LONG-FOOTED POTOROO

(*Potorous longipes* Seebeck and Johnston, 1980)

RECOVERY PLAN

Department of Natural Resources and Environment, Victoria
National Parks and Wildlife Service, New South Wales
State Forests of New South Wales
Parks Victoria

February 2000

Natural Heritage Trust

Helping Communities Helping Australia

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Abbreviations

The following organisations and Government Departments are abbreviated as follows:

NRE	Department of Natural Resources and Environment, Victoria
EG NRE	East Gippsland Region, NRE
NE NRE	North East Region, NRE
ESP	Endangered Species Program, administered by the Biodiversity Group of Environment Australia
NSW NPWS	NSW National Parks and Wildlife Service
NSW SF	NSW State Forests
HS	Healesville Sanctuary
UNSW	University of New South Wales
RTA	Recovery Team Agencies

SUMMARY

Current Species Status

The Long-footed Potoroo is listed as Endangered in Victoria under the Victorian *Flora and Fauna Guarantee Act* 1988, Endangered in NSW under the NSW *Threatened Species Conservation Act* 1995 and Endangered nationally under the Commonwealth *Endangered Species Protection Act* 1992. The species is also classified as Endangered nationally by CONCOM (1991) and Maxwell *et al.* (1996), and is Endangered under the IUCN (1994) criteria.

Habitat Requirements and Limiting Factors

The Long-footed Potoroo is a forest-dwelling rat-kangaroo which inhabits forest with a dense understorey in East Gippsland, south-eastern New South Wales and north-eastern Victoria. It feeds almost exclusively on the sporocarps of hypogeous fungi, and thus depends on habitat with a year-round supply of sporocarps. Long-footed Potoroos appear to occur in small, low-density colonies, which are vulnerable to stochastic processes, such as wildfire. Wild Dogs and Red Foxes are known predators of the species, placing pressure on recruitment and successful dispersal.

Recovery Plan Objective

Ensure long-term survival of the Long-footed Potoroo throughout its distribution, and to achieve the downlisting of the species from Endangered to Vulnerable within the next 10 years, based on the IUCN (1994) criteria of population size and trends, extent of occurrence and probability of extinction. The five-year goals of management are to ensure that at least 90% of currently known colonies across the three sub-populations persist, that the total number of known colonies increases, and that the density of Long-footed Potoroos at measured colonies is maintained or increased.

Specific Objectives

1. Maintain the integrity of the habitat of known Long-footed Potoroo sub-populations.
2. Control introduced predators in the vicinity of as many Long-footed Potoroo colonies as possible.
3. Clarify distribution of the Long-footed Potoroo and determine the species density at selected sites.
4. Determine the response of the species to disturbances associated with timber harvesting.
5. Increase knowledge of the distribution and ecology of hypogeous fungi.
6. Increase biological knowledge to facilitate Population and Habitat Viability Analysis (PHVA) and thus refine species management.
7. Determine the genetic variation between sub-populations of the species.
8. Maintain a captive colony for research, refinement of husbandry techniques and improving public awareness.
9. Ensure community support for, and involvement in, the recovery of the Long-footed Potoroo.

Recovery Criteria

1. An increase in the number of known colonies and 90% of all known colonies still present after five years.
2. An increase of at least 20% in the size of colonies subject to predator control.

Recovery Actions

1. Continue habitat and population protection.
2. Continue and expand predator control programs in Victoria and NSW and monitor response of protected colonies.
3. Establish distribution and population size through broad-scale and fine-scale surveys.
4. Conduct research into the effects of habitat disturbance.
5. Conduct research into the distribution and ecology of hypogeous fungi.
6. Continue collection of basic biological information on the species to enable a Population and Habitat Viability Analysis to be performed.
7. Investigate the genetics of sub-populations and colonies.
8. Maintain a captive colony.
9. Enhance community awareness of, and involvement in, management of the species.

Estimated Cost of Recovery

The total estimated cost to implement the actions in this plan over a period of five years is $1,481,000 (refer to table 1). For the level of priority and feasibility associated with each action, refer to the Implementation Schedule (table 3).

Biodiversity Benefits

The continued active management of, and research on, Long-footed Potoroos contributes to the conservation of the ecosystem of which it is a part. In particular, a management regime which conserves and enhances hypogeous fungi will also be of benefit to other mycophagous ground-dwelling mammals, such as bandicoots and native rats, and to those plants which rely on mycorrhizal associations with the fungi. Control of introduced Dogs and Red Foxes will be of substantial benefit to a range of other native fauna, particularly ground-dwelling mammals.

Table 1. Estimated cost of recovery

Action	Habitat and population protection	Predator control	Distribution and population size	Impacts of habitat disturbance	Biology of hypogeous fungi	Biological information and PHVA	Genetic research	Captive management	Community awareness	**Total**
Year 1	10	115	45	60	0	10	0	11.5	5	256.5
2	10	100	75	75	0	30	5	11	16.5	322.5
3	7.5	100	80	75	100	30	16	11.5	3	423
4	4.5	100	0	75	100	45	0	12	3	339.5
5	4.5	100	0	0	20	0	0	12	3	139.5
Total	36.5	515	200	285	220	115	31	58	30.5	1481

Total costs are estimated in $ × 1000. Agencies contributing to the total costs include Environment Australia (Endangered Species Program), NRE, NSW NPWS, SF NSW and Healesville Sanctuary. Costs for Year 1 are actual expenditure in 1999

