



Marchinbar Island. In 1943, surveyor Wyndham Richardson sketched this map while scouting a location for a radar station; Morry Isenberg marked a copy with where he found the coins.



The evidence trail. A typical Macassan trading boat (top), similar to those that regularly visited the Wessels in the 1700s and 1800s. Anthropologist Dr Ian McIntosh (centre) displays a coin similar to those found in 1944. Mike Owen (above, at left), and archaeologist Michael Hermes display a badly weathered ship's knee (brace) found south of Jensen Bay.

the islands in 2014. We were also hoping to find interesting new artefacts and document the rock art.

OUR JOURNEY BEGAN at Nhulunbuy, a small township on the NT's Gove Peninsula. Our morning flight from Darwin had barely touched down before our hosts, the sea rangers of the Dhimurru Indigenous Protected Area, had bundled us into four-wheel-drives. Within minutes, we were bumping along the Gulf of Carpentaria's rough coastal tracks, over remnant red sand dunes that once stretched all the way to New Guinea. We were heading to Wurrwurrwuy, the site of important Yolngu rock sculptures that decorate a large bauxite shelf. Here we would collect data and advise on the proposed restoration of these extraordinary artworks, which depict a history of contact with Macassan trepang (sea cucumber) fishermen from Sulawesi, which is today part of Indonesia.

The following day, we conducted a heritage ranger workshop for the Dhimurru rangers and members of the broader Nhulunbuy community. In attendance were rangers from nearby Yirrkala and from Milingimbi community on Yurrwi Island, which is the largest of the Crocodile Island Group and about 70km south-west of the Wessels. A large contingent of Norforce reservists of the Australian Army – who patrol remote parts of the Top End coast (see AG 93) – swelled the ranks.

The aim of the workshop, which was sponsored by the Swiss Ubuntu Foundation, Minelab and Pacific Aluminium, was to sensitise the rangers and reservists to the rich heritage they will encounter on the Arnhem Land coast. Specifically, they were taught how to handle the types of Aboriginal and maritime artefacts that are often found here. On the afternoon's field visit to a former Macassan trepang processing site in Melville Bay near Nhulunbuy, everyone also had the chance to work with metal detectors under the tuition of our expert, Bob Sheppard.

That evening, as the tide rose and the sun set, our expedition boarded the *Hama Pearl II* in Melville Bay. The former pearlling boat would be our home for the next five days while we island-hopped through the Wessels. As we cleared the harbour, the south-east trade wind lashed the *Pearl's* starboard side and we battened down for a tempestuous night passage to Jensen Bay on Marchinbar Island, the largest of the Wessels.

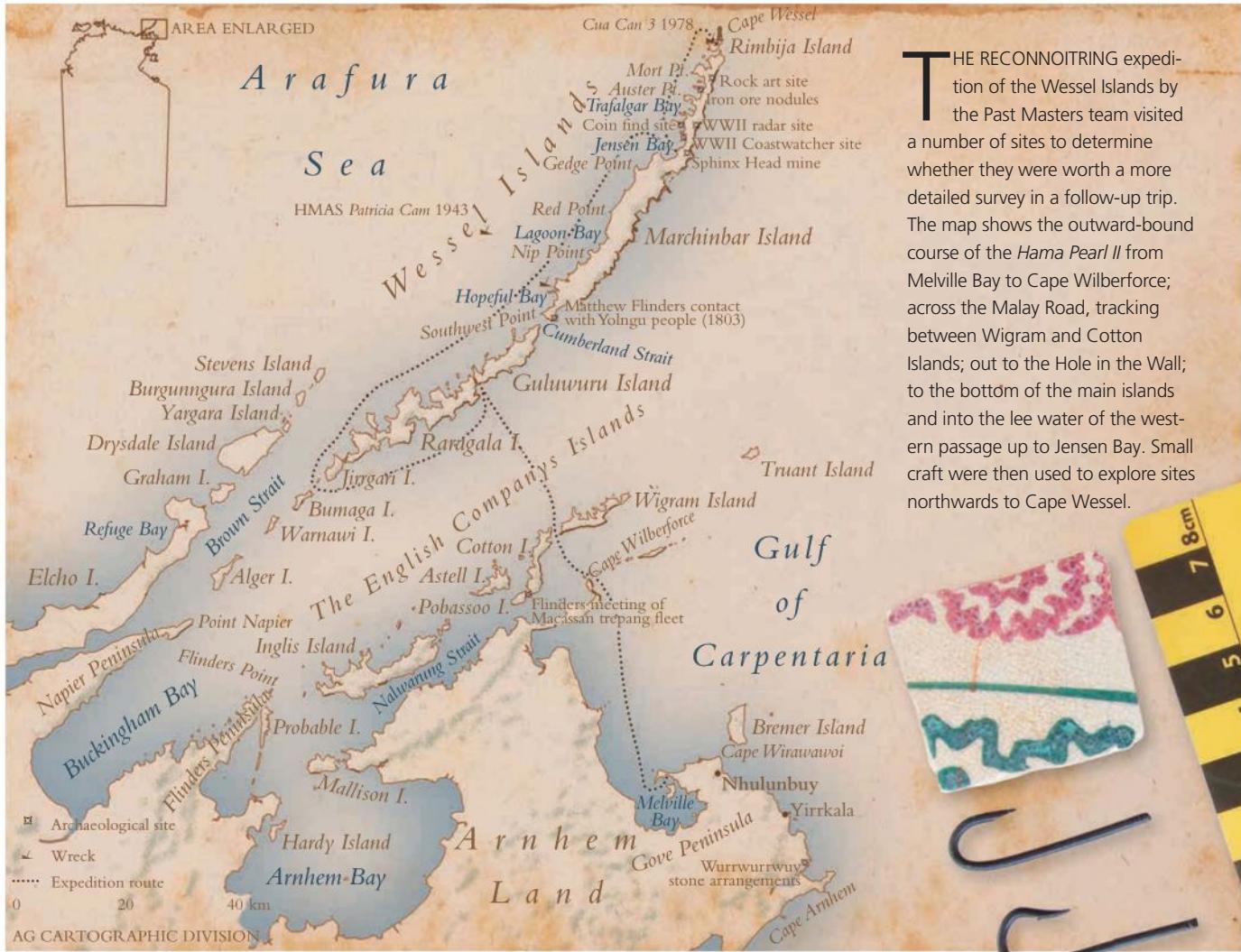
After the bombing of Darwin in 1942, Top End coastal defences were strengthened and surveyor Wyndham Richardson visited Marchinbar by air to plot a site for a radar unit and camp (see map on previous page). As we followed in his footsteps, my mind turned to his subsequent return with a construction corps by sea in 1943. This had been more hazardous than our own journey, given the bombing of nearby Milingimbi and sinking of Navy cutter HMAS *Maroubra* by Japanese warplanes.

As we arrived in the morning, the rising sun slowly revealed Jensen Bay. A low line of dunes rolled out towards a backdrop of hills. The landscape was framed by the skeletal remains of massive trees – a reminder that cyclones regularly whip through this windswept place. In the bay, shallow waters rippled over rocks and boulders, which gave way to gentle beaches. Stretches of white sand concealed turtle nests and were cut by camouflaged creeks and crocodile tracks. We were at the start of our quest.

After the first few euphoric hours ashore, we settled into a routine that we followed each day of the expedition. In the



WESSEL ISLANDS



When Isenberg found the coins in 1944, the region was still a wild, uncharted place.

mornings, some teams would be dropped off along the coast with specific targets; at midday the boats would ferry them back to the *Pearl* to eat lunch and decide on new targets for the afternoon.

Others would take a packed lunch and start early, trekking across the island to the windswept eastern shore. Hours later and tasks completed, they would radio the *Pearl* and boats bearing sea-cooled drinks would be dispatched to pick them up.

The positions transmitted by the returning teams were not always accurate and the boats would have to identify tiny figures that seemed like hermit crabs wandering along the beach. It resulted in frequent delays and depleted drink rations for the last party to be retrieved.

OUR FIRST MAJOR port of call on Marchinbar Island was marked on a map that late RAAF serviceman Morry Isenberg had drawn in the early 1980s. That was more than 30 years after he'd found the Kilwa coins (along with four Dutch coins from the 17th and 18th centuries) while fishing, not far from the Marchinbar radar station at which he was based. He had labelled the site simply "coins". We located the spot but realised the harsh landscape here is ever-changing. We pondered what hope there could be of gleaning much new information about the coins following 70 years of winds, waves and storms.

In 1944, when Isenberg found the coins, the region was still a wild, uncharted and downright dangerous place. Following the 1943 sinking of the *Maroubra* near the mainland, HMAS *Patricia Cam* was sunk in 1944 off the Wessel Islands, bombed by a Japanese float plane.

Yolngu helped rescue the survivors and Wyndham Richardson photographed many of the servicemen, construction crews and Yolngu on Marchinbar. His colleagues' names are on the backs of the photos but the descriptions of Yolngu stretched only to things such as "No. 1 Boy Djingal" or nicknames such as "Swivel Eye" and "Snowball" for some of the children. ▶



TO SEE a short film on the expedition, download the free viewa app and use your smartphone to scan this page.

Ships' graveyard. Geologist Tim Stone, left, and Brad Smith inspect the wreck of 1978 Vietnamese refugee ship *Cua Can 3* on Rimbija Island. Inset: An image taken soon after the captain, Lam Vinh, had grounded her.



Richardson's daughter, Ann Brothers, has recently supplied us with copies of the images and we are trying to identify and record the names of the Yolngu photographed, with help from communities on Gove Peninsula, Elcho Island and Milngimbi.

The geography of Marchinbar Island today is quite different from 20,000 years ago during the last Ice Age. At that time, sea levels were about 150m lower and the Wessels were distant hilltops in the middle of a vast plain that connected Australia to New Guinea. By about 6000 years ago, seas swollen by meltwater from polar ice caps had almost completely flooded this land bridge, isolating Marchinbar's bauxite-capped sandstone into a series of small islands, rocky shoals and reefs. In the millennia that followed, the great weight of the ocean bore down upon the surrounding continental shelf and, by about 3000 years ago, this pressure had forced Marchinbar upwards to roughly its current height above sea level.

Slowly the shoals and reefs became connected as waves, currents and wind conspired to form beach-ridge plains, spits and barrier dunes. A freshwater lagoon that formed at Jensen Bay probably little more than a thousand years ago is a haven and would have made Marchinbar a suitable trading port and

The Wessel Islands have the reputation of being a ships' graveyard.

useful way station for sailors to restock their drinking supplies. Our theory is that this lagoon brought the mysterious vessel that carried the five Kilwa coins to the island.

Unlike the trade winds, trade routes are fickle, but the Yolngu are survivors – pragmatism and resilience are part of their culture. Their oral histories resound with accounts of hardship and camaraderie; they tell of massacres inflicted and endured. They recall battles fought with foreign invaders, as well as times when enemies became allies and foes became family. The Macassan mariners from Sulawesi influenced virtually every aspect of Yolngu life – they brought technology, language, music and vices. Some historians argue smallpox was introduced to Australia by Macassans and that the disease quickly spread

across the continent; the northern Wessels were depopulated by it in the mid-1800s and only seasonally visited as the survivors struggled to recover.

While combing the island for artefacts, we located several campsites behind the main dunes. Using metal detectors at a number of WWII sites, we uncovered handfuls of rifle cartridges, bullets and burst ammunition cases. We found other metal objects, including a large pin, an iron chisel, many heavily corroded axe heads and one beautiful bronze screw that had been refashioned into an oyster shucking knife.

We also discovered a polished stone axe head. This was particularly significant because stone tools have been rare finds in this part of Arnhem Land, since most tools were made of materials that decay, such as wood and bone. It is thought that the trade in axe heads was part of an elaborate exchange cycle: items travelled great distances via hand-to-hand exchanges that promoted bonds among clans and language groups. Macassan items invigorated this trade system as coastal groups began trading steel axes and cloth with inland groups, in exchange for spears, boomerangs and woven bags.

THE WESSEL ISLANDS in general have the reputation of being a ships' graveyard. Matthew Flinders anchored the *Cumberland* in a bay on Marchinbar's south-east corner on 28 October 1803. Next morning, while his men were cutting up a wrecked prau (a boat used by trepangers) for firewood, they met local islanders. Reporting this encounter, Flinders – who had recently circumnavigated the continent – used the term "Australians" for the first time to name the people.

