

Nature Conservation (Threatened Ecological Communities and Species) Action Plan 2007 (No 2)

Disallowable instrument DI2007— 85

made under the

Nature Conservation Act 1980, s 42 (Preparation of action plan)

1 Name of instrument

This instrument is the Nature Conservation (Threatened Ecological Communities and Species) Action Plan 2007 (No 2).

2 Details of instrument

The following Action Plans have been prepared and are available from <http://www.environment.act.gov.au/nativeplantsandanimals/threatecspec/actplans>

- Action Plan No. 5. A subalpine herb (*Gentiana baeuerlenii*)
- Action Plan No. 6. Northern Corroboree Frog (*Pseudophryne pengilleyi*)
- Action Plan No 22. Brush-tailed Rock Wallaby (*Petrogale penicillata*)
- Action Plan No 23. Smoky Mouse (*Pseudomys fumeus*)
- Action Plan No 30. Spotted-tailed Quoll (*Dasyurus maculatus*)

3 Commencement

This instrument commences the day after notification.

4 Instruments revoked

This instrument revokes the following instruments for Action Plans.

- Nature Conservation (Threatened Ecological Communities and Species) Action Plan 2005 (No 3) DI2005-210.
- Nature Conservation Action Plans for Protecting ACT's Threatened Species and an Ecological Community NI 1999-206.
- Nature Conservation Action Plans for Protecting ACT's Threatened Species NI 1998-216.
- Nature Conservation Action Plans for Protecting ACT's Threatened Species NI 1998-7.

Hamish McNulty
Conservator of Flora and Fauna
4 April 2007

ACTION PLAN No. 5

In accordance with section 21 of the *Nature Conservation Act 1980*, the **subalpine herb (*Gentiana baeuerlenii*)** was declared an **endangered** species on 15 April 1996 (formerly Determination No. 29 of 1996 and currently Determination No. 89 of 1997). Section 23 of the Act requires the Conservator of Flora and Fauna to prepare an Action Plan in response to each declaration. This is the Action Plan for:

A subalpine herb *Gentiana baeuerlenii*

Preamble

The *Nature Conservation Act 1980* establishes the ACT Flora and Fauna Committee with responsibilities for assessing the conservation status of the ACT's flora and fauna and the ecological significance of potentially threatening processes. Where the Committee believes that a species or ecological community is threatened with extinction or a process is an ecological threat, it is required to advise the Minister for the Environment, Land and Planning, and recommend that a declaration be made accordingly.

Flora and Fauna Committee assessments are made on nature conservation grounds only and are guided by specified criteria as set out in its publication "*Threatened Species and Communities in the ACT*, July 1995".

In making its assessment of this subalpine herb, the Committee concluded that it satisfied the criteria indicated in the adjacent table.

An Action Plan is required in response to each declaration. It must include proposals for the identification, protection and survival of a threatened species or ecological community, or, in the case of a threatening process, proposals to minimise its effect.

While the legal authority of this Action Plan is confined to the Australian Capital Territory, management considerations are addressed in a regional context.

Criteria Satisfied

- 1.1 The species is known or suspected to occur in the ACT region and is already recognised as endangered in an authoritative international or national listing.
- 1.2 The species is observed, estimated, inferred or suspected to be at risk of premature extinction in the ACT region in the medium-term future, as demonstrated by:
 - 1.2.6 Extremely small population.

Species Description and Distribution

DESCRIPTION

Gentiana baeuerlenii is a small annual herb, standing 2-4 cm high. The flowers are borne singly at the ends of branching stems. Each is bell shaped, greenish outside and blue-white inside with five petals. The species occurs in the inter-tussock space of moist tussock grassland and sedgeland (*Poa labillardieri* and *Carex gaudichaudii*) associated with ground water, possibly a spring-fed area. The area is probably secondary grassland or a relict grassland opening once surrounded by open woodland. The site is on the lower slopes of a broad valley, above a river and lower valley floor.





Figure 1: *Gentiana baeuerlenii*. Scale: shown approximately twice actual size.

DISTRIBUTION

The species is currently known only from one location, which was identified during a remarkable chance rediscovery in the Orroral Valley, Namadgi National Park (Figure 2) by Mr Laurie Adams of the Australian National Herbarium. It was believed to be extinct, having previously been described from the Quidong area near Bombala NSW, from specimens found there in 1887.

HABITAT

The orchid, *Spiranthes sinensis*, the herb, *Ranunculus pimpinellifolius* and the grass *Hemarthria uncinata* were found in association with the herb and this group of more widespread species may be indicators for other potential sites.

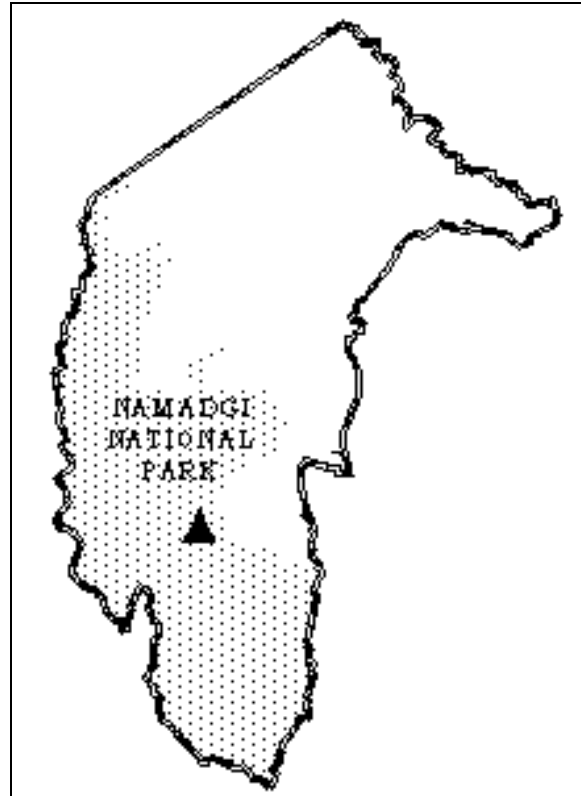


Figure 2: Map showing location (♦) of *G. baeuerlenii* within Namadgi National Park.

Conservation Status

G. baeuerlenii is recognised as a threatened species in the following sources:

National

Endangered. - ANZECC (1993).

Endangered. - Briggs & Leigh (1996).

Endangered. - Part 1, Schedule 1 of the *Endangered Species Protection Act 1992* (Commonwealth).

Australian Capital Territory

Endangered. - Section 21 of the *Nature Conservation Act 1980*, Determination No. 89 of 1997 (formerly Determination No. 29 of 1996).

Special Protection Status Species. - Schedule 6 of the *Nature Conservation Act 1980*, Determination No. 77 of 1996.

New South Wales

Endangered. - Part 1, Schedule 1 of the *Threatened Species Conservation Act 1995*.

Threats

It is very likely that the species was once widespread but has become restricted through activities associated with land clearing and grazing, particularly in times of drought as the wet grassy areas in which it is found would have remained palatable well into the driest seasons. Although the species is likely to be unpalatable to stock because it contains certain chemicals known to render plants distasteful, it could have been grazed inadvertently, along with other herbage species. Its habitat may have been trampled, especially when adjoining areas dried out.

There are now only a few plants at the site, less than ten having been counted in 1994. At the time of discovery in 1992, 20 plants were observed.

The main threat to survival of this population and therefore the species is likely to be deliberate or unintended actions associated with park management activities in the local area. It is not clear whether grazing animals such as kangaroos may also pose a threat to survival of remaining plants, or whether such grazing may benefit the species by keeping competing grass tussocks and other plant growth short and open.

Major Conservation Objectives

The objectives of the Action Plan are to:

- preserve the existing ACT population as it is the *only known location* where the species survives;
- manage the habitat so that natural ecological processes continue to operate; and
- develop successful propagation techniques.

Conservation Issues and Intended Management Actions

SURVEY/MONITORING/RESEARCH

It is very unlikely that the species exists anywhere else in the ACT. Given this degree of rarity, surveys aimed at finding specimens beyond the immediate area are not economically justified. Survey opportunities will be found in other work by making field workers aware of the species and alerting interested naturalists and conservation groups.

Contact will be maintained with the NSW National Parks & Wildlife Service on this matter.

- Environment ACT (Wildlife Research and Monitoring) will monitor the existing population on an annual basis.

REQUIRED MANAGEMENT ACTIONS

Due to the nature and small size of the site containing the species, management actions will be directed towards maintaining existing conditions and ensuring that activities located nearby do not adversely affect the site. To aid management and monitoring of the species the site has been unobtrusively marked.

- The site will kept open if necessary, by artificially trimming the tussock grass during the non-flowering season.- This will be done by careful use of a “whipper-snipper” and removing cut grass by raking to avoid continuous build up of decaying matter which smothers soil and small plants. Any spread of tea-tree will be monitored and appropriately controlled.
- Herbicides will not be used anywhere in the vicinity of the site, where there is any possibility of it adversely affecting the species.
- Activities, such as track development, which could alter the drainage of the site will not be allowed near the site.
- Feral pig control in the area needs to be maintained.
- Expert advice will be sought on the need and potential for *ex-situ* conservation measures to be taken for this species.
- Consideration will be given to burning adjacent areas of similar habitat subject to assessment of each area.

Protection

The small number of plants known to exist would so far not support adequate seed production but when the number available is greater, depending on the season, propagation must be undertaken. This is the only way to ensure biodiversity conservation as the habitat is fragile, is being grazed by macropods and could accidentally be burnt. Nothing is known of the species' fire ecology but it appears to be an annual and dependent on seed

regeneration. Further research on this aspect is required.

There will be no track development near the site; thus, visitor access to the area where the species is located is not encouraged.

Socio- economic Issues

There are no foreseen activities or land uses which are likely to conflict with achievement of the conservation objective. Visitor access to the location will be discouraged.

The conservation and management of the subalpine herb is the responsibility of Environment ACT. Specific conservation measures, such as grass management, will be undertaken within funding provided to Environment ACT (ACT Parks and Conservation Service).

Legislative Provisions

The following legislation is relevant to conservation of flora and fauna in the ACT:

Nature Conservation Act 1980

The *Nature Conservation Act* protects native plants and animals. Activities affecting native plants and animals require a licence which may specify conditions to apply to the activity.

- A person may not take a **native plant** or fell **timber** on unleased land without a licence.

Native plants and animals may be declared as *protected or having special protection status* in recognition of a particular conservation concern that warrants additional protection. Increased controls apply to declared species and licensing constraints are specified.

Licence Conditions (SPS)

The endangered status of *G. baeuerlenii* requires its listing as a Special Protection Status (SPS) species. This is the highest level of statutory protection and is conferred on species which are either threatened with extinction or are a migratory animal subject to an international agreement for their protection. Conservation requirements are a paramount consideration and only activities related to conservation of the species or serving a special purpose are permissible.

The Conservator of Flora and Fauna may only grant a licence for activities affecting a species with SPS where satisfied that the act specified in the licence:

- is required to be done for scientific, educational, propagative or other similar purposes;
- is required to be done for the purpose of protecting persons or property and will be conducted in a way that will, so far as is practicable, keep to a minimum any impact on the species concerned;
- is merely incidental to other acts, and will not appreciably reduce the chances of survival or recovery in the wild of the species concerned; or
- is of particular significance to Aboriginal tradition and will not appreciably reduce the chances of survival or recovery in the wild of the species concerned.

Other Relevant Provisions

The *Nature Conservation Act* provides authority for the Conservator of Flora and Fauna to manage Public Land reserved for conservation of the natural environment. Activities that are inconsistent with management objectives for nature conservation objectives are controlled. Special measures for conservation of a species or community of concern can be introduced in a reserved area, including restriction of access to important habitat.

Land (Planning and Environment) Act 1991

The Land (Planning and Environment) Act is the primary authority for land planning and administration. It establishes the Territory Plan and several of its provisions are relevant to the protection of flora and fauna.

- **Public Land** is reserved via the Territory Plan. Land reserved as wilderness area, national park or nature reserve has conservation of the natural environment as a paramount management objective. The Conservator of Flora and Fauna must prepare a **plan of management** setting out how management objectives are to be implemented or promoted.
- **Places of natural heritage significance**, including important habitat for native species, may be entered in the Heritage Places Register, with conservation requirements specified.

