

**A MANAGEMENT PROGRAM FOR  
THE GREATER BILBY  
(*Macrotis lagotis*)  
IN THE  
NORTHERN TERRITORY OF AUSTRALIA**

**PARKS AND WILDLIFE COMMISSION OF THE  
NORTHERN TERRITORY**

## TABLE OF CONTENTS

1.	INTRODUCTION .....	1
1.1	Species Subject to Management .....	1
1.2	Responsible Authority .....	1
1.3	Legislation and International Obligations .....	1
1.3.1	Northern Territory.....	1
1.3.2	Other States and Territories .....	2
1.3.3	Commonwealth .....	2
1.3.4	International .....	2
1.4	Bilby Status and Management Issues .....	2
2.	AIM AND OBJECTIVES.....	3
3.	MANAGEMENT MEASURES .....	3
3.1	Land Managed for Bilby Conservation .....	3
3.1.1	Inclusion of Bilby Populations in Parks and Reserves .....	3
3.1.2	Management Agreements .....	4
3.1.2.1	Aboriginal Land .....	4
3.1.2.2	Non-Aboriginal Land.....	4
3.2	Management Actions .....	4
3.2.1	Predator Control.....	4
3.2.2	Control of Introduced Herbivores.....	4
3.2.3	Control of Weeds .....	5
3.2.4	Fire Management .....	5
3.2.5	Captive Breeding .....	5
3.2.6	Reintroduction and Translocation.....	6
3.3	Cooperation.....	6
3.4	Public Awareness and Involvement.....	6
3.4.1	Volunteer Participation and Management Agreements.....	6
3.4.2	Public Education .....	6
3.4.3	Recovery Team .....	7
4.	MONITORING AND RESEARCH .....	7
4.1	Monitoring of Bilby Populations .....	7
4.2	Predators .....	7
4.3	Introduced Herbivores .....	8
4.4	Weeds.....	8
4.5	Fire .....	8
4.5.1	Habitat Suitability Model.....	8
4.5.2	Population Dynamics and Habitat Use .....	8
4.5.3	Diet and Food Availability .....	8
4.6	Reintroduction and Translocation.....	9
5.	MANAGEMENT STRATEGIES.....	9
6.	REPORTS .....	9

7.	COMPLIANCE.....	9
7.1	Permits .....	9
7.1.1	Permits to Keep.....	9
7.1.2	Permits to Take .....	10
7.1.3	Scientific Research .....	10
7.2	Animal Welfare.....	10
8.	REVIEW OF PROGRAM .....	10
9.	BACKGROUND .....	10
9.1	Taxonomy .....	10
9.2	Distribution and Habitat.....	10
9.3	Conservation Status .....	12
9.3.1	Wild Populations.....	12
9.3.2	Reintroduced Populations .....	13
9.4	Representation in Nature Conservation Reserves.....	13
9.5	Biology and Ecology .....	13
9.6	Threatening Processes.....	14
9.6.1	Predators .....	14
9.6.2	Parasites and Disease .....	14
9.6.3	Habitat Degradation .....	15
9.6.4	Fire .....	15
9.6.5	Human Settlement.....	15
9.7	Aboriginal Attitudes .....	15
10.	REFERENCES .....	16



# 1. INTRODUCTION

## 1.1 Species Subject to Management

Class: Mammalia  
Order: Marsupialia  
Superfamily: Peramelidae  
Subfamily: Thylacomyinae  
Species: *Macrotis lagotis* Reid, 1837  
Common names: Bilby, Greater Bilby, Dalgyte, Ninu, Walpatjirri, Tjalku, Marrura, Aherte

## 1.2 Responsible Authority

Parks and Wildlife Commission of the Northern Territory  
PO Box 496  
Palmerston, Northern Territory 0831, Australia

Telephone: (61) (08) 8999 4400  
Facsimile: (61) (08) 8999 4793

## 1.3 Legislation and International Obligations

### 1.3.1 Northern Territory

The Greater Bilby *Macrotis lagotis* is defined as Specially Protected under section 26A of the *Territory Parks and Wildlife Conservation Act 1993*. Bilby individuals captured in the wild, and their progeny are the property of the Northern Territory under section 26B of this Act.

It is an offence to possess or trade in live or dead Bilby individuals or parts without a permit issued by the Director of the Parks and Wildlife Commission. The maximum penalty for breaches of these provisions is a \$4000 fine and/or 12 months imprisonment, with additional fines of up to \$200 per animal or part thereof involved.

Section 122 of the *Territory Parks and Wildlife Conservation Act 1993* provides for traditional harvest of Bilbies for food, ceremonial and religious purposes by Aboriginal people.

The transfer of wild-caught or captive-bred Bilbies or their parts from the Northern Territory to other Australian States and Territories is subject to a permit issued under section 34 of the *Territory Parks and Wildlife Conservation Act 1993*.

### **1.3.2 Other States and Territories**

Legislation in Queensland, Western Australia and South Australia concerning Bilbies is similar to that of the Northern Territory.