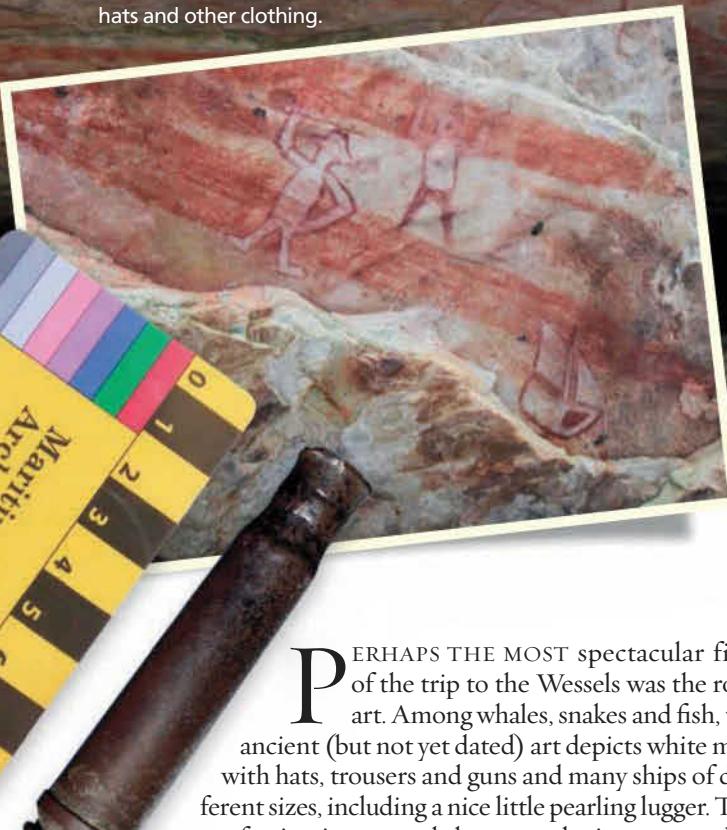
Shipwreck debris and rock art depicting many vessels can be found across the Wessels. At Rimbija Island, the northernmost of the group, what appears to be a rock slipway is littered with nodules of red laterite – iron ore used for smelting. On our next trip, the bay will be targeted to search for ballast stones and other signs of visits. Ballast was used to ensure a ship's stability; the stones would have been dumped in the bay and replaced with loads of timber, turtle shells, wax, trepang and iron ore. Those abandoned rocks probably anchor large clumps of seaweed today and will be difficult to identify. The narrow channel between Rimbija and Marchinbar is strewn with rocks. Palms and old stone fish traps guard sites where Yolngu and white men made metal knives, according to oral records. Did these white men bring the Kilwa coins?

In the end, the provenance of the coins proved to be elusive. It is unclear whether the Kilwa and Dutch coins Isenberg found arrived on the island together. They may have been carried to Marchinbar by early traders, or given to the Yolngu much later in exchange for use of the freshwater lagoon at Jensen Bay. Perhaps they were left by a collector, or were washed up after a shipwreck. In geological terms, Isenberg was just lucky to be there on the day the coins happened to be on the surface of the beach. A day later and he might not have found anything, as coins on a beach are soon buried. Nevertheless, we made great progress at mapping the island and plan to come back on a much bigger expedition. Anthropologists and a historian on our trip worked with local indigenous people to identify likely sites of contact with foreign visitors. The Yolngu are very interested in this project, and in the possibility of uncovering aspects of their past. ▶



Documenting a shared history. Heritage Detection Australia's Bob Sheppard (top, at right) teaches Yolngu rangers and Norforce personnel about metal detector techniques, near Nhulunbuy on Gove Peninsula. Traditional owner Terry Yumbulul (centre, at centre), his wife Clely, far left, and daughter Marina examine finds with team members, from left: Barry Johnson, Mike Owen, Ian McIntosh, Bob Sheppard and Tim Stone. A handful of WWII unfired .303 rounds, burst cases and bullets (above).

Proof of contact. This rock art was painted in the days of steam and sail; the spinning propeller is clearly visible, as if out of the water. The figures (below) are wearing European hats and other clothing.



PERHAPS THE MOST spectacular find of the trip to the Wessel Islands was the rock art. Among whales, snakes and fish, the ancient (but not yet dated) art depicts white men with hats, trousers and guns and many ships of different sizes, including a nice little pearling lugger. The most fascinating artwork, however, depicts a steamship with what seems to be a rotating propeller. To date, no-one has reported seeing a ship with a propeller in cave art, so it could be very important.

The expedition also found a piece of timber believed to be deck bracing for an old sailing ship. Although it, too, is yet to be dated, the timber could support the theory that the coins were washed ashore after a shipwreck. Supporting this theory, the ship with the propeller in the Aboriginal art appears as if she could be on the rocks with her back broken.

Tim Stone, geomorphologist on our expedition, speculates the coins could be from an Arab ship, similar to a wreck discovered off Sumatra in 1998. Or they may have come off a Portuguese vessel that carried Kilwa coins after the Portuguese destroyed the African sultanate in 1505.

We made some remarkable finds during our week in the field



and we established the location of key sites on which to base a comprehensive scientific study of the Wessel Islands in 2014. This will involve marine archaeologists and geophysicists from Indiana University's Office of Underwater Science – a leader in research about submerged cultural artefacts – and searching for shipwrecks will be their focus. The study will also include a detailed rock art survey to look for further clues of an ancient trading network; it will examine middens, systematically analyse evidence of iron-ore collecting and metal working, and confirm the location of mining and military sites on the island.

The Wessel Islands are an archive, holding many secrets that could rewrite histories. Collaboration among heritage managers, Yolngu community members, local rangers and government bodies is key to ensuring heritage assets are protected until their scientific, social and economic potential can be realised. In consultation with traditional owners, we are seeking to have the archipelago listed as a national park and, subject to discoveries during our next expedition, the Wessel Islands may one day be eligible for World Heritage listing.

As it stands, there are still many questions yet to be answered. But we have refined the questions themselves and next year we hope to be in a better position to answer some of them.



Join us next issue

Music pervades our lives, yet we rarely give a thought to the effect it has on us, or the science of what it does to our brains. In our special report we look at the incredible cultural **phenomenon of music** and consider its ancient origins. Also next issue, race across the **Antarctic** with wounded Aussie servicemen; experience the incredible **Wollemi wilderness** just a stone's throw from our biggest city; meet the **remarkable refugees** who have made a fresh start in rural Australia; and come for a sail on Greenpeace's **Rainbow Warrior**. Plus, for subscribers, there's an illustrated guide to **Australia's birds of prey!**

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TRAVEL & DESTINATIONS, YOUR SOCIETY, YOUR AG

Flights of fancy.

The discovery of feathered species – such as four-winged flyer *Archaeopteryx huxleyi* – rewrote what we thought we knew about dinosaurs.



DESTINATION HIGHLIGHT: CHINA PALAEONTOLOGY

Destination dinosaur

China is dinosaur central right now, with more new species found in a typical year here than have ever been discovered in Australia.

THE DISCOVERY of the first feathered dinosaur in 1996 and the tidal flow of feathered species that has followed, put China on the map as the world's most exciting place for dinosaur finds. The best places to see fossils that proved the link between dinosaurs and birds are the Beijing Museum of Natural History and the Shandong Tianyu Museum of Nature in Pingyi County. The Tianyu museum has more complete dinosaur fossils than any other, and was recently recognised by Guinness World Records as the world's biggest dinosaur museum.

Fascinating Chinese dinosaur finds, however, go way beyond feathered species, and there are huge and fantastic museums to explore in Yunnan and Sichuan, too (see page 98).

There are a number of reasons why China has such an abundance and

diversity of excellent fossils, but it's partly due to tectonic activity here during the height of the dinosaurs' rule in the Triassic, Jurassic and Cretaceous.

This activity formed mountain ranges, volcanoes, and basins with lakes that all contributed to a plethora of sediments perfect for preserving fossils. This, combined with the fact that until recently China hadn't been well explored for fossils, means there has been plenty to discover in recent decades. In contrast, Australia is low and flat, with few mountains and river valleys that might expose fossils. There's also little tectonic activity and turnover of rocks, so those on the surface are ancient and heavily weathered.

Getting there: Qantas, China Eastern and China Southern fly daily from Sydney and Melbourne to Beijing and Shanghai. From here internal flights can be taken to Kunming (Yunnan), Chengdu (Sichuan) and elsewhere.

5 OF THE BEST FOSSIL REGIONS IN CHINA

1 INNER MONGOLIA
Major expeditions from the American Museum of Natural History first struck out into the Gobi Desert in the 1920s, discovering species such as *Velociraptor* and *Protoceratops*, and the first nests of dinosaur eggs.

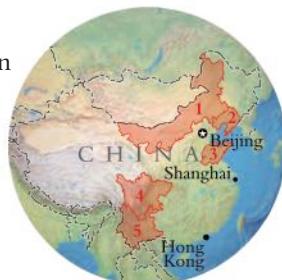


2 LIAONING
Remarkably preserved fossils from here include feathers and insect wings. Following the 1996 discovery of fuzzy *Sinosauropelta*, more than 40 feathered dinosaurs have been unearthed here, showing a seamless chain of evolution to modern birds.

3 SHANDONG
The site of duck-billed dinosaurs, eggs and nests, and also home to the Shandong Tianyu Museum of Nature, which has more than 1000 near complete dinosaur specimens.

4 SICHUAN
Has rich fossil sites for the Middle Jurassic, including hundreds of near complete dinosaurs and sauropods with unusual bony tail clubs.

5 YUNNAN
Site of the first known complete Chinese dinosaur fossil in 1938, Yunnan has since yielded more than 100 great specimens of species such as *Dilophosaurus*.



龙骨 DRAGON

Little known to the outside world, China is home to some of the most spectacular dinosaur museums and fossil sites on Earth.

STORY AND
PHOTOGRAPHY
BY JOHN PICKRELL





BONES



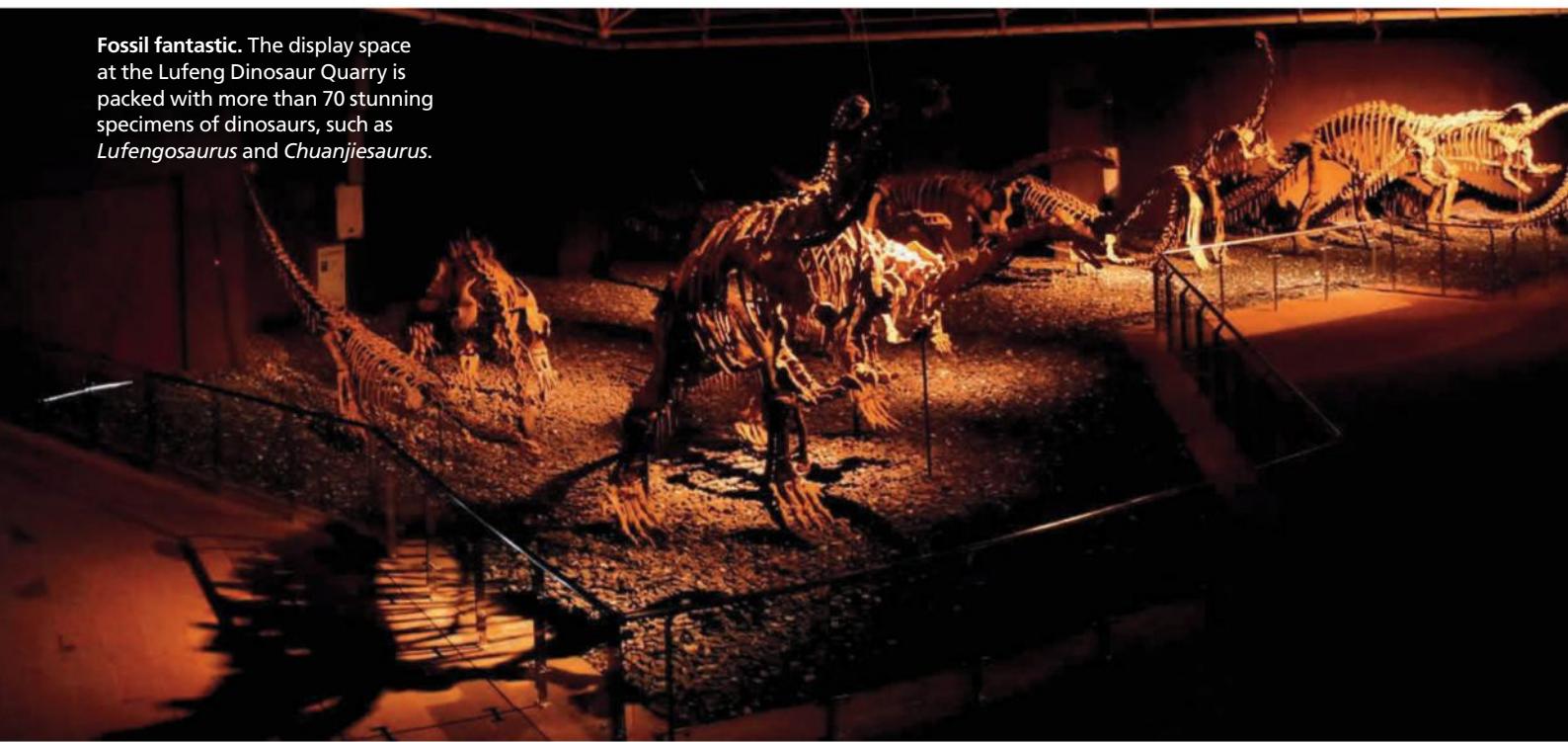
Toothy beauty. This metre-long skull of Allosaur relative *Yangchuanosaurus* is one of the best preserved skulls of a large carnivorous dinosaur in the world.

