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KAKADU • VAMPIRISM • BICENTENNIAL PARK • DINOSAURS
DENSEY CLYNE • SHARK NETTING • ROBYN WILLIAMS

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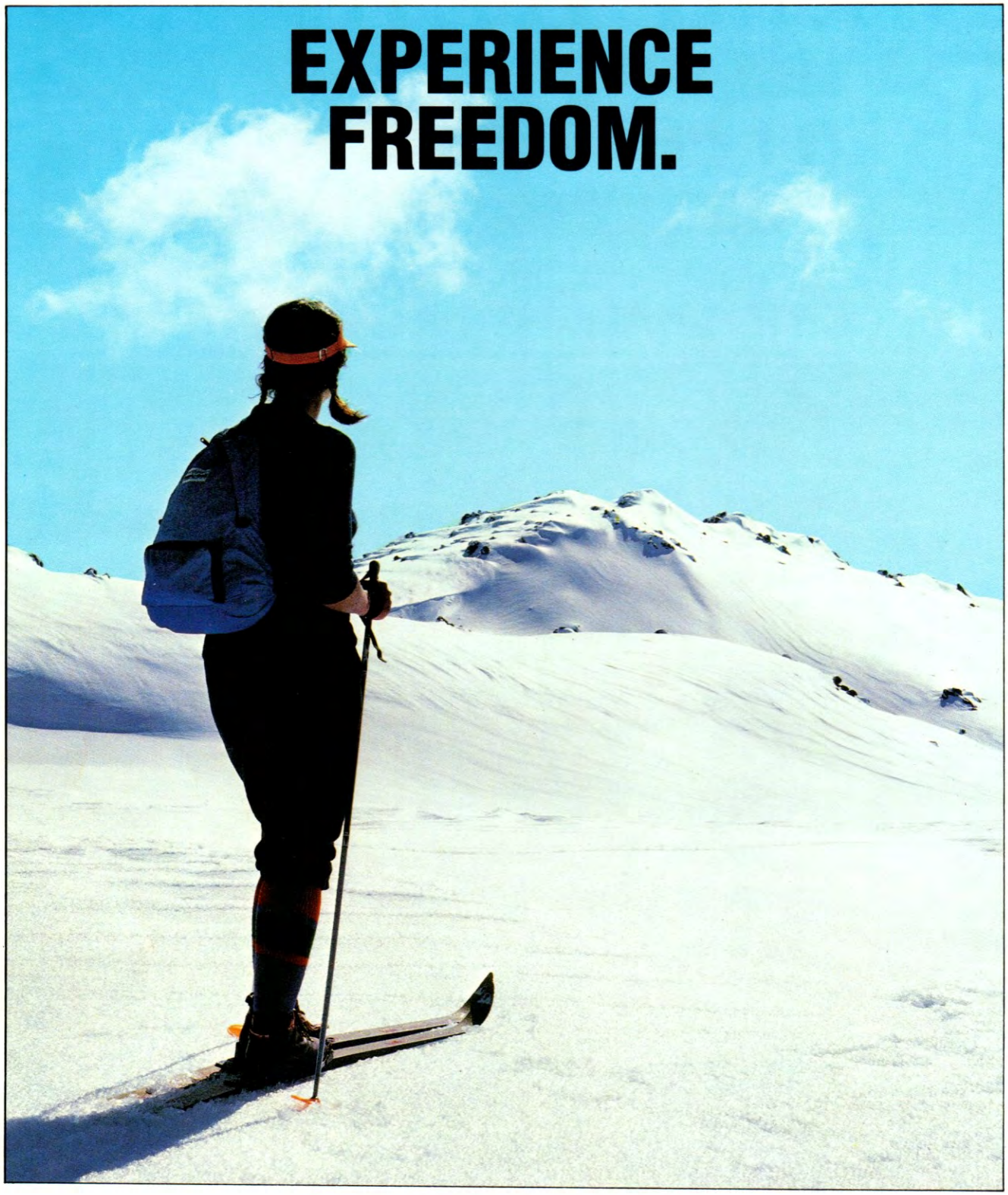

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Australian Natural History

from the INSIDE

Vampires . . . those awe-inspiring, blood-sucking creatures of lore and legend. This issue of ANH reveals the lesser-known facts behind the better-known fiction — facts that might make your blood curdle. Discover Australia's own endearing vampire — the Yarama of Aboriginal legend — superbly illustrated by artist Peter Schouten. We also look at the revised status of Queensland's flying-foxes and a rare photo of a Gould's Long-eared Bat with her tiny twins. Is the Federal Government managing Kakadu National Park in the best interests of the local Aborigines and have the demands of tourism spoilt the beauty and tranquility of the area forever? Find out from Kakadu expert Allan Fox. One of the most significant bicentennial projects for New South Wales is a huge public park in Sydney's western suburbs. Our exclusive article documents the future of this unique multi-purpose resource. Does the efficiency of shark-netting along Australia's east coast justify the cost? The answer may surprise you. ANH introduces yet another regular contributor, the ABC Science Show's Robyn Williams. His provocative article concerning the politics of environmentalism poses some serious questions. We hope you enjoyed last issue's Eastern Pygmy Possum poster. This time you can liven up your living-room wall with one of Australia's most colourful paradise-kingfishers.

Rob Cameron, Editor.

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Two young Numbats, *Myrmecobius fasciatus*. One has been caught in the act of poking its long tongue out. Photo: A. G. Wells NPIAW

Australian Natural History

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Trust President: Kris Klugman
Museum Director: Desmond Griffin

EDITOR
Robert Cameron

ASSISTANT EDITOR
Georgina Hickey

CIRCULATION
John McIntosh

ART DIRECTOR
Sue Oakes

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COVER
The Grey-headed Flying-fox, *Pteropus poliocephalus*.
Photo: G. B. Baker, NPIAW

KAKADU

Tourism and the Future

by Allan Fox

Former Senior Officer with Australian National Parks and Wildlife Service, now an Environmental Management Consultant.

"The trouble is that tourism can be a chronic annual event, disaster, disease or happy recurrence, or whichever way you look at it." — **Lee Talbot, IUCN.**

That final idea, "or whichever way you look at it", encapsulates the dilemma of mixing natural or traditional areas with tourism. The richer and more diverse the resources of an area, then the greater is the range of options for using them.

During 1984, Kakadu National Park had its area almost tripled. This immense park, roughly 160 kilometres east to west, 180 kilometres north to south, lying east of Darwin, straddling the western Arnhem Land escarpment and the East, South and West Alligator Rivers, is judged to be of such value as to be listed a World Heritage Area. Here are natural and cultural values equivalent to those of Lascaux and Yellowstone.

Northern Territory politicians see Kakadu as a major unit in their second most important industry (behind mining), tourism; the Federal Environment Minister and his National Parks Service see it as a difficult and costly resource to manage and for which tourism may help to reduce the burden; the Aborigines, if the immediate traditional owners, see it as "this land, this Earth, like brother and mother", if far away, "they just listen for money . . . money"; the Australian Conservation Foundation sees it primarily as "wilderness"; scientists, as a research resource; local non-Aboriginal people, as a recreation resource to fish and hunt in; and the tour operators and tourist industry, as an Eldorado of riches waiting to be tapped. However Kakadu is an acknowledged World Heritage Area, the heritage of all peoples everywhere.

These perceptions of Kakadu are rank generalisations but they do emphasise the problems the Australian National Parks and Wildlife Service (ANPWS) has in interpreting and fulfilling its responsibilities in managing this wonderful place for all the people.

Tourism is a principal vehicle for bringing people into pleasurable contact with the distant environment. But it is also a means to accumulate corporate profit stimulated by governments desiring to benefit from the economic multiplier spin-offs. Now this in itself is not bad, but the track record of managing tourism within national parks is not a very successful one . . . Heron Island, Koscuisko, Wilpena Pound, Yosemite to mention a few.

Carrying capacity is a concept accepted as a sound basis for farm management and yet no service in Australia has been prepared to seriously utilise it in setting numbers of people or activities that park resources can carry to retain their many qualities. Reinforcing this lack of "political guts" is the fact that, with each change in development, a new and frequently larger public is tapped to oil the economic wheels. So a month ago, when I visited Uluru National Park, I found a significantly different mix of public than was there two years before . . . many of the refugees escaping the Yulara (Ayers Rock village) developments were to be found at Kings Canyon.

It is important for planners and managers to acknowledge that the national parks are for all people. Within a year or two, Kings Canyon too will be graced with super-developments and the drift of wild land users will be onto places like Finke Gorge. But how long will they find refuge there? Park users are being pursued by development. The art of management is to know when the limits have been reached, the point when the apocalyptic slide commences for the natural and cultural resource values, and when these values cannot be sustained. Then, there *must* be a determined hold on the extension of development.

For a park like Kakadu, which is largely owned by the Aboriginal people and leased to the Director of ANPWS for use as a national park under specific conditions, the problem is one where trusteeship is more direct than is usual. Damage to the

These lagoons provide ready access to the privacy of outstations and attract anglers — such intrusion is difficult to control. Photo: Allan Fox

resources or unresponsive management can legally lead to the tenure being terminated. This should make management even more sensitive. Has it?

The View from Djagana

Djagana or Jabiru Dreaming is Kakadu in microcosm, an ancient sandstone outlier isolated as the waters of the East Alligator catchment forced the retreat of the Arnhem Land escarpment. Its caverns and overhangs have attracted visitors for 50,000 years or more and perhaps the story of the past 10,000 is related in the paintings that light the walls of this and nearby outliers. Here there are menus of game the visitor could expect locally, sometimes fading beneath a different set, marking the time when estuarine conditions changed to freshwater many generations ago. Along the walls in secret nooks or on shaded ceilings, weirdly contorted and tormented Namarakain beings danced, part animal, part human and malevolent. On another ceiling the dissected bits of a human figure finished in red ochre. Overlooking a bay of creamy pink walls, a full-breasted beauty eyed the intruder . . . and fading into the dusty pinks, mysterious, beautifully rhythmic, rufous images of the dynamic art period, their meaning now lost in the Mimi explanations of a later culture.

To climb through the caverns and to sit alone on the top of Djagana in the mists of morning or the smoky dusk, is to reach new dimensions in perception and perhaps even an appreciation of the impact of the new visitors.

Already before sunup, during *Wurrgeng,* the cold weather season and peak visitor season, the yellowing sky was shining onto the billabongs and East Alligator waters. Strings of Magpie Geese were lifting from their overnight loafing spots and moving heavily, with echoing calls, to the feeding grounds. All around, the woodland was waking to the chorus of birds . . . the noisy frogs of predawn, afraid of breakfasting predators, fell silent; but clearest calls of all were the haunting bars of rising tones from Coucal Pheasants — music that might have been played on George Zamfir's pipes.

Down along the river's sandbars a serrated log drifted upcurrent, causing a wide parting in the ranks of Whistle Ducks, Radjah Shelducks and Pygmy Geese; the six metre "Saltie" was on the prowl, perhaps after barramundi whose own feeding implosions of water were resounding about the river. I remembered a lonely camp several years earlier down along that bank, when the noisy life-and-death wilderness seemed to spend all night trying to get into the tent. But that was as it was and now it exists only for that brief time before the first campers rise to stoke fires.

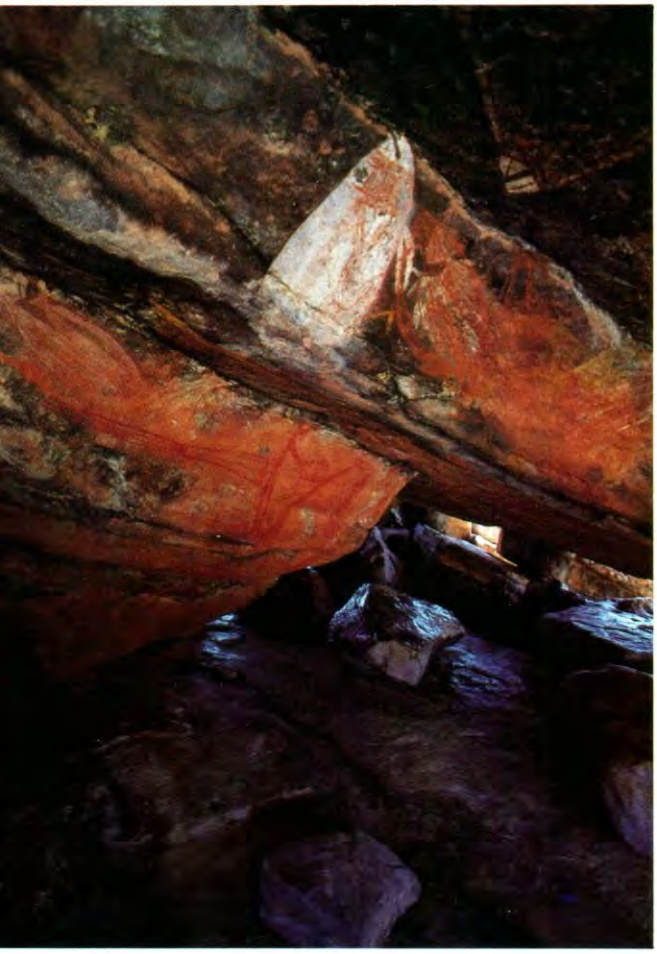
No longer is one allowed to camp on the bank. Apart from the damage done by the increasing load of campers, the Park Service has cut a boat ramp into the high, almost vertical bank by which the Saltwater Crocodiles now gain access to the old campsites . . . boats down, crocodiles up. We all fear the time when some stupid camper will encourage a crocodile to eat him. Here, in Kakadu, Australia holds a major unit of the world's breathing space for those wonderful beasts. I remember one situation. Following the rising tide 70 kilometres up the river during a crocodile survey, we arrived below the road crossing at 3.00am. Swinging the spotlight around, we observed three fishermen up to their waists in the swirling grey water, seeking barramundi . . . two were human and the other, a massive crocodile. In the media's sympathy for such fools if chomped, who will remember that crocodiles are one of the Park's special values to the world heritage?

In the growing light, breaking sticks, a low mumble of voices and bluish haze, rising through the canopy of *Eucalyptus tetrodonta,* attention is drawn to patches of orange, sky blue, green, yellow and white, marking the new camping area, designed for 30 camps but carrying over 80 this morning in its first year of use. "Carrying capacity" is talked about in academic circles, as if all you have to do is state a limit and turn the rest away. But the rangers know that if you have been invited and have travelled four or five thousand kilometres, the last 50 over the worst major park road in Australia, to be met with a "house full" sign, your response at best would be unprintable. In the meantime, both the Territory and Federal Governments are cajoling all and sundry to see this first wonder of Australia. The flood

gates are open . . . thank heavens for the wet season which closes the road . . . but even this respite may soon disappear with the construction of an inappropriate superhighway as has happened this year at another of Kakadu's most beautiful places. Access to Murella Park was once a 40 minute or hour long trip of discovery, with birds and wallabies surprising the visitor at each bend. Current engineering "overkill" has reduced this park experience to a four minute run along the bitumen. In the rush to let in the tourists the words "sensitive" and "appropriate" have not always been in the planner's vocabulary. Perhaps a few mornings' contemplation on Djagana would begin to produce an appropriate perspective . . . it is far from the Canberra office.

Soon the camps below me will divest themselves of people who will descend on the concrete river crossing to endlessly toss their lures, seeking the legendary barramundi lurking in the shadows of the Old

The play of light on polished and painted surfaces and the natural rock textures make for exquisite beauty — Ubirr. Photo: Allan Fox



Lady Dreaming rock, Kalarrbirri Djorgen. These fishermen will stamp all over this special place, which the Narbalek uranium miners once tried to bury with laterite in their efforts to make way for their giant trucks. Here too, lines of white faces will present an uncompromising gauntlet that the Aboriginal people from Oenpelli and Arnhem Land, travelling west to the Border Store or further, must necessarily run.

Just beyond the Border Store is another group of low outliers — the Ubirr (Obiri) complex, holding the best known galleries of Aboriginal art of the hundreds of galleries in the Park. Here, as the sandstone has decayed and collapsed, numerous caverns, walls and overhangs have formed in the outcrops overlooking Nadab, Cahills Plain. The plain is still shining with pale blue water, broken now by reedbeds of *Phragmites* and *Eliocharis,* and echoing with a staccato honking, hooting, quacking and whistling. Water is holding longer on the great marsh and, in a year or two, pockets of lotus will begin to appear as the buffalo menace is gradually removed, one of the positive results of park management. Still, there are many in the Top End who strongly argue that buffaloes should remain because of their attraction to tourists.

A combination of the rich food resources of Nadab, the river and its lagoons and billabongs, along with the Ubirr shelters, gave this place special significance to Aborigines in the wet season. The walls glow in sunset ochre colours with barramundi, catfish, longtom . . . with lizards, turtle and file snakes . . . with possum, wallaby and geese. Two humans, hands in pockets, are said to represent "missionaries telling the Aborigines what to do". Guns too are painted there and Thylacines, side by side with ceremonial and mythical images, one at least very, very old and very, very important, the rainbow, Kalarrbirri, a female creation being who painted this image of herself.

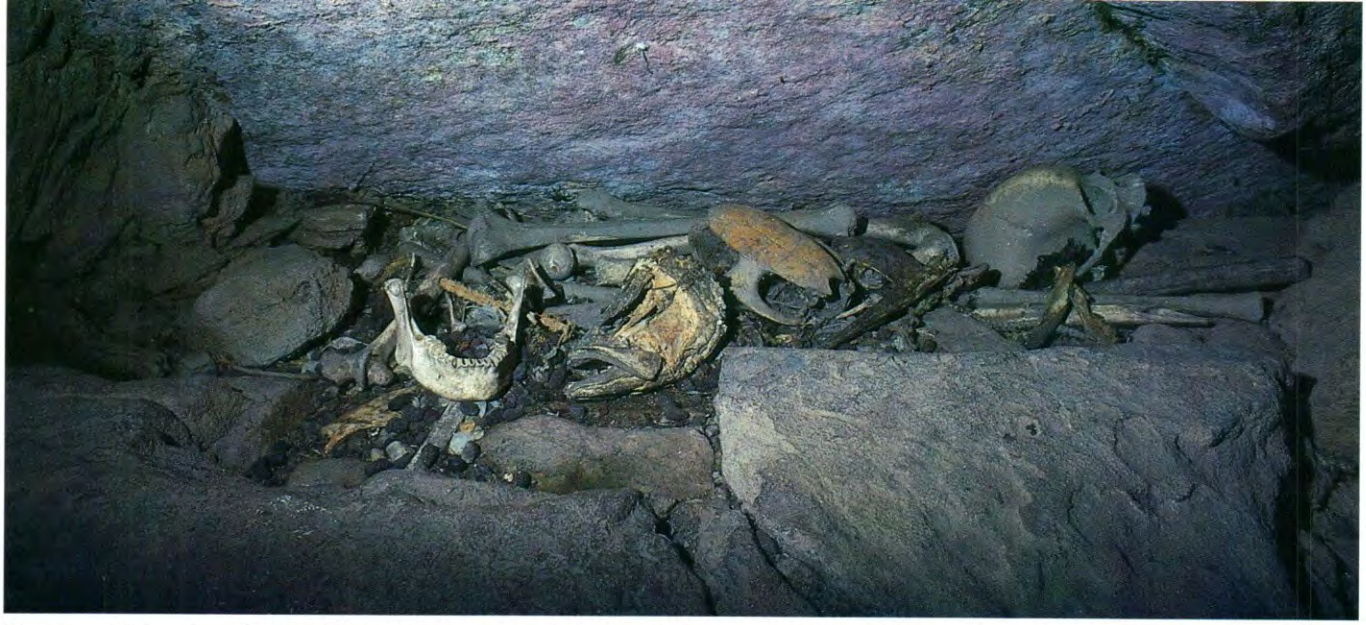
Ubirr exemplifies the dilemma Aboriginal people find in tourism. Here, traditional owners want so much to present a positive image of their culture, its internal relationships, their relationships with the environment and the story of contact, most times tragic, with the white man . . . but, more than anything else, to present a picture of a living culture, of two cultures ultimately playing the same tune with the Earth.

"My people . . . all dead.
We only got a few left . . . that's all.
Not many. We getting too old.
Young people . . . I don't know if they can hang on to this story.
But, now you know this story,
and you'll be coming to earth.
You'll be part of earth when you die.
You responsible now . . . you got to go with us . . . to earth.
Might be you can hang on . . . hang onto this story . . .
to this earth." — Big Bill Heijie.

This is so difficult for us to accept, this "living culture" bit — at Yulara, with its spectacular exhibits, and at Mootwingee too, the story communicated is written in the past tense. Aborigines are presented as museum exhibits, as anachronisms.

But while they want the story presented, and Kakadu is a perfect setting, there is an ever present fear that these complex places like Ubirr will have their Aboriginal values depreciated. The Kalarrbirri image is such a case. For two days back in 1979 I walked Ubirr with Bill Neijie, the old man of the Gagadju, who told me stories of plants, animals, rocks and the people. We came to Kalarrbirri and Bill hesitated . . . "this rainbow very, very important — don't talk about this!" "Do we build the walking track near this place?" I asked. "That's alright, but don't talk about it . . . it's what's in their [visitors] heads that counts . . . if they don't know how important it is or what it means, they can't hurt it", he replied after contemplating the painting for a long time. In 1983 the Parks Service had not only built a decked walkway to it and focussed attention with a widened deck there, but a yellow and brown interpretive sign specifically directs one to it. Bill's comment a few months ago to me was a resigned shrug of the shoulders and a click of the tongue, "it is not so important now".

Ubirr with its sealed road, walking track, decks, signs, pagodas and interpretation is a knockout for tourists but it has permanently lost some value for the traditional owners, its real custodians. The cultural base of the people has been permanently eroded. I wonder whether Catholics would be so resigned about foreigners violating St Peters or, for that matter, the RSL seeing the Cenotaph violated? For the people concerned, these special sites are even more significant. The problem of giving access and interpreting the Aboriginal culture to non-Aborigines by non-Aborigines is incredibly difficult, for even without the cultural contrasts, the difference between



Grave robbing has been devastating — this grave contains a person and food supplied to support the spirit . . . barramundi, turtle and wallaby. Photo: Ian Morris

effective park interpretation and trivialisation is a very fine line indeed . . . carelessness and lack of sensitivity leads quickly to cultural denigration.

But while I contemplate these problems from the perch on Djagana, a Cessna sweeps down the East Alligator, breaks clear of the gorge and engulfs me in noise as it gives its customers a low level view of Ubirr, the geese on the plain and the Aborigines supposedly secluded in their Cannon Hill outstation. Six times that day the plane spent long spells below the lookout on Ubirr. In the words of an American tourist to me a few days later at Yulara "I came out here to get away from my goddamned country's technology and what do I see in the middle of my viewfinder, not the Rock but a bloody helicopter!"