Table 2. Elements of the Long-footed Potoroo National Recovery Plan

Specific Objective	Performance Indicators	Broad Actions	Specific Actions
1. Maintain the integrity of habitat of known Long-footed Potoroo sub-populations.	**1.** Habitat around colonies of Long-footed Potoroos protected in accordance with Victorian Action Statement and NSW Recovery Plan and incorporated into other relevant area management plans.	**1.** Habitat and population protection.	**1.1** Victoria: Implement the Action Statement. **1.2** NSW: Implement the NSW Recovery Plan.
2. Control introduced predators in the vicinity of as many Long-footed Potoroo colonies as possible.	**2a.** Predator control and monitoring of Long-footed Potoroo colonies undertaken at a minimum of 4 sites, with 80% decrease in bait take by predators within first 2 years. **2b.** A 20% increase in Long-footed Potoroo detection rates at these sites within 5 years of commencing predator control.	**2.** Predator control.	**2.1** Continue/implement baiting in Victoria. **2.2** Continue/review canid/pig program for NSW. **2.3** Monitor selected colonies with predator control in Victoria **2.4** Monitor terrestrial mammals in SE NSW.
3. Clarify distribution of the Long-footed Potoroo and determine the species density at selected sites.	**3a.** Improved detection methods for Long-footed Potoroos developed and applied to all terrestrial fauna surveys in eastern Victoria and south-eastern NSW. **3b.** All priority areas surveyed for Long-footed Potoroos within 3 years.	**3.** Establish distribution and population size .	**3.1** Conduct survey work. **3.2** Up to date BIOCLIM prediction. **3.3** Demographic study of sub-populations.
4. Determine the response of the species to disturbances associated with timber harvesting.	**4.** Report published on the impacts of habitat disturbance on the Long-footed Potoroo within the next five years.	**4.** Research into effects of habitat disturbance.	**4.1** Habitat disturbance research-timber harvesting. **4.2** Habitat disturbance research-fire
5. Increase knowledge on the distribution and ecology of hypogeous fungi.	**5.** Report published on the distribution and ecology of hypogeous fungi within five years.	**5.** Research into biology of hypogeous fungi.	**5.1** Research into effects of fire regime on fungi. **5.2** Research into fungi biomass and seasonal variation.
6. Increase biological knowledge to facilitate Population and Habitat Viability Analysis and thus refine species management.	**6.** Conduct population and habitat viability assessment using enhanced knowledge of the population and reproductive biology of the species and thus refine the Victorian Action Statement and NSW Recovery Plan within five years.	**6.** Collection of biological information and do PVHA.	**6.1** Continue data collection in East Gippsland. **6.2** Continue data collection in north-eastern Victoria. **6.3** Produce PHVA
7. Determine the genetic variation within and between sub-populations of the species.	**7.** Report published on the genetic variability within the species during the next two years.	**7.** Genetic research.	**7.1** Clarify genetic variation. **7.2** Refine analysis of DNA in hair for identification. **7.3** Determine genetics of new sub-populations.
8. Maintain a captive colony for research, refinement of husbandry techniques, improving public awareness and as a source for potential reintroductions.	**8.** Successful maintenance of at least one captive colony over the next five years.	**8.** Maintenance of a captive colony.	**8.1** Maintain captive colony for education and research **8.2** Establish new captive breeding colony. **8.3** Continue Avian TB investigations. **8.4** Utilise captive colony for research.
9. Ensure community support for, and involvement in, the recovery of the Long-footed Potoroo.	**9a.** Production within two years of a range of interpretive material, including the establishment of an internet site and a broadsheet, for use in schools, at Healesville Sanctuary and by other interested members of the community. **9b.** Development within three years of a network of community members who are involved in the management of the Long-footed Potoroo.	**9.** Enhance community awareness and involvement.	**9.1** Develop interpretive display for Healesville Sanctuary. **9.2** Static display on recovery program. **9.3** Develop potoroo home page. **9.4** Updates to media and community members involved in management. **9.5** Involve community in management.

INTRODUCTION

Description

The Long-footed Potoroo (*Potorous longipes* Seebeck and Johnston 1980) is one of the largest members of the rat-kangaroo family (Potoroidae). Males weigh up to 2.3 kg and females up to 1.7 kg. Its larger size and longer hind-foot in relation to head length physically distinguish it from its closest relative, the Long-nosed Potoroo (*P. tridactylus*) (Seebeck and Johnston 1980). General descriptions and accounts of the species are provided by Seebeck (1995,1996).

Distribution

The Long-footed Potoroo was first described as recently as 1980, from specimens collected in East Gippsland (Seebeck and Johnston 1980). There are currently three known disjunct sub-populations of the species; one in East Gippsland north-east of Orbost, another in south-eastern New South Wales and a third centred on the Barry Mountains in north-eastern Victoria (Figure 1). A fourth sub-population may exist near Mount Drummer, east of Cann River, where part of a skull was discovered in a predator scat in 1990. A fossil skull has been found at Yarrangobilly Caves, south-west of Canberra (Seebeck 1992), and a museum specimen collected last century has its location as 'near Rosedale', which is in central Gippsland (Seebeck and Johnston 1980).

The East Gippsland sub-population appears to be the most extensive, with 45 separate sites known from an area of about 1120 square kilometres in the catchments of the Brodribb, Bemm, Rodger and Yalmy Rivers. These sites may be grouped into approximately twenty discrete colonies. The continuity between these colonies is currently unclear.

The north-eastern Victorian sub-population, only discovered in 1995, currently comprises 31 sites concentrated in the West Buffalo, East Riley and Tea Tree Range areas of the Barry Mountains. The current known range of the species in north eastern Victoria is approximately 510 square kilometres (Jones and Johnson 1997, Jones 1998).

No animals have been trapped in south-eastern New South Wales, with only 17 definite records obtained from predator scats and hair samples (Broome *et al*. 1996a). These records are distributed across the South East Forests National Park (Genoa and Waalimma sections) as well as Bondi, Nungatta and Yambulla State Forests. The known range of the NSW sub-population is approximately 200 square kilometres. The NSW population appears to be at very low density, probably reflecting habitat which is more marginal than in Victoria (Broome *et al*. 1996a).

Due to the difficulties of trapping the species and the highly fragmented nature of the existing population, accurate estimates of abundance are difficult. From the present distribution it seems unlikely that the total number of Long-footed Potoroos across all known sites would exceed a few thousand animals and may be no more than a few hundred.

Habitat

The Long-footed Potoroo inhabits a variety of vegetation classes from shrubby dry forest to warm temperate rainforest and wet forest. The elevation of confirmed sites ranges from less than 100m above sea level in East Gippsland to greater than 1000m in north-eastern Victoria. Sites on sheltered aspects with moist soils, supporting a mixed species overstorey and a dense understorey, are characteristic of preferred habitat. Dense understorey appears to provide shelter and protection from predators, especially wild Dogs and Red Foxes (Scotts and Seebeck 1989), to which the potoroos are known to be susceptible (Broome *et al*. 1996b).

Life History and Ecology

Long-footed Potoroos give birth throughout the year, though with some seasonal peaks. At Bellbird in East Gippsland, births peak in the July-September quarter, although they may occur throughout the year. At Riley Creek in north-eastern Victoria, births are spread more evenly across the seasons (Green and Mitchell 1997). Higher rainfall, with deeper soil and litter layer, may create a more stable food supply at this site, accounting for aseasonal reproduction.

Pouch life is estimated to be between 140-150 days (Seebeck 1992). The earliest age at which a pouch young was recorded out of the pouch is 113 days (Green and Mitchell 1997). Young remain at-heel until they become independent at about 20 weeks of age. Thereafter, they may remain within their natal territory for at least 12 months before dispersing (Green and Mitchell 1997). Sexual maturity is reached at about two years of age (Seebeck 1992). Expected life span in the wild is not known, although both male and female individuals have been known to live beyond 14 years in captivity (Debbie McDonald [1] *pers. comm*. 1997).

