SWANS

Wildlife Journal

Vol. 14 No. 1 1984

SWANS

Vol. 14 No. 1
1984

The State Wildlife Authority News Service (SWANS) is

issued by direction of the Hon. H.D. Evans B.A., M.L.A. Minister for Fisheries and Wildlife.

Director of Fisheries and Wildlife B. K. Bowen. B.Sc.

The support of the public is an essential component in any conservation or reserve management programme—but an informed, educated public is needed to ensure its continuing success.

This publication is designed as a medium by which the various organisations, individuals, and wildlife management personnel may be kept informed of the work being carried out by this department, of departmental policies and directions: and for promoting a better understanding and appreciation of Western Australian wildlife and the role it plays in maintaining a suitable environment in which man can live.

S.W.A.N.S. is published three times each year:

Extension and Publicity Office,
Department of Fisheries and Wildlife,
108 Adelaide Terrace, Perth, Western Australia 6000

Editor:
Malcolm Taylor
B.Sc. (Hons.) Dip. M.S.

Assistant Editor:
Julie Walsh

Contents

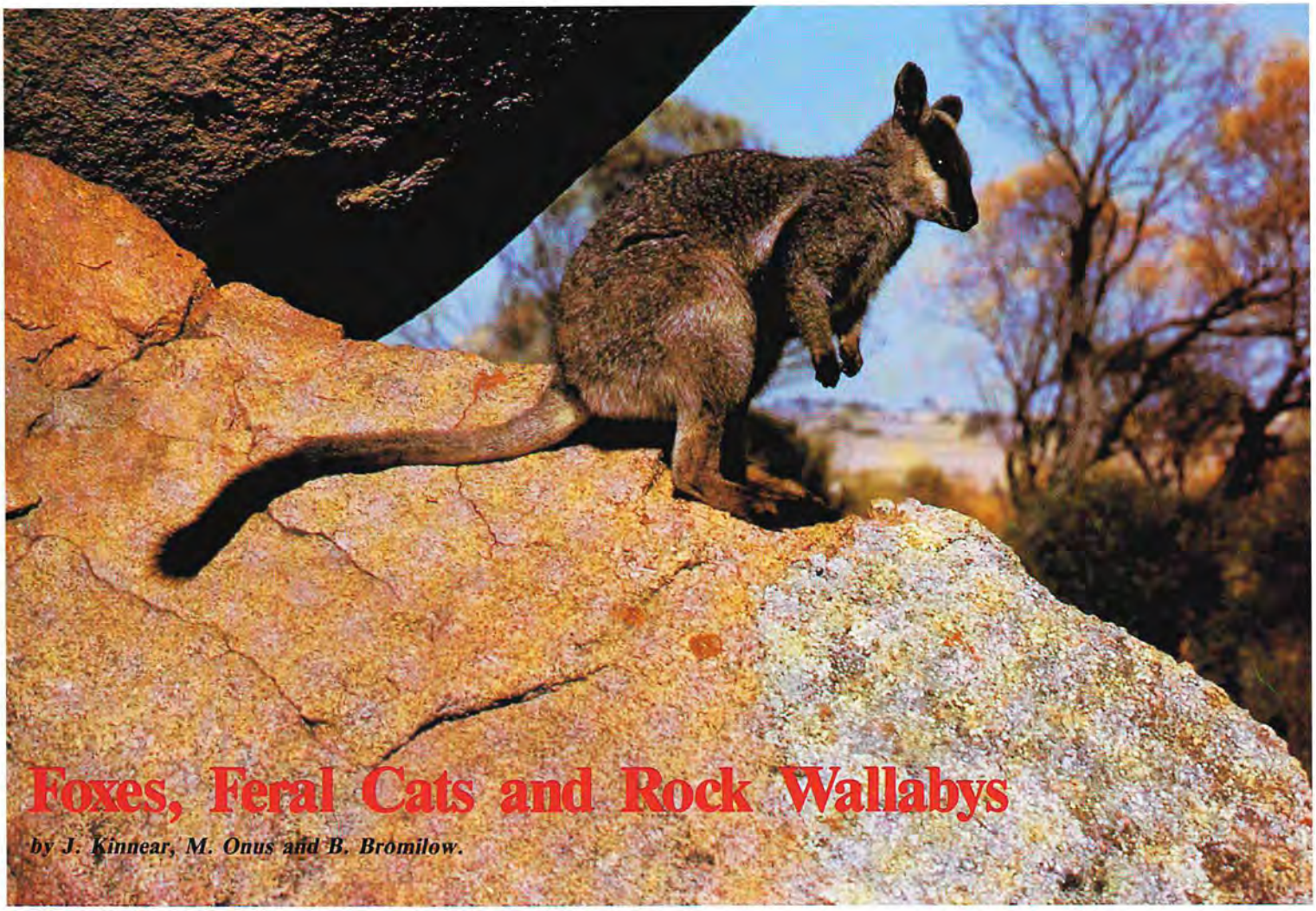
	Page
Foxes, feral cats, and rock wallabys	3
Finding out about desert mammals	9
Breeding by Little Bitterns in nature reserves	14
A flora survey of potential agricultural land in the Ravensthorpe-Esperance area	18
Another step forward: The Atlas of of Australian Birds	22
The Management of small bush areas in the Perth Metropolitan Region	25
Banksia Atlas initiated	26

ISSN 0155-9397

WILLIAM C. BROWN. Government Printer, Western Australia

COVER PHOTO

Little Bitterns photographed on their nest with young. This is believed to be the first photograph taken of nesting Little Bitterns in Australia. For story see Page 14. (Photographs Copyright A.G. Wells)



Foxes, Feral Cats and Rock Wallabys

by J. Kinnear, M. Onus and B. Bromilow.

▲ Black-flanked rock wallaby (*Petrogale lateralis*) of the granite rocks area of the wheatbelt (Photo copyright A.G. Wells).

Introduction

Two species of exotic mammals – the feral cat and the red fox – are widely distributed throughout most of mainland Australia. The cat has a longer history and possibly landed as a shipwreck survivor or through Malays trading with northern coastal aboriginal tribes. The fox was deliberately released about 1870 in Victoria so that the English pastime of following the hounds might be pursued in Australia. Apparently, those foxes which escaped the hounds found Australia a good place in which to raise families. By 1916 decendants of the Victorian introduction had found their way to W.A.

With the establishment of these two foreign species in W.A. a question follows, namely "Has the cat and the fox affected our native fauna?" This is a reasonable question because, after all, both species are genuine carnivores, and it does not seem unreasonable to suspect that foxes and feral cats might just exercise their carnivorous instincts on suitable species of our native W.A. fauna. Furthermore, suspicion becomes stronger when it is realized that, associated with the arrival of the fox in particular, a number of small to medium sized mammals subsequently became rare or extinct on the W.A. mainland.

However, the factors that cause extinctions of species are usually complex and are seldom documented. For some species (e.g. wheatbelt mammals) habitat destruction was particularly severe. The rabbit plagues must have had an effect, disease has been advanced as a cause, and some biologists believe that the climate has changed sufficiently to affect the survival of many W.A. species. These factors acting singly or in concert are plausible explanations and need to be considered.

With regard to the fox, opinions about its impact on the W.A. fauna vary from outright condemnation to indifference. One viewpoint (which dismisses the fox as a factor) equates the fox with the dingo, it is reasoned that since the native species have co-existed with the dingo for several thousand years then why should the coming of the fox worry the fauna? An extension of this reasoning concedes the possibility that foxes may have caused damage in the past, but the damage is done and the

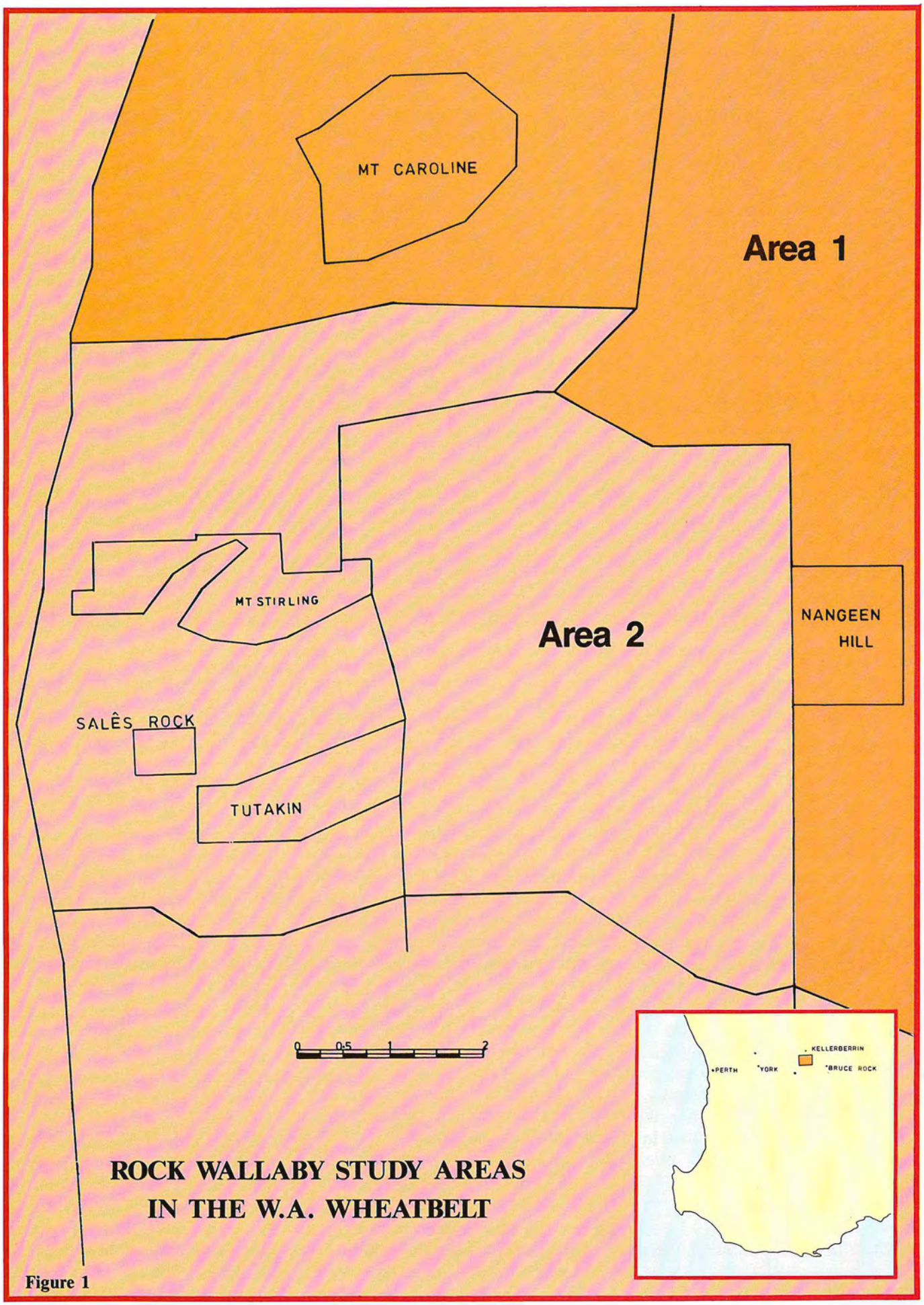

MT CAROLINE
Area 1
Area 2
MT STIRLING
NANGEEN HILL
SALÊS ROCK
TUTAKIN
0 0.5 1 2
KELLERBERRIN
PERTH
YORK
BRUCE ROCK
ROCK WALLABY STUDY AREAS
IN THE W.A. WHEATBELT

Figure 1

surviving species have learned to live with the fox – relax, why worry? This is the so-called "equilibrium theory" of species living in harmony where the "balance of nature" forces are operating.

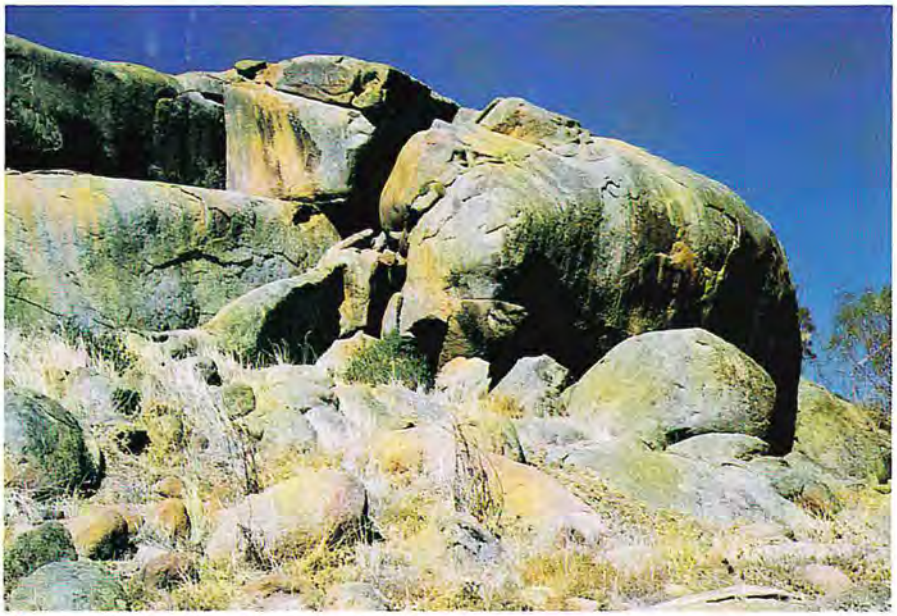
The Rock Wallaby Study

In 1978, we began a study on rock wallabies *(Petrogale lateralis)* in the central wheatbelt where colonies still persisted on some granite outcrops south of Kellerberrin. A survey of these sites revealed that the numbers had declined. We estimated that the total population consisted of about 75 animals; one population had become extinct during the last 10 years and 2 more were nearly so. During this initial phase we sighted and encountered many foxes and feral cats, but we had no cause at this stage to link them to the decline of the rock wallaby colonies, however, as the study progressed, this attitude was to change markedly and these alien species subsequently became the focal point of the study.