### **1.3.3 Commonwealth**

The Bilby is listed as Vulnerable by the Australian and New Zealand Environment Conservation Council (ANZECC) (1991) and in Schedule 1, Part 2, of the Commonwealth *Endangered Species Protection Act 1992* and a national Bilby Recovery Plan has been developed in accordance with this Act. The export of Bilbies or their parts from Australia requires a permit from Environment Australia under section 29 of the *Wildlife Protection (Regulation of Exports and Imports) Act 1982*.

### **1.3.4 International**

The Bilby is listed as Vulnerable by the World Conservation Union (IUCN) (1996). It is included in Appendix I of the *Convention on International Trade in Endangered Species of Wild Flora and Fauna* (CITES) which regulates trade of listed species.

## **1.4 Bilby Status and Management Issues**

This management program has been developed in accordance with the requirements of the *Territory Parks and Wildlife Conservation Act 1993*.

The Bilby is a bandicoot and the only surviving representative of the subfamily Thylacomyinae. It is one of the few medium-sized (100 -5000 g) native mammals remaining in arid Australia. A suite of previously sympatric species including dasyurids, other bandicoots, rodents and small macropods are now severely restricted in range, located only on offshore islands, or have become extinct in arid Australia. Since European settlement, the range of the Bilby has declined by 70% (Fig 1).

The Bilby's decline and current restricted range suggests a sensitivity to the processes that have affected other threatened or extinct species. These processes include predation by Feral Cats *Felis catus* and introduced Red Foxes *Vulpes vulpes*, competition with European Rabbits *Oryctolagus cuniculus* and livestock, altered patterns of fire (Morton 1990) and altered water regimes. Study of the Bilby should provide an opportunity to examine the impact of threatening processes and to test the effect of remedial management. Improving the prognosis for the Bilby through mitigation of the effects of threatening processes should have positive benefits for the conservation of other plants and animals in arid and semi-arid Australia.

Wild populations of the Bilby in the Northern Territory are now almost entirely restricted to Aboriginal lands. Implementation of management measures on these lands will require the support of Aboriginal traditional owners.

The Bilby has a mounting public profile evidenced by increasing support for the Bilby to replace

the “bunny” as a symbol of Easter in Australia. It will be imperative to keep the public well informed on matters of Bilby conservation and to encourage public participation in management of the species.

## **2. AIM AND OBJECTIVES**

This management program is directed at improving the long-term conservation status of the Bilby and its habitat throughout the Northern Territory. The management program seeks to:

1. Include land containing Bilbies in the protected area system of the Northern Territory in accordance with the Northern Territory Parks Masterplan, and to extend management agreements under relevant NT legislation concerning pastoral leasehold and Aboriginal freehold lands for conservation of Bilbies;
2. Develop and apply sound conservation management practices for existing Bilby populations;
3. Promote public awareness of and involvement in the conservation of the Bilby;
4. Undertake scientific research to improve understanding and management of the Bilby;
5. Foster cooperation with other State and Territory Governments, the Commonwealth Government and other interested parties in ensuring that the Bilby survives and prospers.

## **3. MANAGEMENT MEASURES**

### **3.1 Land Managed for Bilby Conservation**

#### **3.1.1 Inclusion of Bilby Populations in Parks and Reserves**

The Northern Territory Parks Masterplan has a specific objective of acquiring land containing populations and habitat of all threatened species for inclusion within the protected areas system. Bilbies are specifically identified as a threatened species requiring such protection. Although current information indicates a paucity of Bilbies on non-Aboriginal lands, an effort will be made to acquire land for Bilby conservation. Such land may constitute suitable habitat formerly occupied by Bilbies to which the species would be reintroduced.

### **3.1.2 Management Agreements**

#### **3.1.2.1 Aboriginal Land**

Efforts will be made to extend management agreements with Aboriginal landholders for conservation of Bilbies either within or outside section 73 of the *Territory Parks and Wildlife Conservation Act*.

A first step in this direction has been the establishment of an agreement, through the Central Land Council, between the traditional Aboriginal custodians and the Northern Territory Government to jointly manage an area of land in the north west of the Tanami Desert. The land is held by the Puurta Land Trust and a Management Committee, comprising four traditional Aboriginal custodians and two Parks and Wildlife Commission officers, and has been established to undertake conservation management of the 2936 km<sup>2</sup> area. A Management Plan is required as part of the agreement and it is anticipated that management of land for Bilby conservation purposes will be an important part of this agreement.

#### **3.1.2.2 Non-Aboriginal Land**

Sparse populations of Bilbies occur on pastoral land in the northern deserts of the Northern Territory. It is possible that some of these areas would be suitable for Bilby conservation and efforts will be made to enter into joint management agreements with pastoral lessees for conservation of Bilbies under section 74 of the *Territory Parks and Wildlife Conservation Act*.