- **Environmental Assessments and Inquiries** may be initiated as part of the approvals process for defined land use and development decisions or activities prescribed as controlled. Assessments are required to address potential environmental impact, including threats to a species of flora and fauna, an ecological community or an area.

Consultation and Community Participation

As the area is well within Namadgi National Park, there is likely to be little community involvement in the foreseeable future.

Implementation, Evaluation and Review

RESPONSIBILITY FOR IMPLEMENTATION

Environment ACT will have responsibility for coordination of the implementation of this Action Plan, subject to the availability of Government resources. In Namadgi National Park, the conservation and management of the species is also the responsibility of Environment ACT.

EVALUATION

Implementation of this Action Plan will be a collaborative exercise between government agencies, landholders and the community generally. The Action Plan will be reviewed after three years. The review will comprise an assessment of progress using the following performance indicators:

- completion of commitments that can reasonably be expected to be finalised within the review timeframe (e.g. introduction of a statutory protection measure for a species; development of a management plan);
- completion of a stage in a process with a time line that exceeds the review period (e.g. design or commencement of a research program);
- commencement of a particular commitment that is of a continuing nature (e.g. design or commencement of a monitoring program for population abundance); and
- expert assessment of achievement of conservation objectives of the Action Plan.

The review will be reported to the ACT Flora and Fauna Committee. This will provide Environment ACT and the Flora and Fauna Committee an opportunity to assess progress, take account of developments in nature conservation knowledge, policy and administration and review directions and priorities for future conservation action.

The following conservation actions will be given priority attention:

- assessment of *ex-situ* conservation measures; and
- putting protection measures in place.

Acknowledgements

The illustration of the species (Figure 1) was prepared for Environment ACT by John Pratt.

References

- Adams, L.G., 1995. *Flora of Australia*. Volume 28, Gentianales. CSIRO Australia, Melbourne.
- Adams, L.G. & Williams, J.B., 1988. *Gentiana* sect. *Chondrophyllae* (Gentianaceae) in Australia. *Telopea* 3(2): 167-176.

Further Reading

- ANZECC, 1993. *List of Threatened Australian Flora*. Australian and New Zealand Environment and Conservation Council, Canberra.
- Briggs, J.D. & Leigh, J.H., 1996. *Rare or threatened Australian plants*. 1995 Revised Edn. CSIRO Publishing, Collingwood.

List of Action Plans - December 1997

In accordance with Section 23 of the *Nature Conservation Act 1980*, the following Action Plans have been prepared by the Conservator of Flora and Fauna:

- No. 1: Natural Temperate Grassland - an endangered ecological community.
- No. 2: Striped Legless Lizard (*Delma impar*) - a vulnerable species.
- No. 3: Eastern Lined Earless Dragon (*Tympanocryptis lineata pinguicolla*) - an endangered species.
- No. 4: A leek orchid (*Prasophyllum petilum*) - an endangered species.
- No. 5: A subalpine herb (*Gentiana baeuerlenii*) - an endangered species.
- No. 6: Corroboree Frog (*Pseudophryne corroboree*) - a vulnerable species.

FURTHER INFORMATION

Further information on this Action Plan or other threatened species and ecological communities can be obtained from:

Environment ACT
(Wildlife Research and Monitoring)
Phone: (02) 6207 2126
Fax: (02) 6207 2122

This document should be cited as:

ACT Government, 1997. *A subalpine herb (Gentiana baeuerlenii): An endangered species*. Action Plan No. 5. Environment ACT, Canberra.

Threatened Species

Action Plan No.6

Corroboree Frog *Pseudophryne corroboree**

In accordance with section 21 of the *Nature Conservation Act 1980*, the **Corroboree Frog (*Pseudophryne corroboree*)*** was declared a **vulnerable** species on 15 April 1996 (formerly Determination No. 29 of 1996 and currently Determination No. 89 of 1997). Section 23 of the Act requires the Conservator of Flora and Fauna to prepare an Action Plan in response to each declaration.

This is the Action Plan for the:

Corroboree Frog *Pseudophryne corroboree**

* Special Note:

As a consequence of the very recent revision of the taxonomic status of the Corroboree Frog *Pseudophryne corroboree*, two species of corroboree frog are now recognised: the Northern Corroboree Frog *P. pengilleyi*, which occurs in the ACT and the Southern Corroboree Frog *P. corroboree*, which occurs in the Snowy Mountains. The Flora and Fauna Committee has recommended that the declaration *P. corroboree* as a vulnerable species be revoked, and replaced by a declaration of *P. pengilleyi* as a vulnerable species. This Action Plan has been drafted to take this proposed change into account.

Preamble

The *Nature Conservation Act 1980*, establishes the ACT Flora and Fauna Committee with responsibilities for assessing the conservation status of the ACT's flora and fauna and the ecological significance of potentially threatening processes. Where the Committee believes that a species or ecological community is threatened with extinction or a process is an ecological threat, it is required to advise the Minister for the Environment, Land and Planning, and recommend that a declaration be made accordingly.

Flora and Fauna Committee assessments are made on nature conservation grounds only and are guided by specified criteria as set out in its publication "*Threatened Species and Communities in the ACT*, July 1995".

In making its assessment of the Corroboree Frog, the Committee concluded that it satisfied the criteria indicated in the adjacent table.

An Action Plan is required in response to each declaration. It must include proposals for the identification, protection and survival of a threatened species or ecological community, or, in the case of a threatening process, proposals to minimise its effect.

While the legal authority of this Action Plan is confined to the Australian Capital Territory, management considerations are addressed in a regional context.

Criteria Satisfied

2.1 The species is known to occur in the ACT region and is already recognised as vulnerable in an authoritative international or national listing.

2.2 Species is observed, estimated, inferred or suspected to be at risk of premature extinction in the ACT region in the medium-term future, as demonstrated by the following:

2.2.1 Current serious decline in population or distribution from evidence based on :

2.2.1.1 direct observation, including comparison of historical and current records.

2.2.3 Continuing decline or unnaturally extreme fluctuations in population or distribution, for a species currently occurring over a moderately small range or having a moderately small area of occupancy within its range.

Species Description and Distribution

DESCRIPTION

There are two closely related species of corroboree frog; the Northern Corroboree Frog *Pseudophryne pengilleyi* (Wells & Wellington 1985) (Figure 1), and the Southern Corroboree Frog *P. corroboree* Moore (Osborne *et al.* 1996). Both are in the family Myobatrachidae and are amongst the most distinctive and easily recognised Australian frogs (Cogger 1992). *Pseudophryne pengilleyi* is confined to the high country of the ACT and the adjacent Fiery Range in NSW, whereas *P. corroboree* is found only in the Snowy Mountains in NSW (Osborne 1989).

The frogs are small (adults 2.5 to 3 cm in body length), and are characterised by yellow and black dorsal stripes (Pengilley 1966, Cogger 1992). This pattern extends over the limbs and flanks. The ventral surface is broadly marbled with black and white or black and yellow. A large flat femoral gland is present on each limb.

Adults of *P. pengilleyi* differ from *P. corroboree* in having: (1) a pattern of dorsal stripes that are usually yellow with a green tinge (rarely yellow) or lime-green; (2) mid-dorsal light-coloured stripes that are less than half the width of the adjacent black stripe at mid-body; and (3) a significantly smaller body and tibia length (Osborne *et al.* 1996). Another difference, which is less obvious, is the longer first component in the advertisement call of *P. pengilleyi*. There are also consistent genetic differences between the two species (Roberts and Maxson 1989, Osborne and Norman 1991).

HABITAT

The frogs use two distinct habitat types; a breeding season habitat associated with pools and seepages in *Sphagnum* bogs, wet tussock grasslands and wet heath, and a terrestrial non-breeding habitat in forest, sub-alpine woodland and heath adjacent to the breeding area (Pengilley 1966). During summer, the adult frogs breed in shallow pools and seepages within the breeding area, before returning to the adjacent woodland and tall moist heath at the end of the breeding season.

The breeding pools are characteristically shallow, and have relatively large surface areas, low water flow rates, and have a long duration (Osborne 1990). This allows the water in the preferred pools to become warmer during the day, possibly enhancing tadpole development.

Litter, logs and dense ground cover in the understorey of snow gum woodland and heathland provides overwintering habitat for subadults and adults (Pengilley 1966).



Figure 1: *P. pengilleyi*, Ginini Flats, Namadgi National Park, ACT. Shown four times actual size.

BEHAVIOUR AND BIOLOGY

Like most frogs, the Northern Corroboree Frog has a two stage life cycle; an aquatic tadpole stage and a terrestrial post-metamorphic juvenile and adult stage. However, they differ from most other frogs in that their eggs are laid out of water, in moss or dense vegetation at the edge of the breeding pool. The embryos develop to an advanced stage within the egg capsule before hatching, and moving to the nearby pool.

Adult males move into the breeding areas during January and February, and call from small chambers in moss or other soft vegetation at the edges of the breeding pools. Females only enter the bogs briefly to lay their eggs in the terrestrial oviposition site, and then leave the breeding site. The males continue calling for a number of weeks, presumably to continue mating. They then leave the bogs during late February and March to return to the over wintering habitat (Pengilley 1966, Osborne 1988). The eggs are laid in a small clutch of about 25 eggs (range 16-40) (Pengilley 1973).

Tadpole development initially occurs within the egg, and the relatively advanced tadpoles emerge from the egg when they are about 15 mm in length (Pengilley 1966, Osborne 1991). Hatching occurs during autumn and winter during periods of high rainfall or snow melt. The pre-metamorphic period is critical for reproductive success, because the tadpoles and eggs are vulnerable to desiccation and pool-drying at this time.

Very little is known about the life-history of the frogs after they leave the pools as juveniles. Pengilley (1966, 1973) suggested that they remain in moist vegetation near the breeding pools for several months, where they feed on a wide variety of small invertebrates. As they grow larger, the juveniles leave the breeding area and move into the adjacent non-breeding habitat where it is thought they remain until they are adults. The diet of subadults and adults consists mainly of ants and, to a lesser extent, other invertebrates (Pengilley 1971a).

DISTRIBUTION

The Northern Corroboree Frog has a high mountain distribution, occurring along the Brindabella and Bimberi Ranges from the summit of Mt Bimberi (ACT) in the south to near California Flats (NSW) in the north, and throughout the Fiery Range and Bogong Mountains in Kosciusko National Park and Buccleuch State Forest (Figure. 2). The species occurs over an altitudinal range from 900 to 1800 m.

In the ACT, the species occurs as two subpopulations (Osborne 1989), each represented by frogs that are genetically slightly different (Osborne and Norman 1991). The southern subpopulation is found only in the

subalpine zone (above about 1400 m), occurring along the Bimberi Range from near the summit of Mt Bimberi (the breeding site is located at 1840 m) northwards to Ginini Flats. This subpopulation occurs only within Namadgi National Park (ACT) and the adjacent Bimberi Nature Reserve in NSW, with the largest populations occurring at Ginini Flats and Snowy Flats in the ACT.

The northern subpopulation (characterised by having greener stripes) occurs further north at lower altitudes along the Brindabella Range from Bushrangers Creek in the ACT northwards to near California Flats in NSW (Figure 2). This subpopulation occurs in Namadgi NP, Brindabella NP and an area of land in NSW near the ACT border which is the responsibility of the Commonwealth. This area includes Coree Flats, an area with a substantial population of northern corroboree frogs.