There are a number of subtle effects of the Kakadu programs. In 1979, when the first Aboriginal ranger training program was commencing, the Ranger uranium mine was being prepared for production. Each week or so we would drive the trainees out onto the site in an attempt to create an awareness of the changes taking place. There followed a break of a month and, in the interim, hundreds of hectares of tall woodland had been swept aside. A clay surface was left and rising beyong it Djitbe Djitbe, the great purple stains on the sandstone cliffs of Mt Brockman marking the passage of the King Brown Snake ancestor into the waterhole on top where he sleeps today. The 19 year old Aborigine beside me muttered quietly as he drove the Daihatsu onto a rise. We were silent for some minutes, then "I hope the King Brown Snake is deep underground" . . . "Why?" . . . "Because we believe that if he is awakened he will destroy the land with fire!" I recount this

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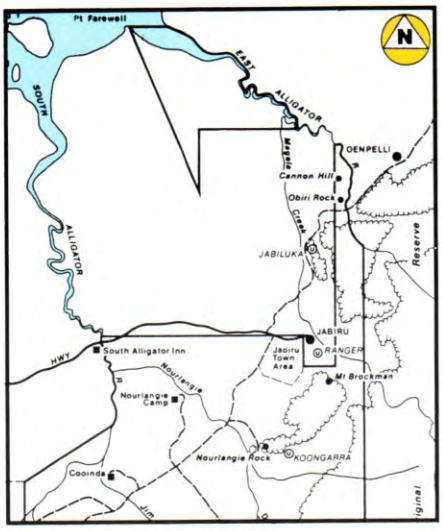
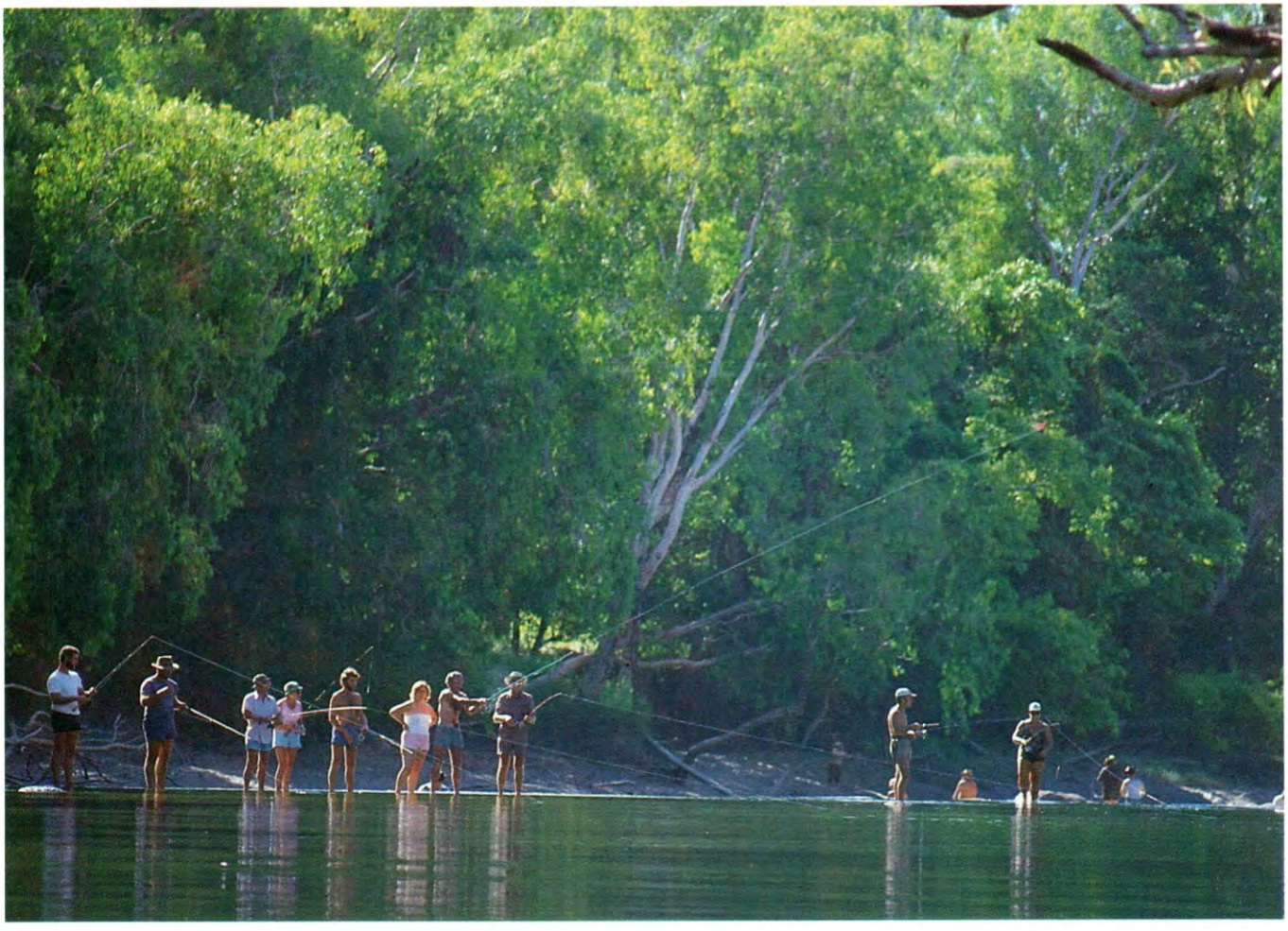


because it broadens the understanding we might have of the changes Aborigines perceive going on in Kakadu. They see mining and tourism together, not separately, damaging their traditional landscapes. From the time this very able and intelligent young person joined our program, until he left four years later, he had almost continuous cause to be in a state of traumatic shock. He was pistol whipped when a group of whites attacked the camp of his people by Mudginberry Lagoon, he and his 14 year old wife were provided a sophisticated $120,000 house because the Federal Service did not want to be seen by the Northern Territory to be giving Aborigines lower quality housing than the other rangers had; he was under continual pressure from his elder relatives to whom he had traditional obligations, to accommodate, feed and to be supplier of alcohol to the large group; he was given no tangible support by senior staff to control this pressure; obligations to his people, to the Service, to the Aboriginal community at large and to his working ranger partner were frequently in conflict; some of the ordinary ranger duties, that is, interpretation, guidance of visitors and enforcement, maintained a continuous condition of stress; and, to cap it off, he could see a rapid growth in visitor numbers taking place. There are few people anywhere who could sustain their composure under this kind of pressure for long. He has since returned to his community where many of the skills learned are being put to good use. Of those first six trainees, all individuals of great worth, one remains today as an effective ranger and he is outstanding. Twice since graduating, this ranger has applied for promotion . . . on both occasions this has been refused. We are yet to see if the Service is prepared to allow positions of authority to be taken by Aborigines.

The traditional owners of Kakadu really have little concept of the meaning of tourism to their future. Bill Neijie always intuitively felt its engulfing power. He fears the physical damage of mining but he knows that there is ultimately an end to it. Tourism, however, "will grow and grow and grow . . . soon bitumen there, all finished. Grass don't grow. You look where timber gone, pulled out. Bulldozer rip it out. Why dig up? . . . they say 'because we want money'. But money for white man. This ground for Aborigine".

Fishing on the road crossing, East Alligator River — sometimes as many as 60 anglers will collect here. Photo: Ian Morris



Bill Neijie passes on his wisdom to the author. Photo: Allan Fox

Earlier this year Bill visited Yulara, as did another traditional owner, Toby Gungali. There was the latest in tourist development and it blew Bill's perceptions apart. He had, just before the trip, seen the Service's concept plans for tourist developments over the whole of Kakadu. It seemed that the maps, with their off-scale scattering of developments, hotels, motels, camps, boat ramps, roads, picnic areas and even Zeppelin Routes, was larger even than Yulara. He returned home bewildered and broke an abstinence rule he had set several years before, in an attempt to escape from his fears. It almost killed him. During these weeks of desperation, where was the support and sympathy of his lessee Park Service? Apparent support ultimately came from outside in the form of a proposed motel . . . $7 million dollars to be spent on his clan's land, with jobs for his children for all time, was the promise. Bill reasoned that, if a "Yulara" was inevitable, then all his values were for nothing, so he may as well join the gold rush. The words he had repeated to us so often must have been a continual torment...

"We want fish, we want goose.
Other men want money.
Him can make a million dollars.
Million dollars...
he just go "poof".
Couple of weeks, nothing.
Million no good for us.
We need this earth to live because
we'll be dead,
we'll become earth.
This ground and this earth...
like brother and mother."

It was all push, push, push...he faltered, almost gave in...he signed a letter of interest under somewhat dubious circumstances, fortunately undated. Still the Service personnel left the old man in a vacuum and under pressure from the "developers". Finally it was left to an employment relief worker with an unusual degree of insight to gradually rehabilitate Bill.

With morning now well under way, dust is thickening among the trees and the thumping of wrecked shock absorbers mark the worried but hopeful arrivals, their expectations fuelled by glossy brochures, hungry governments, enthusiastic naturalists and the reputation of the place. What happens to these expectations will generate the positive or negative energy that flows from the body politic to the politician and ultimately to the management decision.

Like any system, Kakadu is a complex structure of physical, biological and cultural factors, endlessly intricate and detailed. Tourism is just the last new bundle of pressures being brought to bear on it. There will be consequent changes, this is inevitable. I have here touched on just a few of the problems. Success of the management programs will be a measure of the failures . . . most of the problems here are not and could not be covered by a plan of management. Success will depend entirely on the professionalism, on the humanity, on the patient understanding, on the non-partisan political stance of the mediators in this most criticial enterprise.

The stakes are high . . . a World Heritage Area . . . a culture and its people . . . an amazingly rich wildlife heritage . . . tourism in Aboriginal Australia . . . the second most important industry in Northern Australia.

If we take the time to listen to the richness of Big Bill's words the apocalypse may be averted.

"I feel it with my body,
with my blood.
Feeling all these trees,
all this country
When this wind blow you can feel it.
Same for country . . .
You feel it.
You can look,
but feeling . . .that makes you . . ."

Acknowledgement is made to Steven Davis for the many hours he spent with Big Bill helping to record his story.

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RARE & ENDANGERED

NUMBATS: Digging in for a Last Stand

The Numbat (*Myrmecobius fasciatus*), one of Australia's most distinctive marsupials, is the sole member of the family Myrmecobiidae. Its uniqueness, the popular appeal of the animal (shown by its selection as the faunal emblem for Western Australia) and the drastic historic decline in its numbers and range, are among the reasons why the Numbat has become the subject of an extensive field research program by the Western Australian Department of Fisheries and Wildlife.

When Europeans first arrived on this continent, the range of the Numbat extended from southwestern W.A. throughout southern Australia to western N.S.W. Today it is mainly restricted to small areas of wandoo woodland at Dryandra and adjoining jarrah forests in southwestern W.A. From studies in these areas, much information about the needs and lifestyle of this endangered species has been gathered.

The Numbat, *Myrmecobius fasciatus*. Photo: L.F. Schick NPIAW

Unlike other Australian marsupials, the Numbat is diurnal, sleeping mostly at night and only occasionally during the day.

Its diet consists almost exclusively of termites. Fallen limbs and branches, the heartwood of which have been eaten out by termites, provide the hollow logs required for shelter and escape from predators. Although less frequently, Numbats have also been seen to use burrows.

An eastern form, with a redder pelage, formerly inhabitated S.A. and western N.S.W. in areas of mulga woodland. Another population (based on sightings and road kills) has recently been discovered in three southern suburbs of Perth (Canning Vale, Forrestdale and Jandakot). The vegetation of the uncleared parts of this semi-rural area comprises a low banksia woodland with few eucalypts. Few hollow logs are produced so burrows are probably used. Numbats using burrows may be more susceptible to predation by foxes but as long as the land remains uncleared they stand a chance of survival. Unfortunately, this newly discovered area has been allocated for housing.

The principal reason for the Numbat's catastrophic decline in numbers and range since European settlement has been the clearance of land for agriculture. However, all areas known to contain Numbats (with the exception of the recently discovered population south of Perth) are now secure from the threat of land clearance. Dryandra Forest, the major stronghold of the Numbat, is under the control of the W.A. Forests Department. Once managed principally for its timber, a combination of forestry and faunal management strategies has now been adopted.

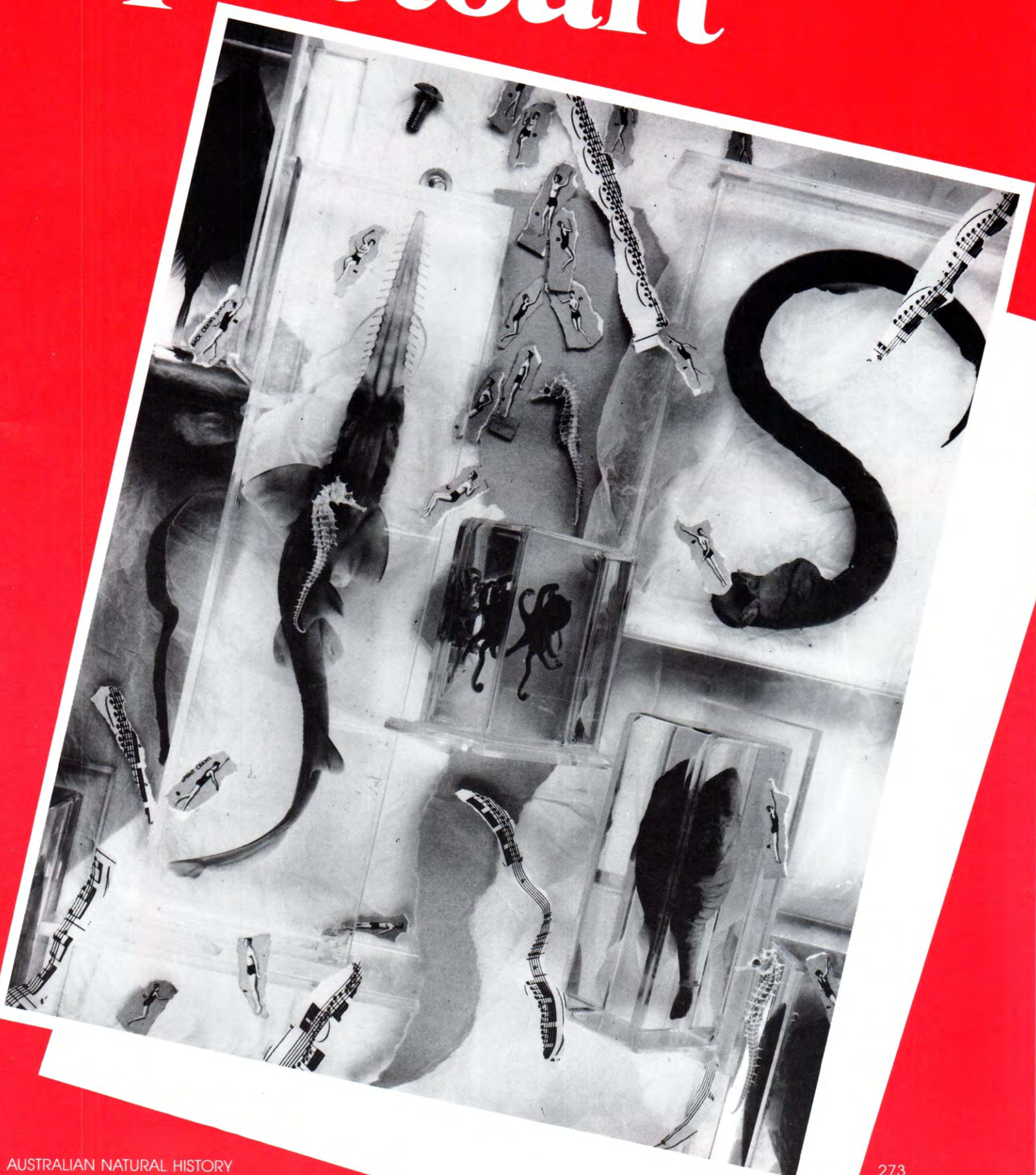
In the early 1970s, the presence of superficial bauxite deposits in Dryandra Forest posed a threat in the form of possible strip mining. Although mining proposals were quickly quashed in that particular area, the fact remains that it is still possible for mining companies to have land-use decisions reconsidered and overturned in mining warden's courts.

Bauxite mining does occur in areas of the extensive jarrah forest. Even though there are large tracts of jarrah not affected by mining, in the face of this threat it might be prudent to at least consider the option of establishing additional populations by reintroduction in areas of their former range. Because many of these areas are now being used for agriculture, such reintroduction strategies can only be successful if farmers are offered some kind of financial incentive to leave pockets of uncleared land on their properties. Such "unimproved" bush paddocks could preserve a wide range of wildlife, including the Numbat.

World Wildlife Fund Australia is sponsoring a captive breeding program for Numbats in Perth. At present the colony consists of six individuals and it is hoped that breeding will commence in the summer of 1984-85. Because the exclusive termite diet is expensive to obtain, an artificial diet is being developed. Once young have been produced, they will be weaned onto this artificial diet in order to facilitate expansion of the breeding program.

As a last thought and, at this stage, perhaps a far-fetched one, the snap-freezing of egg and sperm cells from captive animals to produce "test-tube" Numbats, should be considered. Little work of this nature has been carried out on marsupials. In order to make this procedure a fruitful one, it would also be necessary to determine now which species or what artificial apparatus would be required to serve as surrogate mothers for the test-tube Numbats in the event that they become the species' last stand for survival. If wild Numbats do become extinct, could we forgive ourselves for not having considered every possible way to avoid such an awful catastrophe? □

photoart



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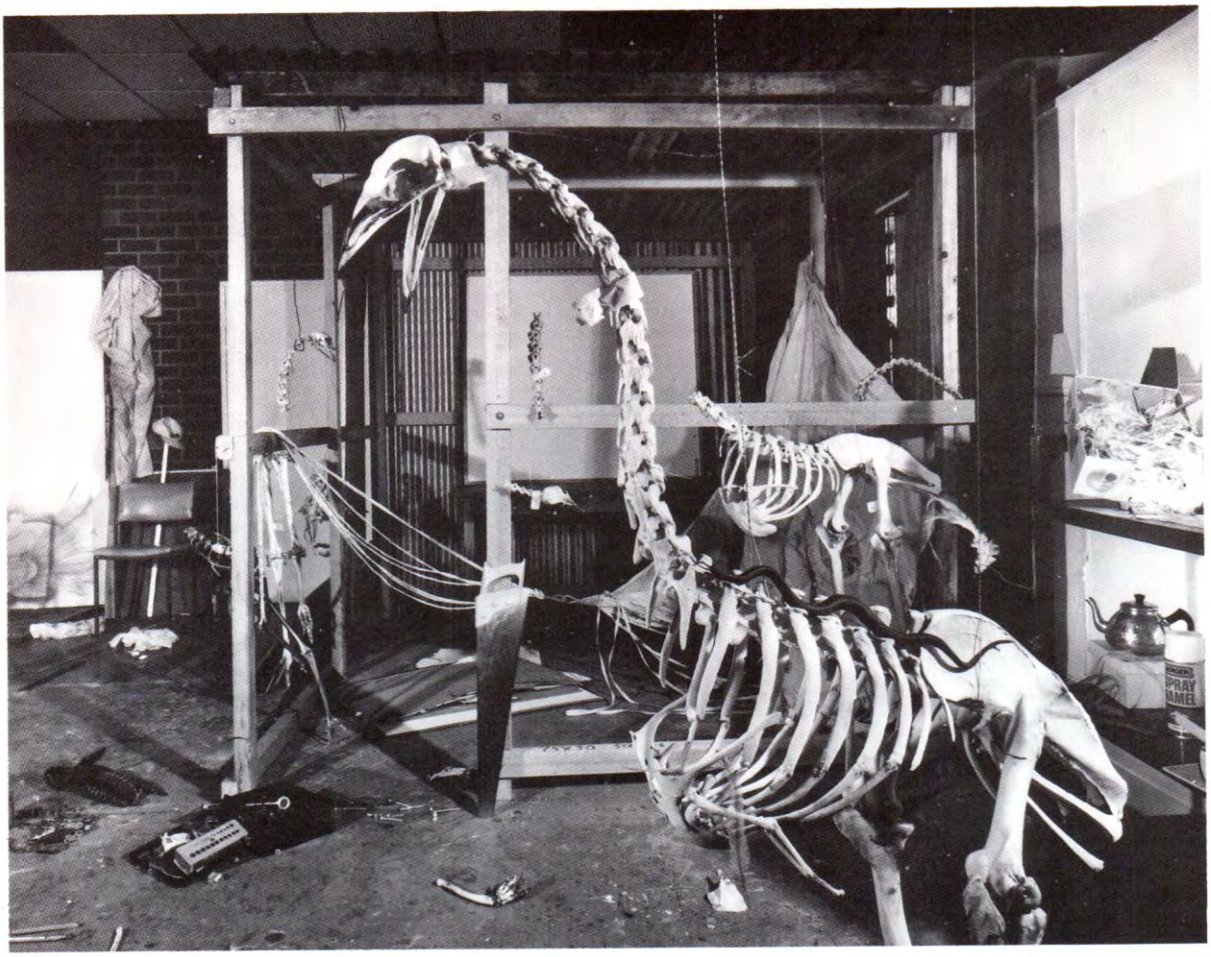

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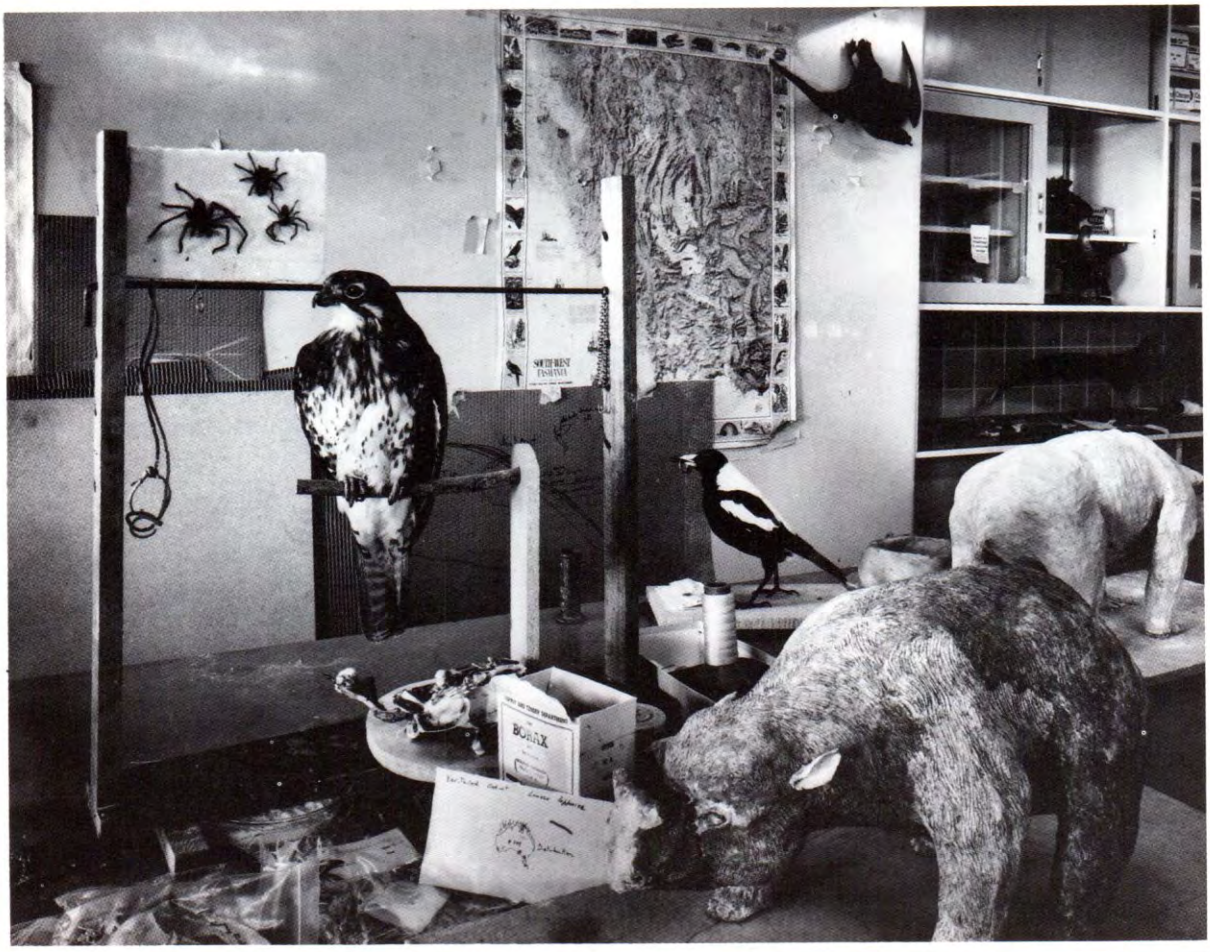


5.

Selections from The Antipodean Suite, *Fiona Hall*

Fiona Hall is considered to be one of the most prominent photographers to have emerged in Australia during the past ten years. Having completed a painting diploma at the National Art School in Sydney in 1975, Fiona travelled extensively overseas working in London and at a later stage completed her M.F.A. in photography at the Visual Studies Workshop, Rochester, New York. Since returning to Australia in 1981 she has exhibited regularly and is now a lecturer in photography at the South Australian School of Arts.

Fiona says of this work — "these photographs came about through a desire to transcribe into visual, photographic terms some aspects of what is often still referred to as the Antipodes. They are inspired by some of the phenomena in this part of the globe and in relation to other parts of the planet. Literal 'meaning' is not the intention. Rather, a visual exploration, an apprehension and comprehension of the material which comes to hand, and eye, to arrive at the cohesion of an idea."

The photographs were produced from material at the Tasmanian Museum and Art Gallery and combined images that have been brought together to form a collage, which gives the recognisable objects such as fish specimens and bird eggs new visual interpretations. These constructed photographs are combined with images of the Museum storage and work rooms where the surreal environment of the manipulated photographs seem to be extended into the real.

This portfolio of photographs by Fiona Hall is presented in association with the Australian Centre for Photography. 1 Sea urchins in glass cases. 2 Emu skeleton in workshop. 3. Birds with tags on legs. 4. Emu pictures with feathers. 5. Museum room with Eagle.

