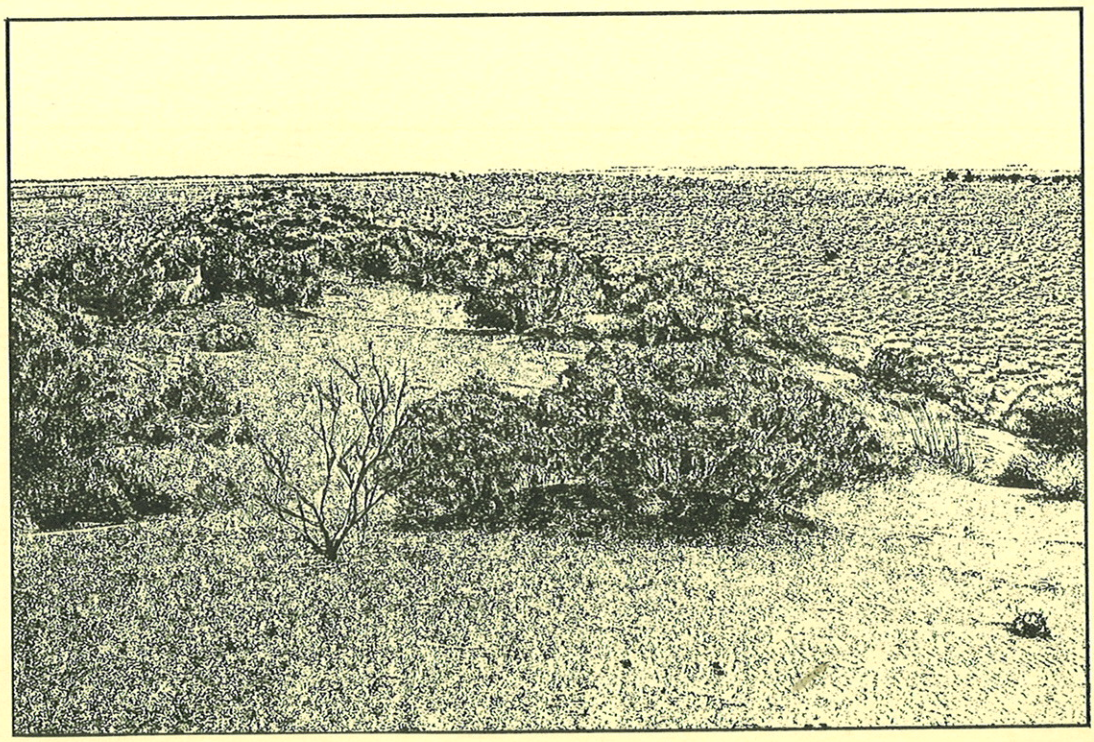
A search for the Rufous Hare-wallaby in the Great Sandy and Little Sandy Deserts, Western Australia, with notes on other mammals

Andrew A Burbidge and David J Pearson



Technical Report No 23

October 1989

Department of Conservation and Land Management

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Technical Report No 23

October 1989

Published by the
Department of Conservation and Land Management
Como Western Australia.

ISSN 0816-6757

Marianne Lewis ..... Editor
Jill Pryde ..... page preparation
CALM Mapping ..... illustrations
CALM Public Affairs ..... Production and distribution

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Abstract

Helicopter and ground searches were carried out for the Rufous Hare-wallaby (*Lagorchestes hirsutus*, Marsupialia : Macropodidae) and other rare and endangered mammals in parts of the Great Sandy and Little Sandy Deserts of Western Australia during June 1986. Searching was concentrated near salt lake systems where fire patterns were more varied. No populations of Rufous Hare-wallabies were located but several large populations of Greater Bilbies (*Macrotis lagotis*) were found. The search area was different from the area where Rufous Hare-wallabies persist in the Tanami Desert in the Northern Territory, lacking the diversity of patches created by frequent small fires and having a high density of foxes.

INTRODUCTION

Approximately 33 per cent of Western Australian desert mammals are extinct or endangered (Burbidge and Jenkins 1984; Burbidge and McKenzie 1989). This decline happened over the vast area encompassed by the central deserts (Tanami, Great Sandy, Little Sandy, Gibson, Great Victoria, Central Ranges, see Beard (1981) for boundaries) during the past 30 to 50 years (Burbidge *et al.* 1988). Burbidge and McKenzie (1989) have shown that all declines and extinctions are restricted to a critical weight range (CWR, mean adult body weight from 35 g to 5 500 g) and that 90 per cent of desert CWR mammals have become locally extinct or have declined to less than 50 per cent of their former geographic range.

