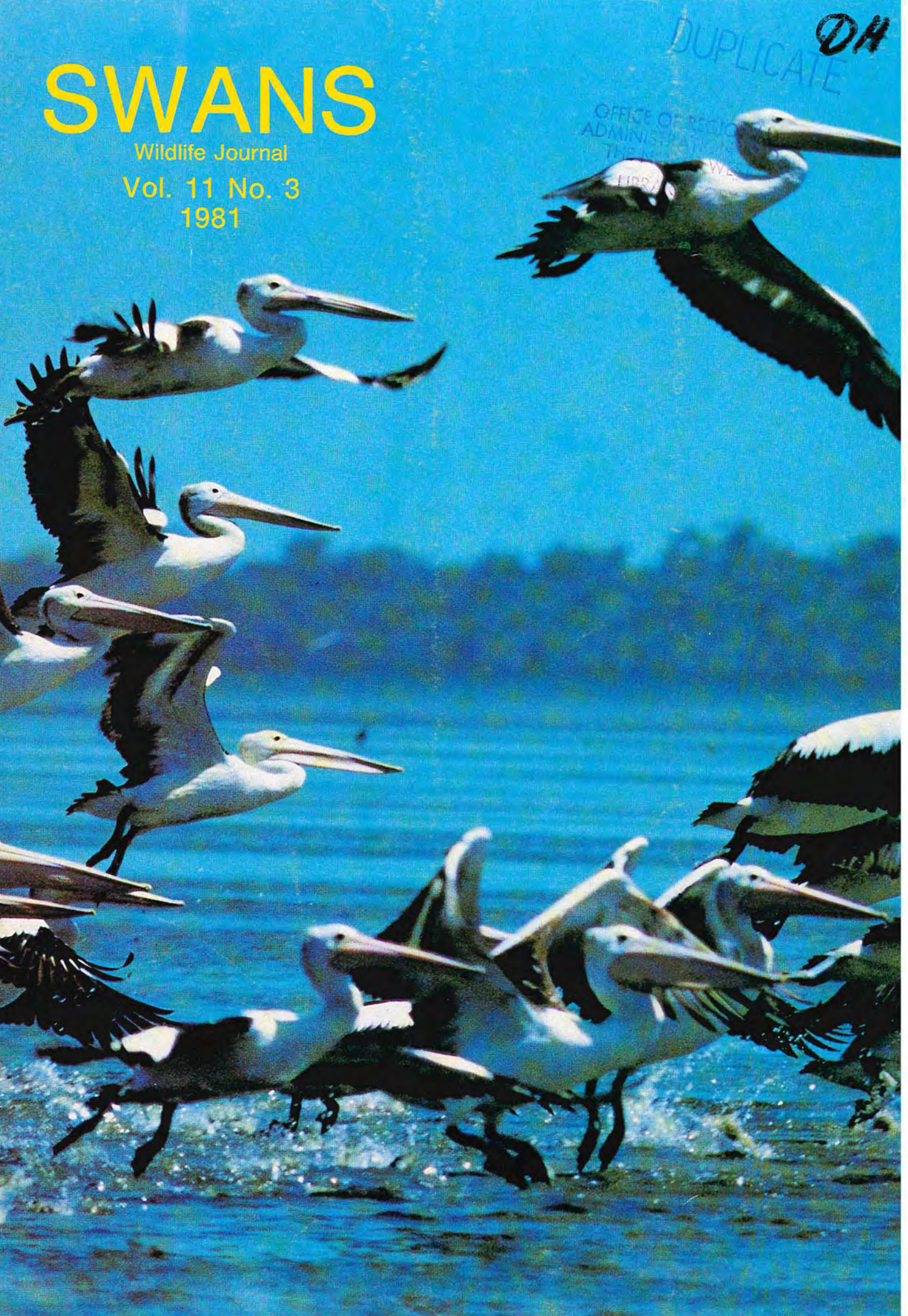


# SWANS

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# SWANS

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*The support of the public is an  
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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  
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**Editor:  
Malcolm Taylor  
B.Sc.(Hons.) Dip.M.S.**

**Assistant Editor:  
Kevin Carhart**

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## COVER PHOTO

A massed flight of Pelicans on an inland lake of South West Australia, for story see Waterbird Survey Commissioned on page 11 (Photo copyright A. G. Wells).

# Rare Marsupial Captured in Gibson Desert

by Clifford Young

It is a small animal, soft-furred and about the size of a domestic mouse but there the similarity ends. With its pointed snout, large darting eyes and sharp teeth it is an aggressive little ball of energy, by night leaping and scrambling with ease over its rocky habitat, maintaining its balance with the help of an extraordinary tail — twice the length of its combined head and body.

Despite its distinctive tail, the Long-tailed Dunnart (*Sminthopsis longicaudata*) has eluded biologists for the past century to the extent that it was classified as one of Australia's rarest marsupial mice. That is, until earlier this year when a colony was discovered in the Gibson Desert by members of the Western Australian Wildlife Research Centre.

Prior to this discovery, scientists only knew the animal from three whole specimens, two of which were collected last century. One of these was collected "somewhere in the Pilbara, Western Australia", and the other resides in the National Museum of Victoria under the vague notation that it was collected "in Central Australia". The third specimen was found at Marble Bar and presented to the Western Australian Museum by R. N. W. Bligh in 1940. In the same museum are some bones identified as belonging to a Long-tailed Dunnart which were found among the chewed-up remains in a Ghost-Bat roost, also near Marble Bar.

In addition, the damaged remains of a female Dunnart, identifiable by its long tail, were collected up by a biological survey team from the Western Australian Wildlife Research Centre in the Hann Breakaways, south of Warburton in 1976.

Although the team was looking for small marsupials, the discovery of the Long-tailed Dunnart was unexpected and represented an exciting find, immediately raising hopes of finding a live specimen. The Officer-in-Charge of the Research Centre, Dr. Andrew Burbidge takes up the story:

"Until we found the remains of the Dunnart, I had paid little attention to the animal. We started our series of desert surveys in 1975. We picked

1975 because it was a good season following three years of good rains, winter and summer, throughout the centre of Australia.

"This had resulted in prolific rejuvenation of vegetation accompanied by a massive increase in the number of small mammals, a typical reaction in the desert. We continued the surveys into 1976 but this wasn't nearly so successful as the

number of mammals was then declining.

"However, while surveying an area around the Hann Breakaways, south of Warburton, we collected the remains of a small marsupial mouse from a clump of spinifex. It was almost certainly a Long-tailed Dunnart and we immediately saturated the hills with metal traps

▼ The long-tailed Dunnart (*Sminthopsis longicaudata*) — Photo Copyright A.G. Wells.



hoping to catch a live specimen. Two days later we admitted defeat and earmarked it for a later expedition.”

Over the next few years, the Research Centre continued with its series of desert surveys, working in the Gibson Desert, the southern edge of the Little Sandy Desert and the Great Sandy Desert but at no stage was another Long-tailed Dunnart sighted. At that point, Dr. Burbidge concluded that, either the animal was indeed rare, or there was something wrong with the trapping technique being employed.

Previously, all small marsupial trapping was carried out using metal traps designed in Europe and the United States. These traps operate on the principle of attracting the animal with bait, for example nuts, to a position where a trapdoor closes behind them, cutting off escape.

Although the Long-tailed Dunnart is carnivorous, preferring a diet of insects and small lizards to nuts, it had been hoped that the oily smell of nuts would have proved attractive or, if that failed, that the animal's

curiosity and territorial sense would have led it to explore the foreign object placed on its doorstep. This had proved successful with other small carnivores on occasion but Dr. Burbidge thought something new may have to be employed for the Long-tailed Dunnart.

“As an experiment, we decided to return to the Hann Breakaways where we found the previous specimen and try to catch a live animal with pit-fall techniques, an age-old method we had adapted for use with small animals in 1978.”

The pit-fall trap as used by the Department's biologists, consists of lengths of plastic piping set vertically into the ground over stretches of suitable countryside and connected by long rolls of nylon mesh 'fencing' about 45cm high. They work on the theory that any small marsupials coming up against the mesh while foraging for food at night will become alarmed and travel along the fence until falling into one of the holes created by the pipe set in the ground. In the case of the Long-tailed Dunnart, it was thought that the holes would have to be particularly deep as the animal, like many of its relations, probably was capable of quite high leaps from a standing position.

The new expedition was scheduled to get underway in June, 1981, but problems began almost immediately.

Dr. Burbidge, who had planned to lead the expedition, was involved in a traffic accident shortly before the starting date and was forced to withdraw from an active role to direct the field party by radio from the Centre's headquarters at Wanneroo.

The second major hurdle came when the field party reached Warburton and attempted to obtain permission from the traditional Aboriginal occupiers of the land surrounding the Hann Breakaways to trap for animals in the hills. Despite several days of negotiations with tribal elders, permission was refused as the land was considered sacred. The Aboriginals objected to the party's planned use of rock drills which were needed to sink the lengths



▲ The rocky habitat provided many problems to field staff trying to set pit-trap lines. A rock-drill was necessary in many cases. — Photo J. Lane.

▼ In some exceptional cases the ground defied even a rock drill and small charges of explosive were needed to break enough rock to set a trap. — Photo J. Lane.



of pipe into the rocky habitat.

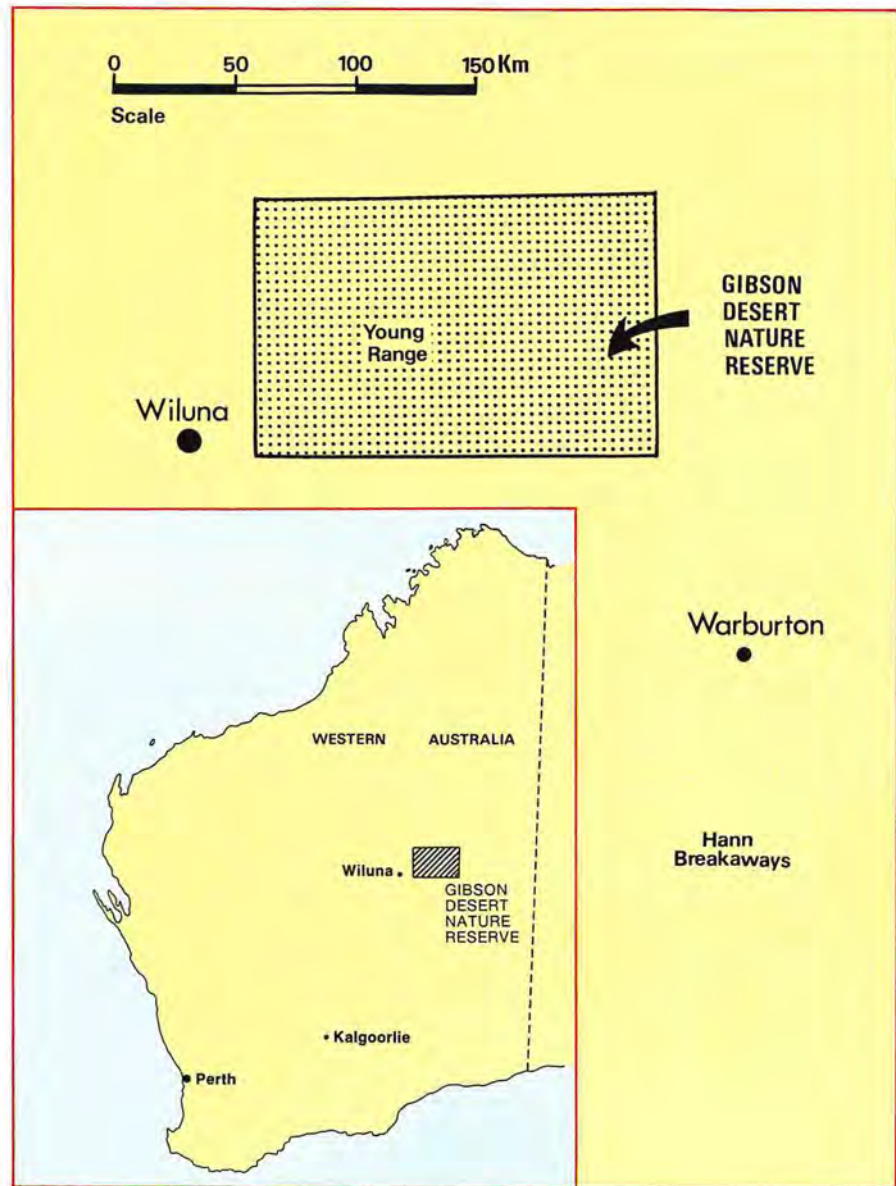
Following this setback, a radio consultation was held with Dr. Burbidge and it was decided the field party should travel further north to the Young Range, a range of hills and breakaways within the Gibson Desert Nature Reserve. Although the country wasn't anywhere near as steep or as rugged as the Hann Breakaways, the team was still confident that the habitat was similar enough to harbour Long-tailed Dunnarts—if they still existed.

