

\$3.00

GIANT **FREE**
COLOUR POSTER

Australian Natural History

DAINTREE RUIN • CURIOUS PLATYPUS • DENSEY CLYNE
RAINFOREST BIRDS • DR BOB BROWN • TIGER SNAKES



Vol. 21 No. 6
Spring 1984

The Australian Museum Trust

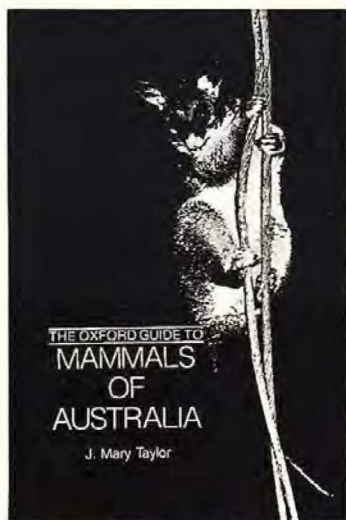


NORTH'S
**NESTS
& EGGS**
OF AUSTRALIAN BIRDS
(THE HISTORY OF OUR BIRDS)
A FACSIMILE EDITION OF AN AUSTRALIAN CLASSIC
VOLUME 1

North's Nests and Eggs of Australian Birds Vol 1 (Facsimile edition)
Alfred North

One of the great works of Australian ornithology and acclaimed as a major achievement — 'really more of a life history of our birds than a catalogue of nests and eggs' — when first published in 1904. It has remained an invaluable document for ornithologists, amateur and professional, ever since.

32 x 24 cm, 444 pp, 20 pp plates and b&w sketches.
boards, 0 19 554509 5
\$80.00



The Oxford Guide to Mammals of Australia
J. Mary Taylor

The first pocket-sized guide to native Australian mammals for use in the bush, zoos and museums, or in the classroom. The major groups include egg-laying mammals, marsupials, rodents, bats, dugong, seals and sea-lions and are presented with descriptions, maps and silhouette drawings. Each genus is described by size, weight, general body features, habits, habitat and reproductive biology.
21 x 13.4 cm, 160 pp, 260 b&w illus.
paper, 0 19 554584 2
\$11.50

**Quality from
OXFORD
... Naturally**

**Australian
ANIMAL
TOXINS**

*The creatures, their toxins
and care of the poisoned patient*

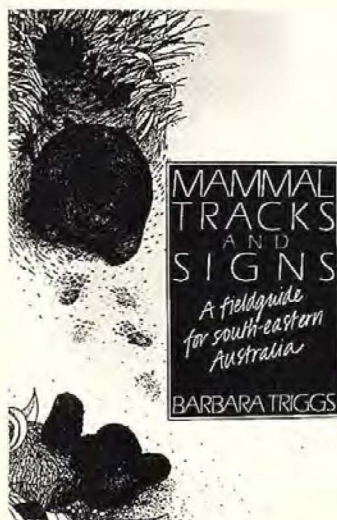
STRUAN K. SUTHERLAND

Australian Animal Toxins
The creatures, their toxins and care of the poisoned patient

Struan K. Sutherland
This comprehensive and up-to-date review provides detailed descriptions of all venomous and poisonous creatures in Australia, both marine and terrestrial, that pose a threat to man or beast.

"Its comprehensiveness is such that most will find it compulsory reading." — *The Bulletin*

23.8 x 16.6 cm, 528 pp, 100 colour and 150 b&w illus.
boards, 0 19 554367 X
\$95.00



Mammal Tracks and Signs
A Field Guide to South Eastern Australia
Barbara Triggs

This indispensable guide for professionals and amateurs of all ages includes copious illustrations and colour photographs of tracks, scats, signs, shelters and skulls of mammals, to enable easy identification and tracking of activity patterns.
20 x 19.8 cm, 204 pp, colour and b&w illus. and photos
boards, 0 19 554430 7
\$25.00
paper, 0 19 554429 3
\$12.99

**VENOMOUS
CREATURES
OF AUSTRALIA**



A Field Guide with notes on First Aid
Dr Struan K. Sutherland
of the Commonwealth Serum Laboratories

MORE THAN 60 of the most venomous creatures of Australia described and illustrated

130 PHOTOGRAPHS IN FULL COLOUR to help identification.
FIRST AID for all attacks, including the most up-to-date advice for:
BITES by SNAKES, FUNNEL-WEB SPIDERS, RED-BACK SPIDERS, STONEFLIES.



STINGS by JELLYFISH, ANTS, BEES, WASPS, etc.
DISTRIBUTION MAPS
NOTES on CREATURE HABITS, APPEARANCE, HOW THEY ATTACK, and THEIR VENOM
ESSENTIAL FOR ALL:
hushunters skin divers campers teachers
hospitals scouts and guides ambulancemen
chemists state emergency services
and of course families at home or on holiday

EASY-TO-READ EASY-TO-USE

Venomous Creatures of Australia
A Field Guide with notes on First Aid
Struan K. Sutherland

More than 60 of the most venomous creatures of Australia are described and illustrated with full colour photographs to help identification. Recommended first aid techniques are given for all attacks including bites from snakes and spiders, stings by jellyfish, wasps and bees with distribution maps and notes on creature habits.
20.2 x 13.5 cm, 128 pp, 60 full colour photos and b&w illus.
paper, 0 19 554318 1
\$9.99

Australian Natural History

from the INSIDE

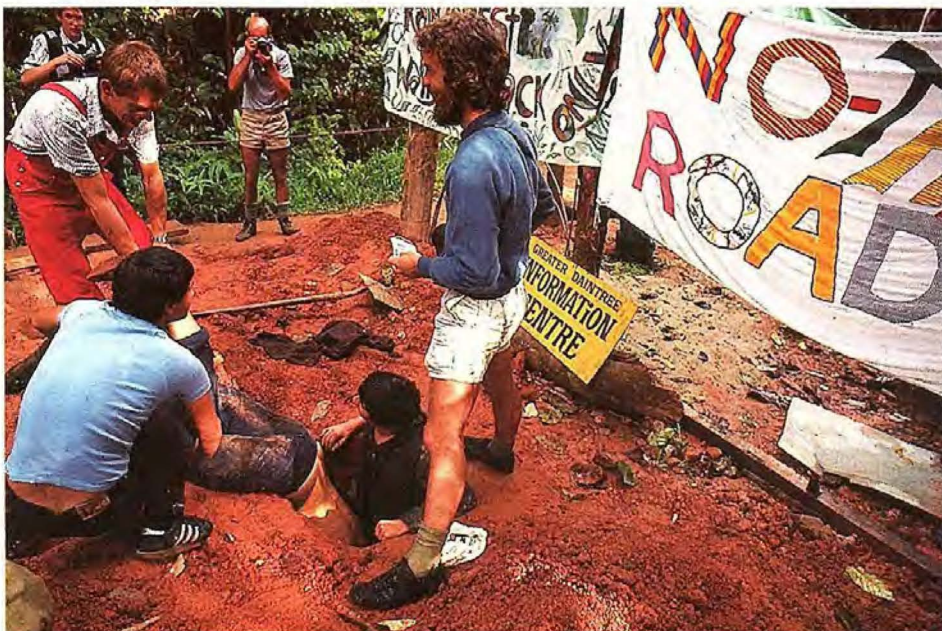
From fertility to sterility . . . when a Federal election is imminent, political expediency often overrides rational decision-making. Daintree, one of the last stretches of coastal wetland rainforest in Australia, is the victim. Voracious land developers, sedentary city-based tourists and certain short-sighted Government politicians and officials will be smiling. This issue of ANH examines the biological value of the Daintree area and

the impact of the road. We introduce several new sections in this issue. Top wildlife writer, photographer and film-maker Densley Clyne has joined the team. So has a free giant colour poster ideal for any lounge room or schoolroom wall. If a platypus closes its eyes and ears when diving for food, how does it find any? How does it survive freezing water and not suffocate in its tiny burrow when other animals would succumb? Find out from our world authority Tom Grant. The gouache painting on the front cover was rendered by ANH's new graphic designer Sue Oakes. We hope you enjoy the superb photographs of the north Queensland rainforest birds and those taken by Ed Douglas in another new section, Photoart. You will notice many other additions in this issue. Write and tell us what you think. Rob Cameron, Editor.

Contents

Daintree — On the Road to Ruin	219	Photoart: Ed Douglas interprets the Australian landscape.....	247
Platypus — a Different Mammal by Tom Grant	224	Quolls — Marsupial Wildlife	250
Densley Clyne looks at		Giant Clams — a Valuable Marine Resource by Richard Braley	256
The spider that swings to the beat of wings	228	Rare and Endangered: Lord Howe Island Woodhen	259
Birds of the Tropical Queensland Rainforest Clifford and Dawn Frith	230	Tiger Snakes of Chappell Island by Michael Cermak	260
Taylor Leahy Patrol: A retracing of the first Mt Hagen patrol by John Burton and Pawel Gorecki	236	Letters.....	263
Liftout poster: Eastern Pygmy-Possum	241	Books.....	264
Dolphin Weaning — World First for Coffs Harbour.....	245		

Below: a blockader has his ankle chained to logs at the bottom of his "foxhole" before being dug into the bulldozer's path; photo C. B. Frith. Right: the serenity of tropical rainforest habitat with palms overhanging a clear stream; photo Leo Meier.



Australian Natural History

Published by
The Australian Museum Trust
6-8 College Street,
Sydney, N.S.W. 2000
Phone: (02) 339 8111

Trust President: Kris Klugman
Museum Director: Desmond Griffin

EDITOR

Robert Cameron

SENIOR JOURNALIST
Christine Deacon

CIRCULATION
John McIntosh

ART DIRECTOR
Sue Oakes

TYPESETTING
Keen Permfilm Pty Ltd

PRINTING

RodenPrint
Sydney

ADVERTISING

Grover and Partners Pty Limited
1 Ball's Head Road, Waverton
N.S.W. 2060
Phone: (02) 922 2977

SUBSCRIPTIONS

Annual subscription (4 issues)
within Australia \$A11.00
Other countries \$A13.00

Two years subscription (8 issues)
within Australia \$A21.00
Other countries \$A25.00

Single copies
Australia \$A3.00; posted \$A3.75
Other countries \$A4.50

For renewal or subscription
please forward the appropriate
cheque, money order or
bankcard number of authority
made payable to:

Australian Natural History
The Australian Museum
P.O. Box A285 Sydney South
N.S.W. 2000, Australia

Subscribers from other countries
please note that money must be
paid in Australian currency.

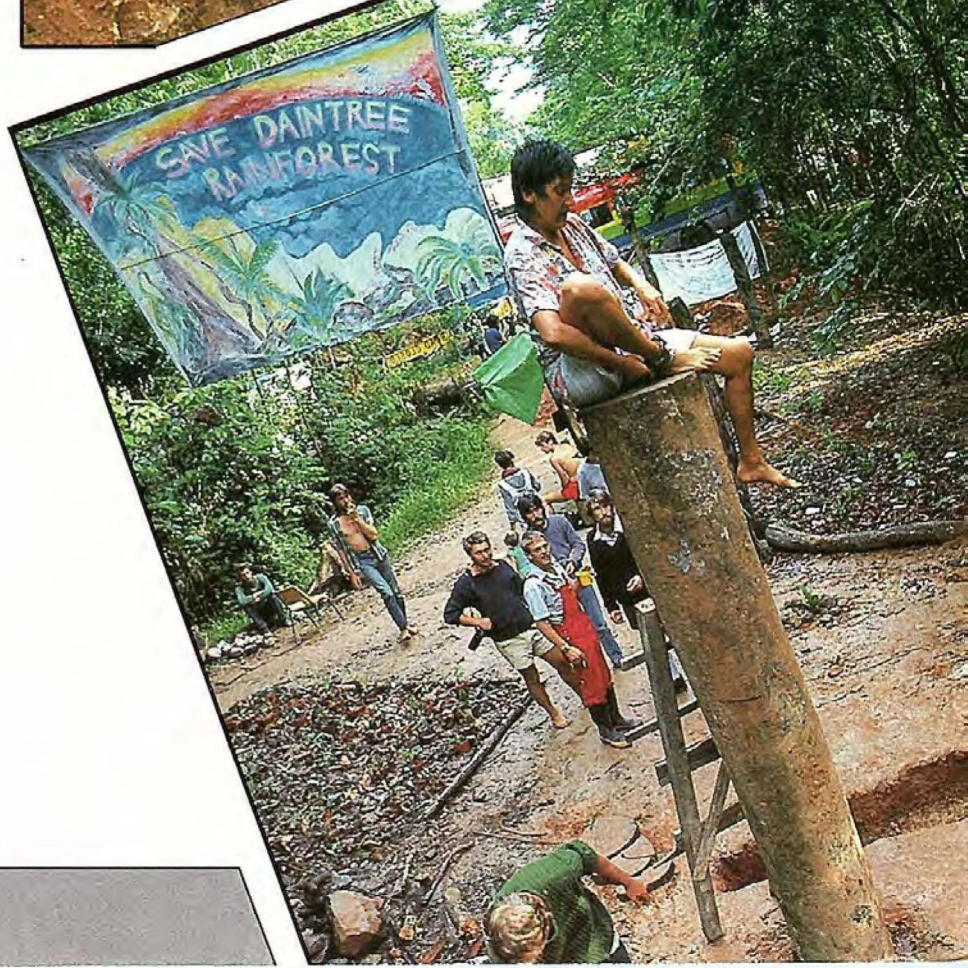
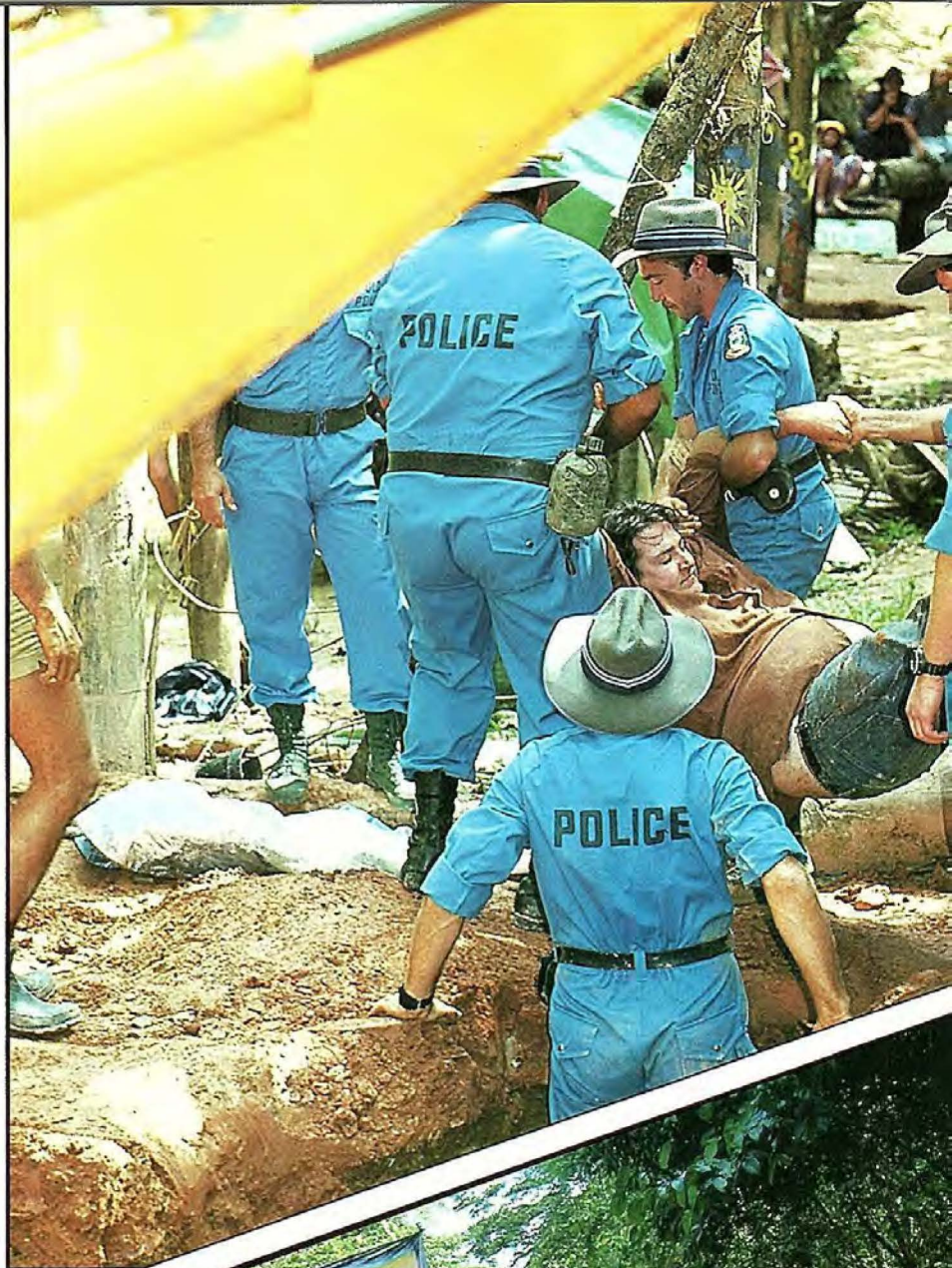
All material appearing in
Australian Natural History is
copyright.

Reproduction in whole or in part
is not permitted without written
authorisation from the Editor.

Opinions expressed by the
authors are their own and do not
necessarily represent the policies
or views of the Australian
Museum.

The Editor welcomes articles or
photographs in any field of
natural history.

ISSN-0004-9840





Daintree

ON THE ROAD TO RUIN

It was a victory for the Queensland Government and a victory for Federal short term political expediency. It was a bitter loss for conservationists who believed that their victory in stopping the damming of Tasmania's Franklin River was the dawning of an enlightened approach from the Federal Government in regard to preservation of our natural heritage. The construction of a road through the Cape Tribulation National Park in the rainforests of north Queensland's Daintree region is almost complete as ANH goes to press. We publish here photos from the attempted blockade in August, taken by Cliff Frith, who was on standby for ANH waiting for the bulldozers to move in. Let's now take a brief look at the biological value of the Daintree area and the environmental impact of the road. This was written from material provided by Dr Aila Keto, President of the Rainforest Conservation Society of Queensland and co-ordinator of an in depth Australian Heritage Commission report on the rainforest. Make sure you also read our interview with Dr Bob Brown in Forum.



Biological value of the Daintree rainforests.

The continuous mantle of rainforest from high mountains to coastal lowlands, with the canopy overhanging sandy beaches fringed by coral reefs, is rare if not unique in the world. In this area the two most outstandingly complex natural communities on earth exist side by side — reefs and rainforests. There are extremely few places left along our coastline where you can experience nature at its undisturbed best. Until recently the area provided a rare opportunity of conserving a rich ecological gradient of forest communities from the sea coast inland over steep mountain ranges 900 metres high, perched river valleys, to gently undulating dry forest to the west.

The area forms an integral part of the Wet Tropics region of North Queensland, which is unquestionably of international significance with respect to surviving, relictual primitive angiosperms. These rainforests have the highest concentration of primitive angiosperm families in the world. These plants may well hold vital clues to the origin, evolution and migration of angiosperms.

A recent survey by the Queensland Herbarium shows a very high diversity in the flora. In this small area of coastal lowland rainforest (below 500 metres altitude), extending from the Daintree River northward for about 30 kilometres, at least 348 higher plant species have been recorded. Eleven per cent (39) of these are as yet undescribed and it is conservatively estimated that a further three to four per cent remain undiscovered. Four of the undescribed species have not been satisfactorily classified beyond Family level.

Eight of the listed species are restricted entirely to this small area, and are endemic to Australia. Three of these have been described only to Family level, and a further two to Genus level. The recently described *Storckia australiensis* belongs to a very small genus. Its closest relatives (3 species) are found only in Fiji (one) and New Caledonia (two). *Choriceras majus*, also restricted to this area, belongs to another very small genus comprising only two species.

Only a few collections have been reported of an undescribed species belonging to the relatively small family, *Hamamelidaceae*. Only two other species in this family occur in Australia. Both of these

belong to monotypic genera: *Ostrearia australiana* is restricted to Mt Bartle Frere and *Neostrearia fleckeri* to the same area and McNamee Creek a little further south.

Of particular interest are the moist mountain summits to the west of Cape Tribulation, such as Mount Sorrow. Here are found several extraordinary insects, including the blind water beetle, *Terradessus caecus*. The only other recorded occurrence of a water beetle adapted to a terrestrial life is in the highland forests of the southern Himalayas.

The Daintree rainforests are an integral part of the whole wet tropics region of north-east Queensland. This region has been shown to be of world heritage status, predominantly by virtue of the outstanding universal values of the tropical rainforests of the area. They are relics of a formerly widespread vegetation type that dominated the Australian continent when it was part of the Gondwanaland landmass.

History of the road

In 1976, a track was bulldozed through the then Timber Reserve by two Cairns developers, one of whom was a former Douglas Shire council Chairman. The legality of this action was questioned at the time by officers of the Queensland Forestry Department. In 1978, the Douglas Shire Council contributed funds for the restoration of the track. A 20 metre wide Road Reserve was gazetted soon after. The Cape Tribulation National Park was gazetted in 1980 with the Douglas Shire Council giving its support only if the Road Reserve remained. Earlier in 1980, the Minister for National Parks, Mr I. Gibbs, told the Douglas Shire Council that he would not oppose the widening of the road to 40 metres and agreed that the alignment could be altered to give the most suitable location in practice. The Premier of Queensland, early in 1983, promised the Douglas Shire Council a contribution of \$100,000 towards construction of a rough four-wheel drive track. In a submission to Cabinet later in September, 1983, the Premier recognised the existence of alternatives and recommended that the allocation of \$100,000 be made instead to the Co-ordinator General's Department Special Works Investigation Vote for the purpose of an investigation. This, he recommended, should involve representatives from the Main Roads



Department, National Parks and Wildlife Service, the Land's Department, The Cook and Douglas Shire Councils and the Far North Queensland Electricity Board. Nothing eventuated. Instead, bulldozers commenced work in the National Park. The previously gazetted Road Reserve had been deemed impracticable by the Douglas Council Shire engineer, Mr Bob Baade. No surveys were carried out for the new route. It was literally forged through the forest by the bulldozer driver. No research on the environmental impact of the road was carried out as required by the National Parks and Wildlife Act 1975-1982, nor any environmental impact study as required under the Local Government Act.