(All photographs by Fiona Hall from the series The Antipodean Suite *1981, Silver Gelatine prints.)*

4.

VAMPIRISM
Fact or Fiction

Peter Schouten's interpretation of the Yarama, a mythological Australian Aboriginal vampire.

by Suzanne Hand

Suzanne Hand is in the process of completing her doctoral research into the evolutionary relationships of Australian fossil and modern bats. This enthusiasm for bats has led to her extracurricular fascination in vampires — those blood-drinking creatures of fact and fiction. Her explicit and well-researched article describes all aspects of vampirism: from the infamous Count Dracula of Transylvania to the lesser-known, blood-sucking Yarama of Aboriginal legend; from the small but very real vampire bats of South America to the historical accounts of humans that have adopted their own vampire habits; and, perhaps most intriguing and blood-chilling of all, some scientific facts behind our perhaps-not-so-fictitious vampires of lore and legend. Is fact stranger than fiction?

What flies like a bird, walks like an ape, scurries like a mouse, jumps like a frog, hides by day, stalks its prey on foot and feasts on blood? A vampire bat!

These fascinating small mammals take their name from a group of mythological blood-sucking creatures that have been caught somewhere between life and death for over 5,000 years. The bats are very real, parasitic blood-drinkers that scuttle about the hot tropics of middle America. Mythological vampires have been no less real for many human cultures since at least the beginning of recorded history. And they are by no means geographically restricted to Transylvania . . .

The Yarama: Australia's legendary vampires

Lurking in the dense forests along the eastern coast of Australia are the Yarama. These diabolical spirits are four feet tall, have huge heads, mouths, throats and bellies, are covered with scaly, red and green skin and have cup-shaped suckers for fingers and toes.

According to *The Demon Book* by V. Hyatt and J.W. Charles, the Yarama sits in the branches of leafy fig trees and waits for its tired, unsuspecting victim to approach. Then it pounces, fastens its suckers and drains off the blood until the victim becomes limp and immobile. The Yarama then runs around the forest to work up an appetite and returns to swallow its victim whole.

The legend goes on to say that if the victim is regurgitated alive by the Yarama and manages to escape, the spirit will take revenge on the whole community by drinking all the water in the area. However, the hapless victim has no true escape, for he too is destined to become a Yarama.

The role of blood as the life-giving substance was recognised early by all human cultures including the Australian Aborigines and quickly became a focal point of many rituals, taboos and legends the world over. Mythological creatures, like the Yarama, that rose from the grave and took as nourishment the life-blood of others have become perhaps the most common of all malign spirits.

Like the Yarama, these demons were commonly held responsible for local disasters such as drought, crop failure, the spread of epidemics, the failure of cows to give milk or chickens to lay eggs. They threatened the continuity of life and the rhythm of nature itself.

Blood offerings to appease omnipotent vampires were common in many early civilisations. Many Australian Aboriginal tribes, for example, are known to have lacerated their faces and arms to protect themselves from the dead. By freely giving their blood, they believed they could prevent the dead from returning to forcibly take it (perhaps as the Yarama might do). This blood, the Aborigines believed, would give the dead strength to face their new existence . . . and hopefully leave the living in peace.

"Blood-suckers International"

Folk-lore about vampires was recorded as long ago as 5,000 years on an Assyrian bowl depicting a man copulating with a headless female vampire. Since then vampire lore has appeared across Europe, Ireland, Africa, India, China, Borneo, Tibet, Nepal, the Americas, Polynesia, New Guinea and Australia; in fact, almost everywhere that man has been . . . and bled. Vampire legends from both the Old and New Worlds are surprisingly similar, featuring blood-sucking spirits that ravage the living commonly between dusk and dawn. With this blood they revitalise their bodies to prevent them from decaying in the grave.

Before the early 16th Century discovery of vampire bats in Latin America by Europeans, the mythological vampire only rarely took the form of a bat, even in the Americas. Instead it usually assumed the shape of a werewolf, cat, dog, bird, snake or often a guise that was attractive to its victim.

For example, the Greek and Roman *lamias* were both lovers and vampires who sexually indulged victims of the opposite sex and only then revealed themselves as blood-suckers. Lilith, an infamous medieval *lamia*, was believed to be the cause of nocturnal emissions and Hyatt and Charles have suggested that the English word "lullaby" may be a corruption of "Lilla-bi" or "Lilith be gone".

The origins of the English word "vampire" are thought to go back to the ancient Hungarian Magyar *wampyr* or even to the Turkish *uber* meaning witch. In general, the mythological vampires of India, Africa, Arabia, Asia, the Americas, Polynesia and Australasia are far more mystical or spiritual in concept than their Balkan and central and eastern European counterparts. The latter being humanoid are more realistic and, in fact, caused waves of mass hysteria (akin to witch hunts) in Europe during the 14th to 18th Centuries.

It is the eastern European concept of the vampire that has been widely adopted — and promoted — by western society. It has, of course, its own charming persona with its full, red lips, its fetid breath stinking of a charnel-house and its dirty nails fouled with clots and gouts of blood. It is also generally invested with herculean strength, invisibility, control over natural forces, mesmerism and the facilities of transmogrification. The latter gives it the power to transform itself into an animal or even a moonbeam or curl of mist.

Vampire mythology may be more highly developed in eastern European provinces such as Transylvania and Wallachia but other cultures have created other vampires. The Russian form has a purple face; the Bulgarian form has only one nostril; the Mexican has a fleshless skull; the Chinese vampire is covered with whitish-green hair; the Bavarian vampire sleeps with its left eye open and its thumbs linked; the Rocky Mountain vampire sucks the blood of its victims' ears through its nose; the Moravian vampire makes its attacks in the nude; and, not to be outdone, the Albanian variety wears high-heeled shoes.

Some vampires such as the Polong and Langsuir are even more bizarre. The Asian Polong and her accomplice, the Pelesit, are an interesting duo. The Polong resembles a tiny, female figure no bigger than the top joint of your little finger.

When she wishes to enter a victim's body to sap its lifeblood, she sends her Pelesit, a demonic house-cricket, to burrow its way in. It enters tail first, chirps encouragingly and the Polong quickly follows. The pair may be enslaved and commanded by a master who must feed them every day on saffron-stained rice or blood drawn from the tip of his fourth finger.

The Malaysian Langsuir is said to be a woman of dazzling beauty that flies and cackles and perches in a tree. She may be recognised by a her long, green gown, her extraordinarily long, tapering nails and her ankle-length, jet-black tresses, which conceal the hole in the back of her neck through which she sucks the blood of children. The Indian Vetala, on the other hand, resembles a dirty, old hag who prefers the blood of sleeping women, provided they are mad or drunk or both. And surely there is no greater thirst than that of the Maha Sohom who lurks about Ceylonese crossroads in order to quaff the blood of passing elephants!

Vampires: exploring the myths

According to lore, those qualified to become vampires and join the ranks of the undead include witches, sorcerers, murderers, debauchers, suicides, still-born babies and the unbaptised or excommunicated. Those with red hair, blue eyes, a birthmark, harelip, crooked toe or erotic temperament were also good bets; even a seventh son was regarded with more than a little suspicion.

A vampire may suck the blood from the living until the victim dies. But, far worse, by mixing its vampire blood with that of a living person, it could infect its innocent victim with its own insatiable lust for blood. That person too would then be eternally trapped between the worlds of the living and the dead.

In the recent Christian past, the idea of vampires was actively promoted. In the 17th Century the Greek and Romanian Orthodox Church, for example, taught that those who had defied the social conventions of the times were likely to become vampires.

It is possible that belief in vampires through the ages may have also been reinforced by, horror of all horrors, accidental premature burials. American statistics show that as recently as the early 1900s not less than one case of premature burial per week was discovered. Those unfortunates found in their coffins in a twisted position, sometimes with the fingers bloody from clawing and even the shroud half eaten, no doubt propagated the fear of the blood-lusting undead.

It has been suggested that the greenish-white hair covering the Chinese variety of vampire, for example, may have its origin in the fungi which grow profusely on the white cotton grave clothes used by the Chinese.

Precautions that could be taken to prevent the dead from returning were varied but usually fairly direct. The Oraons of India and Chuwashé of Finland simply nailed the corpse to the coffin; the Burmese preferred to tie the two big toes together; Arabs fastened the feet; Voightlanders tied the hands; and Californian and Damasas Indians broke the spines of the dead before burial. Other cultures felt the need to cut off the hands, feet or head, placing the latter between the corpse's legs.

Fire or light was believed to ward off vampires, as was garlic and painting with white paint an extra set of eyes on a large black dog! Another deterrent was to place in a field, just outside a village at about midnight, a twin brother and sister born on a Saturday, wearing their shirts and drawers inside out. The Christian cross was also considered a very effective weapon and is often found to this day in Transylvania in isolated places such as in the middle of a field or high on mountain tops.

To prevent a Langsuir (see above) from rising, glass beads were placed in the deceased's mouth and hens' eggs under each armpit. That way she was unable to open her mouth to shriek or her arms to flap. If already arisen, a Langsuir was supposedly put to rest by physically suppressing her, cutting short her hair and nails and then stuffing these clippings into the hole in the back of her neck.

Other methods for "laying" vampires were almost as varied as those designed to prevent one rising. Staking (resulting in fresh blood issuing from all orifices), decapitation, removal of the heart and burning were common methods. Staking, incidentally, was only outlawed in the United Kingdom in 1823.

Placing the thorny stem of a wild rose bush upon the body was also a cosmopolitan practice but seems to have particular relevance for another Malaysian vampire, Penanggalan. This creature, in the form of a trunkless, human head with the sac of the stomach attached thereto, flew about screeching and seeking to suck the blood of mothers and new-borns. Because of her trailing intestines, she had a mortal dread of thorns which might catch a loop of her entrails.

Old habits die hard

Vestiges of superstitious beliefs in vampires are still very much with us. For example, the black veil and clothing traditionally worn by women at funerals was evidently originally devised as a disguise in case the undead tried to return to their loved ones.

The cross at a graveside also has an interesting history. Before its Christian association with the crucifix, a graveside cross is thought to have symbolised an intersection of roads. Crossroads were once traditionally chosen as burial sites for those who had died a violent death (especially at their own hand) and thus likely to return as vampires. It was hoped that should they return they would become confused, not knowing which direction to take at the cross. Dawn would come with its cleansing sun and the neighbourhood would be purged of its monster.

Candles burning around a coffin, the black armbands of mourners and a coin placed on the lips of the deceased, can also be traced back to the days of vampire beliefs. Black armbands, for example, appear to be an interpretation of wristlets originally worn by mourners to act as


Daily Mirror

FORWARD WITH THE PEOPLE

VAMPIRE— A MAN HELD

Held captive for a month?

3 thirsty Russians rush the barricade

Reduced Prices of FRY'S Chocolates

ATTLEE: I'LL TELL CHURCHILL

This headline appeared in the *London Daily Mirror* in 1949 after the arrest of John George Haigh, a modern-day haematodipsiac who murdered nine people to drink their blood.

spiritual fetters. These supposedly thwarted the physic connection between the living and undead and protected the loved one from vampirism.

The coin, piece of pottery or consecrated particle placed on the lips or in the mouth of the dead was apparently initially intended to prevent a vampire spirit leaving or re-entering the body (always through the mouth) after death. This practice seems to pre-date the association of the coin to pay Charon the ferryman who otherwise took souls to Hades.

Even one of the world's largest cities takes its name from a vampire. Calcutta is an anglicised form of Kalighata, a temple built to honour the Hindu goddess and mythological vampire Kali. It is noteworthy too that the worshippers of Kali, for the most part an unsavoury lot, were known as Thugs, another now familiar word in the English language. And let's not forget the Hollywood "vamp" who figuratively drained her men before ruthlessly casting them aside.

Historical vampires: a butcherous bunch

Of all legendary vampires, the most popular is Bram Stoker's seductive and charismatic 19th Century Count Dracula. With his aristocratic arched nostrils, lofty, domed forehead, blood-red lips, sharp, white teeth, black cape and genteel manners, Dracula has, in fact, proved to be one of the most enduring literary concepts of all time.

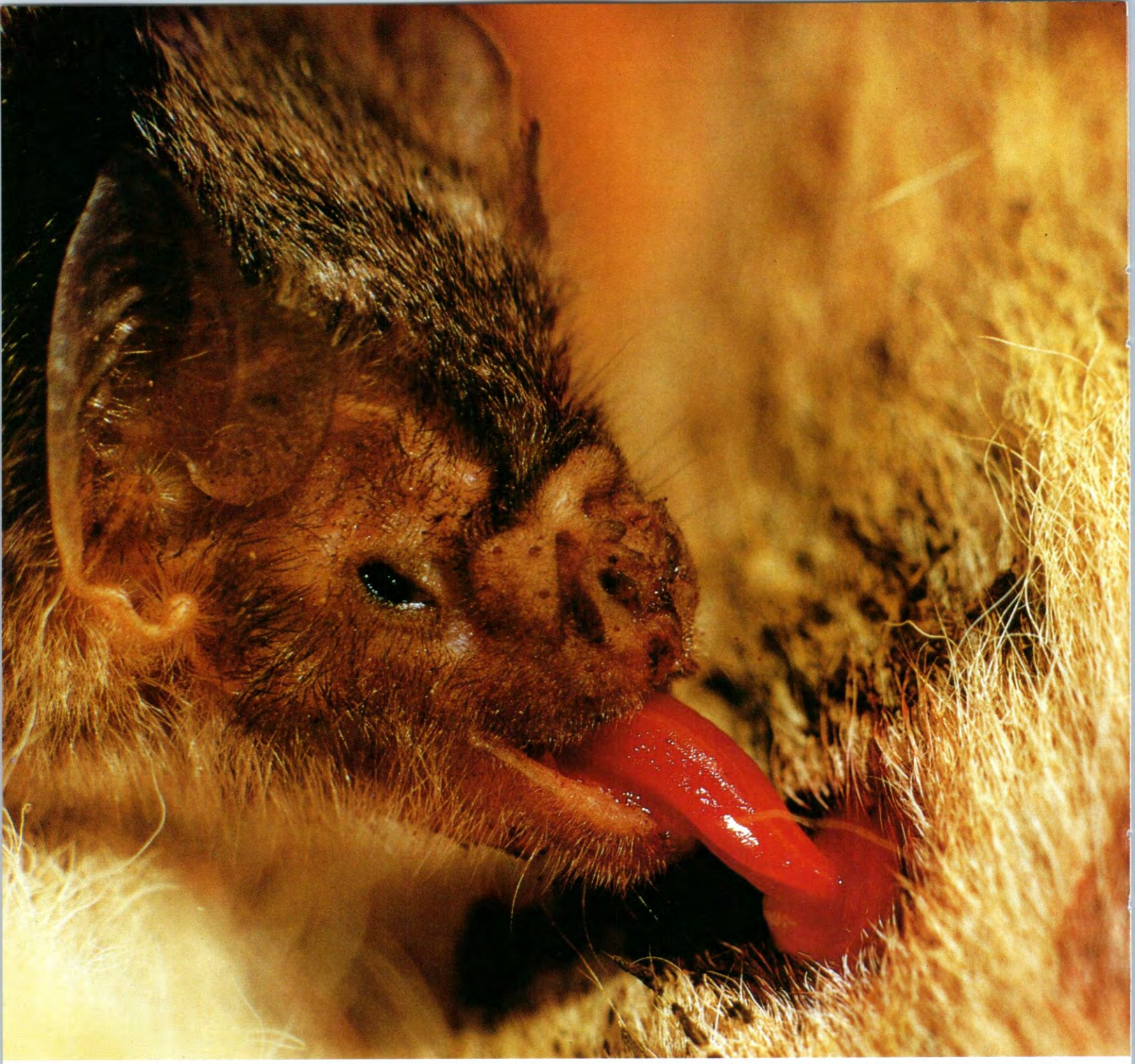
Stoker's Dracula is the personification of the eastern European vampire. Of the 12 or more varieties of vampire believed to still roam the fields and villages of Transylvania (a province of Romania), Dracula probably specifically embodies the *sburator*. These handsome men are thought to enter houses through unopened windows at night to kiss sleeping women and hold them in an erotic spell while stealing their blood.

With this ancient folk-lore, Stoker blended vignettes of real history to come up with his 500 year old Prince of Vampires. His research into the customs and vampire legends of the Transylvanians (which he studied in the British Museum) led him to discover the very real Vlad Dracula the Impaler, a Romanian prince born in Transylvania in 1431 who is said to have mass-murdered over 40,000 people.

Although the historic Dracula was not a sanguinivore in the strictest sense like the literary Dracula, it is difficult to tell who had the more tainted soul. Vlad appears to have had a blood-thirsty penchant for torturing and impaling his enemies on stakes (a symbol of destruction linked with vampirism). He also cut off heads, noses, ears, sexual organs and limbs, blinded, strangled, hung, burnt, stabbed, boiled, skinned, roasted, hacked, nailed and buried alive his victims. And what he supposedly did to his own mistress and to mothers and babies is much too indelicate to repeat. For the strong of stomach, accounts can be found in Florescu and McNally's *Dracula a biography of Vlad the Impaler"*.

A number of other historical figures have given Vlad's reputation a bit of competition. These sadistic murderers were convicted of crimes that, like those of many mythological vampires, involved human blood-drinking while in the transport of sexual excitement.

French poster for Werner Herzog's 1979 film *Nosferatu*. The film, loosely and indirectly based on Bram Stoker's popular 19th Century novel *Dracula*, featured an eastern European-type, mythological vampire but one that lacked the more attractive and sensual qualities of Stoker's original antihero. Poster: courtesy Twentieth Century Fox Film Corporation.

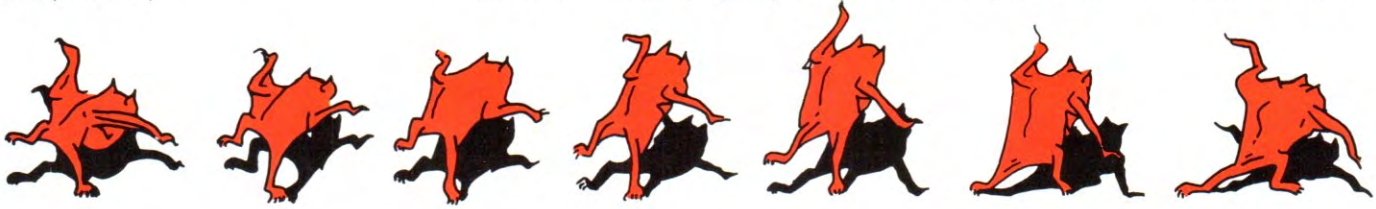


The Common Vampire Bat, *Desmodus rotundus*, of Latin America, drinks from a sleeping calf. It is one of the three species of true vampire bats that subsist solely on blood. Photo: Bruce Dale © National Geographic Society.

The 15th Century Gilles de Raiz or "Bluebeard" and the 16th Century Carpathian countess, Elizabeth Báthory, were probably haematophiliacs, being totally infatuated by *flowing* blood. Báthory is said to have slaughtered and drained the blood of over 600 young girls. She apparently drank and bathed in the blood to keep her skin pale and her body healthy.

Those who gain satisfaction through actually *sucking* blood are known as haematodipsiacs. A modern haematodipsiac may have been the deaf-mute German Kuno Hofmann. On at least 35 occasions between 1971 and 1972, Hofmann forced entry into graveyards, disinterred freshly buried corpses (which he chose after reading the death notices in the newspapers) and then drank their blood. This he believed would make him good looking and strong. Eventually Hofmann turned to fresher victims, shooting two young lovers, which he had found in a car, and drinking the blood from their wounds.

Necrophiliacs and necrosadists are also sometimes loosely described as "natural" vampires. For example, Fritz Haarman, an infa-



mous necrosadist of the early 1920s, was dubbed the "Hanover Vampire" by the press when he murdered over 50 boys, each time with one fatal bite in the throat. After assaulting and/or mutilating his victims, he eventually cut them up and either ate the flesh himself or sold it to the women of Hanover as sausage meat.

Vampire bats: the real thing

Vampire bats, unlike the legendary versions, are alive and well, living in (and only in) Central and South America from Mexico through Argentina and Chile.

Cortez, an early Spanish explorer of Latin America, first became aware of the existence of blood-drinking bats in the early 16th Century in Mexico. He named them "vampire bats" after the mythological vampires and carried news of real blood-suckers back to Europe. The association of lengendary vampires and night-flying bats was clinched and has adversely affected the reputation of all other 947 or so species of bats ever since.

There are three species of vampire bats in two genera. These comprise the Desmondontinae, a subfamily of the New World Phyllostomidae. The Common Vampire Bat (*Desmodus rotundus*) is the best known species. It does indeed feed on human blood but more commonly on that of domesticated animals such as cattle, mules, horses, goats or fouls. The other two less abundant vampire species, the Hairy-legged Vampire Bat (*Diphylla ecaudata*) and the White-winged Vampire Bat (*Desmodus youngi*), appear to prefer bird blood but *Diphylla* will also take mammalian blood. All three species subsist entirely on blood.

With a head-body length of 6.5 to 9 centimetres, wingspan of 30 centimetres and body weight of 30 to 35 grams, *Desmodus rotundus* is a small, timid, delicately built bat that is superbly adapted for its sanguinivorous habits. Its senses, behaviour, shape and digestive capacities are most appropriate for the gathering and digestion of fresh blood.

Specialisations concerned with prey detection, for example, include a well-developed sense of smell, large eyes and good vision, an echolocation system that employs the low intensity calls best suited for detecting large objects, and special sense organs in the noseleaf for the reception of infrared radiation such as emits from warm-blooded bodies.

Stealth and agility are also vital to an animal that may attack prey up to 10,000 times its own size. Due principally to anatomical modifications of the pectoral girdle and limbs, the vampires are the most agile of bats. They retain the ability to fly but can run along horizontal or vertical surfaces with ease, hop lightly about the ground like a frog, scramble backwards and sideways over the bodies of their hosts and walk with an even, deliberate albeit bizarre gait.

They are also capable of executing sudden evasive manoeuvres and catapulting 20 to 30 centimetres from the ground into flight. Commonly, they alight close to their prey and stealthily stalk them on foot. They often feed from the ground, biting ungulates on the fetlock, and, if necessary, following the animal while taking blood from the wound.

Perhaps the most spectacular of specialisations is the dentition of the vampire bats. It is characterised by enlarged, curved and razor-sharp upper incisors and canines and very reduced cheekteeth; a diet of blood requires no crushing teeth.

Vampire bats do not suck blood; rather they lap it. According to A.M. Greenhall, there are four main phases in the feeding cycle of *Desmodus rotundus*: the selection of a suitable site, preparation of that site by licking, the shearing or shaving of fur or feathers, and the actual biting and lapping.

The selection phase may take as long as 40 minutes in the case of animals bitten for the first time or only a few minutes when the vampire is reopening a wound in a more tolerant animal. Typical wound sites are the tips of the fingers and toes (in humans only), the lips, eyelids, tips of nose and ears, anal and teat region, junction of hooves with the skin of the feet and occasionally large surface vessels accessible through the face and neck. In water buffalo that are almost totally immersed, even the insides of the nostrils are attacked.

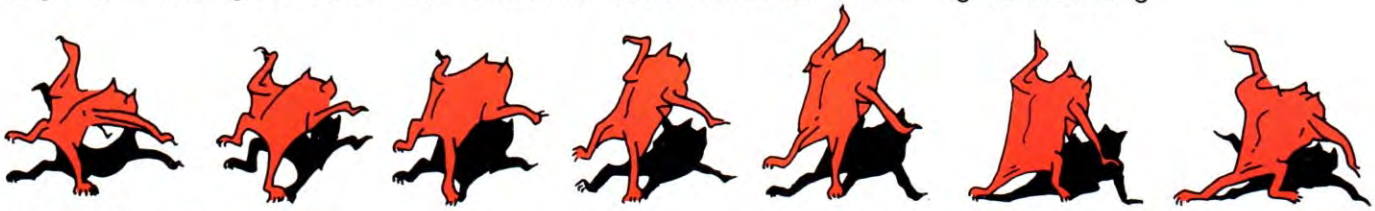
Geographical distribution of true vampire bats, subfamily Desmodontinae, family Phyllostomidae.

Vampire bats, like their mythological namesake, are nocturnal creatures that usually attack while their prey sleeps. Some hosts appear to be far more tolerant of attacks by vampire bats than others; some individuals may be repeatedly parasitised while others are not tapped at all. Try as he might, for example, the eccentric 19th Century naturalist, Charles Waterton, sharing a loft with these bats for several months, could not get one to attack his big toe.