While many desert CWR species are presumed extinct, a few remain in remnant populations in various parts of the arid zone. These include the Greater Bilby (*Macrotis lagotis*), the Common Brushtail Possum (*Trichosurus vulpecula*), the Black-footed Rock-wallaby (*Petrogale lateralis*), the Spectacled Hare-wallaby (*Lagorchestes conspicillatus*) and the Rufous Hare-wallaby (*L. hirsutus*).

Three main hypotheses have been put forward to account for the massive decline in arid zone CWR mammals - changes in fire regimes, the effects of exotic predators and competition from exotic herbivores (Burbidge and Johnson 1983; Burbidge and McKenzie 1989).

Major changes in fire regimes were a consequence of the departure of Aborigines from large tracts of the deserts and their settlement in missions, stations and other communities. Aborigines used fire for hunting, the regeneration of food plants and signalling as well as for numerous other purposes (Gould 1971; Kimber 1983; Burbidge 1985). These uses are thought to have resulted in a tight mosaic of areas of differing age since fire, providing environmental diversity and preventing the development of extensive wildfires in summer. As the Aborigines left their traditional lands for settlements a 'natural' fire regime took over, one of infrequent but very extensive, high intensity summer wildfires, usually started by lightning. This change is thought to have had a profound effect on the mammals, depriving them of the diversity of shelter and feeding areas that they required and leading to a rapid decline and local or total extinction.

Feral cats (*Felis catus*) and Foxes (*Vulpes vulpes*) are now widespread and abundant in the study area. It is not known when cats first became established, but they were present when European explorers entered the area in the 1890s. Most Aborigines residing in the central deserts regard cats as always having been present and some indicate that they moved into central Australia from the west (Burbidge *et al.* 1988), so they may have established from 17th century shipwrecks on the west coast. Foxes entered later, becoming established in parts of the centre by the 1930s (Finlayson 1961; Griffin and Friedel 1985; King and Smith 1985), but not appearing at many places until much later (Burbidge *et al.* 1988).

Rabbits (*Oryctolagus cuniculus*) entered the southern Northern Territory and arid Western Australia from the south-east in the 1890s and became widespread shortly afterwards. Present rabbit distribution is mainly south of the Tropic of Capricorn with pockets in favourable country to the north (Griffin and Friedel 1985). The One-humped Camel (*Camelus dromedarius*) became feral from escapes from pack animals first used in the latter half of the 19th century (Newman 1983). They are now very seasonally common throughout the deserts.

The Rufous Hare-wallaby once had an extremely wide distribution in the western deserts and adjacent better watered regions (Burbidge and Johnson 1983; Burbidge *et al.* 1988). Now it is known only from a single small population in the Tanami Desert, Northern Territory, and from populations on Bernier and Dorre Islands, Shark Bay, Western Australia. The Tanami animals occur in association with a series of salt pans and their persistence is thought to have been due to a combination of winter burning along an adjacent stock route, the breaking up of fire patterns by the salt pans (Bolton and Latz 1978) and, perhaps, the more reliable productivity of the caliche environment.

If the persistence of the Rufous Hare-wallaby in the Tanami is associated with their location near salt lakes then it seems logical that other remnant populations might exist in comparable areas elsewhere. In Western Australia there are several major areas of salt lakes. One of the largest, in the Great Sandy Desert, is the chain of lakes along the Percival Palaeoriver (van de Graaf *et al.* 1977), which includes the following lakes: Tobin, Percival, Auld, George, Winifred, Blanche and Dora. A little to the south, in the Little Sandy Desert, lies Lake Disappointment, one of the largest individual lakes in the State.

Although Aborigines from the area have told us that they do not know of any extant Rufous Hare-wallaby populations (Burbidge *et al.* 1988), they have not travelled widely in these deserts since moving to settlements some decades ago. Accordingly we decided that a careful search for the Rufous Hare-wallaby and other rare mammals may be fruitful.

The remoteness of the area where these lakes occur and the numerous high sand dunes that make vehicle traverse difficult, precluded searching large areas from the ground. As a consequence, it was thought that the only effective method of locating populations of hare-wallabies and other medium-sized mammals would be to search for tracks and other signs from a low-flying helicopter.