Any doubts that the animal existed or about the effectiveness of the new trapping technique were laid to rest on the very first night spent at Young Range. Although only one and a half trap lines were set that night due to the difficulties imposed by the terrain and the need to use the rock drill to set each pipe, an inspection the following morning showed one Long-tailed Dunnart — a male — alive and well at the bottom of one of the holes.

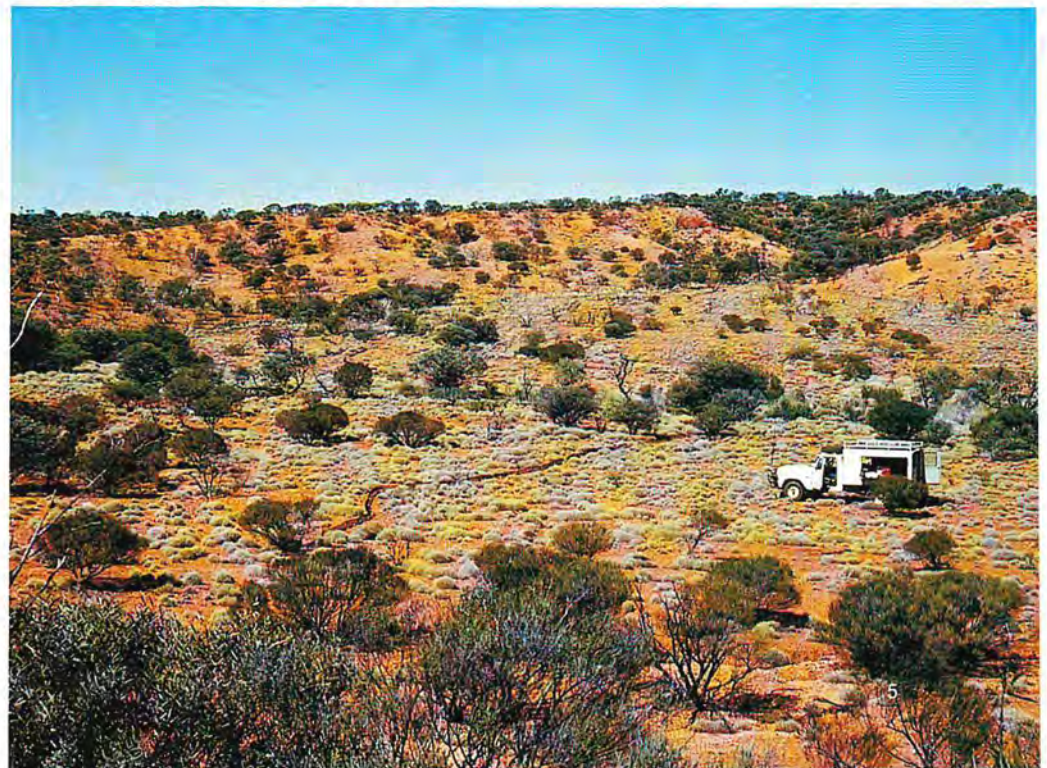
Jubilant, the men immediately despatched the animal to Perth and set to work rigging more trap lines. By the end of a week, another eight animals had been captured, of which five were released.

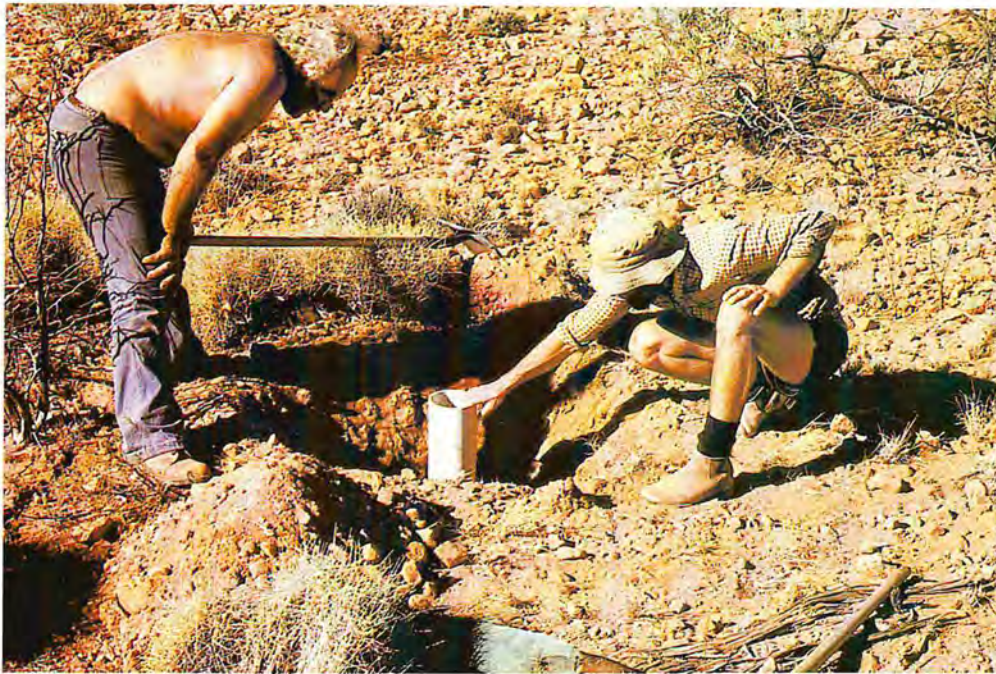
Those animals kept, including the one sent to Perth, consisted of two males and two females. Surprisingly, of the nine Dunnarts caught, only five were found in the pit-traps. The remaining animals were caught in standard metal Elliott traps baited with strips of bacon. This was despite the fact that the same traps had failed to catch any Long-tailed Dunnarts when used in the same area during a previous field trip in 1978. Dr. Burbidge considered the reason for this year's success may have been related to an increase in numbers of the animal in the area, or possibly to the use of bacon — a new ploy. Most of the animals caught were last year's young, perhaps pointing to a particularly prolific breeding season.

Another interesting little marsupial caught at the same time and place as the Long-tailed Dunnarts was the Red-eared Antechinus, *Antechinus macdonnellensis*. Although



▼ A Pit-trap line has been set up across the valley floor in this view of the Young Range. However, most captures of the Long-tailed Dunnart were made on the broken ridges fringing the valley. — Photo P. Fuller.





▲ After a hole was dug, a piece of pipe was set into the ground as a pit-trap.  
— Photo J. Lane.



▲ A roll of mesh was laid linking the pit-traps to guide small marsupials into the traps.  
— Photo P. Fuller.

▼ The first Long-tailed Dunnart captured alive using the new techniques is here displayed before the long trip to Perth. — Photo J. Lane.



occupying the same habitat, the Red-eared Antechinus has about four times the body weight of the Long-tailed Dunnart and is probably less agile. Its diet would also be different, probably eating larger prey such as geckos and possibly even young Dunnarts.

An interesting adaptation which both animals show to their rocky environment is striated (ridged) footpads enabling them to climb smooth slippery rocks with relative ease.

After keeping the animals under observation at the Wildlife Research Centre's headquarters for several weeks, Dr. Burbidge sent them to Dr. Patricia Woolley at La Trobe University in Melbourne. Dr. Woolley is an acknowledged expert in the breeding and rearing of small marsupials, and it is hoped that detailed information on the Long-tailed Dunnart's reproductive cycle will come from her work.

Asked if he still thought the Long-tailed Dunnart was rare after the success of this year's expedition, Dr. Burbidge said information on the animal was still scanty. However, two locations where the animal existed were now known and it was thought that the Long-tailed Dunnart was probably widespread throughout the desert area in similar rocky habitats.

To what extent they still occur in the Pilbara, taking into consideration that the early specimens were found near Marble Bar, is not yet known. Dr. Burbidge considers they may only ever have occurred on the fringes of the Pilbara and are basically a desert dwelling animal.

The Department of Fisheries and Wildlife has no specific plans at present to carry out follow up research on the Dunnart but will continue the surveys of their habitats as opportunity allows.

In addition to its success with Long-tailed Dunnart, this year's expedition proved particularly worthwhile in pioneering new methods of sampling rocky type habitats, an area which in the past has been poorly surveyed.

# The Mottlecah – A Plant in Need of a Place to Grow

With its large grey leaves and crimson flowers, the Mottlecah (*Eucalyptus macrocarpa*) is one of the most striking ornamental mallees in the Western Australian wheatbelt. A recent survey located 191 populations of this plant distributed through 18 Shires over a maximum range of 500 kilometres. However, of these, less than seven percent occurred in Nature Reserves or National Parks. The greatest number of populations occurred on road verges and private land, and the majority of individual plants also occurred on private land. Much of the emphasis for the conservation of these plants in their natural habitat

therefore must be placed on the owners of private land and the general public.

*Eucalyptus macrocarpa* was first noted in 1840 by botanist James Drummond who described it as “a shrubby Eucalyptus with large glaucous (coated), coriaceous (leathery) foliage and conspicuous red flowers, succeeded by large seed-vessels.”

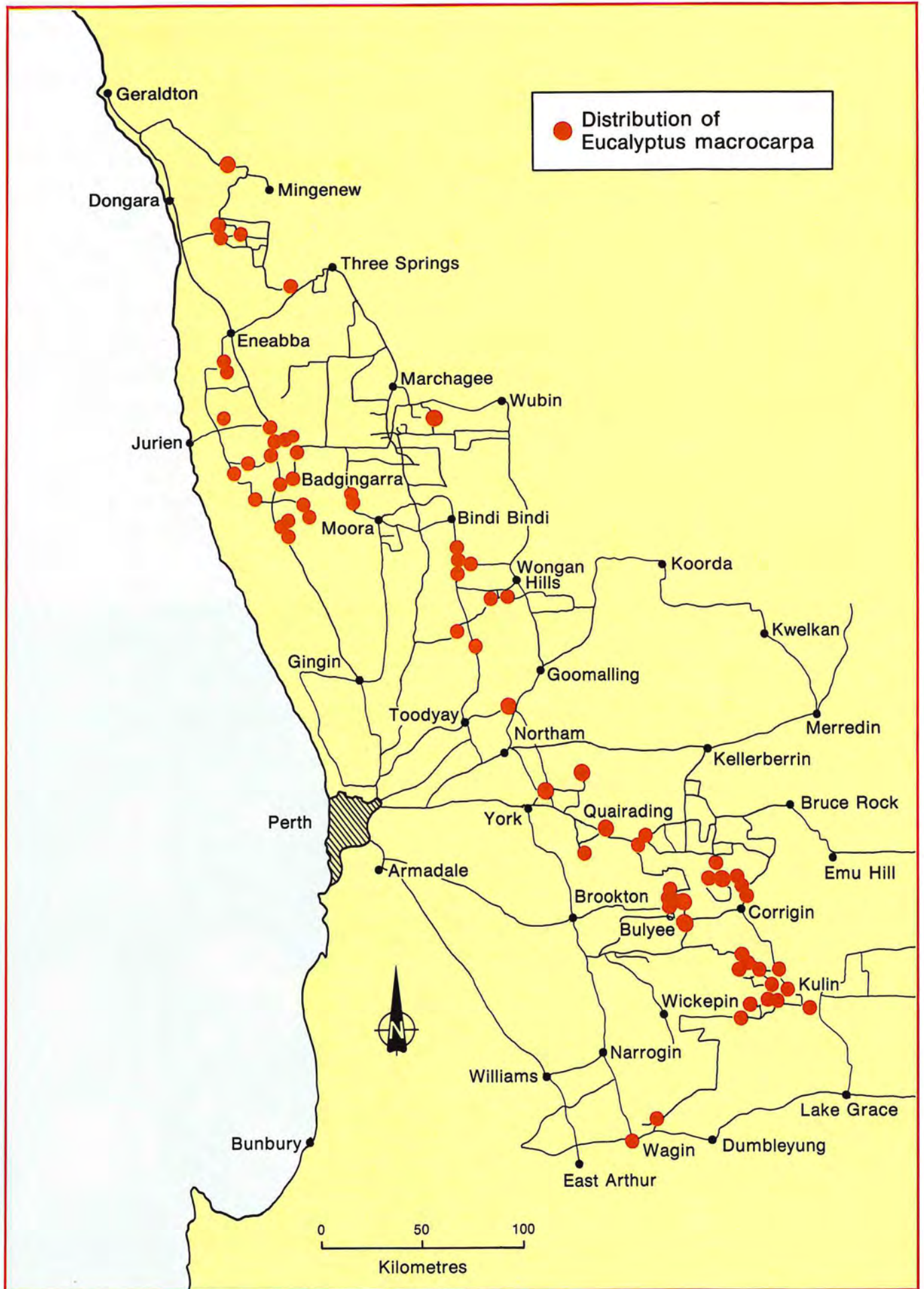
A scant 48 years later, the species was considered threatened by new settlers and in danger of disappearing forever. Botanist F. von Mueller claimed “as this bush is only sparsely distributed in its own region, it is to

be feared, that, in course of time, by the methodic burning-off to which the scrublands are subjected by the settlers, it will pass altogether out of natural existence like so many other local plants of Australia, to make space for the upgrowth of pastoral vegetation.” In addition, von Mueller said *E. macrocarpa* had “claims for ornamental culture, especially when scenic effect was desired, as the flowers were so large and handsome, while the ashy grey of the foliage contrasted remarkably with the ordinary green of shrubberies.”