### **3.2 Management Actions**

#### **3.2.1 Predator Control**

Feral cats, Red Foxes and Dingoes *Canis familiaris* are the main predators of Bilbies. Meat baits containing 1080 poison are widely used to control dingoes in the Northern Territory and in other states to protect the pastoral industry. Meat baits containing 1080 are also used to manage foxes in other states but their potential for controlling foxes in central Australia has not been evaluated. Currently there are no cost effective methods for controlling feral cats in arid Australia.

On the Puurta Land Trust which is subject to joint management by the traditional Aboriginal custodians and the Northern Territory Government, the need for a predator control program will be considered in the development of animal management plans by the Puurta Management Committee. A survey during 1998 will indicate which mammalian predators are present on Puurta.

#### **3.2.2 Control of Introduced Herbivores**

Introduced herbivores are strongly implicated in the decline of the Bilby. This is believed to have occurred and to be still occurring through either competition for food and shelter or through habitat degradation. The European Rabbit as well as feral and domestic livestock are considered to be the most important species causing loss of Bilby habitat. Feral Camel *Camelus dromedarius* populations appear to have increased considerably in desert areas in recent times and it is suspected that they are also having a detrimental impact on Bilby populations.

A survey during 1998 will indicate which introduced herbivores are present on the Puurta Land Trust. In accordance with the Puurta Management Agreement, domestic livestock will be removed from the area for the duration of the Agreement which expires in 2001. The need for a control program for other introduced herbivores will be considered in the development of animal management plans by the Puurta Management Committee.

### **3.2.3 Control of Weeds**

Weeds may degrade Bilby habitat by reducing the availability of their preferred foods and by congesting the ground layer of vegetation which reduces the ability of Bilbies to forage. Couch Grass *Cynodon dactylon* and Buffel Grass *Cenchrus ciliaris* have potential to invade Bilby habitat, particularly riparian areas. Currently no effective methods exist for the broadscale control of Couch Grass and Buffel Grass.

### **3.2.4 Fire Management**

The suitability of some habitat for Bilbies is strongly influenced by the length of time since it was last burnt. Appropriate fire management promotes the availability of several important foods, reduces ground cover to suitable levels and can protect against hot, summer, uncontrolled wildfires which destroy habitat.

The need for fire management on the Puurta Land Trust has been acknowledged by the Puurta Management Committee. A fire management plan will be developed during 1998 which employs strategic burning to develop a patchy vegetation community in different stages of recovery from fire throughout Bilby habitats.

On other Aboriginal lands on which Bilbies occur, efforts will be made to negotiate agreements for the management of fire. Such management will enhance Bilby conservation.

### **3.2.5 Captive Breeding**

Captive Bilby breeding colonies will be maintained as a hedge against the possible catastrophic decline of wild populations. Breeding individuals are currently held at the Territory Wildlife Park and the Alice Springs Desert Park. Captive breeding at the Alice Springs Desert Park will need to be expanded should reintroductions or translocations of Bilbies be attempted (see 3.2.6).

Alice Springs is the collection point for Bilbies rescued by people residing in remote Aboriginal and mining communities. These Bilbies become part of the captive breeding program. Breeding colonies derived from Northern Territory Bilbies are located at the Western Plains Zoo (Dubbo), Monarto Zoological Park (Adelaide), and the Department of Conservation and Land Management, Western Australia. Other institutions keep Bilbies for educational and display purposes.

The entire captive Bilby population is catalogued and managed by staff at the Alice Springs Desert Park as part of the Australian Species Management Program coordinated by the Australasian Regional Association of Zoological Parks and Aquaria. This will continue during the Management Program.

### **3.2.6 Reintroduction and Translocation**

Reintroduction and translocation could be used to expand the Bilby's current range or augment existing populations where Bilby numbers are low, assuming conditions are conducive for population growth.

Should land containing suitable Bilby habitat be acquired for inclusion within the protected areas system, consideration would be given to reintroducing Bilbies to that land subject to the effective control of threatening processes.

### **3.3 Cooperation**

The Parks and Wildlife Commission will encourage cooperation between State, Territory and Commonwealth Governments, and other interested parties in ensuring that the Bilby survives and prospers. The Parks and Wildlife Commission will assign an officer to the national Bilby Recovery Team established under the Commonwealth *Endangered Species Protection Act 1992* and will endeavour to implement the recommendations of the team. Management of captive Bilbies by the Parks and Wildlife Commission will be guided by the procedures of the Australian Species Management Program which is coordinated by the Australasian Regional Association of Zoological Parks and Aquaria.

### **3.4 Public Awareness and Involvement**

#### **3.4.1 Volunteer Participation and Management Agreements**

Public involvement is central to the successful implementation of this Management Program. Such involvement in on-ground management and research actions is encouraged through the Commission's program for volunteers.

A special effort will be made to inform and involve appropriate landholders in cooperative management arrangements aimed at improving the habitat and long-term survival prospects of Bilbies.