METHODS

Selection of search areas

Seven Landsat scenes (Table 1) were acquired to select areas of potential Rufous Hare-wallaby habitat.

Selection assumed that any population remaining along the Tobin-Dora lake chain or around Lake Disappointment would occupy habitats similar to that of the Tanami Desert population (see Saxon 1983). In particular, the presence of mature spinifex hummocks in close proximity to recently burnt and caliche areas was seen as the major determining factor. Dense spinifex hummocks are used as shelter by *L. hirsutus* but become unsuitable once the centre of the hummock dies and the plant begins to spread as a ring. Studies on the Tanami Desert population (Bolton and Latz 1978; Pearson in press) have shown that Rufous Hare-wallabies may travel up to 150 m to feed in recently burnt areas. In addition, caliche areas provide valuable food plants, such as *Eragrostis falcata, E. speciosa* and *Cyperus bulbosus*, and the lakes exert a fire-shadow effect, dissipating large summer conflagrations and promoting a mosaic of areas of different fire age. It was logical, therefore, to concentrate search effort in areas close to salt lakes where a diverse fire mosaic was apparent.

Table 1.

Landsat scenes used to plan the search for the Rufous Hare-wallaby and other rare mammals.

Local date of scene	Satellite number	Path/row	Scene Centre
17.12.80	2	115/75	21°40'S, 125°51'E
18.12.80	2	116/75	21°40'S, 124°25'E
18.12.80	2	116/76	23°07'S, 124°03'E
1.12.80	2	117/76	23°07'S, 122°37'E
30.11.85	5	108/75	21°42'S, 125°19'E
8. 1.86	5	109/75	21°42'S, 123°47'E
23.12.85	5	109/76	23°09'S, 123°26'E

The Landsat scenes were purchased at an image size of 740 x 740 mm (equivalent to 185 x 185 km) in Bands 4, 5 and 7 so as to highlight vegetation and fire patterns. The latest cloud-free imagery was chosen (November, December 1985 and January 1986) to show recent fire patterns. These were then compared with imagery taken five years previously. Areas with burnt and unburnt areas juxtaposed were identified and given search priority while areas that had been recently burnt by extensive fires were excluded from the search.

Testing and evaluation of search techniques in the Tanami Desert

The Rufous Hare-wallaby colony in the Tanami Desert was visited by one of us (DJP) from 2 to 4 June 1986 to determine the optimal helicopter search method and examine the aerial appearance of vegetation currently occupied by hare-wallabies. A Hughes 300 helicopter was used and the helicopter trials lasted for a total flying time of three hours. After experimenting with various heights and speeds, the optimum combination was found to be a ground speed of 30 to 40 km/h at a height of 8 to 10 m from the ground. Visibility was found to be markedly improved with both doors removed. This combination made it possible for two observers, one on each side of the aircraft, to see the individual tracks and tail-drag marks left by an animal moving along on all fours, as well as pads made by a number of animals using the same route.

Search transects were made into the wind because a tailwind adversely affected the handling of the helicopter at low speeds. Trials were limited to a small portion of the known colony areas to minimize any disturbance of the animals. No animals were seen to be flushed by the passage of the helicopter. The day after the trials a hare-wallaby was flushed from an intensively searched area by one of us (DJP) while walking through the area, suggesting that the animals were not driven from the area by the passage of the helicopter.

The time of day was found to be important for the detection of tracks. The best time was soon after sunrise when the tracks were fresh and the sun had risen sufficiently to prevent spinifex hummocks casting shadows across the inter-hummock soil where the tracks exist.

Some of the helicopter time was spent developing a 'search-image' of the particular vegetation type and structure that the hare-wallabies were using. They almost universally occupied areas of mature *Triodia pungens* (3-4 years post fire) with scattered *Melaleuca glomerata* shrubs. The Tanami colony also formerly occupied some areas of *Plectrachne schinzii* hummock grassland (Bolton and Latz 1978; Ken Johnson personal communication[1]).

The search in the Great Sandy and Little Sandy Deserts

Two base camps were established. The first, on the western side of Lake Auld (Fig. 2), was occupied from 9 June to 19 June, while the second, 4 km northeast of Canning Stock Route Well 24 (Karara Well, Fig. 2), was used from 19 to 24 June 1986.

Six people carried out the search in a Bell Jet Ranger helicopter. In addition, Lorna Charlton from the Mammal Department, Western Australian Museum, joined the expedition to make general collections for the Museum.