If you're a bit like me and prone to geeky tendencies, then walking into the display space and open dig site at the Lufeng Dinosaur quarry in China's Yunnan Province is an experience you will never forget. It takes your eyes a little while to adjust in the cool and dim, hangar-like space, but once they have, it's clear that what's exhibited here is something very special. All around you are great numbers of dinosaurs. Not models or casts, but carefully reconstructed, largely complete fossil skeletons of about 70 giant reptiles. They're arranged in great herds and atmospherically lit from below, so some seem to float over you as you wander among the columns beneath.

Most of these skeletons are those of primitive prosauropods, ancestors of the giant sauropods (such as *Diplodocus* and *Diamantinasaurus*), which would later reach lengths of more than 35m. The Lufeng specimens were yet to develop the same titanic proportions, but already evolution had begun to elongate their necks and sculpt them into the more familiar sauropod body plan. And although these prosauropods spent some time on all fours, they were still partly bipedal, standing on their hind limbs to reach into the trees for fresh shoots.

The fossils displayed here at the World Dinosaur Valley in Lufeng, about 60km west of Yunnan's capital Kunming, are the dinosaur equivalent of the Terracotta Army, itself dug up in the 1970s in Shaanxi Province. Like the famous warriors, Lufeng's fossil treasures are arranged in an open dig site and display space, but the dinosaurs were buried much earlier than the third century BC. In fact, the oldest, such as 9m herbivore *Lufengosaurus*, are more than

Fossil fantastic. The display space at the Lufeng Dinosaur Quarry is packed with more than 70 stunning specimens of dinosaurs, such as *Lufengosaurus* and *Chuanjiesaurus*.



190 million years old, from the Late Triassic or Early Jurassic. This makes the mudstones here among the oldest dinosaur deposits in the world.

To find even single genuine fossils on display in a museum rather than plaster casts of them is exciting, but when those fossils are largely complete and there are more than 70 of them, it's nothing short of astounding. Consider for a moment that on the Australian continent as a whole, we have found less than 20 species of dinosaur, and the majority are known from just a smattering of scattered bones. Few species are known from more than one specimen. In the Lufeng Basin alone, more than 120 individual dinosaurs of around 40 species have been found. Ten of those specimens are more than 90 per cent complete; another 60 skeletons are more than 70 per cent complete.

"This is a classical site for the study of Chinese dinosaurs. It's one of the earliest sites where Chinese palaeontologists recognised fossils and started working on them in the 1930s," says Wang Tao, World Dinosaur Valley director. "Major



Chinese palaeontologists such as Professor C.C. Young and Professor Dong Zhiming all worked here... This site is well known by palaeontologists internationally, particularly for famous species such as *Lufengosaurus*."

Another reason why the dinosaurs at Lufeng are unique is that they fill a gap in knowledge about Early Jurassic dinosaurs, which are very

Bone bearers. Yunnan and Sichuan are in China's south-west and border Tibet and Myanmar (Burma). They are among the provinces with the nation's richest fossil deposits.

poorly represented in other parts of the world. Wang says that the fact the individual fossils are so well preserved suggests they died in place at the site, rather than being washed here after death in a river or sea. "We interpret the area as a lake with dinosaurs drinking along the banks. When they died they fell in and were buried by the mud, which is why most of them are well preserved."

ALTHOUGH most people in the West would never have heard of them, China has a series of dinosaur museums that are among the world's largest and most impressive. The site here at Lufeng, and another museum at Zigong in Sichuan Province, are among very



few international sites that have large open digs with partially exposed fossils – others include Dinosaur Provincial Park in Alberta, Canada, and Dinosaur National Monument in Colorado and Utah, USA. Australia's Dinosaur Stampede National Monument at Lark Quarry in Queensland is spectacular in its own way – it has 4000 dinosaur footprints arrayed over an area of 210sq.m – but no fossil bones have been found there.

The discovery of dinosaurs in Lufeng in the 1930s has a link to World War II and the Japanese occupation of China. When Japanese troops invaded in 1937, many universities and research institutes relocated to the southwest, to provinces such as Yunnan and Sichuan, which were still under Chinese control. Because China had lost access to its major east-coast ports, it was forced to build a road to bring in supplies from British-administrated Burma. This ran through the Lufeng Basin, and it was here in 1938 that an assistant to (the now late) Chinese palaeontologist, C. C. Young, first heard reports of

The first references to 'dragon bones' date to the Western Jin Dynasty (265–371 AD).

'dragon bones' found by road workers. In the following years, a great number of dinosaurs were found by geologists led by Young, particularly primitive sauropods such as *Lufengosaurus*.

But the fossils here are not limited to the Early Jurassic; other layers reveal later dinosaurs, with Lufeng continuing to yield interesting fossils today. In the last few decades, a Middle Jurassic bone bed that covers just 3000sq.m has yielded 28 dinosaur skeletons including the giant 27m sauropod *Chuanjiesaurus*, one of the largest dinosaurs known from Asia.

Despite the new discoveries, and the fact that hundreds more dinosaurs are thought to remain in the ground here, the Chinese government has actually requested that the experts in Lufeng put a hold on what they

are digging up, instead prioritising the preservation of what they already have. "If we find too many we will have trouble preserving them and making enough space. It's better to slow down the rate of discovery and get everything we already have well preserved," says Wang. Having more dinosaur fossils than you know what to do with is in stark contrast to parts of Australia, where experts sometimes have to puzzle over just a few fragments of weathered bone.

SIMILARLY spectacular to Lufeng is the dinosaur museum in Zigong, 170km south-east of Chengdu, the capital of Sichuan Province. The first written references to 'dragon bones' (very probably dinosaur fossils) in Chinese literature date to the Western Jin Dynasty (265–371 AD), and refer to their location as on the banks of a river in Sichuan. Dinosaur fossils in general may have been the origin of the myth of the dragon in China, and it's possible that fossils of the beaked dinosaur *Protoceratops* from Mongolia, may likewise have given birth to the ▶



ancient myth of the beaked griffin.

The first dinosaur bone collected in modern times in Sichuan was found by a Californian, Professor George D. Louderback, in about 1915. Fossils continued to be found here in the 1930s, but the rate of discovery skyrocketed in the late '70s.

When a highway was built in 1972 through Dashanpu, 7km from the centre of Zigong, workers exposed fossils, but the bones didn't get much attention as China's academic community was still suffering the ravages of the Cultural Revolution, which had stymied scientific output. Seven years later in 1979, an oil and gas company began excavating a site here for a parking lot. Again workers began to find fossil bones and were perplexed as to what to do with them. Leading Chinese palaeontologist Professor Dong Zhiming, of the Institute of Vertebrate Paleontology and Paleoanthropology in Beijing, says that when he arrived in December 1979 he was shocked by what he saw.

"Fossils were everywhere, just like the peanuts waiting to be taken from the plate... As workers did not care about the bones, they did a terrible devastation at the site. My heart bled."

The great number and variety of fossils gave him the idea of pushing for official preservation of the site and working to get a museum built here to educate the public about the discoveries. Local authorities halted construction to protect the site, and between 1979 and 1981 teams led by Dong dug up about 8000 bones. In 1987 the Zigong Dinosaur Museum opened, and was the first of its kind in Asia. It has more than 30 largely complete fossils skeletons on display, as well as a great deal of interpretive information in both Chinese and English, colourful dioramas and, perhaps most fascinating, an open dig site with many of the partially exposed dinosaurs still in place.

The Dashanpu quarry at Zigong has yielded not only 26 species of dinosaur from the Middle and Late

Palaeo puller. The Zigong Dinosaur Museum (top) is a major Chinese tourist attraction, says senior researcher Professor Peng Guangzhao (above). The sprawling complex features a building in the shape of a giant sauropod, such as these three specimens of *Shunosaurus* (left).

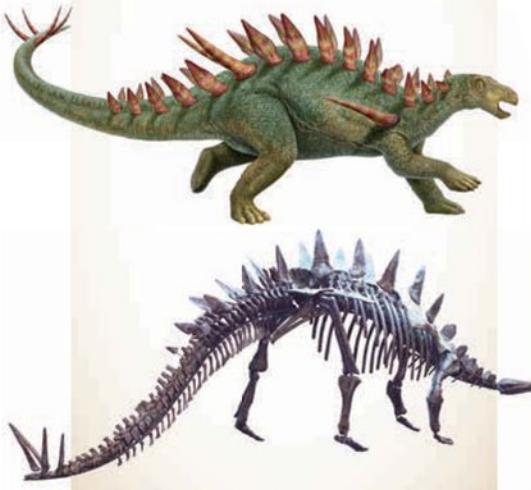
Jurassic (176–145 million years ago) but also a complete fauna of fishes, amphibians, mammals, crocodiles, plesiosaurs and pterosaurs. Other interesting fossils include eggs, skin impressions and plants such as tree ferns and ginkos.

A number of things mark the site out as special, says Professor Peng Guangzhao, senior researcher at the Zigong Dinosaur Museum. These include the fact that, as at Lufeng, there is a great concentration of fossils here. Of the 200 or so skeletons so far dug up, 10 are more than 80 per cent complete and a further 40 are more than 50 per cent so. Another reason for Zigong's importance is that it fills an Asian fossil black spot in the Middle Jurassic. The range of species ▶

*Gigantospinosaurus sichuanensis*

AGE: Late Jurassic

This medium-sized 4.2m stegosauroid had small plates along its back for defence, but also giant shoulder spikes. A fossil skin impression is one of very few known for stegosaurs.

*Gasosaurus constructus*

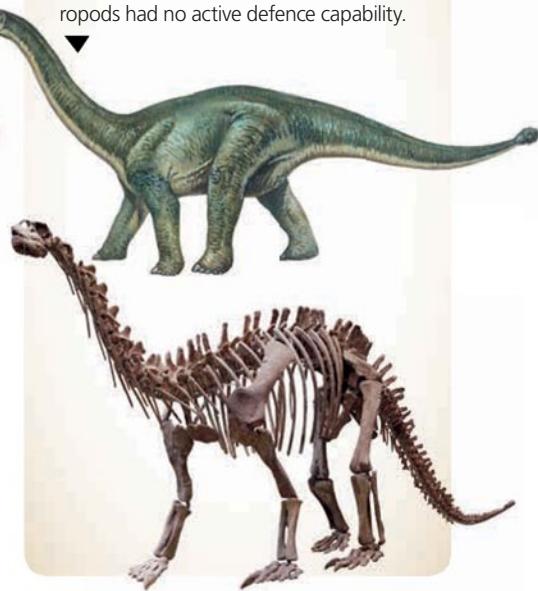
AGE: Middle Jurassic

This 3.5m killer pre-dated giant flesh eaters such as *Yangchuanosaurus*. Although it was small, large claws on its hands and feet would have made it a formidable adversary.

Shunosaurus lii

AGE: Middle Jurassic

This medium-sized, 10m-long sauropod had a bony club at its tail tip, possibly with spikes attached. This challenged the idea that sauropods had no active defence capability.