The Queensland Minister for National Parks, Mr Peter McKechnie, gave approval for the excision from the National Park of a strip 100 metres wide for nearly half its length and 60 metres for the remainder. Mr McKechnie requested a most basic report from senior staff of the National Parks and Wildlife Service after the excision had already been executed.



Preceding page. Top left: a front end loader was used by police to dig out this demonstrator who was then arrested; photo C. B. Frith. Bottom left: sitting atop a pole, Maria resisted arrest until after dark on the initial barricade and was the last to be arrested that day late August 1984; photo C. B. Frith. Right: clearing rainforest reduces productivity as nutrients are largely in the biological components of the ecosystem; photo J. Billington.

The rainforest canopy palms include the circular endemic Daintree palm *Licuala ramsayi*. Photo: Leo Meier.

Locals, Mr Don Grey and Mrs Margaret Thorsborne, blockade a huge bulldozer; Mr Grey was arrested on private property. Photo: C. B. Frith.



A Unique Opportunity

LIMITED
EDITION



"PULPIT ROCK"
by Arthur Boyd

THE ARTHUR BOYD FUND FOR MARINE MAMMALS

The Arthur Boyd Fund for Marine Mammals has been established to finance research into whales, dolphins and other marine mammals, investigating phenomena such as the mass beaching of whales.

Arthur Boyd's "Pulpit Rock" has been produced in a strictly limited edition of only 127 prints. Each print is individually signed by the artist and reflects the superb colours of the original.

Your purchase of this print will support the Arthur Boyd Fund for Marine Mammals, helping us to establish a capital fund for the purposes of financing this much needed research.

Yes, I wish to take advantage of this unique offer.

I want to purchase prints at \$250.00 each.

Enclosed please find a cheque for \$ _____

Please debit my Bankcard, American Express, Mastercard

Name _____

Address _____

Postcode _____

Signature _____

Post orders to the Australian Museum Society, P.O. Box A285, Sydney South, 2000. Orders will be processed strictly in order of receipt. The cost of the print includes delivery by registered mail.

Environmental impact of the road

Roads through rainforests in Queensland have been built with minimal impact. These have been narrow, hand-formed roads winding along the ridge tops without breaking the tree canopy. Examples are the O'Reilly's road to Lamington National Park and the former Palmerston Highway in North Queensland which followed a lava flow that traversed the steep escarpment (the latter has now been widened). These roads were both picturesque and minimally damaging to the environment.

The road being constructed by the Douglas Shire Council traverses very steep slopes (up to 45°) necessitating deep side cuts. In parts, the road has grades over 30°. The deep side cuts into the steep slopes are very unstable. The major land-forming process in this area has been mass movement. Huge landslides have occurred, albeit extremely rarely, in the past, some extending for ten to twelve kilometres. The natural frequency of such massive landslides is unknown, but clearing the forest cover can be expected to result in an increase.

Uncompacted soil from the deep side cuts up to 12 metres in places has been pushed over the slopes onto strand rainforests growing below on sand. Changes in drainage and nutrient status will almost certainly affect these forests. Tree death from partial burial is already obvious. The tonnes of loose overburden will run like a river of mud for a long time to come with as yet unquantified and perhaps unforeseen impact on freshwater ecology of streams and adjacent fringing coral reefs.

The progressive dislodgment of fractured boulders, some two metres in diameter, will continue to exacerbate downslope damage to the forests.

Direct human impact should be taken into account. Indiscriminate clearing for camp sites and fire wood have already extensively modified the littoral forest zone between Cape Tribulation and the Daintree River, particularly at Thornton Beach. Four-wheel drive vehicles have likewise damaged these fragile forests as a result of the *ad hoc* access tracks pushed through to the beaches. The Queensland

National Parks and Wildlife Service is unlikely to be able to prevent a similar fate for the rare rainforest fringed beaches north of Cape Tribulation.

Enclaves of Special Leases and private property within the National Park create possible future management problems and the spectre of intensive tourist development.

Permanent canopy gaps in rainforests will change the nature of these forests in the long-term with greater shift towards species from early successional stages. Introduction of weed species and pests is already apparent, e.g., *Lantana camara* and the introduced *Thunbergia grandiflora*. This latter vine has seriously infested other National Parks as a result of road intrusions and is causing significant tree deaths in adjoining virgin forests.

A red eyed tree frog, *Litoria chloris*, of tropical regions. Photo: C. B. Frith.



the PLATYYPUS a different mammal

Tom Grant is at present an Honorary Visiting Fellow in the School of Zoology at the University of New South Wales. He began studying the platypus for his doctorate studies on its temperature regulation in 1972, and then investigated various aspects of its physiology and ecology. These studies have culminated in a book entitled "The Platypus" which has been published this year by the NSW University Press.

The platypus is synonymous with Australia in the eyes of most people throughout the world (almost as much as the kangaroo). A furry little animal which lays eggs and suckles its young, it is found in the rivers, creeks and lakes of eastern Australia from Cooktown in the north to Tasmania in the south. It is an amphibious animal which gets all of its food in the water, so its distribution is governed by the occurrence of permanent water. It is not normally found in areas far west of the Great Dividing Range where river water supply is never dependable. This means that there are large areas of Australia where the species does not occur.

The small invertebrate animals (like the aquatic larvae of insects such as mayflies and caddis flies) which are the food of the platypus are collected from the bottom of the river, creek or lake by the animal fossicking in the sand and among stones with its duck-like bill. Because this activity is usually carried out at night and the animal is very secretive in its habits, many Australians have not seen a platypus in the wild. People, like fishermen and canoeists, who move quietly on the river in the evenings and at dawn quite often see them. Fishermen may even catch them on hooks, especially if they are using live bait. Some of these people have experienced another unusual feature of the animal. This is being jabbed by the venomous spurs which the male has on its rear ankles. With care it is possible to avoid being spurred by holding the platypus by the tail, but this

method isn't foolproof. From one who knows, a second of inattention can mean a lot of pain!

From the few brief things which have been said about the platypus so far you can see why the first specimens to arrive in Britain from the Australian colonies were met with disbelief — they are certainly unusual animals. The fact that they look unusual isn't surprising as they are the product of the evolutionary process which has shaped the species for a fairly unusual way of life, and it is this aspect which is worth studying further.

The evolution of different ways of doing things is not always the way things happen. Often the evolutionary process produces similar adaptations to similar environmental demands. For example, animals which are exposed to low concentrations of oxygen in the air they breathe because they live at high altitudes, or in burrows where ventilation is poor, often have similar blood characteristics. They may have haemoglobin which has a higher affinity for oxygen than other species, or they may have more haemoglobin in their red blood cells, or they may just have more red cells in their blood.

In this respect, the platypus is similarly adapted to living in burrows as some rodents like the prairie dog, and has a large number of very small red cells in its bloodstream. The large surface area of all these small cells permits efficient absorption of oxygen at the surface of the lungs, from the "less than fresh" air in the atmosphere of the burrows. How-

ever, as more research is carried out on the biology of *Ornithorhynchus anatinus*, biologists are finding that the adaptations of the species to an amphibious way of life are often quite different from those found in other semi-aquatic mammals. For instance, just to be different it seems, the platypus propels itself in the water with its front feet while animals like the otters, beavers and water-rats use their hind feet for swimming.

Most amphibious mammals use vision for finding their way about underwater, and for getting their food. The platypus closes both its eyes and its ears as soon as it dives below the water surface. The bill is used both for location, and for collecting and sorting food. Platypuses do not dive for extended periods, but dive repeatedly for periods of one to two minutes, usually spending a minute or two at the surface between dives when food is chewed and sorted. It is stored in cheek pouches opening into the mouth cavity. These lie next to the horny plates which replace the teeth in the young, soon after they leave their mothers' burrows. The platypus may spend a total of 12 hours a day feeding in this manner.

The bill allows the platypus to poke and prod on the bottom for its food, but it also enables it to navigate underwater. Vast numbers of nerves in the bill collect information from tiny pits all over its surface and relay it to a part of the brain called the cerebral cortex. In most mammals a great deal of this area is concerned with processing information coming from the eyes and ears, but



A Platypus entering the water on a rocky riverbank typical of their habitat in south eastern Australia.
Photo: J. E. Wapstra, NPIAW

in the platypus by far the largest part of the cerebral cortex is involved in handling information from the bill. The platypus could be described as finding its way about by a sophisticated sense of touch, which isn't a bad way to do things when you are trying to locate your food on the bottom of a murky Australian river in the middle of the night! Scientists think that stimulation of the tiny organs in the pits in the bill, by water vibrations over them, permit the animal to sense the presence of moving objects or stationary ones which deflect movements in the water. In this way platypuses can detect objects in the water without actually having to touch them.

Initially it was thought that platypuses were like reptiles in their abilities to regulate their body temperatures. When a lizard is cold it is sluggish and lethargic in its movements. A platypus can swim about for several hours in water in the middle of winter in the Snowy Mountains without becoming the least lethargic or sluggish. The water tem-

perature in a river like the Thredbo River at this time of the year is likely to be close to freezing, but if you could measure the body temperature of a platypus feeding in this river (which has been done using small radio transmitters) you would find that it was about 32°C. That may seem a bit cold when you consider your own temperature of around 37°C, but it is far from cold. A day in summer which has a maximum temperature of 32°C is actually quite a hot day.

By increasing its metabolism, the platypus is able to replace the heat from its body which is lost to the cold water in the river. Its excellent fur coat, which traps a layer of air as insulation, also helps to reduce the speed of heat loss from its body to the water. Most mammals have the ability to elevate their metabolic rates to cope with the stress of lowered outside temperatures, and most have some sort of insulation in the form of fur or fat. The thing that makes the platypus different is that it maintains its body temperature at a

level which is lower than that of most other species. Marsupials have body temperatures around 36°C and most placental mammals are about 38°C. Birds even have temperatures of over 40°C in some instances.

Of course, to maintain such high temperatures requires higher intakes of food. Because the platypus does not have such a high temperature it is more economical. However, lower fuel consumption does not mean impaired performance. In fact the Australian water-rat *Hydromys chrysogaster* is a poorer performer than the platypus in this respect as it can't maintain its body temperature of 37°C in cold water for long periods. Perhaps "poorer" is not the best word to use, as the name of the game is survival, and both species survive in the Australian environment. They just survive in different ways. The water-rat feeds along the river bank much more in winter to avoid having to enter the water. Because of this it doesn't compete nearly as much with the

platypus for food, although their diets do overlap to some extent. Both species are able to co-exist by having adapted in slightly different ways to their specific niches within a similar habitat.

The thing which has really intrigued zoologists is the mode of reproduction in, not only the platypus, but in all of the animals belonging to the group called the Monotremes which also includes the spiny anteater, or echidna and the

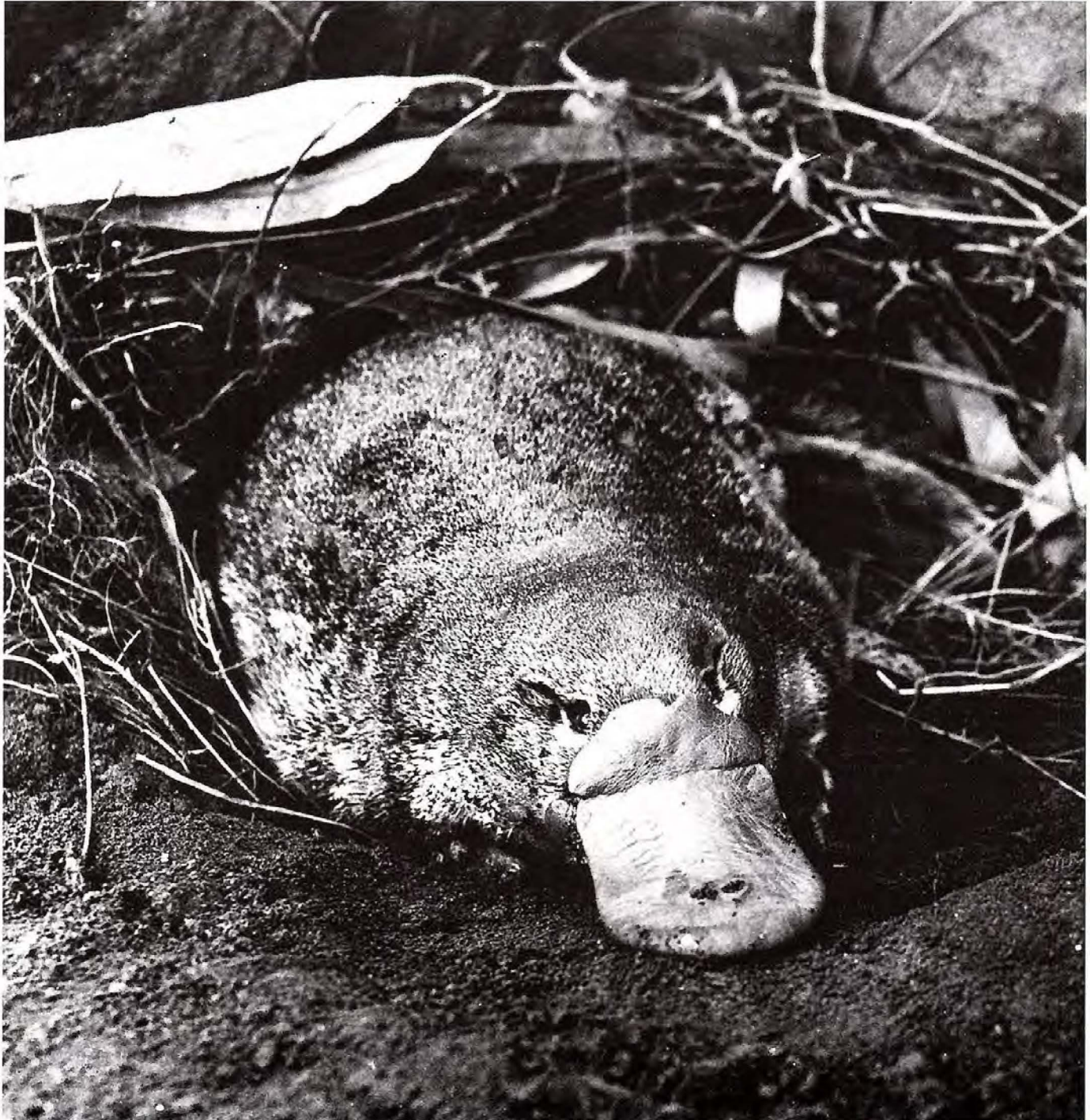
long-beaked echidna of New Guinea. All of these mammals lay eggs and feed their young on milk from mammary glands. In the platypus, the eggs are laid in a burrow in the river bank in spring, and after hatching the young are fed by the mother for about three and a half months before they emerge from the burrow, to become independent at about two thirds adult size. Laying eggs and then suckling the young is certainly an unusual way of doing

things by mammalian standards, but then again, so is the way marsupials have their young when you compare it to placental mammals like ourselves. All three groups of mammals have evolved quite successful methods of reproduction; they are just different methods.

Today *Ornithorhynchus anatinus* is common within its present range, although it is vulnerable to change as it is adapted to a highly specialised way of life. The evolutionary

Platypus emerging from its nest.

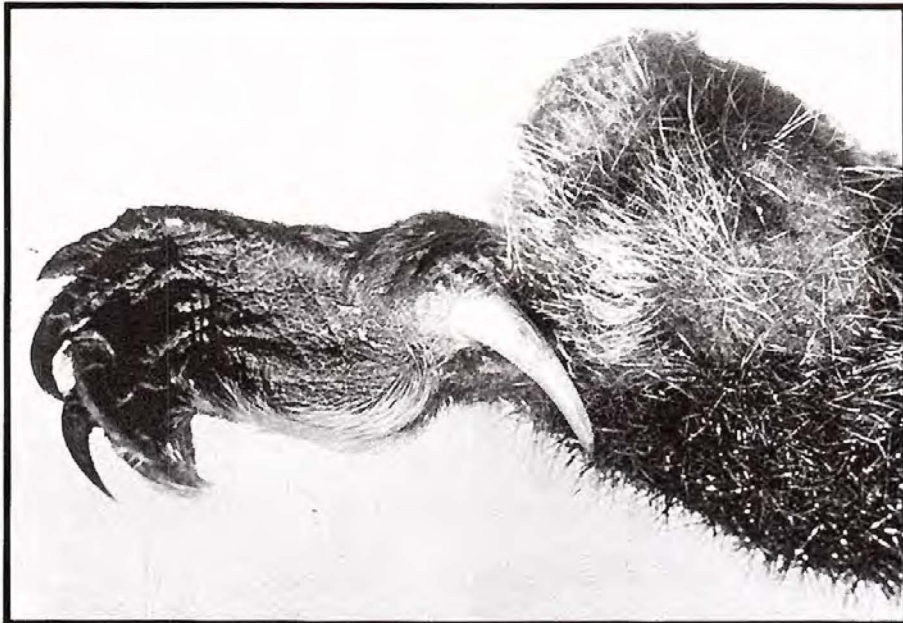
Photo: H. Burrell





The head of the platypus showing the leathery "duck-bill", very sensitive to touch, which enables the platypus to locate its food — small crustaceans, insect larvae, earthworms and small molluscs.

Photo: J. E. Wapstra, NPIAW



The male platypus has a poison spur which can inflict a nasty wound. The webbing between the claws aids the platypus in swimming and is folded into the palm for walking and digging.

Photo: M. Happold, NPIAW

processes, which have occurred in Australia during its long isolation from the other continents of the world, have produced a host of different and unique species of mammals. Both the marsupials and the monotremes have been called primitive mammals at various times by people who have looked at them through eyes accustomed to seeing placental mammals. Unfortunately the term primitive is difficult to define, but fortunately this is of little consequence as survival and reproduction are the measures of success in the biological world, and certainly the platypus does both of these very well.



Densey

THE SPIDER THAT SWINGS TO THE BEAT OF WINGS

Have you met Maggie? She's a lady worth watching. You might find her in your garden after dark, a spider shining white in the torchlight, fishing for insects with a short silk thread dangling from one leg.

Look closely at this spider. You'll see she has patterns of delicate orange and yellow on her abdomen. Her eight legs are banded coffee and cream, her eight eyes rise on a crimson turret from her carapace. Who said spiders were ugly?

Now look closely at that fishing line. Even with its coating of sticky droplets, even with that extra big blob of glue at the bottom — it seems far too simple to catch anything, let alone a powerful flying insect.

What you can't see — though you will if you watch long enough — is how the spider turns her fishing line into something more like a capacious landing net. And what you can't read is the message the spider sends out to lure a special kind of prey. It's written in scent, and it purports not to come from a spider at all.

The magnificent spider *Dicrostichus magnificus* is a member of the orb-weaving family of spiders who no longer makes an orb-web. Somewhere back along the evolutionary path her orb-weaving ancestors branched out to become specialists.

A time exposure shows the spider's trapline whirling on the approach of her prey. The blurred triangle at the top is the spider's leg swinging the line.

Photo: Jim Frazier



You might think the use of an orb-web is already a specialisation compared with, say, chasing after your food on foot.

But a lot of time and energy goes into the making of a web, and some of the insects it catches may be dangerous or unsuitable. Sometimes repairs — even a whole new web — must be made during a catching period.

By contrast Maggie's catching device takes no time at all to make. It uses very little silk. And her victims without exception are harmless and good to eat, because the magnificent spider is a specialist among specialists. Her forte is in the catching of male moths of a particular kind. Except by a rare accident no other insect ends up on her baited line.

So how does she do it? Well, here's the mystery made clear, and it remains no less of a mystery and a wonder for that. The essence — note the word — of the magnificent spider's technique is that she uses a confidence trick on her victims.

Like most male moths, the ones the spider catches track down their mates by following a scent released by a female moth. She may be far away, but a male moth can detect mere molecules of scent with his antennae. The female of each species of moth has her own particular perfume, so there can be no mistake, no mismatching. Or can there?

The fact is that sometimes a male moth finds himself led up the garden path into the embrace of quite the wrong kind of female. No moth this, but a spider that has lured him with a scent that is a facsimile of the scent of the female moth. The magnificent spider uses chemical deception.

Deception of the visual kind as a defence against enemies is well-known among insects, of course. A pattern of false eyes suddenly exposed by a moth lifting its wings, for instance, can frighten away an attacking bird.

This *visual mimicry* is something we ourselves can understand because it's directed at birds, and people and birds both depend mainly on their eyes. But with our second-rate noses the *chemical mimicry* of this spider is something we can't perceive directly.

What can be seen, though, is the sequel — the arrival of a moth at the end of his disastrous flight path, his entanglement and capture at the ambush site. And this part of the story is as remarkable as the rest.

The magnificent spider belongs to a small, elite group of spiders that all use sex scents as a bait for male moths. There are two species in Australia and several more distant American relatives. Because of the way they finally land their catch they all go under the general name of *bolas spiders*.

The *bolas* was a hunting weapon used by South American Indians. Three stones attached to one another by short cords were fixed to the end of a longer cord, coiled like a lasso. A large animal such as a guanaco was stalked on foot, and the bolas flung low to tangle its legs and bring it down.

Maggie's 'bolas' is more like a sticky flypaper with an extra blob at the bottom. But the analogy really falls down in the way she uses it. Instead of stalking her prey and throwing her weapon, she stays put and swings it. The single line becomes a cone-shaped trap. Even a moth flying slightly off beam can't avoid it.

When my colleague Jim Frazier and I set out to film Maggie's

Elyne looks at.....