During the preparation phase, the vampire bat gently licks the selected bite site for 10 to 40 mintues. Its saliva moistens, softens and possibly even anaesthetises the bite area. It has also been suggested that the saliva may contain a depilatory or hair-removing agent.

In the following optional shearing phase, hairs and feathers are clipped cleanly at their base by the vampire's razor-sharp incisors and vehemently spat out.

Vampire bats are the most terrestrially agile of bats, commonly stalking their prey on foot. Drawing: Nelson Leong



This close-up of *Desmodus rotundus* shows the razor-sharp upper incisors used to open shallow wounds in its prey. Note also the cleft in the lower lip, used to complete a tube when the tongue is down-curled during feeding. Photo: W.A. Wimsatt, A.S.M. Mammal Slide Library.

In the final phase, the concave upper incisors are used like a scalpel to neatly and painlessly remove a circular plug of skin, hair and flesh about three to four millimetres in diameter and five millimetres deep. The blood wells up quickly. The specially modified tongue with its lateral grooves is down-curled and applied to the wound, forming, with the cleft lip, a tube through which the blood is drawn by capillary action. The tongue is protruded and retracted slowly to maintain the flow and the lapping action may last up to two hours.

The saliva of *Desmodus rotundus* contains an anticoagulant (desmokinase) that causes the wound to continue seeping blood for many hours even after the bat has finished feeding. The vampire bat has a uniquely protruding lower jaw and recessed pug nose that allows it to breathe normally while feeding.

If the selected bite site is an old wound, the vampire bat may very quickly reopen it by rasping at the scab with the rough papillae on the sides of the tongue or the horny tongue-tip. The tongue-tip may also be used to pierce thin-skinned areas and, if the blood flow lessens, to agitate and thus stimulate the flow.

The biting and feeding behaviour of *Desmodus rotundus* is now reasonably well-understood. Early naturalists, however, had their own ideas about how vampire bats tapped the blood of their prey. Perhaps one of the most novel ideas was that of the brother of the famous naturalist George Wallace: "[His] opinion was that the bat applied one of its long canine teeth to the part, and then flew round and round on that as a centre, till the tooth acting as an awl, bored a small hole; the wings of the bat serving at the same time to fan the patient into a deep slumber."

The Common Vampire Bat has an extremely long and highly distensible, tubular gut so that during an evening's feeding in the wild, it may drink as much as 30 millimetres or up to one and a half times its own weight in blood. Not surprisingly this tends to make uplift impossible. The specialised kidneys of *D. rotundus,* however, permit rapid extraction and disposal of the large volume of water in the ingested blood. After gorging itself until it is bloated and spherical, the vampire bat commences to urinate copiously and continuously, sometimes on its host, adding insult to injury.

Desmodus rotundus is a colonial animal that roosts by day in caves and tree hollows. It has been estimated that a colony of 100 individuals would drink 730 litres of blood per year or the total amount of blood in 20 horses, 25 cows, 365 goats or over 14,000 chickens!

Since the introduction of domesticated animals to Latin America, *Desmodus rotundus* has reached pest proportions over much of its range, being the principle vector of the rabies virus in that part of the world. For natives of the New World tropics the fear of being vampirised is very real.

Vampirism: fact or fiction?

Clearly, at least, some vampires are real, unlike the humanoids noted in the legends above. But the legends are, of course, just legends . . . or are they?

In a lecture entitled "Hard-core porphyrinology", Professor David Dolphin of the University of British Columbia, discussed the nature and symptoms of the relatively rare disorder called iron-deficiency porphyria. They do indeed give pause for thought.

The term porphyria refers to a variety of metabolic disorders that result in an accumulation of iron-free porphyrins in the body. Iron porphyrins, called haems, are molecules vital in several metabolic processes including respiration.

Iron-deficiency porphyria is evidently congenital and results in an incapacity of the body to bind iron to the porphyrin to make haem molecules. As a result, iron-free porphyrin molecules accumulate in the skin and the skin becomes peculiarly and adversely affected by light. Too much exposure to light results in skin lesions and other damage. Not surprisingly, the sufferer quickly learns to avoid daylight. Sounds familiar?

So where, would you suppose, such a sufferer could find those vital haem molecules so necessary for metabolism? Would you be surprised to learn that blood of normal individuals is just loaded with iron-rich haem molecules?

There's more. Evidently, chronic side effects of iron-deficiency porphyria include a tightening of the gums which has the effect of making the teeth appear longer or more protruding than usual and, curiously, the sufferer begins to grow long dense hair over the face and forehead.

The best, however, is still to come. In normal circumstances, the haem molecules that would occur in whole blood have a lifespan of only 120 days. The chemical that normally breaks down this haem is the enzyme cytochrome P450. And it has now been found that the haem-destroying capacity of cytochrome P450 can be enhanced by exposure to a decidedly familiar substance: garlic! Apparently garlic can be lethal to an iron-deficiency porphyria sufferer. Food for thought? □

SHARK NETTING a costly security blanket

by Lucy Hodgson

Perhaps not surprisingly, the average person has a morbid fear of being eaten. In an era when we are led to believe that we can control our environment, being devoured by a less intelligent species seems to be the ultimate indignity. Nowhere is this more clearly illustrated than in our fear of sharks.

A quick survey of beach users on a Sunday would show that most people are more afraid of sharks than they are of drowning or being involved in a car accident on the way home. This is despite the fact that they have more chance of being struck by lightning than being attacked by a shark.

Prior to 1937, Australia had the highest incidence of shark attacks in the world. In an effort to reduce this risk, the New South Wales Government introduced a system of shark netting. The success of this program can be inferred from the following table: (adapted from Coppleson 1962)

Locality	Attacks between 1919 and time netting was introduced (1937)	Attacks since introduction of netting
Newcastle harbour & ocean beaches	12	2 since 1950
Sydney: northern ocean beaches	5	0
Sydney Harbour	15	7, 1942-64 (harbour never netted)
Sydney: southern ocean beaches	9	1
Total	41	9

The effectiveness of shark netting has led many people to believe that a "netted" or "meshed" beach is totally enclosed by a net so that all sharks are excluded from the area. In reality, a netted beach is one that is periodically netted by contractors. These contractors are usually professional fishermen who successfully tender a contract with the N.S.W. Department of Agriculture Fisheries Division to maintain a series of anchored gill nets off beaches in the Newcastle, Sydney and Wollongong areas. The Queensland Government introduced shark netting in 1962 to protect 31 beaches ranging from Cairns to the Gold Coast. The number of netted beaches was increased to 59 in 1975.

The nylon multistrand gill nets are about 150 metres long and six metres deep, set parallel to a beach about 300 to 500 metres offshore. They are held to the bottom by lead weights and kept upright in the water by floats (see drawing). Therefore a net does not cover the length of a beach, or even the entire depth of water over which it is placed. As it is laid parallel to the beach, it may prevent sharks swimming close to a beach when it is set, but it can also trap sharks inshore. Many sharks caught in the nets are ensnared whilst swimming away from the beach. In Queensland 198 drum lines are also used as a method for catching sharks and keeping them away from popular beaches. But because these floating lines are baited with fish meat they may actually attract sharks to an area.

Netting contractors must set nets at a certain number of beaches over a certain period of time so that each Sydney metropolitan beach is meshed at least four times per month. During the week, nets are laid for a minimum of 24 hours and, over the weekend, they are set for at least 48 hours. So, in fact, a "netted" beach probably only has a net set on it for six days each month. These days are picked at the discretion of the contractor and they are planned for the convenience of the fisherman rather than for efficiency of shark catching. Also, heavy seas may move the nets or prevent laying and retrieval. With this sporadic technique, why does netting of beaches appear to be so effective in preventing shark attacks?

A look at the figures for any area where shark netting is carried out shows that, after an initial large catch of sharks, the numbers decline rapidly and remain low. The N.S.W. figures for total number of sharks caught provide an example:

Year	1940	1941	1948*	75/76†	76/77
No. of Sharks	751	705	260	362	317

Year	77/78	78/79	79/80	80/81
No. of Sharks	159	233	325	163

*Shark netting was not carried out over the war years and data for the years 1948 to 1975 are not available.
†Data per 1975-81 include catches from Wollongong and Newcastle.

There are two possible interpretations of this phenomenon. Firstly, sharks could learn to avoid the nets but, if this were so, the risk of shark attack would not be greatly reduced on the days when beaches were not netted. The second and most likely explanation is that shark populations in the vicinity of netted areas are so depleted that the nor-

Close up of a netted White Shark. Photo: R. & V. Taylor

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mally minute probability of shark attack is reduced even further. Reducing the shark population may also mean that more of the sharks' natural food is available so that they are not forced to search inshore for food and mistake the splashing of a surfer or bather for a large fish.

The lack of research on sharks, however, means that it is impossible to say exactly why netting is so effective. Over $600,000 is spent on shark netting in Australia each year but there is no money for research to be carried out on the sharks caught. These potentially valuable scientific specimens are taken five kilometres out to sea and dumped without even being measured. The record of sharks caught in the gill nets is poor, particularly for the earlier years, and the specific names of those sharks that have been recorded are unreliable as few people are able to accurately identify them. This is especially so for the many species of whalers that are all quite similar and that are most commonly involved in attacks on humans off the Australian coast.

If netting does drastically reduce shark populations, is it adversely affecting our marine environment? Sharks are naturally scavengers, eating dead or dying animals and rubbish that would normally degrade slowly and reduce water quality. However, the general hysteria over shark attack means that any beneficial effects that these ocean-going vacuum cleaners might have are overlooked in the panic to rid the beaches of them. This is illustrated by the fact that, when limited netting was introduced in Queensland in 1962 for a trial period, tourist areas clamoured to have their beaches included.

After release of the movie "Jaws" in the United States, coastal areas lost millions of dollars in tourist trade — so much that a conference was convened in 1976 entitled "Sharks and Man: a Perspective". The conference was attended by shark experts from various countries of the world. Unfortunately Australia, despite its reputation for being the most dangerous country for shark attacks, did not have enough money in the shark research kitty to send a representative. The conclusion reached at the conference was that netting, although not 100% safe, is the most effective available protection against sharks. Also pointed out was the need to develop increased safety measures and, at the same time, maintain the "vital ecological niche which sharks must occupy if the delicate balance of the marine ecosystem is to be maintained".

The threat to our marine environment through netting activities is not confined to the removal of the ocean's largest scavengers. Other harmless animals are trapped in the nets; in fact, shark nets catch as many rays as sharks. Rays are not protected animals but their capture in large numbers without any research into the effect is, at the very least, foolhardy. More disturbing is the fact that the Queensland nets catch protected species that would normally carry a $1,000 fine for each animal killed. Since 1962, 468 Dugongs, 2,654 turtles (some species such as the Leathery Turtle are considered to be critically endangered), 317 dolphins and two whales have been caught in the Queensland nets. Animals other than sharks that are still alive when the nets are hauled in are released but few would survive the trauma of capture.

It could be argued that human lives are worth more than the lives of a few harmless marine species but it may not be necessary to risk either. No studies have been carried out to determine whether shark netting could be made more efficient in terms of monetary cost and cost to the environment. Nets are often empty of sharks after being set for the usual 24 hour period yet, when sharks are caught, a significant percentage are harmless species. In N.S.W., between 1975 and 1981, 19% of all sharks caught by contractors were species that are considered harmless to humans.

In Queensland there is a six week period in the colder months of June and July when no netting takes place. Shark attacks are extremely rare in colder water but this could be due to the fact that less people swim in cold water. In N.S.W. shark netting was disrupted by the war between the years 1941 to 1948 but when netting recommenced there was no increase in the number of sharks caught over the pre-war figures. This could indicate that the extent of shark netting carried out today could be drastically reduced with little or no reduction in efficiency.

Dr John Stevens of the C.S.I.R.O. Fisheries Division has produced the first serious scientific work in over 40 years on potentially dangerous Australian sharks. He points out that the number of sharks caught by netting in N.S.W. is roughly equivalent to the number of sharks caught by game fishermen. It is possible that game fishing alone could be sufficient to keep shark numbers down and maintain the low probability of shark attack.

Shark netting contracts were drawn up at a time when beaches were used in a much more confined way than they are today. Beaches used to be visited for a quick dip between the flags so the setting of nets off the main sandy area of a beach was then the most effective method of shark protection. However, the increasing popularity of water sports such as surfing takes people further offshore and closer to headland areas that are not protected by nets. Also, the use of four wheel drive vehicles means that more people are using isolated beaches that are not netted.

Research overseas has attempted to find alternative methods to reduce the risk of shark attack. Methods investigated included bubble curtains, which are walls of air bubbles used to enclose a beach, electrical and acoustic barriers, and chemical deterrents such as that derived from the Moses or Peacock Sole. None of these methods was found to be universally effective so, until more research is conducted into the behaviour and life histories of sharks, it will be impossible to develop other methods of protection.

It is time to reassess the costs of shark netting and determine whether it can be carried out more efficiently, replaced by a better method or whether it is even necessary. Shark netting appears to have made our beaches more secure but, because out usage of coastal areas has changed since the netting program was first designed, the safety factor could now be in question. The cost of this security to the environment should also be assessed as compounded stresses are being applied to the coastal marine ecosystem, particularly through increased fishing pressure and habitat destruction. It will take a brave politician to give the order to limit, or even stop, shark netting and accept responsibility for any future shark attacks.

Further Reading

COPPLESON, V.M., 1962. "Shark attack". 2nd ed. Angus and Robertson: Sydney. 269 pp.

STEVENS, J.D., 1984. Biological observations on sharks caught by sports fishermen off New South Wales. *Aust. J. Mar. Freshw. Res.* 35: 573-90. □

FORUM

Balmain Basket-weavers and The Volvo Set *Versus* Toorak Tunnel Vision

by Robyn Williams

Australian Natural History welcomes celebrated science journalist Robyn Williams as a regular contributor.

"Approximately 80% of our air pollution stems from hydrocarbons released by vegetation. So let's not go overboard in setting and enforcing tough emissions standards for man-made resources." **Ronald Reagan, 10 Sept. 1980.**

"The environmentalist's real thrust is not clean air, or clean water or parks, or wildlife but the form of government under which America will live . . . Look what happened to Germany in the 30s! The dignity of man was subordinated to the powers of Nazism. The dignity of man was subordinated in Russia . . . Those are the forces that this thing can evolve into." **James Watt, U.S. Secretary of the Interior, 24 Jan. 1983.**

"There's a high rate of cancer among my friends. It doesn't mean anything." **Dr Francis Clifford, Health Commissioner, responding to reports about Love Canal, in his jurisdiction, 1978.**

"When you come right down to it, you'd be hard pressed to find any group of people who care as much about the environmental well-being of Niagara Falls as the people at Hooker Chemicals." **Advertisement placed by the company responsible for dumping wastes at Love Canal.**

"Radioactive waste is the biggest contemporary non-problem." **Dixy Lee Ray, Governor of Washington and former head of Atomic Energy Commission, quoted by Dr Edward Teller.**

"All the waste in a year from a nuclear power plant can be stored under a desk." **Ronald Reagan, Feb. 15 1980.**

"A nuclear war could alleviate some of the factors leading to today's ecological disturbances that are due to current high population concentrations and heavy industrial production." **Official of U.S. Civil Defense.**

Statements like these serve to remind, if that's necessary, that the powers that be will say almost anything to dismiss concern about the environment. They do it for a number of reasons. Some wish to avoid liability for damage to health; Hooker Chemicals of Love Canal were behaving quite rationally when they tried to side-step the blame for the cancers and the birth-defects. James Watt and Ronald Reagan are mindful, on behalf of big private companies, that interference by some greenie could delay a multi-million dollar scheme and cost the investors a fortune. They also claim, correctly, that there is never cast-iron proof of hazard or potential damage. So they argue for market forces, not environmental impact statements, and have dismantled controls accordingly.

> "Is there no difference in the eyes of the market place between a Bren gun and a kidney machine, a packet of cigarettes and a bag of fruit?"

Finally, there are those, such as Dr Edward Teller, who sincerely believe that the evidence is on their side and that conservationists protest about *everything* and won't tolerate *any* development: that they're against uranium because of radiation, against coal because it pollutes, against oil because of the greenhouse effect, against hydro-electric power because it floods the wilderness, against wind and solar installations because they clutter the landscape. *Against* . . . simply, universally, *against.*

But I believe there is another reason apart from self-preservation, self-interest and dispute about evidence that makes the opponents of the environmental movement different in their attitude. It's fundamental and subtle and essential to understand if one is to change the debate. It is the state of mind that allows Mr Paul Keating, the Federal Treasurer, to call conservationists Balmain Basket-weavers and the Volvo Set. I shall call the syndrome "Toorak Tunnel Vision". To describe it I must go back to the time I first arrived in Australia 20 years ago, fresh, innocent and extremely European.

My perception was tuned to the density of the European landscape. Hedgerow and moor, woodlands where the light is gentle, coastal cliffs and mountain ranges where people had explored for centuries and made their discoveries famous. In Europe you expect to walk for only a few minutes to find both history, human history and nature, changing all the time. The locals have grown with the changes over hundreds of years and development, when it threatens, will mobilise practically all of them: tories, squires, artisans, socialists, basket-weavers and owners of Scandinavian motor cars alike. Only where the population has been uprooted and dumped onto bleak estates in remote suburbs is the sense of place destroyed. Even in the old urban centres like Battersea locals will still fight for some ancient pub or dwelling. Of course, since 1964, the time I'm talking about, Europe has been plundered terribly, but 20 years ago it was still possible to feel that the old continent could resist all change, war, the 20th Century, glass buildings and autobahns, its fabric was so thick and complex, nothing could tear it apart.

Well, those are, as you'll recognise, the perceptions of someone not yet very old. But the impact of the Australian landscape on those youthful eyes for me was like that experienced by so many visitors and even, sad to say, those who grew up here. It is of seeing urban vistas of utter baldness, where not a tree stands, where the light glares and blasts down on the awful coloured brick dwellings, squatting like pink and orange toads along the tarmac; where primary colours shout at you and even the odd green leaf is too dark and seems simply to compete with the neon and cardboard adverts. It was as if someone had flattened the land and poured tar

all over it. For me, there was nowhere to walk, nothing to look at, nothing to discover.

And there, where the town stopped and the countryside began was "bush". Starting at Blacktown or Essendon the scrub began and continued relentlessly, unchanging all the way to the Indian Ocean, to the Timor sea and northern Queensland. As the writer, Mark O'Connor has observed, that dreadful, dismissive word "bush" condemned the Australian landscape to an almost inevitable extinction, as European eyes failed to see its subtlety and took it as alien in every way.

Now I see this land quite differently. The change in perception has required practice, experience and a great deal of study. Now I see towns which have rediscovered their history, which have opened their streets to people, which have tried to blend new architecture with that sense of place. You don't have to be a very old city to be interesting; but you do have to be carefully planned. As for the countryside, well that's become a revelation. Just as the old European created a completely new landscape, so too, many thousands of years before, did the first humans here in Australia. About 50 or 60 thousand years ago, perhaps even earlier, we could not have looked out on endless eucalypt, not the way it is now. And, as for the flora and fauna of the continent that Banks and Solander found to be a natural treasure trove 200 years ago. Even now we haven't a clue what the extent of our biological inheritance might be, let alone how it works.

So, for what it's worth, I'm saying that my own view has been altered drastically and that this is as a result of both an intellectual and an aesthetic process taking time and patience. Not a process easy to recommend to the developers of this world, but one by all means available to the next generation of Australians.

But, Toorak Tunnel Vision isn't intellectual. Nor is it concerned with waste. Specifically, I mean the nature of modern economic attitudes in some quarters, extending beyond Toorak to Downing Street and Pennsylvania Avenue. Normally it's referred to as the creation of "wealth". A captain of industry here in Australia, the managing director of a giant international company, put the argument this way: that we lost our way in the 1970s and became too concerned with "redistribution, equality and co-operation" instead of "the creation of wealth". Professor Peter Farrel, once of the University of New South Wales, put it more starkly and described artists and even medical people as essentially parasitic because they don't produce this so-called "wealth".

But what is this "wealth" whose creation we must not impede? Are all *things* equal in value as long as they move money? Is there no difference in the eyes of the market place between a Bren gun and a kidney machine, a packet of cigarettes and a bag of fruit? Someone once said that Australia's economy would benefit most if you sent a package from Sydney to Melbourne via Adelaide, Perth and Hobart. In other words, a smash of five cars and a truck on the Hume Highway is really super for the economy because garages benefit, so do manufacturers of coffins, wheelchairs and convalescent homes, let alone the wreckers and smash repair shops and highway patrol staff and makers of splints, bandages and incontinence wear. So, if you want to back Australia, drive a bus down the highway on the wrong side of the road. Or perhaps you'd prefer to start a war. Employment goes up, manufacturing industry goes flat out, demand is accelerated. Is this "wealth"?

Is a rainforest without value? Is a wilderness of no interest simply because you can't trade it? Is filthy air and a dying woodland a small price to pay for the rich civilisation we see all around us? Are these naive questions?

For the economist they are irrelevant questions. For the politician they are incidental. Look at the priority given to science and the environment by governments in Australia in recent times. Uranium is OK. Research is passé (except where it serves industry). Places may be protected, unless they mean money to somebody, like Roxby Downs, like Daintree. No major party dares to stand squarely for conservation in these times of an economic crunch. Is this simply conservatism such as that represented by Ronald Reagan and James Watt? Not quite. You'll find that the Northern Lands Council backs uranium mining; many unions, loggers and hydro-electric workers for instance, strongly oppose conservationists. That you'd expect. Put it another way: how many unions whose future is affected by such issues are doing research on alternatives to benefit both themselves and the rest of us? Are the miners, for instance, both here and in Britain, looking for ways to improve one of the worst jobs imaginable and to replace one of the greatest polluters on earth, coal?

What do Marxists argue? That we should protect the environment, but that we are part of it and protection doesn't mean everything stays the same. If people's needs must be met, so the environment will have to adjust. Is this different from a capitalist view? Not much, except that it's the individual's needs rather than people in general. So, where does that leave conservationists in these tough times? Are you a luxury we can afford only in boom times? Only, it seems to me, if you have a very mean view of the nature of wealth. Our economists, and so our politicians who follow willingly, serve us very badly with such *ad hoc*, limited

criteria. As Oscar Wilde might have put it: an economist (often by definition a cynic) is one who knows the "price of everything and the value of nothing". But what's the alternative?

How do you demand that people sacrifice financially so that apparently esoteric matters of ecology and conservation are supported? How do you get such issues highlighted in elections which have everything to do with the piggy bank and nothing to do with the planet? How do you avoid being Basket-weavers and Volvo Sets in the eyes of the majority?

I'd be a genius if I knew the answers to those questions, but I'd guess that a start would be to return to the roots I spoke of at the beginning — meeting people on their own ground. And if there's a floating population, as is so common today since one is forced to follow employment possibilities and housing one can afford, then the best places, surely, are in the schools and in the places of work.

In the school, and university, the point, I believe, is to aim for the hallowed scientific excellence, because there's nothing worse than a conservation-minded person with fuzzy facts or arguments. But the basic science must be integrated with a sense of history and philosophy. Taught properly, science forces one to ask questions.

Knowledge is subversive. The first battle must be to make environmental studies the most celebrated course available. No hint of the smear, the easy option. Secondly, one should follow up the splendid examples of the Franklin experience and Daintree to ensure that the best possible scientific information is ready when the crunch comes.

Mr Malcolm Fraser, no less, told me that it was the archaeological research that made the difference in the Franklin decision. Without first-class research, it's just a bull-ring. With it you always have a chance. Also required is an international network to back you up. So, in tough times, you tackle the fundamentals, attack the bases of power.

But don't for a minute think that the going is easy. As I indicated before, times have changed. Not necessarily because resources are fundamentally different, but because the political climate has altered for a generation. This is how it was summed up in *Nature* magazine recently in a review of David Dickson's *The New Politics of Science* by Professor Dorothy Nelkin of Cornell University. "Dickson sees a declining interest in the environmental, social and ethical implications of research. As criteria of efficiency replace the emphasis on equity, he sees a re-direction of research away from social priorities. He also discerns changes within the community as commercial and military interests lead to secrecy and to tensions over traditional patterns of science communication. He worries about relationships within universities as certain departments compete to keep their faculty together in the face of well-paid entrepreneurial temptations. But, above all, Dickson worries about the political consequences of the new politics of science. The reduced possibilities for public involvement in political decision making and the increased deference to technical expertise. Indeed, he sees the future of democracy itself as being at stake."