Fortunately von Mueller was inaccurate with his forecast that this species would disappear. However, it is still in danger and will need particular attention to ensure its future survival.

▼ The Mottlecah (*Eucalyptus macrocarpa*) has the broadest fruits and largest flowers of the Eucalypts.







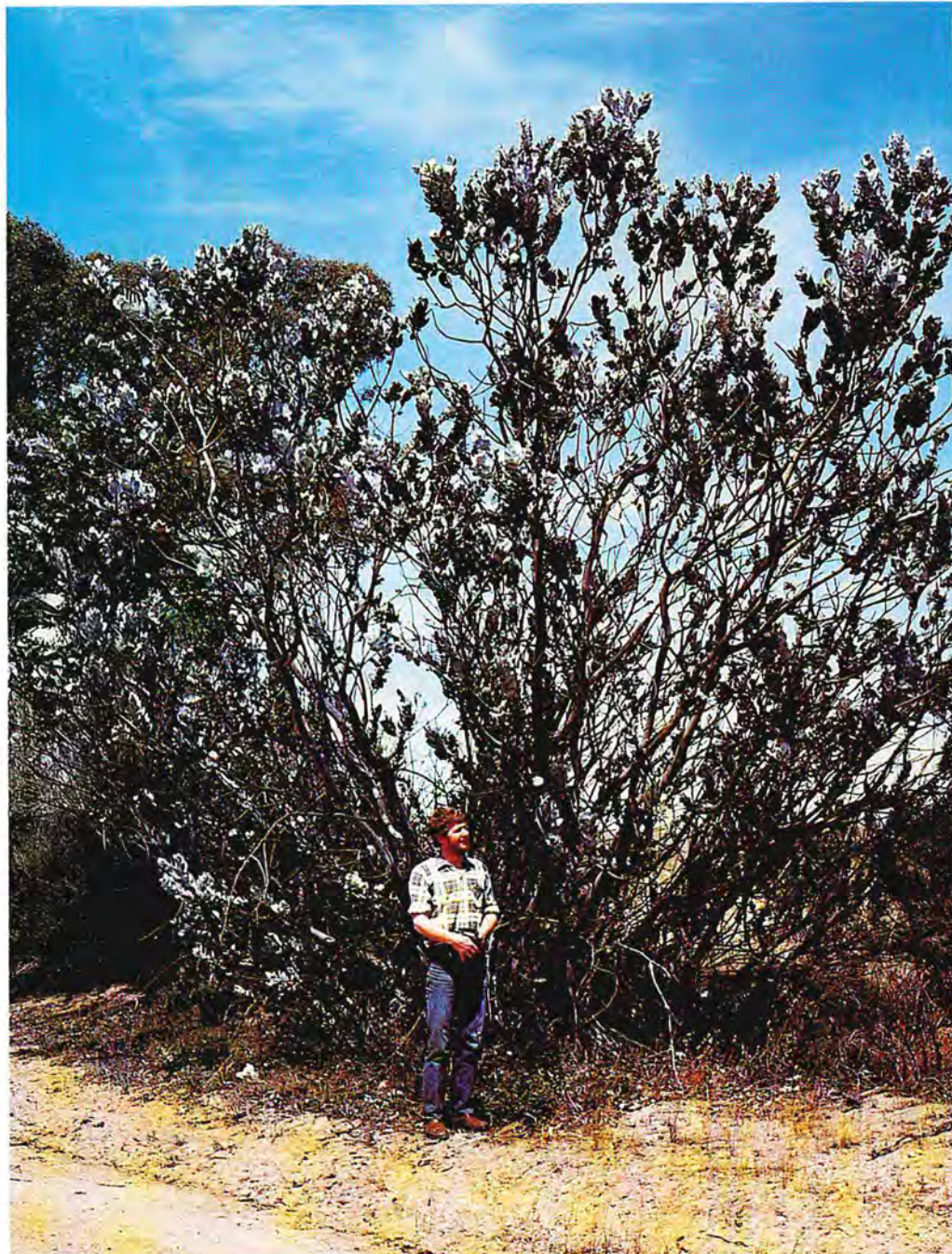
In addition to its ornamental beauty, *E. macrocarpa* is of considerable botanical interest, having the broadest fruits and largest flowers of the eucalypts. Although some geographical variation in size is evident, the plant's flowers can be as large as eight centimetres in diameter. Most flowering takes place between late winter and early summer. Despite the size of its flowers and fruits, the plant itself grows no taller than about five metres and is often considerably less.

The range of the plant is limited, extending in a relatively narrow zone of open sandheath from just north of Geraldton, via the Hill River, Piawaning, Meenaar, Tammin and Bruce Rock to Kulin, where it usually occurs in small patches (Gardner 1979).

Chippendale (1973) provided a small map indicating that *E. macrocarpa* extended in a narrow belt from Geraldton south-south-east to Pingelly, with outlying north-easterly populations in the Mullewa district.

A survey detailing *E. macrocarpa*'s geographical variation was carried out between June and October last year by S.D. Hopper, T.J. Fetherstonhaugh and N. Caputi. Twenty-five populations throughout the plant's range were sampled for morphometric analysis. The largest leaf, fruit, bud and flower were collected from up to 20 plants on a linear transect in each population and a total of 31 measurements were made on each plant whenever possible. These included five leaf dimensions, plus an estimate of leaf glaucousness, 13 fruit dimensions, five bud dimensions, six flower dimensions and plant height. The results will be detailed in a report currently being prepared by the Department of Fisheries and Wildlife (Geographical Variation and Conservation Status of *Eucalyptus macrocarpa* and *E. macrocarpa* x *pyriformis* Hybrids).

In addition the number and location of each population was plotted onto cadastral maps of the Western Australian Department of Lands and Surveys so that land



▲ Although many of the plants grow to considerable sizes, (as in the above photograph) others never grow larger than shrubs (See below) — Photo S. Hopper. ▼





▲ A hybrid species, *Eucalyptus macrocarpa* X. *pyriformis* shows its large and handsome flowers. — Photo S. Hopper.

ownership could be determined. In this way, the number of populations and plants on private land, road verges, Nature Reserves, National Parks, vacant Crown Land etc. was established (see accompanying table).

A consistent geographical pattern was evident in the distribution of population means in all analyses. Populations in the so-called near coastal northern heathlands from Moora west to Cataby and north to Mt Horner were, with few exceptions, differentiated from inland populations occupying the central wheatbelt from Piawaning south-eastward to Wagin and Kulin.

These “nothern heathland” and “central inland” races were distinguishable in a number of characteristics. Northern heathland plants were usually smaller in stature, they had fruits smaller in diameter with staminal rings and discs that projected less above the rim, they had longer pedicels, and their leaves were shorter, more rounded and less glaucous. However, there were some populations with intermediate characters between the two races.

It was also found that the northern heathland race was far less common than the central wheatbelt race, being represented by only nine percent of the total individuals counted and 25 percent of the known populations.

As a result of the survey, the Department of Fisheries and Wildlife has lodged several applications for land to be set aside as Nature Reserves at sites where suitable populations of *E. macrocarpa* occur, particularly the northern heathland race. Where populations or individual plants occur on private land, the owners will be asked to exercise due consideration to the plant's future conservation.

<b>NUMBER OF POPULATIONS</b>			
	<b>Northern heathlands race</b>	<b>Central wheatbelt race</b>	<b>Total</b>
Crown Lands			
i) Conservation Reserves	3	10	13 (6.8%)
ii) Road Verges	25	58	83 (43.5%)
iii) Other	5	16	21 (11.0%)
Private Lands	14	60	74 (38.7%)
<b>Total</b>	<b>47 (24.6%)</b>	<b>144 (75.4%)</b>	<b>191</b>

<b>NUMBER OF PLANTS</b>			
	<b>Northern heathlands race</b>	<b>Central wheatbelt race</b>	<b>Total</b>
Crown Lands			
i) Conservation Reserves	100	2117	2 217 (14.9%)
ii) Road Verges	510	1871	2 381 (16.0%)
iii) Other	204	2406	2 610 (17.6%)
Private Lands	545	7126	7 671 (51.6%)
<b>Total</b>	<b>1 359 (9.1%)</b>	<b>13 510 (90.8%)</b>	<b>14 879</b>

# Waterbird Survey Commissioned

by J.A.K. Lane



Photo Copyright  
A.G. Wells

The Department of Fisheries and Wildlife has recently contracted with the Royal Australasian Ornithologists Union (R.A.O.U.) to undertake a four year study of waterbird usage of selected Wetland Nature Reserves in the South West and Eucla Land Divisions of the State.

The objectives of the project are:

- a) To assess the role and importance of the Wetland Nature Reserve System in the conservation of waterbird populations in the south-west of the State.
- b) To obtain information on waterbird usage to help in the management of Wetland Nature Reserves and in the resolution of conflicts between different uses.
- c) To provide appropriate experience for future monitoring of waterbird abundance.

Total funding amounts to \$93,000 over five financial years. This will be used by the R.A.O.U. to cover the salary of a full-time project co-ordinator, as well as travel expenses, office rental, computing costs,

stationery, printing, telephone, postage, and other administrative costs. Funding is from Departmental Research Funds (\$50,200) and from the Wildlife Conservation Trust Fund (\$42,800). It is worth noting that most of the Trust Fund money is derived from duck-shooters' licence fees — presently \$5.00 per licence per season. In other States of Australia income derived from licence fees goes into general revenue. In Western Australia the money is ploughed back into wildlife conservation projects such as this waterbird study. It would be fair to say that this project would not have got off the ground without the aid of the Conservation Trust Fund.

The project began in April this year with the appointment of Mr Roger Jaensch as Project Co-ordinator. Roger comes from South Australia with a Bachelor of Arts degree majoring in Geography, and considerable experience in the identification and survey of birds, particularly the more secretive species of waterbirds such as cranes and rails. At the time of leaving

Adelaide for Perth he was Bird Records Secretary for the South Australian Ornithological Association and was undertaking a survey of the waterbirds of south-eastern South Australia for the S.A. Government.

Roger's early tasks have been to establish an office, to familiarise himself with a representative sample of the wetlands to be surveyed, to carry out trial surveys, and to prepare computer-compatible survey forms and booklets for later use by R.A.O.U. observers. This preparatory work will continue until December 31, 1981 when fieldwork for the R.A.O.U.'s current project, the Atlas of Australian Birds, is scheduled to finish. R.A.O.U. members will then be able to turn their attentions to this new, waterbird survey project.

There are 263 Wetland Nature Reserves (i.e. Nature Reserves which include or adjoin lakes, swamps, rivers or estuaries) in the South West and Eucla Land Divisions of the State. Of these, 186 are vested in the



▲ Kulunilup Swamp, Shire of Cranbrook. — Photo J. Lane.



▲ Sharp-tailed Sandpiper — Photo A.G. Wells.

▼ Coblaline River flats, Shire of Katanning. — Photo J. Lane.