THE DINOSAURS OF ZIGONG

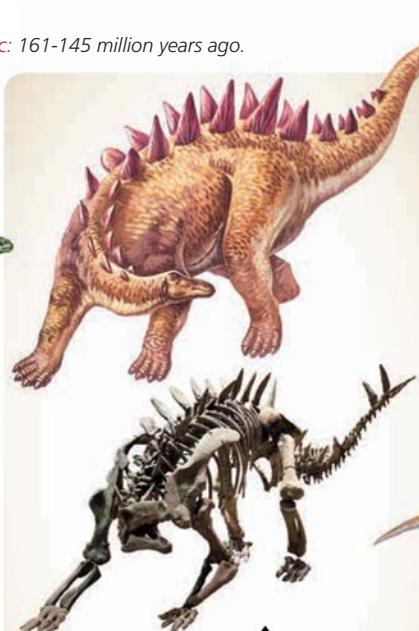
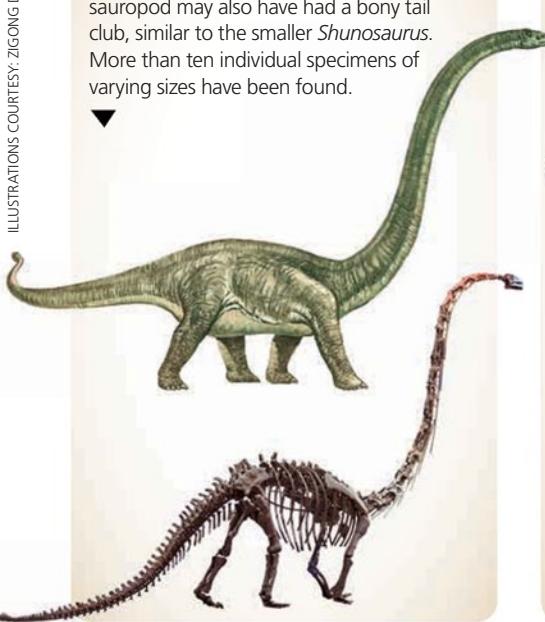
A diverse fauna including stegosaurs, sauropods and carnivorous theropods has been unearthed at the Dashanpu Quarry in China's Sichuan Province.

Middle Jurassic: 176-161 million years ago. *Late Jurassic:* 161-145 million years ago.

Omeisaurus tianfuensis

AGE: Middle Jurassic

This up-to-20m-long herbivorous giant sauropod may also have had a bony tail club, similar to the smaller *Shunosaurus*. More than ten individual specimens of varying sizes have been found.

*Huayangosaurus taibaii*

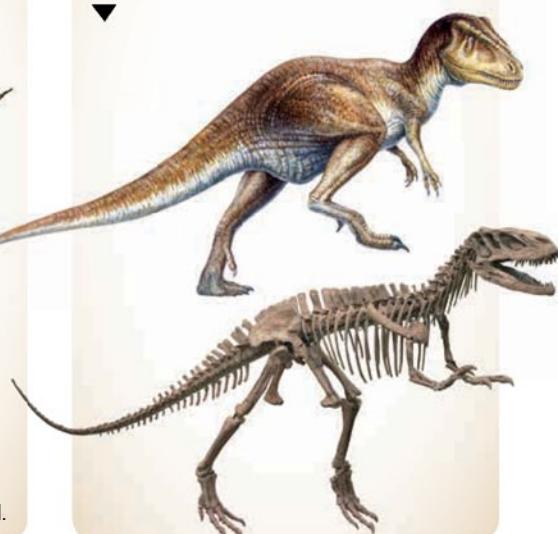
AGE: Middle Jurassic

This 4.3m-long, stocky herbivore had a row of plates along its back for defence. It is the oldest well-preserved stegosaur in the world.

Yangchuanosaurus helpingensis

AGE: Late Jurassic

Long before *T. rex*, this 9m predator stalked the herbivores of south China. A muscled head and neck, and teeth with steak-knife-like ridges, helped it tear off chunks of flesh.





DESTINATIONS



Giant job. A shot from the early 1980s shows workers collecting some of the many thousands of bones pulled out of Zigong's Dashanpu Quarry.



Chipping away. A technician prepares a fossil bone at the Lufeng Dinosaur Quarry.

found here helped palaeontologists piece together the faunas of this time.

"One hundred and fifty million years ago this was a plain with lakes and rivers, and a suitable environment for dinosaurs," Peng says. "It was perhaps a delta, like the Yangtze River. Each year during the flood season, animals that died elsewhere were carried by the floods and deposited here, where they became fossils."

Some of the most interesting fossils at Zigong include the world's most complete early stegosaur, *Huayangosaurus*, and skin impressions from another stegosaur, *Gigantopithecus*, which were among the first stegosaur skin impressions ever discovered. Giant sauropods *Shunosaurus* and *Omeisaurus* have been found with bony tail clubs – defensive structures that would have made formidable weapons to fend off bipedal carnivores such as *Gasosaurus* and *Yangchuanosaurus*. The beautifully preserved 9m-long specimen of *Yangchuanosaurus* is one of the largest and most complete carnivorous dinosaur fossils known from Asia.

Both Lufeng and Zigong may be a little bit off the beaten track for tourists in China, but if you have a passion for dinosaurs, then visits to these spectacular museums will reward you with experiences you are likely to remember for the rest of your life. **AG**



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WHEN: Departures in October 2014 and April 2015

DURATION: 12 nights

INCLUSIONS: International flights (ex Sydney), internal flights, hotel accommodation, all meals.

COST: From \$7490 per person

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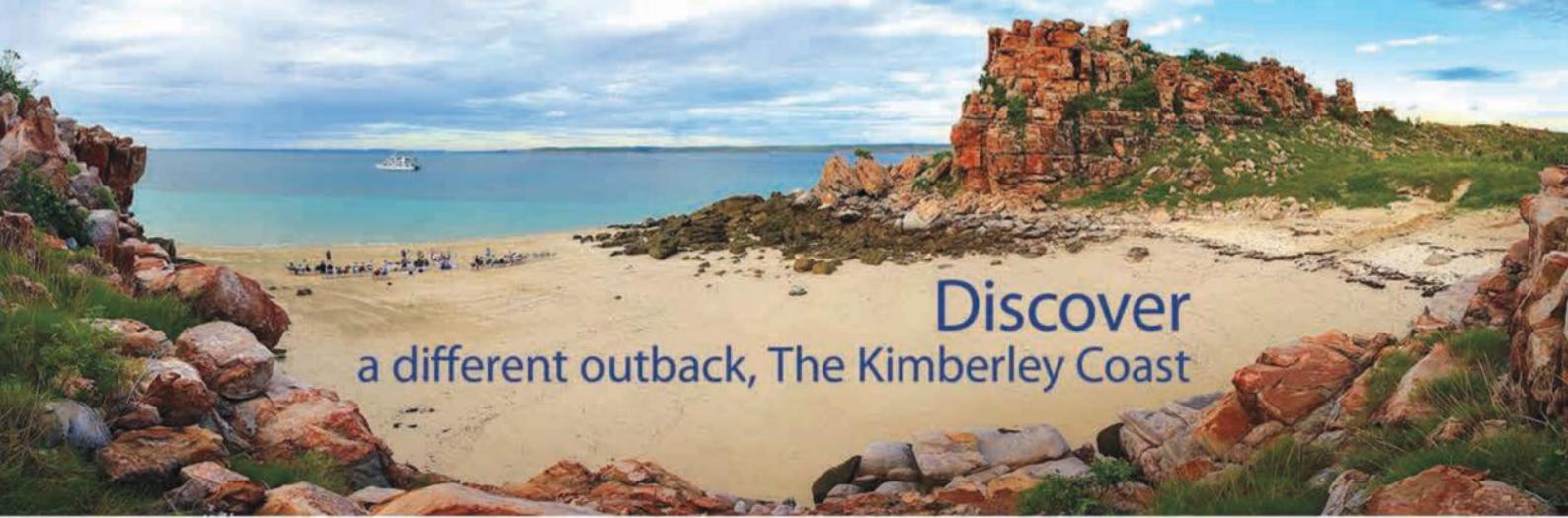
WHEN: Departures in August 2014 and April 2015

DURATION: 15 nights

INCLUSIONS: Internal flights, accommodation in lodges, gers and camps, all meals.

COST: From \$9450 per person

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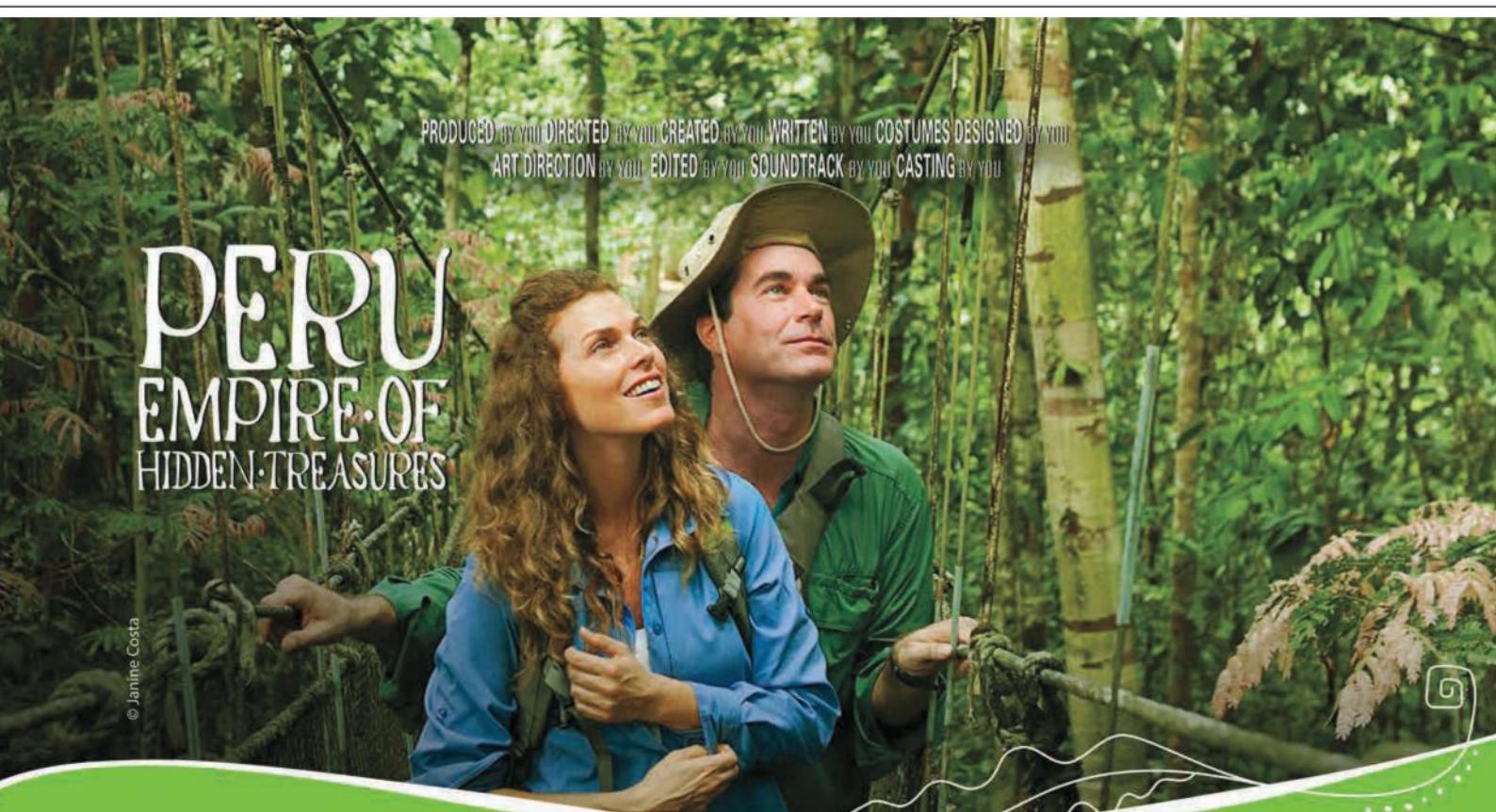
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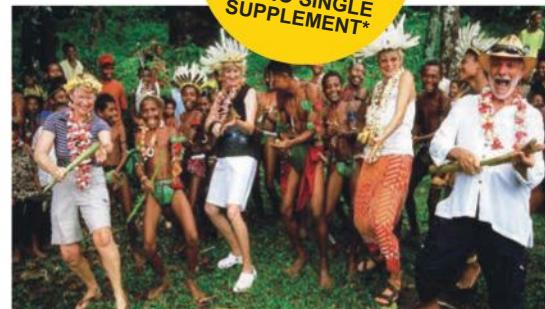
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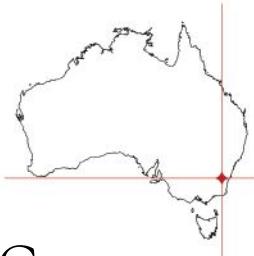
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Dream - Explore - Discover



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SUMMERNATS

Canberra is the centre of the nation's political life – and it's also the heart of the huge Australian modified-car scene.