#### **3.4.2 Public Education**

The Parks and Wildlife Commission will keep the public well informed on conservation of the Bilby. This will occur through the print media, the provision of natural history information through handouts and later on the internet, public presentations, and the publication of scientific papers. The Territory Wildlife Park and the Alice Springs Desert Park will play especially important roles in promoting public awareness.

The results of research relevant to Bilby management will be made available to relevant Land Councils for consideration in management programs organised on behalf of the traditional Aboriginal owners.

#### **3.4.3 Recovery Team**

The National Bilby Recovery Team constituted under the Commonwealth *Endangered Species*

*Protection Act 1992* contains members of the public and non-government organisations, guaranteeing input from a variety of interest groups and effective sharing of information.

## **4. MONITORING AND RESEARCH**

### **4.1 Monitoring of Bilby Populations**

Monitoring is an important part of this management program and will guide any management actions that might be required to conserve the Bilby. However, monitoring Bilbies is difficult because they are burrowing animals which are widely dispersed over very large areas.

An initial survey of Bilby populations was conducted by the Parks and Wildlife Commission across the Northern Territory, Queensland and Western Australia during 1983-1985. This survey used anecdotal reports together with on-ground survey at a limited number of widely dispersed sites to determine the extent of Bilby distribution.

Current research due to be completed in December 1998 is aimed at refining existing techniques to improve procedures for monitoring Bilbies throughout their range within the Northern Territory. Two methods are currently under investigation. Bilby populations are being closely monitored every four months at different sites over a latitudinal gradient. Abundance is being assessed at each site using counts of tracks. In addition, random sites across the Tanami Desert are being sampled to determine the presence/absence of Bilbies in areas with particular habitat characteristics (see 4.5.1).

### **4.2 Predators**

An investigation is being undertaken to assess the abundance and diet of Dingoes, Foxes and Cats in areas where Bilbies live. Predator abundance is being assessed using counts of tracks. This work will be completed in December 1998. Research into the effects of the Rabbit Calicivirus Disease in central Australia will provide additional data on the abundance of predators within the former range of the Bilby.

Research into the control of Feral Cats and Foxes is currently being conducted in Western Australia, Victoria and New South Wales. The results of this research will allow assessment of the efficacy of implementing predator control programs in areas where Bilbies occur.

### **4.3 Introduced Herbivores**

On the Puurta Land Trust, a biological survey is planned for 1998 and this will include an assessment of the distribution and abundance of feral herbivores. This information will assist in the design and implementation of any control programs for these species deemed necessary by the Puurta Management Committee.

On other Aboriginal lands on which Bilbies occur, the abundance of European Rabbits, feral livestock and Camels is currently being assessed on the basis of the presence/absence of tracks at

all monitoring localities described in 4.1. This information will be used to assess the broad extent of the feral herbivore problem in relation to Bilby management.

#### **4.4 Weeds**

The abundance of Couch Grass, Buffel Grass and other introduced weeds is being assessed at all monitoring localities described in 4.1 using point sampling. This is the first attempt to quantify the extent to which weeds are degrading Bilby habitat.

#### **4.5 Fire**

##### **4.5.1 Habitat Suitability Model**

A model incorporating Bilby presence, fire history and rainfall is being developed to predict the suitability of habitat for Bilbies across the entire Tanami Desert. Model development is based on data from randomly located sites at which the presence or absence of Bilbies, mammalian predators, feral herbivores and a variety of other species is determined on the basis of the presence/absence of tracks. This work will be completed in December 1998 and will assist with identifying key Bilby habitat.

##### **4.5.2 Population Dynamics and Habitat Use**

The dynamics of Bilby populations and patterns of habitat use in relation to the time since the habitat was last burnt are being studied using radio-collared Bilbies. This will provide critical data for developing appropriate fire management and predator control programs. This work will be completed in December 1998.

##### **4.5.3 Diet and Food Availability**

The diet of Bilbies at several sites along a longitudinal gradient (see 4.1) is being monitored by faecal pellet analysis. The availability of important foods is also being recorded. The relationship between rainfall, fire history, vegetation cover and temperature, and the production of important foods is being determined by monitoring a series of vegetation plots of known fire age. This work will be completed in December 1998 and will help determine the frequency of fire required to maintain favourable Bilby habitat.

#### **4.6 Reintroduction and Translocation**

Management prescriptions arising from current research into Bilby ecology and threatening processes could be tested in the future using reintroduced or translocated Bilbies.

## **5. MANAGEMENT STRATEGIES**

Should monitoring indicate that management goals are not being met, management prescriptions may be altered or other actions taken in accordance with the aim and objectives of this Management Program.

## **6. REPORTS**

Progress with this Management Program will be reported in the annual report by the Commission. This will include, but not be limited to:

1. Any change in conservation status of the Bilby in the Northern Territory;
2. Progress in the management of wild populations of the Bilby;
3. Results of the captive breeding program;
4. Development of any program for reintroduction or translocation;
5. Summaries of the results of the monitoring and research programs;

## **7. COMPLIANCE**

### **7.1 Permits**

Taking, keeping, researching and inter-State movement of Bilbies is controlled by permits issued under the *Territory Parks and Wildlife Conservation Act 1993*. Conditions are included on permits, and permits will be revoked or suspended by the Director if those conditions are deliberately contravened.