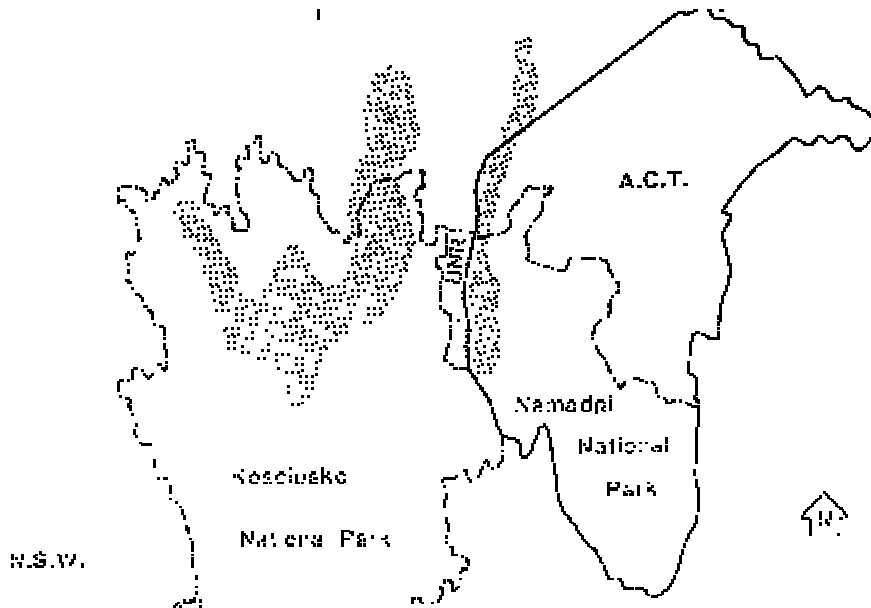


Figure 2: Map showing the distribution for *P. pengilleyi* in the ACT region - the two shaded areas show their known range. Source: GIS Systems Division, NSW National Parks and Wildlife Service, Hurstville.

Conservation Status

Pseudophryne pengilleyi is recognised as a threatened species in the following sources:

International

Vulnerable. - IUCN (1994) (as *P. corroboree*).

New South Wales

Vulnerable species. - (as *P. pengilleyi*): Schedule 2 of the *Threatened Species Conservation Act 1995*.

Australian Capital Territory

Special Protection Status Species. - Schedule 6 of the *Nature Conservation Act 1980*, Determination to be gazetted.

Vulnerable. - Section 21 of the *Nature Conservation Act 1980*, Determination No. 89 of 1997 (formerly Determination No. 29 of 1996) (as *P. corroboree*).

Threats

The Northern Corroboree Frog is faced with a considerable inherent risk from disturbance because of its specialised life history. It has a very low clutch size, each female breeds only once each season, and the tadpoles are slow-growing, spending over six months in the shallow pools. Such a strategy reduces the ability of the species to recover quickly during favourable seasons, and places it at risk from any long-term disturbance which affects the breeding sites.

The frogs are completely dependent on continued water seepage into the shallow breeding pools. During the lengthy (approximately six months) period that the tadpoles are developing, they are vulnerable to mortality if the pools dry. Consequently, any disturbance that reduces flow into the breeding habitat is potentially detrimental.

Activities in the catchments of the breeding sites which may pose a threat include earthworks or road construction, and damage to soil, peat or vegetation.

Feral pigs are a threat as they disturb breeding areas in their search for food such as insect larvae and tubers (Alexiou 1983). Pigs also wallow in the bog pools and can disturb the breeding pools at the time they are being used by the frogs. Trampling by wild horses has caused extensive damage to some breeding sites by causing incision of the bogs, and altering drainage patterns (currently only in NSW) (see comments by Dyring 1992).

In some areas of NSW, exotic weeds, particularly blackberries, are smothering breeding sites. This is less of a problem in the ACT.

Wildfire can severely damage peat and bog areas, causing erosion and decreasing the capacity of the bogs to hold water (Good 1973; Clark 1986).

Drought presents a broader scale threat, and has been observed to prevent breeding, or to dry pools that contain developing tadpoles (Pengilley 1966; Osborne 1988, 1989).

There is considerable public interest in corroboree frogs, with many people expressing a wish to see them because of their bright markings. If human visitation to areas used as breeding sites increases there is a greater likelihood of people disturbing the frogs. This may occur through trampling of the pool edge vegetation, or by direct disturbance to the frogs.

The activities discussed above present obvious threats to the frogs. However, populations of both the Northern and Southern Corroboree Frog have declined considerably over the last ten years despite the implementation of measures to prevent the loss of breeding habitat from road construction, weed spread and the impact of feral animals (see Osborne 1991; 1996), and the absence of damaging wildfires.

In common with a number of other declining species of frogs in south-eastern Australia, the reason for the ongoing declines are not known (Mahoney 1996), and are the subject of continuing research.

Globally, including in parts of Australia, many locations where frog population declines have occurred are in wilderness areas, remote from human impact. There has been growing international concern about similar declines and extinctions of many populations of amphibians at high altitudes (McDonald 1990; Carey 1993; Fellers and Drost 1993; Hedges 1993; Hollis 1995).

Concern about global warming (Pearman 1988; Galloway 1988) has a particular significance for the conservation of cool-adapted species such as the Northern Corroboree Frog (Bennett *et al.* 1991). Due to its restricted high-altitude distribution, the species is likely to be particularly susceptible to climate change.

The depletion of the ozone layer and the consequent increase in ultraviolet radiation (UV-B) has been implicated as a possible cause of frog declines at higher altitudes (Blaustein *et al.* 1994). Its potential effects on Corroboree Frog populations are yet to be investigated.

Major Conservation Objective

The objectives of this Action Plan are to:

- maximise the possibility of ensuring the survival, in the long-term, of viable, natural populations of *P. pengilleyi* at sites across the geographic range of the species in the ACT. This includes the need to maintain the natural evolutionary development of the species in the wild.

The objective is to be achieved through the following strategies:

- Participating in research, monitoring and experimental management aimed at identifying the cause of the continuing population decline, and preventing it.
- Protecting sites and vegetation communities that are critical to the survival of the species. This includes the Ramsar listed Ginini Flat Subalpine Bog Complex in the ACT, which is internationally recognised and is the stronghold of the ACT population.
- Managing activities in the catchments of breeding sites to minimise or eliminate any threat to frog populations.
- Increasing community awareness of the need to protect the frogs and their habitat.

Conservation Issues and Intended Management Actions

LONG-TERM POPULATION DECLINE

During the 1960's and 1970's the Northern Corroboree Frog was quite common in suitable habitat. Many breeding aggregations in the ACT region were reported to be very large, often consisting of many hundreds of individuals (Pengilley 1966; Osborne 1988). The frogs present at some of these breeding sites have been monitored regularly over the last ten years, and the results indicate a substantial decline has occurred, particularly in the Brindabella and Bimberi Ranges in and near the ACT. Observations over a shorter period in the Fiery Range indicate that there may not have been a substantial decline in this area (P. O'Brien, NSW National Parks and Wildlife Service, pers. comm.; B. Gay, State Forests of NSW, pers. comm.).

The causes of the overall decline are not known. Originally it was assumed that the decline was the result of drought that affected the region in the early 1980's, and that once conditions had improved, the frog population would recover (Osborne 1989). However, this has not been the case; many local populations have continued declining, or remained low for over a decade (Osborne 1991, 1996).

- Environment ACT (Wildlife Research and Monitoring) will continue to be represented on the Corroboree Frog National Recovery Team. This group has representation from all agencies responsible for management of land with corroboree frogs.

LOCAL IMPACTS TO BREEDING AREAS

Localised human impacts are known to have had a deleterious effect on some breeding sites (Osborne 1991). Erosion from poorly maintained roads, and the spread of blackberries, have destroyed or damaged some sites (mostly in NSW) where the species occurred (Osborne 1988).

Livestock grazing and trampling may also have caused habitat deterioration, particularly in NSW. Trampling by livestock, including horses, increases erosion and causes incision of bogs (Dyring 1992; Wimbush and Costin 1979). Trampling by wild horses has caused considerable damage to breeding sites in the Fiery Range in NSW (W. Osborne and D. Hunter pers. obs). In some areas feral pigs have caused obvious disturbance to the habitat of the frogs including breeding areas, although the actual extent of impact on the ecology of the frogs requires further research.

- Environment ACT (ACT Parks and Conservation Service) will continue its program of pig control in Namadgi National Park including and around the Ramsar wetlands at Ginini Flats and other Northern Corroboree Frog breeding sites.

Bushfires also have the potential to impact on the frogs by burning vegetation and peat in breeding and non-breeding areas (Clark 1986), although the actual long-term effects of fire are not known. Osborne (1991) considered that autumn fires burning through woodland and heath surrounding breeding sites had

the greatest potential influence. At this time adult and subadult frogs have moved into these areas to feed and to find suitable over-wintering sites. Regular burning of understorey litter and grass cover in these areas, such as occurs during prescribed burns, is likely to reduce the shelter available to the frogs and make them more vulnerable to predation, dehydration or freezing.

A fire fuel management plan is currently being prepared by Environment ACT (ACT Parks and Conservation Service). This plan provides the basis for the protection of breeding sites by controlling the use of fire in the catchments of areas frequented by the Northern Corroboree Frog. Specifically the plan provides for:

- Maps of sensitive sites including all known breeding sites in the ACT. These maps will be available for use in fire emergencies.
- No deliberate burning in the area within 500 metres of each recognised Corroboree Frog breeding site.
- Restrictions on the use of heavy machinery to the minimum necessary for maintenance of existing roads and emergency access. Notwithstanding the above and wherever possible, heavy machinery will not be used within 500 metres of breeding sites. The bushfire suppression agency will be advised of this measure at the appropriate times. This Action Plan and the fuel plan cannot make a prescriptive statement on the use of heavy fire suppression equipment because the *Bushfire Act 1936* overrides the *Nature Conservation Act 1980*.

GLOBAL CLIMATE CHANGE

Changes in climate may have a number of potential impacts on the biology of the frogs; these include altering the breeding season and changing the period required for egg and tadpole development, so that these events occur earlier or later than at an optimum time. Climate change is also likely to influence the hydrology of the breeding pools, and affect the growth and dynamics of vegetation in the breeding habitat. With warmer temperatures, or longer periods of drier weather during spring and early summer, the pools still containing tadpoles may dry before tadpole development is complete (Osborne 1990; Pengilley 1992).

- Environment ACT (Wildlife Research and Monitoring, and the ACT Parks and Conservation Service) will liaise with, and assist, the NSW National Parks and Wildlife Service and researchers in tertiary institutions in undertaking a coordinated research program to establish whether long-term changes in snow cover, precipitation patterns and temperature may have contributed to the ongoing population decline; this will be done under the general direction of the Corroboree Frog National Recovery Team (for both *P. pengilleyi* and *P. corroboree*).

Ultraviolet radiation (UV-B) has increased significantly in recent years due to increasing ozone (e.g. Jones and Shanklin 1995), and is likely to increase as reduction in ozone in the upper atmosphere continues. Although UV-B is implicated in frog declines at high altitudes (Blaustein *et al.* 1994), ultraviolet radiation is unlikely to affect *P. pengilleyi* adults, eggs and embryos because they are hidden within the moss and are unlikely to be exposed. However, the tadpoles may be at risk, as they are exposed in shallow, clear pools.

- Environment ACT will support research on the susceptibility of the tadpoles to ultraviolet radiation; this will be done under the general direction of the Corroboree Frog National Recovery Team (for both *P. pengilleyi* and *P. corroboree*).

SURVEY

An extensive survey has been conducted to determine the distribution of the Northern Corroboree Frog in the ACT and northern Brindabella Range (Osborne 1990; Osborne unpublished data). This information provides a basis for selection of long-term monitoring and research sites, as well as for site protection and management.

- A survey data base will be developed to provide baseline survey information for the species. New searches will be conducted in any potentially suitable areas not yet surveyed.
- As part of the Corroboree Frog National Recovery Team, Environment ACT will participate in a joint ACT/NSW assessment of the distribution of the species.

MONITORING

The continuing decline in populations of the Northern Corroboree Frog, and the disappearance of the species from a number of sites in the ACT region, is reason for considerable concern, and underscores the need for careful population monitoring.

It should be noted that Osborne (1991) cautions that any studies conducted on severely depleted local populations run the risk of causing further losses to those populations if physical searches are made for individuals. This is because the disturbance caused by searching through moss and other vegetation to find frogs may cause any males found to abandon their nest sites, and may dry the eggs.

- Environment ACT (Wildlife Research and Monitoring) will implement a program of population monitoring to assist recording long-term population trends, and to address hypotheses concerning the reasons for the declines.
- Monitoring will be conducted by suitably experienced personnel, and will follow procedures agreed by the Corroboree Frog National Recovery Team to allow for consistency of technique across the region.
- The monitoring program will be coordinated with other similar programs and the results will be made available to the Corroboree Frog National Recovery Team, who will provide general advice to relevant land managers.