By day the magnificent spider lives in a retreat of woven silk among the leaves. She comes out at night to ambush her prey, or in season, to lay her eggs.
Photo: Densley Clyne

extraordinary story for television we had two main problems. The first was the availability of our leading lady. Magnificent spiders are few and far between. Moreover, wildlife film actors can never be depended on to perform on cue, and they're quite likely to walk out on you or get themselves eaten. Wise directors make sure they have several stand-ins ready on the set.

So it was with Maggie, as we soon called her to save breath. In the end we had to use five — or was it six? — separate maggies to tell the story.

The moths posed another problem. For technical reasons you need extra bright light to film tiny animals like insects and spiders — and moths fly to bright lights. Maggie would only swing her line on the close approach of a victim. So how could we film that marvellous action if the moth that should have triggered it was cooking on our movie lamp instead?

It wasn't known at that time exactly what it was that set the magnificent spider swinging just as the moth came within reach. But

over long nights of watching and waiting Jim and I had picked up a clue. If a heavy vehicle drove by, or an aircraft passed overhead, our maggies all responded with a few half-hearted swings. Deep vibrations, we guessed. The beat of the moth's wings.

So as a substitute Jim tried humming, *forte* and *basso profundo*. I joined in, *contralto*. It worked. The spider liked it so much she swung wildly, not just round and round but up and down like a yoyo. But humming at the top of your hum for any length of time is exhausting. By the time Jim was ready to film we were out of breath. So I fetched Jim's guitar and tried strumming.

The low E string did the trick — it worked perfectly and we got our film sequence. So the spider that uses chemical mimicry to delude male moths had the tables turned on her. We tricked with with *acoustic mimicry*.

Maggie didn't get her moth that night, but she got a good fishing story: "You should have *heard* the one that got away . . ."

A diet of fat moths provides Maggie with the energy she needs to produce her enormous eggsacs. She takes a night to make each one, with nights off for hunting in between.
Photo: Densley Clyne





BIRDS

of the Tropical Rainforest

by Clifford and Dawn Frith

Clifford and Dawn Frith live at Paluma near Townsville, where they look out from their living room to the lush tropical rainforest. They are qualified zoologists and have spent the last six years studying and photographing rainforest birds, in particular bowerbirds. There are no authors more qualified to describe the birds of our tropical rainforests.

Australia is synonymous with several unique and spectacular birds; the emu, lyrebird and laughing kookaburra are familiar. Less widely known, but just as interesting, are some of the colourful but little known birds found in our great tropical rainforests of northern Queensland. This remarkably diverse and complex habitat covered approximately one half of a per cent of the continent prior to the arrival of the white Australian. During our 200 years of occupation we have, amazingly, destroyed so much tropical rainforest that less than a quarter of a percent of Australia is now clothed in this luxuriant growth. Whilst the destruction of our richest habitat has been rapid, the gain of knowledge concerning the creatures that live within it, has not. With a recent dramatic increase in public awareness of, and interest in the environment, however, our

*Left: The palm cockatoo, *Probosciger aterrimus*, a pair from Cape York.
Photo: C.B. & D.W. Frith.*

tropical rainforests have seen a steadily growing number of people travelling from overseas and interstate to enjoy this magnificent heritage. Most eagerly sought of all the diverse animal life to be seen relatively easily, are the beautiful birds peculiar to the northern forests.

Our continent has often been described by explorers, naturalists and ornithologists as the "Land of Parrots" because of the great diversity and conspicuousness of members of this much loved family of birds. Indeed, Australia boasts about 1/6th of the world's parrot species. Most characteristically Australian are the cockatoos, as we host no less than 11 of the world's 18 species of these large and raucous parrots.

The palm cockatoo *Probosciger aterrimus*, the largest of the group, is widespread through most of Irian Jaya and Papua New Guinea, but it also occurs in the very restricted Australian tropical rainforests on the northern tip of Cape York Peninsula. Whilst this awe-inspiring cockatoo is shorter in overall length than the

better known black and red-tailed cockatoos, *Calyptorhynchus funereus* and *C. magnificus*, it is a much stockier and heavier bird. Its most obvious attribute is the enormous, and immensely powerful bill which is very nearly twice as large as that of other black cockatoos and is emphasised by the large area of red, bare, facial skin lacking in other species. The great bill is used to crack open and tear apart nuts, seeds and fruits and in particular large pineapple-like fruits of pandanus or screw palm trees. Leaf buds are also eaten, and doubtless insects and their larvae within fruits are eaten if not extracted from tree wood.

Despite the extensive distribution of the palm cockatoo, this tropical rainforest with its limited range in Australia, is relatively inaccessible and difficult country to spend extended periods of time in. Thus, the palm cockatoo remains a little known bird. It nests, like other cockatoos and most parrots, in tree hollows. A single white egg is laid, on a mat of splintered twigs,

between August and late January in Australia.

The palm cockatoo is quite commonly encountered within its limited Australian habitat and groups of half a dozen or so birds can often be seen flying, feeding or perching as a group. Sometimes a bird will raise its great crest, open its wings and all but hang upside down from its perch in display. The significance of this behaviour is unknown, but it may be relevant to pair formation.

From the enormous palm cockatoo, now consider Australia's smallest parrot, the diminutive double-eyed fig parrot *Cyclopsitta diophthalma*. This little bird, the size of a sparrow, occurs in Australia in three distinct and isolated populations down the east coast and the birds of each differ in colouration about the head. The birds we photographed at Iron Range are of the most northern population, formerly known as Marshall's fig parrot, which are confined to the tropical rainforests of northern Cape York Peninsula. In the two more northerly populations the fig parrot is sexually dimorphic, with the males having more red feathering about the head, whereas in the southern birds of south-eastern Queensland and north-eastern New South Wales the sexes are near identical and with little red colouration.

These colourful little parrots are so named for their feeding habit of

eating predominantly the seeds of wild figs. The birds we photographed are feeding on the fruits of a cauliflorous fig tree; that is a tree which presents its flowers and subsequent fruits from the woody trunk and branches rather than from the foliated twigs as do most trees. Fig parrots nest by excavating a hole in a rotten tree trunk or a dead branch, including those of mangrove trees such as we observed at Portland Roads, and place small wood chips on the floor of the nest chamber onto which two white eggs are laid.

The southern population of the double-eyed fig parrot is now regrettably very rare due to the destruction of rainforest, and recent records of the bird are few indeed.

Of the approximately two hundred and eighty five pigeons and doves of the world twenty five occur in Australia of which twenty two are native, and an additional three have been introduced by Europeans. As striking as any of our pigeons is the gaudily plumaged male purple-crowned pigeon *Ptilinopus superbus*. This bird, whose mate is a generally green and grey bird with a purple-blue patch at the back of the crown and some yellow wing markings, is found down the north-east coastal areas of Australia from the tip of Cape York to the Tropic of Capricorn where it nests predominantly in tropical rainforest or on the forest edge. Vagrant birds do, however,

The eastern yellow robin, *Eopsaltria australis*.
Photo: C.B. & D.W. Frith



Above: An adult buff-breasted paradise kingfisher caught in a mist net and banded at nearly 1000 metres (probably the highest record in Australia), raises its crest in defiance.

Photo: C.B. & D.W. Frith

fly south of this breeding range during the winter and have been recorded right down the east coast of the continent, and in Tasmania.

Whilst being very predominantly a bird of the tropical rainforest the purple-crowned pigeon is also to be encountered in mangroves and eucalypt forest with fruiting undergrowth, some good distance from rainforests. Native fruits form the great majority of its diet and these are sought at all levels of the forest structure although birds do spend most time in the upper levels of the canopy and emergent trees. A fine study of tropical pigeons carried out by Frank Crome of the CSIRO established that the purple-crowned pigeon at one particular locality took fruits from forty eight different plants.

The nest of this pigeon is extremely sparse, consisting of a few fine sticks only, and can be very easily overlooked even with its single white egg sitting atop it. Usually, however, the egg is covered by a sitting parent unless flushed by the intruder. Despite the bright colouration of the bird, particularly in the males, they are very difficult indeed to see in the leafy forest canopy unless they are moving about. Once picked up in the field of one's binoculars, however, they are breathtakingly beautiful.



Australia is rich in kingfishers, very colourful dagger-billed and small-footed birds of the family Alcedinidae. The ten species found here exhibit very considerable diversity in size, from that of the enormous kookaburras (46cm) to the diminutive little kingfisher *Ceyx pusillus* (13cm).

The buff-breasted paradise kingfisher is a summer migrant to Australia, flying from Papua New Guinea across the Torres Strait to breeding grounds in the tropical rainforests of north eastern Queensland south to the Townsville area. Birds arrive suddenly and in large numbers during the last week of October and the first week of November, or thereabouts. At this time the birds look their best in bright fresh plumage attained during their recently completed moult in New Guinea, but as their breeding cycle progresses into the tropical Australian wet season they become soiled and worn by the demands of raising a family; particularly the females as they alone spend much time in the nest chamber incubating the eggs. Their streaming white central tail feathers, already conspicuously shorter than those of the males, often become badly tattered or broken off.

Most of the world's approximately ninety species of kingfisher nest in holes excavated into earth banks or termite mounds and our paradise kingfisher is no exception; whereas our kookaburras are different in that they commonly nest in tree holes as well as termite mounds.

Upon arrival in Australian tropical rainforests the paradise

kingfishers form pairs and vocally establish themselves in a small territory of forest containing one or more suitable termite mounds, and commence burrowing into a selected mound. The excavation of a nest chamber may take up to four weeks to complete. The entrance tunnel is dug into the centre of the mound, most often a mound on the forest floor but sometimes on a tree trunk or rock face, and a nest chamber is then formed to house the eggs and sitting female. A clutch of eggs, which are white and almost perfectly round, consists of three or four. As the excavation is made the termites seal off the damage done by the kingfishers leaving the nest entrance tunnel and chamber with a smooth internal surface free of active termites. Not until the birds depart from the mound do the termites seal the entrance aperture and then set to work refilling the void formed by the tunnel and nest chamber.

Our observations at three termite mound nests suggest that parent kingfishers perform very little brooding of the young, and if they do so at all it is only during the first few days of life except, perhaps, during particularly cold conditions. During these first few days of nestling care it would appear to be the handsome longer-tailed male that performs most of the feeding visits to the nest. Perhaps his mate, dishevelled and somewhat exhausted after incubating the eggs over approximately three weeks, needs a bit of a rest before contributing greatly to the provisioning of her demanding family. As the young grow and

become louder and more frantic in their demands, however, the female feeds them more and more often until she is visiting the nest as frequently as her mate. Interestingly the parents bring very small food items to the small young and the meals they bring get larger as the young grow older. Small beetles, spiders, caterpillars, grasshoppers and other insects are brought to the mound and carried into the nest tunnel to the very small nestlings; but once their eyes open and they have become co-ordinated enough to shuffle down the tunnel to meet the arriving parent they are offered larger beetles, grasshoppers, cicadas, preying mantids, stick insects, and frogs and skinks. The regularity with which parent birds bring stick insects, preying mantids and other very cryptically coloured and behaving insects to their young is indicative of the efficiency of their eyesight and hunting techniques. Unlike some kingfishers the buff-breasted paradise kingfisher rarely, if ever, feeds on fish; but pounces upon prey on the forest floor or on tree trunks and branches. Take a walk in rainforests looking specifically for mantids and stick insects and you will quickly appreciate the impressive ability of this handsome hunter.

On the second of February 1984 we each watched an occupied nest mound we had been studying for several weeks, less than one hundred and fifty metres apart. Between 08:20 and 08:30 we were both delighted to witness a nestling emerge from our respective nest entrance to fly strongly up into the forest after an initial flutter to the ground or low perch beside the termite mound. We both blurted out our exciting eye-witness story in unison, and looked at each other in disbelief. At one of these nests the remaining two nestlings were observed fledging from it in similar fashion on the subsequent day, and the opportunity was therefore taken to examine a freshly vacated nest chamber. We removed the side of the mound to expose the entrance tunnel and chamber. The chamber was quite clean except for a carpet of pin feather sheaths dropped by the growing young and, beneath the feather sheaths, the remains of numerous beetles (mostly their elytra). Nest sanitation is in fact maintained by the nestlings, once they are sufficiently co-ordinated, by expelling their

excreta out of, and clear of, the nest entrance and mound to accumulate on the forest floor below.

By about the end of March the young are able to hunt for themselves and in early April their parents commence the return trip to New Guinea, and are followed by their offspring a week or two later. To see an adult pair or a flock of these beautiful birds in fresh plumage flying determinedly across the tropical waters of Torres Strait to Australia would have to be one of the most impressive natural wonders imaginable. May we preserve enough of their tropical rainforest breeding habitat to keep them coming year after year.

The pittas constitute a group of approximately twenty five extremely colourful ground-frequenting birds also known as jewel-thrushes found in Africa (two species) and from northern India through south-east Asia and Indonesia to New Guinea and Australia. Four species are known to occur in Australia, but by far the most widespread is the noisy pitta *Pitta versicolor*, which can be encountered down eastern coastal Australia from the tip of Cape York Peninsula to near Port Macquarie in New South Wales in tropical and subtropical rainforests and scrubs.

Pittas make a living by hopping across leaf-littered ground on their long slender legs in search of animal food, which they forage for by lifting leaves and debris with the bill. They eat larger litter and soil animals such as small lizards, shelled-molluscs and earthworms. To deal with the larger and thicker-shelled snails noisy pittas often use a favoured stone to which they carry their prey to smash it upon. Such "anvils" as they

are called can be found littered about with the remains of snail shells. The noisy pitta also eats fruits, and we have personally witnessed adult birds feeding their young small ripe figs *Ficus destruens*, during our photographic sessions at nests. More surprising to us was the discovery that parent pittas quite often bring leeches in the bill to feed to their young. This is a trait that will doubtless add to the appeal of this bird in many people's eyes.

Noisy pittas are one of our few overseas migrant passerines, or perching, birds. It would appear that birds in the southern part of this pittas range move northward during the winter months, whilst part of the northern populations migrate north and across Torres Strait to New Guinea. It is also suggested that some birds move off the forested mountain ranges of the tropics, such as the Atherton Tableland, down to the coast or to off-shore islands during winter. In spring, however, the noisy pitta makes itself very obvious with its clear loud whistled "walk-to-work" call as pairs establish themselves in breeding territories. They are rather shy and secretive on the dark floor of the forest but occasionally one may be seen hopping across the road, or may be whistled up to the patient observer giving an imitation of the call.

The noisy pitta builds a rather bulky domed nest, with a side entrance hole, on the forest floor using sticks, leaves, bark and mosses. Oddly, birds often build an entrance ramp of sticks beside the nest on which they spread mammal dung, and other pitta species have been noted to do this. Three or four attractively spotted and blotched eggs are usually laid and the subsequent demanding young noisy pittas keep their parents increasingly busy provisioning them until they fledge.

One or more of the Australian "robins" are familiar to almost all Australians as the various species, particularly the red or pink and black species and the yellow robins, together with the widespread hooded robin, cover most of the continent. Our largest robin is, however, little known as it is confined to the upland tropical rainforests of the Atherton Tableland area north almost to Cooktown and south to Paluma near Townsville. This lovely bird is the grey-headed robin *Poecilodryas albispecularis* which

has been our subject of study. Its clear off-repeated single whistled note is often mistaken for that of the unrelated bell miner *Manorina melanophrys*, by birdwatchers from Victoria and New South Wales, recognising this southern species which does not in fact occur very far north of Brisbane.

Grey-headed robins form pairs in spring and vigourously defend rather small territories of rainforest. They build a delicate cup nest of fibres, horse-hair fungus and rooflets which is decorated on the outside with mosses. Nests are usually about two metres above the ground in the fork of a sapling or, very often, on the spiny stem of a lawyer vine or wait-a-while *Calamus* spp. The sharp spines of the wait-a-while would appear to offer the nest, eggs and young some protection from predators such as small rats. The female alone broods her one or two young and feeds them from the rim of the nest. The male forages about the territory by clinging to vertical perches whilst searching the leaf litter for small animals and insects. He pounces then flies to a perch close to the nest and calls the female to him in order to pass her the food with much calling and fluttering of wings. Of course the female also hunts food herself. Whilst often difficult to actually see in the rainforest the grey-headed robin is one of the commonest of birds in suitable habitat.

One bird quite unique to Australian tropical rainforest that many birdwatchers fail to see is the little known Australian fernwren *Crateroscelis gutturalis*. As in the grey-headed robin, this diminutive leaf-litter dwelling bird is confined to upland tropical rainforests between Cooktown and Paluma near Townsville. It produces several very high-pitched fine whistled notes which many people are unable to hear, as it hops, usually in pairs, steadily over the litter in search of small animal foods. The long fine bill of this bird is used rather like a pair of tweezers, to lift individual leaves and toss them aside in the hope of uncovering prey. Once located this bird can usually be seen quite well if one keeps very still.

The nest of the fernwren is a remarkably large and stout structure for such a small bird; being a great globe of soft mosses attached above ground to a creek bank or tree base with a small, often hooded, entrance aperture.

The forest kingfisher *Halcyon malleayi* of eastern and northern Australia.

Photo: C.B. & D.W. Frith



These nests are remarkably difficult to find unless one has established a "search image" for them and their potential sites. Indeed, the bird had not to our knowledge been photographed at the nest before and has only very rarely and inadequately been photographed at all.

Two tiny white eggs are laid during the summer months when insects and other invertebrate food is abundant. Both parents feed the young, in a feverish too-and-fro activity between the nest and the favoured feeding locations of gully and creek beds.

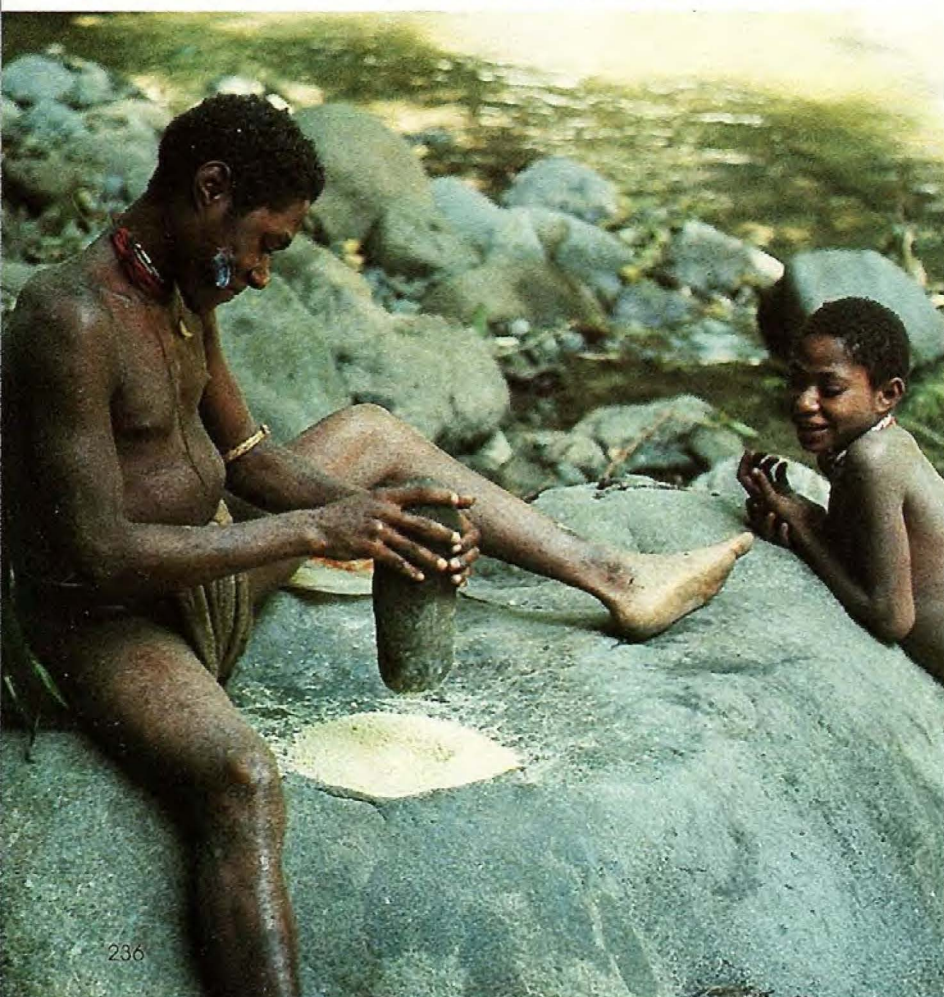
After five years of watching these and other tropical rainforest birds we are still a very long way indeed from learning all about them. Our knowledge of this lush and complex habitat and the animals within it is very much in its infancy. Exciting discoveries such as new species of mammals, birds, reptiles and frogs are still being made in this habitat, which is sadly presently being threatened with disturbance and destruction in some of its most significant remnant areas. Clearly numerous plants and animals await discovery and yet we still have to gather the most basic of facts about most of those discovered by the first explorers to the restricted and unique tropical rainforests of our continent.



The purple-crowned pigeon *Ptilinopus superbus* sitting on its nest.
Photo: J. Purnell, NPIAW

Grey headed robin *Heteromyias cinereifrons*, female gives a greeting display to an arriving male.
Photo: C.B. & D.W. Frith





Top Left: Woman and her child crossing a small tributary of the Lai River, near Rutli.
Photo: P. P. Gorecki

Above: Wild pig shot by a Pinai man near the Nanama River, a tributary of the Upper Yuat. Press reports that these people were contacted in 1984 are incorrect as there are reports of the discovery of the Pinai people as early as 1913.
Photo: P. P. Gorecki

Left: Pinai people grinding tree nuts with natural mortar and pestle to make a shampoo, in the Nanama River area.
Photo: P. P. Gorecki

the TAYLOR LEAHY patrol

The story of how Jim Taylor, Michael (Mick) and Dan Leahy, and Ken Spinks made the first patrol to Mt Hagen in the highlands of Papua New Guinea in 1933 was the subject of a documentary film, First Contact, featuring part of the remarkable cine footage shot by Mick Leahy. No one who has seen it will forget the dramatic scenes as Papua New Guinea highlanders encountered Europeans for the first time, nor the candidness of the men and women — black and white — who recalled those moments for the film-makers.