#### **7.1.1 Permits to Keep**

No permits to keep Bilbies will be issued other than for captive breeding, or display for educational purposes.

#### **7.1.2 Permits to Take**

Permits to take Bilbies and remove them from the wild will not be issued other than as part of the approved captive breeding program, or an approved reintroduction/translocation.

#### **7.1.3 Scientific Research**

Licences for scientific research will be issued for non-destructive, field research programs, or for the study of Bilbies in captive populations.

## 7.2 Animal Welfare

The welfare of individual Bilbies will be of primary concern when permits to keep or take, or licences for scientific research are issued. The Commission will fulfill its obligations for Bilby welfare as provided for under the *Territory Parks and Wildlife Conservation Act 1993*.

## 8. REVIEW OF PROGRAM

A full review of the program, as required under section 75 of the *Territory Parks and Wildlife Conservation Act 1993*, will be carried out within five years of the Management Program being approved.

## 9. BACKGROUND

### 9.1 Taxonomy

A taxonomic synopsis of both species in the subfamily Thylacomyinae is provided by Johnson (1989). Additional Aboriginal names for the species are listed by Burbidge *et al.* (1988). At one time there were several species described in the genus *Macrotis* (Jones 1924). The number of species was reduced to three by Troughton (1932) and then to the two species currently recognised (Ride 1970).

The Lesser Bilby *Macrotis leucura* has not been recorded for 60 years and is now regarded as extinct. Allozyme electrophoretic sampling of *Macrotis lagotis* has supported the view that all extant populations represent a single biological species (Southgate and Adams 1993).

### 9.2 Distribution and Habitat

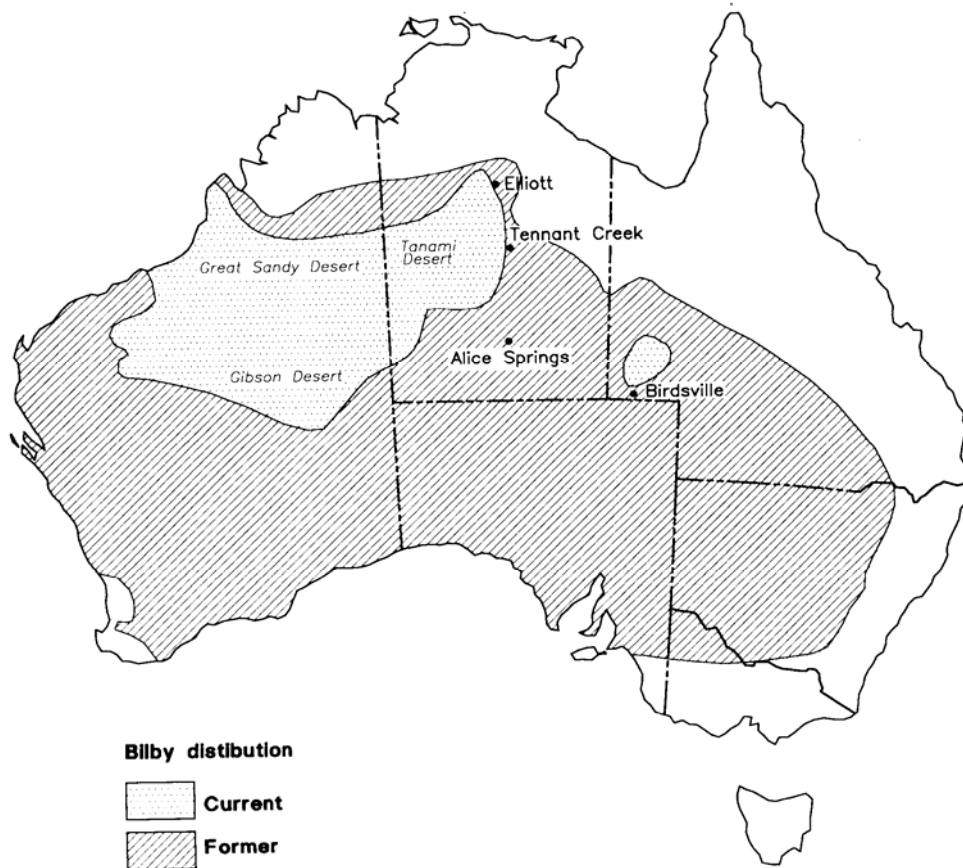
The Bilby was formerly widespread over 70% of continental Australia from about latitude 16° south to Adelaide, and from the western side of the Great Dividing Range to the Western Australian coast. Although there are no confirmed records, the species is likely to have occupied parts of Victoria and central Queensland (Figure 1).