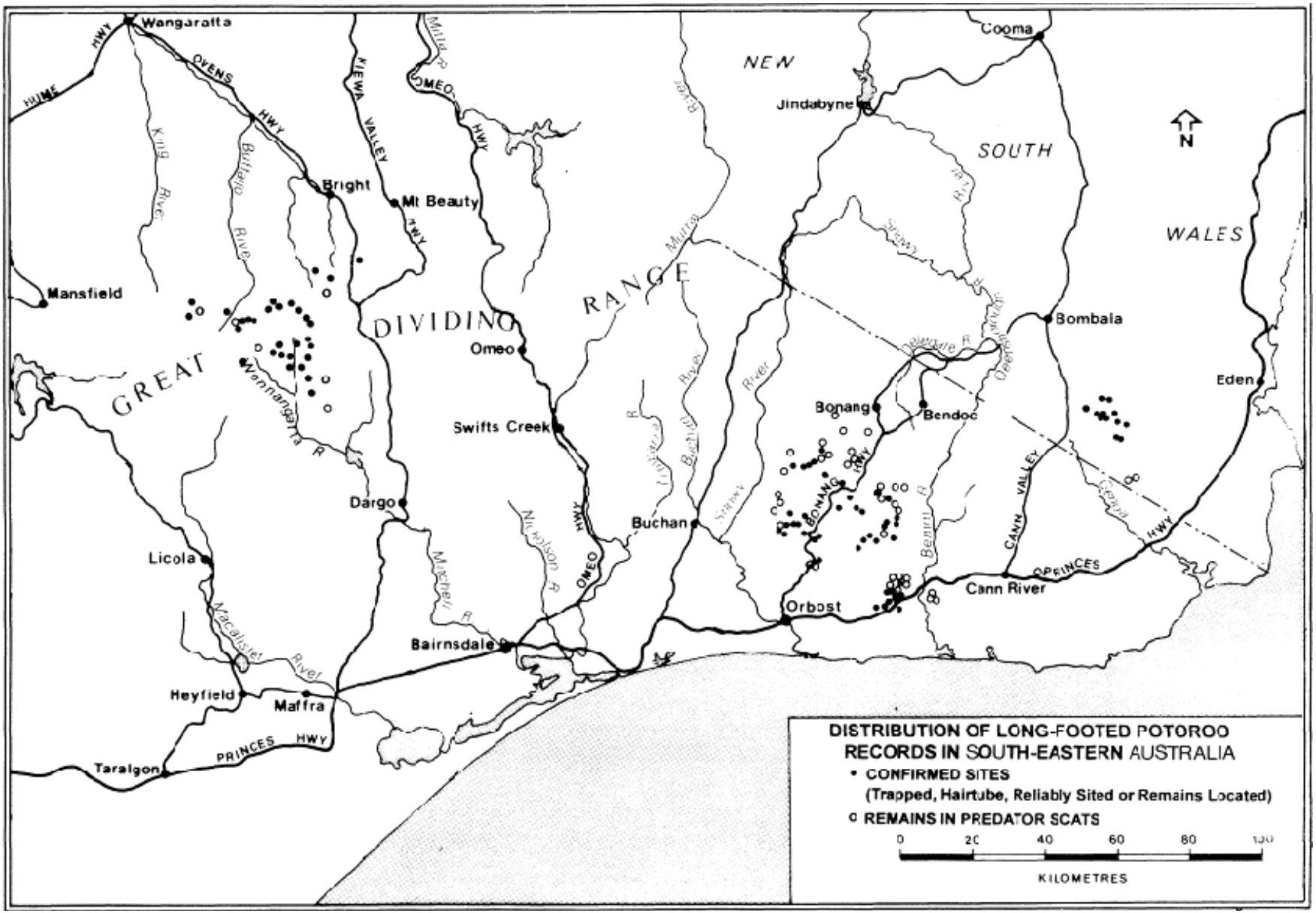
In successional forest in East Gippsland, adult home range varied from 22 to 60 ha, with male home ranges being larger than females, while in north-eastern Victoria home ranges varied from 14 to 23 ha (Green *et al*. 1998). Juvenile home ranges lay within those of their parents. Long-footed Potoroos show territorial behaviour and appear monogamous (Scotts and Seebeck 1989). Males and females may forage in pairs, with the female's home range generally being within the boundary of the male's (Green *et al*. 1998). Little overlap occurs between pairs or between individual adult males. At the apparently more productive north-eastern Victorian site, home ranges for both sexes are smaller and time spent foraging during the night is also less (Green *et al*. 1998).

The Long-footed Potoroo may depend on fungi as a food source more than any other mammal in Australia. Over a three-year study in East Gippsland, fungi comprised an average of 91% of their diet, with invertebrates and plant material making up the remainder. Where the fungal component was lower, the proportion of invertebrates in the diet increased (Green *et al*. 1999). Together with other mycophagous mammals, the Long-footed Potoroo may play a significant role in maintaining the health of the forest by dispersing viable spores from the sporocarps they eat, which subsequently form ectomycorrhizal associations with host eucalypt roots. Such associations may benefit plant vigour and development (Claridge *et al*. 1992, Scotts and Seebeck 1989).

While the proportion of fungi to plants and invertebrates in the diet varies little, it is apparent that the spore classes making up the fungal component differ in their contribution over some seasons, years and localities. Climatic patterns have been shown to influence sporocarp abundance, as well as the occurrence of individual species of hypogeous fungi (Claridge *et al* 1999a,b). Logging and fire may also influence the diversity of fungi at a site, leading to the dominance of fungal species which may more easily survive desiccation and alteration of the soil/litter layer. The diversity of fungal species in relation to land management practices is an important issue which requires more attention (Claridge *et al* 1993).

[1] Debbie McDonald, Mammal Keeper, Healesville Sanctuary

Figure 1. Location of known Long-footed Potoroo sub-populations including records of remains found within predator scats.



Reasons for Conservation Status

The Long-footed Potoroo presents something of a conservation paradox. Unlike most threatened species, which have shown conspicuous historic decline in distribution or abundance, the known distribution of the Long-footed Potoroo has actually increased since its discovery, though it is still very restricted and nowhere common.

Despite recent surveys resulting in the expansion of the animal's known distribution, it remains difficult to determine the species' abundance. The unsuccessful resurvey of some sites where the species has been detected in the past suggests that some colonies may have disappeared or be at very low density. This could also reflect the unreliable nature of survey techniques.

The major reasons for concern about the status of the Long-footed Potoroo are:

- very restricted distribution
- small, fragmented sub-populations and colonies
- low population densities throughout its range
- continuing threat posed by predators and possibly timber harvesting
- susceptibility to stochastic processes such as extensive severe wildfire.

Application of the IUCN (1994) criteria classifies the Long-footed Potoroo as Endangered on the following basis:

B1+2d - Extent of occurrence is less than 5,000 km2 (it is about 1830 km2), **and** the population is severely fragmented with five or less sub-populations (there are three sub-populations which are widely separated), **and** there is evidence of continuing decline in number of locations (the species has not been relocated at several sites).

C2a - Less than 2,500 individuals (the population size is unknown but only about 200 different individuals have been captured or sighted), **and** there is a continuing decline and the population is fragmented, with all sub-populations less than 250 (the largest sub-population is in East Gippsland where about 150 individuals have been detected and there is evidence that the species has disappeared from some sites, both in East Gippsland and in NSW).

Existing Conservation Measures

The Long-footed Potoroo clearly has a very restricted distribution and is no-where abundant. There is very limited knowledge of the effects of fire, logging and other disturbances and the species is vulnerable to introduced predators. Thus a conservative approach to its management is being taken.

In Victoria, the potoroo is listed under the *Flora and Fauna Guarantee Act* 1988 and a Management Strategy (Saxon *et al*. 1994) and Action Statement (Thomas *et al*. 1994) have been prepared. In New South Wales it is listed as Endangered under the *Threatened Species Conservation Act* 1995 and a state recovery plan is in preparation. Interim management arrangements are in place in the meantime.

The species has been recorded in several National Parks and Fauna Reserves, namely the Alpine, Errinundra and Snowy River National Parks and the Martins Creek and Goolengook Flora and Fauna Reserves in Victoria, and the South-east Forests National Park in New South Wales. However the majority of sites are in State forest.

Management prescriptions in Victorian State forest have been included in relevant forest area management plans (e.g. CNR 1995, NRE 1999). The prescriptions require that every known Long-footed Potoroo site is protected by a Special Management Area (SMA), within which logging, new roading and all other new development activities are not permitted. There are also strict limitations on fuel-reduction burning. Special Management Areas are required to contain a range of preferred Long-footed Potoroo habitat types, with

boundaries based on catchment units. Modification of these prescriptions is dependent upon the results of habitat disturbance research, which is currently underway.