STORY BY ADAM MORRISSEY
PHOTOGRAPHY BY THOMAS WIELECKI

EVERY SUMMER, CANBERRA'S population shrinks. The pollies decamp to their constituencies and a battalion of public servants spend their Christmas break in beach-side holiday homes around Batemans Bay. All is quiet in our bush capital. Until, that is, a few days after the new year, when high-octane petrol-heads descend – a motorised version of that other annual swarm, the bogong moth. This is Summernats. Described as Australia's biggest horsepower party, it's the spiritual home of the burnout and a world away from the verbal sparring that fills the other 361 days of Canberra's life.

It may not be everyone's cup of tea, but there's no denying the event's popularity in what is a surprisingly tribal scene. Hot rods, rat rods, customs and muscle cars; show cars, cruisers, burnout monsters and drag cars – they all rub shoulders at EPIC: Exhibition Park in Canberra.

The three-and-a-half-day show made its debut in 1988, so it's been a fixture in the calendar for more than a quarter of Canberra's life and there's no sign of it fading away just yet. In 2013, the 26th event, 101,486 paying fans strolled through the gates and 1767 cars were "entered" for the four-day extravaganza; to be allowed into the grounds, your car must be scrutinised and accepted as an entrant.

Although there's no denying that in past years the event has made the headlines for the wrong reasons (such as the riots that spilled out of the 2008 event), it's equally true that Summernats has grown up. It's boisterous, certainly, but you no longer have the sense that this is an event where the women sit out. It is a family affair, supporting a pastime that is likewise family based. Underlining that point, the ACT police made no arrests in 2013 and weren't called on to intervene in any incidents. "Overall we were very happy with the patron and entrant behaviour at Summernats this year, particularly with the large number of people in attendance," acting superintendent Rod Anderson said.



Burning up. Joe Rezo (above), who brought his family to the Nats, made sure little Ari was well protected. Burnouts create a spectacle but afterwards the car's tyres have no use other than as souvenirs (bottom).

Understandably, with the attendance numbers so high, Summernats brings millions of dollars into the ACT, which is a vital ingredient in its longevity. Summernats co-owner Andy Lopez is particularly happy that the number of attendees buying season passes increased. He knows how that would have flowed on to benefit the local economy.

For those who've never ventured through the gates at EPIC, it's a more varied event than you might imagine. There's an indoor car show where the Elite Top 60 slog it out in a beauty pageant that rewards paint, custom interiors, 'stance' (how a car sits on the road), steroid engines, build quality ▶





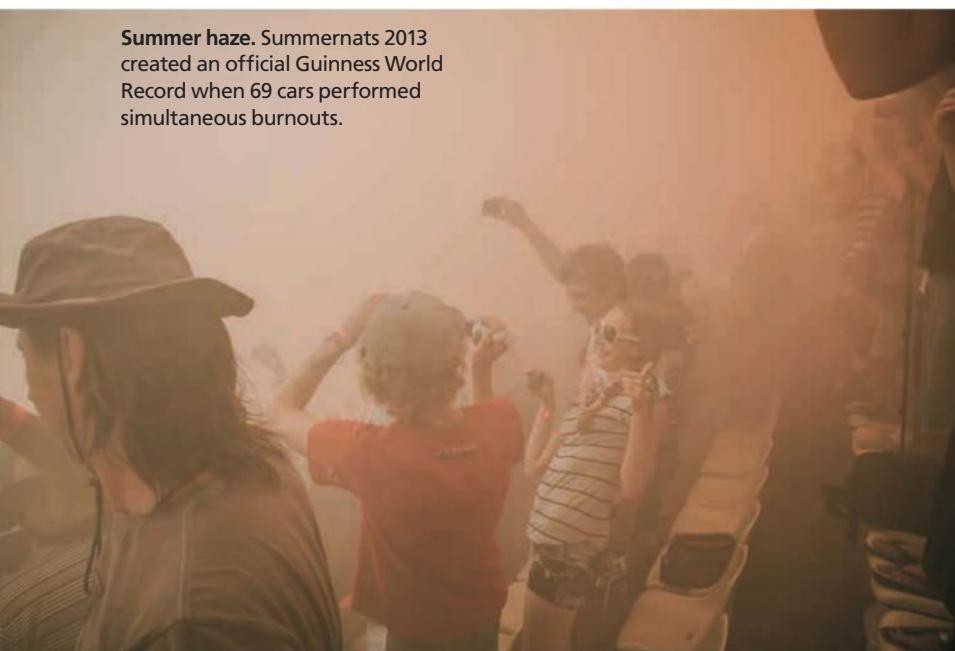
Carnival capers. Time to let off a little steam – or tyre smoke enhanced by a tyre-dye treatment, which comes in various colours. Although most adults at Summernats favour a laid-back style, kids and cars dress up (below); many cars sport a modified body and a custom paint job.



Cruise control. Dave Masalski (above, at left) in the back of his 1975-vintage panel van. His mate Sean O'Faollain, right, is working on a car that will allow him to join the cruisers (above centre) whose work is a mobile display.



Summer haze. Summernats 2013 created an official Guinness World Record when 69 cars performed simultaneous burnouts.



BEARINGS: SUMMERNATS

Where: Exhibition Park in Canberra

When: Every January

Entrants: 1500+

Visitors: 100,000+ (over four days)

Burnout facts: In last year's world-record burnout, a total of 35,000hp hit the tarmac for 30 seconds. The burnout competition usually destroys more than 500 tyres

What's on: Live bands, burnouts, cruising, car shows, grass-driving and go-to-whoa competitions, bars, kids' entertainment, trade stands, airbrushing displays, tattoo competitions

Tickets: Adult – \$120; children – \$35 (season passes; single-day costs vary)

More info: www.summernats.com.au

and innovation. You'd be amazed what can happen to a humble Holden Torana hatchback if you pour six years worth of hard labour into it, and a cool quarter of a million dollars.

"It's the best of the best of the car industry," says first-time car entrant and interstate truck driver David Masalski. "You come here to see what everyone's doing, what the latest stuff is." His HJ panel van will be back for the 2014 Summernats with a whole new look to put on parade.

Outside, those who mock the "show ponies" and "trailer queens" tucked away in the hall declare their loyalties via a popular bumper sticker – "Driven, not hidden" – and they "cut laps" (cruise around the EPIC site) all day, in machines that range from near-stock to wildly modified. Cruising is a badge of honour here and it lifts you above the pedestrian crowd.

Braver souls enter the burnout competition. Win on this stage and you'll earn bragging rights among your peers forever. But, more importantly, you've earned the right to do battle with the gods themselves – the Burnout Masters. Do yourself proud in that arena and your name will join the immortals of the sport. These men and women are performance artists. Their cars are perfectly finished showpieces and their engines are as highly tuned as V8 supercars. Yet they take these machines and thrash them. At the least, the car will end up covered in rubber and infused with smoke; at worst, they risk massive engine failures and catastrophic fires.

While everyone else parties, some people are here to do the hard work. Ricky Caton and Anthony Operoek

do the burnout pad preparation. Anthony is a Canberra lad and drives a Holden VS Clubsport but goes to Summernats to check out the other cars. "Working gets you closer to the action," he says.

Summernats Grand Champion is the ultimate prize, which can only be won by a combination of show-winning looks and innovation, proven performance on the track and popularity with the crowds (as shown by a people's choice ballot). Reigning Grand Champion is Mick Fabar, with 'Zero'd, a 1967 XR Falcon that runs a 7.3-litre turbo diesel truck engine and was built with recycled parts: panels from wrecking yards, a leather trim made of offcuts, and a certified zero-carbon-footprint build. Naturally, it's painted green.

To keep the party atmosphere alive, there are bands playing in the bars. And there's always a headline act on Saturday night – in 2014 you'll see Melbourne punk-rock band The Living End, as well as a yet to be announced "top Australian DJ" for younger audience members. The Miss Summernats competition takes place on the same stage and it's a well-ordered and well-mannered affair – the contestants' clothes stay on and the crowds stay polite or face eviction.

If you need a break from the heat, there are trade stands offering classic car parts and retro clothes for the '50s fans; there are plenty of bars, too. But, simplest perhaps, is wandering the camping grounds, where friends set up and enjoy the show rolling past. AG

SEE more of Thomas Wielecki's evocative images at: www.australiageographic.com.au/journal/issue118.htm



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1842 Shiraz 2011, Barossa Valley, SA

Rob Mack's flavour-packed Shiraz is a delicious hommage to the 'big red capital' of the Barossa Valley which all began in 1842. Bring on the juicy steaks.

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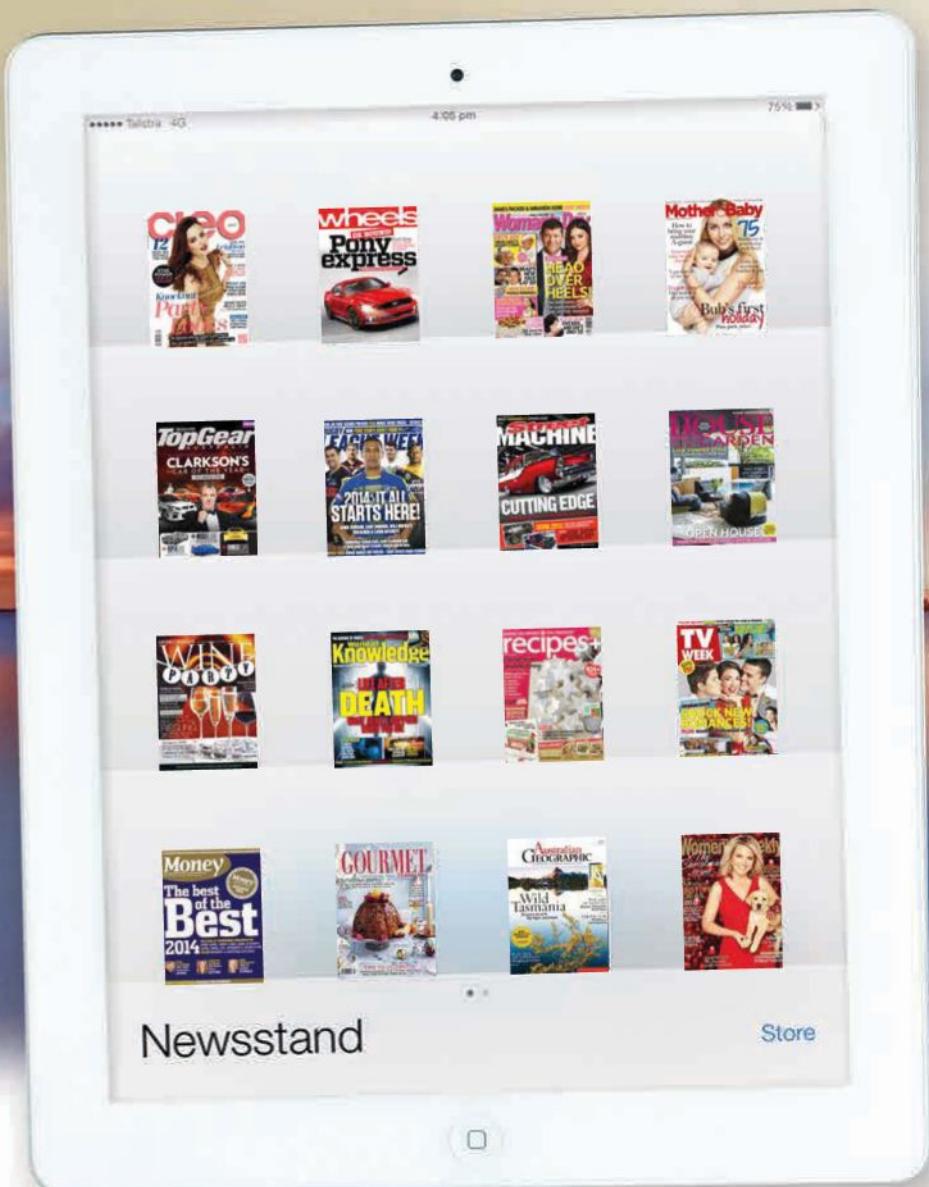


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The Australian Geographic Society runs a variety of events and expeditions to raise funds for Australian scientists, adventurers, conservation and community projects.