RESEARCH

There is considerable existing information on the biology and ecology of the Corroboree Frog. Distribution (Osborne 1989), breeding biology (Pengilley 1966, 1973), diet (Pengilley 1971a), population genetics (Osborne and Norman 1991) and habitat use (Osborne 1990) are reasonably well known. However, some important aspects remain unknown. Basic demographic information is lacking and further research is required on the ecology of juveniles and adults after they leave the breeding pools. Information still required includes estimates of embryonic mortality, tadpole survival, longevity, breeding age, and juvenile and adult mortality.

Other important aspects of research relate to the landscape processes that influence metapopulations, of particular importance in the conservation of this patchily distributed species. Research is required on the extent of movement between breeding sites by individuals and the effect of catchment hydrology on population persistence, particularly with respect to long-term survival during droughts. It is still not clear why the frogs choose particular breeding pools, and in what way hydrology and vegetation interact in the formation of pools.

Research is also needed to examine the possible influence of global climate change on the frogs, including the impact of ultraviolet radiation, changed precipitation patterns and global warming.

Both species of corroboree frog are currently the subject of ongoing research by the Applied Ecology Research Group (University of Canberra). This work has been funded by the NSW National Parks and Wildlife Service and is coordinated by the Corroboree Frog National Recovery Team (see Osborne 1996).

- Environment ACT will support, assist and encourage long-term research coordinated by the Corroboree Frog National Recovery Team aimed at developing a better understanding of: (1) basic population demography including breeding success and tadpole survival; (2) physical and biological properties influencing breeding pool formation and condition of breeding habitat in the ACT and (3) global climatic influences on the frogs.

CAPTIVE HUSBANDRY

Given the recent extinction of a number of species of Australian frogs (Tyler in press), conservation biologists have recommended that efforts be undertaken to improve knowledge of captive rearing and breeding of declining or rare species, before the populations become too small for these efforts to succeed.

- Environment ACT will assess the need to develop procedures for artificial rearing of tadpoles and for captive breeding of adult Northern Corroboree Frogs in the ACT in response to expert advice or a proposal from the Corroboree Frog National Recovery Team.

MANAGEMENT OF GININI FLATS WETLANDS

The most extensive breeding habitat for the Northern Corroboree Frog in the ACT occurs in association with the Ginini Flats wetlands complex, a system of interlinked subalpine Sphagnum bogs (Clark 1980) occupying approximately 125 ha (Lintermans and Ingwersen 1996). As a designated Ramsar wetland of international significance this area is managed primarily for conservation purposes within Namadgi National Park. The area also attracts a moderate amount of recreational use, both in summer and winter, which has the potential to conflict with the conservation of the frog population.

Osborne (1991) noted that the frogs are most vulnerable during two periods of their life-history; firstly the adult males and eggs are easily disturbed by people searching through the moss at the edges of pools, and secondly the tadpoles are entirely reliant on the continued presence of water in the breeding pools for a period of at least six months.

The survival of the Northern Corroboree Frog metapopulation in the Ginini Flats area depends particularly on the maintenance of the network of breeding pools and protection from disturbance of breeding adults and eggs. This will require careful monitoring.

- Environment ACT (Wildlife Research and Monitoring, and the ACT Parks and Conservation Service) will continue to monitor the Ginini Flats population of the Northern Corroboree Frog, including the condition of the general breeding habitat and breeding pools.
- A strict policy of protection will continue to be enforced.
- A policy will be developed to cover the activities of land managers, the general public and individuals undertaking research.
- Guidelines and a code of conduct will be prepared by Environment ACT for park access and interpretation, covering both private tour operators and employees of the ACT Parks and Conservation Service.
- Guidelines will be prepared by Environment ACT for the development and maintenance of any walking trails or vehicle management tracks located, or proposed to be built within the Ramsar wetland area.
- Any proposal for new trails will be subject to environmental assessment.
- Control of feral animals, particularly pigs, will continue as a high priority for Namadgi National Park including areas around the Ginini Flats wetland, and other Corroboree Frog breeding sites in the ACT.
- Feral horses, eradicated from Namadgi National Park in 1987, will not be allowed to re-establish within the Park.

In any feral animal control work, especially in regard to pigs, consideration will be given to ensure achievement of desired outcomes whilst avoiding deleterious side effects.

The fire fuel management plan being developed by Environment ACT will meet the requirements of the Namadgi National Park Management Plan for fire management planning. It will provide fire management policy and prescriptions for areas that include all Corroboree Frog habitat in Namadgi National Park. No burning will be planned for areas within 500 m of breeding sites.

Whilst it is impossible for either this action plan or the fire fuel management plan to rule out the use of heavy equipment near Corroboree Frog habitat during a bushfire, the fuel plan will identify the sensitivity of the breeding sites to this form of disturbance and will identify the means for this information to be made available to the people responsible for fire suppression decisions.

- Active management of known breeding sites and surrounding non-breeding habitat will include removal of exotic tree wildings and prevention of spread of blackberries and other invasive shrubs. Weed removal programs will recognise the need to utilise techniques and chemicals which have the least potential impact on the frog population.

Protection

All but one of the known breeding sites for the Northern Corroboree Frog in the ACT occurs within Namadgi National Park (W. Osborne unpublished data). The single known site outside the park consists of only a few individuals, and occurs in an area surrounded by pine plantation (Blundell's Flat). The largest

populations occur in sub-catchments of the Cotter River above Bendora and Corin Dams. Public access and camping are restricted in these areas, which are managed primarily for conservation and water catchment protection.

- General guidelines for the conservation management of the Northern Corroboree Frog and its habitat in the ACT will be included in the Management Plan for Namadgi National Park (scheduled for revision commencing in 1997).

Legislative Provisions

The following ACT legislation applies to the conservation of flora and fauna in the ACT:

Nature Conservation Act 1980

The Nature Conservation Act protects native plants and animals. Activities affecting native plants and animals require a licence which may specify to apply to the activity.

- A person may not kill, take, keep, sell, import, export or interfere with the "nest" of a native animal without a licence.

Native plants and animals may be declared as *protected* or having *special protection status* in recognition of a particular conservation concern that warrants additional protection. Increased controls apply to declared species and licensing constraints are specified.

Licence Conditions (SPS)

Special Protection Status (SPS) is the highest level of statutory protection and is conferred on species which are either threatened with extinction or are a migratory animal subject to an international agreement for their protection. Conservation requirements are a paramount consideration and only activities related to conservation of the species or serving a special purpose are permissible.

The Conservator of Flora and Fauna may only grant a licence for activities affecting a species with SPS where satisfied that the act specified in the licence:

- is required to be done for scientific, educational, propagative or other similar purposes;
- is required to be done for the purpose of protecting persons or property and will be conducted in a way that will, so far as is practicable, keep to a minimum any impact on the species concerned;
- is merely incidental to other acts, and will not appreciably reduce the chances of survival or recovery in the wild of the species concerned; or
- is of particular significance to Aboriginal tradition and will not appreciably reduce the chances of survival or recovery in the wild of the species concerned.

Other Relevant Provisions

The Nature Conservation Act provides authority for the Conservator to manage Public Land reserved for conservation of the natural environment. Activities that are inconsistent with management objectives for nature conservation are controlled. Special measures for conservation of a species or community of concern can be introduced in a reserved area, including restriction of access to important habitat.

Section 47 of the Act allows the Conservator to give the occupier of land directions for protection or conservation of native plants and animals. This provision is relevant to the management of threats to the conservation requirements of a species or community of concern that occurs on leased land.

- The Ginini Flats *Sphagnum* bogs in Namadgi National Park, which provide an important habitat for the Northern Corroboree Frog, are listed as wetlands of international importance under the Ramsar Agreement. This Action Plan will, when read in association with the Management Plan for Namadgi National Park, provide the basis for ongoing management of Ginini Flats.

Land (Planning and Environment) Act 1991

The Land (Planning and Environment) Act is the primary authority for land planning and administration. It establishes the Territory Plan and several of its provisions are relevant to the protection of flora and fauna.

- **Public Land** is reserved via the Territory Plan. Land reserved as wilderness area, national park or nature reserve has conservation of the natural environment as a paramount management objective. The Conservator of Flora and Fauna must prepare a **plan of management** setting out how management objectives are to be implemented or promoted.
- **Places of natural heritage significance**, including important habitat for native species, may be entered in the Heritage Places Register, with conservation requirements specified.
- **Environmental Assessments and Inquiries** may be initiated as part of the approvals process for defined land use and development decisions or activities prescribed as controlled. Assessments are required to address potential environmental impact, including threats to a species of flora and fauna, an ecological community or an area.

Consultation and Community Participation

Environment ACT (Wildlife Research and Monitoring) is a member of the National Recovery Team that covers both species of Corroboree Frog (*P. corroboree* and *P. pengilleyi*). This Recovery Team was established in January 1996 to direct and facilitate surveys, monitoring, research, captive husbandry and regional conservation efforts. The membership also includes representatives from the NSW National Parks and Wildlife Service, State Forests of NSW, Victorian Department of Natural Resources and Environment, Snowy Mountains Hydro-Electricity Authority, University of Canberra, ACT Herpetological Association and the Amphibian Research Centre (Victoria).

Where appropriate, community participation with activities assisting the conservation of the Northern Corroboree Frog will be encouraged through groups such as the ACT Herpetological Association and the Frog and Tadpole Study Group (Sydney).

Implementation and Review

RESPONSIBILITY FOR IMPLEMENTATION

Environment ACT (Wildlife Research and Monitoring) will have responsibility for coordination of the implementation of this Action Plan subject to the availability of Government resources. Primary responsibility for conservation and management of the species within Namadji National Park and areas that are Territory Land will also rest with the ACT Parks and Conservation Service.

EVALUATION

Implementation of this Action Plan will be a collaborative exercise between government agencies, landholders and the community generally. NSW participation will be critical in some cases. The Action Plan will be reviewed after three years. The review will comprise an assessment of progress using the following performance indicators:

- completion of commitments that can reasonably be expected to be finalised within the review timeframe (e.g. introduction of a statutory protection measure for a species; development of a management plan);
- completion of a stage in a process with a time line that exceeds the review period (e.g. design or commencement of a research program);
- commencement of a particular commitment that is of a continuing nature (e.g. design or commencement of a monitoring program for population abundance); and
- expert assessment of achievement of conservation objectives of the Action Plan.

The review will be reported to the ACT Flora and Fauna Committee. This will provide Environment ACT and the Flora and Fauna Committee an opportunity to assess progress, take account of developments in nature conservation knowledge, policy and administration and review directions and priorities for future conservation action.

The following conservation actions will be given priority attention:

- establishment of monitoring of ACT populations and its coordination with NSW agencies;
- appropriate application in the ACT of research into breeding success and global climatic influences on the species; and
- protection of habitat, especially the Ginini Flats wetlands, with proper control of feral animals, and minimal impact generated by management and visitor activities.

Acknowledgements

Material for the draft Action Plan was prepared for Environment ACT by Dr W. Osborne, of the Applied Ecology Research Group, University of Canberra. Officers of Environment ACT provided additional information, advice and comments.

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List of Action Plans - December 1997

In accordance with Section 23 of the *Nature Conservation Act 1980*, the following Action Plans have been prepared by the Conservator of Flora and Fauna:

No. 1: Natural Temperate Grassland - an endangered ecological community.

No. 2: Striped Legless Lizard (*Delma impar*) - a vulnerable species.

No. 3: Eastern Lined Earless Dragon (*Tympanocryptis lineata pinguicolla*) - an endangered species.

No. 4: A leek orchid (*Prasophyllum petilum*) - an endangered species.

No. 5: A subalpine herb (*Gentiana baeuerlenii*) - an endangered species.

No. 6: Corroboree Frog (*Pseudophryne corroboree*) - a vulnerable species.

FURTHER INFORMATION

Further information on this Action Plan or other threatened species and ecological communities can be obtained from:

Environment ACT
(Wildlife Research and Monitoring)
Phone: (02) 6207 2126
Fax: (02) 6207 2122

This document should be cited as:

ACT Government, 1997. *Corroboree Frog* (*Pseudophryne corroboree*): *A vulnerable species*. Action Plan No. 6. Environment ACT, Canberra.