In 1991 a Long-footed Potoroo Recovery Plan (Research Phase) was prepared (Thomas 1991), which outlined research priorities.

Survey work to define the distribution of the potoroo has been extensive in East Gippsland and north-eastern Victoria (Atlas of Victorian Wildlife, Jones and Johnson 1997, Scotts and Seebeck 1989, NRE Orbost Office unpublished data).

Since the discovery of the Long-footed Potoroo in NSW in 1986 (Dovey 1987), considerable survey work has been undertaken by NSW National Parks and Wildlife Service and State Forests of NSW. Hair-tubing has revealed the presence of the species at 17 sites, but none have yet been captured (Broome *et al.* 1996a). An interim management strategy was prepared for the species in NSW (Saxon and Claridge 1995) which outlined the establishment of Potoroo Management Zones (PMZ) in State Forest. However the recent expansion of the South-east Forests National Park has embraced virtually all of the known locations of the potoroo in NSW. The NSW Long-footed Potoroo Recovery Plan, which is currently in preparation, will detail management arrangements for the species in that state.

Feral canid control programs have been implemented in both Victoria (Marks and Mansergh 1996) and NSW (Broome *et al.* 1996b) to reduce pressure on the Long-footed Potoroo from introduced predators. A positive response to predator control has been observed at the Bellbird trapping grid in East Gippsland, with an approximate doubling in the number of potoroos known to utilise the trapping area over the last ten years (NRE Orbost Office unpublished data).

The habitat reservation and predator control programs also benefit a range of other forest species. Old forest protected through the presence of the Long-footed Potoroo supports arboreal mammals and large forest owls and other hollow dependent mammals and birds, whilst predator control assists a range of small and medium-sized terrestrial mammals, such as the Long-nosed Bandicoot.

Husbandry techniques for the species have been developed by the Healesville Sanctuary in Victoria, where a captive colony of Long-footed Potoroos has been established since 1980. The Sanctuary has assisted with numerous Long-footed Potoroo projects in the past and the colony has been invaluable for developing and refining radio-tracking, baiting and hair-tubing techniques.

Recovery Process to-date

As part of the Recovery Plan (Research Phase), Thomas (1991) outlined 11 specific aims of research required for the conservation of the Long-footed Potoroo. The major project review on the Long-footed Potoroo (Long-footed Potoroo Recovery Team 1998) described progress towards these aims in detail. The aims, and a summary of progress, are as follows:

1. *Improve trapping and radio-tracking techniques.*
Radio-tracking techniques for the species have been developed and refined significantly in the last 14 years. In 1986, individual potoroos could only be radio-tracked continually for periods up to 12 weeks, with 85% of radio fixes obtained being inaccurate due to signal bounce (Scotts and Seebeck 1989). At the Bellbird trapping grid the number of radio fixes rejected as inaccurate has now been reduced to approximately 25% (Green *et al.* 1998, NRE unpublished data).

In 1993 a new radio-collar was specifically designed for Long-footed Potoroos by Ross Meggs of Faunatech Pty Ltd. As a result, sedation of the animals (as per Scotts and Seebeck 1989) is no longer necessary to fit radio collars. In addition, the time for which radio-collars can remain fitted is now well in excess of twelve months, with little or no observed discomfort or injury to the animal (Green *et al*. 1998).

The current trapping protocol is based on that developed by Scotts and Seebeck (1989). This involves a large cage trap with a treadle release mechanism and a tea strainer bait holder. The bait is a mixture of peanut butter, honey, rolled oats and pistachio essence. Whilst trials of various baits found nothing better than this mixture, more productive Long-footed Potoroo trapping has resulted from the careful placement of traps along runs and natural features such as logs (Tony Mitchell[2] *pers. comm.* 1997). In addition, the refinement of bait holders and bait placement techniques has reduced trap interference by Bush Rats (*Rattus fuscipes*).

2. *Locate a second study colony in a site where the species is known to occur, and with a different habitat disturbance history to Bellbird Creek.*
A second trapping grid in old forest was established near Mount Ellery in East Gippsland in 1994, however the resident colony proved to be very small (2-3 animals) and logistically difficult to study. An alternative site at Riley Creek in north-eastern Victoria, also in old forest, was more productive and also offered the opportunity to study a colony from another sub-population. A trapping grid was established at that site in October 1995.

3. *Intensively trap both sites on a seasonal basis for demographic studies.*
Twelve months data has been collected from the Riley Creek site in north-eastern Victoria. Studies at the Bellbird grid continued throughout this period, giving comparative demographic data. Comparison of home range and microhabitat use of the two colonies has been undertaken by Green *et al.* (1998).

4. *Radio-track (long-term) dispersing animals to determine dispersal success and identify barriers to dispersal.*
The dispersal of one sub-adult male has been successfully documented at the Bellbird trapping grid (Green and Mitchell 1997). This animal was radio-collared on the trapping grid and regularly trapped and tracked on the grid before establishing a new home range 2 km away, crossing a forest access road (over 10m wide). The radio-collar was removed after the young male had resided in this new home range for one year. Opportunities to record a dispersal event are uncommon, as radio-collars cannot be fitted until the juvenile neck is well developed, leaving a small window of opportunity before the juvenile leaves its parental home range. Given the irregular and opportunistic nature of such data collection, information on dispersal success and barriers will gradually build over time.

5. *Genetically identify blood samples from each animal encountered to determine genetic viability of sub-populations.*

[2] Tony Mitchell, Fauna Management Officer, NRE, Orbost

The loss of genetic variation in wild and captive populations is currently being analysed using previously collected blood samples from both wild and captive-bred individuals. This will provide information on the severity of any genetic bottlenecks which may have occurred as well as information on historical levels of gene flow between these populations. With the recent discovery of the north-eastern Victoria sub-population, the analysis of blood and hair samples is necessary to establish the genetic variability of the species. However, further blood samples have not been analysed, as the development of species identification by DNA in hair samples was identified as a higher priority by the Recovery Team.

Species identification from DNA in hair samples is a recent development in genetic research which provides valuable information in cases where insufficient data is obtained from hair microscopy to confirm species identification, and has considerable implications for survey work. The technique is particularly useful in areas such as NSW, where potoroos have been detected through the use of hair-tubes, but have not been successfully trapped. Despite the recent lack of positive hair-tube results in NSW, this technique could be widely used in place of trapping as a non-invasive survey technique.

6. *Measure seasonal abundances of hypogeous fungal sporocarps at the study sites.*
In 1994 a pilot sampling program at Bellbird revealed that the measurement of seasonal variation in sporocarp availability was a very substantial task in its own right and was best dealt with as a separate project. This work has not yet been funded. A related project has examined the distribution of hypogeous fungi across the forested landscape of south-eastern Australia (Claridge *et al* 1999a, b).

7. *Identify fungal spores in faecal samples collected seasonally for dietary information.*
Analysis of 212 faecal samples collected from both the East Gippsland and north-eastern Victorian study sites has been undertaken (Green *et al.* 1999). Hypogeous fungal were predominant in the diet, comprising 91% of the remains in the faeces, with little seasonal variation. The occurrence of *Mesophellia* in the Bellbird scats was higher than elsewhere, possibly reflecting the drier or more disturbed nature of the site.