By the end of 1978 we realized that it was important to try and collect some vital statistics on rock wallabies, it was essential to gain some information about things like – the number of wallabies occupying a rocky outcrop, how many babies were born each year, the age of individuals and so on. If it is possible to collect such information, then one can gain some insight into why the colonies of rock wallabies were so small and therefore prone to extinction.

In order to gain such information it is necessary to catch wallabies and measure the length of their foot, check their teeth, check in their pouches for young, fix a numbered tag in each ear and then let them go. All of these activities are routinely performed in most population studies involving wallabies.

Now trapping wallabies is usually not very difficult, we soon learned that rock wallabies considered apples equivalent to lollies, and so it is easy to get them to enter a trap but keeping them there was a problem.



▲ "The Granites" near Shackleton W.A. illustrates the type of rocky outcrops that occur in the wheatbelt and the crevices of which protect rock wallabies that are still surviving in the wheatbelt. (Photo copyright A.G. Wells).

▼ Rock Wallaby trap successfully developed to capture rock wallabies in the wheatbelt without injuring the animals (Photo J. Kinnear).

▲ Enderby Island W.A. The relative isolation of the island from mainland predators has probably assisted the rock wallaby population in its survival within the open habitat of the island.

After modifications which seem adequate to trap any normal wallaby, they still proved to be agile escape artists, at this early stage we found it an easy job to clear the traps because we never caught any, and we used to complain that for our efforts the least rock wallabies could do was to leave a note thanking us for the apple.

When we finally made the traps secure we began to catch wallabies, but it soon became apparent our problems were just beginning, we found that if a rock wallaby cannot escape from a trap it will propel itself upwards with great force and injure its head if measures are not taken to prevent this. What we failed to appreciate was that rock wallabies live in a three dimensional world where up and down is just as natural as straight ahead. After many trials, a trap ingeniously designed and built by Robert Bromilow allowed us to trap rock wallabies virtually without risk.

From our trapping endeavours it was learned that rock wallabies breed continuously throughout the year, and that most adult females were carrying young in their pouch. Moreover, the population was fit and healthy and did not suffer excessive weight loss during drought. Additionally, we learned that the population consisted of mostly mature animals and was not increasing despite the fact most females were bearing young, this information suggested that the reason why the populations were not increasing was because once a juvenile leaves the mother's pouch, it had a low probability of surviving to adulthood.

As evidence from trapping began to build up, our suspicions regarding foxes and feral cats began to grow. Foxes and cats were found to be living in the rocks amongst the rock wallabies, bones of wallabies were recovered from a fox den and rock wallaby hair was found on a firebreak some distance from the rock. We noted that rock wallabies were only found in rock piles that afforded protective shelter in the form of crevices and deep caves, whereas in the past, they were recorded from sites which offered far less protection.

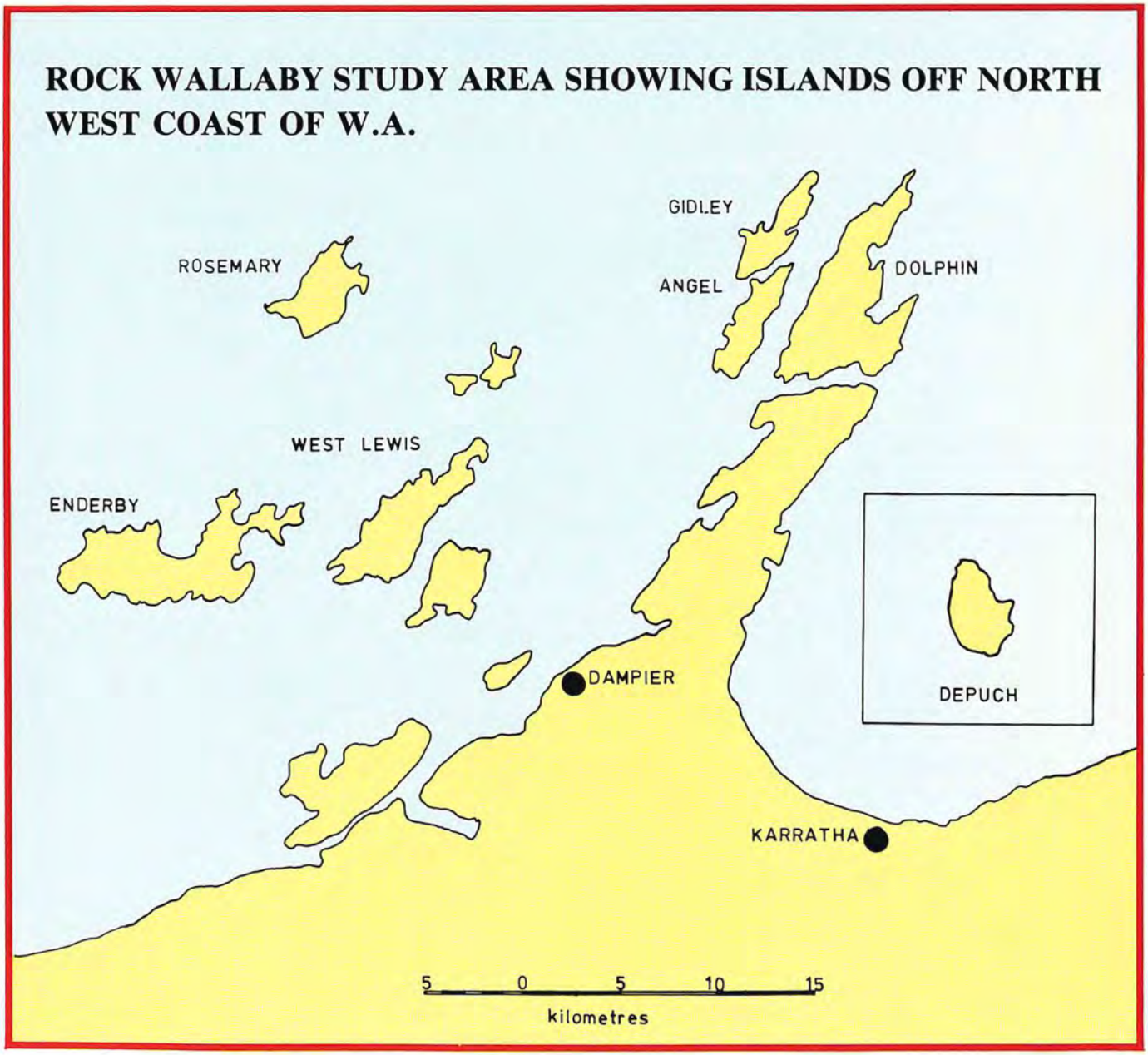
Meanwhile some evidence from studies in the Pilbara served to reinforce our suspicions about the possible effects of foxes and cats. On islands in the Dampier Archipelago another rock wallaby species — Rothschilds' rock wallaby *(Petrogale rothschildi)* — is found on 3 islands, two islands are free of foxes and cats and support thriving populations of

rock wallabies, in contrast the third island, which has foxes and cats, has very few rock wallabies.

To illustrate the differences in numbers between these islands consider the information gained when an observer records the number of rock wallabies seen per hour on a standard traverse of an island (such procedures provide measures of relative abundance). On the islands free of foxes and feral cats (Rosemary and Enderby Island), one routinely observes 12-15 rock wallabies per hour, while on the island that has these predators (Dolphin Island), one sees on average 1 rock wallaby per 3-4 days! This difference is even more striking when one compares population sizes between the islands. On Enderby (fox free), we estimated that there were about 1500 rock wallabies, while on Dolphin, less than 50.

Further north more incriminating circumstances are found on Depuch Island which is an island a few kilometres offshore and due west of Whim Creek. In 1962 the W.A. Museum surveyed Depuch Island and recorded the presence of the rock wallaby *(P. lateralis)* and the fox. Dr. D. Ride, former Director of the Museum, wrote in his report – "tracks of foxes were numerous; . . . fox droppings containing fur bone fragments and arthropod remains are common; and the remains of rock wallabies that had clearly been eaten by a carnivore were to be found in many of the valleys near fresh water and behind the beaches". In his summary of the situation Ride concluded . . . "Today, rock wallabies seem to be present on the Island in large numbers and it seems that foxes have not been successful in reducing the population to a low level. However, there are obvious

ROCK WALLABY STUDY AREA SHOWING ISLANDS OFF NORTH WEST COAST OF W.A.



▲ Rothschild's rock wallaby (*Petrogale rothschildi*) was the species studied in the islands off the north west of W.A. (Photo copyright A.G. Wells).

signs of predation both by foxes and birds of prey and we cannot be at all certain that the relatively recent introduction of the fox will not have some long term effect on the wallaby population".

Ride was obviously uncertain about the outcome of this predator/prey system involving a marsupial and alien predator which has recently become established on Depuch Island. In 1962 the relationship seemed to be at equilibrium, but 20 years later when we visited the Island, we found no trace of the rock wallaby *P. lateralis,* foxes were still there, foraging in the intertidal zones on the beaches, so much for the equilibrium theory and the balance of nature arguments.

Such evidence is rather compelling and it is hard not to feel absolutely convinced that foxes, in particular, must have done a lot of damage to our native wildlife, and indeed also, that the fox still poses a threat. But strong as the evidence appears, it is still circumstantial, it still is easy to be mislead as for example by the difference between rock wallaby numbers on Enderby Island and Dolphin Island, we now know that this large difference in abundance is partly environmental. Research has shown that Enderby is a better place to live for rock wallabies because there is more food, but even though food accounts for some of the difference in numbers, it still does not completely explain why there are so few rock wallabies on Dolphin Island.

Given the above situation, and the circumstantial nature of the evidence, it was decided that an ecological experiment might provide more definitive evidence. Two opportunities for experimentation were readily apparent as for example in the Dampier Archipelago. A useful experiment would involve eliminating the fox and feral cat from Dolphin Island, a population increase would signify predation as a factor affecting rock wallaby abundance. The wheatbelt rock wallabies afforded even better opportunities, and for this reason this area was selected.

For the wheatbelt experiment we divided the 5 rock wallaby populations into 2 zones or areas (see fig. 1). In area 1 foxes and feral cats were to be eliminated or at least their numbers significantly reduced. In area 2 things were to be left alone – that is, no effort to control foxes or feral cats was to be made at all. The outcome of this experiment should shed some light on the following possibilities namely:

(1) rock wallaby numbers should increase in the zone where foxes and feral cats are eliminated if these predators are responsible for keeping the numbers low;

