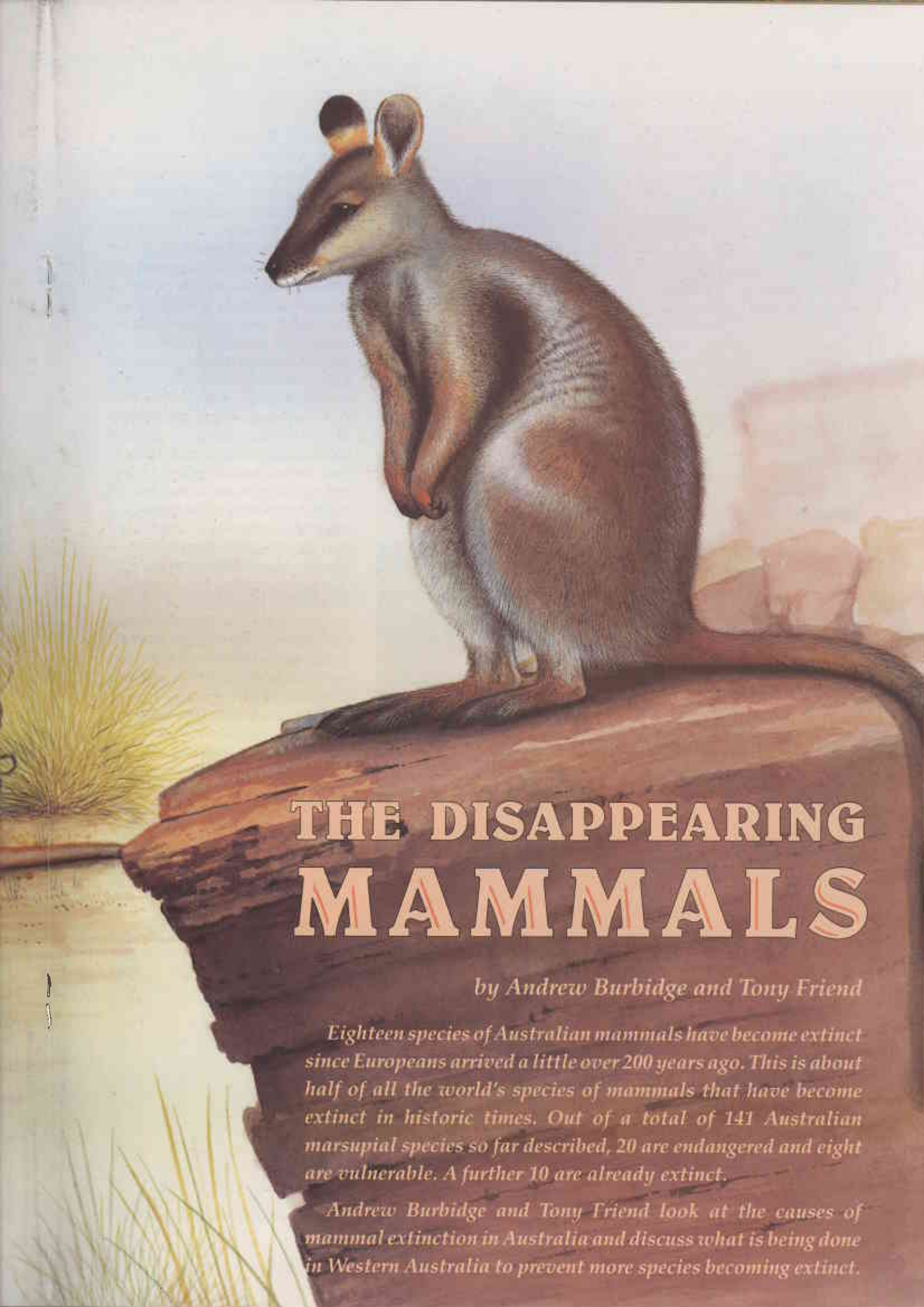

THE DISAPPEARING MAMMALS

by Andrew Burbidge and Tony Friend

Eighteen species of Australian mammals have become extinct since Europeans arrived a little over 200 years ago. This is about half of all the world's species of mammals that have become extinct in historic times. Out of a total of 141 Australian marsupial species so far described, 20 are endangered and eight are vulnerable. A further 10 are already extinct.

Andrew Burbidge and Tony Friend look at the causes of mammal extinction in Australia and discuss what is being done in Western Australia to prevent more species becoming extinct.