8. *Poison bait canids to measure the pressure of predators on Long-footed Potoroo sub-populations.*
Predator control using sodium monofluoroacetate (Compound 1080) commenced in the immediate vicinity of the Bellbird trapping grid in 1990 and continued until 1993. The control area covered approximately 100 ha. In 1994, as part of a statewide Victorian project, cyanide baiting trials commenced at Bellbird with the primary aim of collecting data on predator populations (Marks and Mansergh 1996). The predator control area was expanded to approximately 1000 ha. Cyanide baiting proved unsuccessful at Bellbird, as was the case at several other trial sites (Marks and Mansergh 1996). Due to the risk to non-target native species, particularly Lace Monitors (*Varanus varius*), the use of cyanide was discontinued. The baiting program continued however, using 1080 baits, and has been successful. Initially high bait take was reduced to a very low level after the early baiting sessions, and has remained low since, suggesting that recolonisation by canids is slow. The Long-footed Potoroo population appears to have responded positively, with approximately twice as many individuals captured on the trapping grid by 1996 compared with 1986, before predator control commenced.

9. *Measure predator population dynamics, recolonisation rates and seasonality in each study site.*
While changes in bait take may reflect broad trends in predator population dynamics, obtaining accurate information on predator activity is inherently difficult, requiring a suite of labour-intensive monitoring techniques. A higher priority has been given to assessing the proficiency of 1080 baiting programs in reducing predation pressure from Red Foxes and Dogs. Research currently being undertaken by NRE (Murray 1999) aims to determine the effects of broadscale fox control using 1080 baiting on small mammal populations. Prey response will be measured, by population size, individual longevity, weight and foraging behaviour, providing insight into the full benefits gained from predator control. Indices of relative fox density will also be calculated, providing information on rates of predator recolonisation and activity levels.

10. *Measure and characterise the critical habitat of the species.*
While habitat modelling and the development of habitat parameters has been addressed, the validity and utility of results has been limited by a lack of impartial data for the presence and absence of the Long-footed

Potoroo (Lewis and Thulin 1995). Collection of such data relies upon the incorporation of non-predicted habitat into the survey program, as outlined in Action 3.1 of the Recovery Actions section. The lack of a reliable survey technique remains a constraint.

11. *Analyse the information and produce management guidelines for the species.*
Management guidelines have been produced for both Victoria and NSW (see Existing Conservation Measures section). Assessment and review of these guidelines is an ongoing process, which is outlined within the Actions of the Recovery Plan (see Action 1.1, 1.2 and 1.3).

Strategy for Recovery

The Long-footed Potoroo National Recovery Plan provides direction and priorities for conservation of the species, while allowing for flexibility in arrangements within each State. The program outlined in this recovery plan will take five years, however the recovery process will last indefinitely, especially predator control and habitat protection. The ten-year goal is to achieve the downlisting of the species from Endangered to Vulnerable based on the IUCN (1994) criteria of population size and trends, extent of occurrence and probability of extinction.

The strategy presented here focuses on protecting habitat and controlling feral predators at known Long-footed Potoroo sites. The coincidence of the distribution of potoroos and timber production forests demands that impacts of habitat disturbance through logging are clarified to ensure that conservation of potoroos can be integrated with other forest management practices.

Knowledge of the biology of the Long-footed Potoroo is incomplete and there is a particularly urgent need to establish the distribution and habitat preferences of the species and its food resources. Continuing collection of biological information is therefore important, especially to better direct future management decisions.

RECOVERY OBJECTIVES, CRITERIA AND ACTIONS

Recovery Objective

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2. An increase of at least 20% in the size of colonies subject to predator control.

Performance Indicators

1. Habitat around colonies of Long-footed Potoroos protected in accordance with Victorian Action Statement and NSW Recovery Plan and incorporated into other relevant area management plans.

2a. Predator control and monitoring of Long-footed Potoroo colonies undertaken at a minimum of four sites, with an 80% decrease in the rate of bait take by feral predators over the first two years of implementation and a stabilised level of bait take thereafter.

2b. A 20% increase in Long-footed Potoroo detection rates at these sites within five years of commencing predator control.

3a. Improved detection methods for Long-footed Potoroos developed and applied to all terrestrial fauna surveys in eastern Victoria and south-eastern NSW, so that there is a high probability that Long-footed Potoroos will be detected if they are present.

3b. All priority areas surveyed for Long-footed Potoroos within three years.

4. Report published on the impacts of habitat disturbance on the Long-footed Potoroo within the next five years.

5. Report published on the distribution and ecology of hypogeous fungi within five years.

6. Conduct Population and Habitat Viability Assessment using enhanced knowledge of the population and reproductive biology of the species and thus refine the Action Statement and Recovery Plan within five years.

7. Report published on the genetic variability within the species during the next two years.

8. Successful maintenance of at least one captive colony over the next five years.

9a. Production within two years of a range of interpretive material, including the establishment of an internet site and a broadsheet, for use in schools, at Healesville Sanctuary and by other interested members of the community.

9b. Development within three years of a network of community members who are involved in the conservation and management of the Long-footed Potoroo.

Recovery Actions

Costs associated with each action are represented in $'000s/year. The nominated contributions of participating agencies are listed. Figures for 1999 represent actual expenditure, whilst those for subsequent years are projections of the funds necessary to achieve the recovery actions. Management actions are indicated by **(M)**, research actions by **(R)**.

1. Habitat and population protection (M)

Within East Gippsland, 83% of the known distribution of the Long-footed Potoroo currently lies within State forest, whilst 40% of the known range of the species in north-eastern Victoria is State forest (Jones and Johnson 1997). In NSW less than 10% of the known range is in State forest (New South Wales Government 1999). Given that the effects of logging, roading and fuel-reduction burning are not clearly understood, but are likely to destroy or damage colonies at least in the short-term, these activities are to be avoided until research demonstrates otherwise.

1.1 Victoria: Continue to implement the current Victorian Action Statement (Thomas *et al*. 1994) and Management Strategy (Saxon *et al*. 1994) until replaced by a revised Action Statement (by June 2001). Continued funding for this action is likely to be required long-term (>5 years).

Priority 1

Cost/Year	1999	2000	2001	2002	2003
Total	5	5	2	2	2

1.2 NSW: Continue current management arrangements in NSW, as outlined in the draft NSW recovery plan (NSW NPWS 2000), until the Recovery Plan is approved (by June 2000).

Priority 1

Cost/Year	1999	2000	2001	2002	2003
Total	5	5	2.5	2.5	2.5

2. Predator control (M)

Red Fox and wild Dog/Dingo are recognised predators of the Long-footed Potoroo (Scotts and Seebeck 1989, Brown and Triggs 1990) and the feral Cat is considered a potential predator (Saxon *et al.* 1994). Within NSW, Pigs are recognised as potential competitors for food resources and may destroy the foraging habitat of Long-footed Potoroos (Saxon and Claridge 1995). To ensure the short-term persistence and enhancement of sub-populations already under pressure from predators, the implementation of predator control programs is essential. Control of canid predators is most readily achieved by poisoning with 1080 (sodium monofluoroacetate) using buried baits (Saxon *et al.* 1994). While the number of Long-footed Potoroo sites able to be baited will depend upon resources, a priority listing of sites has been developed. Baiting techniques should follow respective State management guidelines, with particular care taken to ensure that bait take by non-target species, such as the Spot-tailed Quoll, is avoided.