REGISTER YOUR INTEREST



Kimberley Scientific Expedition

We will be returning to the east Kimberley in 2015 for the 13th AG Society Scientific Expedition. Scientists and a select group of volunteers will once again venture out to the dusty roads and big skies of the remote north-west, to find out how the region's ecosystems are coping with cane toads, which arrived during recent wet seasons. We extend an invitation to AG readers to join us in this important endeavour, pitch in with the fieldwork and perhaps even feature in the journal.

COMING IN 2014



DATE:
1–7 March
2014

BEHIND-THE-SCENES: TASMANIAN DEVILS

Join Dr Menna Jones – 2005 AGS Conservationist of the Year – on the fringe of the Tarkine in north-western Tasmania to assist with Tasmanian devil field research. Enjoy a rare chance to see healthy devils in the wild, and go behind the scenes to learn more about this vital conservation work. To book, email info@curioustraveller.com.au.



DATE:
21 March–
11 April
2014

PERU AND PATAGONIA

Explore Latin America with AGS advisory councillor Ian Connellan. Begin in Buenos Aires before heading to Patagonia. Continue to Peru and follow the Inca Trail; visit the mysterious Machu Picchu and see remarkable wildlife in the Amazon. A percentage of the cost of this trip goes to the AGS. To book, call 1300 678 909 or visit chimuadventures.com.



DATE:
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August
2014

WILDERNESS ART WORKSHOP

Want to be able to paint like an AG artist? Join regular AG illustrator Ego Guiotto and artist Dr John Morrison at beautiful Fraser Island's Kingfisher Bay Resort for a residential art workshop. It will feature 'plein air' painting and drawing, guided walks, sunrise and sunset colour excursions, studio work and presentation opportunities.

For more information on these events, email society@ausgeo.com.au or visit australiangeographic.com.au/society

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Help scientists better understand mysterious dugong deaths.

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Explore far and wide on these special trips with the AGS.

YOUR SOCIETY

AUSTRALIAN GEOGRAPHIC SOCIETY NEWS & INITIATIVES

LOOKING BACK OVER A GREAT YEAR

AG Society round-up

With more than \$100,000 raised for conservation, 2013 was a good year for Society-sponsored causes.

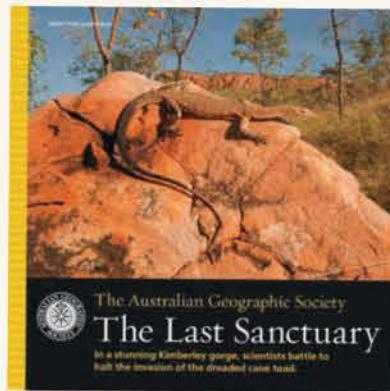
LAST YEAR, the AG Society supported a great many projects, and raised funds and awareness for a wide variety of causes. We especially thank staff and patrons of AG retail stores for their efforts in support of our in-store fundraisers.

As we went to press, our 2013 fundraisers had yielded more than \$100,000 for causes such as the rehabilitation of bushfire-affected wildlife, and for groups working to conserve tree kangaroos, Mary River turtles, mahogany gliders, orange-bellied parrots and Tasmanian devils.

In a continuing collaboration with researchers at the University of Queensland in Brisbane, and University of Kent in the UK, we supplied valuable data to researchers studying how funds are raised in conservation efforts. The results may help us to improve our own efforts for conservation in the future.

Throughout the year, we also supported dozens of adventure, science, conservation and community projects, largely through grants given to outstanding applicants. Notable examples include an archaeological expedition to explain ancient African coins discovered in 1944 on the NT's Wessel Islands (see page 86), Professor Susan Hayes' work in Indonesia to reconstruct the faces of prehistoric humans from fossils, and young aviator Ryan Campbell's solo flight around the world.

Armchair traveller. Free to subscribers with this issue; our Kimberley documentary DVD.



That effort made him the first teenager to circumnavigate the world by plane, and AG Society's 2013 Young Adventurer of the Year. The achievements of Ryan, and our other awardees, were detailed in the last issue. Well done to all our sponsorship recipients and awardees.

To give our subscribers a taste of the AG Society's activities, we have included with this issue a DVD film about our 2012 Kimberley Scientific Expedition. This important scientific trip will be running once again in 2015, and with limited places for volunteers to participate, we encourage you to apply early.

We look forward to what the rest of 2014 will bring, and can't wait to share more exciting AGS stories through the pages of this journal.

AGS CHAIRMAN'S REPORT



Kimberley highlights

See how far your assistance gets us.

IN 2012 WE INVITED two young documentary-makers and former AGS award winners – cameraman Clark Carter and eagle expert Simon Cherrieman – to document our Kimberley scientific expedition.

We wanted to show you, our dedicated supporters, just how far your generous donations go. We've been running remote expeditions for frontline research for more than 20 years, and this particular trip helped scientists begin to understand the effects of cane toads on the area.

Our documentary showcases the raw, startling beauty of the Kimberley, but also the reality of field research – scientists doing innovative, hard and dirty work, very far from home. We think what they do is vital to Australia's conservation effort and we hope that, after watching this fantastic documentary, you will too.

Gregg Haythorpe

Gregg Haythorpe, AG Society Chairman

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ECOLOGY

Dance of the dragon

Lizards that love to bust a move come under the AGS spotlight.

RESEARCHERS supported by the Australian Geographic Society have broken new ground in the quest to unravel the strange dancing language of Australia's native jacky dragons.

Taking body language to a whole new level, these dragons use a form of dance to communicate, with ritualistic tail flicks, head bobs, arm-waving and push-ups constituting the words and sentences of their conversations.

However, researchers do not yet understand just how these words are

heard – or, rather, seen. Dr Shaun New of the Australian National University, Canberra, was fascinated by the movements and eyes of the lizards and set out to study them.

"After my undergraduate degree in zoology, I went back home [to the Pilbara] to rediscover the biodiversity there," he says. "There are an incredible number of endemic species, so many of which are lizards... I just wanted to learn more about them."

This curiosity led Shaun to research the jacky dragon, a native of south-



Slinky movers.
Scientists hope to crack the secret code of the jacky dragon – an Australian native that communicates by dancing, and has incredible eyesight.

eastern Australia (found from South Australia to south-east Queensland) and one of our first native reptiles to be scientifically described.

His project used computers to plot the tail flicks in three dimensions and looked at how the dragons used their unusual eyes. Shaun found that the jacky dragons have 323° peripheral vision, compared with a human's paltry 120° .

Although the dragon's dancing code has not yet been cracked, Shaun is well on the way to learning more.



Swim team. Lachie Carracher, (left, at right), and Kim Hands, at left and below, completed the 2013 Lake Argyle challenge.



ADVENTURE

Swimming with winners

Former AG Society awardees combine forces to swim and paddle across Australia's largest artificial lake.

IN THEIR SEARCH for novel challenges, 2012 AG Society awardees Kim Hands and Lachie Carracher have proved the Aussie spirit of adventure is alive and well. "We wanted to start a tradition of the Young Conservationist and the Young Adventurer doing something together in the year they were awarded," says Kim, who was recognised for her conservation work with the Stop the Toad Foundation. "We also wanted to highlight links between conservation and adventure."

With this goal in mind, they planned to take on the 20km Rottnest Channel Swim in February 2013, with Kim swimming and Lachie, a white-water kayaker, paddling alongside her. However, the duo hit a major snag during training. In late 2012, while on a diving trip in Tonga with fellow AGS awardee Don McIntyre, Kim was paddling beside Kylie Maguire when

Kylie was bitten by a shark. After Kim pulled a bleeding Kylie into the inflatable kayak and radioed for help, the risks of the venture hit home. The idea of an ocean swim became incredibly daunting.

Kim came up with a new plan. Registrations were opened for a 20km Lake Argyle swimming challenge. Australia's largest artificial lake (AG 113) – and the home of a healthy population of freshwater crocodiles – the Argyle is in Western Australia's Kimberley, where both Kim and Lachie's award-winning projects were mostly set. With Lachie by their sides, Kim and her relay partner Amy Gates completed the swim in May 2013. The finish was exhilarating, says Kim, not only for the sense of achievement, but also because the bar has been raised for future AG Society winners.

SOCIETY FUNDRAISER

Dig dugongs out of trouble

Help experts understand threats to these enigmatic mammals.



DUGONGS ARE coastal creatures; they stick close to the shore and graze on seagrass meadows in the shallows.

Each year about 50 are found dead on Queensland beaches and some 90 per cent of these fatalities are unexplained. Researchers are looking at both the impact of development along the coast and the after-effects of natural disasters, such as the January 2011 floods in Queensland, which washed large amounts of topsoil and debris into the ocean.

The effect of such a deluge of terrestrial material into dugong habitat is unknown, but it may have had dramatic health consequences.

Your support will help the University of Queensland dugong research team find out more about the health of the species and also improve our overall understanding of tropical coastal ecosystems.



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OR VISIT our website: www.australian-geographic.com.au/society/campaigns.htm



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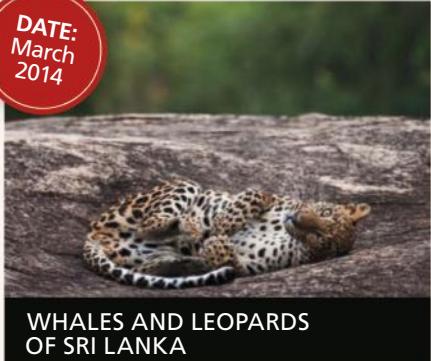
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DATE:
May
2014

DATE:
March
2014



WHALES AND LEOPARDS OF SRI LANKA

WHO: Exodus Travel

COST: From \$2630 **BOOKINGS:** 1300 130 814 or australiasales@exodustravels.com

Join editor-in-chief Chrissie Goldrick on this nine-day wildlife tour of Sri Lanka. With your camera at the ready, journey to Yala National Park in private vehicles to see leopards, before visiting the coast to search for sperm whales and blue whales from a private vessel. A percentage of the profits of this trip go towards the AG Society. Book now!

DATE:
24 August
2014



SVALBARD EXPRESS

WHO: G Adventures

COST: From \$3710pp twin-share. Quad and trip share cabins also available.

BOOKINGS: 1300 796 618 or melbourne@gadventures.com

Board the MS *Expedition* for encounters with icebergs, glaciers and wildlife. From this ship you can discover the Arctic's Spitsbergen Island. Polar bears, seals, reindeer and colonies of birds coexist in this harsh land, which can only be explored for a few months each year.

DATE:
18 April
2015



DISCOVER LEGENDS BEYOND THE BATTLEFIELD

WHO: Fairy Chimneys Travel **COST:** from

\$5767pp twin-share **BOOKINGS:** 1300 766 595 or info@gallipoli-2015.com.au

Like the original ANZACs, embark on this epic cruise to sign on for adventure and sail into history. Prepare to explore tradition, myth and conflict as Turkey unlocks its legends for you to discover. Highlights include history, cultural encounters, archaeological sites and a battlefield pilgrimage complete with ANZAC voyage re-enactment.



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AUSTRALIAN GEOGRAPHIC subscribers are eligible for all manner of discounts. Here are some of the special offers available when you show your Society membership card or quote your membership number.