Western Australian Wildlife Authority. The W.A. Department of Fisheries and Wildlife has responsibility for their management. Over recent year a fair amount of data on waterbird usage of these areas has been gathered opportunistically, however a comprehensive assessment of usage, and seasonal changes in usage, has never been made. Such a survey has simply been beyond the limited resources of the Department. For Government (or private enterprise) to undertake a project of this magnitude using salaried officers, the financial cost would be very large indeed — despite the enjoyable nature of the “work”! The R.A.O.U. however, with its large and enthusiastic network of amateur ornithologists (there are more than 300 active “Atlassers” in the south-west of the State), is able to undertake the project at low comparative cost.

The information gained from the project will be invaluable. So often the Department is faced with a potential conflict of uses to resolve, and has little or no data on waterbird usage of the wetland concerned on which to base a decision: From river-diversion and peat-mining proposals in the Lake Muir area, to diatomaceous-earth mining and ground-water extraction on the northern Swan Coastal Plain the Department has to make judgements about the likely affects of such proposals. The information obtained from the R.A.O.U. project will go a long way towards filling the data gap.

How will the project operate? As explained above, the latter half of 1981 will be devoted to setting it up. During 1982 R.A.O.U. members (and others who join in on the project — it is not essential to be an R.A.O.U. member to participate) will survey waterbird usage of 100 or so of the best and most accessible Wetland Nature Reserves. Surveys will be at two-month intervals with additional visits at times of particular interest such as during the breeding season and as the wetlands dry out in summer. Emphasis will be placed on determining the species of

waterbirds which utilise each reserve; their numbers, and the extent of breeding activity. All waterbird species will be covered, not just ducks and swans. Thus the survey will also include grebes, pelicans, cormorants, herons, egrets, bitterns, ibises, spoonbills, dotterels, plovers, sandpipers, stilts, avocets, gulls, terns, water-hens, crakes, rails, etc. In addition to receiving survey forms and booklets, observers will also be supplied with "kits" for each of the Wetland Nature Reserves they cover. Each kit will include location and access maps, a black and white aerial photograph of the area to be surveyed, and historical data on seasonal changes in water depth and salinity. Roger Jaensch will also spend much of his time in the field assisting observers with survey methods. During the last two years of the project (1983 and 1984) all Western Australian Wildlife Authority vested Wetland Nature Reserves in the south-west will be surveyed.

All data will be stored and analysed by computer to provide fast and comprehensive feedback to observers. The R.A.O.U. will also produce annual summaries of the information obtained and a final report at the end of the four years discussing the methods employed, the results and their implications for management both of waterbirds and Wetland Nature Reserves.

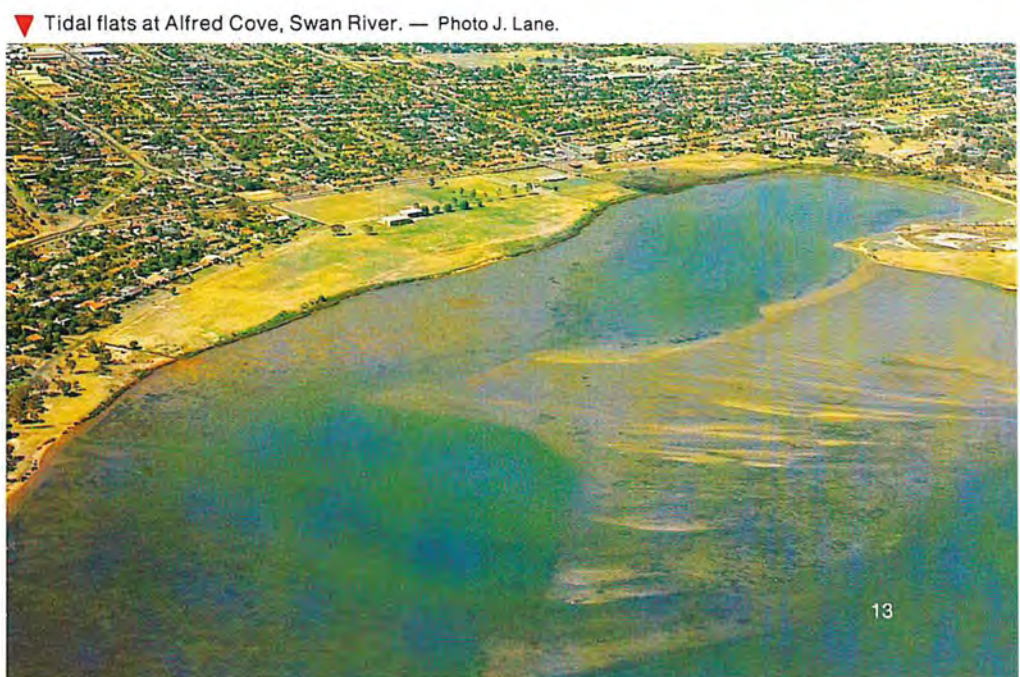
Over the past three years, Technical Officer Don Munro of the Department's Waterbird Research Group has installed depth gauges on 80 of the wetlands to be surveyed. These gauges have been installed primarily to assist in the duck season decision-making process, however they will also be involved in the R.A.O.U. project. Water depth and water quality are important factors affecting waterbird usage of wetlands. Monitoring of depth and quality (initially salinity and pH) at two monthly intervals throughout the project will make it possible to quantify relationships between these factors and use by various species and thus will enable us to reach more definite conclusions about habitat preferences of waterbirds than has



▲ Beverley Lakes, Shire of Beverley. — Photo J. Lane.



▲ Shoveller duck — Photo A.G. Wells.



▼ Tidal flats at Alfred Cove, Swan River. — Photo J. Lane.



▲ Lakes Gore, Carbul, Kubich and Gidong, Shire of Esperance. — Photo J. Lane.



▲ A massed flight of Pelicans. — Photo Copyright A.G. Wells.

▼ Shark Lake, Shire of Esperance. — Photo J. Lane.



been possible in the past.

The third objective of the project is to provide appropriate experience for future monitoring of waterbird abundance. At the present time, there is no effective monitoring of waterbird populations in the south-west of W.A. This is an undesirable situation. It means that major changes in the conservation status of waterbird species can occur without our knowledge. It is probable that population declines of 80-90% would be required at present before “alarm bells” would start ringing. When a species has declined to one-tenth of its former abundance and is still going downhill, that doesn’t give wildlife managers much time to research the problem, determine the cause or causes, and take — if possible — remedial action. Clearly there is a need for a monitoring system to give us earlier warning of changes in the abundance of waterbird species.

Two alternative systems are possible. One is for Government to provide the Department of Fisheries and Wildlife with additional staff and money sufficient to carry out extensive annual surveys of waterbird populations of the south-west. At today’s prices, this would cost in excess of \$100 000 per annum. The other alternative is to provide sufficient funds for a non-Government group (such as the R.A.O.U.) to co-ordinate surveys by amateur ornithologists. The advantages of this second alternative are firstly that the financial cost would be far less (probably one-tenth of the cost of a survey using paid staff); and secondly, a survey using amateur observers (amateur only in the sense that they are unpaid) necessarily involves greater public awareness of wetlands and waterbirds, and wetland/waterbird conservation issues. The Waterbird Survey Project, in addition to fulfilling its own objectives, will provide a valuable training ground for participants in any future project to monitor the conservation status of waterbirds in the south-west. It is therefore an important development of wildlife conservation in Western Australia.

# Wasp's mating instinct aids orchid pollination

Text and photographs by A.G. Wells

The flowers of many plants are large and attractively coloured to attract suitable pollinating animals to the plant; but in the case of Hammer orchids (*Drakaea* spp) the flowers are small and insignificant, a fact that has caused naturalists to ponder on their method of pollination.

In her book "Orchids of the West", first published in Perth Western Australia in 1951, Dr. Rica Erickson wrote:

"Observers are prompted by unusual modifications in orchids to puzzle over their significance. Hammer orchids (*Drakaea* spp) offer such a problem. Consider the insignificant flower. The airy prominent labellum resembles an insect. There is the head with its glistening eyes. There is the body with shaggy thorax and smooth sheeny wings. It is more like an insect than the labellum of the Slipper orchid (*Cryptostylis* sp.)

whose glistening glands are supposed to simulate an insect's appearance sufficiently to attract an ichneumon fly. The stem which holds the labellum aloft is pale and fades from sight, leaving the insectiform labellum more detached. Study the elaborate hinge. It is strong and well buffered on both sections, prepared for a powerful swing. Yet the labellum is not sensitive. In no way can it be induced to fly over, like that of the Flying Duck orchid. It is hinged but does not balance delicately on a claw to be swung over by an insect's shifting weight, like the labellum of some of the *Caladenias*. It can be flicked, but falls back again

into its pendulous position. As the flower grows older, the lower it hangs. The slightest breeze sets it trembling. It resembles an insect. Can it be a bait that attracts a predatory insect? The darting swoop to carry off the prey would fulfil the flower's purpose. The anchored bait would fling the marauder by its own momentum against the column, there to pick up the pollinia. For the flower's stratagem to succeed, the predator must repeat this flying dive at another labellum, to deposit the pollinia on another stigma. Insects may be deceived many times in their sexual appetite, but will they make more than one mistake over food? If food is not the lure, perhaps the visitor seeks a mate, and copulates on the wing."

In more recent years, Dr. Erickson's prophetic words have

▼ Warty hammer orchid — *Drakaea elastica*



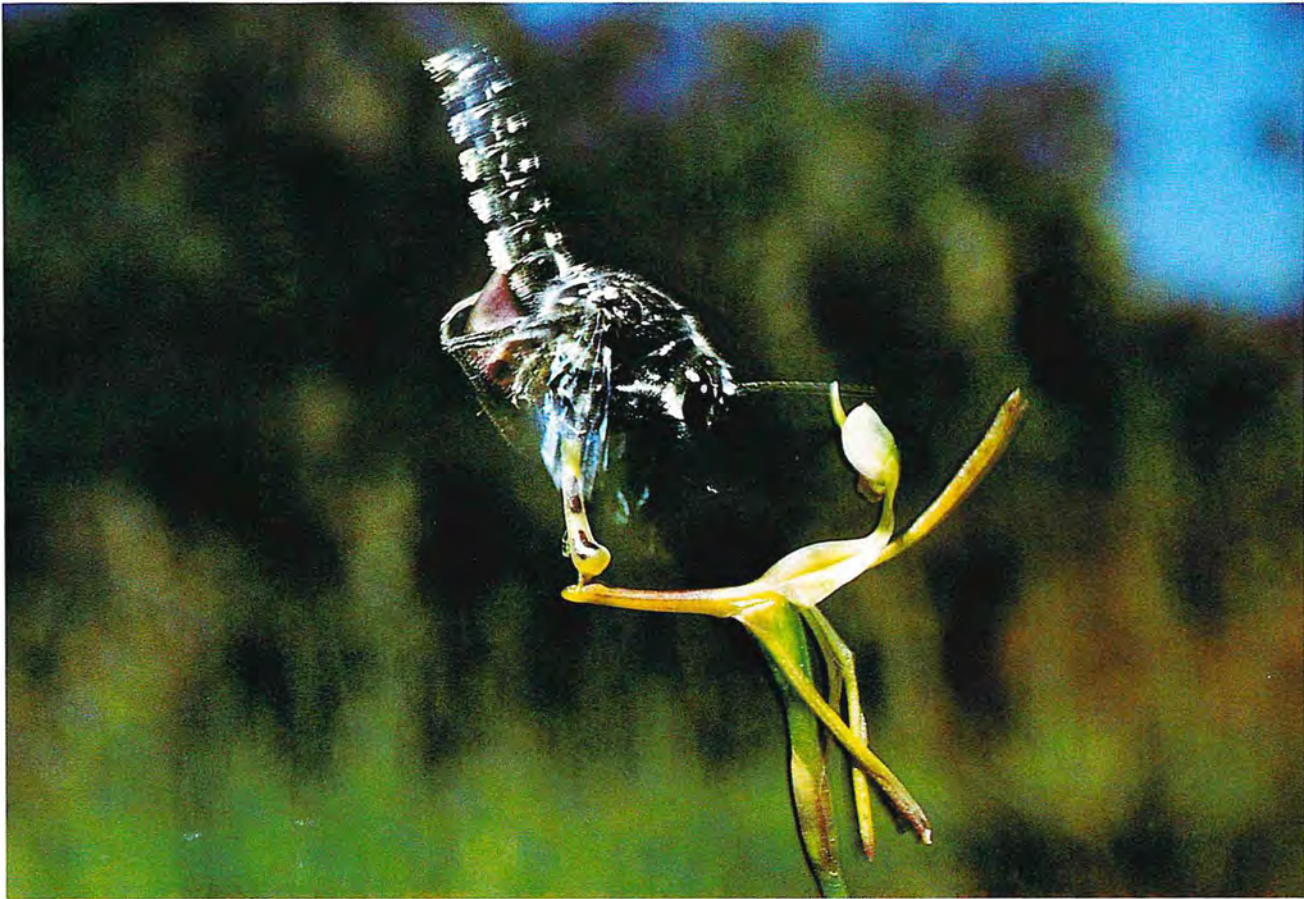


▲ Male Thynnid wasp (undetermined species) alights on the "pseudo-female" labellum of *Drakaea elastica* (Oct. 1980)

▼ Male wasp attempts to carry off the decoy.