2.1 Victoria: Continue predator control programs at Bellbird and implement baiting program at other known colonies with order of priority being Riley Creek, Sardine and Martins Creek. Expand predator control to cover other sites as opportunity permits, with priority to be based on known size of colonies,

access, past predator control and importance for research and monitoring. Opportunities to integrate this work with other predator control programs will be taken whenever possible.

Funds will be required for fox baiting, vehicle running costs and consumables. Continued funding for this action is likely to be required long-term (>5 years).

Priority 1

Cost/Year	1999	2000	2001	2002	2003
Total	30	20	20	20	20

2.2 NSW: Continue baiting across the known range of the species in NSW as per the current program and implement detailed interagency Pig and canid control program for a broader area across the south-east corner of the state. Continued funding for this action is likely to be required long-term (>5 years).

Priority 1

Cost /Year	1999	2000	2001	2002	2003
Total	45	50	50	50	50

2.3 Victoria: Continue to monitor Long-footed Potoroo colony at Bellbird. Monitor colonies after implementing predator control program at Riley Creek, to measure the effect of predator removal. This will require trapping on about a three-monthly cycle, which will also permit the continued collection of data on Long-footed Potoroo reproduction, growth and dispersal. Continued funding for this action is likely to be required long-term (>5 years).

Funds will be required for vehicle running costs, radio collars and consumables associated with trapping.

Priority 2

Cost/Year	1999	2000	2001	2002	2003
Total	25	25	25	25	25

2.4 NSW: Conduct bi-annual monitoring of ground-dwelling mammals (inluding the Long-footed Potoroo) within the area subject to predator control.

Priority 2

Cost/Year	1999	2000	2001	2002	2003
Total	15	10	10	10	10

3. Establish distribution and population size (M)

Many unsurveyed areas have been identified as suitable Long-footed Potoroo habitat through preliminary BIOCLIM predictions. Given the recent discovery of the north-eastern Victoria sub-population, and the lack of information on the geographical extent of other known sub-populations, it is clear that the overall distribution of the species is still not well understood. The conservation status of known sub-populations, and the species as a whole, cannot adequately be assessed until the true distribution of the species is ascertained. In applying BIOCLIM, the predictive limitations of this tool must be recognised. BIOCLIM predictions will only reflect true population distribution when the dataset used in the analysis incorporates distributional data from across the full range of the species. As the predicted distribution may only show a subset of the true distribution of the species, surveys outside the BIOCLIM predicted areas are required to seek and incorporate data from such outlying areas. Surveys within areas of non-predicted habitat will also yield non-biased absence data for the species, which is essential for modelling habitat parameters.

3.1 Undertake survey work in areas of potential Long-footed Potoroo habitat, based on BIOCLIM predictions and Ecological Vegetation Class (EVC) mapping, within NSW and Victoria. This will involve hair-tubing, trapping and predator scat collection and the use of indirect signs such as diagnostic forage-diggings and potoroo scats. Areas of non-predicted habitat should also be included in the survey program. Priority for survey are those areas with a strong likelihood of supporting the species and where the extent of the population is not well understood. These areas are north-east Victoria, West Bondi forest (NSW), the Genoa Wilderness (NSW) and Coopracambra National Park (Victoria).

Funds will be required for hair analysis, the purchase of hair-tubes, treadle traps, and consumables, as well as a contribution to ongoing vehicle running costs and salary for two field technicians in North-East Victoria.

Priority 1

Cost/Year	1999	2000	2001
Total	45	75	75

All hairs collected in the field should be preserved in such a way that DNA analysis can be carried out if microscopy proves inconclusive for species identification. Protocols have been developed by Dr William Sherwin of the University of NSW.

Long-footed Potoroo survey techniques will be built into all comprehensive terrestrial mammal survey programs conducted by government agencies in eastern Victoria and south-eastern NSW. Other organisations such as Universities and Field Naturalists Clubs will also be encouraged to use these techniques during their survey work in the region.

3.2 Incorporate all current locality date into a revised BIOCLIM prediction for the distribution of the Long-footed Potoroo. Update BIOCLIM prediction as new Long-footed Potoroo records are obtained.

Priority 2

Cost	2001
Total	5

3.3 Undertake further survey work in known areas of Long-footed Potoroo habitat to establish demographics of sub-populations and obtain further information on biology and dispersal. This will

involve tracking, trapping and hair-tubing of Long-footed Potoroos and could be undertaken at Bellbird by expanding the current monitoring area.

Costs associated with this action will be covered by contributions to Action 2.3.

Priority 3

4. Research into impacts of habitat disturbance (R)

The main causes of habitat disturbance within the distribution of the Long-footed Potoroo are timber harvesting and fire. A number of the confirmed Long-footed Potoroo sites in Victoria occur within previously logged forest (Saxon *et al.* 1994). While this suggests that Long-footed Potoroos do utilise regrowth forest, it is unclear whether such areas will support the species throughout the regeneration process, or whether colonies have declined or increased after logging. It is not known if disturbance increases vulnerability to predators, or if food resources are affected. To facilitate informed forestry and Long-footed Potoroo management planning, it is clearly important that the effects of timber harvesting on the Long-footed Potoroo are clarified.

The impact of fire regime (the frequency and intensity of fires) may also be very important, but will be more difficult to unravel. Fire regime will have a complex impact on habitat structure and food availability (see action 5.1) and fire events have the obvious potential to kill individual potoroos and destroy colonies. Few of the current potoroo sites have been subjected to extensive wildfire within the last 30 years, though all the sites in regrowth forest in East Gippsland were subject to intensive slash burns after harvesting. Current policy is to avoid planned fires at potoroo sites, but the necessity to do this, or the way in which fire should be applied to habitat management is unexplored.

4.1 Develop and undertake a project to assess the effects of timber harvesting and associated activities, such as slash burning, on Long-footed Potoroo distribution and abundance. To maximise the chances of obtaining a statistically valid result, the project design must provide for sufficient replication to account for natural variation between Long-footed Potoroo colonies. This variation is itself poorly understood. The study should be undertaken by project officers employed by NRE. It is likely that the project will take up to four years (depending on funding) to produce sound results. The project will involve sampling for potoroo presence in a range of age-classes of regrowth, as well as old forest controls, within the distribution of the Long-footed Potoroo. Another component of the project will be experimental disturbance of an area with resident Long-footed Potoroos. The potoroos will be monitoried prior to, and for several years after, the disturbance event. The results of this research will contribute to the revision of the Victorian Action Statement.

Funds would be required for vehicle running costs, as well as contributing to the salary of a project officer.

Priority 1

Cost/Year	**1999**	**2000**	**2001**	**2002**
Total	60	75	75	75

4.2 Investigate the effects of disturbance by fire on potoroo colonies and habitat.

The impacts of fire on hypogeous fungi is the highest priority fire related research task and will be investigated as part of Action 5.1. There are no plans to conduct experimental burning of potoroo sites, however the short-term impact of fire events on resident potoroos should be investigated opportunistically. Costs and timing for the later action are difficult to estimate and funding will be pursued when the situation arises.

Priority 3

5. Research into the biology of hypogeous fungi (R)

Understanding the ecology of hypogeous fungi is a key to understanding Long-footed Potoroo distribution and abundance, given that the species is almost totally mycophagous, and that microhabitat use may be influenced by the availability of food resources (Scotts and Seebeck 1989). Understanding seasonal variation in sporocarp biomass and productivity is also very important. With conflicting evidence and opinions on the role and impact of fire in relation to symbiotic (mycorrrhizal) fungi (Taylor 1991, Claridge 1992, Claridge *et al*. 1992), the response of hypogeous fungi to fire (including slash and fuel-reduction burning) also requires attention.