I quote that statement at length as a warning. In the recent U.S. election, around two-thirds of the youth of America supported the most anti-conservationist regime seen in America for generations. What then, about this country? Does anybody know what young people think here? Could it be that their outlook is reflected in contemporary music? Gone are the protest songs of ten or more years ago. Instead we have self-indulgence, commercialism, hopelessness and cynicism. Culture Club sings "war is stupid", followed by "people are stupid". Such pessimism.

Conservationists must now be very street-wise politically. This is *not* the time to isolate yourselves and your efforts in single-issue parties like the Greens in Germany, but instead bring high quality advice and lobbying right across the board to *all parties, to all unions, to all* aspects of teaching and research.

The women's movement has grown from a somewhat haphazard but bold beginning to an almost universal, mature, confident part of everyday life. Environmental concern must see itself as all-encompassing.

Having talked about politics, work, education and popular perception (however superficially) it remains for me to talk personally because it's how we each behave that makes such a difference.

What then do I do? Well, I often cycle to work. I always use public transport. I obsessively turn the lights off. I put bottles out for the recyclers to collect. I re-use envelopes. I undercook food and always reject wrapping paper, superfluous packaging, processed food and too much meat. I sabotage air-conditioning, shut down heaters and try never to use lifts. I get angry when I see people using escalators instead of striding along and I could garotte those who call lifts to go up (or worse down) one or two floors. I hate, loathe and detest those who design buildings where the stairs can't be used and the windows can't be opened.

As a result my friends, colleagues and family think I'm completely mad. Most Australians don't behave like I do.

When it comes to reducing waste we haven't even begun. Don't talk to me about building zillion dollar power stations to meet future increases in demand. Whose demand? For what? Another pile of plastic garbage? Another orgy of waste?

We used to think more about these economies ten years ago. Then we had doomsdayers talking about *the energy crisis* and the *population bomb.* We worried more and tried to be responsible through some personal restraint. No longer. Only a few try now. Perhaps it's time for conservationists to show individuals how everyday measures can make a difference. Children, especially, should be aware, but they don't seem to be. Mine find my economies to be eccentric.

I think of them as aesthetic. There is something intrinsically beautiful about thrift and efficiency. There is a lot of ugliness in waste and carelessness.

"Dont talk to me about building zillion dollar power stations to meet future increases in demand. Whose demand? For what? Another pile of plastic garbage? Another orgy of waste?"

poster

BUFF-BREASTED PARADISE-KINGFISHER

The striking Buff-breasted Paradise-kingfisher or White-tailed Kingfisher, *Tanysiptera sylvia,* is one of seven attractive, long-tailed species of paradise kingfisher distributed in eastern Indonesia, New Guinea, the Bismarck Archipelago and northern Queensland. It is the only paradise-kingfisher that occurs in Australia.

The Buff-breasted Paradise-kingfisher migrates to Australia from New Guinea to breed. Birds arrive from October to November and begin to establish their territories. At this time the presence of this species becomes obvious from its loud, persistent calls, a high-pitched trill given constantly throughout the day during the breeding season and a "chuga chuga chuga" repeated six or seven times at intervals. The major breeding habitat for this species is dense lowland rainforest with active termite mounds on the floor. Once an adult pair has mated, they begin to burrow a nest chamber into the side of a termite mound. The chamber, which takes three to four weeks to dig, is about 130 millimetres high and 150 millimetres in diameter on completion. Its entrance is no more than 300 to 350 millimetres from the ground and may occasionally be as low as 150 millimetres. These once noisy kingfishers fall almost silent as nesting begins.

A week after the nest hollow is prepared, the female lays one to three round, white eggs. Hatching takes place with remarkable regularity, usually from the last week in December through to the second week in January. After they emerge from the eggs, the chicks grow rapidly but remain in the nest for 24 days. Much of their time is spent fighting among themselves. They are fed a diet by the parents similar to that of the adults: invertebrates and small vertebrates taken from the forest floor and lower vegetation. The noisy, aggressive chicks drop much of their food to the chamber floor where it attracts fly maggots. These, combined with droppings and decaying food, make a kingfisher's nest an unpleasant place.

Young kingfishers are not cute like many other chicks. The feathers of other baby birds emerge covered in pulpy sheaths, which they soon break through, leaving some remains at their bases. In kingfisher chicks, however, the sheaths and feathers grow together for some time giving the birds the appearance of being covered with spines. As the breeding season progresses, even the adult kingfishers lose some of their attractiveness. Continually entering and leaving the nest, their plumage becomes soiled and their tails, originally making up more than half their length, become abraded and broken.

Buff-breasted Paradise-kingfishers return to New Guinea between March and April, adults departing before the young birds. There have been observations of individual birds in Australia during the winter that suggest that some of the population may be resident throughout the year. □

Walter Boles
Ornithology Department
Australian Museum

The Buff-breasted Paradise-kingfisher, *Tanysiptera sylvia*, about to make a meal of this grasshopper. Photo: C.B. & D.W. Frith

letters

Importing Aquatic Organisms

Ms Parr's article "Populations threatened: inadequate quarantine laws" (A.N.H. Vol. 21 No. 5) creates the impression that the dumping of ballast water is the main or only means by which exotic aquatic organisms may colonise Australian waters, that colonisation from this source has been firmly established, that a technical solution is readily available and that the Department of Health is unaware of, or unconcerned about, all of the above.

Ballast water is in fact only one means of importing aquatic organisms. Some 10 million live aquarium fish are imported annually. As the majority of these are fresh water inhabitants and as we are advised by the various fisheries authorities that the Australian freshwater environment is particularly susceptible to colonisation, this aspect of aquatic quarantine was given top priority.

As well, there has been an upsurge of interest in recent years in aquaculture and many proposals have been received by this Department to permit the importation of huge quantities of exotic species for this purpose.

After careful studies by our scientific staff, most of these proposals have been rejected and it is apparent that some of these proposals could have had ecological consequences far in excess of those so far demonstrated from ballast water. In fact, the 1982 report to which Ms Parr referred concluded that: *"No unequivocal evidence was available to show that any taxa found in either ballast water or mud was competitive or commensal with, or predatory or parasitic on, Australian marine organisms. There is a fundamental lack of information about this complex ecological problem and it is beyond the scope of this project to provide this information."*

Incidentally, contrary to Ms Parr's statement that the Department was unaware of the N.S.W. Fisheries Division report, the report was carefully studied and a letter outlining the Department's response was sent to the Australian Fisheries Council on 25 March 1983.

Preliminary studies in the N.S.W. report suggest that mid-oceanic exchange of ballast fails to reduce the number of species, particularly benthic species, carried in the ballast tanks, and treatment of water on arrival has been proposed. The development of such a system is not as simple as may at first appear. Chlorine treatment has been suggested but the risks involved may in fact offset the benefit of treatment.

This Department is currently studying a number of alternative water treatment systems and would need to consult with the Australian Fisheries Council and a number of other bodies before the final implementation of any one system.

K.A. Doyle
Assistant Director-General,
Animal Quarantine,
Commonwealth
Department of Health

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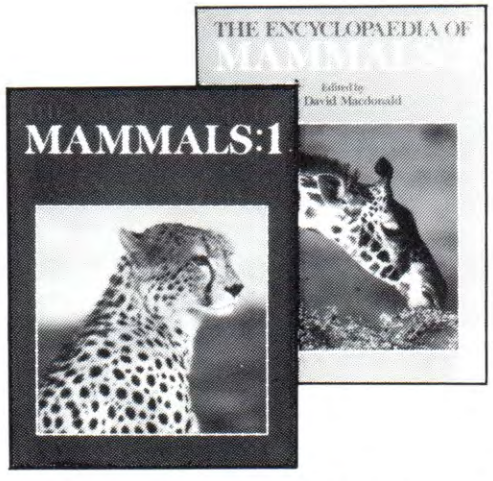

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Sydney's Bicentennial Park 1988

by Simon O'Brien and Rob Thorman

On 26 January 1888 some 40,000 citizens of Sydney crowded the area known as the Lachlan Swamps to see the Premier, Sir Henry Parkes, and the Governor, Lord Carrington, proclaim the opening of Centennial Park. Upon arriving in New South Wales as Governor, Carrington was surprised to find that there was no area in Sydney where people could "ride and drive". In 1886, therefore, he recommended that the Lachlan Swamps be devoted to this purpose. Parkes took up Carrington's idea with the result that the 220 hectare site was "dedicated to the enjoyment of the people of New South Wales forever". Centennial Park was never intended as an area of conservation, rather it was to be an area of development featuring stately buildings, sculptured gardens and grand avenues. As it turned out, however, many of the more grandiose plans did not materialise.

Dedication of Centennial Park, 26 January 1888. Photo: courtesy Mitchell Library, N.S.W.

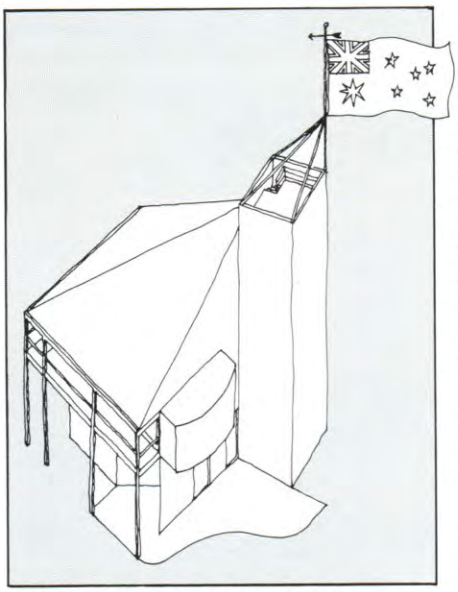
One hundred years later there are now plans to open a Bicentennial Park, west of Sydney at Homebush Bay. The cost, which will be shared equally between the State and Commonwealth Governments, will be eight million dollars. As it is now envisaged, the new park will consist of 53 hectares of wetland and 30 hectares of developed parkland. Besides its smaller dimensions, the new park will differ from the old in that much of it will be managed for the conservation of the natural environment rather than for the sole purpose of public recreation.

Homebush Bay is bounded on two sides by factories and will therefore provide a unique opportunity for industry and conservation to work in harmony. To an extent this is already happening with existing industries. The abattoir has cleaned up its effluent discharge and has installed afterburners to reduce odour, although with a westerly breeze over the park one would still be aware of its existence. CSR Limited has planted trees along the waterfront to obscure much of the refinery and thus enhance the area surrounding the park. As part of its centenary in 1983, Concord Council awarded CSR a Centenary Landscape Award for perimeter landscape along the frontage of Homebush Bay.

However, some threat to the park arises from the possibility that incompatible industries, both ecologically and aesthetically, will be built on the largely vacant land to the west of the park. This threat could be overcome if the land, which is currently owned by various State and Commonwealth authorities, is developed integrally within the framework of a larger park. This would conserve important wetland areas along the Parramatta River foreshore and ensure that appropriate, co-ordinated development and recreation occur in the area. In its present dimensions the park is divided into two areas. The southern section, which in the past has been used for dumping rubbish, will be reshaped, planted and used for public recreation. It will feature an artificial lake and island, cycle and pedestrian paths, picnic and barbecue pavilions and associated car parks. The landscaping will be based on classic design principles of order and geometry with a series of axes and focal points. Predominantly native plants will be used with avenues of fig trees (*Ficus hillii*).

The northern section of the park has been dedicated to the conservation of mangroves (almost entirely *Avicennia marina*). Mangroves are important primary producers and form the basis of many estuarine food chains. They provide shelter, organic matter and vital breeding grounds for birds, fish, crustacea, molluscs, worms and insects. In fact, the mangroves of Homebush Bay support at least 17 species of fish and 50 species of waterbird, including the Red-capped Plover *(Charadrius ruficapillus)* and the Black Duck *(Anas superciliosa)*, species that are becoming rarer in the Sydney region. Mangroves also play an important role in the stabilisation of the foreshore and act as a filter that reduces the amount of nutrients and pollutants entering our waterways.

Mangrove swamps have traditionally been regarded as unpleasant places, unworthy of preservation and have consequently suffered badly at the hands of government and private developers. It is vital, therefore, to educate people, especially the young, about the important role mangroves play in the natural environment. To assist this process there are plans to build a Field Study Centre, which will include a viewing tower and teaching room. School and university groups will be able to treat the park as an open classroom to learn



Sketch of the proposed visitor information centre. Courtesy Public Works Department

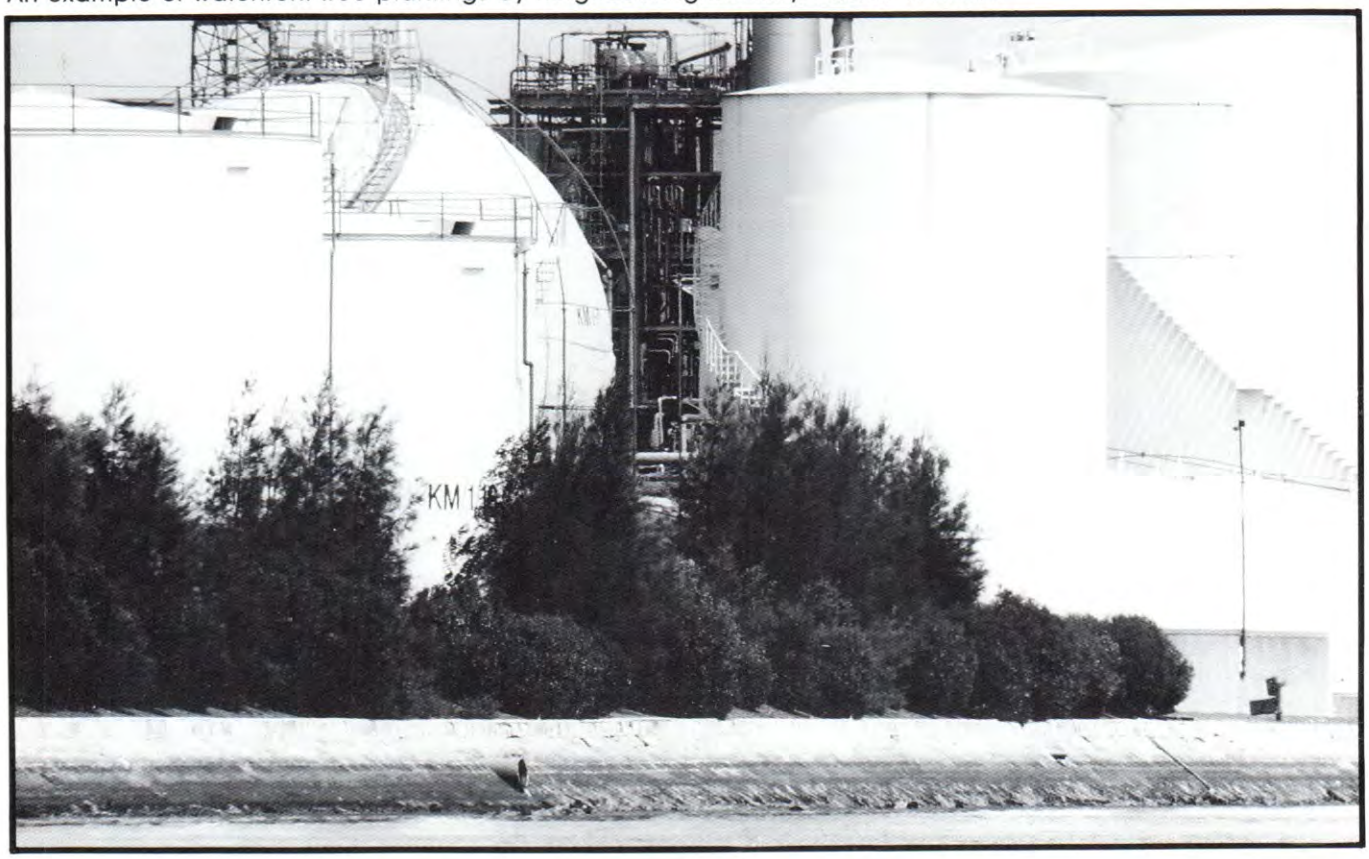
about mangroves and the principles of ecology.

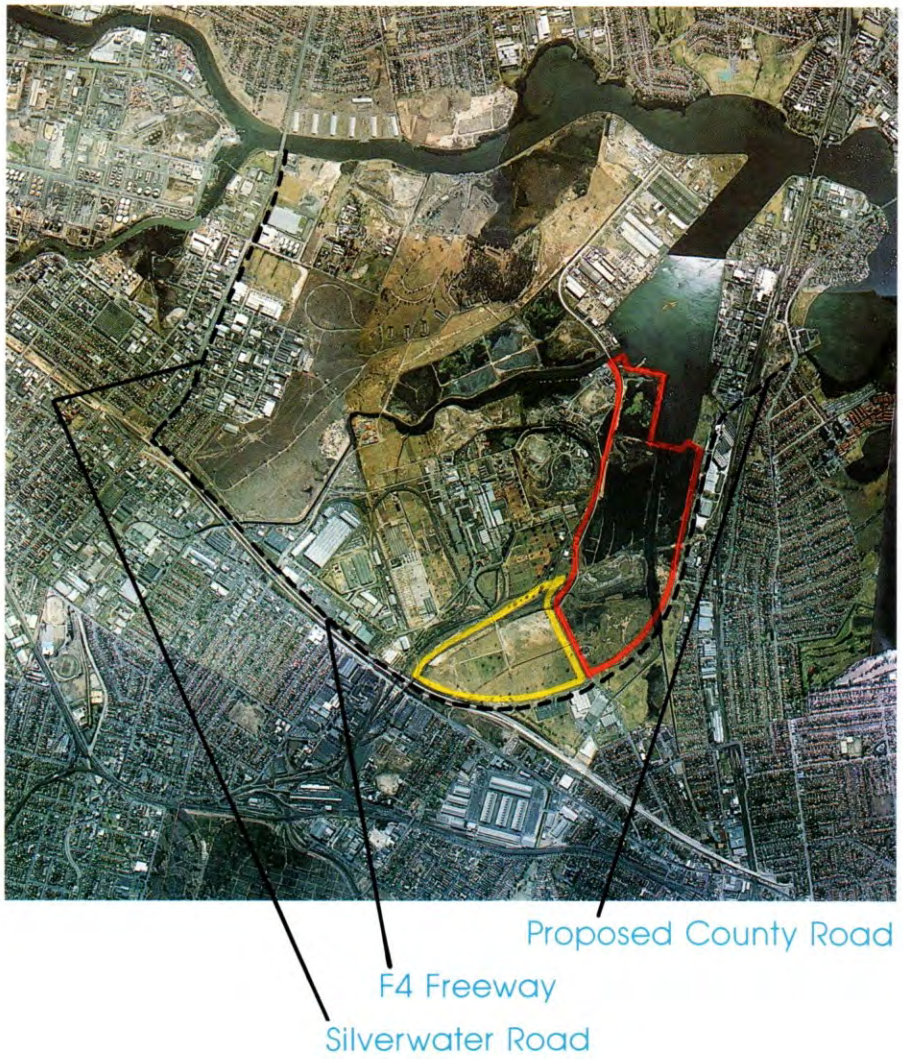
The flora and fauna in the northern section of the park have been affected by a variety of human activities in the past. The Maritime Services Board dredged a pond, known as M.S.B. Lake, which now offers a unique habitat for waterbirds. Bunds or levee banks were constructed with fill in preparation for land reclamation. These will be incorporated in a network of trails that will provide comfortable walking access through the mangroves and to waterfront areas. There is also a 2CH radio mast that will continue to exist within the park. Although there has been a general increase in mangroves and a decline in the saltmarsh community (consisting mainly of *Sarcocornia quinqueflora*), in certain areas the structures outlined above have led to silting and have also prevented the daily flushing of the mangroves, causing them to die. This is because the trees have aerial roots or pneumatophores that provide the root system with oxygen; and these must be exposed to air regularly if the trees are to survive. Measures, such as reopening old watercourses with culverts, have now been taken by the park authorities to improve tidal flushing.

Improved tidal flushing should also contribute to the control of mosquitoes. There are four species in the park but only one, *Aedes vigilax*, is a potential problem to local residents. To manage the mosquitoes Concord Council sprays with Abate, an environmentally sound insecticide that is degradable in less than three weeks. It is specific for mosquitoes having "minimal to negligible effects on non-target organisms".

Bicentennial Park as it is presently planned will contain the largest remaining area of mangroves on the Parramatta River. It is a far-sighted project that will enhance the urban environment and provide a valuable resource for recreation, education and conservation. However, while the State Government has undertaken a number of commendable bicentennial projects for 1988, present plans for Bicentennial Park only include 83 hectares. One hundred years ago the government had the foresight to proclaim 220 hectares as a Centennial Park for a city of 350,000 people. It would be appropriate, therefore, to consider inclusion of further lands if Bicentennial Park is to follow the grand tradition of Centennial Park and be truly worthy of the 3,500,000 people who will live in Sydney in 1988. □

An example of waterfront tree plantings by neighbouring industry. Photo: J. Fields





Aerial view of Bicentennial Park and neighbouring lands. Photo: 1982 C.M.A. Sydney Colour Series

Bicentennial Park

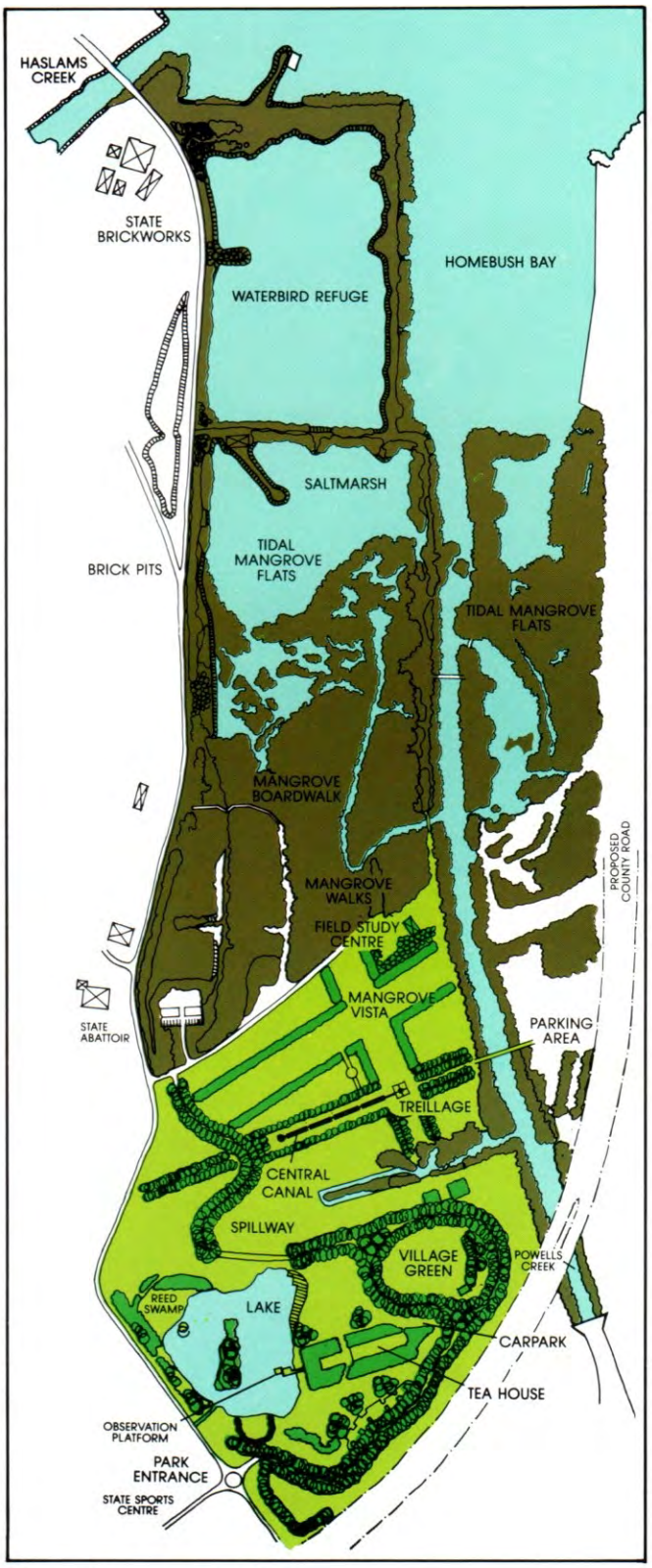
State Sports Centre

Royal Spoonbill, *Platalea regia*. Photo: J. Fields

Construction of the artificial lake and island in the southern section of the park (see plan). Photo: J. Fields

Site of future footbridge through the mangroves in the northern section of the park. Photo: J. Fields

M.S.B. Lake, dredged by the Maritime Service between 1955-1961. Photo: J. Fields



Plan of Bicentennial Park.