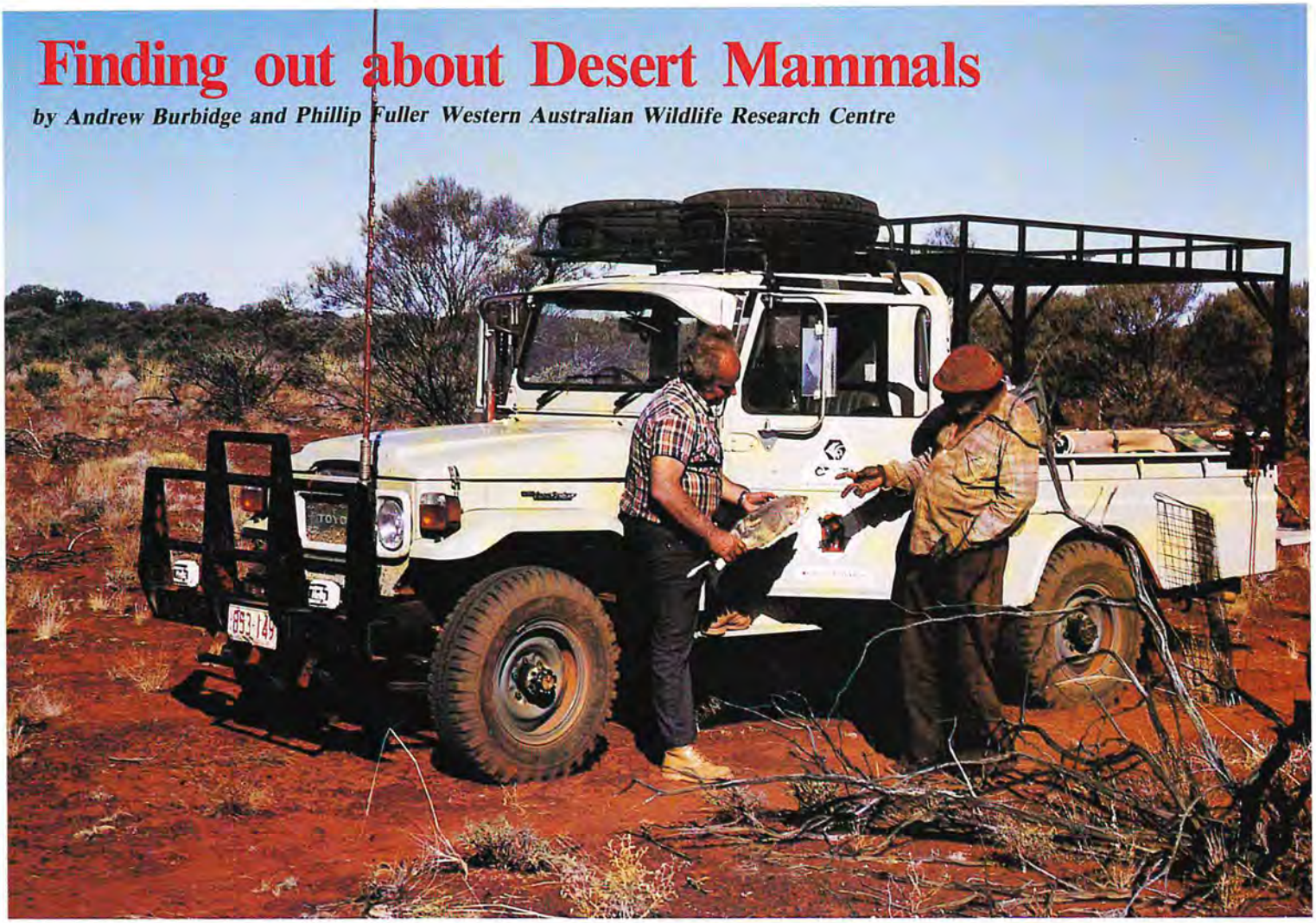
(2) at the same time little or no increase in rock wallabies should be observed where nothing was done to keep the numbers of foxes and feral cats down.

While it is easy to plan and design experiments such as the one outlined above, the implementation of the actual experiment has not been easy and has required a sustained commitment to see it through. At the start of the experiment we needed to know two things – how many rock wallabies there were and how to eliminate (or at least reduce significantly) foxes and feral cats. The Bromilow trap solved our first problem, the other problem is another story which must wait until another issue.

At this writing, 2 years have elapsed since we have trapped the rock wallaby populations, in the meantime intensive fox control studies have been carried out. It is not possible to predict the outcome at this stage, but a preliminary assessment may be possible this year for one population. Hopefully, the outcome will allow us to reach some conclusions one way or the other. Whatever the answers, it should be an interesting story to tell.

Finding out about Desert Mammals

by Andrew Burbidge and Phillip Fuller Western Australian Wildlife Research Centre



▲ Phil Fuller and Aboriginal informant Micky Robinson at Tjirrkali, Gibson Desert. Mr Fuller is holding a Dalgyte skin. Photo: R. Southgate

Until quite recently surprisingly little was known about the mammals of the interior of Western Australia. Because of the inaccessibility of the region there were few systematic attempts to document the fauna of central Australia and by the time four-wheel drive vehicles became available it appeared that many species had either become extremely rare or were extinct.

That we knew anything about the mammals of the deserts in past times was due largely to the efforts of one person, H. H. Finlayson of Adelaide. Prior to his work our knowledge was confined to a few scattered records from explorers and missionaries and the only extensive scientific study, that of the Horn Scientific Expedition to Central Australia, which took place in 1895.

Finlayson's expeditions to central Australia from 1931 to 1935 are graphically described in his famous book 'The Red Centre'. He travelled with camels collecting and recording mammals and had a close working relationship with the Aborigines of the region, obtaining much information and help from them. Finlayson's studies were concentrated in northern South Australia but he also recorded information from Western Australia and the Northern Territory. His unequalled knowledge of the distribution and status of central Australian mammals was summarized in a scientific paper published in 1961. As well as distributional data, this paper also gave a variety of Aboriginal names for the mammals of the region.

Following Finlayson's work little mammal research was done in the deserts until the 1970s when the Western Australian Wildlife Research Centre started vertebrate surveys in Western Australia and the Northern Territory Government appointed biologists to study endangered species there.

It soon became apparent that many of the species which Finlayson found to be abundant and widespread were now rare or extinct. The species most affected were those of intermediate size between the large kangaroos and the small native mice, dunnarts and bats. Recent analyses of the decline of mammals in Western Australia by the authors and N. L. McKenzie have shown that declines and extinctions in mammals are confined to species with adult body weights between 55g and 5kg.

Why did this catastrophic decline occur? In order to answer this question it is first necessary to know something of the history of the decline: when did the various species

▲ Spinifex plains in the Gibson Desert Nature Reserve. Photo: A. A. Burbidge

disappear and what changes took place in the environment at that time? The only way to find this out was to repeat Finlayson's technique of asking the Aborigines.

We started this study in 1977 in the Warburton area. One of us, Phillip Fuller, knew several Aborigines from Wiluna and Laverton areas so we took a Laverton man with us to Warburton to introduce us to people there. During 1977 we visited a number of Aborigines. We showed them photographs and drawings of a variety of animals and we also had the benefit of knowing the Aboriginal names which H. H. Finlayson had recorded from adjacent areas to the east. This work taught us three things.

▼ Western Barred Bandicoot. A close relative of the Desert Bandicoot which once had a wide distribution in the arid interior but is now thought to be extinct. Photo: A. G. Wells

Firstly, the knowledge of middle-aged and elderly Aboriginal people about wildlife is astounding. This was, perhaps, not unexpected since Aboriginal people lived as hunters and gatherers and depended on their ability to locate animals for food. However, it goes further than this: we were told many details about the biology of the animals, – what they eat, where they breed, how many young they have, and so on.

Secondly, desert Aborigines have a very close relationship with the animals of their country. Animals are seen as part of the land. They are a most important part of Aboriginal mythology and culture and are of great significance in their beliefs.

Thirdly, many Aborigines have difficulty in relating to pictures of animals. Subsequent to the 1977 work we have, where possible, used "puppet" skins of actual animals to show people rather than photographs.

Some of our recent work has been carried out in collaboration with Dr Ken Johnson of the Northern Territory Conservation Commission and Mr Ric Southgate, a biologist employed under a World Wildlife Fund grant to study the Dalgyte or Bilby (SWANS Vol 13, No. 1, 15-17).

Our understanding of the disappearance of many desert mammals is now much greater, and a lot of new information about the various animals has been recorded. An example of this work has been described already by J. A. Friend, P. J. Fuller and J. A. Davis in SWANS Vol 12, No 3, pp 21-26. Some other highlights of this work are discussed below.

Brush-tailed Bettong or Woylie — *Bettongia penicillata*.

Most modern treatments of this small wallaby describe its former distribution as a southern one, including western New South Wales, north-western Victoria, southern South Australia and the south-west of Western Australia. Even the distribution given in the latest authoritative publication 'The Complete Book of Australian Mammals' is similar. These authors apparently ignored H. H. Finlayson's statements that it occurred in north-western South Australia and south-western Northern Territory. Our work has confirmed this and revealed an even wider distribution including much of the Gibson Desert. As with all mammals, different names are used for the same animal by people who speak the different dialects of the Western Desert language. However, a person who speaks a particular dialect may also know the names from two or three other dialects used nearby. Some of the names for the Brush-tailed Bettong are Putujuru, Karpitji and Yalkamarri.

In the desert the Brush-tailed Bettong lived in sandy spinifex country. It built a grass-lined nest in a spinifex hummock and would often run into a hollow log when chased. Woylies in the south-west of the State build a grass-lined nest under a fallen shrub and have also been found in hollow logs. We were told by one group of people from the northern Gibson Desert that the Putujuru made a short burrow under a clump of spinifex in the same way as Mala do. (Mala is the Rufous Hare-wallaby, *Lagorchestes hirsutus*.) This behaviour has not been reported before. According to our informants this species survived in the desert until the mid-1930s.

Desert Bandicoot—*Perameles eremiana*

Few Europeans have seen a live Desert Bandicoot. The last museum specimen was collected in 1931 at Gahnda Rockhole in the north-western Great Victoria Desert and the species is presumed to be extinct. The Desert Bandicoot is well known to Aborigines and some of their names for it are Walilya, Kililpi, Yinmi, Tjura and Maljurkura.

We were told it lived in sandy spinifex country and spent the day in a nest, which was in heaped up leaf litter or under a spinifex clump, often at the end of a short burrow. It ate termites, ants and grubs and had two young at a time. Aborigines captured the animal by tracking it to its nest and then jumping on the nest and grabbing the occupant. Apparently it survived until the late 1930s or 1940s.

Lesser Stick-nest Rat—*Leporillus apicalis*

Visitors to outback caves are often confronted with large structures of sticks and stones welded together with a tar-like substance. The structures are especially common in "breakaway" caves in the Gibson Desert but have been found as far west as Tallering Peak, Yuna and Mt Stirling. These structures were built by large native rodents called Stick-nest Rats. Two species are known—

▼ Sandplains and dunes in the Gibson Desert Nature Reserve. Wallabies and Bandicoots were once abundant in this habitat. Photo: A. A. Burbidge

▼ Brush-tailed Bettong. Photographed in the south-west, this species once extended through much of the deserts. Photo: A. G. Wells.

the Greater (*Leporillus conditor*) and the Lesser (*Leporillus apicalis*). Both species are thought to be extinct on the mainland, but, fortunately, the Greater Stick-nest Rat still occurs on Franklin Island, South Australia.

Older Aborigines from the central deserts know Stick-nest Rats well. Although we are not sure which species they were describing, excavation of the nests has revealed skeletal remains of the Lesser Stick-nest Rat. Some Western Desert language names for Stick-nest Rats are Tjuwalpi, Arrutju, Yininma, Tjurulpa, Punuwuru, Tanpinka, Intjurrka and Kutungu.

When the explorer Ernest Giles passed through central Australia in 1872 and 1873 he reported stick-nests in scrub and open country. "In these scrubs are met nests with twigs and sticks to the height of four feet, the circumference being fifteen to twenty. The sticks are all lengths up to three feet, and up to an inch in diameter. Inside are chambers and galleries, while in the ground underneath are tunnels, which are carried to some distance from their citadel. They occur in many parts of Australia, and are occasionally met with on plains where few trees can be found. As a general rule, they frequent the country inhabited by the black oak (Casuarina). They can live without water, but at times, build so near a watercourse as to have their structures swept away by floods. Their flesh is very good eating" (Giles 1889, Vol I, pp. 57 and 58).

Today this type of stick-nest can not be found and most Aborigines do not remember seeing them. However we did meet one old man from the Cavenagh Range who remembers such nests, which we believe were made by the Greater Stick-nest Rat. If this is so then it would appear that the Greater Stick-nest rat disappeared before the Lesser. We were told that in most areas stick-nest rats disappeared a long time ago but some of our informants remember seeing them about 40 years ago. We were also told that they ate grass seeds.

Evidence that stick-nest rats were declining before Europeans entered central Australia came from one old man from Papunya, Northern Territory. When we asked him about the animal, giving a name we knew from further south-west, he said he had never seen one but his grandfather had told him they once occurred in his country. He accurately described their nests, even though he had never seen one and had learnt about them perhaps 50 to 60 years ago.

Kuluwarri

One of the most surprising results of our work has been to find out about a mammal previously unknown to scientists. Several groups of people asked us why we did not have a skin of the Kuluwarri or Kulkuma. It was described as being a marsupial with soft, long fur, and of a similar size to or slightly smaller than the Burrowing Bettong, *Bettongia lesueur*. We were told it inhabited sand dune country with a spinifex (*Triodia*) dominated vegetation and that it ate grass. A feature described by several people was that it had long hair on its feet which helped it leave indistinct tracks. Some people said it was very quiet and some people said it was deaf because they could creep up to its nest in a spinifex clump and capture it. All people agreed that it was good "kuka" (meat). It was generally agreed that it had disappeared during the 1940s.

We have no idea what this animal was. We do know of two wallabies which might have occurred in the area and which we did not have in our skin collection. One, the Central Hare-wallaby, *Lagorchestes asomatus*, is known to science from only a skull collected near Lake Mackay, N. T., in 1931. The other, the Broad-faced Potoroo, was last collected in the south-west in 1870s but probably had a wider distribution since fossil remains have been found at North West Cape. On the other hand, it is possible that the Kuluwarri has never been seen by scientists, and became extinct before it could be recorded or studied.

It could possibly have been a bandicoot because while most people said it had one young at a time, some said it had two. H. H. Finlayson recorded the name "Kulwarri" from the Daly Waters areas of the Northern Territory and believed it was applied to a bandicoot but was not sure which species.