5.1 Undertake research on hypogeous fungi in SE Australia, particularly in regard to the impact of timber harvesting, short-term impacts of slash-burning practices and impacts of wildfire and prescribed burning.

The project will require a specialised project officer and could be undertaken as a post-doctoral project, specifically focussing on the effects of disturbance on hypogeous fungi. Due to the wide range of Australian mammals which rely on hypogeous fungi as a food source, and the role of the fungi in forest health, this research has wide biodiversity benefits. A detailed project brief for this work has been prepared.

Funds will be required for vehicle running costs and fieldwork equipment.

Priority 1

Cost/Year	**2001**	**2002**
Total	80	80

5.2 Undertake research into seasonal variations in fungal biomass in undisturbed habitat.

This research could be undertaken as a Masters project. Funds will contribute to vehicle running costs.

Priority 2

Cost/Year	**2001**	**2002**	**2003**
Total	20	20	20

6. Collection of biological information and completion of Population and Habitat Viability Analysis (R)

Due to the low trappability of the Long-footed Potoroo, information on the biology of the species remains patchy, particularly in relation to attributes such as dispersal patterns and demography of sub-populations, recruitment, natality and mortality. Such information can only be obtained through long-term collection of data. Collection of such information should continue at the Bellbird trapping grid, from which a decade of more-or-less continuous data on the colony has already been obtained.

The north-east Victorian sub-population was only discovered in 1995, and thus collection of biological information is still at an early stage. A trapping grid has been established at Riley Creek and twelve months of intensive population research performed, followed by two years of monitoring. Given the variability in vegetation, climate and disturbance history between Riley Creek and Bellbird, continued collection of biological information from both sites is necessary to improve our understanding of the biology of the species.

All individuals captured for the first time should be sampled for genetic work. This requires a blood sample, tail-tip sample or sample of approximately 50 hairs to be taken, following the protocol outlined for hair sample preservation (see Action 3.1).

It is important to note that any research conducted within the habitat of the Long-footed Potoroo is a form of disturbance, with a potentially negative effect on the local population. To minimise any form of disturbance occurring through human activity at a Long-footed Potoroo site, predator control

should be included in the program, except in cases where the relationship between potoroos and introduced predators is to be examined.

Population and Habitat Viability Analysis (PHVA) (Soulé 1987) is a form of theoretical modelling which is a useful tool in the management and conservation of some faunal species (Casey *et al*. 1990, Possingham 1991). PHVA allows predictions of population viability, persistence and rates of extinction. Variables which can be incorporated into the model include life history characteristics, population demographics and levels of environmental variability. Thus a good understanding of the population ecology of the subject species is important. It is possible to simulate a range of outcomes, through incorporating different values into the PHVA model. This can be particularly useful if knowledge on the attributes of the species is limited (Saxon *et al*. 1990), and can reveal aspects of a population which are most likely to affect its chances of survival (Shaffer 1981, Lacy and Clark 1990). Population and Habitat Viability Analysis can also be used to assess the impacts of management actions, and identify the need for modifications (Possingham 1991).

Saxon *et al*. (1990) undertook a preliminary PVA for the Long-footed Potoroo and identified carrying capacity, levels of migration and adult mortality as the factors most likely to affect the persistence of the species. While results of the PVA gave direction for future research, the ability of the model to assess Long-footed Potoroo population viability and persistence was limited due to a lack of knowledge of the biology of the species (Saxon *et al*. 1990).

6.1 Continue to collect biological information as part of the monitoring program at Bellbird in East Gippsland.

Costs associated with this action will be covered by the ESP contribution to Action 2.3.

Priority 1

6.2 Continue to collect biological information from at least one intensive study area in north-eastern Victoria.

Funds would be required for vehicle running costs and consumables. After 2002 costs associated with this action will be absorbed into ongoing monitoring (Action 2.3).

Priority 1

Cost/Year	1999	2000	2001	2002
Total	10	30	30	30

6.3 Produce a PHVA model for the Long-footed Potoroo. Utilise the model, as relevant new knowledge is gained on the species, to compare management scenarios or to assess those factors which are likely to affect the probability of sub-population persistence.

Funds will be required for the salary of a biostatistician. This action cannot be undertaken until information is gained on the effects of habitat disturbance (as outlined under Action 4.1), the extent of distribution and population size (as outlined under Action 3) as well as the genetic variation between sub-populations (as outlined under Action 7.1).

Priority 2

Cost/Year	2002
Total	15

7. Genetic research (R)

Genetic research is a central component in addressing many of the recovery objectives for the Long-footed Potoroo. Genetic data is an integral component of PHVA modelling, as well as informing the management of captive and wild populations.

It is important to determine if the Long-footed Potoroo, throughout its distribution, comprises a metapopulation, or if sub-populations are separated by discrete geographical boundaries, with distinct genetic characteristics. Information on the genetic relationship between sub-populations is particularly useful for tracing past corridors of dispersal and determining levels of sub-population isolation. In the past, movements between populations may have enhanced the conservation of genetic diversity, including rare alleles. Such movements may not now be possible, potentially leading to loss of genetic diversity and an increased chance of inbreeding, which would substantially threaten the long-term conservation of the species. An estimate of historical levels of genetic exchange, from genetic data, is therefore important information for the modelling component of a PHVA.

Through recent research, DNA amplification can now be used to identify potoroo species and can confirm Long-footed Potoroo presence from hair samples in cases where insufficient data is available from microscopy of hair. DNA amplification from hairs collected in hair-tubes is limited by the field conditions to which hair-tubes are exposed, as these conditions are conducive to the breakdown of DNA. Currently DNA amplification is possible after four days of simulated field conditions; however, a period of at least a week is required for the successful application of the technique in the field. Sex determination from DNA in hair is still being developed, because genes that allow sex determination in other marsupials are difficult to amplify reliably in potoroos (William Sherwin[3] *pers. comm.* 1997). Other genes are currently being tested.

7. 1 Establish the genetic variation within and between the three known sub-populations of Long-footed Potoroo, as well as the genetic variation between individuals within sub-populations. The latter will guide the development of appropriate geographic units of management, based on measured levels of gene flow. The former will produce important base-line data for checking the success of genetic management.

Funds would be required for the analysis of at least 150 new samples by a consultant geneticist. A more detailed analysis of previously-collected samples, using other genetic loci, would also be incorporated, to improve the precision of results.

Priority 2

Cost/Year	**2000**	**2001**
Total	5	6

7.2 Refine the technique for identification of Long-footed Potoroo individuals and gender from DNA hair analysis. Endeavour to extend the period of field conditions to which hairs can be exposed while still enabling DNA amplification.

Funds would be required to employ a consultant geneticist.

Priority 2

Cost/Year	**2001**
Total	10

7.3 Determine genetic makeup and viability of any new sub-populations.

Costings for this action cannot be estimated until new sub-populations are discovered.

Priority 3

8. Maintenance of captive colony (M + R)

The captive colony at Healesville Sanctuary, currently comprising one female and one male, is an important educational and research asset. Unfortunately the female is inbred and both individuals have had significant levels of exposure to Avian Tuberculosis (Rosie Booth *pers. comm.* 1999). In addition, no captive-born individuals have been successfully raised since 1992, which may be due to an inbreeding depression of reproductive ability. The current objective is to maintain the captive colony, with opportunistic acquisition of injured or orphaned Long-footed Potoroos from the wild.