ACTION PLAN No. 22

In accordance with section 21 of the *Nature Conservation Act 1980*, the **Brush-tailed Rock-wallaby** (*Petrogale penicillata*) was declared an **endangered** species on 27 December 1996 (formerly Instrument No. 1 of 1997 and currently Instrument No. 192 of 1998). Section 23 of the Act requires the Conservator of Flora and Fauna to prepare an Action Plan in response to each declaration. This is the Action Plan for the:

Brush-tailed Rock-wallaby *Petrogale penicillata*

Preamble

The *Nature Conservation Act 1980* establishes the ACT Flora and Fauna Committee with responsibilities for assessing the conservation status of the ACT's flora and fauna and the ecological significance of potentially threatening processes. Where the Committee believes that a species or ecological community is threatened with extinction or a process is an ecological threat, it is required to advise the responsible Minister, and recommend that a declaration be made accordingly.

Flora and Fauna Committee assessments are made on nature conservation grounds only and are guided by specified criteria as set out in its publication "*Threatened Species and Communities in the ACT*, July 1995".

In making its assessment of the Brush-tailed Rock-wallaby, the Committee concluded that it satisfied the criteria indicated in the adjacent table.

An Action Plan is required in response to each declaration. It must include proposals for the identification, protection and survival of a threatened species or ecological community, or, in the case of a threatening process, proposals to minimise its effect.

This Action Plan was prepared by the Conservator of Flora and Fauna in accordance with the requirements of the *Nature Conservation Act*, in consultation with the Flora and Fauna Committee and after the statutory period for public comment.

While the legal authority of this Action Plan is confined to the Australian Capital Territory, management considerations are addressed in a regional context.

Criteria Satisfied

- 1.2 The species is observed, estimated, inferred or suspected to be at risk of premature extinction in the ACT region in the near future, as demonstrated by:
 - 1.2.1 Current severe decline in population or distribution from evidence based on:
 - 1.2.1.1 direct observation, including comparison of historical and current records.
 - 1.2.1.5 severe threats from herbivores, predators, parasites, pathogens or competitors.

Species Description and Ecology

DESCRIPTION

The Brush-tailed Rock-wallaby *Petrogale penicillata* (Figure 1) is a member of the family Macropodidae. The animal is small to medium sized with a distinctive long dark tail having a conspicuous brush at the tip (Sharman and Maynes 1983, cited by Connolly 1995). The tail is often longer (560-670 mm; average

610 mm) than the head and body length (520-580 mm; average 540 mm) (Sharman and Maynes 1983, cited by Connolly 1995).

Males weigh between 5.9-7.5 kg and females 5.0-6.5 kg (Lee and Ward 1989; Sharman and Maynes 1983, cited by Connolly 1995). Size, pelage colour and body markings vary between localities (Lim *et al.* 1981; Ride 1970) and also within a colony (Baynes pers. comm., in Connolly 1995).

The fur is generally dull brown (Sharman and Maynes 1983, cited by Connolly 1995), grey on the shoulders and rufous on the rump (Close 1993, cited by Connolly 1995). There is a light-coloured stripe on the cheek and a black dorsal stripe extending from about eye level to the back of the head. The inside of the ears appears yellowish and a pale grey side-stripe of fur with a black ventral stripe may be present (Sharman and Maynes 1983, cited by Connolly 1995). In New South Wales, the colour of the fur on the belly is red/orange and the forepaws and hindlimbs are black (Short 1980). The soles of its feet are extensively granulated to grip steep surfaces (Sharman and Maynes 1983).



Figure 1: *Petrogale penicillata*.

HABITAT

P. penicillata inhabits cliffs and other steep rocky areas that have a combination of specialised features which provide areas for shelter, basking and social activities (Short 1980, 1982). Short (1980, 1982) concluded from comparative studies of areas occupied by the species in the tablelands and coastal mountains of NSW that it frequented sites having abundant ledges, caves and passageways, shorter ledges and a higher proportion of covered areas. Favoured sites also had a northerly aspect (Short 1982), which allows the animals to sun themselves during the morning and evening periods. In the ACT, there is evidence that the species formerly

inhabited caves, crevices and sheltered ledges at certain boulder sites in the Tidbinbilla Nature Reserve and Namadgi National Park (Connolly 1995; Ormay 1996).

BEHAVIOUR AND BIOLOGY

The basic activity pattern observed from studies of the species inhabiting rocky outcrops in gorges near Armidale (Ralston 1983) was that at dusk, they usually left the outcrops to feed (Ralston 1983, cited by Connolly 1995). They returned to an outcrop before sunrise, then entered their refuges and emerged onto ledges exposed to the sun. Depending on the weather, they then spent the day either on the ledges or within their caves. While on the ledges, they rested, groomed themselves and engaged in social, alert or feeding activities. They also moved about the rock outcrops.

The species has a generalist diet with a preference for grasses and forbs. However, in times of shortage, it feeds on a wide variety of grasses and shrubs. This wide range of acceptable food items suggests an adaptation for survival, against both drought and competition from herbivores with more limited food preferences (Short 1989; Lim *et al.* 1987; Copley and Robinson 1983, cited by the Department of Conservation and Environment, Victoria (DC&E) 1991).

Females produce a single pouch young and breeding may be continuous. Once the pouch is permanently vacated, offspring are left in a rock shelter (DC&E 1991). The possession of a suitable shelter may be important for successful breeding (Joblin 1983, cited by DC&E 1991).

DISTRIBUTION

Former Distribution

P. penicillata was once common and ubiquitous throughout the mountainous country of south-eastern Australia (Short and Milkovits 1990, cited by Connolly 1995), being found in suitable rocky areas in a variety of habitats. It was formerly found along the Great Dividing Range from Nanango in south-east Queensland, through to East Gippsland in Victoria (Eldridge and Close 1992; Short and Milkovits 1990, cited by Connolly 1995). Scattered populations were also found in suitable habitat across the western slopes of NSW and the Grampian Ranges and nearby outcrops in western Victoria (Maxwell *et al.* 1996).

Present Distribution

There has been a dramatic decline in the distribution and abundance of the species, especially in Victoria, and in western and southern NSW, where its range has been severely reduced (Connolly 1995; Maxwell *et al.* 1996). Except for populations in the Warrumbungle Ranges, the species is now absent from the western slopes and plains of NSW. The geographic range since European settlement is estimated to have been reduced by 50-90% (Kennedy 1992, cited by Connolly 1995). The species is considered to be locally common only in the north-eastern part of its range (Hill 1991, cited by Connolly 1995). Introduced populations are present in Hawaii and New Zealand (Short 1980).

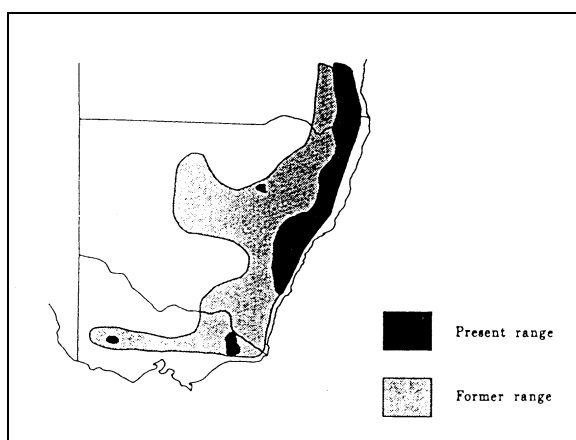


Figure 2: Map showing the present and former range of *P. penicillata* in south-eastern Australia (from Short and Milkovits 1994, cited by Connolly 1995).

In the ACT, the species is presumed to be extinct, with the last confirmed sighting occurring at Wallaby Rocks in the Tidbinbilla Nature Reserve in 1959 (Ormay 1996). However, findings of Rock-wallaby bones and evidence of the species in predator scats along the Orroral Ridge in Namadgi National Park suggest a more recent occurrence of the species (Reside and Martin 1996). The nearest known extant colonies to the ACT are at Taralga (near Goulburn) (136 km NNE of Canberra) and in Kangaroo Valley, NSW (187 km ENE of Canberra).

There are three known captive populations of the species in Australia (NSW NPWS 1998) which are the focus of behavioural, management and genetic research:

- Tidbinbilla Nature Reserve (TNR) ACT, where animals have been introduced from Kawau Island, New Zealand;

- Healesville Sanctuary, Victoria, that holds animals caught from Little Plains in Gippsland; and
- Adelaide Zoo, that holds animals from Healesville.

One means of artificially boosting wild populations which has been trialled is to accelerate the breeding rate by using Tamar Wallabies as surrogate mothers. The development of this technique is being advanced at TNR, Healesville and the Adelaide Zoo.

Conservation Status

P. penicillata is recognised as a threatened species in the following sources:

International

Vulnerable. - IUCN Red List of Threatened Animals 1994 (Groombridge 1993).

National

Vulnerable. - Part 2, Schedule 1 of the *Endangered Species Protection Act 1992* (Commonwealth).

Australian Capital Territory

Endangered. - Section 21 of the *Nature Conservation Act 1980*, Instrument No. 192 of 1998 (formerly Instrument No. 1 of 1997).

Special Protection Status Species. - Schedules 6 and 7 of the *Nature Conservation Act 1980*, Instrument No. 197 of 1998.

New South Wales

Vulnerable. - Schedule 2 of the *Threatened Species Conservation Act 1995*.

Endangered Population. - Warrumbungles population, Part 2, Schedule 1 of the *Threatened Species Conservation Act 1995*, December 1997.

Victoria

Endangered. - CNR (1995) Threatened Fauna in Victoria - 1995. Department of Conservation and Natural Resources, Victoria.

Threatened taxon. - Schedule 2 of the *Flora and Fauna Guarantee Act 1988*.

The species is also the subject of Action Statement No. 19, prepared by the Victorian Department of Conservation and Environment.

Threatening Processes

A number of factors have been cited as reasons for the dramatic decline in the distribution and abundance of the species. They include predation by the European Red Fox (*Vulpes vulpes*), Cat (*Felis catus*), Dingo (*Canis familiaris dingo*) and/or wild Dog (*Canis familiaris familiaris*); competition with Goats (*Capra hircus*), European Rabbits (*Oryctolagus cuniculus*) and Sheep (*Ovis aries*); management of land between populations incompatible with the species' survival; hunting; disease; climatic change; wildfire; and drought (Hill 1991, cited by Connolly 1995).

Weeds, disturbance, habitat modification and inbreeding are also cited as possible contributors to a continuing decline in the population at Kangaroo Valley (NSW NPWS 1998).

Predation by dingos and introduced carnivores, in particular, the Red Fox and possibly feral cats, has reduced the likelihood of successfully recolonising areas where populations have become extinct in Victoria. Young and juvenile rock-wallabies appear to be particularly vulnerable to Red Fox predation (Hill 1991; Kinnear *et al.* 1988, cited by Connolly 1995), especially when dispersing between rocky habitat (Sharman and Maynes 1983, cited by Connolly 1995). Hill (1991, cited by Connolly 1995) notes that the feral cat has been known to hunt mammals which weigh up to 3 kg, implying that the pouch-emerged young Brush-tailed Rock-wallabies may be vulnerable to cat predation. Cats are also known to carry a protozoan parasite, *Toxoplasmosis*, which can cause death in a range of marsupial species (DC&E 1991).

Competition with introduced herbivores, namely goats, rabbits and sheep may have reduced the carrying capacity for the species and, in turn, the size of each population (Hill 1991, cited by Connolly 1995). Goats may also compete with the species for shelter (Hill 1991) and have been observed physically evicting Yellow-footed Rock-wallabies (*P. xanthopus*) from caves (Lim *et al.* 1980 in Lobert 1988, cited by Connolly 1995).

Hunting is cited as a cause of decline, since hundreds of thousands were shot as agricultural pests and hunted for fur during a sustained commercially-driven period late last century and early this century. Bounties were paid on over 500,000 Rock-wallabies between

1894 and 1914 (Short and Milkovits 1990, cited by Maxwell *et al.* 1996), and an extensive fur trade existed from before 1890 through to 1927 (Lunney, Law and Rummery pers. comm., in Maxwell *et al.* 1996). This led to the decline of many populations and local extinctions, and may have been the primary cause of the initial decline of the species, at least in central and southern NSW. The species was also hunted extensively in the Grampians area of Victoria (Maxwell *et al.* 1996).