AUSTRALIA has a worse record than any other continent for rates of mammal extinction. We are lucky that it isn't even poorer. Of the surviving species of Australian mammals, eight now occur only on continental islands. If Western Australia's Barrow, Bernier and Dorre Islands did not exist, or had been affected by introduced predators, a further four species would be gone.

Not only has Australia lost a great many mammals forever, but there are also many species that are endangered or vulnerable. Why has Australia such a bad history of mammal conservation?

CRITICAL WEIGHT RANGE

A recent scientific paper by two CALM research scientists has shown that extinctions and dramatic declines in range among Australian mammals are virtually

confined to non-flying mammals with mean adult body weights between 35 g and 5 500 g; this was termed the *critical weight range* (CWR). The many smaller mammals (marsupials such as dunnarts; rodents such as native mice) are still common, as are the larger kangaroos and big wallabies. CWR mammals that have declined or become extinct are not restricted to one or two families but come from most groups of marsupials and native rodents.

Extinctions and declines have not happened equally in every part of the continent. The more arid an area, the more species that are extinct or endangered - one third of the native mammals of the deserts of the interior are either locally or totally extinct, and almost all of the remaining CWR arid zone species are endangered. At the other extreme, no mammals of the wet tropics of Western Australia are either extinct or endangered. Biology and habitat also have some effect. Ground-dwelling mammals are more likely to be endangered or extinct than are tree-dwelling species or those that live in rock-piles (such as rock-wallabies).

There have been many hypotheses as to why particular species or suites of species have declined in, or disappeared from, various parts of Australia. These include clearing for agriculture, draining or salination of wetlands, grazing and browsing by introduced animals, changed fire regimes, introduced predators, disease, and overkill by hunters.

ELIMINATED HYPOTHESES

Some of the hypotheses can already be dismissed as common causes of the disappearance or decline of an array of species throughout their former ranges.

Disease

There is no direct evidence that disease has led to the extinction of any Australian mammal. Disease might possibly have removed mammals a long time ago when there were no biologists to study the effects; but if disease were a primary cause of extinction or decline in a significant number of species, it is curious that it should selectively affect the CWR species, especially those occurring in arid regions.

Illustration - previous page.
From left - Red-tailed phascogale, western barred bandicoot, rufous hare-wallaby and black-footed rock-wallaby.
Illustration - Martin Thompson

The western barred bandicoot, now restricted to Bernier and Dorre Islands in Shark Bay, was once common in much of southern Australia.
Photo - Wade Hughes ◄

Once common in the WA Wheatbelt, the dalgyte (or bilby) is now restricted to remnant populations in the northern deserts.
Photo - Jiri Lochman ►

Hunting

While many species of Australian mammals have been hunted for thousands of years by Aborigines (many were hunted by early Europeans too), and while hunting of some species continues today, there is no evidence that post-European declines and extinctions have been the result of excessive harvesting. Most species exterminated by overkill elsewhere in the world were large; in Australia, larger species, such as kangaroos, have suffered no major declines except where their habitat has been destroyed, while many CWR species that have never been hunted by Europeans have disappeared.

Clearing

Clearing has been confined to a small proportion of the continent of Australia, and few if any mammals were restricted to areas that were cleared at the time they became extinct. While clearing has doubtless been responsible for the local decline and disappearance of several mammal species, it could not have been the primary cause of total extinction for many.

Likewise, drainage and salination could not have affected many species, since few were restricted to areas that have been so affected. The only exception was the only non-CWR mainland species that is extinct - the toolache wallaby, which occurred in the south-east of South Australia and the west of Victoria. Swamps formed a significant part of its habitat, and most are now drained. This destruction, which also included the clearing of vegetation, was the major cause of the toolache's demise.

GONE FOREVER: EXTINCT SPECIES OF AUSTRALIAN MAMMALS

Thylacinus cynocephalus, thylacine
Perameles eremiana, desert bandicoot
Chaeropus ecaudatus, pig-footed bandicoot
Macrotis leucura, lesser bilby
Potorous platyops, broad-faced potoroo
Caloprymnus campestris, desert rat-kangaroo
Lagorchestes leporides, eastern hare-wallaby
Lagorchestes asomatus, central hare-wallaby
Onychogalea lunata, crescent nailtail wallaby
Macropus greyi, toolache wallaby
Conilurus albipes, white-footed rabbit-rat
Pseudomys fieldi, Alice Springs mouse
Pseudomys gouldii, Gould's mouse
Leporillus apicalis, lesser stick-nest rat
Notomys macrotis, big-eared hopping-mouse
Notomys longicaudatus, long-tailed hopping-mouse
Notomys amplus, short-tailed hopping-mouse
Notomys mordax, Darling Downs hopping-mouse

BOX 1

PROBABLE CAUSES

The remaining possible causes - introduced herbivores, changed fire regimes and exotic predators - are widespread in their distribution and effect.