The first day was spent searching an area on the eastern side of Lake Auld near Camp 1 to familiarize personnel with the search techniques developed in the Tanami. Thereafter, each search day followed a similar pattern.

At 0745 h (Western Australian time) the helicopter, with the rear doors removed and with four observers on board, commenced searching a selected area within a short travel time (usually less than 45 min) from camp. The height and speed determined in the Tanami Desert tests were used, except that speeds up to 55 km/h were used to cross open areas or areas that did not appear suitable for hare-wallabies, eg large areas of very old spinifex. Animal tracks could be seen easily up to 25 m each side of the helicopter and traverses were spaced about 300 to 400 m apart. Where dunes were present traverses were selected near the base of a dune rather than along the crest.

After completing 1.5 to 2.5 h searching one pair of observers was dropped off in a promising area to carry out a ground search and the second pair was put down in another area nearby. Each pair carried food, water, a compass, matches, a camera and a daylight white smoke canister. One pair also carried a portable VHF radio enabling communication with the helicopter at short range.

The helicopter then returned to camp to refuel. After replacing the rear doors (to increase airspeed) and loading up to six 20-L jerrycans of extra fuel, the remaining two observers would then travel to a more remote search area where the doors were again removed and the air search commenced. After a short ground search the helicopter returned the last two observers to camp, refuelled and picked up the first two pairs of observers, completing all flying by 1630 h. When the ground parties had walked some distance from the place where they had been dropped the helicopter pilot was guided by use of the VHF radio or by the lighting of a fire.

On 20 June a flight was made to remote rocky hills around Lake Disappointment to search for evidence of the Black-footed Rock-wallaby.

1 K Johnson, Conservation Commission of the Northern Territory, Alice Springs.

A total of 55 h was flown during the search in the Great Sandy and Little Sandy Deserts.

RESULTS

The area searched is shown in Figures 1 and 2.

Native Species

Rufous Hare-wallaby *Lagorchestes hirsutus*

No sign of this species was located.

Greater Bilby, Dalgyte *Macrotis lagotis*

Numerous populations of this species were located (Figs 1 and 2). Habitat varied. Some colonies were associated with the salt lake chain, often being concentrated in caliche, while others were found some distance from the lake flats in swales and sandplains. Fire history also varied. Some populations were in areas that had been burnt during the past few years, while others were in long-unburnt country. Food depended on the habitat. Animals living on caliche soils were found to be eating mainly the bulbs of *Cyperus bulbosus*; other populations were concentrating on termites.

Some of the populations were large by current standards. Along the Percival Lakes from longitude 124°30' to 125°30'E there was an almost unbroken series of populations, living in habitats with a variety of fire ages and soil types. This is by far the largest concentration of Bilbies we know of in Western Australia. Another population on the western side of Lake Auld (22°09'S, 123°44'E) was as large as any located in the State during the recent World Wildlife Fund Australia searches (Southgate 1987).

Helicopter searching is an ideal method of locating Bilby populations. At the low searching levels and speed used to search for hare-wallabies, tracks can be readily identified. Additionally, their diggings, both for food and for burrows, can be seen easily from 200 to 300 m above the ground at speeds of around 110 to 140 km/h.

Common Brushtail Possum *Trichosurus vulpecula*

Fresh scratchings, consistent with possums, were found on coolabahs in the Rudall River (22°13'S, 122°53'E). However, no other sign, such as droppings, was found and the scratchings may have been made by goannas (*Varanus* spp., probably *V. giganteus*) or feral cats. A fading track, consistent with the Common Brushtail Possum, on a dune at 21°34'S, 123°48'E, is the best evidence we found that this species still occurs in the area searched.

Black-footed Rock-wallaby *Petrogale lateralis*

We searched the following areas for this species : Scott Bluff, Runton Range, Sir Fowell Headland, Constance Headland, Calvert Range and unnamed ranges near Diebel (Tipil) Rockhole. The species was known to occur in the Calvert Range where there is a thriving population (J.E.Kinnear[2] personal communication). Small numbers are also known to occur in the Durba Hills but we did not search this area. We located old droppings in sheltered places at Sir Fowell Headland, but no recent signs. We did not find any sign of the species in the other areas searched.

Burrowing Bettong, Boodie *Bettongia lesueur*

Old, collapsed warrens, attributed to this species, were noted at a number of locations scattered throughout the search area, where the soils were hard enough to retain some of the formerly mounded structure. In the search area warrens were sighted only in lateritic soils. Details of the location and abundance of Burrowing Bettong warrens will be presented in a later paper covering a larger area of Western Australia.