Following on from fellow explorer Charles Marshall's personal account in Australian Natural History (Vol. 21, No. 3, 1983), this article documents the retracing of the routes taken by the explorers 50 years on. This was recently undertaken by John Burton and Pawel Gorecki, both from the Department of Prehistory, Research School of Pacific Studies, Australian National University.

The background to the patrol lay jointly in the search for gold — the Leahys were gold prospectors — and in the Australian-run Administration's desire to extend its control into the previously unknown interior of New Guinea. That a journey of exploration reminiscent of nineteenth century Africa came about so late in the history of The Pacific, in 1933, can be partly put down to the difficulty of the terrain. But the main reason was lack of money. Jim Taylor's patrol diary, now in the Australian Archives, records that Morobe District, from where the highlands were initially administered, was only able to contribute £10 towards the cost of a reconnaissance flight over the Wahgi Valley before the patrol set off on foot. (This was when Taylor, it is said, was finding his own money to buy lumberjack boots at £7 a pair!)

Fortunately for the historian, Mick Leahy kept detailed diaries and took several thousand 35mm photographs with his Leica, in addition to shooting cine film. The still pictures are now in the Australian Library where we have recently been able to see and compare them with our own slides of the area. More than once we had the experience of discovering that we had taken our photographs from the very same vantage points that Mick Leahy had used.

Exactly where the patrol went is a subject of continuing interest, not least because many of the Papua New Guineans who met the patrol are still alive. The world they described has long since vanished and the patrol provides a point of reference separating memories of the traditional way of life from the modern experience. Leahy's photographs illustrate this world and its people, and depict the material

trappings of the economy before its transformation by European goods and deliberately imported shell-money.

The route of the patrol can be reconstructed from several sources of information. Perhaps the most useful is Jim Taylor's diary. Taylor described many conspicuous landmarks and continually noted the names of the streams and rivers that the patrol crossed, as well as the time spent on the move — often down to the exact minute. In the course of our research into the history and material culture of the highlands we have had numerous occasions to ask exactly where the patrol went.

In 1980 one of us (J.B.) was living near Avilamp with the Tungei, a tribal community of about 2000 people, while making a study of the stone axe quarries at the head of a tributary of the Tuman River. Men over 60 years of age often volunteered anecdotes relating the last use of the quarries to the coming of Jim Taylor, who seems to have been the only European from this time to be remembered by name. (Taylor became a figure well known to highlanders in subsequent years.)

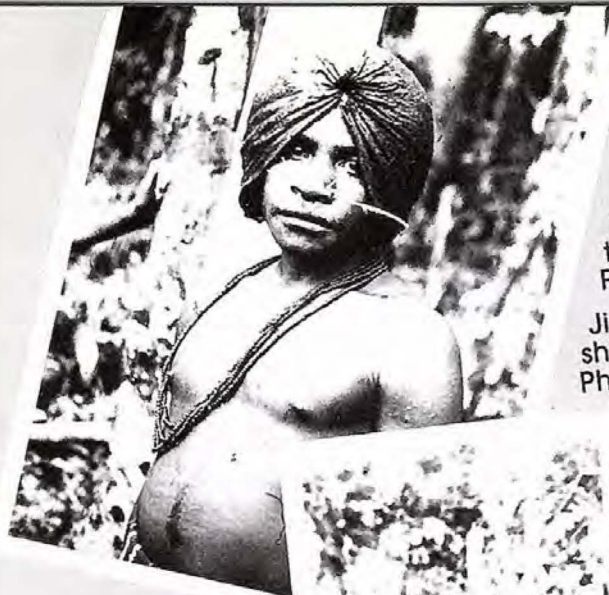
It quickly became apparent that memories of the patrol are quite clear, and that they could be put to effective use in, among other things, correcting age estimates for the older generations of men and women. Census-taking began much later, in the 1950s, so that this is of no small medical and demographic interest.

How did the Avilamp people first encounter the patrol? People who were there say they saw the patrol's reconnaissance aircraft first, a De Havilland DH-50, as it flew in the direction of Mt Hagen. Later the party of Europeans and their long line of carriers and New Guinea

police arrived on foot. Taylor's diary records both the course and duration of the flight, and it seems that the aircraft passed over the upturned and very surprised heads of the Tungei at approximately 10.15 on the morning of 27 March 1933 (see map).

The patrol left its base at Bena Bena the following day, at 8 am. They were soon across the Asaro River (in old accounts this is called the Garfuka). In four days they reached the furthest point of Mick Leahy's patrol of a few weeks previously at Chuave as they skirted to the north of Mt Elimbari. This was the point from which C. W. Marshall and the Leahys had first glimpsed the 'Long View' — the open land of the Wahgi in the distance. They crossed the Mai River (in the patrol accounts, the Mairifutiga or Cornigunu) and shortly afterwards passed near the site of Kundiawa, the provincial town of modern Simbu (3 April), before resting at Camp 10, near Kerowil in Western Highlands Province, today the seat of the North Wahgi Council (6 April). The people here were speakers of the language known as Middle Wahgi (*yu wei* or "speech true"). Here a temporary airstrip was constructed and the patrol was resupplied by air.

Camp 10 was just above the Wahgi River, close to a particularly fine vine bridge which Jim Taylor and Mick Leahy crossed to have a look around and meet the South Wahgi people near the modern township of Minj. The bridge was suspended from two six metre pylons and was braced by several lines of stays extending for about ten metres behind the pylons on each bank. Many similar bridges are still in use today and it is possible to distinguish two types: V-shaped ones with rope walkways, and U-shaped ones with



Jimi River man and boy, could have been taken on the Ganz tributary, in contrast to the Hagen area, these people are not wearing any shell ornaments.
Photo: M. Leahy

Jimi River man, probably on the Ganz tributary, and showing typical Jimi dress without shell ornaments.
Photo: M. Leahy



wooden or bamboo walkways. The Wahgi bridge was of the V-shaped type.

On 14 April the main body of the patrol moved off again along the northern side of the Wahgi Valley, and after passing through the small Nii language area (Camp 14), entered the modern Dei Council and the Melpa language area, in which they were to spend most of the next four months. After several more days on the march they arrived at Ogelbeng, a small hamlet five kilometres north of the present Mt Hagen township, where they established a permanent base camp on 18 April (Camp 15).

A point which is interesting to us is the detour taken by the patrol over what Jim Taylor called the "island", a prominent ridge standing out from the swamplands which line the central part of the Wahgi Valley. In fact this took them to Kuk where, over the past 12 years, a team of archaeologists led by Jack Golson of the Australian National University has discovered evidence of agricultural systems dating back to 9000 years ago. Taylor mentions meeting two men "who were making a gar-

den in the middle of a swamp. The garden was surrounded by deep drains and strong dykes . . ." It is the remains of precisely these kinds of drain, discovered by archaeological excavation, that have provided evidence for the distant prehistoric cultivation of the swamp.

The patrol was resupplied by air at Ogelbeng, and it was learned that the small party of police and carriers remaining at the Kerowil airstrip was in grave danger of attack. Jim Taylor and Dan Leahy flew back to Kerowil on 29 April to lead the group to the permanent camp at Ogelbeng. This time they followed a southerly route, using the vine suspension bridge to cross the river onto the southern side of the Wahgi Valley.

Initially they were among Middle Wahgi speakers again, and it is interesting to note Jim Taylor's description of "two very highly decorated children wearing possum fur, Bird of Paradise feathers, and a head-dress bearing a geometrical design of red and blue (this last worked on wood)". These were certainly what are known as "Geru boards" and are distinctive insignia used in Wahgi pig festivals. However,

this need not mean a festival was in progress. Children were also given them to wear at other times as a protection against sickness or malevolent spirits.

On 2 May the party crossed the Kanye River, where the water cuts through what Taylor described as a "gorge about 15ft deep by 6ft wide of blue stone". Mick Leahy was not present on this occasion, but appears to have photographed it in August 1933, when the patrol passed again by this spot. Later in the day they left the Middle Wahgi and were again in among Nii speakers. They reached Aviamp in the afternoon and ascended a ridge to camp at a place called Kuimi (Camp 17). "To the eastward lay a beautiful cultivated valley, a part of which we had just crossed, and below westerly flowed the Tuman — one of the Wahgi's largest tributaries," Taylor wrote in his diary. The place was not hard to find in the territory of the Tungei, and proved to be the house-site of a middle-aged man at the time of the patrol, Alsap Wu of Tungei Eska clan. The "beautiful valley" must have been one of several which flank the long spur on which Kuimi is situated.

The Tungei today recall their amazement at the arrival of two

white men on their ground. We have to remember that knowledge of their existence was, for the Tungei, based on nothing more than rumour spread by the tribes of the northern side of the valley and the Mt Hagen area. At that time warfare was constant, so that individuals could not move far from the safety of their home territory. Taylor noted seeing two men at the Kanye crossing that he had met and given beads to at the Kerowil airstrip, some ten kilometres to the northeast; this may represent the greatest distance that individuals could travel freely.

The meeting of the Tungei with the Europeans passed without incident. According to eye-witnesses, Jim Taylor demonstrated his rifle by shooting off the branch of a *Nothofagus* tree. This made them realise how powerful the white men were and later, it was said, some men excavated the camp latrine pit to use its contents in a war-magic potion.

The patrol crossed the Tuman River into the Melpa speaking area the next day and returned soon thereafter to Ogelbeng, having each day encountered hundreds, if not thousands of people. In fact, with hindsight, we can say that because the tribal territories were arranged in two rows, one on each side of the valley, the patrol made first contact with almost all the tribal groups of the Middle and Upper Wahgi Valley in the short space of three weeks since first setting out from the Kerowil airstrip. This might be reckoned to be the most intensive period of first contact in the highlands: the area was very densely settled and several politically autonomous groups might be encountered every day.

A complete contrast is offered by the two expeditions made into the very sparsely populated Jimi Valley during May and June 1933. The first trip, between 9 May and 20 May, took a party consisting of the four Europeans and some of the police and carriers to the Sau and Ganz River areas. The second, between 1 June and 18 June, took them in a wide circle down the Baiyer Valley, along the left bank of the Lai, across the grasslands at Ruti, and back to Ogelbeng by way of the Mogilpin (Muklpin) River. We have both recently visited these areas, one to investigate the stone axe quarries of the Sau/Ganz area — which incidentally the patrol came upon in full production — and one to the Lai/Lower Jimi/Mogilpin area. In both instances we found

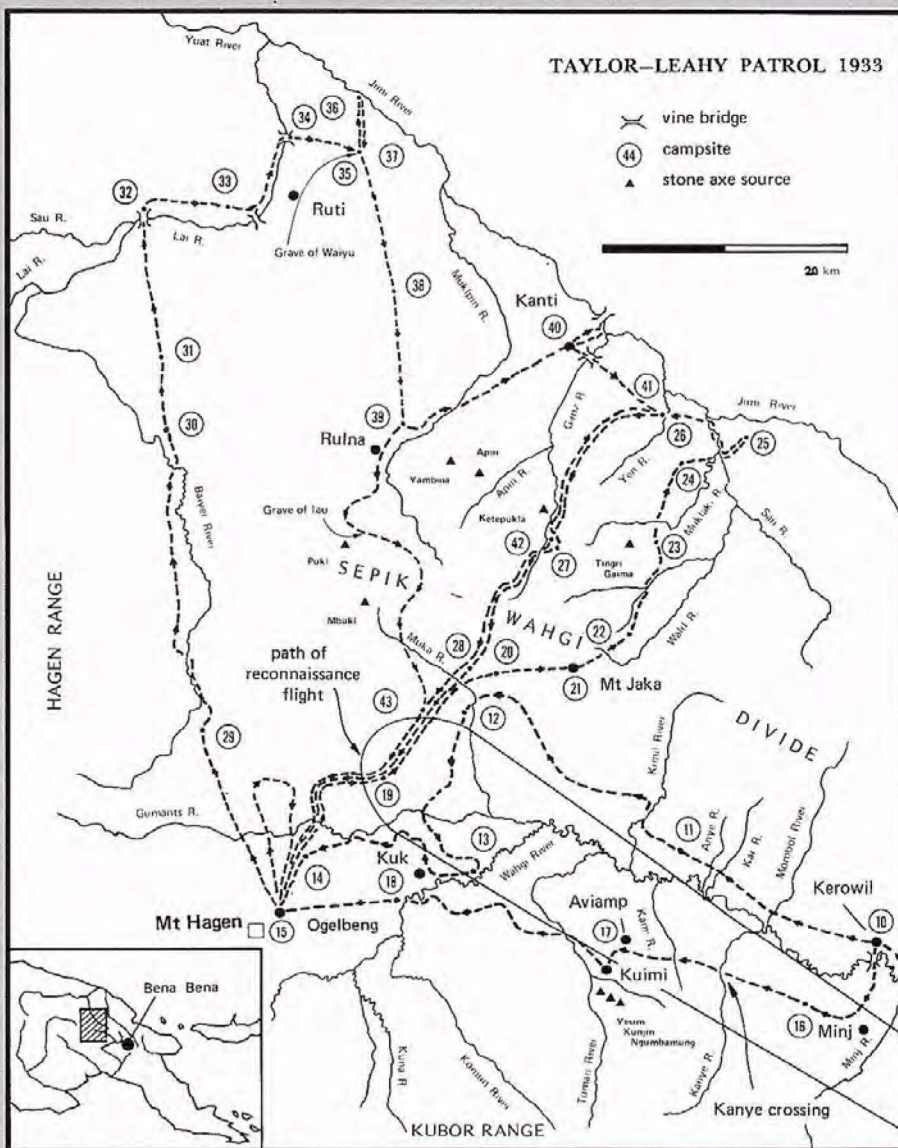
ourselves constantly crossing the route of the Taylor-Leahy patrol (see map).

The more intriguing of the two northern expeditions was the second one. The object of the trip was to examine as completely as possible the drainage system of the Baiyer and Jimi Valleys and to prospect in the streams for gold. What is not often appreciated is the degree of hardship this entailed for the patrol members, who had constantly been on the move for two months by this time. The country traversed was extremely rugged; over the two Jimi trips they climbed to a maximum altitude of 2945 metres on Mt Jaka and dropped down to a low of 400 metres in the gorge of the Lai River. (The gently sloping floor of the Wahgi Valley lies at 1600 metres.) The area was also virtually uninhabited, and environmental conditions particularly conducive to a variety of tropical diseases. Until this

point the expedition had suffered cases of illness but no deaths.

But on the trip to the Lower Jimi two carriers were lost, probably through catching pneumonia brought about by exhaustion and a shortage of fresh food. Commenting on the first death, that of Jonas Waiyu on 8 June, Taylor wrote that "this is the first death I have ever had on patrol, and we are all very grieved". Waiyu's grave is located at the site of Camp 35, and though its exact position is not known, it appears to lie within the boundaries of what will soon become a wildlife sanctuary.

The patrol turned back for base soon afterwards and by this time quite a number of the company were ill. The decision was made to send the sick back to Ogelbeng with Dan Leahy and Ken Spinks by the shortest route, while Jim Taylor and Mick Leahy continued to explore the lower part of the Ganz River. The two





1. Jim Taylor at Wahgi Bridge in April, 1933.
Photo: M. Leahy

2. Hagener wearing sausage wrapper.
Photo: M. Leahy

3. Hagen couple in ceremonial dress and decoration, probably at Ogelbeng.
Photo: M. Leahy

4. Hagener wearing shell valuables.
Photo: M. Leahy

5. Man near Mt Hagen with Tuman axe.
Photo: M. Leahy

The photographs from the M. Leahy collection, were taken in 1933 and are reproduced with permission of Mrs Jeannette Leahy, Zenag, Lae, Papua New Guinea.

parties split up not far below the modern mission station at Rulna on 13 June.

The party of sick carriers made slow progress up the Mogilpin River and another of them, lau, died on 18 June. The location of his grave is well remembered locally — it is on the land of the Tipuke tribe — and when visited last September was respectfully bordered with ceremonial cordylines. Stories about the patrol heard among the neighbouring Kawelka tribe by the anthropologist Andrew Strathern mention lau's death, but give him the name Parke, a Melpa man's name meaning *Raggiana* Bird-of-Paradise. At both places it is also the local belief that the dead men were Europeans — they were lowland Papua New Guineans — which indicates something of the strength of the impression that the patrol made on local communities who associated all its members with strange human spirits.

Another interesting aspect of the Lower Jimi is that at least three of the vine bridges crossed by the patrol are maintained in exactly the same locations today. Two of these bridges (across the Lai River) are also found in an area which had no human settlement at the time of the patrol. Each bridge now has a small village on its northern side, newly built by people attracted to the cattle station at Rufi. The third bridge, at Kanti, did have a village by it when seen by the patrol. Today this still exists in the same place, which shows a significant degree of permanence for a society which bases its economy on shifting cultivation. (In contrast, in the densely populated Wahgi Valley a short-fallow agricultural cycle is followed and settlements are nearly all permanent.)

The fact that bridges were continually repaired and that permanent settlement was found nearby in a vast and almost uninhabited area suggests that they lie on historically important trade routes linking the northern coast of Papua New Guinea with the highlands. The ethnographic work of Ian Hughes

suggests that the Yuat, the continuation of the Jimi and Lai rivers, was indeed a trade route for cowrie and greensnail shells, and the very small *Nassa*, or "dogwhelk", shells, all of which were highly valued up in the Wahgi Valley. It may be that in the Lower Jimi the Taylor-Leahy patrol stumbled across the middlemen in this long-distance trading system.

While exploring in this difficult country the Leahys never stopped prospecting for gold. Colours were found in many creeks, but never in sufficient amounts to warrant full-scale exploitation. The Ganz River was visited twice because of its initial promise, but here again the prospectors failed to locate a suitable gold mining area. Fifty years later, with more modern exploration techniques and using helicopters to reach remote creeks, gold in payable quantities may at last have been found in the area. It is ironic that the find was made along the Apin River, a major tributary of the Ganz.

Historians and biographers have already found the Taylor-Leahy patrol a rich and intriguing subject from the point of view of Australia's colonial policies, the development of the highlands and the emergence of Papua New Guinea as a nation. But for us the diaries and photographs have been a useful supplement to our own reconstructions of traditional social and economic life, as otherwise revealed by archaeology and oral history. They have also provided us with a subject of immense human interest — every highlander over the age of sixty, we discovered, had a story to tell about the first white men. The availability of this unique historical background is possible only because of the extraordinary human and scientific approach taken by these Australian explorers. It is an achievement which can only be praised and thankfully acknowledged.

Further reading

Brown, Paula 1972 *The Chimbu*. Cambridge, Mass: Schenkman Publishing Company.

Hughes, Ian 1977 *New Guinea Stone Age Trade*. Canberra: Department of Prehistory, Australian National University.

Simpson, Colin 1954 *Adam in Plumes*. Sydney: Angus & Robertson.

Souter, Gavin 1963 *New Guinea, the Last Unknown*. Sydney: Angus & Robertson.

Strathern, Andrew 1979 *Ongka, A self-account by a New Guinea big-man*. London: Gerald Duckworth.

poster

Eastern Pygmy-Possum

Australian Natural History is proud to announce the inclusion of a free giant colour poster with each magazine. The poster is replacing the "Centrefold", thereby solving the problem of intrusive staples and allowing a much larger format. This edition's poster features two of those particularly cute marsupials, the eastern pygmy-possum, feeding on a nectar-rich bottlebrush. The poster is designed to appeal to all, and to beautifully complement any schoolroom, bedroom or lounge room wall. We hope you enjoy it. Many thanks to Esso Australia Ltd for their generous poster sponsorship.

The eastern pygmy-possum is one of the few marsupials which regularly visits flowers. With its brushed tongue it licks nectar from the flowers of bottlebrush, tea-tree eucalypts, and banksia. Pollen collects all over its fur while feeding but the elaborate grooming activities of the eastern pygmy-possum ensures that most of this protein-rich pollen ends up in its gut. However, some pollen remains on the fur where it may be transferred between blossoms. Such "marsupial pollination" is only a recently exposed phenomenon and there is much to be discovered.

Like many possums (and the bandicoot) the second and third toes of the hindfoot of the eastern pygmy-possum have been fused into one strong organ. This enables the eastern pygmy-possum to have a firm grip on branches while releasing its five-digit forepaws to manoeuvre beetles, moths and their larvae, and soft, small fruits such as those of the coastal beard-heath (*Leucopogon parvifovus*) to its mouth.

During daylight the eastern pygmy-possum is relatively inactive and may be found in abandoned birds' nests, hollows or even underneath the bark of gum trees. In these nests the eastern pygmy-possum is often tightly curled into a small ball of unresponsive fur. In this condition known as torpor, the possum will feel cold to the touch as it has reduced its metabolic processes in order to save energy. In cold, wet conditions the eastern pygmy-possum may remain in this state of dormancy for up to two weeks. However, it is this energy saving torpor which usually causes the eastern pygmy-possum to grow obese in captivity.

At night a spotlight can sometimes illuminate the eastern pygmy-possum hanging with its prehensile (grasping) tail from branches in rain-

forest, sclerophyll and heath communities. However, beware, sometimes these lights tell predators, such as owls, where the evening meal lies!

Tiny, hairless young are born between September and April but are kept in the pouch of the female eastern pygmy-possum until almost fully furred. After a short period in the nest they are able to forage independently at six weeks of age when only about one third of the average adult weight of 24 grams. Although the eastern pygmy-possum has six nipples in the pouch, the average litter size is only four. The female is quite precocious in that only four months after birth she may carry her own young in her pouch. An average female may have between two and three litters per year. In the wild the eastern pygmy-possum lives for at least two years and in captivity one individual lived for eight years.