The Bilby was distributed throughout the southern part of the Northern Territory and extending 80 km northward of Newcastle Waters in the 1930s (Finlayson 1961). By the late 1960s it had disappeared in the southern parts of the Northern Territory but was still present on a number of pastoral stations in the vicinity of Alice Springs. A survey of Bilby distribution in 1983-85 indicated that the Bilby had continued to decline on pastoral leases and it was uncertain whether the decline of the Bilby had halted. Recent fauna surveys have failed to find active Bilby colonies in the northern Simpson Desert (Gibson and Cole 1988) and the MacDonnell Ranges (Gibson and Cole 1993). There is an unconfirmed record in the Wakaya Desert east of Tennant Creek (Gibson *et al.* 1994)

The species is now patchily distributed across only 30% of its former range. Wild Bilby populations are currently restricted to parts of the Tanami, Great Sandy Desert and Sturt Plain

bioregions, between Kintore in the south and Newcastle Waters in the north (Johnson and Southgate 1990). There is an outlying population between Boulia and Birdsville in south-western Queensland.

On a broad scale, the present distribution associates well with the absence of the introduced



### Distribution of the bilby

European Rabbit and Red Fox, and areas where pastoralism is absent or grazing intensity is low (Southgate 1990). The distributions of the Feral Cat and Dingo overlap that of the Bilby.

Past reports indicated that the Bilby occupied an assortment of habitats including the more fertile regions of South Australia (Jones 1924), the grassy districts of southern Western Australia (Gould 1863) and the western plains of New South Wales. Habitats currently used by Bilbies include spinifex sand plains (Gibson 1986), mulga and spinifex systems (Newsome

1962; Smyth and Philpott 1968), lateritic rises (Gibson 1986) and alluvial surfaces or drainage areas (Watts 1969; Gibson 1986).

Southgate (1990) suggested that most of the area within its current distribution, except rocky hills or ranges, was potential habitat for the Bilby.

Figure 1.

### **9.3 Conservation Status**

#### **9.3.1 Wild Populations**

The Bilby is extremely patchily distributed within its currently occupied range and the species is considered vulnerable to extinction. The population has not been accurately quantified in the Northern Territory but there are likely to be in the order of a few thousand animals.

The area currently occupied is probably the least favourable part of the former distribution. Soils are unproductive and effective rainfall is low and unpredictable.

#### **9.3.2 Reintroduced Populations**

Reintroduction programs conducted in Simpsons Gap National Park (1983-87) and Watarrka National Park (1988-1993) did not result in the establishment of viable Bilby populations (Southgate *et al.* 1994). However, the programs did establish a set of procedures to successfully transfer captive-bred animals to a free-range existence and techniques to monitor the reintroduced population and the associated environment. The programs also demonstrated the vulnerability of small populations to environmental pressures and the difficulties of controlling predators such as foxes and cats in the arid zone. The decline of the reintroduced population at Watarrka was associated with an increase in predator activity.

#### **9.4 Representation in Nature Conservation Reserves**

No populations of Bilby occur within formally declared conservation reserves in the Northern Territory. The land occupied by the Bilby is predominantly under Aboriginal reserve, freehold or pastoral leasehold land. The Puurta Land Trust is subject to joint management by the Traditional Custodians and the Parks and Wildlife Commission, and retains a Bilby population (see 3.1.2.1).

#### **9.5 Biology and Ecology**

The Bilby has many behavioural and physiological characteristics in common with other species of bandicoot. The diet often includes plant and animal material. Growth and development are rapid compared to other similarly sized marsupials (Lee and Cockburn 1985; Cockburn 1990). Unlike other bandicoots, the Bilby has prominent large ears and a black and white tail. It is semi-fossorial, constructing a burrow for shelter during day-light hours and intermittently throughout the night. Burrows may reach a depth of two metres and generally descend in a gentle spiral. No nest chamber is constructed and no nest material is placed in the burrow. An individual may use several burrows within a home range (Smyth and Philpott 1968; Watts 1969; Southgate 1987).

The species is sexually dimorphic with males reaching 2500 g and females 1200 g. Bilbies are generally solitary but may occur in small groups of 2-4 animals where an adult male, adult female and their previous litter reside in an area. Males, females and juveniles may occupy overlapping home ranges. Johnson and Johnson (1983) reported that captive Bilbies form a linear hierarchy that is most pronounced among males but is maintained by very little aggression, especially compared with other bandicoot species. Scent marking may be undertaken and appears to be directly correlated with dominance rank. Burrows were found to be the most frequently marked areas and may act as a signal to other animals indicating presence and dominance.

From records kept on captive animals and from animals captured in the wild it is evident that young may be born throughout the year. One or two young usually constitute the litter but triplets have been recorded. McCracken (1986) determined the oestrus cycle as approximately 21 days (range: 12-37) and the gestation length about 14 days (range 13-16). Pouch life is about 75 days after which the young are cached and suckled in the maternal burrow for a further two weeks before becoming independent. Under ideal conditions, there is the potential to produce four litters every year. Females may commence breeding at about six months of age or 600 g and, in captivity, may continue breeding up to five years. Males have bred in captivity at about 800 g, or eight months of age.