Common Wallaroo, Euro *Macropus robustus*

Three animals were seen at Well 24. Fresh droppings were found at Picture Hill, Scott Bluff, Runton Range, Sir Fowell Headland, Calvert Range and the unnamed hills at Diebil Rockhole.

Marsupial Mole *Notoryctes typhlops*

Fresh tracks, consistent with this species, were found on a dune 3 km east of the Lake Auld camp on 10 June 1986. This was about two days after rain had fallen in the area.

Feral Species

Rabbit *Oryctolagus cuniculus*

Occasional signs of rabbits were found in scattered locations in caliche soils, but they were not located elsewhere.

2 J.E. Kinnear, Department of Conservation and Land Management, W.A. Wildlife Research Centre, Woodvale.

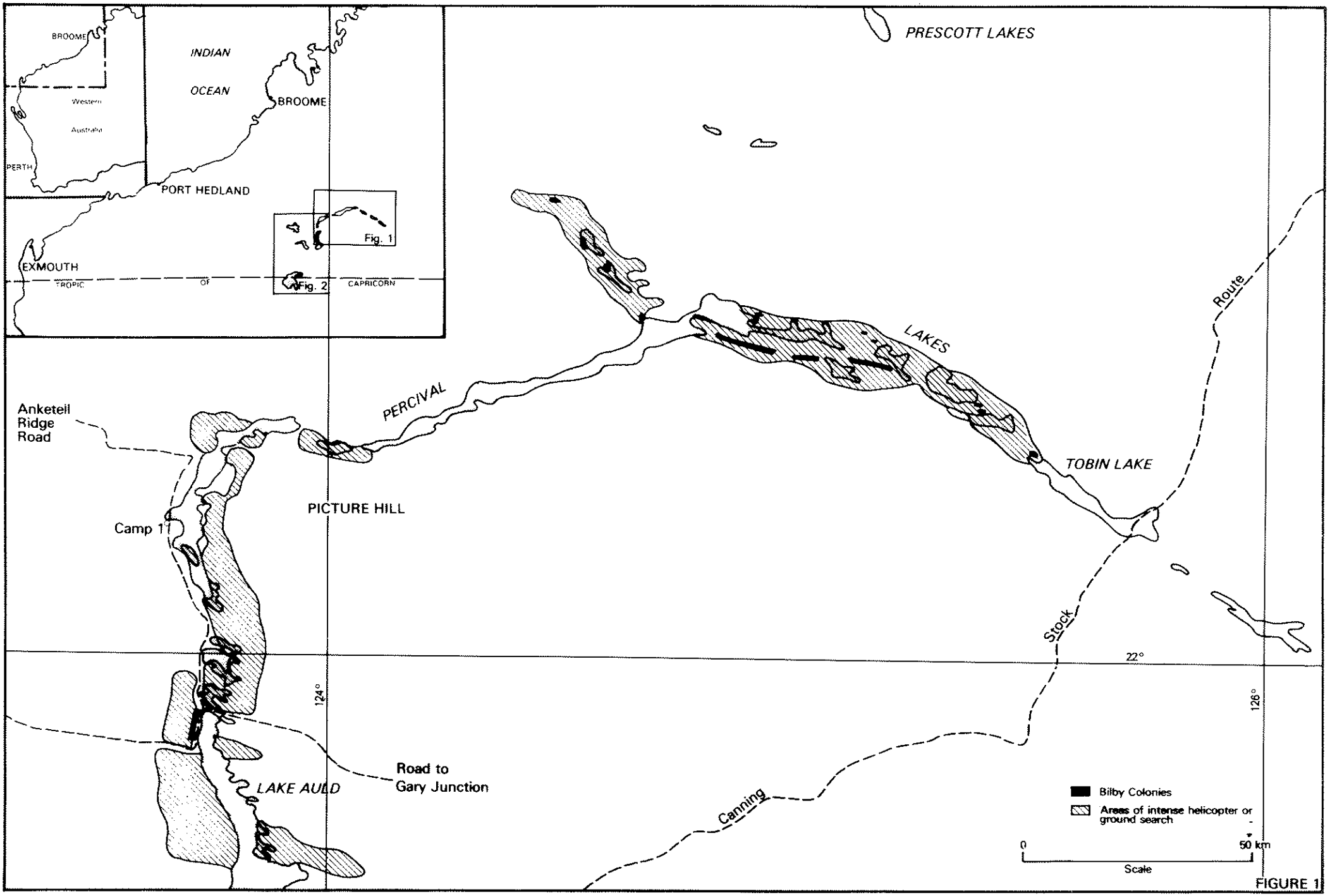

FIG. 1: AREAS SEARCHED BY HELICOPTER AND BY GROUND PARTIES

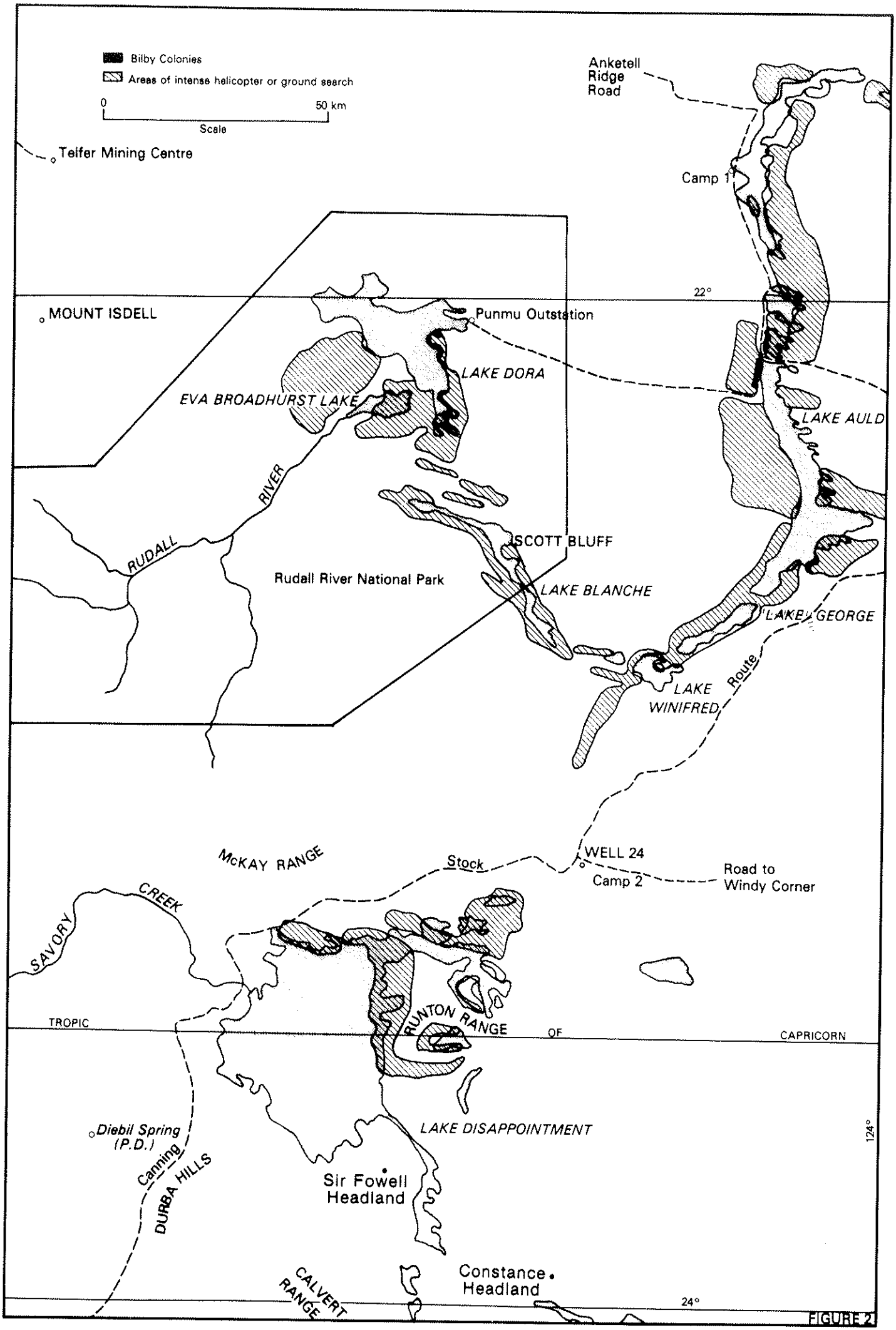

FIG. 2: AREAS SEARCHED BY HELICOPTER AND BY GROUND PARTIES

Dingo *Canis familiaris*

Dingo tracks were common in all areas searched.