Introduced Herbivores

Rabbits, goats, cattle, sheep, donkeys, pigs, camels and so on, are widespread in Australia. Pastoralism (open-range grazing) is the major land-use of much of the arid zone, but many exotic species extend into conservation reserves and unoccupied deserts. The effects of introduced herbivores on the native vegetation and habitats have been significant. However, there is nothing to suggest that introduced herbivores have much affected the spinifex communities that dominate the sandy and stony deserts, although rabbits may have eaten out the nutrient-rich refuges that the native species depended on in hard times.

Fire Regimes

Fire is one of the most significant modifiers of habitat in Australia, but while there are several studies on the effects of single fires on mammal populations there are few data on the effects of the frequency, extent, and season of fires on the status of CWR mammals.

Fire regimes are known to have changed significantly in parts of Australia since European settlement. The propensity of Aborigines for burning the country was noted by some early European visitors. In much of the western desert the movement of Aborigines to settlements has occurred only in the last 25 to 60 years, and it is possible to crudely reconstruct the pre-European situation. Here it has been suggested that the fire regime changed from one where numerous, mainly small fires occurred throughout the year to one dominated by infrequent, large, summer fires. As a result, the vegetation has apparently changed from one with small patches in different stages of recovery following fire to one with much larger, less diverse patches.

It is thought that many mammals depended on the recently burnt country for food and the adjacent, denser vegetation for cover. Research has shown that the disappearance of mammals from the deserts of Western Australia, north-western South Australia and the south-western Northern Territory coincided with the depopulation of the area by Aborigines and the subsequent change in the fire regime.

INTRODUCED PREDATORS

Three exotic predators are now widespread in Australia. The dingo is thought to have been introduced between 3 000 and 8 000 years ago, and it is usually assumed that its effects on mammals pre-dated European settlement. In contrast, the feral cat and the red fox are much more recent arrivals.

The cat occurs throughout the continent and appears to have been present for a long time. There is no doubt that cats prey upon CWR mammals as large as rufous hare-wallabies, which weigh about 1600 g. However, extinct CWR mammals such as the pig-footed bandicoot (350 g), the desert rat-kangaroo (890 g) and the central hare-wallaby (1500 g) persisted in the western deserts until at least the 1930s and probably as late as the 1950s (*LANDSCOPE*, Winter 1987), which suggests that the cat has not been the primary factor in their decline.

The fox arrived later, around the mid 1800s. It spread rapidly from Victoria, colonising most of the continent except the wet tropics by the 1930s. The lack of mammal extinctions in the wet tropics and in Tasmania (apart from the thylacine) is consistent with the distribution of the red fox, and foxes have been implicated in the demise of many native Australian mammals. But the relationship is not absolute; in some parts of Australia it seems clear that the native mammals had begun to decline or had disappeared before foxes arrived.

It has been known for some time that foxes can eliminate island populations of CWR mammals. Recent research in Western Australia by Dr Jack Kinnear and colleagues from CALM (see *LANDSCOPE*, Summer 1988-89, Summer 1989-90 and Winter 1990) has demonstrated that fox control around remnant mammal populations leads to a rapid increase in numbers of native mammals such as numbats, woylies (or brush-tailed bettongs), black-footed rock-wallabies, Rothschild's rock-wallabies, common brushtail possums and, surprisingly, western brush wallabies, which have an adult body weight of eight kg. Control of foxes is now considered a pre-requisite for both the management of remnant CWR mammal populations and for the successful re-introduction of CWR species to parts of their former range.

NEARLY GONE: EXTINCT ON THE MAINLAND, NOW RESTRICTED TO ISLANDS

Dasyurus viverrinus, eastern quoll
Tasmania

Perameles bougainville, western barred bandicoot
Bernier & Dorre Is, WA

Bettongia lesueur, boodie or burrowing bettong
Barrow, Bernier & Dorre Is, WA

Bettongia gaimardii, Tasmanian bettong
Tasmania & Bruny I, Tasmania

Lagostrophus fasciatus, banded hare-wallaby
Bernier & Dorre Is, WA

Thylogale billardierii, Tasmanian pademelon
Tasmania & 16 other Tasmanian islands

Leporillus conditor, greater stick-nest rat
Franklin Is, SA (recently introduced to Salutation I, Shark Bay, WA)

Pseudomys praeconis, Shark Bay mouse
Bernier I, WA

Burrowing Bettong

BOX 2

The banded hare-wallaby, once abundant in WA's South-West, now occurs only on Bernier and Dorre Islands.
Photo - Marie Lochman ►

CALM researchers are studying the western barred bandicoot on Dorre Island as a precursor to preparing a recovery plan to extend its range.
Photo - Tony Friend ▼

WHAT HAS BEEN DONE?