Our deductions about the reasons for the decline in desert mammals will be discussed in a future issue of SWANS.

ACKNOWLEDGEMENTS

We would like to express our thanks to the Aboriginal people at the many communities visited. Their friendly and warm welcome was at all times greatly appreciated. Without their co-operation and deep interest the work could not have been carried out.

Our thanks are also extended to the many advisers at these communities for their hospitality and help.

FURTHER READING

Burbidge, A. A. and Fuller, P. J. (1979) Mammals of the Warburton Region, Western Australia. *Records of the Western Australian Museum,* Vol 8, 57-73.

Finlayson, H. H. (1935). "The Red Centre". (Angus and Robertson: Sydney.)

Finlayson, H. H. (1961). On central Australian mammals. Part IV. The distribution and status of central Australian species. *Records of the South Australian Museum*, Vol 14, 141-191.

Friend, J. A., Fuller, P. J. and Davis, J. A. (1983). The Numbat in central Australia. SWANS, Vol 12, No 3, 21-26.

Giles, Ernest (1889). "Australia Twice Traversed". (Sampson, Low, Marston, Searle and Rivington: London.)

Strahan, R. (Ed.) (1983), "The Complete Book of Australian Mammals". (Angus and Robertson Publishers: Sydney.)

▼ Phil Fuller with Aboriginal elders and the chairman at Blackstone. W.A. The man on the right is holding a skin of the Western Native-cat and the man in the foreground is holding a Burrowing Bettong. Photo: R. Southgate.

Breeding by Little Bitterns in Nature Reserves

by Roger Jaensch, Field Officer with the Royal Australasian Ornithologists Union.

Female little bittern adjusting eggs (Photo copyright A.G. Wells).

One of the most attractive and intriguing waterbirds found in Western Australia is the Little Bittern *Ixobrychus minutus*. Because it usually feeds, roosts and breeds entirely within the cover of dense swamp vegetation, few observers have been aware of the behaviour of this tiny, 30cm-long heron. However, recent fieldwork by amateur participants in the Royal Australasian Ornithologists Union's Survey of Waterbird Usage of Wetland Nature Reserves has revealed much about the breeding ecology of the Little Bittern. Excellent photographic opportunities have also enabled Bert and Babs Wells to produce a unique comprehensive record of the breeding of this cryptic bird.

Background

Taxonomists recognise three principal subspecies of the Little Bittern. The piebald Eurasian subspecies spends the northern winter in the eastern half of Africa where it intermingles with the widespread but largely sedentary and more colourful African subspecies. Eurasian Little Bitterns occur as far east as northern India but are not strongly migratory and would not mix with Little Bitterns of the Australasian subspecies *I.m. dubius*.

In Australia, the Little Bittern may be found in reedbeds, flooded tea-trees and other dense swamp cover from north-coastal Queensland through southern Australia to the South-West. Rather isolated occurrences in the Kimberley, Top End and New Guinea and the lack of southern observations in winter months support the idea that Australasian Little Bitterns migrate northwards each autumn. Intensive fieldwork in both the north and south is needed to confirm this theory.

Data from the RAOU Waterbird Survey

Data from the RAOU's South-West Waterbird Usage Survey (1981-85) has partly mirrored the findings of the Atlas of Australian Birds (1977-1981) in regard to distribution of Little Bitterns in W.A. Most survey records have been of one to three birds at Jandabup Lake, Thomsons Lake, Forrestdale Lake, Benger Swamp (all on the Coastal Plain), Pleasant View Lake, Angove Lake, and Mettler Lake (all Albany Shire) Nature Reserves. In addition, discoveries of five birds at Kulunilup Swamp and seven at Yarnup Lagoon (both in Cranbrook Shire) have filled the distrubution gap between Manjimup and Albany and enhanced the conservation value of nature reserves in the Lake Muir region.

Experienced ornithologists in W.A. have been well aware of the relative ease of finding Little Bitterns on the Coastal Plain: these birds are usually less easily encountered in the

Eastern States. Well known non-reserve haunts in W.A. include Herdsman Lake, Mongers Lake and Wilgarup Swamp (near Manjimup) while a bird was recently seen at a sanctuary in the West Gingin area. Little Bitterns have been found breeding at some of these wetlands.

Apart from wandering immatures, most observations of Little Bitterns occur as a result of observers tracking down adult males calling to advertise their nest sites. RAOU observers had found one pair of Little Bitterns nesting at both Pleasant View and Forresdale Lakes, but loose colonies were located in 1983-84 at Jandabup Lake and Yarnup Lagoon.

▲ Eggs hatching (Photo copyright A.G. Wells).

The Jandabup Colony

The presence of a loose colony of Little Bitterns at Jandabup Lake (Wanneroo Shire) was fully established on 19 November 1983 when a third nest was discovered within 30 metres of two similarly-spaced nests which had been located by R. King and D. Watkins on 15 and 18 November. Although colonies of Little Bitterns of varying density (eg. one pair per three hectares to 15 pairs per hectare) have sometimes been noted in Europe, little or no published evidence of colonial nesting exists in Australia.

Three calling males were first heard at Jandabup about half an hour after sunset on 10 November. On still, late-spring evenings the deep, monotone croaking or grunting advertising calls of male Little Bitterns may carry for more than 100 metres.

The first nest, containing two half-grown young, was located about 20 metres from where one male had been calling on 10 November, in a tall dense clump of spike-rush *Baumea articulata*. This nest was empty within a few days but two striking stripey immatures were seen in a nearby rush clump on 7 December. The second nest was found in less dense rush and unlike the first, was not so close to the rush edge or as low to the waterline. It held 3 eggs on 18 November, but one hatched within a day and the nest was bare by 2 December.

It has been written of the Eurasian Little Bittern that nests within loose colonies may be occupied in stages. Again, this tallied well with the Jandabup colony as the third nest contained only one egg when first located and when the clutch of five was complete, the young in the other nests had all left. The third nest was in even less dense *Baumea* and was in a particularly favourable position for observation (from a hide) and flash photography of the sitting adults.

A Chronological Photographic Record

Bert and Babs Wells were most fortunate in being able to photograph the breeding cycle at the third nest, from incubation to the stage of young leaving the nest. The usual precautions were taken to minimise disturbance and the bitterns were apparently not upset.

During daylight at least, the parents approached and left the nest by clambering deftly through the rushes. Their long toes and strong claws are well suited to this method and it was not surprising to see these appendages well developed from an early stage in the growth of the chicks. Sitting birds will only fly from the nest if caught by surprise, skimming swiftly above the rush tips with shallow wing beats. In this attitude their trailing feet and pale wing patches are especially conspicuous.

Incubation

Incubation of the five eggs in the third nest took 20-21 days and during brief periods of observation, only the female was seen on the eggs. Generally a little rough in texture, the white eggs of the Little Bittern look remarkably like those of a pigeon. Nests are typically shallow and flat or slightly concave and are composed of many fine pieces of *Baumea* stems and seed heads.

Hatching of the eggs in the third nest began on 10 December and finished on 14 December. The fifth egg did not hatch but remained in the nest. Initially only the female was seen attending the young. She was particularly concerned at the threat of intruders and on one occasion, a Marsh Harrier passing overhead caused her to leave the nest in great haste, knocking a chick into the water (30cm below). The chick was later discovered and replaced in the nest by the photographers, after eight fat leeches had been removed from the chick's body! It was thought that this youngster survived to fledgling.

Feeding the Young

The male bittern was first seen at the nest on 16 December when he deposited black tadpoles (*Littoria moorei*?) into the nest bowl. Male

▲ Female disgorging tadpole to feed young. (Photo copyright A.G. Wells).

▼ Female leaving to search for food. (Photo copyright A.G. Wells).

birds are recognised by the extensive deep pink-red skin on their faces and bills: females gain a temporary pink flush when feeding the chicks. Males are generally more richly coloured on their necks and show a black rather than grey-brown back when seen in flight.

Over the following four days, both male and female were seen with equal frequency, bringing tadpoles to the nestlings. The pair were seen together on only one occasion. As the oldest chick grew strong enough, it would reach up and grapple with the adult's bill (perhaps stimulated by the red on the bill of the adult, as is the case with some other birds, eg. gulls), shaking it vigorously. This would induce the parent to regurgitate a tadpole, but the grappling chick would sometimes miss the food, ensuring that the less developed chicks would not miss out. As it was, two chicks were lost to unknown causes before 20 December.

The bittern chicks were able to adopt the cryptic bittern defence posture from an early stage: that is, necks fully outstretched and bills pointed skyward. When the oldest chick was about ten days old the partents would only come as close as the back of the nest, possibly concerned that their frequent visits would soon attract a predator. Alternatively, the parents may have been encouraging the young to leave the nest, also a safety precaution. On 20 December, both chicks were seen to leave the nest for increasing periods of up to two hours. No doubt they were being fed nearby by the parents. Rapid development of young and early nest-departure are well known aspects of breeding of Little Bitterns in Europe and to a lesser extent in Western Australia.

Conclusions

Rapidly falling waterlevels meant that the two roaming young and their parents would have left the nest vicinity soon after 20 December. Although observers had no guarantees that the young lived to be free-flying, there was no immediate reason to doubt it. The perils of harriers, rats, snakes, swamphens,

accidents and competition possibly necessitate the large clutch of four or five eggs for a heron that presumably lives for quite a few years. Of course, Little Bitterns dispersing from drying lakes at night face death from collision and nocturnal predators and many have been picked up dead or in unusual surroundings.

An old bittern nest was found in rushes near the three 1983 nests, indicating nesting in a previous year. More searching could reveal more nests but the significance of the colony cannot be properly gauged without exhaustive searches of all ready lakes in the region. It seems that minimal burning of the rush would be desirable so that dense clumps with old stems (for nest material) can develop.

▲ Chicks display a "cryptic pose" to blend with reeds. (Photo copyright A.G. Wells).

▼ Chick leaving the nest (Photo copyright A.G. Wells).

The Yarnup Colony

On 23 December 1983, D.G. Watkins detected at least six Little Bitterns calling at Yarnup Lagoon. On following this up on 2 February 1984, R. Jaensch saw seven adults (only one female) and located five active nests: one with three eggs, two with four eggs and two with four young. The nests were sited in dense thickets of *Melaleuca laterita* (to 2.5m high and 10m wide) in a band fringing one third of the 25 ha lagoon. Most of the nest sites incorporated fine sedge, or spike-rush *Baumea articulata* growing within the *Melaleuca,* and were adjacent to extensive rush-beds in the lagoon. Water under the nests was mostly 20 to 40cm deep.

After five hours of careful searching, a further 14 nests of various ages were found in this belt (ie. 19 in total). Seven nests contained eggshells or 'fresh' material indicating use in the 1983-84 nesting season. Several instances of three old nests placed within two metres of each other suggested repeated use of a territory by a pair which built new nests each year.

Two of the active nests contained fresh eggs and the chicks were mostly less than 10 days old. These different stages and the seven recent nests could again indicate use of nests in stages, or otherwise repeat nesting by the five to seven pairs accounted for.

A fascinating aspect of behaviour by the adults was that if the sitting bird was flushed quietly from the nest, it would return to the nest within three minutes and harass the intruding observer from a distance of no more than 1.5 metres! Peering with neck horizontal and clambering at a level of half the height of the teatree thicket, the parent jabbed the observer and uttered sharp 'kuk' or 'khot' noises until he left the scene.

The Yarnup colony could well be the largest documented colony of the Little Bittern in Australia. Challenge to this claim may come from the Riverina districts of New South Wales but colonies of similar size may yet be found elsewhere in the South-West (eg. Kulunilup Lake.) The most serious threat to the Yarnup colony would be burning of the teatree fringe: 'cold burns' in surrounding scrub could enter the flooded thick teatree canopies but would stop in the reeds beyond. The bitterns seem to prefer the most mature teatree which is thickened with sedge and rush.

A Flora survey of potential agricultural land in the Ravensthorpe-Esperance mallee belt.

by M.A. Burgman, Consultant Botanist to W.A. Wildlife Research Centre

Some interesting botanical finds have occurred in the first year of a two year flora survey of mallee country to the north of current farms between Ravensthorpe and Cape Arid National Park (see map).

Of the 850 species and varieties of plants collected in the area in 1983, 95 (11%) are either rare, geographically restricted or very poorly known. Of these, 21 are considered to be very rare and possibly threatened by the current development proposals. For example, *Gyrostemon ditrigynus* was known only from the type collection made by L. Diels in 1909, 60 km north of Esperance. The species was collected in this survey 60 km east of Salmon Gums on the edge of the Dingo Rock proposed land release area. Urgent survey of this and similar poorly known species is necessary to establish their abundance, distribution and conservation status. Some of the other notable collections of rare species made in 1983 include *Gyrostemon prostratus, Adenanthos ilecticos, Ricinocarpos trichophorus, Leptospermum maxwellii* and *Andersonia macranthera.*

In 1979, the Rural and Allied Industries Council proposed that there were 2.6 million hectares of land between Ravensthorpe and Cape Arid suitable and available for agriculture. In response to this, the Western Australian Wildlife Research Centre initiated a botanical survey of these land release areas using funds awarded by the Australian Biological Resources Study (see SWANS 13 No. 1). The survey was undertaken by myself with technical assistance provided by biologist Shapelle McNee. The principle aims in the first year, 1983, were to compile a comprehensive flora list for the area and to obtain information on the distribution and conservation status of rare and geographically restricted plants.