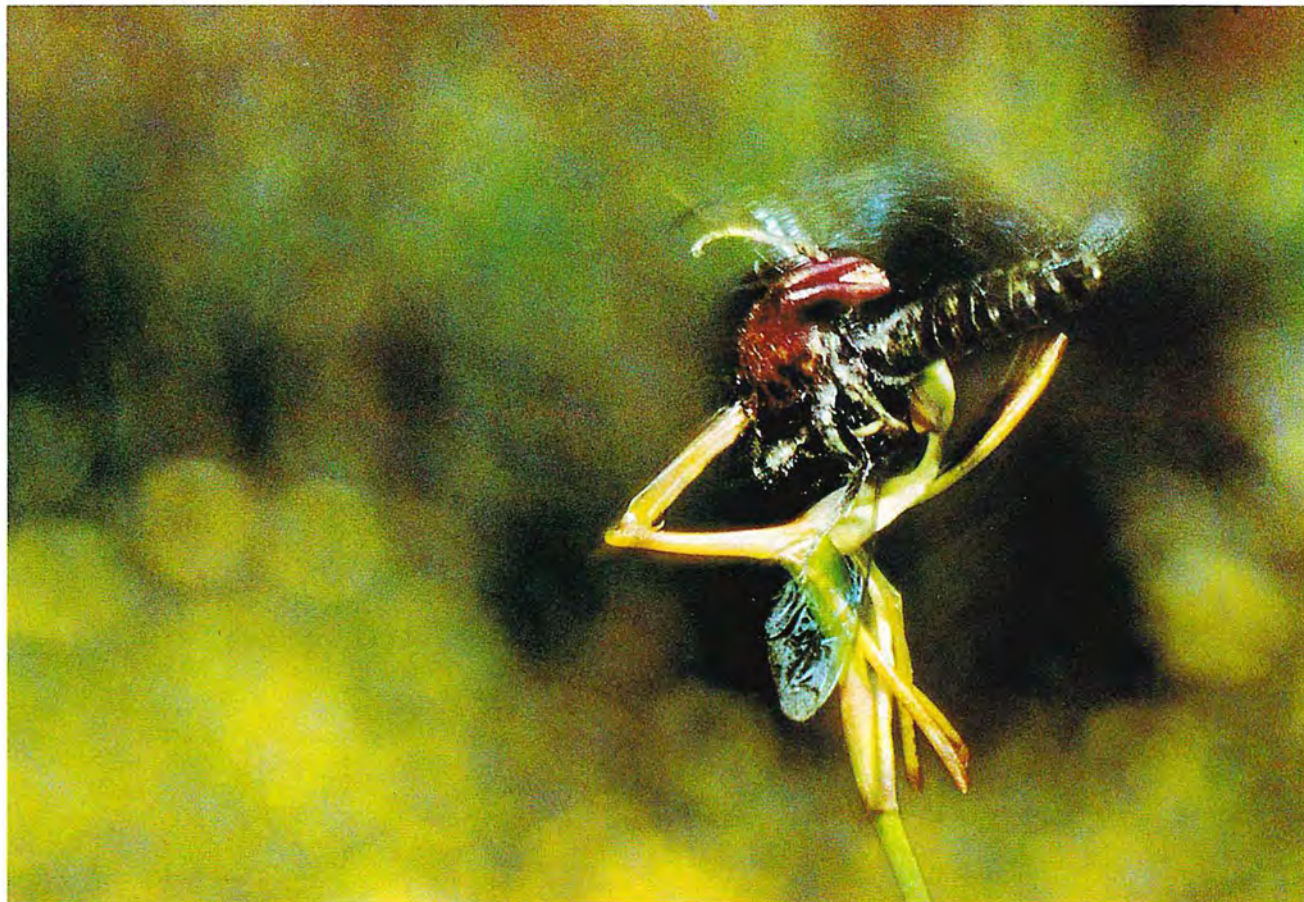






▲ The lifting action of the wasp is restrained by the hinge on the stem of the orchid.

▼ The male wasp is thus catapulted into the column, when pollen masses are transferred from the stigma to the body of the insect.



been reinforced by the research studies of Professor Warren Stoutamire, of Akron University, Ohio, U.S.A., during the course of a number of visits to Western Australia. In a bulletin published by the American Orchid Society in 1974, he wrote:

“Thynnids appear to be extensively involved in pseudo-

copulation with Australian terrestrial orchids. Thynnids are parasitic wasps, with winged males, and smaller wingless, often ant-like, females. The latter are specialised for digging in the soil in search of insects which the wasp larvae parasitise. The males have the unusual habit of picking up the earth bound females, mating with them in flight, and visiting flowers, where both sexes

feed while mating. The briefly mobile female is at once fed and fertilised, before being released for egg-laying”.

Professor Stoutamire (in pers. comm.) suggested that some of the orchids in the genera *Caladenia* and *Drakaea* emit a gas-like compound (pheromone) which is likely to be the same in chemical character as that employed as an attractant by the female thynnid wasp. The orchid appeared to succeed with its stratagem, because the male wasps emerged some considerable time before the females. He had also observed that when the female wasp was in a condition for mating, she climbed to the tip of a grass stem, there to await the arrival of a male.

During the spring of 1980, attempts by the writer to photograph this phenomenon near Perth were thwarted by many weeks of persistent poor weather — unusual for the “wildflower season” of Western Australia. However, just when Hammer orchids were in full bloom, and on the first warm sunny windless day, thynnid wasps were seen to be active. Some orchids were visited several times, whilst others seemed to be ignored. It was therefore a matter of luck, in setting up the photographic gear, to anticipate which orchid would provide the action. However good fortune eventually prevailed to enable the accompanying series of photographs to be obtained.

Early in the afternoon, with the arrival of the cool sea breeze, activity of the male wasps ceased entirely.

During the course of the photography, many diligent searches were made in the surrounding grassed areas for female thynnids, but without success.

Several months later, at another locality (Peaceful Bay on the south coast), another undetermined species of thynnid wasp was found with females, both sexes feed whilst copulating, on the profuse flowers of *Eucalyptus ficifolia*.



▲ This photograph illustrates the similarity between the “pseudo-female” labellum of a hammer orchid and a wingless female Thynnid wasp of an apparently different undetermined species.

▼ A male and female of the latter species is shown feeding and mating on *Eucalyptus ficifolia* (February 1981)



# Carnarvon Wildlife District—A Big Country

by Clifford Young



One of the first things that strikes you about the Carnarvon wildlife district is its sheer size. Although it is by no means the largest in Western Australia it still covers an area of 137 153 square kilometres or about twice the area of Tasmania.

The Carnarvon district, encompassing the Shires of Carnarvon, Shark Bay, Exmouth and Upper Gascoyne, boasts a rich wildlife through a staggering variety of habitats ranging from semi-desert to sub-tropical, and a coastline hundreds of kilometres in length. Several major offshore islands including Dirk Hartog and Bernier and Dorre Islands complete the picture.

Once you come to terms with the size and complexity of the district, the second surprise awaits you. Responsibility for patrolling the whole district, as is the case with all Western Australia's wildlife districts, lies with one man. Wildlife Officer Kevin Marshall has been stationed in the Carnarvon district for the past two years after having gained extensive wildlife management experience throughout much of Western Australia. Prior to this appointment he was stationed at Mt. Magnet and at Esperance.

Besides regularly patrolling the

countryside carrying out bird counts and general wildlife and flora surveys, Kevin is responsible for policing the actions of the district's many licenced kangaroo shooters,

and also has to be continually on the lookout for nest-robbers—a growing threat to the State's native wildlife.

The Carnarvon area is particularly well-endowed with parrot species, the main target of nest-robbers. Although the district is large and seemingly difficult to police

▼ Wildlife Officer Kevin Marshall during a regular radio schedule with Departmental officers in Perth. — Photo C. Young.





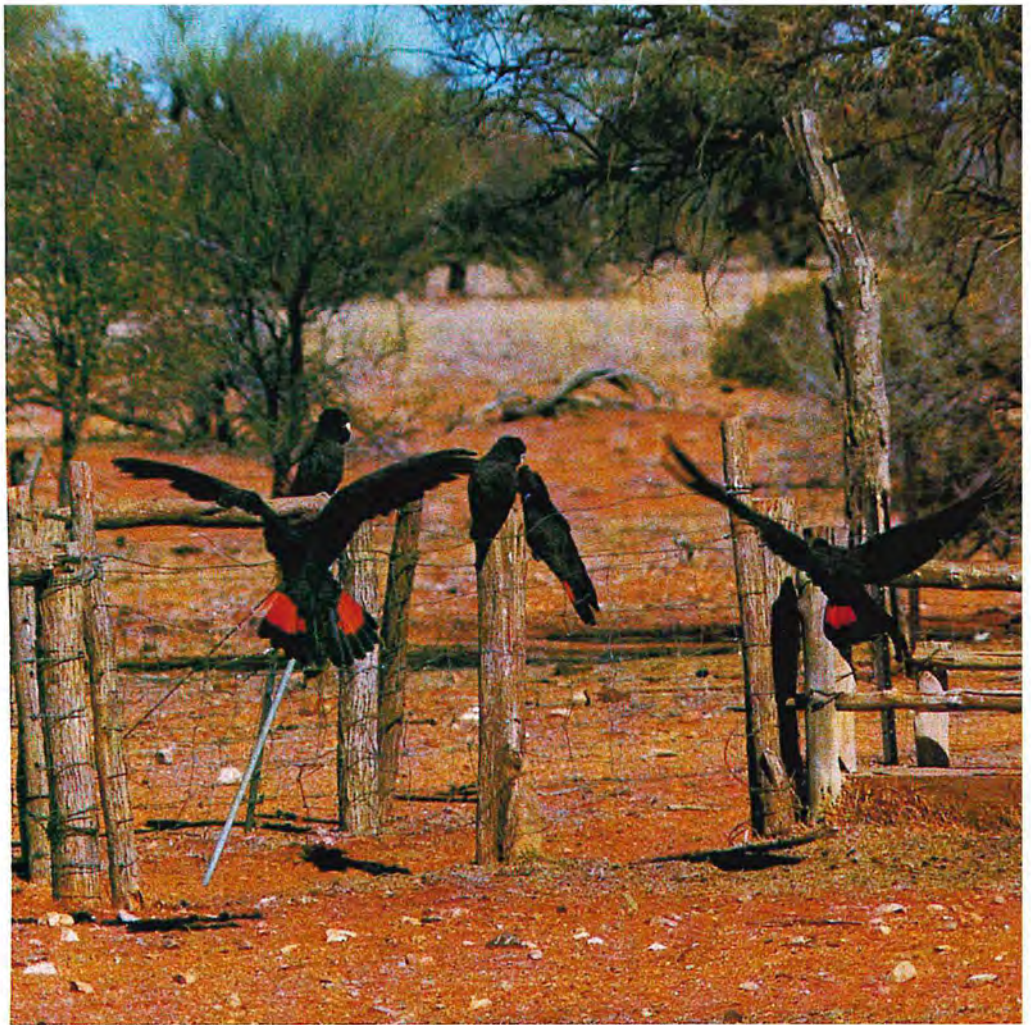
Branches of a stately River Gum overhang a pool on the Lyons River in the Upper Gascoyne. — Photo C. Young.

effectively, Kevin knows the country well and has documented most of the major bird breeding areas. As most nest-robbers operate during only a relatively short period each year—when the young fledglings are still in the nest—the patrol areas to be covered are considerably reduced. Nevertheless, Kevin still spends a great deal of his time on the road. In the first six months of this year he clocked up more than 12 700 kilometres patrolling both inland and along the coast.