Wildfire and drought are considered potentially serious threats to the survival of small isolated populations. Either could be the ultimate cause of extinction (Hill 1991, cited by Connolly 1995). They have been cited as causes of successive extinction of the remaining small isolated populations in Victoria (DC&E 1991).

Inbreeding and loss of genetic diversity may also be a threat where animals are unable to disperse from their natal colony (Buchan 1996). Barriers to movement between colonies have arisen through changes in land use, habitat destruction and loss of some colonies.

Management of land between populations is likely to affect the survival of dispersing individuals, especially through exposure to predation (Hill 1991, cited by Connolly 1995). The density of predators in the intervening habitat and hence the risk of mortality will be affected by the policies for Red Fox and Dingo/dog control in that area (Connolly 1995). Cleared land, roads and fences may also be obstacles to movement (Opdam 1990, in Hill 1991, cited by Connolly 1995).

Uncontrolled human disturbance effects to colonies are undefined, although a cautious approach should be adopted (Lobert and Waters 1988; Wakefield 1971, cited by Reside and Martin 1996). Reside and Martin (1996) consider that uncontrolled human usage of historic Rock-wallaby sites in the ACT severely jeopardises any attempts at re-introduction. The granite boulder piles afford little protection from climbers or adventurers scrambling over them.

Altered fire regimes (that is, less frequent fires) have been cited by Norris and Belcher (1986, cited by Reside and Martin 1996) as making a possible contribution to the decline of the species, as fire is likely to have a role in providing foraging habitat.

Major Conservation Objectives

The major long term conservation objectives are to re-establish viable, wild populations of *P. penicillata* as a component of the indigenous biological resources of the ACT region and to contribute to the national conservation of the species. This is interpreted to include the species' potential for evolutionary development in the wild.

Animals can only be reintroduced to a site when the processes which caused the local extinction of the species in the first place have been dealt with. Effective control measures directed at predators and feral goats need to be developed and established in the field.

These objectives are to be achieved by:

- continuing to manage suitable captive stock based on a sound knowledge of genetic differences between populations;
- continuing to support establishment of a captive colony in Victoria through enhanced reproductive techniques, which are undertaken at the Tidbinbilla Nature Reserve;
- developing a re-introduction strategy which will include reviewing potential areas suitable for the eventual release of the species into the wild. This will also require sustained effective fox control and an understanding of other threats to enable appropriate management measures to be put in place; and
- establishing a managed wild population within the ACT, consistent with the above re-introduction strategy.

Recovery teams for the species have been established in both NSW and Victoria and another for southern NSW, although there is as yet no national recovery strategy in place.

⇒ Environment ACT will support regional and national efforts for the recovery and conservation of the species.

Conservation Issues and Intended Management Actions

CAPTIVE POPULATION AT TIDBINBILLA NATURE RESERVE (TNR)

A captive population of *P. penicillata* is housed at TNR as part of a public display of wildlife. Besides playing a role in public education,

other objectives of the captive management program for the species are to:

- maintain a manageable captive population and to ensure long-term genetic integrity of the population; and
- contribute to the conservation and re-establishment of the species within its former and present range (Underwood 1997).

The captive population housed at TNR originates from unprovenanced animals which were introduced to Kawau Island in New Zealand late last century. TNR currently maintains the largest captive group of the species. These animals are critical to the success of a number of *P. penicillata* conservation programs and are being used by researchers into cross-fostering which offers the potential for rapid increases in the size of colonies.

Recent and ongoing work in conjunction with Victoria and NSW has indicated that the TNR animals are genetically suitable for release in the ACT region.

⇒ Environment ACT, in conjunction with recovery teams, will continue the captive breeding program to increase captive populations for possible recolonisation in suitable habitat areas throughout the species' former range.

SURVEY

Following from the last confirmed sighting in the ACT in 1959, the first comprehensive survey work was undertaken by Ormay in 1982 and 1985, with 38 sites checked and five of these showing traces of former occupation (Ormay 1996).

In 1994, Connolly (1995) assessed sites for suitability for re-introduction and surveyed additional sites using colour and aerial photographs. She located a further 13 sites and selected six study areas for assessing their suitability, by applying a quantitative approach.

Both Ormay (1996) and Connolly (1995) concluded that there were no sites, at that stage, suitable in the ACT for re-introduction of the species, the main reasons being the accessibility of sites, presence of predators and proximity of sites to cleared land (Connolly 1995).

Reside and Martin (1996) searched 13 sites in the ACT and obtained additional evidence of previously unknown prior occupation at seven of these. The results provided further indications that the species is extinct in the ACT. In this study, the ACT sites were classified on the basis of habitat qualities and predator susceptibility (high, medium or low), which serves as a useful basis for assessment of suitability for re-introduction of the species.

⇒ As part of developing a re-introduction strategy, Environment ACT will assess the suitability of those sites identified as being potentially favourable for re-introduction, and will follow up any new useful information on sites within Tidbinbilla Nature Reserve and Namadgi National Park.

RESEARCH

As part of the program established to assist the recovery of Victorian populations of Brush-tailed Rock-wallabies, TNR has been involved in a range of research programs designed to enhance the recovery of this species. These include:

- cross fostering of Brush-tailed Rock-wallaby pouch young to a surrogate species;
- the development of Brush-tailed Rock-wallaby pouch young transport and transfer management techniques;
- collection of biological data and other information relating to reproduction in the species; and
- DNA studies relating to the genetic diversity of captive and wild populations of the Brush-tailed Rock-wallaby.

⇒ Environment ACT will, through its partnership with the Cooperative Research Centre for the Conservation and Management of Marsupials, seek collaboration with scientists working on conservation genetics and breeding programs which may have application to a recovery strategy for the species.

PREDATOR CONTROL

Effective, long term predator control is fundamental to any re-introduction program for the Brush-tailed Rock-wallaby in the ACT. There are no current plans for sustained predator control at any of the potential release sites - this is likely to be a major undertaking and could not be carried out unless there is clear Government commitment and public support. The effectiveness of predator control measures will need to be considered as an integral part of any management program.

Once initiated, predator control will need to be sustained indefinitely and this may be a costly exercise.

The Commonwealth Government is preparing the Threat Abatement Plan for predation by the European Fox, which will outline a national approach for controlling the impact of foxes on threatened species. This will be an important framework and reference for any predator control program initiated in the ACT as part of a Rock-wallaby introduction program.

⇒ Environment ACT will monitor development of fox control techniques and national fox threat abatement proposals as a component of any re-introduction strategy.

PROPOSED MANAGEMENT STRATEGY

In order to progress towards the objectives of this Action Plan, a re-introduction strategy will be developed, the main elements of which will be:

- ⇒ determining the most appropriate source and genetic attributes of animals;
- ⇒ identifying potentially favourable sites for re-introduction and assessing their suitability;
- ⇒ ensuring that effective control programs for predators and feral goats are capable of being put in place, sustained in the long term and closely monitored;
- ⇒ developing management strategies to conserve and enhance the sites where re-introductions have occurred;
- ⇒ developing community education and participation programs in support of Brush-tailed Rock-wallaby conservation, especially in regard to any re-introduction sites where there may be conflicting uses;
- ⇒ developing funding and support mechanisms for the program; and
- ⇒ determining and fostering public and Government support for re-introducing the species into the wild in the ACT.

Any decision to implement the strategy will be dependent on:

- general acceptance of the feasibility of implementing the proposed re-introduction strategy;
- establishing a recovery management team with relevant expertise to oversee the implementation of actions;
- long term commitment of funds to support predator control and other management activities; and

- Government commitment to a revised Action Plan setting out an implementation program for the re-introduction of the species.

EDUCATION AND LIAISON

The captive population of *P. penicillata* held at the Tidbinbilla Nature Reserve is part of the public display of many wildlife species. The Brush-tailed Rock-wallaby colony is maintained for scientific research, provides recreational opportunities and is a component of education, conservation, and species recovery programs (Underwood 1997).

Protection

All potential areas for re-introduction of *P. penicillata* are currently within TNR and Namadgi National Park, hence there will not be a need to establish further reserves.

Environment ACT (ACT Parks and Conservation Service) is undertaking management programs for predator control in reserved areas as part of other conservation objectives. The knowledge and experience developed in these programs will be valuable in any predator control program included in a proposed reintroduction strategy.

Socio- economic Issues

There are no current activities or land uses which are likely to conflict with achievement of the conservation objective during the term of this Action Plan.

Once sites for re-introduction have been identified and long term predator control measures put in place, implications for existing and proposed land use activities will require detailed consideration.

Current unrestricted use of sites for abseiling and rock climbing is likely to severely jeopardise any attempts at re-introduction (Reside and Martin 1996). These activities may therefore need to be reviewed at any sites where re-introductions are likely, and a public awareness program will need to be undertaken, with sufficient lead time prior to implementation.

Any additional predator and other feral animal control programs implemented for the conservation of this species will be beneficial for other species and for neighbouring landholders.

⇒ Environment ACT will include community consultation and public education about land-use issues, in any strategy for re-introduction of the species into the wild in the ACT.

Legislative Provisions

The following legislation is relevant to conservation of flora and fauna in the ACT region:

AUSTRALIAN CAPITAL TERRITORY

Nature Conservation Act 1980

The Nature Conservation Act provides a mechanism to encourage the protection of native plants and animals, the identification of threatened species and ecological communities, and the management of Public Land reserved for nature conservation purposes. Specified activities are managed via a licensing system.

Native plants and animals may be declared in recognition of a particular conservation concern and increased controls and penalties apply. Species declared as endangered must also be declared as having special protection status (SPS), the highest level of statutory protection that can be conferred.

Petrogale penicillata is listed as a SPS species and any activity affecting such a species is subject to special scrutiny. Conservation requirements are a paramount consideration and only activities related to conservation of the species or serving a special purpose are permissible.

The Conservator of Flora and Fauna may only grant a licence for activities affecting a species with SPS where satisfied that the act specified in the licence meets a range of stringent conditions. The public display at TNR complies with specified licence conditions for SPS species.

The Conservator must also approve a management plan for the keeping of animals for public display. A species management plan has been approved for keeping the captive population of the species at TNR.

Further information on licensing can be obtained from the Licensing Officer, Nature Conservation Regulation, Environment ACT, telephone (02) 6207 6376.

Land (Planning and Environment) Act 1991

The Land (Planning and Environment) Act is the primary authority for land planning and administration. It establishes the Territory Plan, which identifies nature reserves, national parks and wilderness areas within the Public Land estate.

The Land (Planning and Environment) Act establishes the Heritage Places Register. Places of natural heritage significance are to be identified and conservation requirements specified.

Environmental Assessments and Inquiries may be initiated in relation to land use and development proposals.

NEW SOUTH WALES

Threatened Species Conservation Act 1995

The Act came into effect on 1 January 1996 and requires the preparation of recovery plans for endangered species (other than those presumed extinct), endangered populations, endangered ecological communities and vulnerable species. Threat abatement plans are required to manage key threatening processes with a view to their abatement, amelioration or elimination. A Species Impact Statement is required when a development application is made on land which contains areas declared to be critical habitat under Part 3 of the Act or which is likely to significantly effect threatened species, populations or ecological communities or their habitats.

The preparation of a Recovery Plan for *P. penicillata* is mandatory as the species has been listed as vulnerable.

The NSW Scientific Committee has made Final Determinations to list the Warrumbungles population of the species as an Endangered Population (December 1997) and the European Red Fox (*Vulpes vulpes*) as a Key Threatening Process (March 1998).

Consultation and Community Participation

Environment ACT (TNR) is a member of the Southern NSW Recovery Team comprising representatives from the NSW NPWS (Southern Zone) and the Kangaroo Valley Friends of the Brush-tailed Rock-wallaby. This group is currently focussing on conservation actions for the Kangaroo Valley population, although its scope of activity is likely to be broadened to cover management issues in the ACT region if a re-introduction program is established.