A total of 2 250 km of roads, tracks and survey lines were used in the field sampling to ensure that there was adequate sampling of all soil and vegetation types in all seasons. In seven trips to the area, 19 900 km were travelled. An attempt was made to collect all plants in flower and fruit. The collections were dried and identified at the Western Australian Herbarium (with considerable assistance from the staff of that organisation). Voucher specimens for all identifications were retained in the Herbarium for future reference by botanists, ecologists and biogeographers.

The major families represented in the collections included the Myrtaceae, Leguminosae, Proteaceae and Asteraceae. The most important genera in terms of number of species were *Acacia, Eucalyptus, Melaleuca* and *Grevillea.*

The richness of heathlands in the study area is reflected in the fact that species occurring as shrubs less than 0.5 m in height made up 45% of the flora list. Mature mallee stands were the most extensive vegetation form but they had relatively few species.

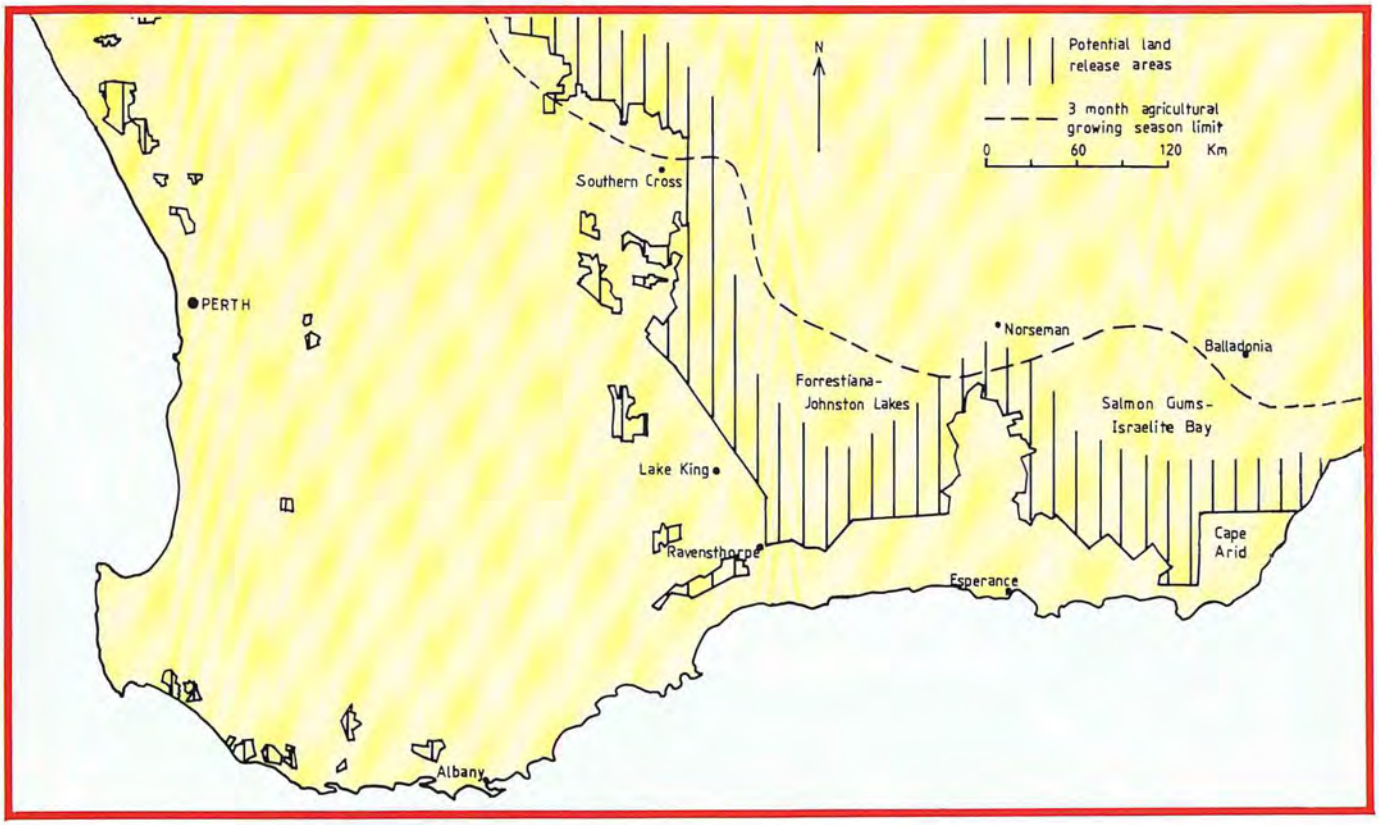
The study area has been accessible only since the late 1960s when the land was surveyed to assess its agricultural potential. Intensive collections in relatively small parts of the study area have been made recently by E. M. Bennett, K. Newbey and P. van der Mosel, and K. Newbey has conducted surveys for many species of rare plants. By comparing the flora list made in this survey with those made by these other botanists, it was estimated that 70%-80% of all plants in the area were collected in 1983. Thus, more than 1 000 plant species probably occur in this belt of mallee country.

The area is relatively undisturbed with introduced plant species making up just 2.6% of the total number.

Little botanical collecting has been done apart from that mentioned above, in part due to the remoteness of the area. It is not surprising that 154 species (19% of the total collected) were undescribed or of uncertain taxonomic status.

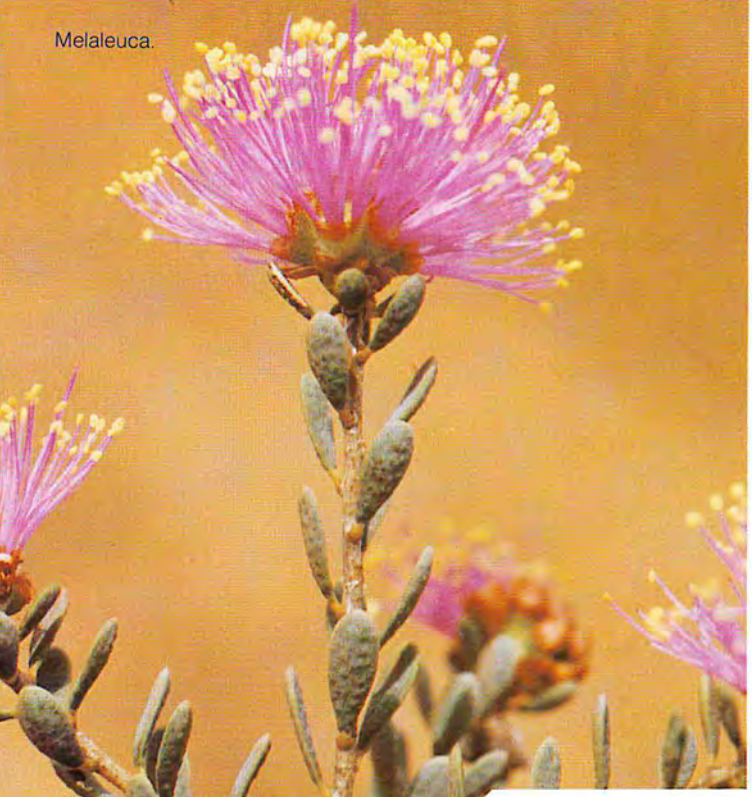
It is well known that there is a close relationship between the flora of south-west Western Australia and southern South Australia. These areas are now separated by the arid expanse of the Nullarbor Plain. However, in past ages of more amenable climate and lower sea levels, they were joined by a continuous tract of vegetation. This is reflected in the fact that 26% of the plants collected in this survey are also found in South Australia. About half of these species do not have a continuous distribution across southern Australia but are restricted to isolated areas, one in south-west Western Australia and the other in South Australia.

The implications for conservation of the proposed agricultural developments are difficult to assess because of the size and remoteness of the area, limited accessibility and the large number of undescribed and poorly collected plants. Many of the species thought to be rare and threatened are very poorly collected. It is possible that surveys will reveal that they are widespread or that they lie outside the proposed development areas (e.g. *Eucalyptus* sp. nov. aff. *diptera).* However, at least in the cases of *Conostylis* sp. nov., *Adenanthos ileticos, Ricinocarpos trichophorus, Eucalyptus forrestiana* subsp. *dolichorhyncha* and *Eucalyptus stoatei,* the ranges of the species are fairly well established and much of their probable remaining habitat co-incides with proposed land release areas. In the cases of *Eucalyptus merrickii, Eucalyptus* sp. nov. aff. *angustissima* and *Boronia* sp. nov. aff. *thryptomeneoides,* even though they are not well known, it is likely that significant portions of their habitat are threatened.



An urgent consideration in 1984 is to survey those species most threatened by land release and to recommend measures by which they may be conserved. Existing reserves will be surveyed briefly to provide a preliminary assessment of their adequacy in conserving the flora. Finally, an ecological study will be initiated in order to identify areas of unusual or rich flora. In this way, conservation reserves may be recommended that will best ensure the continued existence of the flora of the study area.

It is clear, however, that much more detailed survey work than is possible during the term of the current (two year) project will be required to adequately assess the impact of proposed land releases on the native flora. The present study, if nothing else, has demonstrated that the Ravensthorpe-Esperance mallee belt has an interesting and relatively poorly known flora with many endemic plants. A useful overview of the flora is now in hand, providing an opportunity for thorough consideration of the results of more detailed future surveys on specific areas chosen for agricultural land release.



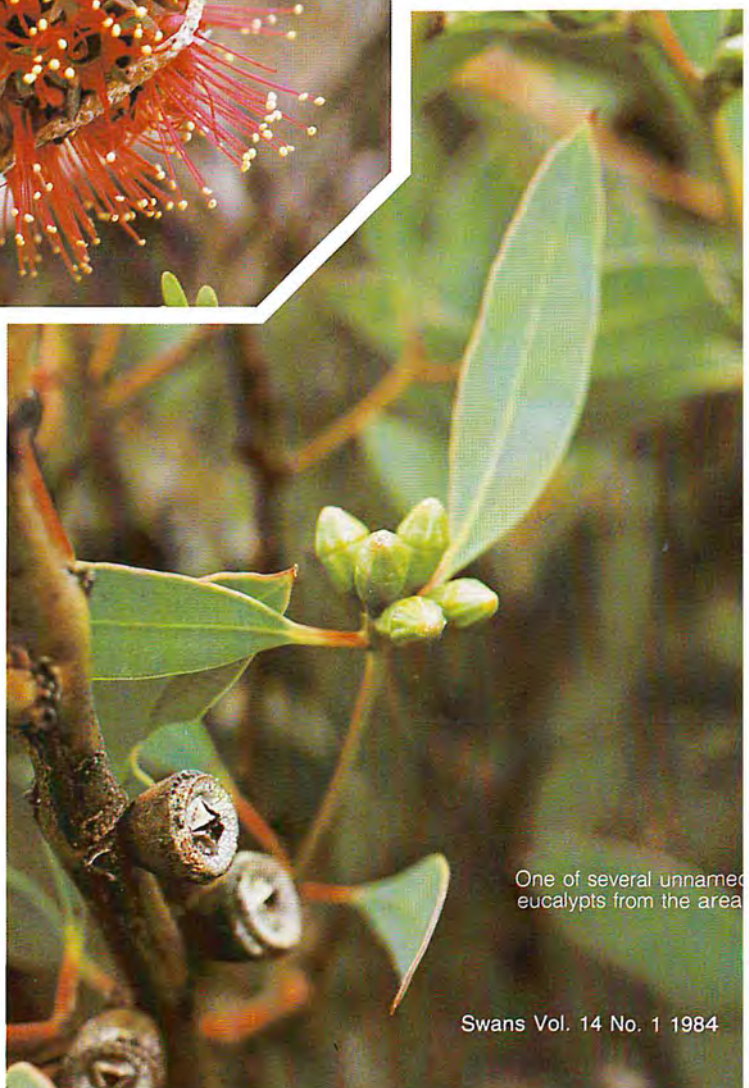
Melaleuca.

Trunks of the mallee eucalypt shown below.

Flora Survey — Some of the range of flowers observed.

Kunzea baxteri

Conostylis pauciflora



One of several unnamed eucalypts from the area

Thysanotus.

Rare red flowered form of Eucalyptus eremophila.