For many years mammal conservation was based largely on the protection of habitat, where this was possible. Many very important conservation reserves have been set aside to protect endangered mammals. In Western Australia Barrow Island was reserved in 1908 to protect its amazing suite of mammals and Bernier and Dorre Islands were reserved in 1957. The rapid growth in the conservation estate in the 1960s and 1970s protected a number of important mammal sites. However, slowly it became clear that, on the mainland, habitat protection was not enough; species were being lost from reserved areas.

Over the past two decades there has been a revolution in mammal conservation in Australia. All around the country studies have commenced into endangered mammals, looking for the reasons for their decline and aiming to develop conservation techniques. Research has been carried out mainly by the State conservation agencies, but universities have also been involved. Recently, the financial assistance of World Wide Fund for Nature Australia (WWFA) and the Australian National Parks and Wildlife Service (ANPWS) has speeded up this vital work.

Western Australia has been in the forefront of these studies. Research has been conducted into the numbat (*LANDSCOPE*, Winter 1990), the woylie, the tammar wallaby, the chuditch (*LANDSCOPE*, Winter 1987) and many other species. Research has concentrated on fire ecology and on the effects of introduced predators. The results of all these studies have been incorporated into management guidelines for CALM-managed lands where the species exist.

WHAT'S TO BE DONE?

Huge reductions in numbers and range have left the mammals that we now label "endangered" with small, restricted, often fragmented populations. Urgent priorities in research and management are to pinpoint the processes now threatening those populations, and to act to reverse their effect. Fox control programs are being expanded, protecting remnant populations of endangered mammals and allowing re-introduction of some species into parts of their former ranges. However, there are still a number of endangered species in Western Australia about which we know little beyond their status. There are still only a few about which we know sufficient to confidently engage in full-scale recovery programs.

Australia's endangered mammals fall into three categories.

Restricted to Islands

Firstly, there are those that are extinct on the mainland and only persist on offshore islands, most of which are free of introduced predators (see Box 2). Apparently these species are unable to survive in the face of ecological changes on the mainland since white settlement. Other species equally intolerant of change that did not have island populations became extinct (Box 1, except for the thylacine, which became extinct on an island). Species in this group are fairly secure in the short term, but those dependent on small islands in particular are extremely vulnerable to catastrophe. In the case of the Shark Bay mouse, which is only on one small island, and the banded hare-wallaby and western barred bandicoot, which are only on two, the loss of even one population must be prevented at all costs. The security of these species will be enhanced by the establishment of new populations in predator-free places, preferably within their previous ranges.

In Western Australia, research into re-introducing mammal species to the mainland and introducing them to islands has begun. In 1990 a captive-bred group of the greater stick-nest rat was introduced

ENDANGERED AND VULNERABLE WESTERN AUSTRALIAN MAMMALS

A. RESTRICTED TO MAINLAND; MASSIVE REDUCTION IN RANGE AND NUMBERS.

Dasyurus geoffroii, chuditch or western quoll
Dasycercus cristicauda, mulgara or minyi-minyi
Phascogale calura, red-tailed phascogale
Sminthopsis psammophila, sandhill dunnart
Myrmecobius fasciatus, numbat or walpurti
Macrotis lagotis, dalgyte or bilby or ninu
Pseudocheirus occidentalis, western ringtail possum
Bettongia penicillata, brush-tailed bettong or woylie*
Pseudomys australis, plains rat
Pseudomys shortridgei, heath rat
Pseudomys occidentalis, western mouse
*Introduction under way to islands in South Australia.