Environment ACT (TNR) also has membership on the Victorian Brush-tailed Rock-wallaby Team, which includes representatives from the Department of Natural Resources, Parks Victoria, Healesville Sanctuary, Adelaide Zoo, Monash and Melbourne Universities, and private ecological consultants (Biosis Research and Wildlife Unlimited). This group meets regularly to review the status of colonies, predator control programs and cross-fostering trials. TNR is participating in the cross-fostering trials where rock-wallaby embryos are transferred to the pouches of Tammar Wallabies.

⇒ Environment ACT (ACT Parks and Conservation Service) will continue to support the Southern NSW and Victorian Recovery Teams.

⇒ Environment ACT (ACT Parks and Conservation Service) will encourage appropriate community participation in activities associated with the conservation of the species in the ACT. This will be arranged through groups such as the Friends of Tidbinbilla, the Canberra Bushwalkers Club, the ANU Rock-climbing Club and Outward Bound.

Implementation, Evaluation and Review

RESPONSIBILITY FOR IMPLEMENTATION

Environment ACT (Wildlife Research and Monitoring) will have responsibility for coordinating implementation of this Action Plan subject to government priorities and resources.

Actions will be implemented in consultation with the Southern NSW and Victorian recovery teams, and will be consistent with regional programs. The ACT Parks and Conservation Service will be responsible for the on-ground implementation in areas under its control.

EVALUATION

Implementation of this Action Plan will be a collaborative exercise between government agencies and the community generally. The Action Plan will be reviewed after three years. The review will comprise an assessment of progress in developing the proposed re-introduction strategy and, if appropriate, achieving the targets set within this strategy, including:

- ⇒ identification of suitable re-introduction sites;
- ⇒ setting a time frame for breeding of sufficient animals; and
- ⇒ implementing and setting a time frame for an effective long term predator control program.

The review will be reported to the ACT Flora and Fauna Committee. This will provide an opportunity for Environment ACT and the Flora and Fauna Committee to assess progress, particularly in regard to the likely effectiveness of any long term predator control program, take account of developments in nature conservation knowledge, policy and administration and review directions and priorities for future conservation action.

Acknowledgments

The illustration of the species (Figure 1) was prepared for Environment ACT by Mr Wayne Byatt.

Valuable comments on successive stages of drafting were provided by Dr John McIlroy, a former member of the ACT Flora and Fauna Committee, now residing in Akaroa, New Zealand.

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List of Action Plans - October 1999

In accordance with Section 23 of the *Nature Conservation Act 1980*, the following Action Plans have been prepared by the Conservator of Flora and Fauna:

- No. 1: Natural Temperate Grassland - an endangered ecological community.
- No. 2: Striped Legless Lizard (*Delma impar*) - a vulnerable species.
- No. 3: Eastern Lined Earless Dragon (*Tympanocryptis lineata pinguicolla*) - an endangered species.
- No. 4: A leek orchid (*Prasophyllum petilum*) - an endangered species.
- No. 5: A subalpine herb (*Gentiana baeuerlenii*) - an endangered species.
- No. 6: Corroboree Frog (*Pseudophryne corroboree*) - a vulnerable species.
- No. 7: Golden Sun Moth (*Synemon plana*) - an endangered species.
- No. 8: Button Wrinklewort (*Rutidosis leptorrhynchoides*) - an endangered species.
- No. 9: Small Purple Pea (*Swainsona recta*) - an endangered species.
- No. 10: Yellow Box - Red Gum Grassy Woodland - an endangered ecological community.
- No. 11: Two-spined Blackfish (*Gadopsis bispinosus*) - a vulnerable species.
- No. 12: Trout Cod (*Maccullochella macquariensis*) - an endangered species.
- No. 13: Macquarie Perch (*Macquaria australasica*) - an endangered species.
- No. 14: Murray River Crayfish (*Euastacus armatus*) - a vulnerable species.
- No. 15: Hooded Robin (*Melanodryas cucullata*) - a vulnerable species.
- No. 16: Swift Parrot (*Lathamus discolor*) - a vulnerable species.
- No. 17: Superb Parrot (*Polytelis swainsonii*) - a vulnerable species.
- No. 18: Brown Treecreeper (*Climacteris picumnus*) - a vulnerable species.
- No. 19: Painted Honeyeater (*Grantiella picta*) - a vulnerable species.
- No. 20: Regent Honeyeater (*Xanthomyza phrygia*) - an endangered species.
- No. 21: Perunga Grasshopper (*Perunga ochracea*) - a vulnerable species.
- No. 22: Brush-tailed Rock-wallaby (*Petrogale penicillata*) - an endangered species.

No. 23: Smoky Mouse (*Pseudomys fumeus*) - an endangered species.

No. 24: Tuggeranong Lignum (*Muehlenbeckia tuggeranong*) - an endangered species.

FURTHER INFORMATION

Further information on this Action Plan or other threatened species and ecological communities can be obtained from:

Environment ACT
(Wildlife Research and Monitoring)
Phone: (02) 6207 2126
Fax: (02) 6207 2122

Environment ACT Homepage:
<http://www.act.gov.au/environ>

This document should be cited as:

ACT Government, 1999. *Brush-tailed Rock-wallaby* (*Petrogale penicillata*): *An endangered species*. Action Plan No. 22. Environment ACT, Canberra.

ACTION PLAN No. 23

In accordance with section 21 of the *Nature Conservation Act 1980*, the **Smoky Mouse (*Pseudomys fumeus*)** was declared an **endangered** species on 6 January 1998 (formerly Instrument No. 7 of 1998 of currently Instrument No. 192 of 1998). Section 23 of the Act requires the Conservator of Flora and Fauna to prepare an Action Plan in response to each declaration. This is the Action Plan for the:

Smoky Mouse *Pseudomys fumeus*

Preamble

The *Nature Conservation Act 1980* establishes the ACT Flora and Fauna Committee with responsibilities for assessing the conservation status of the ACT's flora and fauna and the ecological significance of potentially threatening processes. Where the Committee believes that a species or ecological community is threatened with extinction or a process is an ecological threat, it is required to advise the responsible Minister, and recommend that a declaration be made accordingly.

Flora and Fauna Committee assessments are made on nature conservation grounds only and are guided by specified criteria as set out in its publication "*Threatened Species and Communities in the ACT*, July 1995".

In making its assessment of the Smoky Mouse, the Committee concluded that it satisfied the criteria indicated in the adjacent table.

An Action Plan is required in response to each declaration. It must include proposals for the identification, protection and survival of a threatened species or ecological community, or, in the case of a threatening process, proposals to minimise its effect.

This Action Plan was prepared by the Conservator of Flora and Fauna in accordance with the requirements of the *Nature Conservation Act*, in consultation with the Flora and Fauna Committee and after the statutory period for public comment.

While the legal authority of this Action Plan is confined to the Australian Capital Territory, management considerations are addressed in a regional context.

Criteria Satisfied

- 1.2 The species is observed, estimated, inferred or suspected to be at risk of premature extinction in the ACT region in the near future, as demonstrated by:
- 1.2.6 Extremely small population.

Species Description and Ecology

DESCRIPTION

The Smoky Mouse *Pseudomys fumeus* (Figure 1), is a native mouse, similar in size to a small rat (Watts and Aslin 1981). It is pale grey to blue-grey to black above, with a grey to white belly (Cockburn 1995) and a ring of dark hairs around each of its large, bulging eyes (Mayo pers. comm.). The feet are pink with white fur (Cockburn 1995). The species is distinguished by its bicoloured tail, which is blue-grey dorsally, white ventrally and lightly furred (Mayo pers. comm.). The species has a head and body length of 85-100 mm (average 90 mm), a tail length of 110-145 mm (average 140 mm) and weighs between 45-90 g (average 70 g) (Cockburn 1995).

Variability in size and colour has been noted between two forms found in Victoria. The western form, known only from the Grampians is larger and darker than the eastern form (east of Melbourne) (Cockburn 1995). It appears that the specimens found in NSW are similar to the eastern form and a male trapped in the Brindabella Ranges had a pink scrotum (Osborne and Preece 1986), whereas those from the Grampians were darkly pigmented (Cockburn pers. comm.).



Figure 1: Smoky Mouse *Pseudomys fumeus*. Scale: approximately half natural size.

HABITAT

P. fumeus has been found in a range of vegetation types from coastal heath to heathy woodland. These range from the coast to subalpine heath and dry forest of Broad-leaved Peppermint *Eucalyptus dives* and Brittle Gum *E. mannifera*, or Mountain Gum *E. dalrympleana* and Silvertop Ash *E. delegatensis* forests, and Snow Gum (*E. pauciflora*) woodland in the subalpine regions. They also occur in fern gullies in wet forest in the Grampians (Menkhorst 1995). Surveys undertaken in eastern Victoria and south-eastern NSW (e.g. Jurskis *et al.* 1997; Ford 1998a,b; Broome *et al.* in prep.) indicate that the species' preferred habitat is ridge-top sclerophyll forest (Cockburn 1995) with a diverse understorey of heathy shrubs, especially from the families Fabaceae and Epacridaceae (Menkhorst and Seebeck 1981).

DISTRIBUTION

Former Distribution

Subfossil deposits indicate that *P. fumeus* was once widespread in south-eastern NSW, at Yarrangobilly, Marble Arch and London Bridge near Googong (Mayo pers. comm.) and in parts of eastern and western Victoria, including the Buchan district, the Grampians and near Nelson (Lee 1995).

Present Distribution

P. fumeus occurs mainly in Victoria as disjunct populations in the Grampians, coastal slopes of the Otway Ranges, Central Highlands, Barry Mountains, near Mt Cobberas and coastal east Gippsland between Marlo and Tamboon Inlet (Lee 1995). There are relatively few recent (post 1979) records from known sites in the Victorian highland areas, Mt William and coastal East Gippsland, despite extensive hair-tube surveys and carnivore scat analyses (J. Seebeck cited in Department of Conservation and Natural Resources 1996) and trapping at Mt William (A. Cockburn pers. comm.). However, a few recent (post 1995) records have been obtained from predator scats in the highland areas near West Buffalo and Mt Cobbler (N. Jones, pers. comm.) and Mt Stradbroke (Belcher 1995). One individual was found near Toombullup (January 1998), and possible hair records were obtained from Mt Beauty (April 1998) during surveys in NE Victoria (G. Newell pers. comm.).

Evidence for the species was found from hair sampling tubes in 1993 at Mt Poole in Nungatta State Forest in the Eden district of south-eastern NSW, (Broome *et al.* in prep.). In 1994, a NSW State Forests research team, trapping for potoroos in Nullica State Forest, caught the first *P. fumeus* to be trapped in NSW (Jurskis *et al.* 1997). The site is now included in South East Forests National Park (Nullica Section). More animals were trapped nearby in Nullica State Forest (C. Slade SFNSW, pers. comm.; Ford 1998a,b).

In Kosciuszko National Park hair records were obtained from the Pilot and Ravine areas, and three individuals were found dead near the Yarrangobilly Caves in October 1998 (Broome *et al.* in prep.; Ford 1998b).

In the ACT, two males have been trapped in the Brindabella Ranges in Namadgi National Park, one from Bulls Head (Osborne and Preece 1986) and one from Mt Kelly (Mayo 1987) (Figure 2). Repeated trapping surveys since this time have not resulted in any additional captures. However, further evidence has been obtained from one probable and one possible hair record from Mt Namadgi in 1994 (Broome *et al.* in prep.), and from an unconfirmed report of a trapping near Mt Coree in the 1970s (T. Macdonald pers. comm.). These findings suggest that it is highly likely that the species still occurs within and adjacent to the ACT, although probably in low densities (Broome *et al.* in prep.).

The broader distribution of records in subfossil remains indicates that the species' range has contracted significantly (DCNR 1996). Lee (1995) notes that the species probably declined prior to European settlement, and has declined further more recently due to habitat loss. The current distribution of *P. fumeus* is relictual and extremely difficult to interpret, thus it is not possible to identify any particular cause precipitating the declines (Cockburn pers. comm.).