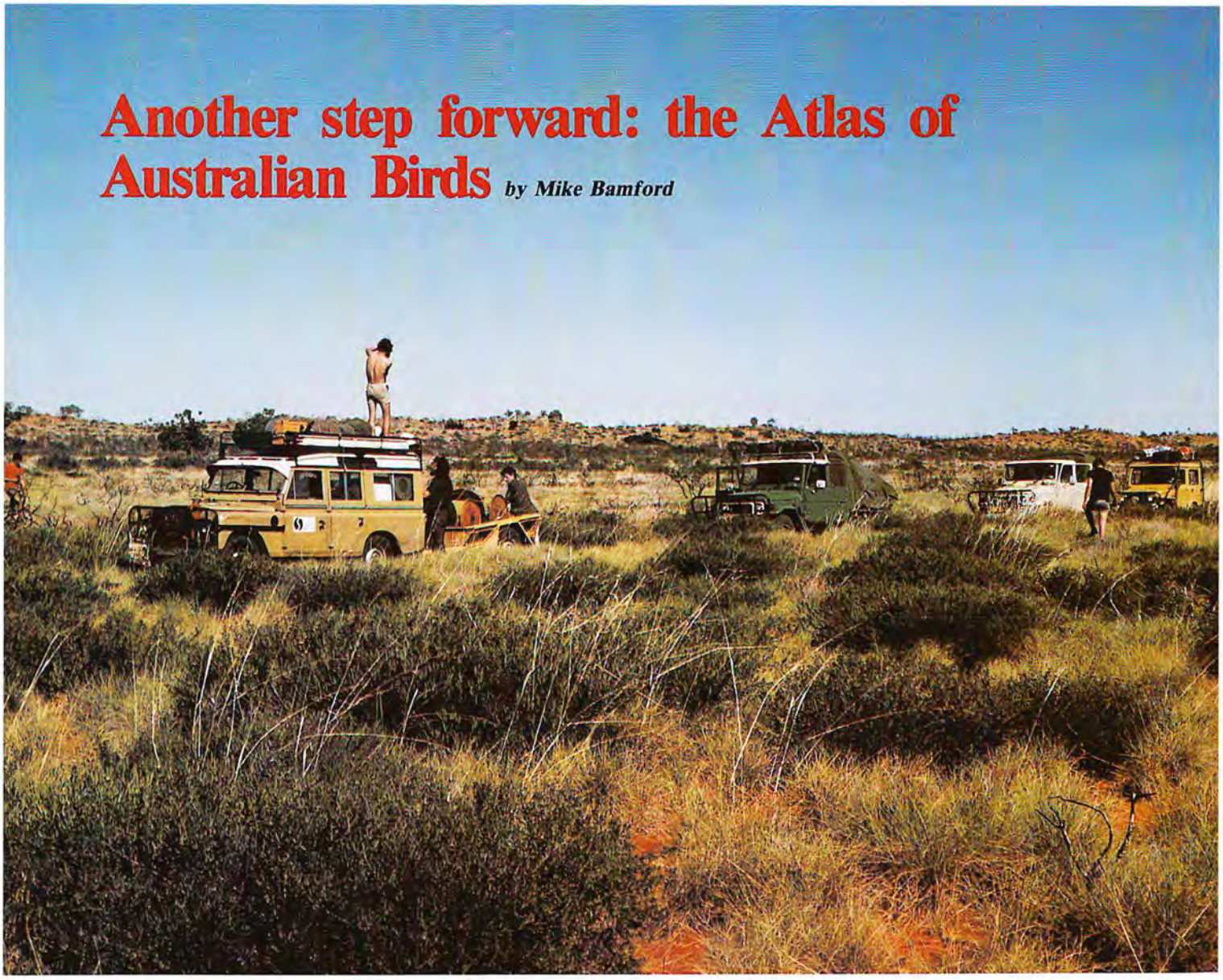
Adenanthos ileticos.

anksia media.

Eucalyptus angustissima.

Another step forward: the Atlas of Australian Birds

by Mike Bamford



Nineteen eighty-four will see the publication of a book unique in Australian ornithology, as it is based on the combined efforts of both professional and amateur bird-watchers. The book is an atlas, presenting distribution maps of the nearly 700 species of birds found in Australia, maps which are based solely on observations, rather than on the inspired guesswork which has been used to produce such maps to date. This emphasis on observation, and the fact that the data for these maps was collected by a union of amateur and professional ornithologists, make them truly remarkable.

Whatever a person's interests, it seems that almost everyone retains some of the fascination with animals that we all have as children, so ecological research involving wildlife which people can relate to often attracts attention. Birds are a group of animals which people can relate to readily, as they are extraordinarily conspicuous and have almost universal aesthetic appeal.

These fortuitous properties of birds bring together the most unlikely people, simply because of a shared interest and pleasure in watching and identifying them, and this unusual situation was put to good use by the Royal Australasian Ornithologists Union in the recently completed Atlas of Australian Birds. The result was not only a valuable contribution to our knowledge of the distribution of Australian birds, which is important for their conservation, but also increased contact between professional ornithologists and the large number of experienced, so called amateur bird-watchers.

The concept of a bird atlas was not a new one, as similar schemes, generally coordinated by experienced ornithologists but using volunteer observers have been carried out elsewhere, including in Britain and South Africa. However, the project was particularly ambitious in Australia because of the continent's vast size and the small number of observers themselves, the majority of whom occurred in the south-east and south-west corners of the country.

For the study Australia, including Tasmania and coastal islands, was divided into 812 one degree grid blocks, all of which were visited at least once from the beginning of 1977 to the end of 1981. Many, of course, were visited by a large number of people many times over. During the five years of field work, 2929 Atlassers contributed 2 715 000 records, each record consisting of the observation of a bird species in a particular grid block, many of the

records being accompanied by valuable information on breeding, behaviour and habitat.

In addition to the Field Atlas, as the results of this work have been called, an Historical Atlas was also produced, records being gleaned from publications and old notebooks to document changes in distribution, many of which have been due to the impact of European Man. For the period up to 1900, 30 400 records were found, 149 600 were found for the period from 1901 to 1950, and 594 100 were collected for the period from 1951 to 1976. Although by no means providing a complete picture, some of these historical records are of great interest, and many an Atlasser has considered wistfully the birds which were once known from his area.

The Atlas project was coordinated from RAOU headquarters in Melbourne by four full-time staff members and numerous volunteers. In addition, each state had a regional organizer and a vetting team, the volunteers in these positions liaising more directly with the Atlassers than it was possible for the Melbourne team to do. One of the roles of these organizers and vetting teams was to check record sheets for outstanding errors before they were sent on to the head office. Some of these errors were the result of putting down the wrong number for a species of bird, giving it that of a different species, while others were due to over-enthusiasm. It is surprisingly easy to see a particular bird that you especially want to see, or just to make an honest mistake in identification after a hard day in the bush. However, on many occasions, the unusual observation was correct, since information on the distribution of birds in Australia before the Atlas was incomplete for a large number of species, and no-one could be entirely sure where things would and wouldn't turn up. This is not to imply that the Atlas has completely remedied this situation; only that it has contributed to our knowledge of Australian birds.

Much of the field work for the Atlas was carried out by observers

▲ Looking for migratory waders at low tide at Bush Point, just south of Broome.

▲ Looking for waterbirds in a swamp near Bunbury.

▼ Looking for waterbirds in Fogg Dam N.T.

near their own homes and on weekend trips and holidays. It was just a matter of keeping binoculars, identification guides and notebooks handy, as well as having a fairly good idea of where you were. There were inevitable problems with well-populated areas, favourite holiday spots and even the grids along major country highways receiving more attention than other localities, but as these inequities became apparent, it was possible to mention sites lacking in coverage in the RAOU newsletter. Observers, either individually or in groups, could then plan bird-watching trips of the greatest value. However, despite the way in which Atlassers manipulated their holidays to go to the most out of the way places, it was beyond the bird-watcher in the family car to get to the more remote corners of the Australian continent. To get to isolated stretches of coastline in the north, and to some desert areas of the inland, ornithological expeditions were organized at great personal expense and, of course, reward. In August, 1981, just four months before the Atlas was due to finish, the last unvisited grid blocks, in the Great Sandy Desert of Western Australia, were reached by one such party in four-wheel drive vehicles.

The continuous monitoring of incoming data, which was used to be able to advise on and plan for bird-watching trips, was followed by more detailed analysis after completion of the field work. This analysis, and the preparation of the Atlas, took a period of almost two years, the four full-time staff again being assisted by a veritable army of volunteers. The Atlas consists of 730 pages, within which is contained, in addition to the distribution maps of almost 700 species of birds, information on the environment, such as climate and vegetation, which can affect the distribution of birds. Six hundred and forty-eight birds are illustrated in black and white, and with each entry is given general information on the species, so the Atlas can serve as a reference book for more than just distributions. When the Atlas is published, the total cost of the entire project will come to about $500,000.

When the field work for the Atlas ended, it must have come as a shock for families who no longer had to plan their weekends and holidays around the need to get to certain locations which required more coverage, but several schemes, some already in existence, others newly created, were able to draw upon the enthusiasm sparked by the Atlas. The Nest Record Scheme, a project designed to bring together observations made on breeding birds by individual bird-watchers, received a boost in the number of contributing ornithologists, while the RAOU has begun to coordinate volunteers to carry out regular bird surveys at localities of their own choosing, thus getting some ideas on specific communities and local abundances. In W.A., an annual Bird Report was instigated to gather the observations made by keen bird-watchers over each year. The resulting annual publication will make this data readily available for anyone interested in particular species or trends over periods of time. Similar reports are already in operation in some other states, and all these schemes are both complementary to the Atlas and could be used, in the future, to keep it up to date.

In addition to projects such as these, the Atlas has generated an interest in Australian bird-life which has resulted in the formation of locally active bird-watching and study groups consisting of members of the growing RAOU. In the tradition of the Atlas and the RAOU, these groups include both professional biologists and so-called amateur "birdo's". In many ways, this interest in and awareness of birds that the Atlas fostered across a broad spectrum of the community is as important as the information it collected for the conservation of Australian birdlife. The continuing interest produces more information, but the growing awareness of birds that has developed is just as vital. people are what conservation is about, too.

The Management of Small Bush Areas in the Perth Metropolitan Region

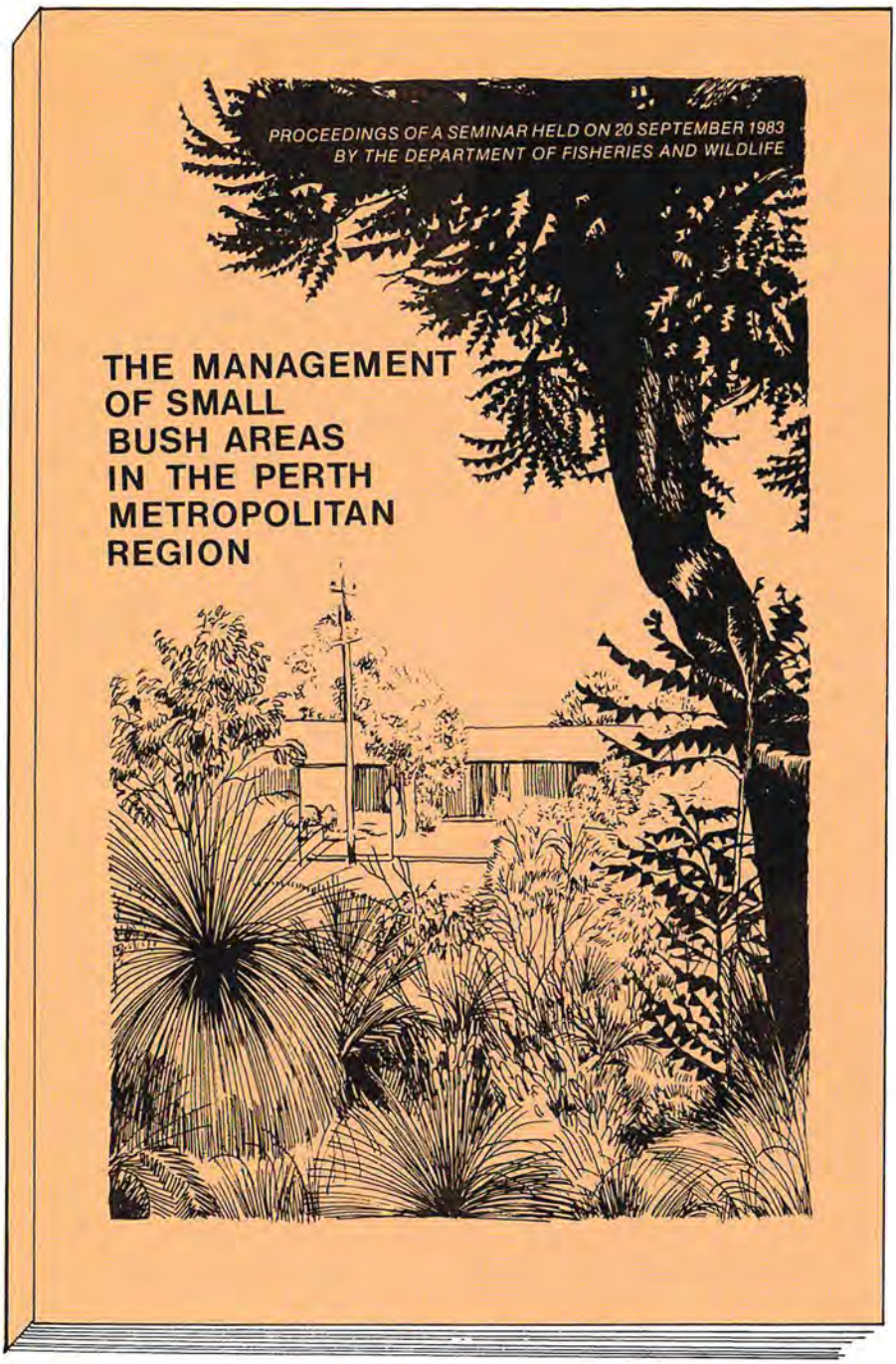
by Robert Powell

On 20 September 1983 the Department of Fisheries and Wildlife held a seminar on the management of small bush areas in the Perth Metropolitan Region. Over a hundred persons attended.