Although the eastern pygmy-possum is widespread over southeastern Australia it is believed to be an uncommon animal as it is rarely observed or trapped in wildlife surveys. However, a population of the eastern pygmy-possum in a coast banksia (*Banksia integrifolia*) woodland at Wilsons Promontory National Park, Victoria, was estimated to have 21 individuals per hectare which is relatively abundant for small mammals in Australian ecosystems. The reliance of the eastern pygmy-possum on *Banksia* trees for food and shelter possibly enables it to survive better than most small mammals in heathland communities with a disturbed understorey. However, like much of our native wildlife, the greatest threat to survival of the eastern pygmy-possum is likely to be predation by the feral cat.

Vivienne Turner,
Botany Department,
Australian National University.

FORUM

Dr Bob Brown: Daintree Rainforest

Tasmanian politician and nationally respected conservationist Dr Bob Brown talks to ANH's Rob Thorman about the struggle to save the rainforest at Daintree, north Queensland.

What are the similarities between the Franklin and Daintree issues?

Both these regions have world heritage value. That is, their natural, scenic and wilderness significance is beyond that of parochial, state or even national value. They are of world significance. The Daintree area is smaller than that of the Franklin, but it has a greater concentration and variety of plant and animal life. It is the first wilderness you will come to if you leave Melbourne and head up the eastern seaboard. After two centuries of European settlement in Australia there is no wilderness left on the eastern seaboard south of Daintree. The significance beyond that lies in the primitive plant life and the fact that the area is different to the rainforest further south; it has close links with rainforest elsewhere in the equatorial regions of the planet.

How do they compare with regards to State and Federal relationships?

It is similar to the Franklin in that we have a State Government pouring money into the destruction of a nationally significant part of the environment. A part of our natural heritage is being destroyed for short term gain. The difference is that with the Franklin we had a Labour Government move to save that region, as a result of election promises. They moved swiftly to do that, and were treading on somewhat unknown territory, which proved to be firm ground when the High Court on July 1, 1983, ruled in favour of the Commonwealth stopping the dam proceeding. The difference between the two is the sense of urgency with which the present Commonwealth Government sees it. The Franklin issue was seen as important to the Federal Labor party as an electoral plus in the run up to the last election. However, the present Minister Mr. Cohen, appears not to want to involve the Common-

wealth in another confrontation with a State Government, which could lead to High Court action in the run up to a Federal election.

Where does a Federal Government stand legally, when an area of world significance is not actually listed on the world heritage?

That makes no difference, the legalities of it follow the politics. It is a political decision whether the Commonwealth will nominate the Daintree as World Heritage. The spirit of the World Heritage Treaty Convention is quite clear. Australia is under an obligation to discover and nominate the natural areas within its borders that are of world significance. We know that the Daintree is there and that it is of world significance, so it is simply breaking the spirit of the World Heritage Convention for us not to have nominated it. On the day the Federal Government nominates the region, it becomes obliged to save it. That obligation doesn't wait until the nomination has

"We're in the middle of a fight to preserve for all time the maximum possible area of what is left of our natural heritage"

been accepted by the World Heritage Committee. The Federal Government could have stopped the bulldozers had the minister been motivated to nominate it.

Isn't there a danger of the conservation movement using the World Heritage listing as a weapon to conserve areas, when they may not be of that standing?

That possibility could exist, but the Federal Government has extremely good advice; they have a Natural Heritage Commission; The Department of Home Affairs and Environment is there specifically to deal

with this sort of matter. They have access to the top scientific and wilderness advice in the nation. So there's no danger that the minister is going to frivolously nominate any area. The real danger is that the minister of the day, whatever the colour of government, will refrain from nominating a significant area because there is a political penalty involved. So Australia's heritage can come to grief due to lack of political will to save it. That was the direction the Franklin River was heading towards under the Fraser Government, and I'm afraid that's the direction we're heading with the coastal part of the Daintree wilderness under the Hawke Government. The loss of Lake Pedder and the win of the Franklin River have raised Australia's awareness of how little wilderness is left and how valuable it is. The politicians are being led by public opinion, rather than leading public opinion on this issue. We are certainly a long way short of the American situation where all the great National Parks are under federal jurisdiction and are protected from the short-term exploitative interests in the U.S.A. We need to move very rapidly in Australia towards having a truly National Park set-up which protects our national wild areas. The pressure for exploitation of these areas, and they're very small, I'd say less than 5% of our surface area, is going to be intense in the next couple of decades, and of course once they're lost they're lost forever. So we're now in the middle of a fight to preserve for all time the maximum possible area of what is left of our natural heritage, so that future generations will be able to see at least pockets of this country as they were when the first Europeans arrived in 1788.

Have we got an organisation like that, is Australian National Parks and Wildlife geared to take on that role, or should a new body be set up?

Australian National Parks and Wildlife and the Australian Heritage Commission certainly are, it simply requires the proper funding and staffing of these organisations. There



is the difficulty in the Australian constitutional set-up which requires a great deal of goodwill and negotiation between federal and state governments. But what it really requires is an accepted jurisdiction over our special national parks and wilderness areas by the Federal Government. This is new to Canberra and to the state governments and it's still a testing time. The current minister doesn't show a strong advocacy for federal protection, he's more concerned with the short term political fall-out.

The Daintree issue developed into a confrontation between conservationists and the Queensland Government. Although it's successful in focusing the public's attention on this particular issue, isn't it damaging to be on such bad terms with the government? Surely there's a risk of losing ground on broader conservation issues.

Maybe. There certainly needs to be a great deal of political maturity involved in any blockade action, and that hasn't always been so. For instance, there's no doubt that the chance of saving the Errinundra Plateau in Victoria was greatly diminished if not lost because of pre-eminent blockade, which was not wanted by the local people or the conservation movement in Victoria. There's a danger of that occur-

ring in other places. The blockades are successful in increasing news attention but they're not successful unless they come in the wake of a campaign. This involves lots of work to tell the Australian public what is threatening by any particular development; and to enlighten the politicians involved. A blockade itself will not stop the bulldozers because they will ultimately have mechanical might and the law of the State Government to ensure that they proceed. They are simply a final appeal to the people of the country to save the region through pressure on the politicians. They won't talk unless a lot of campaigning work is done.

As far as Queensland politics is concerned, would there be any reason for Bjelke-Petersen not to push for the road through?

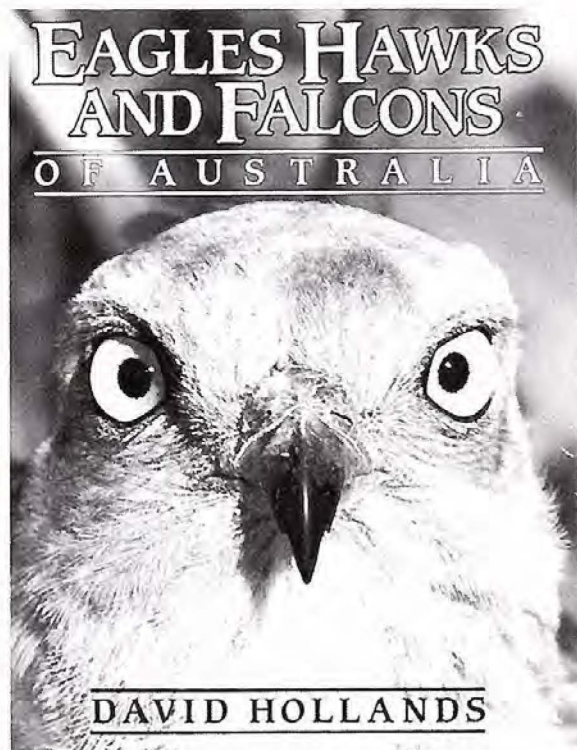
I don't think he gives two hoots about the road, he has said the road will go ahead as sure as the sun comes up in the morning. I think he's much keener to be seen to flex his political strength in Queensland than his concern about Daintree. He was most audacious about the Daintree when announcing the National Park there in 1980 at the World Wilderness Conference in Cairns, but he clearly doesn't understand the value of wilderness. A wilderness is a truly wild area free of the invasion of modern machinery, roads and development. Despite the Premier's comments that the area is a museum of plant and animal species in what is one of the few remaining examples of undisturbed coastal rainforests in the world, it's the first museum in Australia that has had the recognition of a Premier in one year and 3 years later had the Premier funding bulldozers to drive through the middle of it. One can't help but suspect that there are real estate and other reasons which haven't come to the fore, for pushing the road through that coastal wilderness. Neither the Premier nor any of his ministers have given a valid reason that would stand up in an open forum for putting the road through. The Queensland Minister for the Environment has said that it is to prevent drug running and movement of illegal immigrants. If one were sin-

cere in that, you don't build a road and facilitate the traffic that you want to block. One of the great troubles with the destruction of Australia's natural heritage is that the people most involved haven't been in there on its own terms to experience it. They may have been over it in a helicopter, but as far as putting a pack on their back or landing on one of the beaches, and spending time in the quietness that the wilderness must be enjoyed in, this hasn't happened. I suspect they don't understand the special refreshment and inspiration to the human spirit that comes through that experience and unfortunately can't make an enlightened decision.

What's public opinion on this issue amongst the local communities?

It's split. The feeling of the clear majority of the small settlement at Cape Tribulation is against the road. At the northern end at Bloomfield, there's division. Some of the folk who live there, old timers, felt so strongly about the issue that they were in the forefront of the blockade last year, and were shaken around by bulldozer blades. They showed tremendous strength, but there was no media there to cover it. Further south in Mossman and probably Port Douglas, it is fair to say that the majority of people there are in favour of the road. They've been sold on the idea that it's development although there's been no other solid argument put forward. Further south again in the major local city of Cairns, which has an international airport and will in the future attract increasing numbers of wilderness-oriented tourists, particularly from the U.S.A.

THOMAS NELSON AUSTRALIA
*announces the publication of a magnificent new
bird book by field ornithologist David Hollands*



EAGLES HAWKS AND FALCONS is the culmination of twelve years of field work, two Land-Rovers, hundreds of thousands of kilometres of bush roads, nine cameras and countless rolls of film.

David Hollands has achieved his goal of finding, studying and photographing all 24 diurnal birds of prey in Australia. Each of the sections captures the spirit of the bird as well as presenting the ornithological facts.

The comprehensive Field Guide incorporates many new and previously unpublished observations. Inspired by world-famous bird photographer, Eric Hosking, David's field trips took him to remote locations where his photographs capture each bird in a dramatic and original format, both at the nest and in flight.

With a foreword by Graham Pizzey, **EAGLES HAWKS AND FALCONS** is essential reading for every raptor enthusiast, as well as for the field ornithologist.

THE AUTHOR

David Hollands is a busy country doctor living in Orbost, Victoria. All his spare time is spent travelling the back roads of Australia searching for birds of prey. He is a well-respected authority on the subject and his photographs are breathtakingly evocative of each of the species he studies.

EXTENT 212 pp
150 full colour plates

PRICE \$49.95

ISBN 0 17 06411 5

A limited number of signed copies of
EAGLES HAWKS AND FALCONS OF AUSTRALIA
by David Hollands
are now available from:

Andrew Isles
Natural History Books



We specialise in Natural History books and have an extensive range of new, secondhand and antiquarian titles in stock.

Write now if you wish to be put on our mailing list.

Catalogues currently available are:

List No. 7 — 1,000 new Natural History titles.

Catalogue Number Two — 400 secondhand and antiquarian ornithological titles.

Catalogue Number Three — Reptiles, Amphibians and Fishes, will be available later this year.

We mail books anywhere.

147 Greville Street,
Prahran,
Victoria 3181
Australia.

Phone: (03) 51 5750
(03) 529 6850

Baby Dolphin Weaned by Humans

WORLD FIRST FOR COFFS HARBOUR

A baby dolphin named Buttons has won the affection of the Coffs Harbour Pet Porpoise Pool and attracted world-wide interest from the scientific community.

Buttons is a remarkable first for the oceanarium at Coffs Harbour; it's the first time that a baby dolphin has been rescued from the wild and reared on a substitute for mother dolphin milk. When Phillip Ducat and his girlfriend Lee Ann went for an early morning swim on the 12th February this year, they had no idea of the part they were about to play in the event. They noticed a disturbance in the water near the entrance to Hat Head Creek and investigated in a canoe. A baby dolphin was swimming and repeatedly diving about a dead adult lying on the bottom in about a metre of water.

Phillip and Lee Ann rang the oceanarium and the manager Hec Goodall and two local high school boys began the 95 kilometre drive to Hat Head. They were equipped with necessary medication and appropriate transportation equipment. Phillip meanwhile had rounded up some local assistance from a few surfers and was attempting to apprehend the slippery little dolphin in the shallow but wide tidal creek. A mullet net loaned by fisherman Vince Jordon aided the procedure and the dolphin was eventually cornered against a sandbar. The baby dolphin was supported on a rubber mattress in the back of the oceanarium utility and covered with a tarpaulin for the trip back to Coffs Harbour. It is necessary that the dolphin's skin remains constantly wet to avoid the stress of the journey and the drying effects of the wind when transporting them out of their environment and to support their body weight which is normally cushioned by the water.

A veterinary autopsy examination of the adult female bottle nose dolphin, *Tursiops truncatus*, later disclosed she had choked on an eel which was doubled over and lodged in her oesophagus with the tail section at her larynx. A small mullet and the metre long eel was all she had eaten for at least three days, possibly longer, as the body was in a generally poor condition.

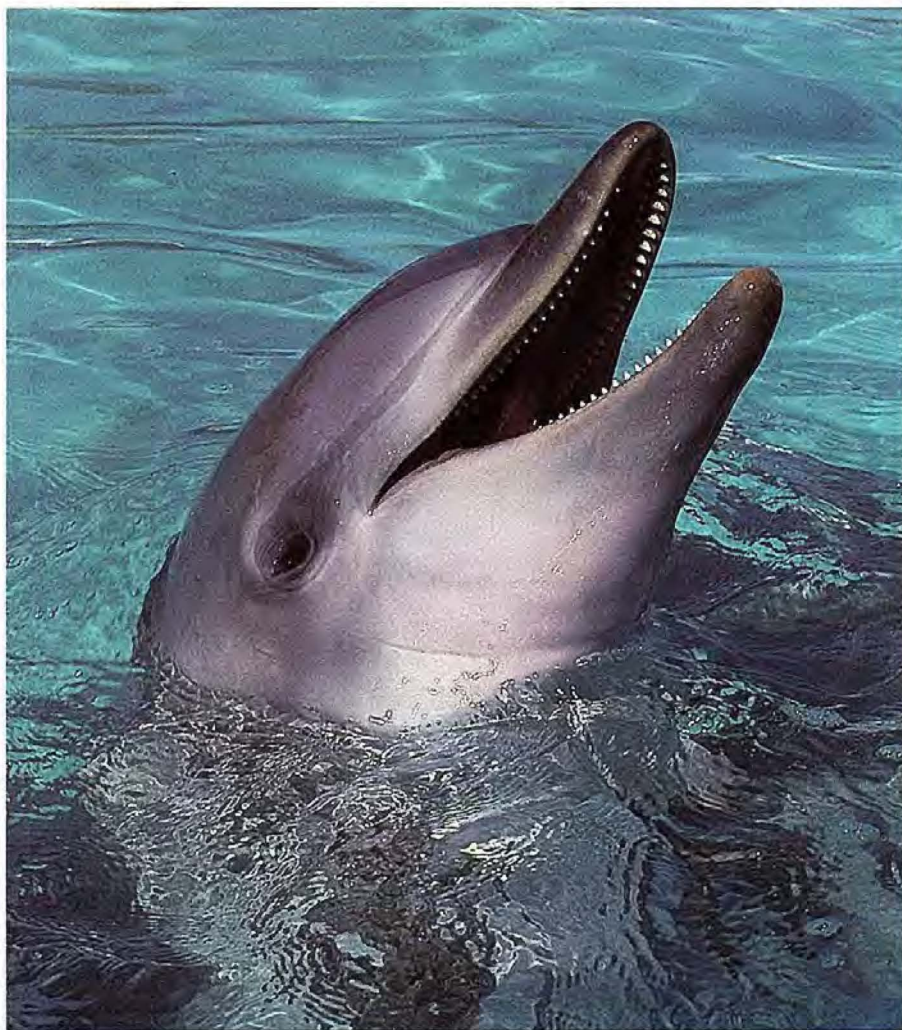
The baby dolphin was obviously hungry but the oceanarium crew had grave reservations about

rearing an unweaned baby dolphin — it had never been done before. The calf was put into a separate pool and a specially prepared formulae was mixed. It consisted of a newly developed high calorie formula recently developed for chronically-ill patients and premature babies, by the pharmaceutical company Mead Johnson. The Isocal HCN, as it is called, was mixed with liquefied fish and placed in a bottle fitted with a calf feeding teat. Previous efforts to hand-rear an orphaned dolphin had failed due to the difficulty in finding a substitute for the extremely rich dolphin mother's milk and in persuading the baby dolphin to suckle. The dolphin calf has a ribbon-like tongue with a feather shaped tip, which it rolls tube-like about one of its mothers' teats, nudging the mother which squirts milk down the baby's throat.

The baby normally feeds for only a few seconds at a time, then returns to the surface to breathe. The nursing period for baby dolphins sometimes last for two years, however, the average is about 18 months.

Previous rescue attempts of dolphin calves has involved considerable handling and force feeding. Vicki and Greg Pickering tried a different tactic. Vicki squirted the substitute milk into its mouth. Eventually the baby dolphin got the taste of the milk and began sucking greedily on the bottle teat. When the baby dolphin began sucking on Vicki's finger between bottle fills, she began substituting small fish for the finger and after a few weeks the baby was swallowing over a kilogram of fish a day.

Every two hours the oceanarium crew donned wetsuits and held the dolphin calf for feeding sessions,





day and night. After a fortnight the number of bottle feeding efforts were reduced by utilising a large syringe and injecting quantities of the feeding solution into the dolphin.

During the next six weeks of intensive care the baby was housed in a separate section of the porpoise pool where she communicated with the resident dolphin family through the divisional mesh with a serenade of clicks, squeaks and whistles. When she was strong enough she was released into the same pool as the three other dolphins, and quickly responded to human affection.

The Pet Porpoise Pool oceanarium enjoys co-operative association with the National Parks and Wildlife Service which remain responsible for marine mammals in New South Wales. They and the oceanarium crew will decide the best course for Button's future. She may be returned to the sea at the end of her infancy or may remain in the Pet Porpoise Pool. Attempts at securing stranded and injured marine mammals is no unusual event at the Pet Porpoise Pool. Sadly some animals are too weak or ill to survive, but a number of fat contented seals residing at Coffs Harbour testify to successful results.

Not all attempts are successful. In January a diseased pygmy killer whale *Feresa attenuata*, stranded near Minnewater, north of Coffs Harbour, was rescued and transported to the oceanarium. The rescue effort included members of the Grafton National Parks and Wildlife Service and members of the Australian Museum, but despite a four day battle, they were unsuccessful in saving the whale.

Buttons obviously relishes oceanaria life, lapping up all the attention lavished on her. She frolics about in the pool attempting to copy the other dolphins in their daily sea circus routine. The recovery of a five month old dolphin has taught us how to rear a young dolphin and given her a chance to reach maturity.