THE ULTIMATE KIMBERLEY EXPEDITION

WHO: Lindblad Expeditions – National Geographic
SAVE: \$250 onboard credit
WEB: orionexpeditions.com
PHONE: 1300 361 012

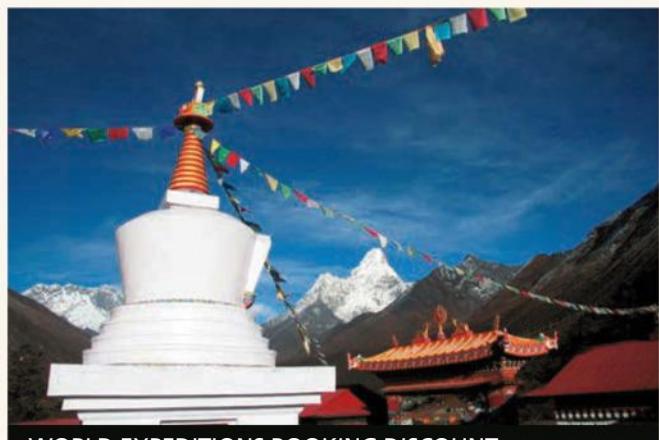
Book a 2014 Kimberley Expedition with Lindblad Expeditions – National Geographic Cruises, one of the leading expedition cruise operators in the Asia-Pacific region, and receive \$250 to spend on board. Applies to new bookings only. Please quote "AG".



KIMBERLEY COAST EXPEDITION

WHO: Aurora Expeditions
SAVE: 10% discount
WEB: auroraexpeditions.com.au
PHONE: 1800 637 688

Discover a different outback on a cruise along WA's Kimberley Coast! Led by the original Kimberley Adventurer, Mike Cusack (AG's Wilderness Couple), you'll be taken on the adventure of a lifetime with activities including rock painting interpretation, swimming under waterfalls, bush walks and beach BBQs.



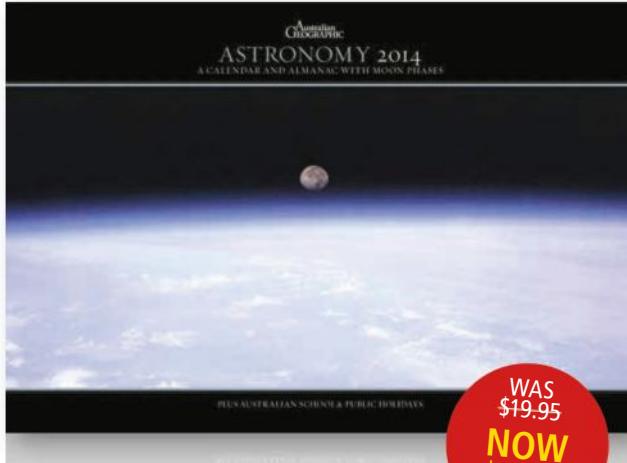
WORLD EXPEDITIONS BOOKING DISCOUNT

WHO: World expeditions
SAVE: \$100 off any new trip booking valued over \$1000 in 2014 for travel before 31 December 2014.
WEB: worldexpeditions.com

Bookings must be done with World Expeditions retail offices or at www.worldexpeditions.com. Offer is per person, per booking. The voucher can be used on brochured World Expeditions branded trips only and is not valid for private group bookings. Quote 'AUS GEO' to redeem.

Australian GEOGRAPHIC

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CODE: AGR106

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CODE: AGR104

▼ HOUSEHOLD ORGANISER

Size: 240 x 350mm

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CODE: AGR103

WAS
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NOW
\$9.95



▼ AUSTRALIAN WILDFLOWERS

Size 240 x 350mm

Featuring stunning wildflower photography, this calendar contains big, clear grids and lists all Australian school and public holidays.

CODE: AGR101

WAS
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NOW
\$9.95



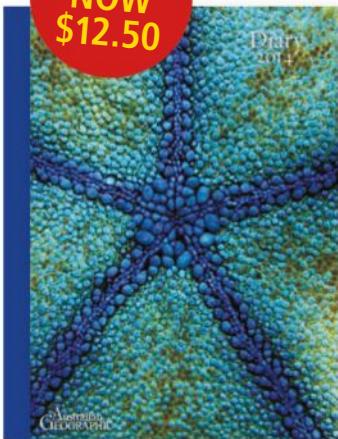
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Australian
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\$9.95



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WHAT'S ON
Highlights of exhibitions and events from across the nation.

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Your social media comments on our stories.

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DEAR AUSTRALIA
Frank reminisces about an adventure with traditional owners in remote WA.

YOUR AG

FEEDBACK, READER PHOTOS, BOOK REVIEWS & ASK AN EXPERT

YOUR PHOTOS

Seaside serene
by Kyal Sheehan

I took this early morning photo of Sydney's Bondi Baths using a long exposure to soften the ocean.

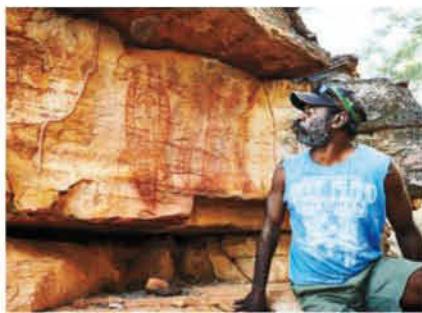
Submit your photographs for possible publication at: australiageographic.com.au/journal/reader-photos-your-shots-of-australia.htm



PROTECTED LANDS

What a fabulous story (*Trendsetters*, AG 117) about Kakadu traditional owner Jeffrey Lee stopping the mining of traditional land and then handing it over to the national park. The story goes to show that even vast amounts of money are insignificant compared with strong links to the land. This brave and noble act should be trumpeted on the front page of every Australian newspaper. Well done.

JOHN R. FRANCIS, OAM, HORSHAM, VIC



Kakadu dreaming. Jeffrey Lee of the Djok clan at Koongarra, now part of Kakadu National Park.

DESERT MEMORIES

Having travelled through much of our desert country, I thank you for a most enjoyable desert special issue (AG 116). It brought back a lot of memories, such as the time I left our Simpson Desert camp early in the

morning to capture the glorious colours of a desert dawn. I was pleasantly surprised to see a black dingo watching me from a nearby dune. Being quite used to the pale golden dingo, this one really stood out. How interesting to see a white dingo featured in John Muir's Strzelecki crossing.

GWEN BARRY, RIDGEHAVEN, SA

LAND RIGHTS

It is unfortunate that Marcia Langton (*The Aboriginal balancing act*, AG 115) has to resort to antagonising language in comparing wilderness campaigners to the "far right". This is absurd because the conservation movement has been the most vociferous supporter of Aboriginal land rights. This does not mean, however, that

conservationists will never oppose inappropriate use of land controlled by Aboriginal people (mining of high-conservation-value land for instance). Ruined land is ruined land.

The 'real' travesty of justice that Marcia Langton speaks of is that the very industry she unconditionally supports is the one that will forever deny Aboriginal people real land rights. As long as Aboriginal people do not have veto [power] over proposed mines, the concept of land rights will be largely imaginary. Claiming that mining will rescue Aboriginal people and deliver benefits forever is the same logic Europeans have been using ad nauseum; and the result is a degraded environment and a human population in a great deal of trouble. Instead of finding evils in the conservation community, Professor Langton should perhaps be joining their ranks to ensure that something remains of the natural world that her ancestors occupied.

CHRIS BELL, FERN TREE, TAS

TRUE MOTIVES

As a long-time reader of the magazine, I find the content of most issues interesting, informative and well written. However, the commentary by Dr Benjamin Thomas Jones (*Embracing the enemy*, AG 116) misrepresented the facts in saying that the 19th-century explorers saw themselves as heroes in the making.

Sturt, Eyre, Stuart (who was responsible for lifting the 'veil of mystery' over the centre of Australia), the Forrest brothers, Giles and Gregory, were self-effacing and definitely not given to keeping journals just to "thrill the public with tales of brave adventure and to ensure their own celebrity and legacy".

I have read each of their journals and all of them are narratives of their journeys. None of them mention what must have been privations in the extreme. Giles was occasionally given to expressions of imagination and hopes, but this does not distract from his very readable journals setting out his routes and distances. He was driven by a burning desire

Continued page 126 ▶

Inventions

WITH DR KARL KRUSZELNICKI

THE SELFIE

HELLO, and welcome to my first column here in AUSTRALIAN GEOGRAPHIC. The loose theme is Australian innovation. So I thought that I would start off with how we Australians brought a new word into the English language, and my small part in this discovery.

Back in 2002, Nathan Hope went out for a mate's 21st birthday and had a little accident. On 13 September, he went onto an online forum (using the pseudonym Hopey) to ask about the dissolvable stitches that were now in his lower lip. People asked him how he came to get these stitches, and at 3.19pm, he typed:

"Um, drunk at a mates 21st, I tripped ofer [sic] and landed lip first (with front teeth coming a very close second) on a set of steps. I had a hole about 1cm long right through my bottom lip."

He then posted this "self-photograph" (below) showing the stitches in his lower lip.

And then, according to the Oxford English Dictionary (OED), he posted the very first written use of the word 'selfie', in any medium (paper or electronic).

And sorry about the image quality, it was a selfie.



Snap-happy. Karl demonstrates the 'selfie' with a shot from his own phone.

The OED is the definitive record of our rapidly evolving English language. In November it declared that the Word of the Year for 2013 would be selfie. Over the previous year, the usage of this word had increased by an astonishing 17,000 per cent.

This was measured by doing a statistical analysis of the Oxford English Corpus, which is an electronically stored structured set of texts. Each month some 150 million words are collected. This database is statistically analysed every day to track new and emerging words – and selfie was the most often used. Runners-up for the Word of the Year included 'twerk' (to dance in a low squat in a sexually provocative manner, using thrusting hip movements), 'binge-watch' (to watch many episodes of a TV show in one bout) and 'showrooming' (visiting showrooms to examine goods before buying them online).

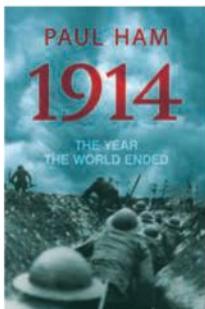
And what was the forum where Hopey posted the first-known use of selfie? It was my very own Dr Karl Self-Serve Science Forum on the ABC (www.abc.net.au/science/drkarl/)!



Gob-smacking. The first 'selfie', a term coined in 2002 by Nathan Hope.

DR KARL is a prolific broadcaster, author and University of Sydney physicist. His 34th book, *Game of Knowns*, is published by Pan Macmillan. Follow him on Twitter at: twitter.com/DoctorKarl

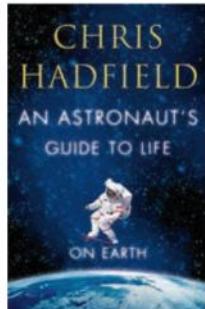
AG'S BOOKSHELF



1914, The Year the World Ended

PAUL HAM, WILLIAM HEINEMANN, \$49.95

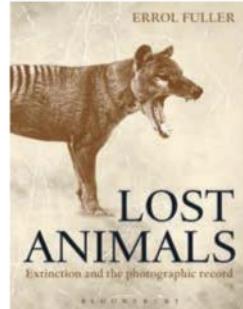
Prize-winning Australian author Paul Ham's thesis is that the men who ran Europe either willingly chose, or weakly agreed, to go to war in August 1914. This contrasts with the common belief that governments ineptly "sleepwalked" their way into the conflict. His judgement is that World War I – which wounded or killed more than 37 million people and paved the way for the Russian Revolution, Nazism and the Cold War – was avoidable. His closely argued evidence is drawn from primary national archives, classic texts and from new sources.



An Astronaut's Guide to Life on Earth

CHRIS HADFIELD, MACMILLAN, \$32.99

Canadian astronaut Chris Hadfield is famous as the commander of the International Space Station. Chris oversaw an emergency spacewalk and skilfully engaged those of us back on Earth through his wonderful photographs and videos about life in space (plus there was his zero-gravity rendition of David Bowie's *Space Oddity*). He tells his story through anecdotes and has plenty to draw from: he was selected as an astronaut in 1992 and led 25 shuttle launches. The book is highly readable and the author's enthusiasm is charming.



Lost Animals, Extinction and the photographic record

ERROL FULLER, BLOOMSBURY, \$49.99

By restricting his focus to extinct animals of which there are photographs, writer and artist Errol Fuller has assembled a chronicle of animals – mammals and birds – that have become extinct from about 1870, to as recently as 2004. It is a poignant book, indeed. Perhaps because drawings of animals in the wild are usually scientific, they lack even a hint of the personality of the creature. But these photographs can't help but communicate a sense of the animal's individuality, giving emphasis to our loss.



CANBERRA

ON COUNTRY: CONNECT, WORK, CELEBRATE

An exhibition of indigenous land- and sea management practices.