The diet of the Bilby may be dominated by invertebrate or plant material depending on season and habitat (Southgate 1987). Seed is the plant food most widely consumed and the two most

common species eaten are the annual grasses *Dactyloctenium radulans* and *Yakirra australiense*. The bulb *Cyperus bulbosus* is another important food plant. Invertebrates such as ants, termites and insect larvae (Cossidae, Lepidoptera) are also eaten by Bilbies. Much of this food is excavated from the soil and diggings may attain 250 mm in depth. The diggings are used to expose the roots of shrubs such as *Acacia spp.* which contain insect larvae, to penetrate termite galleries or ant nests containing seed stores, or to expose bulbs.

Some of the seeds and bulbs eaten may occasionally become locally abundant. Under these circumstances, Bilbies can reach densities of 12 - 16 individuals per km<sup>2</sup>. Bilbies at lower densities (of one or two per km<sup>2</sup>) commonly have a more diverse diet which may include a broad mix of invertebrate and plant material.

## **9.6 Threatening Processes**

### **9.6.1 Predators**

Important predators of the Bilby include the Dingo, and more recently, the introduced Red Fox and Feral Cat. Other potential predators include the carpet python, monitor lizards and several species of large raptor.

There is mounting evidence that predation from Foxes and Cats has been a major contributing factor in the decline of medium-sized mammals in arid Australia. Predation played a major role in the elimination of the small reintroduced Bilby populations at Watarrka National Park (Southgate *et al.* 1994). The northern limit of Fox distribution associates well with the present southern distribution limit of the Bilby and both Jones (1924) and Finlayson (1961) considered Foxes to have played a sinister part in the decline of the Bilby in the southern part of its former distribution. The current overlap of the Bilby with Cat and Dingo distribution indicates these species can coexist in regions like the Tanami Desert. An increase in the distribution of the Fox, arrival of another predator species or an increase in the abundance of the Feral Cat or the Dingo is likely to place increased predation pressure on the existing Bilby populations.

### **9.6.2 Parasites and Disease**

The taxonomic groups such as the bandicoots, small macropods and dasyurids that appear most susceptible to extinction are also those that appear highly susceptible to parasites from introduced animals (Freeland 1993). For example, animals which forage among the litter or soil are likely to encounter faeces from Feral Cats which contain the infective stage of the protozoa *Toxoplasma gondii*. The infective stage, if ingested, can lead to obscured vision, difficulty in walking and calcification of the heart resulting in death or an increased probability of predation.

### **9.6.3 Habitat Degradation**

There are a number of agents which can alter food availability and thus are likely to affect the survivorship of Bilby populations.

There are data clearly demonstrating that grazing by Rabbits and introduced livestock reduces the abundance of important annual grasses, sedges and the regeneration of shrubs, prolonged grazing pressure can eradicate these plants at a regional level resulting in habitat degradation. Grazing for stock is also associated with compaction of soil, and altered water regimes

compounding the direct effects of grazing, and altering patterns of predation and competition.

Weeds such as Couch Grass *Cynodon dactylon* have become major problems along some drainage lines in central Australia and have severely affected the distribution of *Cyperus bulbosus*. There is a threat that Couch Grass could enter the paleo-drainage lines of the Tanami and Great Sandy Deserts and reduce the availability of *Cyperus bulbosus*.

#### **9.6.4 Fire**

Fire plays an important role in reducing plant cover and creating conditions that are favourable to the growth of major seed producing plants like *Dactyloctenium radulans* and *Yakirra australiense*. Too much cover by tussock or hummock grasses (e.g. *Triodia* or *Plechtrachne* spp.) may also reduce the ability of the Bilby to forage effectively. Therefore, fire may be used as a management tool to improve habitat quality for the Bilby.

#### **9.6.5 Human Settlement**

Bilby populations have disappeared in areas where the pattern of human habitation and management is most pronounced. With human settlement, water and food often become more common and permanent allowing populations of competitors and predators of the Bilby to become more stable and resilient. For example, bores, garbage dumps, cattle carcasses and road kills enable predators to survive drought periods when previously they would have undergone a marked decline. The spread of human settlement (out-stations, mining camps or pastoral leases) will potentially lead to an entrenchment of the threatening processes discussed above.

### **9.7 Aboriginal Attitudes**

Attitudes of Aboriginal people to Bilby conservation and management vary across different regions. Although the Bilby was a favoured traditional food, few animals are now taken because few people possess the skill to track and dig the animals out from burrows. Concern about the disappearance of the Bilby varies within and among Aboriginal communities. Many people think Bilby populations persist in good numbers outside their country while others are uncertain about threats to the species or its status.