*By Hec Goodall,
Manager, Coffs Harbour
Pet Porpoise Pool.*

Photos by Howard Hughes

Frank Hurley in Papua

Photographs of the 1920-1923 Expeditions



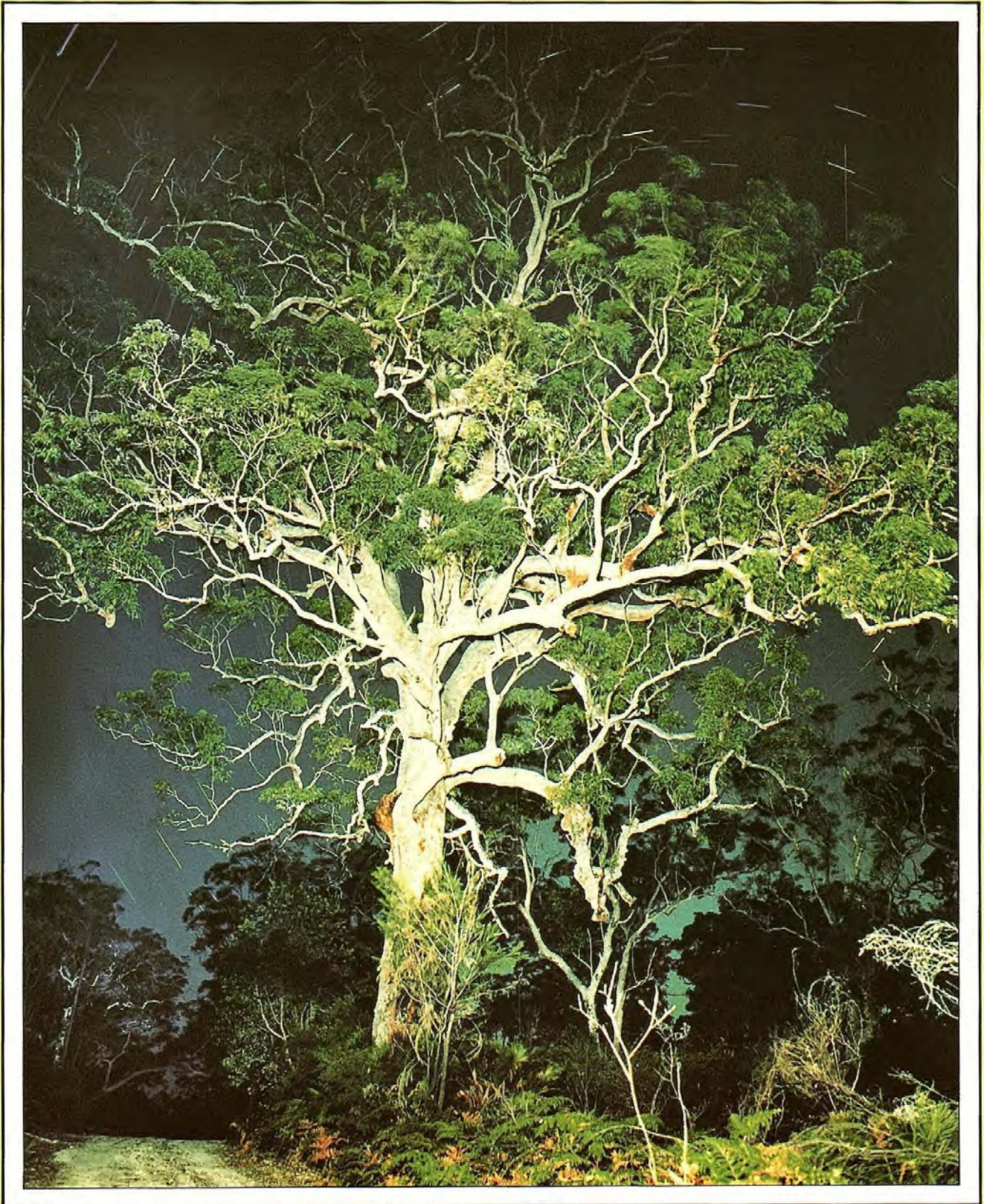
Jim Specht and John Fields

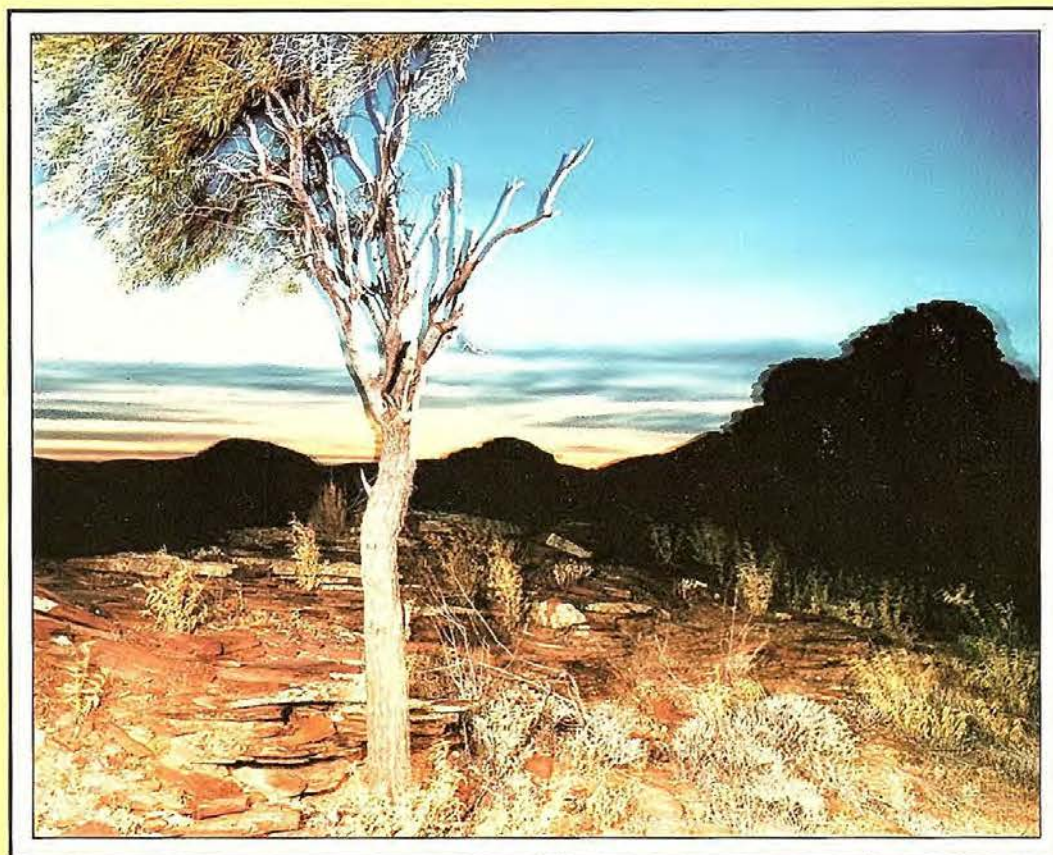
Frank Hurley's photographs of Papua have been selected for their historic significance and reproduced in fine detail as a celebration of the work of this acclaimed early Australian photographer.

Published by Robert Brown and Associates
P.O. Box 29 Bathurst, N.S.W. 2795

This quality book is available from
The Australian Museum Shop
6-8 College Street, Sydney. Ph: (02) 339 8111
OPEN Sunday and Monday: Noon to 4.30 pm
Tuesday to Saturday: 10 am to 4.30 pm

photoart





"... the landscape is basically so ancient and so worn away by time, and the elements that we see are only an indication of what once was ... through the flash and the long exposures I think I was able to bring out some of that power and that feeling."



Ed Douglas is an expatriate American born in 1943 who has been living and working in Australia since the mid 1970s. He is currently head lecturer at the Photography Department of the South Australian School of Arts, a position he has held since 1977. He has been widely exhibited in one person and group exhibitions in Australia, America, Europe and Britain, and is represented in the collections of the Australian National Gallery, the Bibliotheque Nationale, Paris, George Eastman House, New York and the San Francisco Museum of Art.

Since moving to Australia, much of Douglas' work has been concerned with the landscape. The work reproduced here has been selected from a much larger series titled *This Land of Time*. Douglas' landscape photographs are metaphorical; they imbue the landscape with a power and energy, not unlike the Aborigine's concept of the Dreamtime.

Artists in Australia have been attracted to the landscape for many reasons. Its use as subject matter in all areas of art has generated a great diversity which pays homage to a remarkable and unique landscape, and has caused as much heartache as it has joy for the people who dwell in it and the artists who attempt to depict its nature. This same diversity continues today in contemporary photographic practise. Photographers tend to exploit not only the diversity of form but also the ability of the camera to transform what is "out there" into complex personal interpretations.

In this and future issues of *Australian Natural History*, we will be presenting portfolios by Australian photographers whose work deals essentially with the landscape. These selections are made in co-operation with the Australian Centre for Photography, an organisation that exhibits and promotes Australian photography and holds large selections of original

work by photographic artists for sale in its printroom. This new feature in *ANH* will illustrate, through photography, the many interpretive skills that enable photographers to produce highly personalised documents and accounts of their experience in the Australian landscape.

Today there is very little of the "Romantic Vision" that permeated treatment of the landscape at the turn of the century and before. The "Droughts and Flooding Rains" that have caused Australians to both fear and respect their landscape, have resulted in a different kind of approach. Contemporary landscape interpretations deal more with these harsh realities, with land abuse and exploitation. Today's Australian photographers show a genuine concern for the heritage of our earth.

Future portfolios will illustrate a great variety in style and use of the medium of photography; from that which celebrates the unique beauty of the landscape through a more traditional or pure approach, to work which explores the natural world via abstraction or by using forms, structures and landmarks in generating more experimental compositions through techniques such as montage, superimposition, sequencing and serial work, and as Ed Douglas' work shows: using flash to isolate and give emphasis to chosen forms.

All photographs by Ed Douglas from his series *This Land of Time* 1981 (Type C, Colour Photograph).



QUOLLS



Quolls have been the subject of considerable recent research in Australia. Dr Janet Godsell reports on the eastern quoll, while Jenny Arnold and Karen Maisey talk about western quolls, being studied in the forests of the south west. Ian Mansergh reports on the tiger quoll from the south east and Tasmania, while Robert Begg studied quolls from northern Australia, whilst he was officer in charge of wildlife research with the Conservation Commission of the Northern Territory.

Drawing by Peter Schouten of the tiger quoll.

For bush walkers and campers in Tasmania, one of the most delightful sights at night is to see an inquisitive eastern quoll approach the camp, and, raising onto its hind legs in a characteristic investigatory pose, sniff the air. A lithe and attractive animal with its many spots, large ears and tail that flounces as it runs, this marsupial predator is almost completely nocturnal. However, due to its greatly reduced range since the early 1900's, the ecology of this species has been largely neglected.

Previously, the common name of the quoll, as for other species in the genus *Dasyurus* was "native cat". Not only was this name inappropriate in describing the features of these animals, but it could also be confused with the "feral cat", an introduced placental carnivore which has had a deleterious effect on many native Australian mammals and birds. The aboriginal word "quoll" is now the accepted common name for members of this genus.

Unlike its larger relative, the dark brown tiger quoll *Dasyurus maculatus* which has spots on its back and tail, the eastern quoll *Dasyurus viverrinus* has two colour phases, fawn and black, and has spots only on its back. Although both colour phases can occur in the same litter, fawn coloured individuals are the most common, and some populations have no black individuals.

EASTERN QUOLLS

Eastern quolls once occurred in dry sclerophyll forest throughout eastern Australia from northern New South Wales to South Australia and Tasmania. Present evidence suggests that they have disappeared from most of their previous range on the mainland. In South Australia, the species became extinct around 1900. The last quoll collected in New South Wales came from a Sydney suburb in 1963, and the last authenticated record of quolls in Victoria was in 1958. Reasons for the decline of this species are unknown though it has been suggested that a disease swept through the large dasyurids around the turn of the century. The effect of foxes, feral cats and land clearance have, no doubt, contributed to the severe reduction in its range. Sightings of eastern quoll in Victoria as recently as 1979 provides optimism that populations still exist on the mainland of Australia. In contrast, the eastern quoll still occurs in large numbers in Tasmania in habitats of mixed dry sclerophyll forest and pasture.

During the time when the female rears her young outside the pouch (August-November) she occupies only one den. At other times of the year, both females and males occupy many dens, often using the same den for relatively few consecutive days and sometimes travelling up to one kilometre between dens. Dens may occur in rock piles or in crevices between boulders, in logs or piles of logs or brush, in haystacks or under buildings. The preferred type of den for quolls in southern Tasmania are burrows which they construct themselves. Burrows vary considerably in complexity from simple ones with only one entrance, one tunnel and one hollowed out sleeping area to those with many entrances, interconnecting tunnels and several sleeping areas, some of which may be lined with grass. As only females (in captivity) collect grass for their den boxes while making nests for their young, it is presumed that the dens in the wild containing grass nests, are those which are used by breeding females. Some dens also contain a latrine which is probably used by young before they are old enough to venture outside.

In habitats of pasture and eucalypt forest in southern Tasmania, burrows occur almost exclusively within the forests. Large numbers of dens within forests are situated beneath blackberry bushes. Apart from females rearing young, quolls seldom monopolize a den. Most dens are used by at least two individuals, though not on the same day, and some are occupied by up to a dozen animals. Although the factors influencing the popularity of dens are not known, dens situated near tracks or adjacent to pasture are used by more individuals than dens elsewhere in the forest. Occasionally adult females, or males and females cohabit dens on the same day. Although den sharing partners may be related to each other, unrelated quolls also cohabit dens. This suggests that there are several factors which influence communal den use. As the same individuals do not consistently share dens, eastern quolls do not appear to form socially cohesive associations, at least while denning.

The home range of quolls, as determined from radio-telemetry (groups of animals were tracked for three weeks to three months) is about 45 hectares for males and 35 hectares for females. The larger size of the male home range is typical of many mammalian carnivores in



Eastern quoll, *Dasyurus viverrinus* in characteristic pose.
Photo: J. Godsell

which the male is larger in size than the female, and reflects the greater energetic requirements of an animal with a larger body weight. Quolls move as solitary hunters throughout their home range despite a large amount of overlap between the home ranges of resident adults, both between and within the sexes. As no part of the home range is used exclusively either by an individual or a group of individuals, eastern quolls are therefore not territorial.

NORTHERN QUOLLS

Northern quolls show little aversion to, and in fact often seem to thrive around, human habitation. They are common in mining camps, cattle stations, and outback hotels, and have been recorded from wrecked ships on seashores. One early naturalist, Fleay, wrote of two from Northern Queensland that regularly entered one person's home at night and lapped water from a medicine glass beside his bed. The northern quoll is the smallest member of the genus *Dasyurus*. The name *Dasyurus* actually means "hairy tail". The northern quoll may use the tail for balance while running, leaping or climbing, holding it well up over its back, but it is not prehensile like that of the common ringtail possum *Pseudocheirus peregrinus*.



Northern quoll in its rocky habitat of the Top End.
Photo: Ian Morris

Unlike the eastern quoll, the northern species has a well-developed big-toe or hallux. The specific name *hallucatus*, in fact, comes from the Latin for "with notable big-toe". The hallux has no claw, and the undersurface of the toes and feet are covered with fleshy pads which are crossed by numerous transverse grooves, giving a striated "tread-like" pat. The striated foot-pads are clearly of importance on the smooth rocky surfaces over which they run, conditions not usually encountered by their southern relatives who live in more heavily forested areas.

The presence of a hallux and long-clawed toes helps the northern quoll to climb trees. This ability was attested by early hunters in Queensland, who talked of mistakenly shooting quolls out of trees while looking for possums. They may also utilise hollows in trees as refuges, particularly in country where rocky crevices and caves are not so common. Semon, an early naturalist travelling in the Burnett River area of north Queensland, reported finding northern quolls in fallen trees that he split open to look for bandicoots that his dogs chased in.

It was the moult phase that the famous collector Dahl was looking for in Arnhem Land, N.T., in the mistaken belief that they might be a species of numbat *Myrmecobius*. He formed this impression from the local Aboriginal people's description of a "jirian", their local name for the northern quoll. Dahl's disappointment at discovering the true identity of the species was tempered by his collection of the first specimen of the

rock ringtail possum *Pseudocheirus dahli*, while chasing the elusive jirian.

Like all dasyurids, northern quolls have a primitive dentition, which provides for their catholic carnivorous/insectivorous diet. They have forty-two sharp teeth, with small incisors, large canines, and molars with three sharp cusps, and an aggressive nature that enables them to tackle any animals of their own size or smaller. Early naturalists make frequent reference to the northern quoll's "pugnacious disposition", and in one story to illustrate this, Fleay, in describing the transport of one specimen, relates how it lacerated the hands of two helpers before take-off, seized a bus-driver's fingers through the mesh of its cage, and bit a bulldog through the lip at it inspected the quoll's cage at a transit stop.

Semon described them as "small but bloodthirsty animals which way-lay mammals and birds and do not despise insects". They have also been reported as eating geckoes, fish, nesting birds and common ringtail possums, and also partake of fruits including wild figs.

Fortunately, unlike their southern relatives, there appears to have been little decline in the distribution and abundance of northern quolls. Limited settlement and limited agricultural development over most of the species' range accounts for their relative abundance with little competition from feral cats.

Northern quolls could also be placed under some stress by the increased frequency of fires in northern Australia since the coming of

man. This includes fires lit by Aborigines for hunting, clearing, or a wealth of traditional reasons, and those lit by European man for the ubiquitous "burning off". This fuel-reduction burning is usually done in the early dry season, a period when northern quolls are most active in response to their breeding season. In one control-burn study conducted by the author, there was little immediate mortality of northern quolls, but breeding was delayed somewhat and the average number of pouch young per female was less than under normal circumstances. Different fire regimes can also cause significant long-term changes to the vegetation and so affect an area's suitability as animal habitat. There is some local risk to northern quolls where poison baits are used in dingo control programmes.

The ever-increasing spread of the cane toad *Bufo marinus*, introduced from Hawaii to control insect pests of sugar-cane, may result in the local extinction of some northern quolls. Cane toads have large poison glands on their shoulders that are toxic to many predators. They have been observed to cause the death of a western quoll within thirty minutes of its mouthing the toad. There is no reason to believe that other individuals of *Dasyurus* spp. would be any less vulnerable. It is worth noting that the only recent reports of the common occurrence of tiger quolls coming to the attention of the Queensland Museum are from areas where cane toads are not known to occur. Yet, the northern quoll is still the most secure species of the genus *Dasyurus*, and it is to be hoped that this security continues.

WESTERN QUOLLS

The western quoll is now being studied in the wild in the jarrah forest near Manjimup as part of a broader investigation being carried out by the Forests Department of Western Australia into the effects of fire on the forest ecosystem. Radio tracking and trapping are used to gain information about its activity and behaviour.

At Manjimup, a female western quoll was captured in an area of jarrah forest which had been burnt by a wildfire nine months previously. She was fitted with a collar bearing a radio transmitter and released. It was thus possible to track her on foot at night. She made two circuits of the area each night, the first and generally the longest beginning about 6 pm. She moved briskly at a fast walking pace, stopping from time to time for periods of five to twenty minutes. Often during these stops the radio signal suddenly became loud suggesting that the animal had climbed a tree. Certainly, several have been observed up trees. While it was being tracked, the animal seldom ventured into the unburnt forest, even though the food available in the burnt area seemed

limited. Birds were the most numerous animals and trapping indicated that housemice were present. She spent most time in the valley where a stream was flowing at the time and frogs were abundant. There were also a large number of caterpillars about and caterpillar skins were recovered from three scats or dung collected during the tracking programme. Other components of these scats were beetle remains, grass seeds vegetative material, and house-mouse hair. Scats collected from other locations in the forest most commonly contained vegetation and insect remains. Kangaroo and quenda hair were recovered from two scats. From these observations, it would appear that the western quoll is an omnivore feeding on small mammals, insects, vegetation and carrion.

The Manjimup quoll used two borrows while she was being radio-tracked. She rested one metre inside the entrance of one borrow located at the base of a marri tree. The other appeared to be an old rabbit warren. The teats of this animal (captured in September) were extended, suggesting she may have had young in the burrow. We have a

suggestive tie-up with observations from the captive colony here. The birth dates of all litters born in captivity fell between late May and late June. Furthermore, a number of females were trapped with young litters in their pouches during late autumn and early winter so that the animals probably have a rather restricted breeding season. Animals born in early June would have left the pouch in September but would probably still be suckling if they had the opportunity.

The development of the coat is one obvious indicator of developmental progress. Others include the development of eyes and ears, the eruption of the teeth, the development of muscular co-ordination and the development of the ability to regulate body temperature. By the time the animals were 15 weeks old, as well as having thick coats, they were well co-ordinated and had a fine array of incisors and molariform teeth.

An aspect of development investigated in the captive colony was temperature regulation. One could speculate that pouch life for young quolls would be very different from that of kangaroo and wallaby

The western quoll *Dasyurus geoffroi* in the forest habitat of the south west.

Photo: A. G. Wells



joey. Unlike the capacious kangaroo pouch, the quoll's pouch, with its opening facing towards the ground, would seem to offer a less stable and secure environment for the litter. A dramatic change in the animal's ability to control their body temperature takes place between 12 and 14 weeks of age. By that time when the coat was well developed and presumably provides good insulation, they were able to maintain their body temperature at 15-16 degrees above air temperature for at least an hour.

If the western quoll appears in its breeding pattern to be adapted to the climate of the south west of Western Australia, some aspects of its physiology seem to fit it for life in a more arid and variable environment. Only in extreme low and high temperatures does it 'work' to protect the stability of its internal environment, either by shivering violently in the cold or by panting vigorously and salivating in the heat. It seems to us that such a strategy would enable the animal to economise on both its energy needs and its water requirements.

At dusk the quoll's explosive calls could be heard each evening as they chased each other up the walls and around the rafters of their cages. This active play is no doubt an important part of the development of a predator, dependent upon precise co-ordination if it is to capture live prey.

Because of the major range restrictions suffered by the species Michael Archer regards it to be endangered along with other dasyurid species such as the numbat, the red-tailed phascogale and the dibbler which are now similarly restricted to the south-west of Western Australia. The importance of its forests and woodlands as refuges is being recognised. We have a large responsibility to see that these important ecosystems remain healthy and viable.

TIGER QUOLLS

The tiger quoll, *Dasyurus maculatus*, is the largest of the quoll species, indeed it is the largest marsupial carnivore that survives on the mainland of Australia. The tiger quoll was seen by Captain Phillip in 1788 and was the first quoll to be described. However, in spite of this early record many aspects of the ecology of the species remain ill-defined or unknown. The species is rarely recorded over most of its mainland range which is in the forests along the eastern coast of Australia from



Tiger quolls mating — the male grips the female's body with his forepaws and the back of her neck with his teeth. Photo: D. Whitford, NPIAW

northern Queensland to south-western Victoria, but is more common in Tasmania. Spots on the tail are characteristic of the tiger quoll as the spots on other quoll species are restricted to the body. Another feature is the first toe of the hindfoot (or hallux) which is present on the tiger quoll but absent on the eastern quoll *Dasyurus viverrinus*. The species has had many common names throughout the various regions within its range, spotted martin, tiger cat, spotted-tail dasyure, spotted tailed native cat all refer to this species but tiger cat is probably the name most commonly used.

The tiger quoll is dependent on the forest and inhabits a variety of types from rainforest, tall open-forest, denser woodlands and coastal forests. In these environments the trees are tall to medium in height and within these habitats the species nests and seeks refuge in tree hollows, hollow logs, caves and rock crevices. Because the species has maintained the hallux and its pads are ridged it is a very capable climber. It is predominantly nocturnal with secretive habits.

SCENT MARKING AND COURTSHIP BEHAVIOUR

The scent marking behaviour has been observed only during the breeding season in captive quolls. Females rub their faces and bodies, particularly their cloacas over tufts of grass, against other objects and sometimes against other males and females. At this time females spend an increased amount of time grooming their faces, pouches and cloacas. Scent marking behaviour is important in advertising that the female is in breeding condition.

Courtship observed in captivity usually consists of the male following or chasing the female and sniffing her cloaca. Females are frequently aggressive towards the males which pursue them, particularly if they

have already mated, and hiss loudly while resisting the male's attempts to mount. A persistent male eventually succeeds and while mounting, grips the body of the female with his forepaws and the back of her neck with his teeth. Females which have not previously mated become quite during mating and assume a posture similar to that of many placental carnivores, in which the shoulders are lowered, the rump is raised and the tail is turned to one side. Mating may last for several hours. Males may drag the female by the neck from one site to another during the long act of mating. This behaviour is probably responsible for the bite wounds found on the necks of females during the breeding season.

When the male fertilizes the female, as many as 30 young may be conceived. The production of many ova (super-ovulation) has been found to occur in dasyurids such as the Tasmanian devil, tiger quoll and the eastern quoll. This apparently wasteful mechanism may serve an important function for a seasonal breeder, breeding only once a year. Another possible safeguard against reproductive failure during the short annual breeding season is that eastern quoll females are polyoestrous. This means that a female which fails to mate, or prematurely loses her pouch young after her first oestrus, will enter a second oestrus approximately 35 days later.