AUSTRALIAN DINOSAURS

The Cretaceous reptiles of Australia (i.e., those that occurred between 135 and 65 million years ago) are by far the best known of the Mesozoic forms. And among these, the dinosaurs were perhaps the most awesome. The "Australian dinosaurs" poster (painted by Mark Hallett and published by the Queensland Museum in 1982) depicts some of the dinosaurs known to exist in Australia 100 million years ago. With the exception of *Muttaburrasaurus langdoni*, Australian dinosaurs are represented by very few specimens, a sad contrast with the abundant dinosaur remains known from North and South America, Eurasia and Africa. Reconstructions of the Australian forms are based, therefore, on comparisons with more complete skeletons from other continents. The colours used are similar to those found in living reptiles.

Pterosaurs, flying reptiles that were contemporaneous with but not closely related to dinosaurs, ranged in size from that of a sparrow to enormous creatures with wingspans of 15 metres. The first Australian pterosaur fossils were discovered in 1979 in early Cretaceous marine limestones east of Boulia, western Queensland. The specimens include an incomplete lower jaw, a vertebra and part of the shoulder girdle. These fossils, compared with material from overseas, are unique in that they are uncrushed and undistorted. Although probably mainly fish-eaters they culled their meals from the shallow, inland sea that covered a large area of central Australia, they may also have been scavengers of the land, as depicted here.

Dinosaurs have basically been divided into two groups on the basis of their pelvic structure: saurischians or "reptile-hipped" dinosaurs (Hughenden sauropod, *Austrosaurus mckillopi, Kakuru kujani* and *Rapator ornitholestoides*) and ornithischians or "bird-hipped" dinosaurs (*Muttaburrasaurus langdoni, Fulguratherium australe* and *Minmi paravertebra*). Saurischian dinosaurs have a rod-like pubis and ischium that diverge from each other. In ornithischians, these bones are parallel. However, the discovery of unusual saurischians with sub-parallel pelvic bones from central and eastern Asia has complicated this simple classification. Perhaps these forms represent a structural link between the saurischians and the ornithischians?

Austrosaurus mckillopi, known from a partial skeleton collected from Maxwelton, north-central Queensland, and the unnamed sauropod, known from a single, incomplete vertebra from Hughenden, northern Queensland, are believed to have reached lengths of 17 and 22 metres respectively. They were quadrupedal animals with very long necks. They browsed on the ferns, pines and cycads that abounded in the warm, moist climate of inland Australia.

Among the smaller herbivores were *Fulguratherium australe* and *Minmi paravertebra*. *Fulguratherium australe* is known from an incomplete, opalised femur from

Skull of *Muttaburrasaurus langdoni*. Note the hollow chamber above the snout and in front of the eyes. Photo: Kate Lowe

the early Cretaceous sediments of Lightning Ridge, northern New South Wales. It is thought to have been a swift and agile runner. *Minmi paravertebra,* a small, armoured ankylosaurian dinosaur, is represented by part of a rib cage, vertebral column, a foot and some armour from a site near Roma, southeastern Queensland. *Minmi,* which reached a length of four metres and a width of nearly one metre, is the first ankylosaur discovered in Australia and the most complete example known from the Southern Hemisphere. Two other armoured dinosaurs have recently been collected from near Hughenden and Boulia, Queensland, but these have not yet been prepared.

The skull and most of the skeleton of *Muttaburrasaurus langdoni* were found in early Cretaceous marine sediments near Muttaburra, 100 kilometres northeast of Longreach, Queensland. This 11 metre dinosaur could have browsed on all fours but, if necessary, could have also reached higher vegetation by standing on its hind legs. A curious, hollow chamber above the snout

1. Hughenden sauropod
2. *Rapator ornitholestoides*
3. *Austrosaurus mckillopi*
4. Pterosaurs
5. *Minmi paravertebra*
6. *Muttaburrasaurus langdoni*
7. *Kakuru kujani*
8. *Fulguratherium australe*

Opposite: The "Australian dinosaurs" poster, painted by Mark Hallett and published by the Queensland Museum in 1982, is available from the Australian Museum Bookshop, Sydney at $2.50.

Map of Australia showing sites (in red) at which dinosaur remains have been collected.

and in front of the eyes perhaps aided in the amplification of sound or perhaps augmented the animal's sense of smell. The thumb was modified into a spike, like that of the European species of *Iguanodon,* and was possibly used in defence or sexual competition. The skeleton of *M. langdoni* is the most complete of any dinosaur yet discovered in Australia. The Queensland Museum is in the process of preparing a cast of the skeleton for display.

Kakuru kujani was a flesh-eating dinosaur known from early Cretaceous sediments near Andamooka, southwestern South Australia. It had very slender limbs, grew to a length of three metres and appears to have been a swift and active hunter. *Rapator ornitholestoides,* a much larger carnivore, was probably bipedal and reached a length of eight metres. It may even have been capable of attacking some of the larger plant-eaters. Remains have been found at Lightning Ridge, New South Wales.

Among Australian dinosaurs not represented in the poster, but nevertheless worthy of note, was a large, bipedal carnivore related to species of *Allosaurus.* It grew to a length of ten metres and stood four metres high. It was formerly believed that this type of dinosaur became extinct by the end of the Jurassic. The single anklebone discovered from early Cretaceous deposits at Cape Paterson, Victoria has now extended the time range for the allosaurs. This specimen also appears to be more robust than those found on other continents.

Dinosaurs are also known from footprints and trackways. The most spectacular of these are found near Winton, central Queensland. Here 300 small, plant-eating dinosaurs stampeded at speeds of up to 15.5 km/hr for fear of being trampled or eaten by a large, three-toed, carnivorous dinosaur that had walked towards the lake where the smaller dinosaurs were drinking. These trackways represent a mere minute snatched out of the geological record 100 million years ago. They provide fascinating information about the social behaviour and mobility of the dinosaurs; insights that could not be gleaned from fossil bones alone.

The demise of the giant reptiles at the end of the Cretaceous (65 million years ago) has been attributed to various causes. Among the more popular notions are gradual environmental change in climate and/or vegetation, competition with mammals, cosmic explosions (supernovae) and collisions with asteroids. Whatever the reason(s), the dinosaurs, along with ichthyosaurs, plesiosaurs, pliosaurs, pterosaurs and a host of other animal groups, became extinct.

After many years of progress at a very slow pace, the search for Australian dinosaurs is gathering speed. New specimens are turning up constantly and, although the Australian record is not now and probably never will be as rich as that of most other continents, it is the very scarcity itself that makes the search and particularly the discovery of Australian dinosaurs all that more exciting. □

A Correction

In reference to Tom Grant's article "The Platypus a different mammal" (A.N.H. Vol. 21 No. 6), the caption for the colour photograph on p.227 should read "The bill is the feature of the platypus from which its scientific name is derived. It is not hard like that of a duck but is quite soft and pliable and is used both for locating and procuring food". The caption for the black and white photograph on the same page should read "The male platypus has a poison spur on each of its rear limbs. The hind feet are only partially webbed and are not used for propulsion through the water".These errors are *not* the responsibility of the author.

Densey

. . . AND IS ITCHING TO TELL YOU ABOUT PROCESSIONARY CATERPILLARS

If you've got a wattle tree in your garden, you might have noticed roundish, creamy-brown growths appearing suddenly on the lower trunk, like some kinds of furry mould. And if you were tempted to scrape them off, you'll have missed being able to follow up a fascinating life story.

Far from being a fungus, these fluffy blobs are the artefacts of an insect. Your tree has been selected as a nursery site by a small, brown moth called *Ochrogaster contraria*, best known for the processionary habits of its caterpillars.

When the moth lays her eggs, masses of loose, hair-like scales come off the end of her body to cover and protect them. Watching, you wonder how all that fluffy stuff could have been packed so tightly around her. She may lay several egg batches and other moths may lay nearby, so you're probably convinced that the fungus infection is spreading and that steps must urgently be taken.

A female moth *(Ochrogaster contraria)*. Note the compacted scales (the white area at the tip of her abdomen) that will be used to cover her eggs. Photo: Densey Clyne

But instead of doing anything rash, keep a daily watch and you'll see how the blobs fluff out even more as tiny caterpillars hatch from hidden eggs and mill around inside. After a few days they'll come out for their first meal.

Early this summer some egg masses were laid on the *Acacia pycnantha* outside my front gate. One morning when I went to fetch the milk, I found a thread of tiny hatchlings moving head to tail up the trunk and along a branch. Until I looked closely at the leader inching — or millimetering — along in front, it might have been just a fine crack in the bark.

The vanguard was already approaching the twig ends but down below they still poured from the nursery in ranks of four or five, thinning to single file higher up the trunk.

How to count such enormous numbers of three millimetre long caterpillars when the eye could hardly separate them? Easy. I took the milk inside and got my tape measure. I measured the entire procession from base to twig, added each of the extra ranks below, and divided the result by one caterpillar length. Give or take a few there were 2,743 of them.

Ochrogaster contraria moths covering their eggs at the base of an *Acacia pycnantha* tree. Photo: Densey Clyne

Later in the morning I saw them clustered around the rims of the phyllodes, nibbling side by side. On acacias with true feathery leaves the little caterpillars will scatter to tackle individual leaflets and they're harder to see.

For most of their lives processionary caterpillars are nocturnal. However for several weeks these caterpillars went up the tree at first light, returning at midday to cluster on and under the leaf litter around the tree.

Each caterpillar in its comings and goings left a thread of silk behind it. At first these threads were visible only as a sheen on the bark. Reinforced twice a day they became first a narrow, white track, which the leader always followed exactly, and then, as the caterpillars grew, a shining highway with access roads to branches and twigs.

Now the caterpillars feed only at night. On warm, summer mornings when I went for the milk the tail end of a broad, furry phalanx was moving down instead of up and milling around the entrance of a white, silk tent at the base of the tree. In this tent the caterpillars spent their days and periodically moulted, adding spiky cast skins to the growing mass of dung pellets on the floor.

Protein-rich, leaf-browsing caterpillars are the insect equivalent of protein-rich, grass-grazing sheep and cattle. They are the main course on the menu of most insectivores — birds, lizards and many other insects. This means that moths, in order to keep their species in equilibrium, must produce vast numbers of eggs. If all those eggs hatched and if all those hatchlings survived to turn into more egg-laying moths, forests would fall. Life on land would come to a stop or at least pause for a breather.

Clyne looks at.....

This silk "tent" at the base of an *Acacia pycnantha* tree is the daytime shelter for some processionary caterpillars. Photo: Densey Clyne

Closer to home, my acacia tree this summer could not have survived 2,000 unchecked, chomping mandibles. But by the time they were half-grown the caterpillars had already been reduced to fewer than 300. I noticed a finger-sized hole through the tent wall one morning and some disturbance inside. Perhaps a big lizard or a currawong? Perhaps a boy with a stick? Parasites and diseases also play an important part in checking numbers.

At 35 millimetres the caterpillars were ready to pupate. Would they burrow at the base of the tree? Not a wise move when you think about it. The moths that emerged next season would be likely to lay their eggs on the same food plant; the tree would have no fallow season to recover; and the caterpillars would starve. Call it the wisdom of nature.

Processionary caterpillars go on an overland trek once they're fully grown. In a suitable place they squirm down into the ground (it could hardly be called burrowing) and pupate there in a mass.

So I wasn't surprised, with all the comings and goings in my garden, to find evidence of their going one day — squashed, furry bodies everywhere on the drive. Seeing the slaughter, a friend erected a sign beside the drive. It read: "CAUTION! 5 KM. CATERPILLARS CROSSING".

Too late for this year, but some of them will have made it.

Driving out in the country you might have noticed the silk nests of bag-shelter caterpillars strung up in roadside acacias. Some are as big as your head. The abandoned ones are often stained by the dissolved droppings after rain.

These bag-shelterers build their roundish nests high off the ground, whereas the tent-shelterers put their tents around the base of the tree. It's curious that both these moths are given the same name and regarded as the same species.

Wherever they live, processionary caterpillars are strictly *not to be handled*. The fine, furry coats that look so rich and beautiful against the light contain dangerous, urticating hairs. ("Urticate" comes from the Latin *urere* meaning to burn; stinging nettles belong to the genus *Urtica*). And if you've ever been stung by a stinging nettle I can assure you that processionary caterpillar hairs are far, far worse.

It happened to me recently, when handling the caterpillars in our wildlife film studio. Your eyes

Processionary caterpillars *(Ochrogaster contraria)* moving up a tree to feed. Photo: Densey Clyne

stream; there's intense itching and swelling that lasts for several days; you may feel nauseated; and you look awful.

So why, you may ask, do I let these dangerous animals live in my garden, let alone suggest you do the same? Well, like so many of the animals we fear, they're only dangerous in their own defence. A garden is the stage for drama and comedy and they're part of the *dramatis personae*. If you stay in your priceless, front-row seat and watch the play to the end without throwing brickbats, they'll do you no harm. □

Gould's Long-Eared Bat

THE CUTE OR THE UGLY?

Gould's Long-eared Bat (*Nyctophilus gouldi*), like most smaller bats in Australia, is poorly known and rarely encountered by the average urban dweller. Although they are feared, disliked and much-maligned their reputation as ugly and verminous creatures is undeserved. The long ears, relatively large eyes and ornamented face of this species gives it an interesting, if not friendly, appearance and serve to distinguish it from the other so-called plain-faced bats (family Vespertilionidae) in Australia.

They are primarily forest dwellers, venturing occasionally into human dwellings for shelter but rarely taking up permanent residence there. They are not cave dwellers — they prefer instead to roost in tree hollows. There they can be found in small colonies of 20 or more individuals (usually females) or in small transient groups of five or less (usually males). They are one of the more common species of bats in the sclerophyll forests of eastern and southwestern Australia but can be found in habitats ranging from rainforest to scrubland. However, while the species as a whole has a wide distribution, individuals do not. Although capable of flying long distances, these bats may choose to spend their entire life (perhaps 20 years or more) in one small patch of forest, feeding each night in the same places, using the same flight paths to get there and roosting in a selection of familiar tree hollows within their home range.

Gould's Long-eared Bat is one of 55 or so "micro-bats" (that is, non-fruit eating bats) in Australia and ranks among them as a medium sized animal with a wingspan of about 300 millimetres and weight of about ten grams. Like most micro-bats, Gould's Long-eared Bat feeds primarily on insects and spiders, which they generally catch in mid air or pluck from surfaces using their highly developed sonar system. However some individuals have been seen sitting on a branch, quietly "listening" for rustling sounds made by moving prey. This helps them to locate the prey in darkness before pouncing on it. Their aerial hunting techniques are more elaborate and may involve highly acrobatic manoeuvres as the bat pursues its prey among branches of trees before finally scooping it up with the tip of the wing, the "apron" formed by the tail membrane or seizing it directly in the mouth. While watching these bats as they negotiate obstacles and, simultaneously (somehow) still keeping track of their moving prey, we begin to appreciate how highly sophisticated their sonar system really is and how skilled they are at using it. Because their abilities in this regard far exceed those man-made sonar systems, bats (and this species in particular) have become the subject of intensive research.

By listening to their echoes these bats cannot only detect the presence of objects, both large and minute, but can also determine the position of the object in space, its relative velocity, size, shape and texture. Thus they can not only find their prey but identify it, enabling them to make judgments on the probability of capturing it and its palatability.

Their signals also enable them to identify others of the same species. For social species like *N. gouldi* this is very important. Their vocal repertoire includes a large number of social signals that, as observed in a captive colony, are used for individual recognition and establishment of social status. Most of the signalling, however, occurs between mothers and their young and their constant communication enables them to maintain their close bond, which continues for the first three to four months. Even when the mother goes out to feed at night she regularly flies past the entrance of the roost and "twitters" to her young until she hears a response from inside. Upon entering the roost she calls to her young, which in turn respond with single "twit-twits". These signals must contain sufficient information to permit identification of her young from all others, since the mother, time after time, will correctly select her own offspring from the nursery.

Gould's Long-eared Bat usually gives birth to twins. They are conceived in autumn and born the following spring. Pregnant mothers may gain more than 50% of their own body weight, which makes hunting difficult a couple of days before birth. When born the young are naked, have closed eyes and small rubbery wings, and use their small milk teeth for gripping their mother's teats (one under each armpit). They cling to her for three to five days during which time she may fly with them under her wings or deposit them in a roost while making brief trips out to feed. The young grow rapidly and by seven days have a dusting of fur. By ten days they are completely furred but do not take on the appearance of the adult until they are about three weeks old. At this age they begin exercising their wings by fluttering them while hanging in the roost but not venturing outside. They make their first attempts at flying a week later and by five weeks they regularly leave the roost on short forays.

On their first ventures outside they are accompanied by their mother. These trips are brief and involve many crash-landings. Whenever the young falter and crawl to safety, calling with a "twit-twit", the mother flies over to them. This is a vulnerable period for the young because not only must they learn to fly, but they must also learn to use their sonar systems to avoid obstacles and hunt for food. If they don't learn quickly they may suffer a serious crash or starve to death. Their clumsiness also makes them vulnerable to predators and this may account for the low survival rate of young bats.

Novice fliers, probably from the same colony, can be found flying together — a behaviour that may afford them some protection, some social contact and an opportunity to take advantage of each other's hunting prowess. As these groups often contain one or more adults, these skills may also be taught to or mimicked by the young. However, most of the bats one might ordinarily encounter are likely to have already learned the business of hunting and navigating. Their long evolutionary history (at least 60 million years) and long life expectancy of adults (20 years or more) are testimony to the success of these skills. □

Dedee Woodside Zoology Department University of N.S.W.

Opposite: Gould's Long-eared Bat, *Nyctophilus gouldi*, shown here with her adorable seven day old twins. Photo: K. Atkinson

living moments

Aboriginal carved trees of New South Wales

by David Bell and Zoë Wakelin-King

Of the 299 Aboriginal carved trees known to be in existence in New South Wales, 78 are still located on their original sites; the other 221 trees are on properties and in museums. Both the sites and the trees themselves are significant items of N.S.W. Aboriginal cultural property and, as such, are protected by law from wilful destruction. David Bell has been involved in extensive field surveys of Aboriginal carved trees for the Australian Heritage Commission and the N.S.W. National Parks and Wildlife Service; and Zoë Wakelin-King, Technical Officer in the Department of Anthropology at the Australian Museum, manages the Museum's collection of 62 carved trees. This article illustrates the historical and cultural significance of this often-neglected aspect of Australia's national heritage.

Carving into bark on a tree photographed early this century at Yarras near Wauchope, northern N.S.W. Possibly associated with a ceremonial ground, this site could not be located during the 1979/1980 National Parks and Wildlife Service survey. Photo: T. Dick

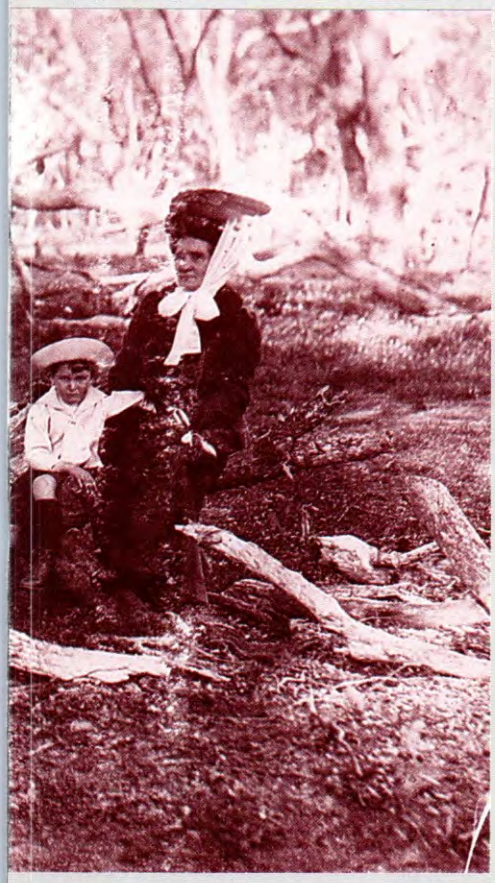
"Almost directly under the hill near our halting place we saw a tumulus, which was apparently of recent construction . . . It would seem that some person of consideration among the natives had been buried in it, from the exterior marks of form which had certainly been observed in the construction of the tomb and surrounding seats . . . To the west and north of the grave were two cypress trees, distant between 50 and 60 feet. The sides towards the tomb were barked, and curious characters deeply cut upon them, in a manner which, considering the tool they possess, must have been a work of great labour and time."

This account by Surveyor-General John Oxley records the first European encounter with Aboriginal "carved trees", 167 years ago on 29 July 1817, during his "Expedition to ascertain the Course of the Lachlan River".

The term "carved tree" or "dendroglyph" covers a wide variety of forms, techniques and designs carved into the trunks of living trees accompanying either burial or ceremonial sites. Most designs on the specimens that exist today appear to have been carved with a metal tool such as a steel axe, which determines their maximum age at about 200 years. However, the "Oxley Trees", on which the designs appear to have been cut with a stone tool, could be much older. Given the vulnerable nature of the carvings to destruction by bushfires and other natural causes, it is not surprising that more of these older examples have not survived. However, it may be that some of the existing designs are in fact older ones which have been recarved with metal tools. Linked with the

introduction of metal instruments, it seems likely that the practice of tree-carving proliferated during the 19th Century.

It was not until the late 19th Century, when colonial encroachment on Aboriginal territory and culture was far advanced, that any systematic attempts were made to record



This box tree, one of five trees marking a grave site on the Macquarie River near Narromine, provides an unusual setting for a picnic in 1909. This particular tree has not survived but one of the original trees is still growing at the site. Photo: E. Milne

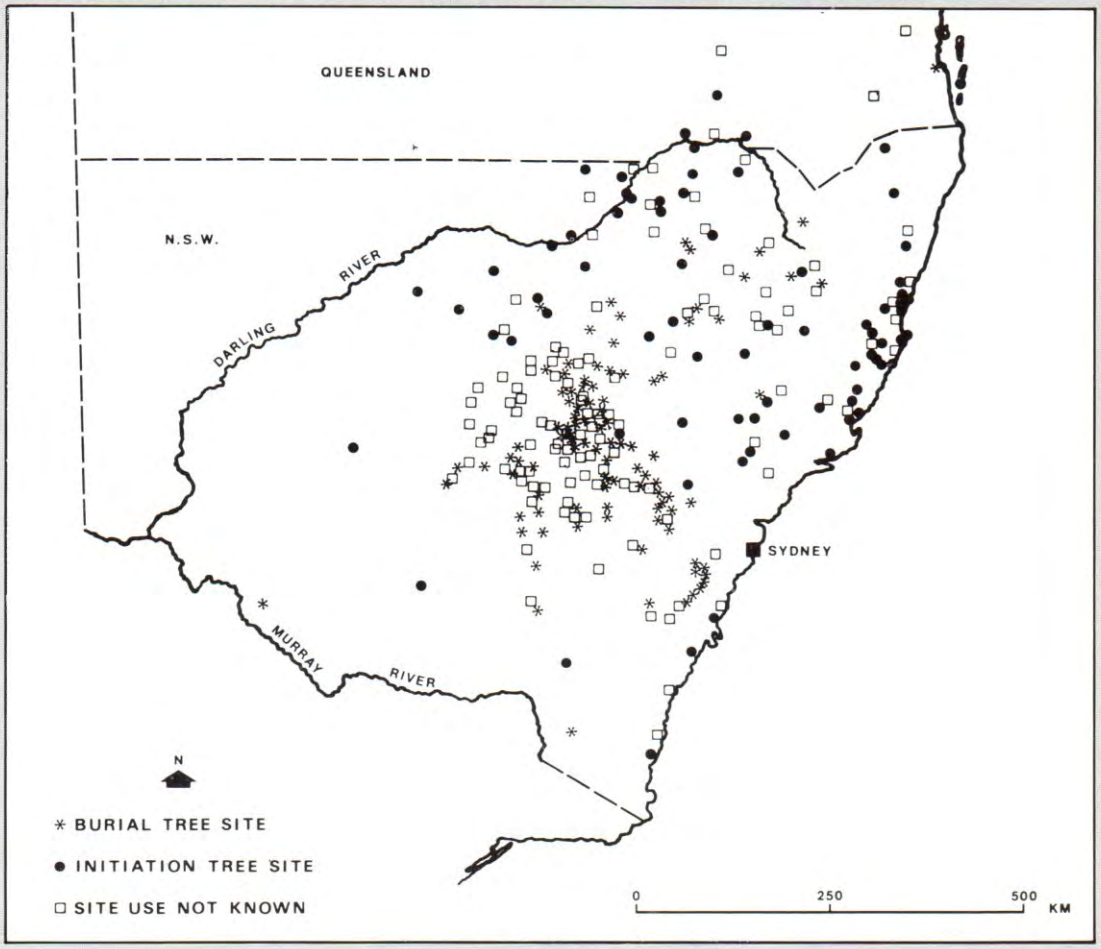
and understand these monuments. Between 1890 and 1910 R.H. Mathews, a N.S.W. Licensed Surveyor, observed and recorded a number of initiation ceremonies held by various tribes in N.S.W. at sites containing carved trees. His records include location plans of the sites, sketches of the tree designs and descriptions of the ceremonies. These records are particularly important because the ceremonies Mathews observed were, in many cases, the last to be celebrated at those sites: it was during this time that the lifestyle of the Aboriginal people was drastically changing due to the disruption and dispersal of their social groups with the spread of European settlement. Unfortunately, little has been recorded from the Aborigines themselves about the specific purpose or the meanings of these designs.