In addition to his other duties, Kevin also carries out occasional aerial wildlife surveys. A recent aerial survey of the islands off Carnarvon showed a problem developing which demanded immediate attention. A growing herd of feral goats on Bernier Island, a Nature Reserve, was posing a threat to the island's fragile vegetation and, in turn, the survival of the native wildlife. Two important species of hare-wallaby, the Western Hare-wallaby and the Banded Hare-wallaby, occur on Bernier Island and their survival is very important as the species have almost completely disappeared from the mainland. As a result of the survey, an eradication programme is now underway against the goats.

Although Kevin spends much of his time on patrol, he has few regrets. The variety of the country and its wildlife keep his interest and enthusiasm for the job high. A large percentage of his time is also spent on public relations work throughout the district, discussing all aspects of wildlife and vegetation with local station owners and Shire officials. Without local assistance, and co-operation a wildlife officer's job would be almost impossible to carry out effectively.

Despite Kevin's distance from the Department of Fisheries and Wildlife's headquarters in Perth he is not isolated from up to the minute advice and information. All the Department's Wildlife Officers, Fisheries Inspectors, field researchers and headquarters staff are in constant communication with one another via an elaborate state-wide radio network. Besides its



▲ Red-tailed Black Cockatoos are a distinctive feature of the Carnarvon Wildlife District. — Photo K. Marshall.

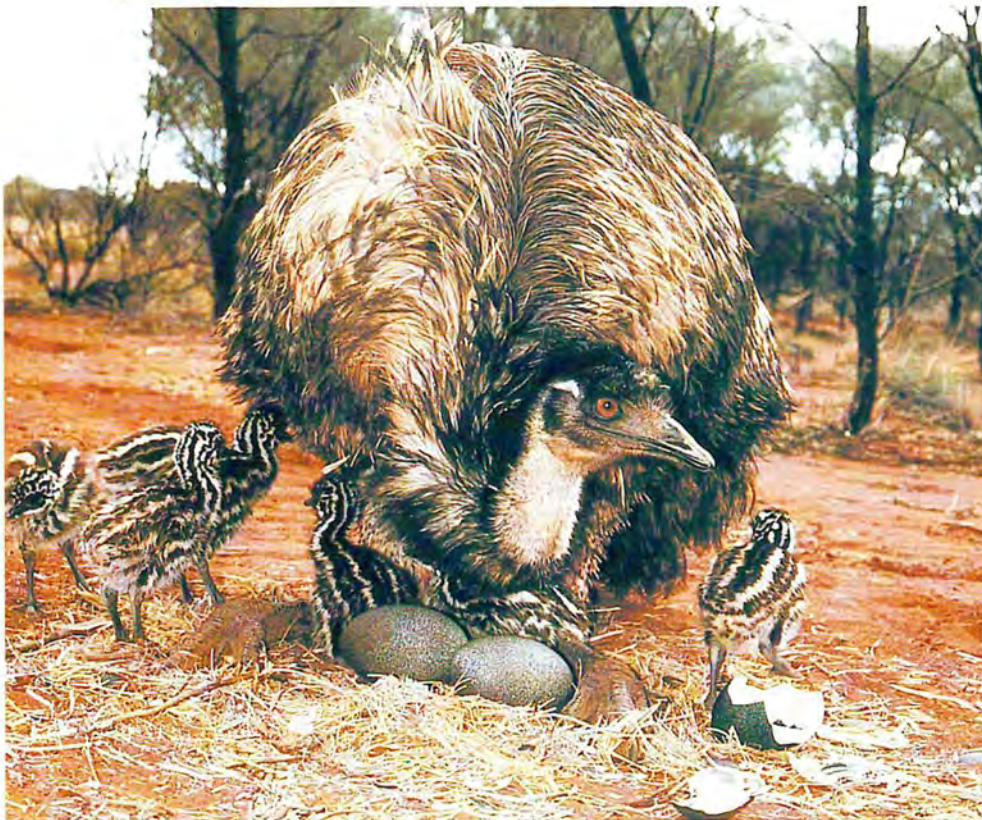
▼ A male Carpet Snake, about one metre in length, seen in a hollow log in the dry Yannerie River bed, north of Carnarvon. — Photo K. Marshall.





▲ Mt. Augustus, one of the largest rock formations in Western Australia, looms over the surrounding countryside as it is lit by the early morning sun. — Photo C. Young.

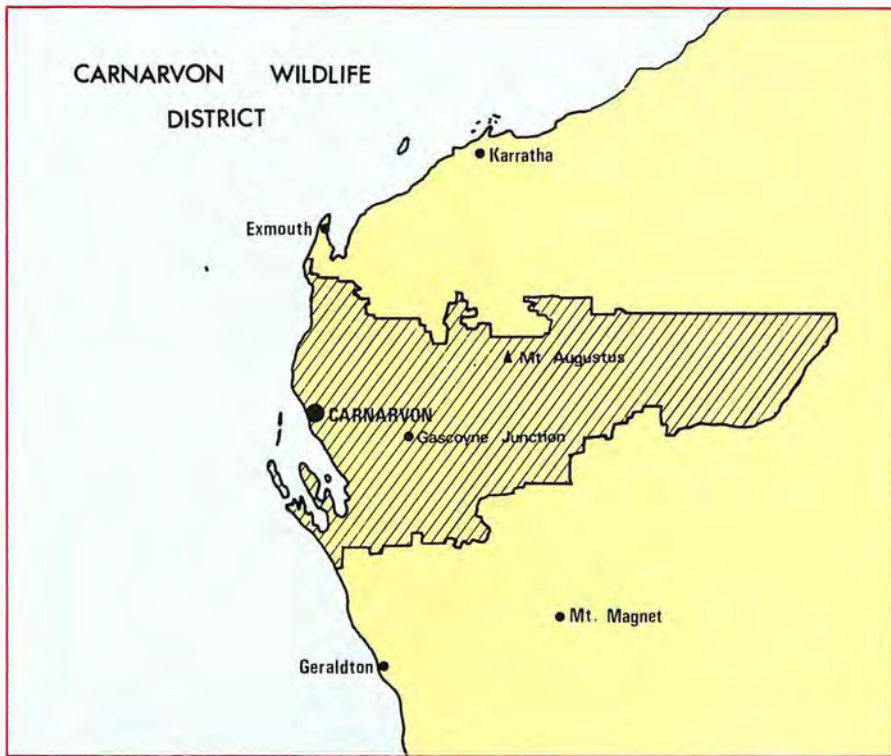
▼ An adult Emu at the nest. — Photo Copyright A.G. Wells



obvious value for passing information, the radio network also serves as a safety precaution. As most of the wildlife officers in particular operate alone for long periods in the bush, the radio schedules allow them to seek help if stranded by mechanical problems or ill health.

In addition to his radio reports, Kevin also sends frequent written reports detailing his wildlife observations made while on patrol. The following is an extract from a recent report outlining patrols made during May, June and July this year:

“The following pastoral leases were traversed—Jimba Jimba, Lyons River, Eudamullah, Minnie Creek, Gifford Creek, Cobra Station, Mt. Augustus, Landor, New Forrest, Meeberrie, Billabalong, Wooleen, Muggan, Mt. Narryer, Byro and Yaringa. Weather conditions have ranged from fine to extremely wet with temperatures mainly in the low 20’s. Wildlife observations throughout the district have been above average almost



certainly as a result of this year's good rainfall in contrast to the past four years of near drought conditions.

"Waterbirds, in particular, have been among the first to benefit from the improved conditions. Among those which appear to have increased in number are the Straw-Necked Ibis, Grey Teal, Black Duck, Wood Duck, Pink-eared Duck and Mountain Duck. Cockatoos and Parrots and birds of prey (of which 18 species occur in the Gascoyne Region alone) have also showed some increase in numbers and many are breeding for the second time this year. The Plains Turkey or Bustard also seems well established in parts of the district, particularly to the north and east. Abundant food and ideal conditions have no doubt contributed to attracting these nomadic birds to the region. Personal observations have ranged from individual birds to eleven in one flock.



▲ A flock of Little Corellas (*Cacatua sanguin*) photographed within the Carnarvon town area. — Photo K. Marshall.

▼ Red Kangaroo joeys seek shelter during the heat of the day. — Photo K. Marshall.



"Red Kangaroo numbers are also showing an increase which will be welcomed by the district's professional shooters. At present, many shooters are averaging between 25 and 35 kangaroos each night, and most are in excellent condition with a surplus of body fat on many carcasses.

"The 1981-82 season in the Carnarvon district looks like becoming one of the best for nearly a decade, for both wildlife and the pastoral industry. Good rainfalls along with the recent flooding of the Gascoyne River and its tributaries have meant ideal conditions throughout the region including the normally dry Upper Gascoyne. Vegetation and wildflowers are flourishing."

The Carnarvon wildlife district has never looked so good.

# Thomsons Lake Nature Reserve

More than 1000 Nature Reserves have been gazetted in Western Australia to perpetuate representative areas of the state's natural and semi-natural vegetation and wildlife. Despite the number of reserves in existence, there are still many types of wildlife habitats which are poorly represented, particularly in the metropolitan area. Among these areas are wetland systems which are so important as breeding and feeding areas for waterfowl.

Many otherwise suitable lakes have been spoilt for waterfowl by surrounding development, filling or rubbish disposal, pollution or by being used for active recreation such as waterskiing. In some instances, attempts to beautify lakes by clearing and grassing foreshore areas and deepening the lakes have ruined them for waterfowl. Most waterfowl feed in the more productive lake shallows and nest in the protection of dense vegetation which often characterises "untouched" lakes.

Those lakes retaining their natural form are also highly prized by people who enjoy their scenic qualities and

natural bushland and deprive pleasure from quietly observing the rich wildlife such lakes support.

One such lake which still boasts a diverse variety of vegetation and wildlife and yet is within reach of the Perth and Fremantle metropolitan areas is Thomsons Lake, the largest and one of the less developed of a chain of freshwater wetlands in the City of Cockburn.

Thomsons Lake is a gazetted Nature Reserve situated about 34 kilometres south-west of Perth and 19 kilometres south of Fremantle and lies between the smaller Kogolup

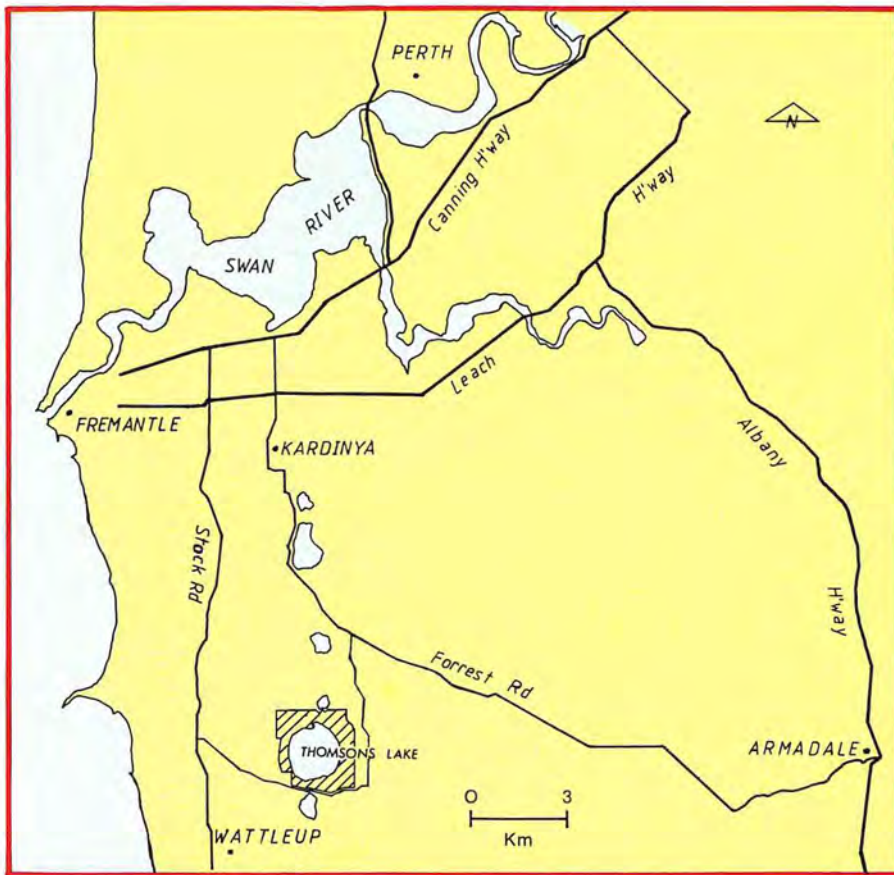
and Bananup Lakes. The Reserve is bounded to the east and west by rural small holdings, to the south by Russell Road and the University of Western Australia's Marsupial Breeding Station and to the north by uncleared bushland zoned rural and owned by the State Housing Commission.