In the northern quoll, females have no true pouch but at the start of the breeding season the "pouch area" on the female's abdomen does undergo a series of changes. The rudimentary pouch offers very poor protection to the young, compared with the pouches of other marsupials. Up to one third of the young may be lost before their pouch development is completed. Those remaining leave the mother's "pouch" in August or September

when they are six to eight weeks old. The young then remain in the nest for a further two to three months. This means that during the breeding season one resident male probably mates with a number of females, and possibly defends them from transient males.

Until eight weeks of age, the eastern quoll are carried in and completely enveloped by the pouch. At 13 weeks the quolls exhibit defensive behaviour towards intruders. This involves an open-mouth gape, hissing and while leaning back on its haunches, lifting one front paw. Play behaviour also develops once the eyes open. Early forms of play involve mouth-to-mouth grappling and biting the head, limbs and tails of other young and the mother. By sixteen weeks of age juveniles venture from the den and spend considerable amounts of time in play-fights, wrestling and chases.

In the tiger quoll the social play of the young is well developed by fourteen weeks and similar to kittens, they stalk, chase, play in the sun and at this stage the mother aggressively defends her young. For many years the paternal behaviour remained unknown but it was thought that the male may have taken no interest in his young. This apparently is not so as "fathers" have been observed to groom their mates and bring food to the nest.

The limitation of the breeding season to a short period in late autumn to early winter seems to fit the western quoll to the climatic conditions in which it now lives — that is with a reliable winter rainfall and a moderate temperature range. The young embark upon their free time at a time when temperatures are mild and when food and water are likely to be abun-

dant. By carrying their pouch young during the winter, the females do not have to deal with the added stress of water shortages and high temperatures during lactation. In contrast, marsupials adapted to life in deserts, where rainfall is low and unpredictable, tend to breed when suitable conditions present themselves, rather than according to the strict march of the seasons. It would be interesting to know whether the western quoll living in the inland was flexible in its time of breeding.

FEEDING AND DIET

The eastern quoll is a generalized predator feeding mostly on insects and other invertebrates, small mammals, birds and bird eggs, reptiles and amphibians, and fruit. It is an opportunistic feeder and the frequency of items in its diet reflect those food types which are seasonally abundant. The fruit of the blackberry which ripens in Tasmania, during February and March, becomes a popular food resource and some quolls eat blackberries almost exclusively at this time. The opportunistic feeding habits of quolls are well illustrated by this seasonal switch to a largely vegetarian diet. Young quolls display an innate ability to hunt and at least in captivity, do not learn feeding techniques from their mother. By 16 weeks, weaning is complete and the diet of the young is similar to that of adults.

The tiger quoll is apparently an opportunistic feeder. Its prey includes the smaller mammals and because of its ability to climb includes sugar gliders and feather-tails. It has been observed to raid birds nests and to leap from upper branches to catch roosting fowls by the neck, killing them in the fall. The northern quoll has been reported as eating geckoes, fish, nesting birds, common ringtail possums and wild figs. The western quoll's diet includes caterpillars, small mammals, insects, vegetation and carrion; apparently it favours an omnivorous diet.

CONSERVATION STATUS

Around the turn of the century an early trapper around Lilydale, Victoria used to capture about 100 eastern quoll for every tiger quoll. It was not until 1935 in Victoria that the quoll species obtained legal protection. The cyclic nature of eastern quoll populations was noted by several early observers and the presence of a parasitic flea corresponding to periods of high abundance is circumstantial evi-

dence that it may be a factor in limiting the population.

An important question regarding the conservation of the tiger quoll is, what is the area needed to support a population? This remains unknown, however, the tiger quoll once occurred on King Island, area about 110 square kilometres, but became extinct earlier this century as the island was cleared and developed. Tiger quolls occur in many national parks in the Kosciusko, Snowy River, Cobberas National Parks and are much more common in Tasmania. The species appears to be relatively secure and as the largest marsupial carnivore on the mainland it occupies an important place in the ecology of our forests. The more favoured habitats of the tiger quoll, rainforest, tall open forest and open forest, have been under represented in the reserve system particularly in Victoria where although 4 per cent of the land area is in national parks, only 2 per cent of the forested areas are included.

Northern quolls appear to have declined little in abundance and distribution. However increased fires such as those lit by Aborigines or for fuel-reduction burning may have caused stress to the population. Different fire regimes can cause significant long-term changes to the vegetation and so affect an area's suitability as animal habitat.

Western quoll's distribution has diminished since European settlement, however populations still exist in areas of bushland, as reports of occasional sightings testify. Michael Archer regards it to be endangered along with other dasyurid species which are similarly restricted to the south-west of Western Australia. The area was the setting for great biological diversification in the past and the importance of its forests and woodlands as refuges is now being recognised. There are several national parks and reserves in the area such as the Leeuwin-Naturaliste Ridge area and the Whicher Range area which is a low scarp between the southern end of the Darling scarp and the Leeuwin-Naturaliste Ridge.

While northern and tiger quolls appear not to be endangered, the disjunct distribution of the other two species is cause for concern. A system of reserves with connecting forest "corridors" to maintain a population which is not genetically isolated and the preservation of suitable habitats is a prime requirement for the conservation of the eastern and western quoll species.

Tiny baby quolls in the rudimentary pouch of the eastern quoll.
Photo: J. E. Wapstra, NPIAW



GIANT



The author, Richard Braley lives at Mourilyan in Queensland and over the last 10 years has been extensively involved in tropical bivalve research in the Pacific. The present research is affiliated with the University of New South Wales and the Australian Institute of Marine Science at Townsville, while James Cook University Townsville has also recently received funding for giant clam research.

Poaching and over-harvesting has led to the demise of giant clams, in particular the two largest species *Tridacna gigas* and *Tridacna derasa*. On the Great Barrier Reef, about 30 foreign clam vessels have been captured while poaching in the past dozen years. It is estimated that the illegal clam muscle on these vessels represented about 500,000 clams. The entire soft body of the clam is edible except for the kidney, but the most sought after part is the sweet adductor muscle that controls the opening and closing of the shell valves. Pacific Islanders have often overharvested clams but in some areas of Papua New Guinea villagers have been farming clams on a subsistence basis for many years. They carry small clams to a reef adjacent to their villages and allow the clams to grow to a size fit for a feast. Poaching is a serious problem; commercial fishing boats, primarily

Taiwanese fishing boats, have been stripping reefs of giant clams for years as the frozen or dried adductor muscle sells commercially for high prices in Hong Kong, Singapore and other far eastern markets.

The National Marine Fisheries Service of the United States, reports the rampant destruction of the clam populations on the pristine Helen Reef, south of the Palau Islands. Clam fishing by Taiwanese vessels on Ashmore and Cartier Islands, an Australian External Territory in the Indian Ocean is also cause for concern since the declaration of that area as a national park.

Giant clams belong to the family Tridacnidae. There are seven living species, five belong to the genus *Tridacna*, *T. gigas*, *T. derasa*, *T. maxima*, *T. squamosa*, *T. crocea* and two to the genus *Hippopus*, *H. hippopus*, *H. porcellanus*. These clams are related in an evolutionary

sense to the cockle clams. Their unique form and life history evolved relatively recently in the Eocene period, 55 million years ago. By contrast, many molluscs had evolved and radiated in the Jurassic, 180 million years ago. Giant clams are distributed only in the Indo-Pacific tropical seas with the Great Barrier Reef in the centre of their distribution. Fewer species are found in the eastern (Polynesian) islands of the Pacific and the Indian Ocean to the west than on the Great Barrier Reef. All species are represented here with the possible exception of the rare China clam *H. porcellanus*, which was recently described from the southern Philippines and Indonesia.

Conservation measures and cultivation of giant clams have been suggested for a number of years. The Micronesian Mariculture Demonstration Centre in Palau in the West

CLAMS



From Left to Right: Diver photographing a giant clam on the Great Barrier Reef. Photo: Kev Deacon

Giant clams live in shallow reef areas where the algae in their tissues are exposed to light. This photograph shows a diver examining a giant clam in its habitat, while diving from the vessel anchored in the background. Photo: Kev Deacon

Giant clam, *Tridacna maxima* at Escape Reef in the Caroline Islands. Photo: R. Braley

Spawning of the giant clam *Tridacna gigas* at Escape Reef on a full moon in December. Photo: R. Braley

The early life of giant clams is spent in a relatively short larval swimming period of from 7-16 days depending on the species. Giant clams and other mollusc larvae move with an amazing organ called the velum. The microscopic larvae has a ciliated velum which serves both for locomotion and entrapment and movement of food particles.

minute intervals. Population density of breeding adults has been suggested as the important factor in reproductive success with the probability of fertilisation decreasing quickly as the distance between spawning adults increases. Below a certain minimum population density, the populations are thought to be unable to recover. High densities of more than 100 giant clams per hectare or more than 40 per acre, have been recorded. At such high densities these clam species tend to clump together spatially by species, preferring some substrates. The smallest species, *T. crocea*, bores into coral rock and has been found at incredible densities of 100-200 per square metre at some Great Barrier Reef sites. At such densities orientation of the shell creates competition with others of the same species as shell edges may cut through an adjacent individual. High densities of all species are an exception.

Caroline Islands has played a key part in the research into rearing larvae of giant clams.

Other successful work has been done in Fiji, Guam and Papua New Guinea. The Great Barrier Reef is one of the few areas where brood stock can be readily obtained from populations of the large species of giant clams, but these clams have been declared protected animals.

Giant clams are hermaphroditic, that is they produce both eggs and sperm, with the sperm spawned first, several hours before the eggs are released. Natural spawning of giant clams on the Great Barrier Reef has been observed and photographed by the author around new and full moons in December. A powerful jet of water and gametes shooting to the surface with enough force to create a wave at the water surface a metre above, occurred at two

Clams and other bivalve eggs carry a small amount of yolk compared with the eggs of many other organisms. They settle on the bottom quickly before they succumb to predators or currents. Uni-cellular golden brown algae seem to be the most nutritious food for growth of many bivalve larvae. Giant clams settle as juveniles at about 0.25 millimetres. The percentage success in settling from early larval stages is very low. The nutritional needs of larvae must be studied to pave the way for a commercial hatchery.

Growth of giant clams is rapid. Individuals of *T. gigas* and *T. derasa* reared from eggs in Palau were at commercial size in two years. The requirements of clear, shallow, protected waters are adequately met in Great Barrier Reef waters.

A modification of the Australian system of stick and tray culture used in the Sydney rock oyster industry could be employed in cultivation of giant clams, permitting reseedling of overharvested reefs throughout the Pacific and Indian Oceans. A multi-purpose hatchery built on the Great Barrier Reef would assure continued research on the numerous tropical reef organisms which have commercial potential. The world's largest reef system would become a major producer of high protein marine foods. Giant clams would be an excellent choice of animal to consider farming on a large scale. The Great Barrier Reef Marine Park Authority is presently making zoning plans for vast areas of the Reef and many areas are zoned for use which could include mariculture.

Giant clams are highly evolved among bivalved molluscs in terms of their symbiotic relationship with single-celled dinoflagellate algae. The species of zooxanthellae, *Symbiodinium microadriaticum*, is commonly found in symbiotic associations with marine organisms such as corals, sea anemones, and jellyfish. They live within the body of the host, receiving carbon dioxide and nutrients from the host's metabolic processes. In turn, the host can utilise some of the products of the algal photosynthesis, such as simple sugars, glycerol and other products. Research has demonstrated the algal partner may supply more than 50% of the metabolic carbon requirements of giant clams. The zooxanthellae in clams are free within the blood system unlike many other marine associations where the algal cells are lodged within host cells.

Studies on the clam-algal association have indicated that there are different strains of zooxanthellae, based on biochemical differences, which appear to be identified with each host species. This might be expected for hosts as varied as anemones and giant clams but some recent evidence also suggests that there are specific strains of zooxanthellae for each species of giant clam. Zooxanthellae cells are not transferred in the eggs of giant clams so that this symbiosis must be re-established each generation. Late stage larvae and juvenile clams ingest zooxanthellae from water and by an unknown mechanism, the algae are transported to the mantle tissue. Juvenile clams which accept the 'wrong' strain of zooxanthellae will, it's hypothesised, be less successful in growth and survival than its cohorts that receive the 'right' strain. Clams settling at certain depth may receive several strains of algae but only the best adapted strain would survive and flourish in the clam's tissue.

Living within the blood spaces of the clam the zooxanthellae apparently move freely through the circulatory system. Photosynthesis occurs when they are situated in the blood spaces just under the mantle surface, exposed to the intense tropical sunlight.

The variety of colours observed in the mantle of giant clams is due in part to the millions of algal cells in the exposed mantle surface and to numerous cells (iridocytes) which refract light to produce mainly blues and greens. These colours may function to protect the clam from ultraviolet radiation reaching the shallow marine habitat in which they live. In populations of *Tridacna gigas* along the north-central Great Barrier Reef and Port Moresby area of Papua New Guinea, four mantle colour patterns were all combinations of browns, light brown (olive brown) and blue/green which is associated with eyes on the mantle edge. Six colour patterns of *Tridacna derasa* include browns, ochre, turquoise blue, blues, green, grey and white. Patterns here are more complex than in *T. gigas* as they include lines, spots and specks. The smaller species of *Tridacna* show a great variety of colour but patterns have not been classified.

The eyes of giant clams are primarily found on the exposed mantle along the shell edge. When a shadow passes over the eyes, the clam can respond rapidly, but not



Giant clams of the species *Tridacna derasa*, at three year growth size at Palau's Micronesian Mariculture Demonstration Centre in the West Caroline Islands. Photo: G. Heslinga

so rapidly as to trap a diver, as legend claims. The famous Pearl of Allah, a 6.5 kilogram white pearl, was found in a giant clam, which is said to have taken the life of a diver who discovered it. Smaller species of clams can close more quickly. Damaged tissue in the large species appears to be repaired relatively rapidly, by amoebocyte cells which are somewhat similar to white blood cells. The mantle colour of *Hippopus* is camouflaged against the mainly sand rubble of their preferred habitat. There are no eyes on the mantle so they do not respond to shadows. In *Tridacna* the iridocyte cells which refract light are concentrated around the eyes in a circular pattern. The symbiotic algal cells are likewise concentrated immediately around the slightly pear shaped eye. Although the eyes were considered by early researchers to be mainly light concentrating organs for the benefit of the algal partner, the discovery of an optic nerve connection suggests the eye evolved initially for the purpose of detecting movement. Light refracting cells forming the circle around the eye may act to increase the eye's sensitivity to changes in light intensity and direction.

Giant clams are interesting and commercially valuable marine life, which are suitable for cultivation. The restocking of over exploited reefs and their cultivation as a delicacy depends on further research and investment in a new industry.

RARE & ENDANGERED

SAVED FROM EXTINCTION Lord Howe Island Woodhen

The woodhen, *Tricholimnas sylvestris*, is a flightless rail, endemic to Lord Howe Island. It is about the size of a bantam and weighs about 450 grams. It is omnivorous and digs and scratches for food with its bill.

In the *Red Data Book*, the list of threatened species published by the International Union for Conservation of Nature and Natural Resources, the woodhen has the highest priority. It is listed among the 21 endangered genera of birds as it is the only surviving member of its genus.

When the island was first discovered in 1788 woodhen were plentiful. There were no native land mammals, but several have since been introduced.

The island was settled in 1834 and by 1853 the woodhen was found only in the more inaccessible areas of Mt Lidgbird and Mt Gower. Their decline has been rapid, although small numbers were known to persist in a few lowland areas until 1938. With people came dogs and cats (before 1845), pigs (before 1839), goats (before 1851) and eventually the black rat (in 1918). The plight of the woodhen was not fully appreciated until 1969. The only place they could be sighted was above the rock step on "Get Up Place" on Mt Gower.

An environmental study of the island in 1971 led to an intensive study by the authors of the biology of the remaining woodhen on Mt Gower. Our research from 1971-1975 was made possible with funds from the Lord Howe Island Board, the Australian Museum Trust and the Commonwealth Department of Environment. Most of this time we had almost all the woodhen individually colour-banded. The population appeared to remain at 20 to 25 birds. Breeding success was low, rarely more than 5 chicks were raised and in some years possibly none. This work led to the publicity of the precarious state of the woodhen.

In 1976 we prepared a submission outlining our views on preventing the extinction of the

woodhen. This resulted in Dr Ben Miller being appointed for two years by the National Parks and Wildlife Service of NSW, with funds from public donation collected by the National Parks Foundation of NSW. Ben Miller considered the pig was the greatest threat to recolonisation. He initiated work on their destruction and this was achieved by shooting with the aid of dogs.

A Captive Breeding Centre was established in June 1980 with three pairs from Mt Gower. By the end of the program in December 1983, the aviculturist Glenn Fraser had raised 74 chicks and released them back into the wild.

The first captive bred birds were released in April 1981 on Little Slope, where, in February 1983, the first breeding was proved when we saw two pairs with chicks. That same autumn, we banded 10 chicks on Mt Gower, the most we had ever found there.

"Back Garden Approach": in 1979 a solitary male woodhen appeared down by Salmon Beach and eventually took up territory on the lowlands. In November 1981 Glen Fraser introduced a captive bred female to this bird; they produced many offspring, which then bred in neighbouring areas. The total number of woodhen is now over 150, compared with less than

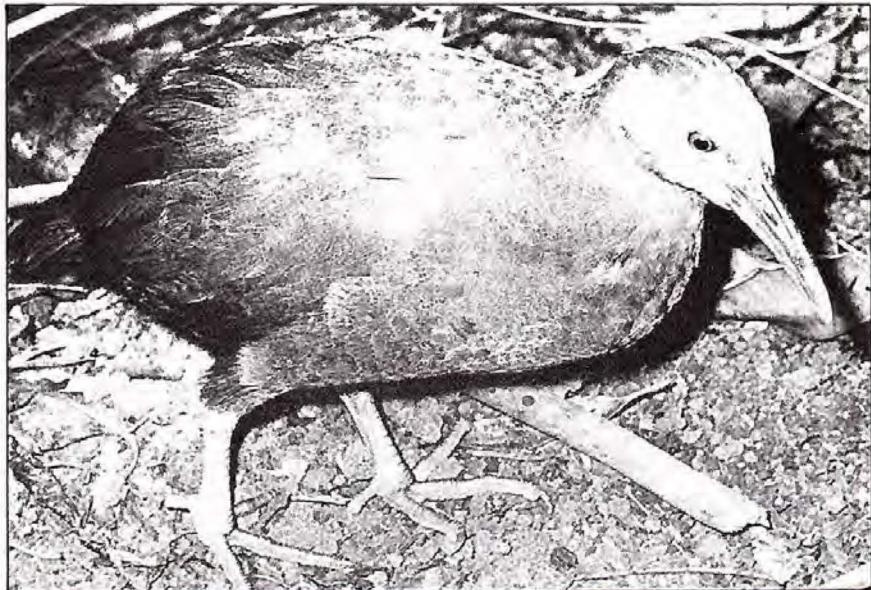
30 five years ago.

Endangered species should not be assumed to occupy remnant prime habitat. The woodhen survived on top of Mt Gower in a very marginal habitat as is shown by the difference in their breeding behaviour and success on Mt Gower and the lowlands. Too much attention to detail on Mt Gower might have led to wrong conclusions about the behaviour and population dynamics of the lowland birds.

The returning of captive bred birds to their natural environment and the successful raising of young is, we believe, a world first for this course of action in the conservation of any species of endangered bird.

Now that success has been achieved, surveys must be made at regular intervals to ensure the woodhen continues to thrive. Ben Miller's two year study and the setting up and running of the breeding program cost \$262,800. Other costs included our earlier research, the pig destruction and work by Rangers from the Board.

By John Disney, Research Associate and retired Curator of Birds at the Australian Museum, and Dr Peter Fullagar, in charge of water fowl behavioural research at CSIRO Division of Wildlife Rangelands Research.