The Department recognises the importance of bush areas in Perth, not only for conservation, but also in providing knowledge and enjoyment to the public. Since Perth suburbs contain a confusing mixture of cultivated plants, bush areas are necessary if people are to become familiar with local species of plant and the associations in which they combine; one can also learn about the animals that are associated with the plants. The Department is becoming increasingly involved with bush areas in the Metropolitan Region, particularly in providing advice to other organizations. It is currently in the final stages of preparing a draft management plan for Metropolitan nature reserves. The aim of the seminar was to bring together ideas on managing bush areas, and to later summarize those ideas for reference.

The seminar's programme was a busy one. During the course of the day, twenty-two speakers, from Government Departments, biological consultancies and amateur groups, spoke on different aspects of the topic. Below are a few of the things learnt.

Dr Neville Marchant, botanist at the W.A. Herbarium, spoke generally about the flora of the Perth Metropolitan Region. The flora of



south-western Australia is richer than that of most parts of the world and is remarkable in containing a very high proportion of species (68%) that occur naturally nowhere else. The flora of the Perth Metropolitan Region is comparable in richness and interest with the south-west generally. Of the many different plant communities, the Darling Scarp and some of the swampy areas on the eastern side of the Swan Coastal Plain have the richest flora in the Region, which has a total of about 1500 species. In addition about 400 introduced species have become naturalized, of which some create problems in the management of bush.

The Herbarium is presently working on producing a "Flora of the Perth Region" (from Gingin to Bunbury).

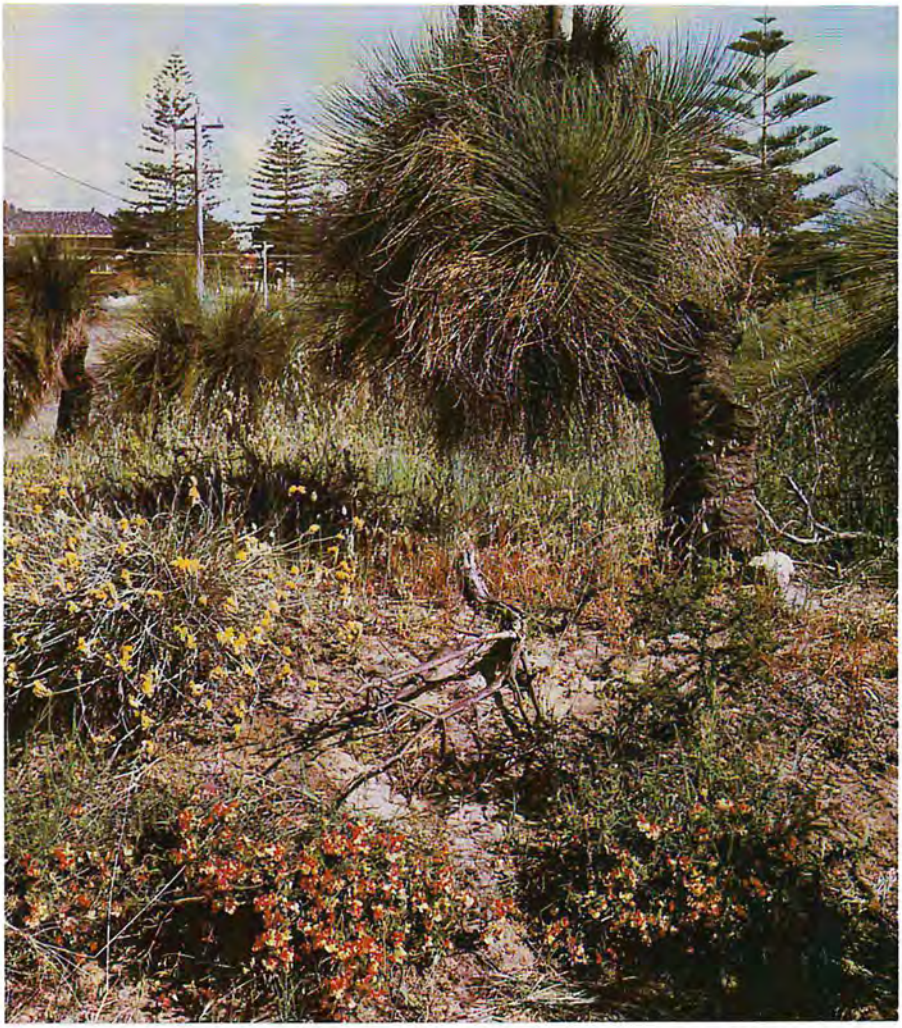
As well as preserving samples of the local flora, bush areas also provide important habitat for fauna. Although most mammals have disappeared from bush within Perth suburbs, many bush areas contain a good variety of birds, reptiles and insects.

Dr Ray Hart, of R.P. & R.M. Hart, Consulting Biologists, discussed the results of a survey he had made of bush birds in Metropolitan bush areas. Although some bird species have adapted well to to the suburbs, other species persist only in bush areas. The latter species are not even attracted to large-scale plantings of native shrubs, such as the botanic gardens in Kings Park (which do, however, attract large numbers of several honeyeater species).

Suburban bush areas serve to encourage more birds as part of the human environment. Many birds are migratory or nomadic, and bush areas assist the movements of such species.

If bush is to be retained and managed it is necessary to gain the interest of local residents and the local Council. Mr Peter McMillan, while a lecturer at Claremont Teachers College, organized groups of College students to compile information on such areas. This information was presented to groups of local residents formed into Habitat Action Committees, who could then approach their Councils to seek the preservation of the areas. In many cases the Council was agreeable to the idea, and a number of bush areas have thus been preserved. In concluding, Mr McMillan emphasized that there was little point in having a bush reserve without making a continuing management input.

In managing suburban bush, two of the chief problems are fire and weeds (introduced plants), both of which are connected, directly or indirectly, with people. Dr Paul Wycherley, Director of Kings Park, displayed data to show that virtually all the fires in the Park during the last forty years were started, either accidentally or deliberately, by people. Weeds, especially veldgrass, provide extra fuel and thus increase the intensity of such fires, which may severely damgage the tree canopy as well as the understorey. The following winter the veldgrass regenerates strongly, suppressing the recovery of the local vegetation. If several such fires occur only a few years apart the



▲ This small area of road verge, bordering Broome Street, Cottesloe, is managed by a committee of residents. It contains 37 species of naturally occurring plants. At left are grey cottonheads *(Conostylis candicans);* at bottom is *Leschenaultia linarioides.* (Photo R. Powell.)

▼ Warden's board, Hollywood Reserve. (Photo R. Powell).

native vegetation does not have time between the fires to restore its canopy and density, and so to crowd out much of the veldgrass.

The largest, most damaging, fires are usually those that are lit by incendiaries, who normally operate in places where they will not be seen. Dr Wycherley explained that, for this reason, foot and bicycle access to the bush was being improved, and interpretative material was being provided, to encourage people to enjoy and use the bush more.

Other speakers provided further data relevant to managing suburban bush. Ideally one should study the area over a long period. Miss Alison Baird, botanist, provided an example where this had been done. The University of Western Australia marked out quadrats in Kings Park in the late 1930s; some of them remained for thirty years or more, and were used as sites for periodic study of the vegetation. They provided valuable information on the effects of fire and the spread of veldgrass, and the life cycles of many of the plant species. Many of the common low shrubs are long-lived, resprouting from below ground after fire, and changing very little is size over thirty years.

There were several sessions on particular areas. Mrs Goldie Cannon, Gardener, Nedlands City Council, gave a talk entitled "Hollywood Reserve: A Community Affair". This reserve, bordered by Smyth Road, Karella Street and Dalkeith Road, has become increasingly used and enjoyed by local residents, many of whom have also involved themselves in helping manage the reserve. There are groups of weed-pullers and wardens (particularly children), and reserve neighbours have volunteered to report fires. Corresponding to the increased community involvement in the reserve, the deliberate lighting of fires, and other vandalism, has declined markedly. Publicity and encouragement are needed to foster people's interest; this requires some work but is well worth the trouble.

Only three years ago the reserve's vegetation was very degraded. Since then the prevention of fire has allowed the survival of seedlings from natural regeneration. Moreover Mrs Cannon has developed several techniques for weeding at different times of the year, and this has further enhanced natural regeneration in weeded areas.

Parts of this reserve have been converted from bush into garden by the planting of native but not local species. There still remains, however, the opportunity to retain other parts of this odd-shaped reserve as bush, and thus preserve a sample of the original vegetation of the City of Nedlands. The juxtaposition of garden and bush could be retained as a feature of interest.

Bungendore Park, in the Town of Armadale, also involves public participation, in the form of the Bungendore Park Management Committee. The Committee is chaired by an Armadale councillor, and its membership is composed of representatives of the Forests Department and several local groups. One such group is the Armadale-Kelmscott Branch of the W.A. Wildflower Society; Mr Kim Sarti of that Society outlined the aims and work of the Committee. The work has included surveying the Park and rehabilitating some old gravel pits. The reserve is being publicized by articles in the local newspaper and by a pictorial display. Work to encourage, but control, public access is to be undertaken.

▲ Restoration of old gravel pit, Bungendore Park. After spreading back the topsoil, the disturbed areas are either left to regenerate naturally or are planted with local species. Here, jarrah and marri and some associated understorey species are being planted. (Photo K. Sarti).

▼ Path for access and fire control—Peter Day's bush, a top of Darling Scarp, Darlington. (Photo P. Day).

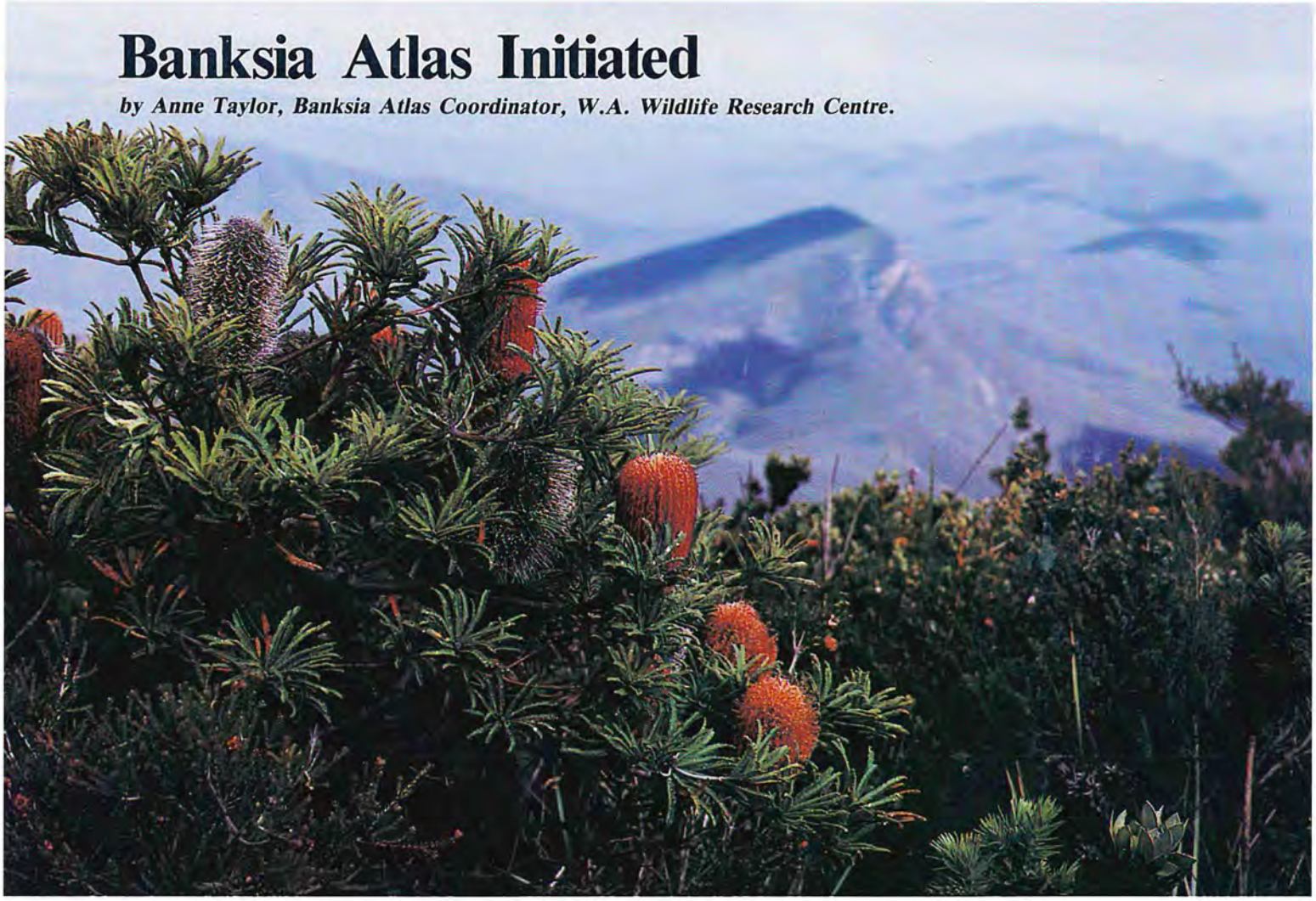
With sound mangagement even very small areas of bush may be maintained in good condition. Mr Peter Day of the Eastern Hills Branch of the Wildflower Society manages a third of a hectare of bush (part of his house block plus an adjoining vacant lot) at the top of the Darling Scarp. By the use of some simple techniques involving access, weeding and fire control, he has been able, without undue effort, to maintain and improve the condition of the bush, while bush on most adjacent lots is rapidly deteriorating.