When and where: Until 20 July, National Museum of Australia, Canberra.

More information: www.nma.gov.au/exhibitions/on_country/home

HOBART

ROYAL HOBART REGATTA

Tasmania's oldest sporting event began in 1838 and broke a Guinness world record last year.



When and where:

8–10 February, Regatta Ground, Queens Domain.

More information: www.royalhobartregatta.com

SYDNEY

FLICKERFEST FESTIVAL

Watch great short films at the beach.

When and where: 10–19 January, Bondi Pavilion, NSW.

More information: www.flickerfest.com.au

LEURA, NSW

THE LEURA SHAKESPEARE FESTIVAL

Sport for Jove performs *Much Ado About Nothing* and Edmond Rostand's *Cyrano de Bergerac*.

When and where: 11–15 January, Everglades Gardens, Leura, NSW.

More information: www.sportforjove.com.au

BOYUP BROOK, WA

BOYUP BROOK COUNTRY MUSIC FESTIVAL

It features country music artists, bush poetry and a street carnival.

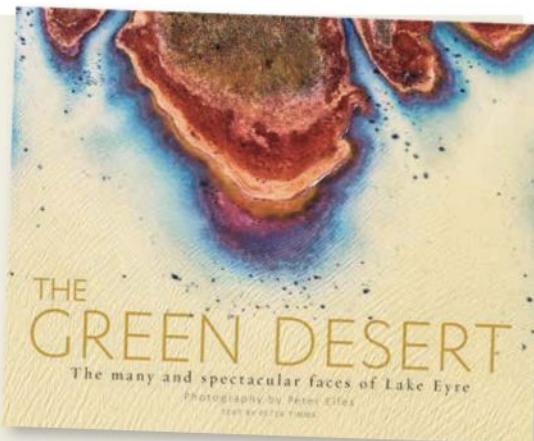
When and where: 13–16 February, Boyup Brook Music Park, WA.

More information: www.countrymusicwa.com.au

Competition



WE HAVE five signed copies of Peter Elfes's beautiful book, *The Green Desert: The Many and Spectacular Faces of Lake Eyre* (HarperCollins, 2013) to give away. Peter has been photographing the Lake Eyre region for five years, and in this book he reveals the spectrum of colours, the dramas and the infinite changes that can be witnessed here. You can enter the competition by downloading the free



viewa app and using your smartphone to scan this page, or by visiting the AUSTRALIAN GEOGRAPHIC website.



to ascertain what lay in the country that was unexplored. This same ambition was the overriding motivation for all the brave men mentioned.

DEAN J. HARRIS, SOMERTON PARK, SA

HUNTERS AS HELPERS

I read with interest Mike Braysher's article regarding recreational shooting in national parks. As a hunter with more than 45 years of experience, the idea of opening the parks seems sensible. The National Parks and Wildlife Service (NPWS) is hard-pressed to devote the time, energy and resources to controlling feral pests. Any hunting in the parks should see the park closed to the public during these times. Only those with appropriate marksmanship skills should be allowed to participate. If managed correctly, I have little doubt that an ongoing program of shooting feral pests would contribute to controlling these unwanted aliens.

JIM JEFFERS, CANTERBURY, VIC

Editor's note: The NSW government says the 12 parks selected for the trial are all far-western parks with low visitor numbers. Hunters are now required to integrate and work with state pest management services.

YOUR PHOTOS ▲

Battle of wills

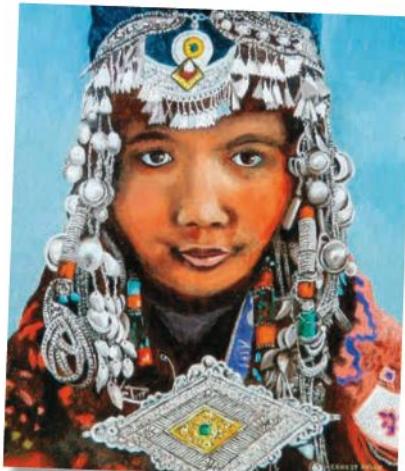
Scotty McAdam

The moment this dingo caught sight of me at Myall Lakes NP, he stopped and looked me up and down. He quickly decided I was no threat, and kept moving.

ART IMITATES LIFE

In September 2013, I requested and received permission to do a painting of a girl from the Spiti Valley, in the Himalaya Mountains of north-eastern Himachal, India, based on a photograph from your story *The lost kingdom of Shambhala* (AG 106). Here is a photograph of the finished painting, done in oils. I hope you like the result.

ERNIE KELLY, JEWELLS, NSW



Talkb@ck

MID-FLIGHT MYSTERY

When we marked the anniversary of the 1935 disappearance of famous aviator Sir Charles Kingsford Smith, you shared some of your thoughts with us on our website, Facebook and Twitter.

Legend! His life story is definitely worthy of a feature film.

ALLEN JAMES COOK

Be sure to visit the awesome likeness of him if you're ever in Gosford, NSW. He has a commanding view from Rumbalara Reserve.

MAURICE VAN CREIJ

My dad flew with Smithy, way back then!!

NERRY MURRAY

Smithy was my earliest childhood hero. I still take the time to visit the memorial in Brissie now and then.

RUSSELL STEWART

What an amazing life and example to reach out beyond the norm... Sad end.

JENETTE POHLMANN

Yes and we have an airport named after him but nobody calls it by its name. It is always referred to as Sydney Airport. What a shame!

EVELYN HANSTEIN



GET INVOLVED IN THE CONVERSATION
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ASK AN EXPERT



Q What do ants do in the winter? Where I live in Tasmania, I never see them during the winter.

CLEA EYKELKAMP, TAMAR RIVER, TASMANIA

A **PROFESSOR ALAN ANDERSON,**
CSIRO DARWIN LABORATORIES, SAYS:

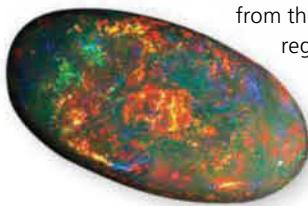
The activity of ants in cool-temperate regions, such as Tasmania, is highly seasonal. Most species prefer high temperatures and so have low activity during colder months; they just stay inside the nest. The times of the day that ants forage can also be highly seasonal. During colder months most foraging occurs during the middle of the day. In summer this time of day is often too hot for foraging, so most activity occurs in the early morning, late afternoon, or at night. Some species forage only during the night (nocturnal) in summer and only during the day (diurnal) in winter. One Tasmanian species – Hickman's epaulet ant – is remarkably adapted to the cold in that it forages only at night during the colder months!

Q "Why is Australia so rich in opals?"

VAL SMITH, PADSTOW, NEW SOUTH WALES

A **PROFESSOR PATRICE REY,**
UNIVERSITY OF SYDNEY, SAYS:

Almost 90 per cent of the world's opals are found in central Australia. There are several reasons for this. Opal generally forms within 20m of the surface in a silica-rich gel. Around 100 million years ago, a vast sea that covered 60 per cent of Australia – from Coober Pedy in the south to the Gulf of Carpentaria in the north – began retreating. This drying out increased acidity levels at shallow depth, releasing silica through the weathering of sandstone and causing the formation of common opals in the resultant silica-rich gel. Further weathering lowered the acidity again, allowing precious opal to form. The vibrant colour in precious opal comes from the refraction of light through regularly arranged silica spheres. The spheres in common opal are less regular in pattern and diameter, which results in a duller colour.



GOT A
QUESTION FOR
AN EXPERT?

Email it to
editorial@ausgeo.com.au

Dear Australia...

WITH **FRANK POVAH**



A DEBT OWED

FOR ME, Australia is a sacred being, nourishing a multitude of creatures that rely on her bounty for their existence. I feel privileged to be old enough to have seen some of her special places when they were still largely unscarred, and I've always felt pride in how AG brings the wonder of our country home to those who may not be able to experience it firsthand.

Every now and again, we publish an issue with special meaning for me. The stories on the Wessel Islands and the dugongs in this edition awoke vivid memories of childhood experiences on Cockatoo Island in WA's Buccaneer Archipelago, and sent my mind back many decades to that magical place. Its waters nurtured a giant coral garden crammed with life. It was common to see acres of sea churned to foam by feeding fish or great schools of belly-flopping mantas.

Despite my conscience, I still feel a thrill when I remember being taken by Aboriginal people on traditional dugong and turtle hunts. Out on the water in a tiny dinghy, oars muffled with hessian sugar bags, I would sit on the stern thwart behind

the oarsman, hardly daring to breathe, for I'd been told dozens of times that dugongs and turtles can hear us.

The spearman stood in the bow, weapon at the ready and silently indicated the direction the boat should take by the tiniest shifts of his body. "It seen h'our shadow move too, boy," I was told. He dropped one shoulder: "left"; then both: "slower". Another shrug and the oars were stilled, the dinghy drifting above the seagrass. The initiation scars on his shoulders rippled as he tensed, and then – *thwissht* – away went the spear. Harpoon in the quarry, the line hissed out and the dinghy raced through the water until the dugong or turtle tired. The hunter then hurled himself overboard to secure the catch, which was dragged to the dinghy and quickly killed. Later, I was given a bit of meat to take home to Mum for "bein' such a good luck".

It may prick my conscience now, but it wasn't my childhood heroes who brought these species to their parlous state. It also reminds me that I owe much to our beloved land and its indigenous peoples.



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The anti-fan

LAT/LONG 108

THOMAS WIELECKI, left, is not really a Summernats fan. He's not a great lover of cars, although many of his jobs are for car magazines. "People and travel, that's what I'm good at. All that technical car stuff is a bit boring," says the photographer.

Thomas admits that when Summernats started, in 1998, he was excited. "It was one massive riot – drunks, sweat, screaming, fights. It was the closest I knew I'd get to being a war photographer and I loved it." He's attended about nine since then. "It's less of a war zone [now], with the security and everything." But when offered the AUSTRALIAN GEOGRAPHIC job, he jumped at the chance to document the crowd.

Thomas isn't sure why he "can go up to anyone and ask them to do just about anything for a shot and they will". A friend says he has "a disarming manner", but Thomas claims he's a shy person. Put a camera in his hands, however, and he changes – he's willing to front anyone.

Wacky antics

THE GOOD LIFE 38

WRITER FLEUR BAINGER, above, grew up in South Australia and moved to Perth in 2006. Until a couple of years ago, her visits to Rottnest Island were only daytrips. "I just didn't get it," she says. "People raved about Rotto but I couldn't understand what was so special."

Then Fleur took a short holiday, staying on the island for two nights. "It's a completely different place after the last ferry leaves. So tranquil. And the residents are so happy – they think they're the luckiest people in the world... Some of them hardly ever go to the mainland. 'Why bother?' they say."

Photographer Andrew Gregory has been interested in Rottnest for a long time and Fleur became just as enthusiastic. The pair ventured out to a small rocky island just off Rottnest to go snorkelling. "Those seals were so playful," she says, "and it looks as though I was mirroring their wacky antics!" According to the locals, Fleur says, most of the good snorkelling spots on Rottnest are safe as they're not very deep; sharks are usually only a problem beyond the outer reef.



REWIND



Forged by fire

PHOTOGRAPH BY BRENT MELTON AG 17, JAN-MAR 1990, PAGES 82-103

EAGLE-EYED CLOVIS SASSINE PLUCKS a pair of fused flagons from the production line of a glass-manufacturing works in the Sydney suburb of Waterloo in 1989. The alchemy of fashioning glass from the base ingredients of lime, sand and soda through intense heat was first practised by the ancient Egyptians, and the process has changed little in the intervening 4500 years. Additions to the basic recipe create variations in the finished look or function of glass and these formulas remain closely guarded secrets. Photographer Brent Melton documented many facets of Australian glassmaking for this story – from the noise, grime and heat of large-scale industrial processes – such as the Australian Consolidated Industries (ACI) bottle-making factory where Clovis worked – to the deft skills of traditional glassmakers who hand blew individual pieces. ACI, one of the world's largest glass-container makers, extinguished its furnaces in 1997 and moved out of the city; the former factory site is now a desirable patch of Sydney real estate, known as Crown Square.



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Duration: 10 days

Rio Carnival Package

From: AUD \$2,790*

Visiting: Rio de Janeiro

Duration: 6 days

South America Circle

From: AUD \$6,860*

Visiting: Rio, Iguasu, Buenos Aires, Cusco, Lima, Puerto Maldonado, Puno

Duration: 21 days



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