In addition to the centrally placed lake (about 172 hectares), the Reserve also includes some 300 hectares of mainly woodland and open forest in a buffer 100-400m wide around the lake. The reserve's vegetation had developed on two dune systems of Pleistocene age and is characteristic of the diverse range of vegetation and flora found on the dune systems of the Swan Coastal Plain. It includes a variety of plant associations dominated by Flooded Gum (*Eucalyptus rudis*), Jarrah (*E.*



The reed beds around the fringes of Thomsons Lake provide excellent cover for waterbirds. — Photo C. Young.





▲ Location of Thomsons Lake Nature Reserve.

▼ *Banksia menziesii* is one of several *Banksia* species present in the woodlands surrounding the lake. — Photo I. Crook.



*marginata*), Pricklybark (*E. todiana*), Swamp Paperbark (*Melaleuca preissiana*) and various *Banksia* species.

## History of the Reserve

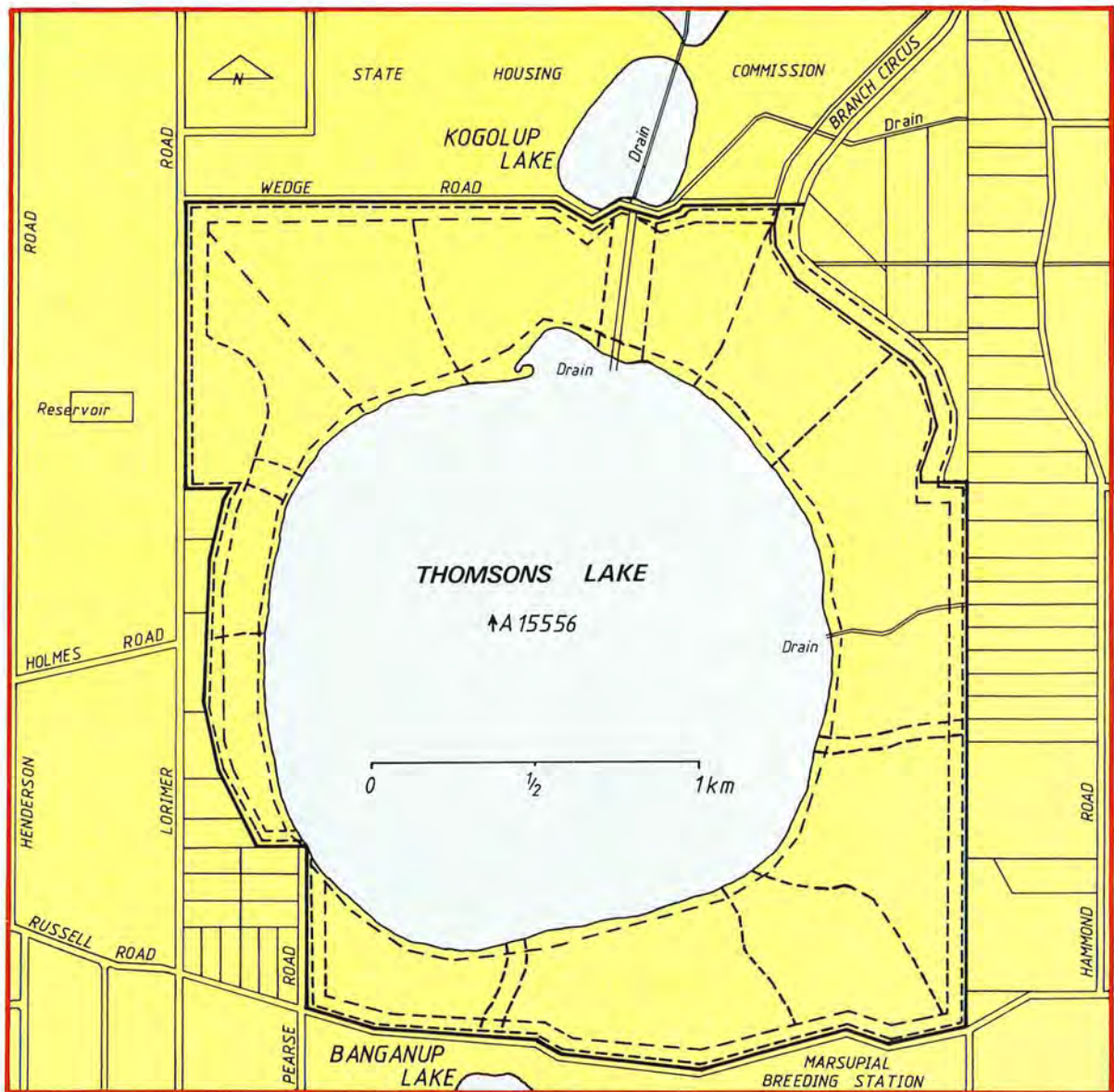
The value of Thomsons Lake as a potential reserve was first formally brought to the attention of the Department of Fisheries and Wildlife in 1954 by Mr. Waverney Ford of Hamilton Hill who prepared the first recorded fauna list for the area. At that time the Reserve included areas north and south of Russell Road and was set aside for the purpose of drainage.

At the time of Mr. Ford's report there was a proposal to lease the southern part of the Reserve for the grazing of sheep and cattle. However, on the basis of the report and general knowledge of the area the Department objected successfully against the proposal.

In July, 1955 the purpose of the Reserve was changed to Drainage and Conservation of Fauna and the value of the Reserve to wildlife was further confirmed by Fauna Warden G. C. Jeffrey in May, 1956: "... Mr. Ford certainly put us on to a good area for a sanctuary. The birdlife there at the moment is marvellous... I have never observed birds so tame. The blue wrens and thornbills came within ten feet of me as did the robins and grey fantails."

The Conservator of Forests was equally impressed with the area: "... this reserve contains, for a single compact area, probably the greatest number of native plant species once common to the metropolitan area and coastal plain. This years spring flowering, particularly in the area of Russell Road, is reported to have been simply breath-taking..." (*Conservator of Forests, in litt. to the Under-Secretary for Lands, November, 1960*).

However, at this time (during the late 1950's and early 1960's), the Reserve was being ill-used by nearby landowners for grazing their cattle. Wood was being cut illegally and wildfires were causing some damage to the vegetation.



▲ Thomsons Lake Nature Reserve showing present network of firebreaks (dashed lines).

Being an unvested reserve, the Department was powerless to control trespass by cattle or prevent such things as timber-poaching. A Vesting Order for the Reserve was therefore sought in favour of the Fauna Protection Advisory Committee, the forerunner to the Western Australian Wildlife Authority and the vesting authority for most of the Nature Reserves now managed by the Department of Fisheries and Wildlife. This was granted and in January, 1969 the role of the Reserve for nature conservation was further strengthened by a change of purpose to "Fauna Conservation, Research and Drainage" and in August, 1970 elevated to Class A under the Land Act.

### Physical Features

The Thomson Lake Nature Reserve occupies a depression between two series of sand dunes, the junction between the dune systems being marked by a chain of wetlands between Kardinya in the north and Wattleup in the south.

Thomson Lake is the largest of these wetlands but varies between being dry to 3.3m in depth, depending on season and rainfall. A field study conducted at the lake in 1976 recorded the lake's diameter as 1700m and its average depth as one metre. Aerial photography in subsequent years (1977 and 1978) showed the winter diameter of the lake as 2000m and 1700m

respectively. The amount of water in the lake varies widely however. Metropolitan Water Board data show the lake to have dried in the summer of 1961, '62 and '63, and to have reached its greatest recorded depth of 3.6m above the lake bed in October, 1968. The lake bed itself is 11.79m above sea level and the surrounding dunes rise to approximately 45m above sea level.

### Drainage

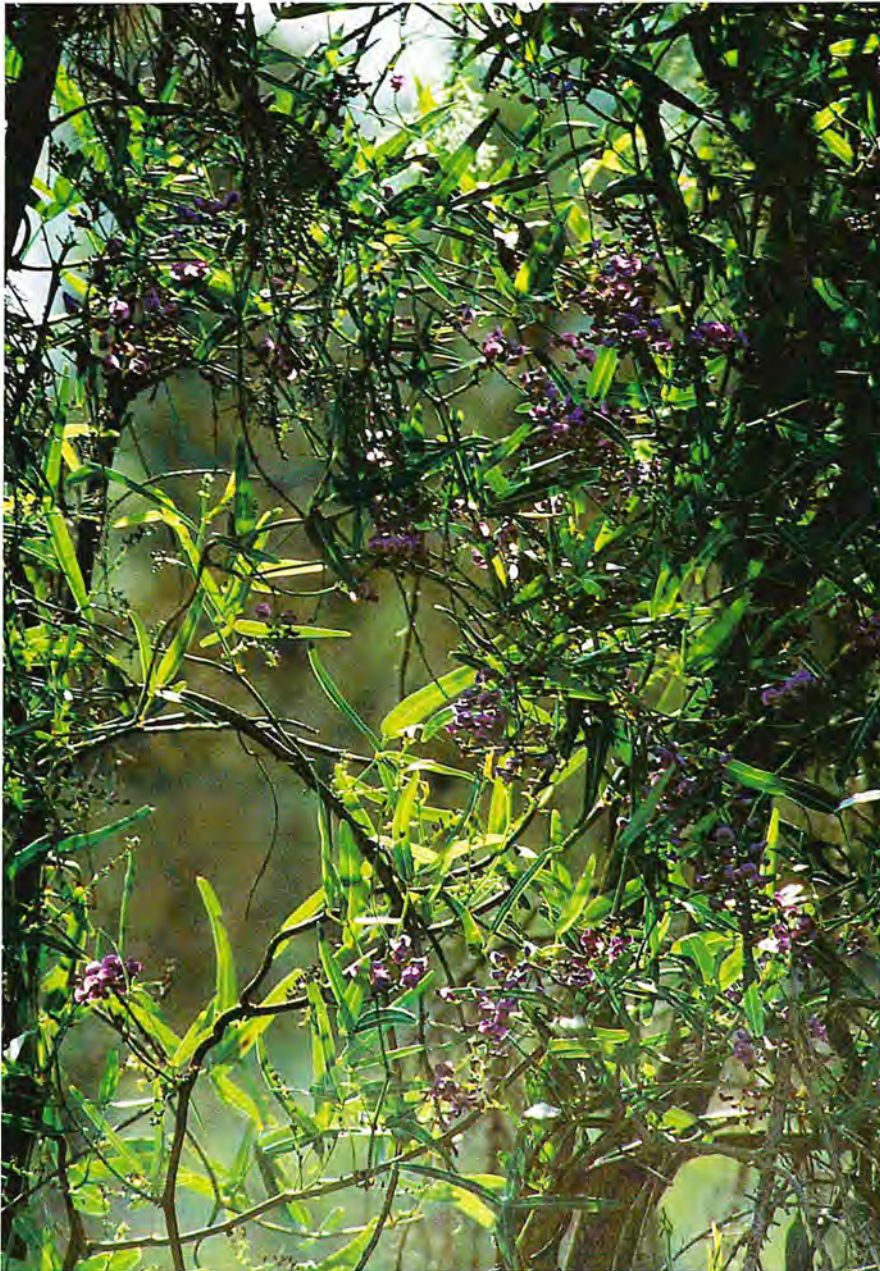
At present, drainage water flows into the lake from the north, from Lake Kogolup, and from agricultural land to the east. This has led to occasional blooms of the blue-green alga *Microcystis aeruginosa* indicating that significant amounts



▲ The bright flowers of *Hardenbergia comptoniana* and a *Hibbertia* species are among many which brighten the bush through spring. — Photo I. Crook.

▼ Good winter rains this year have filled the lake to its outer fringes for the first time in many years. — Photo C. Young.