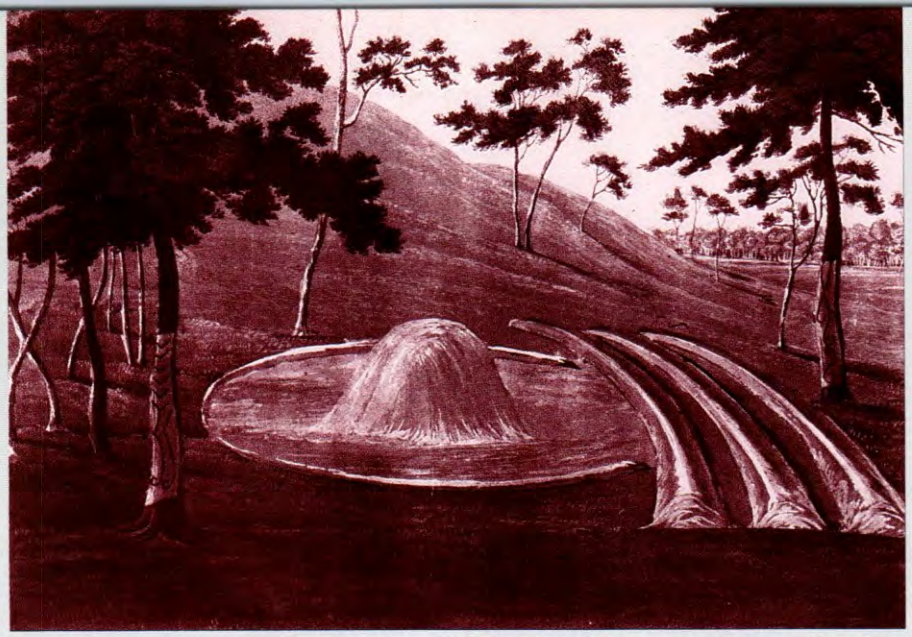
This photograph, taken in the 1890s, typifies the fate of many Aboriginal carved trees. These two, from an unknown site near Back Creek west of the Bogan River, were "saved" when the holding was cleared and preserved in an inverted position as gate posts. There present whereabouts is unknown. Such European insensitivity to the Aboriginal significance of carved trees is a recurrent, but hopefully declining, aspect of Aboriginal-European relations. Photo: A. G. Mitchell

Carved trees associated with burials are found mainly in the central-west of N.S.W. and particularly along the Bogan, Macquarie and Lachlan Rivers and their tributaries. They were mainly associated with the Kamilaroi and Wiradjuri tribes who occupied this area at the time of European contact. Mound or "simple disposal" grave sites, in areas east of the Darling River, are frequently marked by carved trees. In other areas, stones, "mourning caps" of gypsum, fences or huts may occur. Where other types of burials and mortuary practices occur in the southeast of Australia, they do not appear to have been associated with carved trees.

Where tree-carving is associated with burial, usually two trees at least are carved (although as many as seven have been recorded) with the designs arranged such that they face the grave. A common carving technique involved the removal of the

Map showing the distribution of carved tree sites in southeastern Australia.



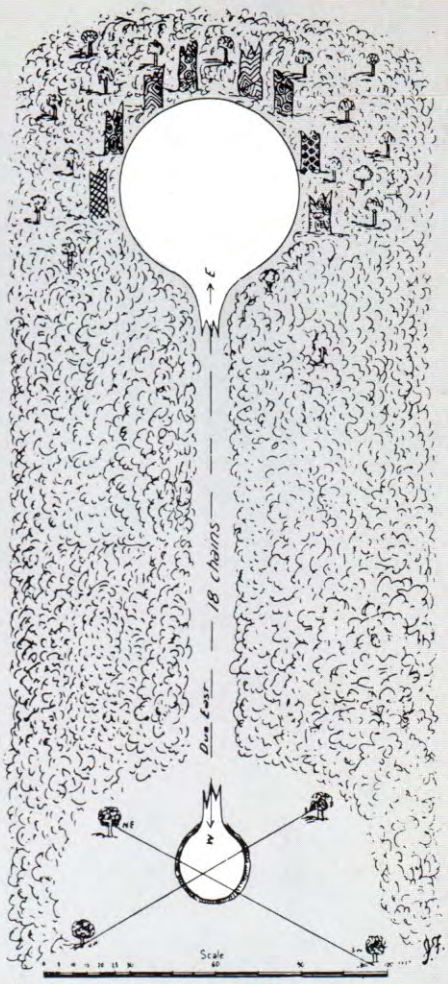


An engraving showing the layout of the burial site and positions of the two carved "cypress trees", discovered in 1817 by Oxley's party while they were camped on the south banks of the Lachlan. When this site was rediscovered in 1913, Aborigines from the district remembered the grave as that of a "karadga", an important medicine man or chief of the Calare tribe, who was drowned while crossing the flooded river by canoe. By 1913 all traces of the mound and raised "seats" had disappeared; and the tree on the left was reduced to a stump with only a fragment of the carving remaining. Both tree trunks were taken to the Australian Museum and a cairn erected, flanked by posts bearing facsimiles of the two carvings, to commemorate this historic site. Photo: Australian Museum Archives

outer bark and sapwood from a portion of the trunk, making an oval or lozenge-shaped section one to two metres in length and from a half to one metre in width (the dimensions depending to some extent on the size of the tree). The designs were then carved into the inner wood of the cleared panel. The most commonly used trees were box trees (*Eucalyptus* spp.) though carved cypress pines (*Callitris* spp.) were not uncommon. The designs were non-figurative, displaying an amazing variety and combination of geometric forms, curves and lines. Vertical and horizontal lines occurred rarely. The significance of the different designs is unknown but they may have identified the social or spiritual affiliations of the dead person who, in some cases, was reputed to be someone of importance, such as a great warrior or chief.

Other carved trees are associated with ceremonial (or bora) grounds where initiation ceremonies were performed. During these initiation ceremonies, which were intended to "socialise" young men into adults, candidates who had been isolated from the rest of the tribe for some period of testing and trials, were assembled at specially prepared ground in a secluded spot for instruction and rituals of various kinds. Some of these sites consisted of two cleared circles of ground, connected by a pathway, around which were arranged different kinds of constructs and designs made of earth, logs, carvings, etc. The carved trees, which exhibit a greater variety in number, technique and design than those associated with burials, are thought to have been used in the education of candidates.

Several large bora grounds of this type, containing up to 120 carved trees, have been recorded from the area between the Bogan River and just across the border in southeastern Queensland. These sites were used for initiation ceremonies late last century. Records indicate that Aborigines travelled from a wide surrounding area for these events and that some tribes from particular areas used more than one site. This degree of mixture and overlapping of culture groups explains why designs at the sites do not appear to be locally distinctive. The range of designs is very broad, from simple "cut-out" shapes in the form of animals and humans (or supernatural beings in human form) to geometric designs indistinguishable in style from those found beside burials. The designs used may reflect the particular level of initiation carried out at the sites. At Gundabloui, on the Moonie River just south of the Queensland border and west of the Barwon River, Mathews witnessed an initiation ceremony in 1894, apparently designed to "finally admit" to adulthood people who had attended previous ceremonies at other sites. At this site there is a greater number of simpler designs representing forms of animals or figures.



▲ Sketch of a ceremonial ground, recorded in the 1880s in the forest near Gloucester in the Newcastle area, showing the position of carved trees. This site no longer exists and none of the carved trees is known to have survived. The general layout of the ceremonial ground — two circles of cleared ground connected by a path — occurs at many sites associated with initiation ceremonies. At some sites, the designs were carved on trees beside the path connecting the two circles. Photo: Australian Museum Archives

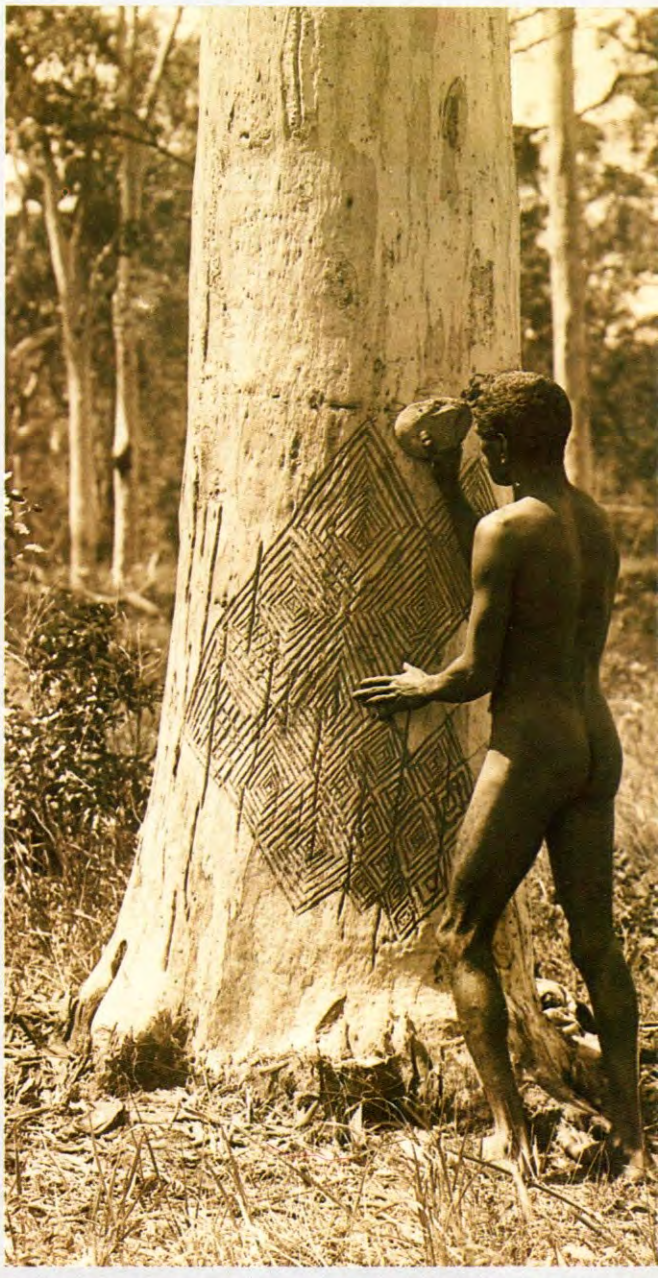
A particularly distinctive design on a burial tree near Trangie, New South Wales, the only known example of a parallel-lined motif with a horizontal dividing line. ▼ Photo: E. Milne

The carved trees at initiation sites east of the Divide, between the Hunter Valley and Moreton Bay, are distinct in a number of ways from their inland counterparts. Designs were carved into the outer bark of the trees, which were usually large bloodwoods and gums (*Eucalyptus* spp.), and the carvings extend all the way around the trunk and up to eight metres above the ground. The designs themselves are complex, consisting of concentric diamonds, lozenges or panels of intersecting lines, regularly repeated over the whole surface. An old man of the Gumbainggar tribe, initiated at a Nambucca site in the 1920s, has said that the carvings on these trees were used to instruct the young men in the beliefs and social obligations of the tribe, and that some of the motifs symbolise the actual social structure of the groups using the site.

Unfortunately, intensive white settlement in the north coast area, the particularly fragile nature of these bark-carved designs and their vulnerability to bushfires, have meant that very few of these magnificent trees have survived. However, an increasing public awareness of the cultural significance of carved trees has helped reduce the extent of their destruction. Since 1970, all Aboriginal sites and artefacts, including carved trees, have been protected by law. In addition, the N.S.W. National Parks and Wildlife Service has developed a protection program which endeavours to minimise the decay and destruction of those trees remaining in rural areas.

In the past, our understanding of the practice and designs of tree-carvings has been limited to an all-too-fragmentary European historical perspective. There is undoubtedly much oral history in the various Aboriginal communities today about the significance of different carved tree sites. In recent years liaison with Aboriginal communities has contributed to the management of sites. The respect and support of the broader Australian community will also help to ensure the survival of this unique part of our national heritage. □

◀ Carving of a goanna-like figure on a tree near a ceremonial ground at Coronga Peak, west of the Bogan River between Cobar and Byrock. This isolated site was believed to have been used for ceremonies in the 1890s by Aborigines of the Kamilaroi or Wiradjuri tribes. Carvings of this type occur less frequently than the designs made up of curved lines or geometric shapes, but are found alongside them at a number of ceremonial grounds throughout the northern half of central-western N.S.W. and in the adjacent area of Queensland. R. H. Mathews, a surveyor who witnessed ceremonies at several of these *bora* grounds in the late 19th Century, reported that on some occasions the actual portion of the lizard or other shape cut out of the bark was itself used in the ceremony. Photo: E. Milne



Demonstration of the carving of a large gum with designs similar to those found on trees at initiation sites in the north coast region. This photograph is one of a series taken at Port Macquarie early this century in an effort to reconstruct and record the pre-European lifestyle of the Aborigines in the area. Trees at initiation sites on the north coast were frequently carved all the way around the trunk to heights of three to eight metres above the ground and the intricate designs incorporate geometric or concentric motifs which are thought to signify clan affiliations. Photo: T. Dick ▶

A five metre trunk of a bloodwood, currently displayed in the Aboriginal Gallery at the Australian Museum. This tree, believed to be one of between seven and thirty carved in 1873 at a ceremonial site in the Smoky Cape Ranges near Kempsey, was taken to the Museum in 1903 following a report from a local resident that the rest had been destroyed or removed. Despite having been cut into five segments for shipping, this tree trunk is now the best preserved example of this regional type of tree-carving. Photo: Australian ▼Museum Archives

Going in to Bat for Queensland Flying-Foxes

by Ruth Lane

On 29 March 1984, the Deputy Governor of Queensland declared the four species of Queensland flying-fox to be non-protected fauna for the purpose of the *Fauna Conservation Act* 1974. The four species are the Grey-headed (*Pteropus poliocephalus*), Little Red (*P. scapulatus*), Black (*P. alecto*) and Spectacled (*P. conspicillatus*) Flying-foxes. This disturbing development comes at a time when other States such as New South Wales are moving to ensure the protection of these fascinating, gregarious creatures. The decision to remove their protected status was apparently made without referral to the Queensland National Parks and Wildlife Service, which has accumulated much information relevant to the management problems of flying-foxes. In fact no person with any professional expertise in flying-fox biology was consulted.

Prior to European settlement, flying-foxes would have fed solely on blossoms and native fruits. These still form by far the major part of their diet. However, pregnant and lactating females, not wanting to carry their young over long distances, may opt for a closer (rather than their preferred) food supply; and, in some areas, due to clearing of large expanses of native forests or to lack of rain that prevents some species of eucalypts from flowering, flying-foxes are forced to look for alternative sources of food. So, where there is intensive cultivation of fruit, flying-foxes can cause problems to growers by eating and spoiling produce. But it is only in such circumstances that this damage occurs and, at most times and in most areas, flying-foxes cause little trouble to fruit growers.

Populations have dwindled significantly since the first major study (made in the 1930s by Francis Ratcliffe) of flying-foxes. Many colonies have shifted locality and some have disappeared altogether. In addition to the clearing of forests, the indiscriminate shooting of flying-fox colonies by people regarding them as pests has made severe inroads into populations.

Flying-foxes are the major nocturnal pollinators of hardwood forests and are responsible for the dispersal of seeds over long distances. Seeds of some species are too large to be carried by birds and for this reason flying-foxes form an integral component of the ecology. If the decline in numbers continues unchecked, who knows what wide-scale, long-term consequences will result?

The Little Red Flying-fox, *Pteropus scapulatus*. Photo: K. Atkinson

▲The Grey-headed Flying-fox, *Pteropus poliocephalus*, in flight. Photo: N. Speechley NPIAW

◀Two Little Red Flying-foxes, *Pteropus scapulatus*. Photo: D. Griffiths NPIAW

The slaughter, which has gone on in the past and which the Queensland Government has again sanctioned, involves a great deal of cruelty. The shooters fire into the most densely populated part of the colony; many animals are killed but more are maimed than are killed outright. Throughout October, during which time most births occur, the pregnant females are easily distressed and, if disturbed by gunshots, may abort on the spot. Since females only produce one offspring per year, abortions dramatically reduce population numbers. Recent reports even suggest that flying-fox shooting is a growing "sport" for children after school. Such grisly behaviour and disrespect for wildlife should not be encouraged!

"Shooting out" the local flying-fox colony is not an immediate solution to the fruit grower's problem. Studies of flying-foxes have shown them to be capable of communicating new food sources to the rest of the camp and to have exceptionally good memories. Those individuals that may possibly survive after a "shoot out" will set up camp elsewhere and, remembering the food source, continue to raid the orchard. It makes far greater sense, as well as being more humane, to station a deterrent in the orchard itself. The astute orchardist could, for example, with the permission from the appropriate local authority, poison the fruit at the perimeter of the orchard, thereby killing only the would-be tell-tales before they have a chance to return to camp with news of their discovery. The electronic scarecrow, recently released by the New South Wales Department of Agriculture, emits a high intensity and high frequency sound undetectable to humans. The device has an effective range of 4-5 hectares and wards off all birds, bats and other vertebrate and invertebrate pests.

It appears that the Queensland Minister was lobbied by a small number of fruit growers in his electorate and, on the basis of this one-sided and short-sighted argument, proceeded with amendments to the legislation. The decision could not have been well-considered since no-one was notified of the impending change in legislation. The removal of the protected status and resulting indiscriminate shooting of flying-fox colonies is a backward method of wildlife management. Crop protection systems must be developed so that the orchardist maintains the high quality of produce and, at the same time, maintains his compatibility with the native flying-foxes.

The Australian Mammal Society has sent a letter to the Minister requesting that a moratorium be called to allow for a more balanced and scientific appraisal of the situation. Negotiations are still continuing. However, this is not enough. Members of the public must also express their concern in writing to the Minister for Tourism, National Parks, Sport and The Arts (c/o Parliament House, Queensland, 4000) for, without an immediate moratorium, the carnage in Queensland flying-fox colonies will continue. □

The White-Faced Heron

THE SUPREME GENERALIST OF AUSTRALIA'S HERONS

by William E. Davis, Jr

The White-faced Heron is a supreme generalist, exploiting a wide range of food resources and breeding successfully under varied conditions including human habitations. This tolerance of humans and the easily recognised effects of chemical pollutants in animals at the top of food chains, make White-faced Herons potentially good environmental indicators. Similar biological "stoplosses" or warning devices have been used in the United States and have proved essential in the recognition and removal of fatal resistant pesticides. Professor William Davis, Jr, of the College of Basic Studies at Boston University, Massachusetts, has studied the White-faced Heron for many years. He describes in more detail how such a widespread generalist can be used to detect environmental threats and thus help in the conservation of a wide range of wildlife.

The White-faced Heron (*Ardea novaehollandiae*), known to many Australians as the Blue Crane, is Australia's most widespread and versatile heron. Probably no heron in the world exploits a wider range of habitats than this common and fascinating bird. I have seen White-faced Herons standing among the breakers on the storm-swept rocky prominences of Victoria, walking dry pastures in the foothills of the Snowy Mountains, foraging in the mangrove forests near Sydney and along rivers in the dry interior. Anywhere in Australia, if you find a puddle of water, there will be a White-faced Heron peering into it.

Why is this bird so successful? It is successful because it is a supreme generalist, capable of exploiting a wide range of food resources, utilising a variety of foraging behaviours and successfully breeding under extremely varied conditions. The White-faced Heron has actually benefitted from the environmental disruptions accompanying European settlement, capitalising on the stock tanks that now dot the pasture landscape and nesting in the ornamental trees of suburban gardens. The White-faced Heron has not only increased in abundance throughout Australia but has colonised widely in the Australasian Region. Recorded as early as 1865 in New Zealand, it has undergone an explosive population growth within the past few decades, becoming New Zealand's most common heron. It has also colonised Lord Howe Island, New Caledonia, New Guinea and a smattering of the smaller South Pacific islands. Its dramatic spread parallels that of the Cattle Egret (*Ardeola ibis*), which has apparently benefitted from the extensive world-wide conversion of forest to pastureland and now has a cosmopolitan distribution.

The White-faced Heron, *Ardea novaehollandiae*, foraging for food at the water's edge. Photo: Ford L. Kristo

Foraging behaviour

The White-faced Heron utilises a wide variety of foraging techniques, adjusting its foraging strategy to the prevailing conditions. When fishing along a tidal mudflat or shallow river, it typically walks slowly, stalking its prey. Its posture can be upright or crouched and from either it can snap its neck and head forward to grab a fish or prawn. Like all herons, it has an odd articulation in its sixth cervical vertebra, which gives the neck a crooked appearance and enables the bird to dart its head forward with lightning speed.

When a White-faced Heron spies a fish at some distance, it may actively pursue its prey, dashing and darting about, flicking out a wing for balance. It may forage more actively in very shallow water or on the mud or sand at the water's edge, walking rapidly as it searches for and picks up tiny prey items.

In shallow water a bird often foot-stirs, standing first on one foot and then the other, stirring the water and substrate in front of it with the free foot and sending small prey items dashing from their hiding places. White-faced Herons glean food items from a variety of substrates. I have watched them pick insects from the remnant hull of a wooden boat half buried in the mud, glean insects from the emergent vegetation in low spots in a wet pasture, and even pick flies off dead sheep and possums in dry grasslands of more arid areas.

White-faced Herons seem to prefer small prey items. I have watched a bird spend more than five minutes subduing and beating into manageable form a ten centimetre fish, which it finally swallowed with great difficulty. Other herons, such as the similar sized Nankeen Night Heron (*Nycticorax caledonicus*), easily

handle and swallow considerably larger fish. At Careel Bay, north of Sydney, birds were seen to take mainly fish five centimetres or smaller, tiny crabs and amphipods. Studies of stomach contents of White-faced Herons in New Zealand showed the herons feeding on adult and larval beetles, dragonfly and damselfly larvae, spiders, fish, crabs, shrimp, ostracods and frogs, to name just a few.

Sometimes White-faced Herons use other birds to help them in their foraging. I watched a White-faced Heron move rapidly along in shallow water to keep up with cormorants that were driving fish into shallow water. As well, the herons commonly utilise White Ibis (*Threskiornis molucca*) as "beaters", following them and taking prey disturbed by them. Often these herons defend "their" beaters, driving off any other herons in the area, sometimes to the detriment of their foraging success. At times White-faced Herons behave quite socially, with ten or 15 birds foraging within 100 metres along the edge of the mudflats without any apparent hostility. At other times they are aggressive and territorial, fluffing their head, neck and back hackles and actively pursuing other herons.

It has been documented for Little Blue Herons (*Egretta caerulea*) in North America that juvenile birds forage less efficiently than adults. My observations on immature White-faced Herons suggest that this difference in foraging efficiency may exist in this species as well. Young birds forage with their parents long after they have fledged and thus have ample opportunity to pick up pointers on food procurement. I have also watched an immature bird spending many minutes catching fish that were clearly much too large for it to handle successfully, and I assumed that the bird was "practising", testing its limits, learning what it could and could not do. Foraging with adults may add to the juvenile's foraging repertoire and improve its chances of survival in times when foraging conditions are harsh, or when it is hard-pressed to feed a nestful of its own young.