## 10. REFERENCES

- Burbidge, A.A., Johnson, K.A., Fuller P.J. and Southgate, R.I. (1988). Aboriginal knowledge of the mammals of the central deserts of Australia. *Aust. Wildl. Res.* **15**, 9-39.
- Cockburn, A. (1990). Life history of the bandicoots: development rigidity and phenotypic plasticity. In '*Bandicoots and Bilbies.*' (Eds J.H. Seebeck, P.R. Brown, R.L. Wallis and C.M. Kemper.) pp. 285-92. (Surrey Beatty: Sydney.).
- Finlayson, H.H. (1961). On central Australian mammals Part IV. The distribution and status of Australian species. *Rec. S. Aust. Mus.* **14**, 141-91.
- Freeland, W.J. (1993). Parasites, pathogens and the impacts of introduced organisms on the balance of nature in Australia. In '*Conservation biology in Australia and Oceania.*' (Eds C. Moritz and J. Kikkawa.) pp. 171-180. (Surrey Beatty & Sons: Chipping Norton.).
- Gibson, D.F. (1986). A biological survey of the Tanami Desert in the Northern Territory. Conservation Commission of the Northern Territory, Technical Report, No. **30**.
- Gibson, D.F., Cole, J.R. (1988). A biological survey of the northern Simpson Desert. Conservation Commission of the Northern Territory, Technical Report, No. **40**.
- Gibson, D.F. and Cole, J.R. (1993). Vertebrate fauna of the west Macdonnell Ranges, Northern Territory. Conservation Commission of the Northern Territory, Unpublished Report.
- Gibson, D.F., Latz, P.K., Cole, J.R., Wurst, D.P. and Parsons, D.J. (1994). Flora and Fauna Survey of the Wakaya Desert, Northern Territory. Conservation Commission of the Northern Territory, Unpublished Report.
- Gould, J. (1863). '*The mammals of Australia.*' (Taylor Francis: London).
- Johnson, C.N. and Johnson, K.A. (1983). Behaviour of the bilby, *Macrotis lagotis* (Reid) in captivity. *Aust. Wildl. Res.* **10**, 77-87.
- Johnson, K.A. (1989). Thylacomyidae. In '*Fauna of Australia. Mammalia.*' (Vol. 1B), (Eds D.W. Walton and B.J. Richardson.) pp. 625-636. (Australian Government Publishing Service: Canberra.).
- Johnson, K.A. and Southgate, R.I. (1990). Present and former status of bandicoots in the Northern Territory. In '*Bandicoots and Bilbies.*' (Eds J.H. Seebeck, P.R. Brown, R.L. Wallis and C.M. Kemper.) pp. 85-92. (Surrey Beatty & Sons: Sydney.).
- Jones, F.W. (1924). '*The mammals of South Australia.*' (Government Printer: Adelaide.).
- Lee, A.K. and Cockburn, A. (1985). '*Evolutionary Ecology of Marsupials.*' (Cambridge University Press: Cambridge.).

- McCracken, H.E. (1986). Observations of the oestrous cycle and gestation period of the greater bilby, *Macrotis lagotis* (Reid) Marsupialia: Thylacomyidae). *Aust. Mammal.* **9**, 5-16.
- Morton, S.R. (1990). The impact of European settlement on the vertebrate animals of arid Australia: a conceptual model. *Proc. Ecol. Soc. Aust.* **16**, 201-213.
- Newsome, A.E. (1962). Rabbit-eared bandicoots or bilbies. *Aust. Nat. History* 97-98.
- Ride, W D.L. (1970). '*A Guide to the Native Mammals of Australia.*' (Oxford University Press: Melbourne.).
- Smyth, D.R. and Philpott, C.M. (1968). A field study of the rabbit bandicoot *Macrotis lagotis* Reid (Marsupialia), from central Western Australia. *Trs R. Soc. S. Aust.* **92**, 3-14.
- Southgate, R.I. (1987). Conservation of the Bilby. Wildlife Fauna Department, Northern Territory Conservation Commission. Unpublished Report to World Wildlife Fund (Australia).
- Southgate, R.I. (1990). Distribution and Abundance of the Greater Bilby *Macrotis lagotis* Reid (Marsupialia: Peramelidae). In '*Bandicoots and Bilbies.*' (Eds J.H. Seebeck, P.R. Brown, R.I. Wallis and C.M. Kemper.) pp. 293-302. (Surrey Beatty & Sons: Sydney.).
- Southgate, R.I. and Adams, M. (1993). Genetic variation in the Greater Bilby *Macrotis lagotis*. *Pac. Con. Biol.* **1**, 46-52.
- Southgate, R.I., Bellchambers, K., Romanow, K.A. and Whitfield, S. (1994). Reintroduction of the Greater Bilby. Conservation Commission of the N.T., **Vol I**. Pp 95.
- Troughton, E.L.G. (1932). Revision of the rabbit-bandicoots. *Aust. Zool.* **7**, 219-235.
- Watts, C.H.S. (1969). Distribution and habits of the rabbit bandicoot. *Trs R. Soc. S. Aust.* **93**, 135-141.