In holding and breeding Long-footed Potoroos in captivity the main objectives are to:

- maintain husbandry skills required to successfully breed Long-footed Potoroos.
- promote public education.
- provide ongoing field and captive management research opportunities.

There are currently no plans to develop a captive breeding program as a source of animals for re-introduction to the wild, though such a program has potential in NSW if that sub-population proves to be extinct. Any such program would need to be based on new founder individuals taken from the wild and housed apart from the current captive colony, in order to minimise the risk of avian tuberculosis transmission

A number of zoological institutions in addition to Healesville Sanctuary have expressed an interest in participating in the Long-footed Potoroo captive program. Long-footed Potoroo displays, as part of the educational program, should be established at selected institutions as the opportinity presents, based on orphaned or injured wild animals.

8.1 Maintain the current captive colony at Healesville Sanctuary for education and research purposes. Rejected pouch young or injured individuals from the wild will continue to be placed at Healesville Sanctuary, but may be transferred to other institutions with the agreement of Healesville management and the recovery team.

Priority 1

Cost/Year	1999	2000	2001	2002	2003
Total	11.5	11	11.5	12	12

8.2 Should a reintroduction program be required, a new captive breeding group comprising three male and three female wild founders will be established. The captive breeding program would be established at an appropriate zoological institution, as agreed by the recovery team. Until the genetic variation between wild sub-populations is quantified, all potential founders for a re-introduction program should come from the East Gippsland sub-population. In the event of reintroduction, this should ensure that the release of any captive-bred individuals did not diminish natural genetic variation occurring between sub-populations.

Costs associated with this action cannot be estimated until a reintroduction program is required.

Priority 3

8.3 Continue the investigation of Avian Tuberculosis in the captive population, including the development of an effective vaccination, diagnostic screening and the identification of factors which may contribute to the expression of the disease.

Costs for this action are not yet estimated.

Priority 2

8.4 Encourage use of the current captive colony for research particularly into behaviour and reproductive biology.

Costs associated with this action cannot be estimated until interest is shown by a research institution.

Priority 3

9. Enhance community awareness and involvement in management (M)

Currently the only opportunity most people have to view Long-footed Potoroos is at Healesville Sanctuary, where a nocturnal display has greatly assisted in increasing public awareness of the species.

However, there is potential for the Sanctuary to undertake more informative public awareness projects, which would develop community support for the recovery effort of the Long-footed Potoroo. Current signage does not adequately distinguish between the Long-footed Potoroo and its closest relative, the Long-nosed Potoroo. In addition, the signage does not provide detail sufficient to promote public awareness of the status of the species.

While an educational brochure on the Long-footed Potoroo has been published by NRE, other avenues for raising public awareness will also be explored. These include the development of a Long-footed Potoroo home page on the World Wide Web and media coverage of management and research activities.

Work on the potoroo has received a high profile in local media and has been featured regularly in state media. Consequently, public interest in the species is high. Regular publicity of management works on the potoroo should continue as a routine part of the conservation program.

Opportunities also exist to involve people outside the conservation agencies in field management of the species. In the past, volunteers have assisted with field work in East Gippsland, New South Wales and north-eastern Victoria. In north-eastern Victoria students from Charles Sturt University have been involved in survey work. The relatively remote distribution of the species does not lend it to ready support from a 'Friends' type group, however the continuing involvement of interested individuals and students will be encouraged. Landholders close to known colonies will be encouraged to undertake predator control work and will receive material support to do this work.

9.1 Develop a detailed interpretive display for the nocturnal display at Healesville Sanctuary. Funds required for consumables as well as associated production costs.

Priority 2

Cost/Year	2000
Total	7

9.2 Prepare a static display on the Long-footed Potoroo recovery program to be used at zoological institutions, workshops and field days.

Priority 3

Cost/Year	2000
Total	5

9.3 Develop a Long-footed Potoroo home page as part of the NRE World Wide Web site on the Internet, with regular updates on the progress of management of the species.

Priority 1

Cost/Year	2000
Total	1.5

9.4 Provide regular updates to local and state media on Long-footed Potoroo management activities and prepare a community mailing list and broadsheet to keep interested individuals and groups informed about management activities on the species.

Priority 1

Cost/Year	1999	2000	2001	2002	2003
Total	2	1	1	1	1

9.5 Develop a network of tertiary students, especially from Charles Sturt University and the East Gippsland Institute of TAFE, as well as members of the public interested in helping with Long-footed Potoroo conservation works and allocate tasks to those people.

Priority 2

Cost/Year	1999	2000	2001	2002	2003

Total	1	1	1	1	1

Table 3. Implementation Schedule

Action	Description	Priority	Feasibility	Lead agency	Cost Estimate ($000s)					
					1999	2000	2001	2002	2003	Total
1.1	Habitat management in Victoria	1	100%	NRE	5	5	5	2	2	19
1.2	Habitat management in NSW	1	100%	NSW NPWS	5	5	2.5	2.5	2.5	17.5
2.1	Predator control in Victoria	1	100%	NRE	30	20	20	20	20	110
2.2	Predator & pig control in NSW	1	100%	NSW NPWS, SF	45	45	45	45	45	225
2.3	Monitor colonies with predator control in Victoria	1	100%	NRE	25	25	25	25	25	125
2.4	Monitor terrestrial mammals in NSW	2	100%	NSW NPWS	15	10	10	10	10	55
3.1	Survey work	1	100%	NRE, NSW NPWS	45	75	75			195
3.2	Up to date BIOCLIM prediction	2	100%	NRE			5			5
3.3	Demographic study	3	80%	NRE						0
4.1	Habitat disturbance research-timber harvesting	1	100%	RTA	75	75	75	75		300
4.2	Habitat disturbance research-fire	3	80%	RTA						0
5.1	Research impacts of timber harvesting and fire on hypogeous fungi	1	100%	RTA			80	80		160
5.2	Research biomass and seasonal variation of hypogeous fungi	2	100%	RTA			20	20	20	60
6.1	East Gippsland biological data collection	1	100%	NRE						0
6.2	North-east Vic. biological data collection	1	90%	NRE	10	30	30	30		100
6.3	Produce PHVA model	2	80%	NRE				15		15
7.1	Establish genetic variability	2	95%	UNSW		5	6			11
7.2	Refinement of DNA analysis of hair	3	95%	UNSW			10			10
7.3	Examine genetics of new populations	3	95%	NRE, NSW NPWS						0
8.1	Maintain captive colony	1	100%	HS	11.5	11	11.5	12	12	58
8.2	Captive breeding for reintroduction	3	80%	RTA						0
8.3	Continue TB investigations	2	100%	HS						0
8.4	Utilise captive colony for research	3	100%	RTA						0
9.1	Interpretive display for Healesville	2	100%	HS		7				7
9.2	Static display on recovery program	3	100%	NRE		5				5
9.3	Develop potoroo home page	1	100%	NRE		1.5				1.5
9.4	Media updates and broadsheet	1	100%	NRE	2	1	1	1	1	6
9.5	Community involvement	2	90%	NRE	3	2	2	2	2	11
Total					**271.5**	**322.5**	**423**	**339.5**	**139.5**	**1496**

= No cost associated or estimated, or costs covered by another action (see action in text)

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