Breeding behaviour

The Australian Nest Record Scheme contains a collection of breeding data on White-faced Herons and documents the wide diversity of conditions under which these herons have successfully bred. The White-faced Heron breeds throughout Australia from sea level to over 1,000 metres in altitude. It has been reported breeding in every month of the year, although in southeastern Australia the most active breeding months are from September to December. Upland forests, woodlands, grasslands and pastures with scattered trees, coastal mangrove forests, swamps, urban gardens, rice plantations, orchards, saltbush plains and dry creeks encompass only a few of their reported breeding surroundings, many very close to human habitation. Their choice of nesting tree is just as wide as their choice of habitat. Dead trees are selected as well as live ones and the height of the nest above the ground or water varies from about four to 40 metres. Nests are usually located in forks along horizontal branches, often near branch ends but sometimes in the middle of the tree or atop the crown. Frequently trees over water or along creeks are selected but nests have been reported where the nearest water was about three to five kilometres away.

Little is known of the courtship behaviour of the White-faced Herons but once pair formation has been accomplished, the pair construct a nest. It consists of twigs and pencil-thick sticks and is often lined with dry grass or reeds. The male, as in many species of herons, procures sticks, which it turns over to the female, who then weaves them into the nest structure. The nest may be nearly a metre across and a third of a metre deep but often are such flimsy structures that the eggs can be seen through them from the ground. Sometimes the birds will use an old nest, adding to it and re-lining it. It may have been the same individual's nest from the preceding year, a nest of a different individual, or even one belonging to another species of bird such as a cormorant, raven or crow.

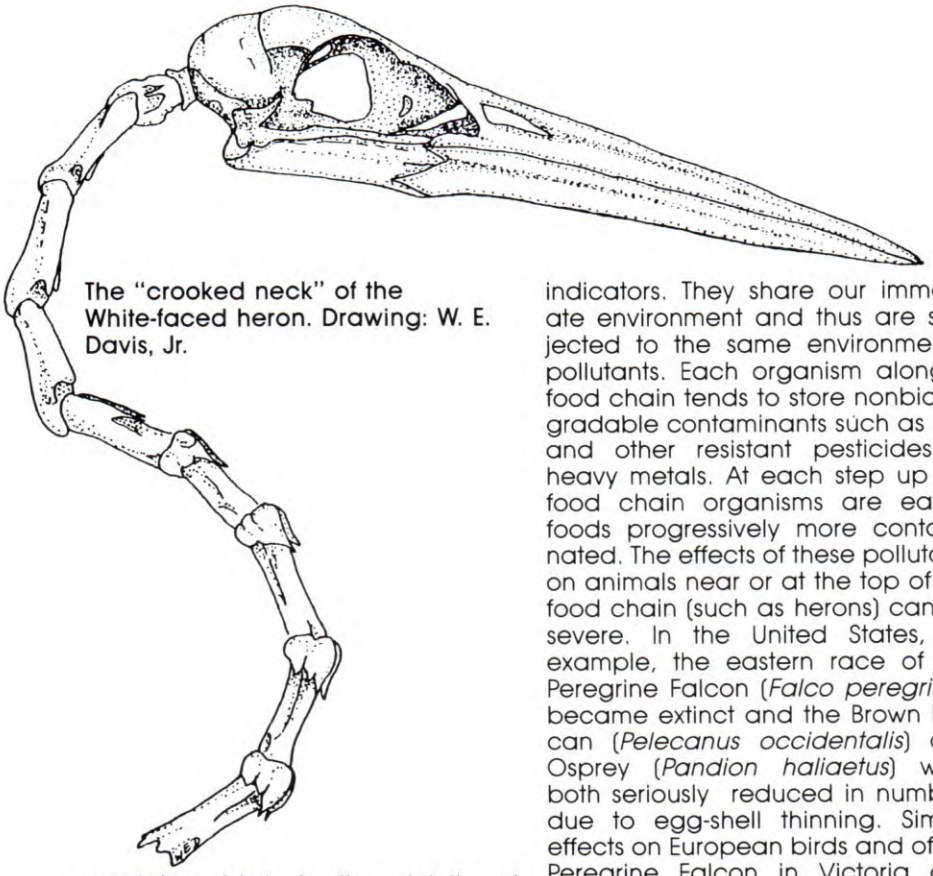
Eggs are blue-green in colour and about the size of a small chicken egg. Up to six may be laid, although the more usual clutch size is three to five. After an incubation period of three to four weeks the young hatch. The pattern of raising the young is similar to that of most herons. Incubation often begins with the first or second egg, so that the eggs may hatch several days apart, giving the first-hatched a head start. There is fierce competition among chicks for food and rarely does the last-hatched chick survive. This seeming waste of chicks may be a strategy by which herons are able to raise an extra chick during those years when there is a super-abundance of food.

The White-faced Heron, *Ardea novaehollandiae*, in flight. Photo Ford L. Kristo

Both parents feed the young by regurgitation either onto the floor of the nest or directly into the beaks of the young birds. In the early stages of nesting, one parent will remain at the nest. When the other bird returns, there is an elaborate nest relief ceremony whereby they raise their plumes and utter a series of guttural calls. Once the baby birds have developed the ability to regulate their own body temperatures, both parents may be absent from the nest, foraging long hours to satisfy the seemingly insatiable appetites of the fast growing young. As with most bird species, this is the period of the year when the highest energy demands are placed on the adult birds and when the availability of food is most crucial. A visit to a heron nest can be quite uncomfortable at this stage, as young birds' when disturbed will often deposit for you the contents of their most recent meal. The smell of a dozen or more half-digested fish is quite indescribable.

Young White-faced Herons, while still in the nest, will sometimes assume a "bittern" stance when the nest is approached. With necks stretched straight up, bills pointed to the sky and completely motionless, they look much like sticks protruding from the nest. After a few more weeks the young birds fledge and accompany their parents to the feeding grounds. They may stay with the parents until the following season.

Although the White-faced Heron is largely a solitary nester, it sometimes nests in loose colonies of three or more pairs. There seems to be a preference in these situations for each pair to have its own tree. The pair, however, may share its nest tree with other species of birds. Nesting alongside other species seems to be a mixed blessing for herons. There have been reports of Magpie Larks (*Grallina cynoleuca*) attacking



The "crooked neck" of the White-faced heron. Drawing: W. E. Davis, Jr.

predatory birds in the vicinity of heron nests, while other reports indicate harassment of the nesting herons by this same species.

Environmental indicator

The fact that White-faced Herons are tolerant of humans makes them potentially excellent environmental indicators. They share our immediate environment and thus are subjected to the same environmental pollutants. Each organism along a food chain tends to store nonbiodegradable contaminants such as DDT and other resistant pesticides or heavy metals. At each step up the food chain organisms are eating foods progressively more contaminated. The effects of these pollutants on animals near or at the top of the food chain (such as herons) can be severe. In the United States, for example, the eastern race of the Peregrine Falcon (*Falco peregrinus*) became extinct and the Brown Pelican (*Pelecanus occidentalis*) and Osprey (*Pandion haliaetus*) were both seriously reduced in numbers due to egg-shell thinning. Similar effects on European birds and of the Peregrine Falcon in Victoria and New South Wales have been well-documented. In each case the disrupting factor was traced to DDT.

Since the banning of DDT in the United States in 1972, Osprey and Brown Pelican populations have made a slow recovery. These birds were environmental indicators, providing early warnings that DDT and other chlorinated hydrocarbons were posing a serious environmental threat. More recently, herons, particularly the Black-crowned Night Heron (*Nycticorax nycticorax*), have been used as environmental indicators along the east coast of the United States. Here potentially dangerous DDE and heavy metal concentrations have been identified in egg-shells and bird tissue and have indicated local areas of concern. In Australia there is continued support for the use of DDT and related pesticides long after overwhelming biological evidence has led to their banning in the United States and Europe. Is it necessary for Australia to suffer biological damage similar to that of their North American and European counterparts before the problem of resistant pesticides is taken seriously?

White-faced Herons should be monitored for egg-shell thinning, pesticide and heavy metal concentrations, so that they may serve the same function that herons, terns and gulls are currently performing in the United States. Perhaps then Australia may be in a position to avoid some of the mistakes that other nations have made. □

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The Atlas of Australian Birds

M. Blakers, S.J.J.F. Davies and P.N. Reilly. Melbourne University Press, Melbourne, 1984: 738 pp., $49.95.

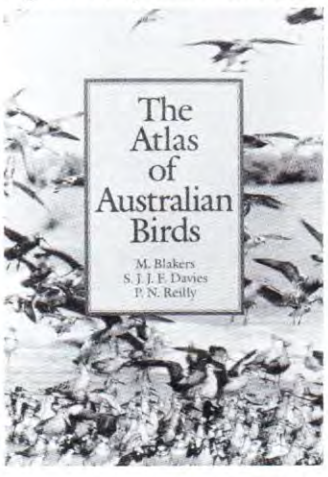
In 1972 the Royal Australasian Ornithologists' Union began planning a most ambitious project: an atlas of Australian birds to record the distribution of every species that bred here or visited regularly. This project was to be modelled on the recently completed *Atlas of the Breeding Birds in Britain and Ireland*. However, there were significant differences between the two schemes since Australia had relatively few observers, its landmass is many times that of the British Isles and the birds atlased include all species (not just breeding species).

It is remarkable, then, that the Australian atlas not only went ahead but was successfully completed. Short-term regional atlases confirmed the feasibility of a large-scale project and funds were provided by government, business and private individuals. A great number of volunteers and assistants co-ordinated observers, vetted the records, organised submitted reports and extracted historical information from journals and collections. However, most important of all were those who supplied the meat of the atlas, the field observers. From 1 January 1977 to 31 December 1981, 3,000 people had contributed their sightings from all parts of the country, which had been divided into 885 1° blocks.

For the next two and a half years, the information was drawn together, culminating in the appearance of *The Atlas of Australian Birds*. It is a landmark in Australian ornithology being both an important source of ornithological information and a valuable conservation tool. Not surprisingly, it has been awarded the Whitley Medal for 1984.

Each of the 656 breeding species and regular migrants has a full page devoted to it. A two-colour map presents the 1° blocks in which the species was recorded; various sized symbols give the relative rate at which it was reported; and different colours indicate confirmed breeding. Coverage ranges from that of familiar and widespread species such as the Willie Wagtail found in 94% of the blocks to the Paradise Parrot, which was not recorded once. Although the latter may have sadly passed into extinction, another long-absent bird, the Night Parrot, was rediscovered and subsequently recorded four times during the course of the atlas.

Further analysis of the map data appears in the text, including status, abundance, historical changes and environmental factors affecting the species' distributions. Seasonal movements, not discernable from the maps, have also been extracted from the data. For a portion of the species, there are sufficient historical records (divided into time spans of pre-1900, 1901-1950 and 1951-1976) to present these separately. The contraction of some native species and the expansion of introduced birds such as the House Sparrow can be clearly seen. Accompanying each species account is a pen-and-ink vignette, and a series of six transparent overlays (purchased separately at $6.00 each) assist interpretation by relating the distribution of the bird to environmental features like vegetation, rainfall and elevation.



Given the immensity of the task and the success with which it was fulfilled, it is perhaps trivial to comment on possible shortcomings of the book. However, by granting each species an equal amount of coverage, some of the information that could have been derived from the atlas was excluded or given less prominence than it may have merited; for some, timing of seasonal movements and annual fluctuations were identified but were unable to be shown visually; display of historical changes would have been enhanced by including all maps for a species together; there is a bias shown by observers for rare species and favourite birding localities — a bias which is recognised by the organisers; and some of the more remote blocks, in areas where so little is known, needed more than a single visit, a goal much easier said than done!

And, of course, five years in the recent history of Australian birds cannot hope to give the full picture, particularly as much of that period took place during widespread drought. The next five post-atlas years may witness a substantially different pattern, at least for some species. Ideally, a system of constant updating could incorporate new information as it becomes available. More realistically, another atlas, sometime in the future, would provide an update on the current finds and perhaps pinpoint species even now undergoing critical decreases in range.

— Walter E. Boles

An Illustrated Guide to the Estuarine Polychaetes of New South Wales

Pat Hutchings; illustrated by Ross Goldingay. Coast and Wetlands Society, Sydney, 1984: 160 pp., $6 (including postage).

The polychaete worms are one of the most important animal groups found in the bays, harbours, coastal lagoons and river estuaries along the N.S.W. coast. They are extremely numerous, occurring in all the various habitats found within these waters, with over 200 species already described. Owing, however, to their habit of living mainly buried beneath the sandy mud, or among the roots of strap weed or eel grass, polychaete worms are known only to the initiated and the keen fishermen who regard a few species highly as bait.

It commences with a general introduction detailing the complex structures used in the identification of polychaetes and illustrated by clearly labelled drawings. This is followed by a key to the families. The species more commonly occurring in the estuaries are then described, family by family, in taxonomic order, with details of habitat and occurrence. Each description of the species is accompanied by clear line drawings.

Appended are a comprehensive glossary and a bibliography that covers

the more important Australian literature on polychaetes.

This guide should prove a most valuable addition to the library of all marine biology students and is, in fact, essential for anyone interested in the ecology and natural history of our estuaries. **— Isobel Bennet**

The Reader's Digest Book of the Great Barrier Reef

Reader's Digest, 1984: 384 pp., $35.00.

The *Reader's Digest Book of the Great Barrier Reef* is not a scientific text book, despite the impressive list of contributors that reads like a "who's who" of marine science. Neither is it an identification guide for visitors to the reef, although a look through the pages of impressive colour prints, supplied by Australia's leading photographers, might suggest that it is. This book is a comprehensive look at the Great Barrier Reef as an ecosystem, as a place of history and entertainment, and a celebration of one of nature's more spectacular masterpieces.

The book is divided into four parts. The first part — "24 hours on a coral reef" — captures in words and pictures the magic of diving on the reef, the constant bustle of changing tides, feeding times and the everyday fight for survival, giving way to the mystery of the reef at night. If you cannot visit the reef these chapters will take you there.

The second part, with fascinating aerial and satellite photographs, shows the geological and biological processes that formed the reef. It also looks at the influences that are destroying and rebuilding the reef today.

"Life above and among corals", the third and longest part, looks at the staggering diversity of flora and fauna to be found on the reef; from microscopic plants to whales. This section does not simply give a list of species but examines their interactions, giving an insight into the complexity of this unique marine ecosystem.

The fourth section looks at humans and the reef, covering such topics as the the role the reef has played in Australia's history, island resorts to visit and what to do there, and conserving the reef for the future. This section explains what government authorities are responsible for the reef and the roles they play in research, resource use and conservation.

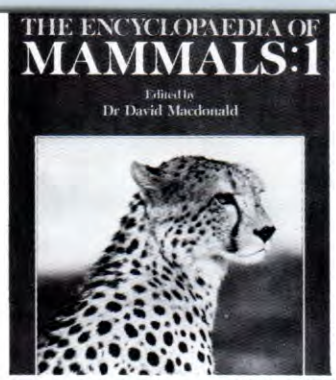
To complete the book there are maps, an index and glossary of scientific terms making this the most comprehensive book to date on the Great Barrier Reef. The excellent colour plates, the easily readable and authoritative text and the mere fascination of the subject itself recommend this book to a wide audience; from scientist to armchair traveller, from photographer to historian.

The only aspect that detracts from the book is the unimaginative and old-fashioned layout. However, the subject matter of the text and photographs are spectacular enough to make up for the dull design. Overall, a book that would do justice to any library or coffee table.

— Lucy Hodgson

The Encyclopaedia of Mammals: 1 and 2. (1: Carnivores, seals, whales, dolphins and primates; 2: Herbivores, insectivores, bats and marsupials.)

Edited by D. Macdonald. George Allen & Unwin,



London, Sydney, 1984: 911 pp., $49.95/volume.

Over the last decade, there have been many summary works produced on the world's mammals. Among these are *Walker's Mammals of the World* (recently revised by Nowak and Paradiso), the *National Geographic Book of Mammals*, Eisenberg's *The Mammalian Radiation*, *Mammal Species of the World* edited by Honacki, Kinman and Koeppl and the ongoing series *Mammalian Species* published by the American Society of Mammalogists. All of these have unique strengths as well as weaknesses and many, despite their minor weaknesses, have become standard references. As a result, most of us in the field of mammalogy find it difficult to avoid turning first to these familiar and trusted friends when urgently in need of vital information about, say, the Mzab Gundi or the Russian Desman.

Macdonald's new encyclopaedia, however, has had no difficulty whatever in finding its way into the "first-grabbed-for" section of my reference library, perhaps because, apart from the inevitable minor problems (see below), I trust it as a basically reliable source. How could I do otherwise?

This lavishly produced encyclopaedia was written by no less than 200 authoritative contributors. Among them, from Australia, are Mike Augee, Chris Dickman, Greg Gordon, Tom Grant, Peter Jarman, Tony Lee, John McIlroy, Roger Martin, Bill Poole, Eleanor Russell and Andrew Smith. It cannot of course replace the superb and much more detailed work specific to Australia, the Australian Museum's *Complete Book of Australian Mammals* edited by Ron Strahan.

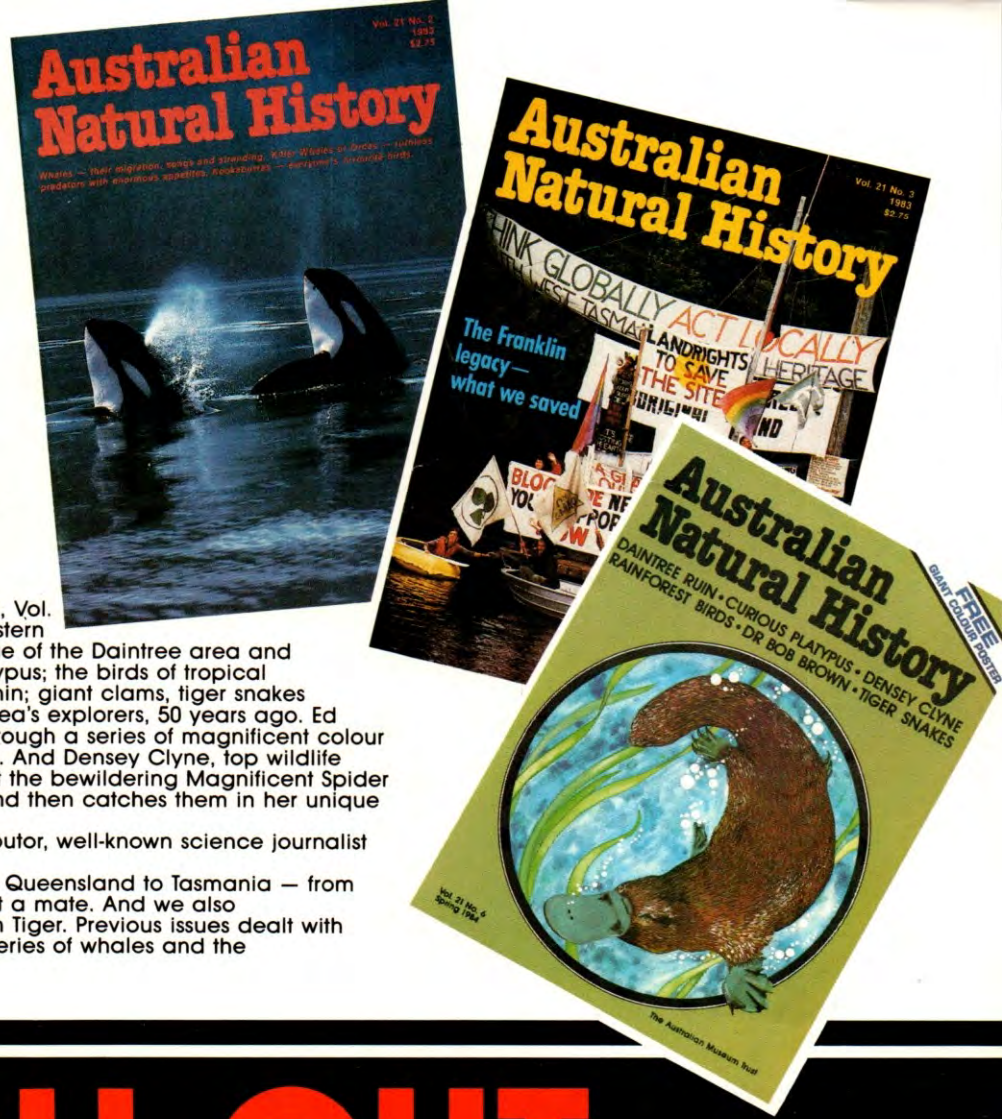
The vital statistics of the *Encyclopaedia of Mammals* include 750 full-colour photographs, 72 colour drawings, hundreds of other drawings and diagrams, attention (although sometimes only a sentence) given to all 4,000 or so living species, summaries of the basic biology of all the groups and many species, a reasonable bibliography and good indices and (not the least noteworthy) a stunningly well-designed layout.

As a mammalian morphologist I was also pleased to see the unusual addition of many skull and skeletal diagrams and the discussions of phylogeny, although most of the text understandably deals with behaviour and ecology.

In many of these ways it is, as the dust jacket modestly declares, an encyclopaedia that ". . . has no rivals". However, it does have a few faults. For example, in the section on marsupials (which most of us will probably turn to first!), the cute drawings by D.K.K. Twinney stand out as distinctly flawed. The reconstruction of *Procoptodon* shows multiple toes on each foot, the *Diprotodon* is a runt and many of the South American marsupials look like rodents (for example, the *Metachirus*). The Australian carnivores are better but fall well short of the level of the rest of the book (witness the five-toed *Antechinomys* and the bizarre *Dasykaluta* which is, incidentally, consistently misspelt as *Dasykatula*). The kangaroos also include a most curious three-toed *Hypsiprymnodon*.

These faults, however, evaporate within the otherwise superb overall quality of the encyclopaedia. All reference libraries will have to have it and, I believe, few mammalogists or mammalogically-minded amateurs will be able to stand the envy of seeing it on someone else's bookshelf.

— Dr Michael Archer



Read the Natural Authority

The last issue of *Australian Natural History* (Spring, Vol. 21, No. 6) offered a giant colour poster of the Eastern Pygmy-possum. We looked at the biological value of the Daintree area and the impact of the road; Australia's very own Platypus; the birds of tropical Queensland rainforest; weaning of a baby dolphin; giant clams, tiger snakes and quolls; and retraced the tracks of New Guinea's explorers, 50 years ago. Ed Douglas interpreted the Australian landscape through a series of magnificent colour photographs in our new regular feature Photoart. And Densey Clyne, top wildlife writer, photograper and film-maker, talked about the bewildering Magnificent Spider that lures male moths by chemical deception and then catches them in her unique swinging line of silk.

In this issue we introduce another regular contributor, well-known science journalist Robyn Williams.

The winter issue looked at the marine world from Queensland to Tasmania — from conservation aspects to how fiddler crabs attract a mate. And we also documented an alleged sighting of a Tasmanian Tiger. Previous issues dealt with kangaroo harvesting, the Franklin River, the mysteries of whales and the dehydrating drought.

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Australian Natural History

SPECIAL OFFER

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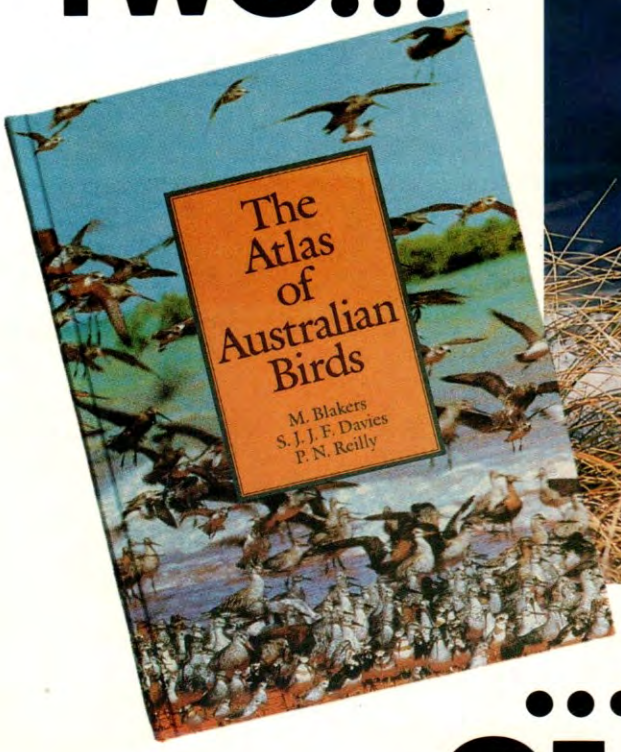

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