The last session, on management planning, served partly as a summary. Two things are of vital importance in managing bush areas: (1) gaining the interest and co-operation of the public, and (2) formulating and using a sound plan of management. The two should be combined: a draft management plan should be well publicized, and the final plan should take into account the knowledge and ideas of the public (as expressed in submissions) and should encourage the public to take an active part in management.

The papers given at the seminar have been compiled and published, and will shortly be available free of charge from the Extension and Publicity Office Department of Fisheries and Wildlife, 108 Adelaide Terrace, Perth W.A. 6000.

Banksia Atlas Initiated

by Anne Taylor, Banksia Atlas Coordinator, W.A. Wildlife Research Centre.



▲ *Banksia brownii* in flower at Bluff Knoll in the Stirling Ranges National Park Western Australia. (Photo S. Hopper).

The Banksia Atlas, an exciting new three year project, has been initiated recently. It is the first Australia-wide plant mapping project to be undertaken using volunteer contributors.

Joint funding by the Australian Biological Resources Study (ABRS) and the Western Australian Department of Fisheries and Wildlife has allowed the appointment of a national coordinator and a computer programmer to run the project. As the coordinator, I will be based at the Western Australian Wildlife Research Centre. It is appropriate to base the *Banksia* Atlas in Western Australia, because 57 of the 72 named species occur in the State. Moreover, staff at the Wildlife Research Centre have four years' experience in running pilot plant atlas projects aimed at developing suitable systems to run successfully a project like the national *Banksia* Atlas.

▲ *Banksia petiolaris* a ground flowering specis of banksia. (Photo S. Hopper).

The Atlas project aims to involve interested persons throughout Australia in recording information on the distribution, habitat and biology of *Banksias*. Information will be sorted and analysed by computer enabling rapid retrieval of desired tabulations and maps for any particular species.

The role of volunteers in assisting in the collection of scientific data is particularly relevant in a country the size of Australia which has only a relatively small number of professional botanists located mainly in capital cities. Collaboration of this nature is well established in other countries particularly the U.K., whose Atlas of the British Flora was completed in 1969 largely on the basis of records contributed by amateur botanists throughout the country.

In Australia, the Royal Australasian Ornithologists Union

(RAOU) recently enlisted the help of 3 000 volunteers over a five year period (1976-81) to provide records for their Australian Bird Atlas.

Between 1979-83 the Department of Fisheries and Wildlife selected kangaroo paws and orchids as the subjects for two pilot projects to test the feasibility of computer based flora mapping using amateur volunteers for field recording. Both projects have been successful in highlighting problems and providing experience to Wildlife Research Centre staff in running a volunteer contributor Atlas Project.

Banksias were considered to be most suitable for a nation-wide flora mapping project for the following reasons:-

They are typically Australian and have distinctive, easy to recognise flowers.

A field guide and recent taxonomic study are readily available.

They are of considerable commercial value—the *Banksia* cut flower industry is currently worth in excess of $1 m. a year.

They are important as a food source for honey eating birds, mammals and insects which also act as pollinators for the plant.

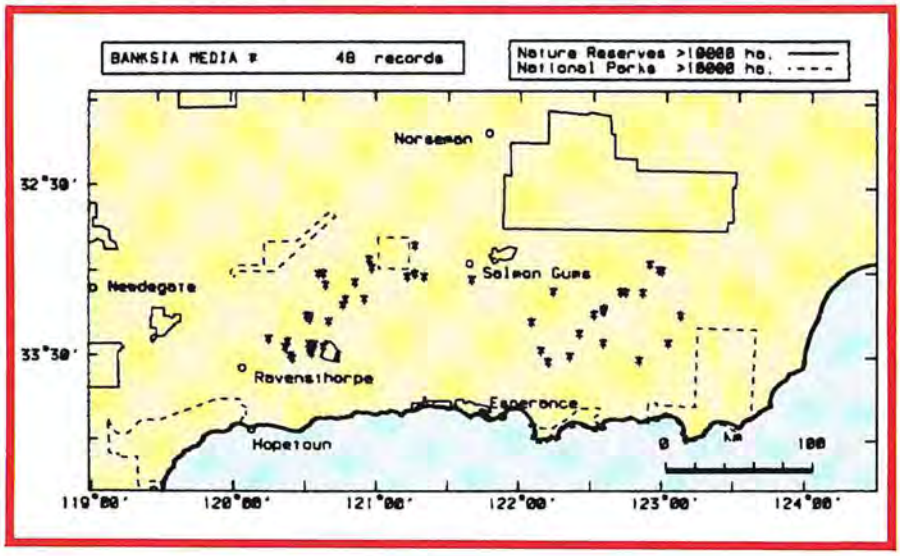
Hybrid forms (e.g. *B. marginata x B. integrifolia)* are known to exist but have been scarcely studied.

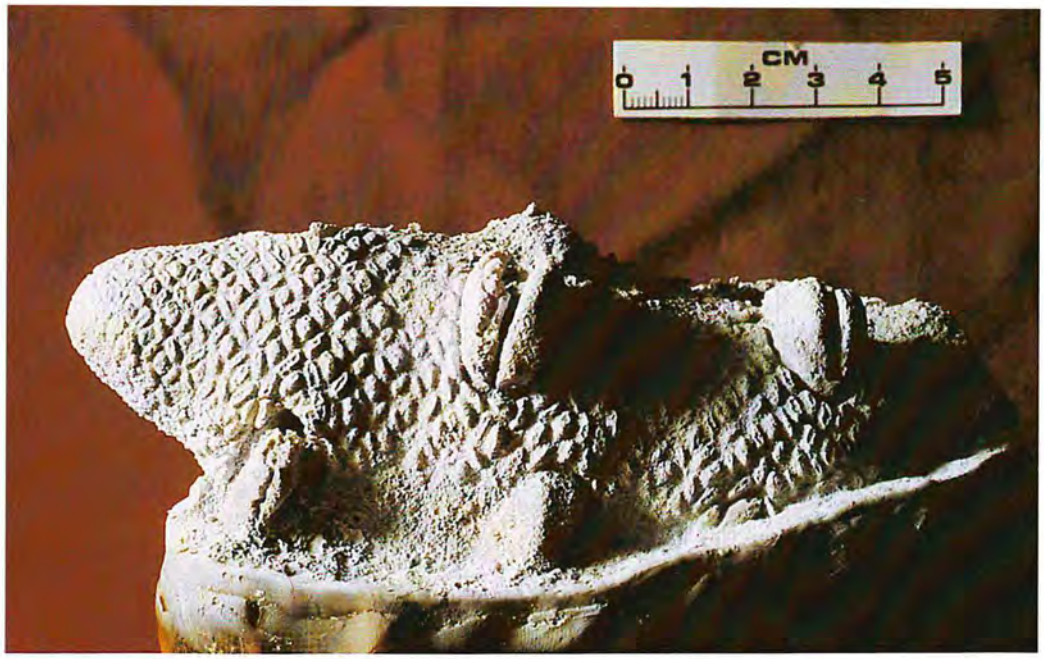
One of the main outcomes of the project will be up-to-date maps on the abundance and distribution of all *Banksia* species throughout Australia. Such maps are the first stage in understanding the environmental factors limiting species distribution.

They are also an extremely important tool enabling immediate assessment of the conservation status of a species by observing its distribution both throughout its range and within protected areas such as National Parks/Nature Reserves. Possible threats to a species' existence by, for example new land releases or mining ventures, can be quickly

▲ Survey results are stored on a computer and appear in display form on the screen as above.

▼ Enlargements of the display are possible to show individual sites.





▲ Fossilized *Banksia archaeocarpa* a species from the Eocene era. The fossil was recovered from the Kennedy Ranges of W.A. (Photo K. McNamara).

▲ White-cheeked Honeyeaters on *Banksia baxteri* at Cheyne Beach W.A. (Photo S. Hopper).

▼ Honey Possum on *Banksia coccinea* also photographed at Cheyne Beach. Birds and small mammals both take part in Banksia pollination (Photo S. Hopper).

identified and appropriate action taken where necessary.

Information gained on the habitat and biology of *Banksias* including pollination mechanisms and the response of different species to fire, will be useful in preparing reserve management plans, particularly when the fragile populations of rare or endangered species need to be safeguarded.

Apart from these valuable functions it is also hoped that the Atlas will provide a meaningful and enjoyable reason for contributors to travel in the bush and to learn more about their countryside and native plants first hand.

How the Atlas will Work

1) Each contributor receives a book of recording sheets, instruction manual, field notebook and map.

2) Completed record sheets sent to the Wildlife Research Centre, Wanneroo.

3) All information received entered into computer.

4 Six monthly progress report and interim distribution maps sent to all contributors.

A number of field trips are planned both to localities where rare or endangered *Banksias* are thought to occur, and to remote areas which would otherwise probably not be covered. Contributors to the Atlas will have the opportunity to join in many of these trips.

All volunteers are welcome in this project whatever their previous knowledge of *Banksias*. Field trip–identification sessions will be held for those who would like extra instruction.

Interested persons please contact Anne Taylor [Ph. (09) 405 1555] at the Wildlife Research Centre, P.O. Box 51, Wanneroo, 6065.

FROM THE EDITOR

Recent changes introduced by the Government will result in control of Wildlife activities within Western Australia being transferred from the present Department of Fisheries and Wildlife to a new Department concerned with Land Management in Western Australia.

This issue of SWANS will be the last that I will produce as Editor.

I would like to thank readers for the many encouraging letters I received over the years and the rapid growth rate in readership has been a great reward to me.

I have received strong support from the staff of the Department, particularly from Wildlife Research staff at the Wanneroo Wildlife Research Centre, many of whom have had several of their research projects featured in SWANS.

Western Australia has a truly unique flora and fauna and it has been my privilege to increase the awareness of Australians towards the State's unique biological heritage.

M.L. Taylor
EDITOR.

Department of Fisheries & Wildlife District Offices

Head Office: 108 Adelaide Terrace, Perth. Tel. (09) 325 5988
Wildlife Research Centre: P.O. Box 51, Wanneroo. Tel. (09) 405 1555.

Albany:	Stirling Terrace Tel. (098) 41 4811
Broome:	Hamersley Street Tel. 92 1121
Bunbury:	Stirling Street Tel. (097) 21 2598
Busselton:	12 Queen Street Tel. (097) 52 2152
Carnarvon:	Fishing Boat Harbour Tel. (099) 41 1185
Dongara:	Carnarvon Street, Port Denison Tel. (099) 27 1187
Esperance:	Wallaceway Centre Tel. (090) 71 1839
Fremantle:	Collie Street Tel. (09) 335 6369
Geraldton:	Fisherman's Wharf Tel. Wildlife — (099) 21 3510 Fisheries — (099) 21 1956
Jurien Bay:	Bashford Street Tel. (095) 48 1048
Kalgoorlie:	Maritana House, Boulder Road Tel. (090) 21 4148
Karratha:	Welcome Road Tel. (091) 86 8289
Lancelin:	Gingin Road Tel. (095) 78 1111
Ledge Point:	Derburgh Street Tel. (095) 78 1078
Mandurah:	15 Leslie Street Tel. (095) 35 1240
Manjimup:	Department of Agriculture Tel. (097) 71 1299
Moora:	Padbury Street Tel. (095) 41 1055
Mt Magnet:	Hepburn Street Tel. (099) 63 4174
Pingelly:	Park Street Tel. 273
Shark Bay:	Knight Terrace, Denham Tel. (099) 48 1210
Waroona:	PWD, S-West Highway Tel. (095) 33 1331
Wongan Hills:	Quinlan Street Tel. (096) 71 1395
Wyndham:	PWD, Sharp Street Tel. 61 1342

WILDLIFE DISTRICTS IN WESTERN AUSTRALIA