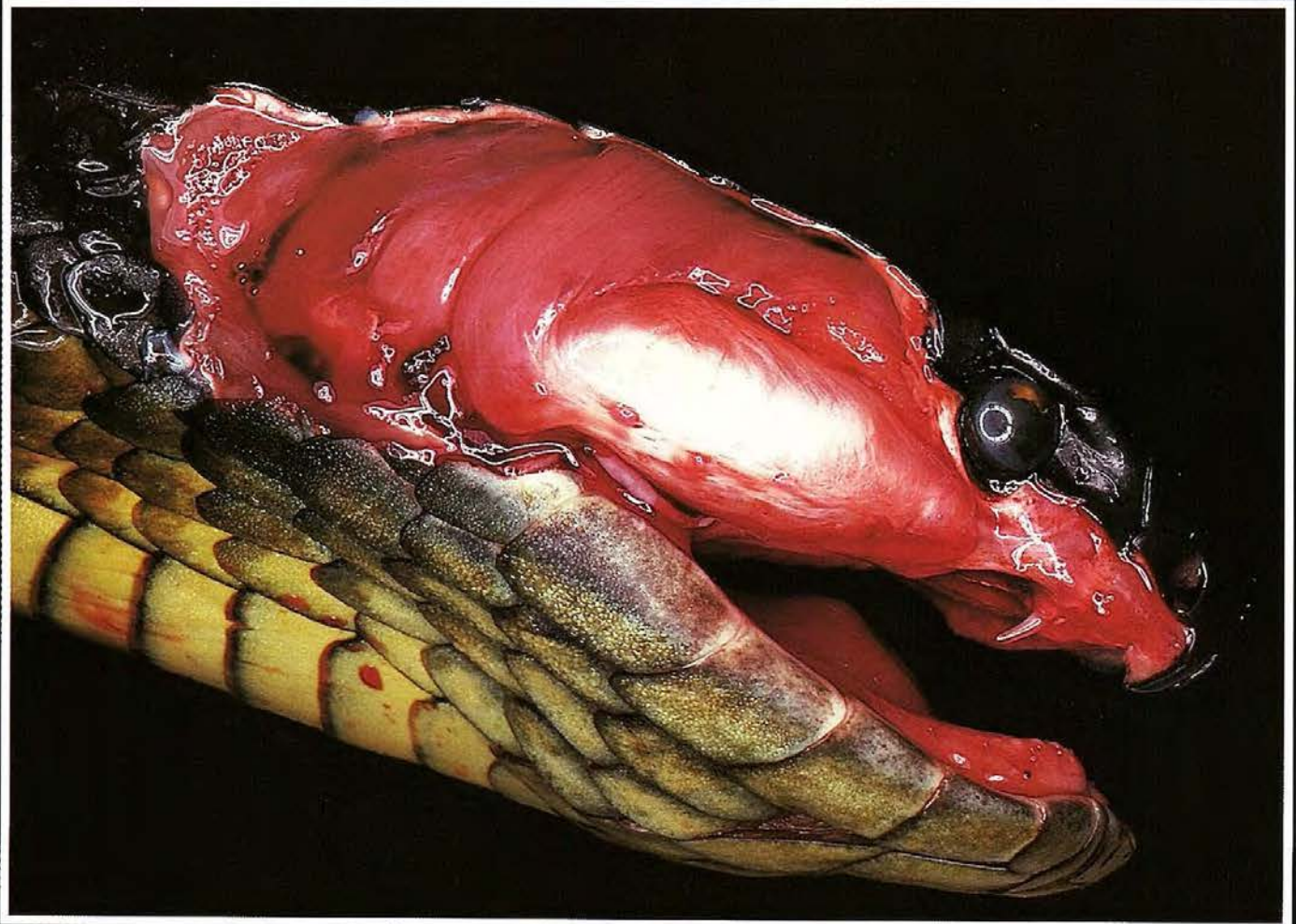


TIGER SNAKES OF CHAPPELL ISLAND

North Queensland herpetologist Michael Cermak describes his recent expedition to Chappell Island in Bass Strait to capture deadly black tiger snakes for Wild World Australia in Cairns.

A close-up of the head of a tiger snake showing the venom gland, duct and fang.

Photo: M. Cermak



I first heard of Chappell Island some fifteen years ago when reading Eric Worrell's book "Song of the Snake". Chappell Island is part of the Furneaux Group in Bass Strait lying north-east of Tasmania, and is one of over twenty islands which comprise the group. The largest islands in the group are Flinders and Cape Barren, the only populated islands — where the main source of income is fishing, farming and extraction of oil from the mutton-bird population. From the wharf at White-mark on Flinders Island, one can just see Chappell Island some 15 kilometres to the south-west.

It is the fascinating ecology of tiny Chappell Island which resulted in the declaration of a fauna reserve, the Chappell Island's Nature Reserve. The fauna includes a sole species of snake, the extraordinarily large black tiger snake, and a large population of mutton-birds which nest in burrows dug in the soil and a population of Cape Barren Geese. As a keen herpetologist, I have always yearned for a visit to Chappell Island in order to observe these large snakes in their environment, and to note their unusual habits.

In February 1984, my wife and I arrived in Launceston, Tasmania and obtained the necessary permit from the Tasmanian National Parks and Wildlife Service. We decided to fly over to Chappell Island, in preference to hiring a boat, because Bass Strait is notorious for its treacherously unstable weather. We were delighted to learn that the landing strip on Chappell had been slashed only a few days previously.

Nine o'clock in the morning we were cruising around Chappell in Munro Aviation's four seater aircraft. Innumerable fears of the landing passed through our minds. The landing strip beneath us looked small, and in spite of the slashing was almost indistinguishable from its surroundings. However, the landing was uneventful, we disembarked safely, and the pilot took off again.

The quiet tranquillity that surrounded us was very noticeable after the noise of the aircraft. There was a tiny 'worm' of fear at the possibility of being marooned with only big black tiger snakes and mutton-birds for company!

We decided to have a look on the northern side of Mount Chappell the only hill, about 200 metres high, which has two peaks covered in large boulders and grass tussocks. We were greeted by several pairs of magnificent Cape Barren geese,



Tiger snake swallowing a mutton bird, their main food on Chappell Island.

Photo: M. Cermak

which are quite common on most of the Furneaux Group of islands.

The mutton-birds, properly called short-tailed shearwater *Puffinus tenuirostris* which we encountered on Chappell, have a fascinating life cycle. When the chicks shed their fluffy coats and become adults they leave their burrow-nests for a journey which takes them seven years to complete. A map of their journey appears as a figure of eight, around the world. During the seven years it takes them to complete it, they never touch land feeding and sleeping on the great oceans of the world. Then they return to the burrow where they were born, to nest and care for the next generation.

We spent twenty minutes walking on the side of the hill. Though the terrain looked like an excellent snake habitat, we saw no snakes. When we approached the flats between the foot of the hill and the shore, we noticed the first mutton-bird burrows, and then several tiger snakes, lying in the open.

There are two recognised species of tiger snake — the mainland or eastern tiger snake *Notechis scutatus*, and the black tiger snake *Notechis ater*. The black tiger snakes are further divided into five subspecies, inhabiting southern parts of Australia, Tasmania and the Bass Strait Islands as well as some small islands off South Australia. While most tiger snakes attain a maximum



Close up of the head of a tiger snake.

Photo: M. Cermak

length of 1.5 metres, the Chappell Island subspecies *Notechis ater serventyi* reaches over two metres and is the darkest colour form. The toxicity of its venom is less than other species of tiger snakes, but because of its length and the size of its venom glands, the volume of venom injected in a single bite is relatively enormous. For this reason it should be classed amongst the most dangerous.

As we meandered between the burrows, we discovered a tiger snake about every ten steps, sometimes spotting three or four at a time. They were just lying outside the burrows of the mutton-bird nests, absorbing the warmth of the morning sunshine, and taking absolutely no notice of us. I could approach within one metre bend over to observe, then walk away without disturbing them at all. The aim of the expedition to Chappell Island was to collect a few specimens for research and public display at "Wild-world Australia" an outstanding animal park just north of Cairns, north Queensland. I began collecting some of the larger snakes, and in half an hour had six big specimens weighing a total of fifteen

kilos. From these we selected the best-looking few, and transferred them to calico bags, ready for transportation to Cairns, around 3000 kilometres away.

I captured the rare sight of a tiger snake actually swallowing a mutton-bird chick on film. This usually happens inside the burrow as the snakes investigate one nest after another, poking their heads into the holes. Once they detect a mutton-bird chick, they slide in for an easy snack. After the meal, they usually curl up outside the burrow in the sun.

The absence of permanent water on the island forces the snakes to obtain their necessary drinking water by sucking dew from the vegetation, or drinking from the pools formed after rain on the flat rocks along the shore. The limited food supply is another factor affecting the population. While the juvenile snakes feed on small skinks, the adults feed solely on mutton-bird chicks, which are available in thousands from the moment they hatch until they are too big for the snakes to swallow. The snakes have the opportunity to feed during the only two months of the year when the

mutton birds are the right size. They build up sufficient fat reserves to live for the remainder of the year. In their juvenile stages the snakes may eat each other but once they reach maturity they are not known to be cannibalistic. The population of skinks on the island is not sufficient to support the thousands of tiger snakes born each year.

While I walked around the island I saw as many as seventy tiger snakes, and not one of them showed the slightest sign of aggression. This particular subspecies is known for its inoffensive behaviour. On quite a few occasions, I picked up a snake by the tail, lifted it up in the air, then put it back on the ground only to see it slide away some two metres and settle down. I have never experienced anything like that with any other species of venomous snake.

Chappell Island is one of the very few places where the harmony between the flora, fauna and the whole environment has not been upset by the introduction of domestic and farm animals. Our pilot, politely declining to inspect our cargo, returned us safely to a far less harsh environment.

Letters

Doubts on Thylacine

Mr Mooney's article "Tasmanian Tiger sighting casts marsupial in new light" is a most interesting contribution. In essence, based on a single sighting made at 2.00 a.m. in March, 1982, in northwestern Tasmania by a member of the National Parks and Wildlife Service of Tasmania, we are led by Mooney to conclude that the Thylacine definitely exists. Perhaps it does. It concerns me, however, that such a "vital" conclusion is based on no more than unsubstantiated data of this sort. Similar, equally insubstantial sightings of other creatures such as Loch Ness's Nellie, Extraterrestrials, Yettis, Yowies and the Queensland Tiger seem to have inspired much less confidence as proof for existence. My own sighting in 1969 of a Tasmanian Devil near Margaret River in southwestern Western Australia, leads me to err on the side of extreme caution. At 10 metres distance, in my car's headlights I saw (without doubt but much amazement) a Tasmanian Devil amble onto the dirt road in front of me. As I edged closer for a better look, it miraculously transformed into a black and white pig and disappeared into the brush on the other side of the road. If I hadn't edged that little bit closer, I would still be convinced that I saw a Tasmanian Devil. Clearly it's easy to make errors of judgement in situations of this sort.

None of the many Tasmanian surveys carried out since the 1930s has produced a single shred of material evidence to support the notion that the Thylacine has survived the devastation we inflicted on it in the name of sheep. If it really does survive, this persistent failure would

seem to me to be very hard to rationalise.

Two of the presumptions reached by Mooney include: 1, the Thylacine survives in several remote densely forested areas of Tasmania; 2, carcasses are not being found because Tasmanian Devils, which have built up large numbers, eat the dead Thylacines before they can be found.

Both conclusions seem very unsound. As Mooney himself notes, the wilderness areas where these Thylacines are supposedly surviving are certainly not the preferred habitat for the species. In fact, the main basis for the original persecution of Thylacines by Tasmanians was the fact that Thylacines preferred the more open woodlands and adjacent savannah country — the same type of habitat in which sheep were run.

There can be no doubt that Thylacine populations able to survive in the wilderness areas would long ago and persistently since then have increased in numbers in direct proportion to the amount of suitable habitat. This suitable habitat does not now, anymore than it did in the 1930s, stop at the edge of the wilderness areas. At the very least, Thylacines would be constantly encountered along the margins of the forbidden sheep country. Therefore, to accept Mooney's conclusions is also to accept an assumption that the Thylacine is behaving in a manner unique to known organisms. It must have since the 1930s consciously not only avoided its preferred habitat but consciously restricted itself to regions within the confines of the otherwise relatively uniform wilderness areas. This would have to be a most intelligent sort of Thylacine and one that had to be able to pass its

extraordinary resolution on to several generations.

The idea that the now very abundant Tasmanian Devils eat the dead Thylacines before they can be found by humans, as an explanation for why no dead Thylacines have been recovered since the 1930s, is equally imaginative. It seems at least as probable that the Tasmanian Devils now occur in larger numbers precisely because there are now no Thylacines, the Devils having extended into part of the niche once utilized by the now extinct Thylacines.

As a zoologist who has had a very vivid personal experience with the unreliability of sightings, I find myself less than overwhelmed by Mooney's conclusions based as they are on a supposed sighting. Despite his own subsequent effort as well as those of many other previous optimistic zoologists, there is unfortunately no shred of material evidence to support the view that the Thylacine exists. The supposed sightings are all there is.

Should the vast amounts of money being spent on this research continue to go down the drain when biological reason urges otherwise? The Tasmanian N.P.W.S. must make up its own mind about this. Surely, however, there are more useful ways to spend money in the interests of conservation than in chasing phantoms of the past.

Mike Archer,
School of Zoology,
University of NSW

Federal Government Kangaroo View

Your winter 1984 (Vol. 21 No. 5) issue contained letters from Mr Daly of Greenpeace and Dr Mosley of

the Australian Conservation Foundation concerning the article on kangaroo harvesting by Gordon Grigg.

In the official notice of its decision the US Fish and Wildlife Service (USFWS) stated that the withdrawal of the proposal to delist three kangaroo species from the Threatened List under the US Endangered Species Act "is based on new data from the Australian Government that indicate that these kangaroo populations have declined as a result of severe and widespread drought during the Australian summer (December-January) of 1982-83". In that notice, the USFWS acknowledged that "populations still number in the millions" and that "the Australian states have demonstrated efficient conservation programs".

The USFWS also foreshadowed that it may again propose delisting if data becomes available demonstrating recovery of populations after the drought.

In a letter to Marian Newman of the Kangaroo Protection Foundation a senior official of the USFWS wrote "The Australian Government has been completely open in its dealings with us, and has been very willing to provide any information we requested. In fact, it was the Australian Government's honesty in providing the latest data on declines in numbers that led to the withdrawal of our delisting proposal. The Australian Government has never tried to "dupe" the US, and it has not been deceitful in any way".

Professor J. D. Ovington,
Director,
Australian National Parks
and Wildlife Service,
Canberra, A.C.T.

booksbooksbooksbooksbooks

A Guide to the Freshwater Fish of Victoria

Phillip L. Cadwallader and Gary N. Backhouse. Victorian Government Printing Office, Melbourne, 1983: 249 pages, \$13.50.

In the past few years considerable scientific research has been carried out on the freshwater fishes of Australia. Currently, about 200 species of fishes are known from freshwaters of Australia, although about a quarter of the species are typically marine fishes, which sometimes enter freshwater. Previously little was known about where the species occurred and even less about the life history of the fishes. At least 40 species new to science have been discovered from freshwaters of Australia in the last 15 years.

As a result of increased interest in native Australian freshwater fishes, several workers began work on books to summarize what is known about and identifying them. The first of these to be published in recent years was the *Freshwater Fishes of South-eastern Australia*, edited by R. M. McDowall treating 71 native species and 11 introduced species. Although including Victorian fishes, only limited information was available on these. A second book, *A Field Guide to Inland Fishes of Western Australia*, by G. R. Allen was published in 1982. Two more books dealing with all freshwater fishes of Australia are expected over the next year.

A Guide to the Freshwater Fish of Victoria provides more detailed information about the Victorian species. Dr Cadwallader has been a research scientist in the Victorian Fisheries and Wildlife Division since 1975. Mr Backhouse is a senior field management officer for

the Division. The book contains a brief introduction, short chapters on inland waters of Victoria, man's impact on native fishes, collecting, keeping and photographing fishes, parasites of freshwater fishes, and structure and classification of fishes. The work includes an extensive glossary, which is essential for any work designed to aid in identifying fishes.

There is a key to the families of freshwater fishes of Victoria, with an outline drawing for each family, aiding rapid identification. There is a brief discussion of family and keys to the species for each family. For each species, there is a brief description, aids in identifying the fish, and information on distribution, habitats and life history. A map is given for the distribution of each species in Victoria. Forty-three native species and 11 introduced species are included in the work. Colour photographs for all species are grouped together.

Each fish is large enough to see detail and the figures have not had their tails chopped off, which is a common problem with books of this nature. The outstanding colour photographs were mostly provided by G. Schmida, who has specialised for several years in photographing freshwater fishes of Australia. There is an extensive list

of references at the end of the book and a comprehensive index. Technical terms are used extensively, but explained in the glossary. Errors are few and relatively minor. For example, gudgeons are said to be bottom living, but species of the genus *Hypseleotris* from Victoria are free-swimming and settle to the bottom at night or when frightened. Similarly the Tamar River goby is not mentioned from Tasmania, where it is locally abundant. The book is bound in a soft cover and is conveniently sized to carry when fishing.

— Dr Doug Hoese

MARINE INVERTEBRATES OF SOUTHERN AUSTRALIA: PART 1.

Edited by S. A. Shepherd and I. M. Thomas. South Australian Government Printer, 491 pages, \$17.00 and \$21.00 on plastic paper.

This book, long overdue, is a most welcome addition to the list of Handbooks of the Flora and Fauna of South Australia.

After a first chapter giving a general introduction to the marine environment, there follows a very useful chapter illustrated with simple food webs and giving the types of feeding utilised by the invertebrates in the various habitats, such as sandy and rocky open coasts and sheltered bays and inlets.

The chapters following cover eight of the major marine phyla commonly found along the South Australian coast. Each phylum is dealt with by an authority on the subject. Each chapter has a key to the various orders of the phylum, and in some instances there is also a key to families and even to species. A comprehensive glossary and selected bibliography are given at the end of each chapter. Clear text

figures throughout the book illustrate some of the more important features necessary for identification.

There is a certain imbalance in the various chapters, some being dealt with much more fully than others. However, this would appear to reflect the relative abundance of populations and paucity of information on the group in South Australia, together with difficulty in field collection and preservation, rather than omissions on the part of the author.

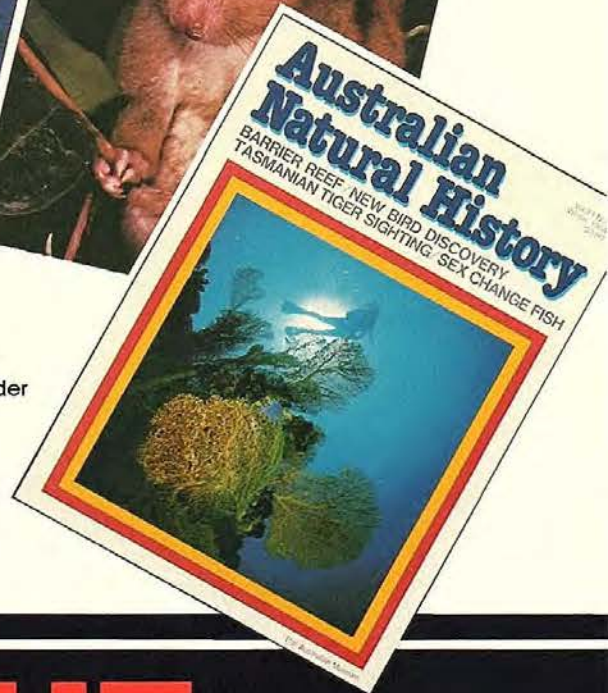
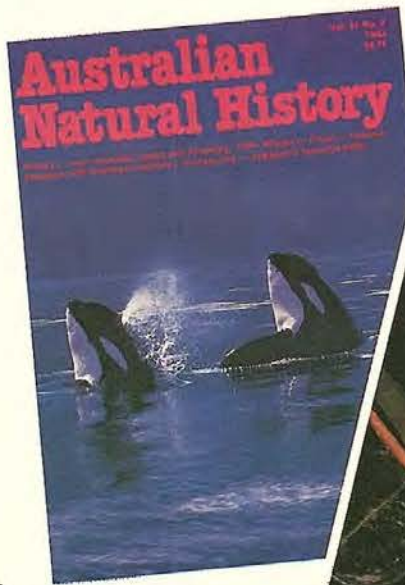
Colour plates are most helpful, sometimes almost essential, for easy identification of marine invertebrates by the non-specialist, and the greater number of plates appearing in the book will prove to be very useful. The reproduction, unfortunately, is not always sharp and clear, especially in the case of small species which are often extremely difficult to photograph.

Undoubtedly this book will prove to be a most valuable reference for students and all those interested in the invertebrate animals of the seashore. The various authors have contributed information previously unknown or scattered in journals, and the editors are to be congratulated on bringing together for the first time, the most important information known to date about these groups of animals. Theirs has been not only a tremendous task, but obviously a labour of love, based both on their own work and knowledge, and on their intense interest in marine animals.

— Isobel Bennett



Read the Natural Authority



Last issue *Australian Natural History* (Vol. 21, No. 5) looked at the marine world from Queensland to Tasmania — from conservation aspects to how fiddler crabs attract a mate!

We looked at marine invasions — of sand dunes by introduced plants, of Japanese sea bass in ballast water from overseas shipping.

Our reported sighting of the Tasmanian tiger has been followed by a search expedition to the area.

We reported the discovery of a new rainforest bird, the Eungella honeyeater, and introduced several regular features, book reviews, a letters page to encourage reader participation.

This issue we introduce Rare and Endangered and a regular contribution from Densley Clyne.

Volume 21, No. 4 examined kangaroo harvesting. Is harvesting threatening the survival of kangaroos? Dr Gordon Grigg's controversial article says no! The previous issue reported the discovery of Fraser Cave, a discovery which catalysed the campaign to save the Franklin. The whale mini special number two, explored the mysteries of whales enchanting songs, while number one looked at drought and the demise of Australia's greatest river, the Murray.

WATCH OUT IN COMING ISSUES . . .

- ★ **SMELLS OF THE BUSH:** remember the perfumes of childhood visits to the bush?
- ★ **KAKADU NATIONAL PARK:** the impact of tourism on this scenic and ecologically fascinating area complete with invaluable Aboriginal cave art.
- ★ **SALTWATER CROCODILE:** is this species really threatened?
- ★ **GOING INTO BAT FOR THE QLD FLYING FOX:** did you know they are no longer a protected species in Queensland? Find out why.
- ★ **ABORIGINES TODAY:** a definitive photographic essay of today's urban and rural Aborigine.
- ★ **STEREO PHOTOGRAPHY:** 3-dimensional images that you've never seen before; touch a funnel-web spider with safety.

Australian Natural History

Adventure Country.

If there is any country in the world that deserves the title "the last frontier," it must surely be Papua New Guinea.

With its spectacular mountain scenery, idyllic tropical islands, seething rivers, untrodden jungles, and heritage of interwoven cultures thousands of years old, Papua New Guinea abounds with unique opportunities for adventure-minded travellers.

You can step back in time and visit villages a world away from the twentieth century; and retire at night to the comfort of the expeditionary vessel, the Melanesian Explorer.

Or if you are reasonably active you can trek mountain paths that have served as the local highways for thousands of years. Along the way you'll experience an intoxicating richness of flora and fauna. Four wheel drive tour options are available.

For a touch of luxury with your adventure there is PNG's world famous wilderness resort, Karawari Lodge.

For details on these and other Adventure Holidays in Papua New Guinea contact your travel agent or nearest Air Niugini Sales Office.

Sydney: 232 8900
Brisbane: 229 5844
Cairns: 51 4177

AIR NIUGINI
THE NATIONAL AIRLINE OF PAPUA NEW GUINEA