Fox *Vulpes vulpes*

Tracks of this species were seen commonly throughout the search area, especially on sandplains and dunes around the salt lakes. Two animals were seen from the helicopter amongst dunefields near Lake Percival.

Feral Cat *Felis catus*

Cat tracks were very common in all areas searched.

One-humped Camel *Camelus dromedarius*

Numerous single animals and herds were sighted, mainly near salt lakes. Most herds were from two to ten animals; one herd numbered about 40 individuals.

A full list of the mammals known from the Great Sandy and the northern Little Sandy Deserts can be found in McKenzie and Youngson (1983).

DISCUSSION

Rufous Hare-wallaby

We believe that the method we used to search for this species was most efficient and that populations would have been located had they been present. Thus, it seems most unlikely that the species still exists in the search area.

The search area differed in two significant ways from the area in the Tanami where the species persists.

The first relates to the lack of frequent small-scale burns. An examination of the Landsat images purchased for the search showed that most fires occurred in the summers of 1979-80 and 1984-85. Very little of the area searched showed much variety of fire age. Typically we found either long unburnt or recent summer-burnt areas, with recent fires being extensive.

The second relates to the density of foxes. Very few foxes occur at the Tanami Desert site (Bolton and Latz 1978), in contrast to the search area where foxes were abundant.

Our failure to find hare-wallabies in the search area does not help clarify the reasons for the decline and extinction of so many arid zone mammals. The search area showed evidence of all three of the factors hypothesized as being the cause of the decline. Fire patterns were unsuitable, foxes and cats were present in abundance and camels and rabbits were also present, camels being particularly common.

Some comparatively small areas (several hectares each) did seem suitable for hare-wallabies, showing much similarity to the area in the Tanami Desert where the species persists. In these places the salt lakes and sand dunes had acted to break up the fire patterns, producing some vegetational diversity. While we have no way of knowing whether these areas would have been suitable over the past 30 years or so, it seems logical to assume that they, or nearby areas, were. If this is the case then it would suggest that predation by foxes has been a major factor in the decline of the Rufous Hare-wallaby, as has been shown to be the case for rock-wallabies in the south-west of Western Australia (Kinnear *et al.* 1988). However, Southgate (1987) found that the current distribution of Greater Bilbies in Australia was correlated with an absence of rabbits and foxes; a finding inconsistent with the observed abundance of foxes and Greater Bilbies along the salt lakes in the search area.

Other species

Of the other species of critical weight range (Burbidge and McKenzie 1989) mammals that we searched for, we found convincing evidence of only the Greater Bilby and the Black-footed Rock-wallaby. Both species have declined and are now restricted to small, remnant populations. The populations of the Bilby were the largest we know of in Western Australia. It is noteworthy that the largest colonies are within the proposed Percival Lakes Nature Reserve (Burbidge *et al.* 1983). This area, plus several other areas, was recommended for reservation following a biological survey of the Great Sandy Desert sought by the Environmental Protection Authority so that conservation reserves could be declared in this natural region. So far none of the recommendations has been implemented.

The Black-footed Rock-wallaby has also declined dramatically, and is continuing to decline, in the deserts of Western Australia (Burbidge *et al.* 1988). Evidence of this continuing decline was found during this survey when we found old droppings, but no recent sign, at Sir Fowell Headland. The population at the Calvert Range seems to be the last of any size for several hundred kilometres in any direction and its conservation is of considerable importance.

ACKNOWLEDGEMENTS

This study was supported by a grant for helicopter charter from the Australian National Parks and Wildlife Service. Other costs were met by the

Western Australian Department of Conservation and Land Management.

We thank the Central Land Council and the Conservation Commission of the Northern Territory for permission to conduct experimental helicopter searching over the Rufous Hare-wallaby colony in the Tanami Desert, and Ken Johnson and Peter Jarman for assisting with the experiments and commenting on a draft of this paper.

We thank Capricorn Helicopters and pilot Murray Bolton and West Coast Helicopters and pilot Stuart James for their help and expertise.

We also thank the following people from the Department of Conservation and Land Management who helped with various aspects of the study: Michael Churches, Gordon Graham, Clete Mathews, Tony Start and Barney White, and especially our colleagues in the field: Lorna Charlton, Phil Fuller, Dan Grace, Gerry Maynes and Ric Stone.

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