Chuditch

B. OCCUR ON ISLANDS; MASSIVE OR SIGNIFICANT REDUCTION IN RANGE AND NUMBERS ON MAINLAND.

Parantechinus apicalis, dibbler
Isoodon obesulus, southern brown bandicoot or quenda
Isoodon auratus, golden bandicoot or wintaru
Lagorchestes conspicillatus, spectacled hare-wallaby or wampana
Lagorchestes hirsutus, rufous hare-wallaby or mala
Petrogale lateralis, black-footed rock-wallaby or warru
Macropus eugenii, tammar

Dibbler

BOX 3

A Shark Bay mouse from Bernier Island. This species has not been recorded on the mainland since 1858.
Photo - Marie Lochman ◄

Dorre Island, Shark Bay. A nature reserve that is the refuge for three species of mammals now extinct on the Australian mainland.
Photo - Tony Friend ▼

onto Salutation Island, Shark Bay, from Franklin Island, off the South Australian coast. If a new population is established here, this project will have significantly increased the total number of stick-nest rats and reduced the vulnerability of the species to extinction.

Restricted to the Mainland

The second group of endangered mammals comprises those species that have experienced massive declines in range and numbers since white settlement, and persist only as remnant populations on the mainland. They constitute the most endangered group, because where a historic decline in range happened, it is likely that the causal factors are still operating, or might be re-activated. These species appear, however, to have some temporary ecological refuge on the mainland that has allowed them to survive so far despite the changes that so greatly reduced their numbers.

Again, an increase in the number of populations of these species through re-introduction and exchange of individuals between isolated populations to maintain gene flow should place these species in a more secure position. CALM has begun a program of re-establishment of numbat populations in areas being maintained fox-free, and this will continue until the number of secure colonies is adequate. The woylie and chuditch are two more obvious candidates for this strategy. In addition, CALM scientists have this year begun studies on the western mouse (funded by WWFA) and on the red-tailed phascogale (supported by ANPWS) to define strategies for managing and increasing populations of these two small mammals.

Those species that are widely but thinly distributed in non-agricultural areas, such as pastoral country or the deserts, may be somewhat more secure but it is difficult to locate populations in order to study and manage them. In Western Australia, this group includes the sandhill dunnart, the dalgyte (or bilby) and the mulgara. Further understanding of these species is required before conservation strategies can be formulated.

Island and Mainland Survivors

The third group consists of those that occur on offshore islands but also have remnant, low-density populations surviving on the mainland, despite large historic declines. Western Australian examples include the dibbler, golden bandicoot, tammar, black-footed rock-wallaby and spectacled hare-wallaby.

Species in this group are better off than those in the other two groups, as they appear to have some temporary mainland ecological refuges as well as predator-free island refuges. They offer the opportunity to study population dynamics on islands and the mainland, in order to isolate factors causing declines on the mainland.

The fox has already been shown to be a major threat to CWR mammals. While control programs using highly selective poison baits are effective, they are also expensive and limited in application. A long-term solution to the fox problem currently being evaluated is the use of a specific viral agent that suppresses reproduction. The effective dispersal of this agent will rely on accurate knowledge of the ecology and socio-biology of the fox in Australia, and this research is currently being carried out by CALM scientists in Western Australia, with support from ANPWS and WWFA.

Too many of our mammals are extinct. So many more are endangered or vulnerable. Lessons have been learned and management has begun. But much more research and management will be needed before Australians can be sure that no more mammals are lost forever.

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In the central Kimberley, a screw-pine-surrounded creek - just one of the threatened areas in this fragile frontier. Turn to page 22.

LANDSCOPE

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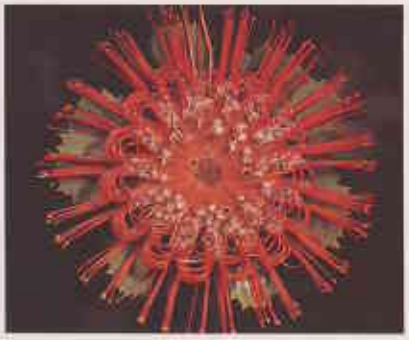

Public awareness and involvement is vital in the conservation of WA's rare and endangered flora. Page 49.

Ten WA mammal species have become extinct in the last 200 years. What can be done to ensure no more are lost forever? Page 28.

Until 1984 more was known about what was underneath the Nullarbor than what was on top. But with such a vast area to study, where do we start? See page 16.

Forests protect our environment. They also provide timber. How do we strike a balance? Turn to page 35.

FEATURES

REGULARS

SPECIALS

COVER

Dolphins and whales are perhaps the best-known inhabitants of Western Australia's coastal waters. But this unique area is also home to an astonishing range of marine flora and fauna, from sea-turtles and coral reefs in the north to sea-grass banks and great white sharks in the south. See page 10.

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