▲ Sunlight filters through the vegetation around the lake. — Photo C. Young

of mineral nutrients, nitrogen and phosphorus, may be entering the lake system. This brings with it the possibility of algal poisoning among waterfowl and eutrophication and deoxygenation, firstly of the bottom sediments (leading to the possibility of increased occurrence of botulism in water birds) and finally of the whole lake.

Because of this threat, consideration will be given to establishing a programme to monitor phosphorus and nitrogen levels of the lake water and drainage water as part of an overall management plan

by the Department of Fisheries and Wildlife.

### Vegetation

A field study of the reserve in 1976 by Mrs. P. Clay positively identified more than 200 plant species and pointed out that the area supports 13 of the 23 tree species known from the Swan Coastal Plain as a whole.

A more recent study by Dr. Barbara Rye has shown that the Reserve also supports a population of about 80 plants of *Dodonea hackettiana*, a species declared rare under the flora provisions of the

Wildlife Conservation Act.

Mrs. Clay recognised 15 vegetation "zones" on the Reserve during her study and, in addition, noted the distribution of Tuarts (*E. gomphocephala*). These were mainly found on the higher ridges scattered through the Jarrah and Banksia open forest and woodland areas.

In the same year as the field study was carried out, the root-rot fungus (*Phytophthora cinnamomi*) was isolated from an area of small Banksias close to the southern boundary of the Reserve. There is no evidence of the (*phytophthora* having spread at this time.

### Wildlife

Small marsupials and native rodents were not recorded during the 1976 field study of the reserve and the marsupial fauna was restricted to the Western Grey Kangaroo (*Macropus fuliginosus*), Brush Wallaby (*Macropus irma*), Brush-tailed Possum (*Trichosurus vulpecula*) and the Short-nosed Bandicoot (*Isodon obesulus*). Although the mammal fauna is not of great significance, the Reserve is rich in other wildlife. Seven species of Amphibia, 12 reptiles (three snakes and nine lizards), and a total of 136 bird species have been recorded from Thomson Lake and the surrounding bush at the time of publication.

The lists show that Thomson Lake continues to support a remarkably diverse bird fauna in particular, there being few indications of species having being lost from the Reserve since observations began. However, considerable variation in numbers and types of birds on the Reserve were evident during the six months of the 1976 study. Mrs. Clay made observations on several lakes in the Cockburn area and these suggest that, as a group, the Cockburn wetlands provide a more complete range of habitats for waterbirds than Thomson Lake or any other single lake in the chain.

For example, Red-necked Avocets (*Recurvirostra novaehollandiae*) occurred in far greater numbers in the shallow waters of Bibra Lake than elsewhere, whereas White-faced

Hérons (*Ardea novaehollandiae*), White Egrets (*Egretta alba*), and Yellow-billed Spoonbills (*Platalea flavipes*) preferred the sheltered waters of Thomsons and Kogolup Lakes with their natural bush surrounds. Several small waders such as Greenshanks (*Tringa nebularia*) and Red-necked Stints (*Calidris ruficollis*) also showed a preference for the shelter provided by reeds around the Thomsons Lake shore, whereas Pink-eared Ducks (*Malacorhynchus membranaceus*), which feed almost entirely on aquatic invertebrates occur in greatest numbers on the productive Yangebup Lake during periods of falling water levels.

In addition to the decided preferences of waterbirds for one place or another, these very mobile birds also come and go, from lake to lake, in response to interference and changes in things like food supply, lake water levels and their own biological requirements for places to feed, breed and moult.

Thomsons Lake should therefore be seen as part of a system of waterbird habitats. It has the added value, attributable to its size, variation in depth from shore to centre, and the shelter offered by reed banks on its shoreline, of supporting the most diverse fauna in the chain and of being a major breeding site for a number of species. Monitoring of water levels and changes in levels and water quality are therefore, a most important facet of management of the Reserve.

## Management

The value of Thomsons Lake Nature Reserve is not limited by its ecological features and wildlife. Being situated less than 35 kilometres from Perth and 20 kilometres from Fremantle it is easily accessible to the public. It consists of a most attractive balance of wetland, lake foreshore and bush environments which present the best potential for development for public use of all the metropolitan wetland Nature Reserves.

Consequently, any management plan prepared for the Reserve has to not only protect the environment but



▲ The sheltered waters of Thomsons Lake provide a favourable habitat for large water bird species. — Photo C. Young.

cater for members of the public interested in visiting the Reserve.

A Management Plan prepared by the Department of Fisheries and Wildlife therefore includes provision for information facilities on the reserve's features to be available to the public in addition to signposting walking tracks and the provision of adequate carparks on the fringes of the Reserve.

Other management objectives related to the Reserve include fire protection, monitoring water quality and levels, rehabilitating damaged vegetation, and preventing mis-use of the reserve such as rubbish-dumping and the use of off-road vehicles.

It is important that a Nature Reserve such as Thomsons Lake should be used, particularly by those who wish to observe the riches of the

wildlife it supports. Equally important, all use must safeguard its natural values.

These dual objectives of perpetuation and use can only be achieved by good management, however, the Management Plan also has a wider purpose. Together with others of the series it begins to draw the Metropolitan Nature Reserves together: a system within a system which provides a patchwork of dedicated wildlife habitats close to the city, and opportunities for many people to study, learn about or just contemplate the intricate patterns of nature.

Adapted for SWANS by Clifford Young from Management Plan No. 2 by I. G. Crook and T. Evans

# Dolphins die after stranding near Cape Leeuwin

At least nine Spotted Dolphins (*Stenella attenuata*) died after being stranded on a beach near Cape Leeuwin earlier this year. The fate of another four dolphins stranded at the same time but pushed back into deeper water by local residents and fishermen is unknown.

The dolphins were first seen by amateur fishermen in the early morning of Thursday, 18th June on a beach located about half-way between the Cape and the entrance to nearby Hardy Inlet. A local P.W.D. employee, Mr. Castledine, was one of several people who went to the dolphins' assistance. Although none of the animals showed signs of injuries, nine were already dead. There was nothing to indicate why the animals were stranded, whether through pollution, threat from predators, faulty navigation or some unknown biological instinct which drove them ashore.

Mr. Castledine said the four dolphins still alive were carried from the beach to the quieter waters of Hardy Inlet where they were released. One of the animals

transported to the inlet was a small juvenile. Mr. Castledine said when it was originally found on the beach the young animal had been uttering a succession of cries. It held its eyes tightly closed for the entire time it took to transport it to the Inlet.

The stranded animals varied in size with the largest measuring 2.04m in length.

Spotted Dolphins have not previously been recorded off Western Australia although they would be expected to occur in these waters. They belong to the Genus *Stenella* which comprises the smallest of the dolphins. Spotted Dolphins are among several species which are known to associate with tunas, a fact many fishermen in the tropics take advantage of by deploying their nets around schools of dolphins that in the hope that tunas will be present underneath them. Consequently, many dolphins are caught in the same net and, despite efforts by fishermen to free the animals, some deaths almost always occur. However the number of deaths has been greatly reduced in recent years following a major research programme and introduction of special nets and procedures.

This latest incident is not the first record of strandings in the Cape Leeuwin area. In March, 1976 it was reported that 35-40 dolphins had swum ashore near the mouth of the Hardy Inlet. Many of the beached dolphins resisted attempts by

tourists, local fishermen and residents to push them back into the sea, as some were freed only to swim onto the beach once more. However, some of those pushed or towed into deeper water were seen to swim away and it was hoped these animals survived their ordeal. A total of about 18 dolphins died in the incident.

Further north, at Quindalup Beach, two Pilot Whales became stranded in November, 1980. Despite repeated attempts to tow the animals into deeper water they persisted in returning to shore where they eventually died. Their carcasses were finally disposed of at sea.

A rather more unusual record of a beached whale was made at South Beach, near Fremantle, in August this year. An adult female Pygmy Right Whale (*Caperea marginata*) was washed ashore with no obvious signs of injury apart from the loss of much of its dark skin pigment, which probably occurred following death.

The Pygmy Right Whale, not to be confused with the Southern Right Whale, is a little known species of baleen whale. Although confined to southern waters it has rarely been recorded and almost never identified at sea. Less than one hundred sighting reports have come from beached specimens in New Zealand, Australia and South Africa. Most of Australia's sightings have been made in Tasmania and South Australia. Only one other confirmed record of a Pygmy Right Whale washed up on a West Australian beach exists and that was from more than 12 years ago when some bones identified as belonging to the animal were

▼ These Spotted Dolphins died despite assistance from local fishermen and residents. — Photo P. Lambert.



▼ The mottled ventral surface of these dolphins are characteristic of the Spotted Dolphin. — Photo P. Lambert.





▲ This female Pygmy Right Whale was washed ashore dead at South Beach, near Fremantle, earlier this year — only the second time this whale has been recorded off Western Australia. — Photo C. Young.

discovered east of Esperance on the south coast.

As its name suggests, the Pygmy Right Whale is a relatively small whale, rarely attaining a length greater than six metres. The South Beach specimen measured 5.7m in length.

The whales are thought to inhabit

coastal waters throughout the lower half of the southern hemisphere and probably feed on plankton.

After being washed ashore, the South Beach specimen was examined by staff of the Western Australian Museum who also removed samples for the Museums' collection, including the animals skull for display. The remains of the whale were buried but a decision on whether to preserve the entire skeleton for the Museum has still to be made.

With recent increased public interest in marine mammals, a more

concerted effort is under way to ensure that efforts are made to rescue any that beach themselves alive, and to obtain maximum information from those that cannot be rescued or that arrive dead on the shore. Anyone finding a beached animal should immediately contact the local Fisheries and Wildlife Officer or the W.A. Museum. If the animal is already dead, the remains should be hauled out of the highest tide but otherwise not disturbed. A photograph, a note of the total length and a record of whether the animal has teeth or baleen plates would be very useful.

## Departmental Fisheries & Wildlife Offices

**Head Office: 108 Adelaide Terrace, Perth, W.A. 6000. Tel. 325 5988**

**District Offices:**

Albany: Stirling Terrace, Albany, W.A. 6330. Tel. 41 4811.  
 Broome: Hamersley Street, Broome, W.A. 6725. Tel. 92 1121.  
 Bunbury: Stirling Street, Bunbury, W.A. 6230. Tel. 21 2598.  
 Busselton: 12 Queen Street, Busselton, W.A. 6280. Tel. 52 2152.  
 Carnarvon: Carnarvon Marina, P.O. Box 774, Carnarvon, W.A. 6701. Tel. 41 1185.  
 Denham: Knight Terrace, Denham, W.A. 6537. Tel. Shark Bay 48 1210.  
 Jongara: Lot 322, Carnarvon Street, Port Denison, Dongara, W.A. 6525. Tel. 27 1187.

Esperance: Wallaceway Centre, Esperance, W.A. 6450. Tel. 71 1839.  
 Fremantle: Cnr Collie St and Marine Tce, Fremantle, W.A. 6160. Tel. 335 6369 and 335 3405.  
 Geraldton: Fisherman's Wharf, Geraldton, W.A. 6530. Tel. 21 1956 (Fisheries), 21 3510 (Wildlife).  
 Jurien Bay: Bashford Street, Jurien Bay, W.A. 6516. Tel. 48 1166.  
 Kalgoorlie: Maritana House, cnr Cheetham and Boulder Roads, Kalgoorlie, W.A. 6430. Tel. 21 4148.  
 Karratha: Lot 750, Welcome Road, Karratha, W.A. 6714. Tel. Karratha 85 1427.  
 Lancelin: Gingin Road, Lancelin, W.A. 6508. Tel. 78 1111.

Ledge Point: Deburgh Street, Ledge Point, W.A. 6508. Tel. 78 1078.  
 Mandurah: 15 Leslie Street, Mandurah, W.A. 6210. Tel. 35 1240.  
 Manjimup: C/o Agric. Dept Manjimup, W.A. 6258. Tel. 71 1299.  
 Moora: Padbury Street, Moora, W.A. 6510. Tel. 41 1055.  
 Mt. Magnet: Hepburn Street, Mt. Magnet, W.A. 6638. Tel. 96.  
 Pingelly: Park Street, Pingelly, W.A. 6308. Tel. 273.  
 Waroona: c/- P.W.D. South West Highway, Waroona, W.A. 6215. Tel. 33 1331.  
 Wongan Hills: Quinlan Street, W.A. 6603. Tel. 71 1395.  
 Wyndham: c/- P.W.D. Wyndham, W.A. 6740. Tel. 61 1342

# WILDLIFE DISTRICTS IN WESTERN AUSTRALIA