BEHAVIOUR AND BIOLOGY

Studies undertaken on the summit of Mt William in the Grampians indicate that *P. fumeus* relies on three very distinct food sources, all of which are rich in nitrogen (Cockburn 1981a). *P. fumeus* forages for legume seeds and epacrid berries, as well as bogong moths, during summer. This was confirmed in the study of the population in the Nullica State Forest near Eden, which showed that habitat preference is directly related to a dietary preference for legume seed and epacrid fruits, also during summer months (Ford

1998a). In winter, the species switches to hypogeous (underground) truffle-like fungi that are common round the roots of certain shrubs and grasses, when few seeds are produced from the shrubs (Cockburn 1995). The spring diet of the Nullica population was shown to be dominated by fungi (Ford 1998a).

This reliance on seasonal food sources creates a nutritional crisis for *P. fumeus* during late spring. The fruiting bodies of the hypogeous fungi disappear through loss of soil moisture at a time when there are few alternative sources available until the mid-summer plant productivity flush (Cockburn 1995). Thus, the species can survive during this period only in restricted habitats where Bogong Moths are attracted to spring blossoms and new seeds are set (Cockburn 1995). However, studies on the Nullica population (Ford 1998a) indicate that decline does not appear to be linked with fungal decline, which suggests that decreased social factors or predation could well be a causal factor.

Smoky Mouse; Locality Records

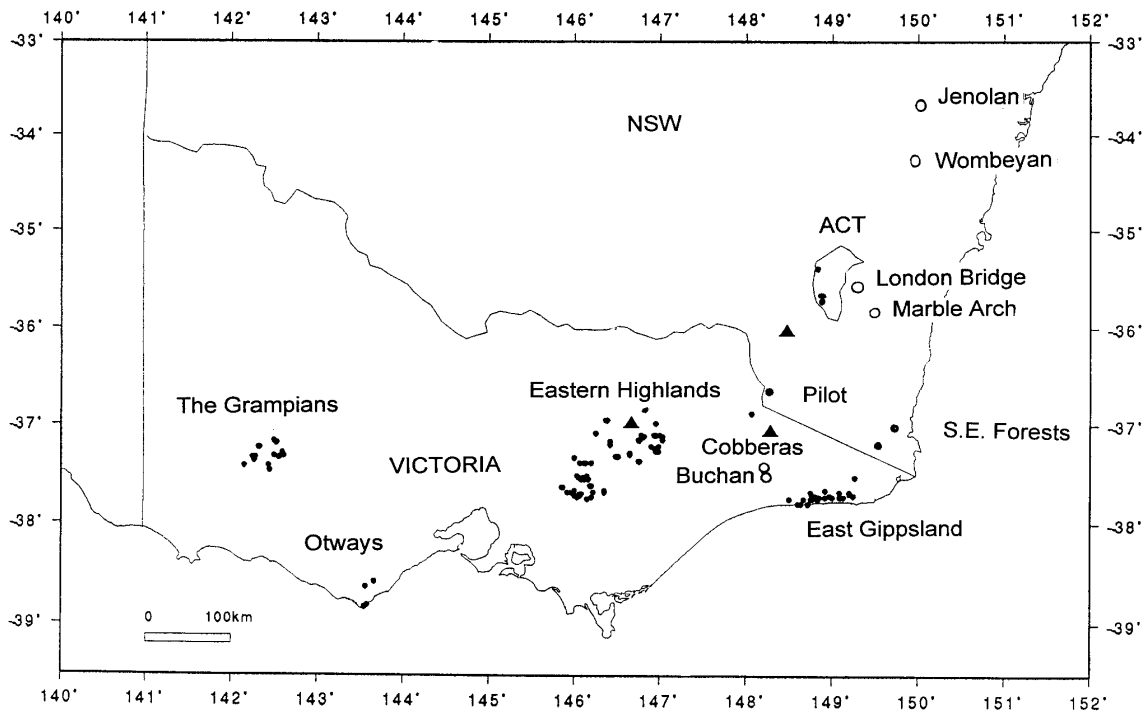


Figure 2: The distribution of *P. fumeus* in south-eastern Australia (Broome *et al.* in prep.).

- Trapping and hair-sampling tube records.
- ▲ Predator scat records.
- Subfossil remains.

Population Fluctuations

P. fumeus populations are subject to large annual fluctuations in abundance (Cockburn 1981b; Ford 1998a). Cockburn (1981b) attributes this to the decline in available food sources during late spring whereas Ford (1998a) indicates that the causes are unclear, but suggests that males may decline due to social conflict. Fluctuations for females are not so large because they tend to be more selective in their habitat choice and occur in higher densities in the preferred habitat which offers protection during the late spring nutritional crisis. Individuals with home ranges outside these favoured sites (more males than females) generally do not survive, although it has been suggested that they may perform an important exploratory role in colonising new areas (Cockburn 1981b).

Once breeding territories are established, breeding commences and females produce one to two litters, each of three to four young. The species has been recently discovered as being a communal plural breeder - up to five reproductive females were found co-habiting in burrows during the breeding season and a high degree of breeding synchrony was observed within nests (Ford 1998a). The females often live to breed in the second year with older ones breeding slightly earlier than the younger animals (Cockburn 1995).

This pattern of life of *P. fumeus* on Mt William in the Grampians is probably representative of the species throughout its range, given the overall similarity in habitat, which has a diverse understorey of heathy shrubs, especially legumes (Cockburn 1995). Cockburn (1995) notes that this vegetation complex is fire-generated, and suggests that the species is dependent upon post-fire succession for survival. However, the species' possible disappearance from its former stronghold in the Grampians is not, at first glance, associated with visible vegetation change, or with the disappearance or decline of any vascular plant species (Cockburn pers. comm.). This may suggest some effects on the ecology of the hypogeous fungi, which form such an important part of the species' diet (Cockburn pers. comm.).

Conservation Status

P. fumeus is recognised as a threatened species in the following sources:

International

Rare. - IUCN Red List of Threatened Animals 1994 (Groombridge 1993).

Australian Capital Territory

Endangered. - Section 21 of the *Nature Conservation Act 1980*, Instrument No. 192 of 1998 (formerly Instrument No. 7 of 1998).

Special Protection Status Species. - Schedule 7 of the *Nature Conservation Act 1980*, Instrument No. 197 of 1998.

New South Wales

Endangered. - Schedule 1 of the *Threatened Species Conservation Act 1995*.

Victoria

Vulnerable. - *Flora and Fauna Guarantee Act 1988*.

Threatening Processes

Since European settlement throughout the species' range, several major environmental changes have occurred that are likely to have seriously disadvantaged the species. These are (Lee 1995):

- **vegetation clearance**, resulting in loss of habitat and likely contraction of range;
- **inappropriate fire regimes**, resulting in changes to the floristic composition of ground and shrub vegetation - may have deleterious effects on food sources; and
- **predation** by the introduced European Red Fox (*Vulpes vulpes*) and Cat (*Felis catus*) - may be significant for small isolated populations, particularly in relation to the recent discovery of communal nesting (Ford 1998a).

When combined with the existing fragmentation of many of the remaining forest habitats, the effects of wildfires, inappropriate fire regimes and predation are all likely to exacerbate serious problems resulting from reduced dispersal, recolonisation ability and gene flow (Saunders *et al.* 1991; Fahrig and Merriam 1994). These combined effects are limiting populations to small, isolated, fire and predator refuges within the species' preferred heathy habitat (Broome *et al.* in prep.).

Major Conservation Objectives

The major conservation objective is to secure in the long term, viable, wild populations of *P. fumeus* as a component of the indigenous biological resources of the ACT region and contribute to the national conservation of the species.

This objective is to be achieved by:

- encouraging research aimed at identifying and managing the causes of population decline;
- co-operating with regional and national bodies to ensure coordination of research and monitoring programs;
- increasing awareness with land managers and the community of the need to protect the species and its habitat; and
- where appropriate, implementing any identified management action.

Conservation Issues and Intended Management Actions

Lack of knowledge on ecological requirements, particularly in relation to fire, prohibits specification of detailed management prescriptions. In the case of the Mt William population in the Grampians (which is relatively well studied), no management actions specifically aimed at the species have been undertaken (Lee 1995), although a fire management plan has been drawn up for the Otway Ranges (Lane 1997). Survey and research priorities can therefore be set (Lee 1995).

SURVEY

Following the two sightings in Namadgi National Park (NNP) in 1986 and 1987, intensive small mammal trapping efforts were directed at the two localities (Lawrence 1986; Lintermans 1988). However, no additional captures of *P. fumeus* were made. In the 1993-94 summer, an intensive hair-sampling tube survey was undertaken within predicted habitat areas in both Namadgi and Kosciuszko National Parks. From 1,354 tubes placed by the ACT Parks and Conservation Service in NNP, only one probable (from hair in a bird's nest) hair sample of *P. fumeus* was obtained at Mt Namadgi (Broome *et al.* in prep.). There were no positive identifications from hair analyses from numerous scats collected in various places throughout NNP (Mayo pers. comm.). From 1,490 tubes in Kosciuszko National Park (1994-95), one hair sample was

obtained from a hair tube at The Pilot. Another was found in October 1996 from a Quoll scat at Ravine, at the northern end of the Park. Subsequent trapping surveys in the Ravine area were unsuccessful but three individuals were found dead at Yarrangobilly, most likely resulting from cat predation (Ford 1998b). Other potential sites will be surveyed as resources become available.

Research at the Nullica site in 1997-98 revealed 15 females and 13 males at the site, but numbers declined during the summer (Ford 1998a). Low numbers of individuals have been trapped at four other sites nearby in South East Forest National Park and three sites to the north in Nullica State Forest (Ford 1998b; C. Slade SFNSW, pers. comm.). These findings suggest that a metapopulation exists in the area.

Broome *et al.* (in prep.) describe the results of surveys conducted in south-eastern NSW between March 1993 and October 1998 and present predictive models of the potential distribution of the species, using all extant records from the species' entire known range until October 1998.

Due to apparent late spring die-offs (Cockburn 1981b; Ford 1998a), the optimal times for surveying populations is from late August to late September in the coastal forests and from September to November in the sub-alpine areas.

⇒ Environment ACT will follow up any new useful evidence of the species' presence within Namadgi National Park or neighbouring areas in the ACT.

⇒ Environment ACT will liaise with the NSW National Parks and Wildlife Service (NSW NPWS) to ensure coordination of efforts on a regional basis.

RESEARCH

Broome *et al.* (in prep.) have identified the urgent need for further ecological and genetic studies, and research on appropriate fire regimes. Ford (1998a) undertook a detailed study on the ecology and social organisation of the recently discovered population in south-eastern NSW to determine whether Cockburn's findings can be generalised across the range of the species. This highlighted the role of predation as a threat to the population, as does the recent find at Yarrangobilly.

⇒ Environment ACT will, through co-operation with regional efforts, support research programs which may have application for a recovery strategy for the species. Priority research projects are:

- survey of areas of known potential habitat;
- determination of appropriate fire regimes for the species' habitat; and
- effects of predation.

It is typical of the species that trap success has been very sporadic. However, ongoing monitoring through trapping, and in addition pitfall trapping at the Nullica site, will continue with an intensive predator control program by NSW agencies to see if populations do re-establish.

REQUIRED MANAGEMENT ACTIONS

- The inadequate knowledge of the habitat of this species in the ACT, and its apparent rarity, makes it difficult to specify actions other than ones already encompassed within the management of Namadgi National Park, including the Bimberi Wilderness Area. The following actions are based on the information available up to 1990 and should be reviewed as new information becomes available:
- to minimise the risk of increasing the predation pressure on the species, no fire trails or walking tracks to be constructed near areas most likely to comprise Smoky Mouse habitat, including none in the Bimberi Wilderness Area;
- continue to manage pig control programs involving poisoned wheat baits so as to avoid areas of likely Smoky Mouse habitat;
- consider the conservation requirements of this species in the preparation of the Bush Fire Fuel Management Plan covering Namadgi National Park. When, and if feasible, provide in that plan for regeneration of areas of heath. In the event of wild fires likely to burn into heath or dry sclerophyll forest on ridges, liaise with the appropriate ACT or NSW bush fire suppression authority so that heath and understorey conservation requirements are taken into account in deciding the management response to such wildfires;
- no fuel reduction burning in the Bimberi Wilderness Area. Any planned burning in possible Smoky Mouse habitat to involve monitoring of the vegetation in reference to the apparent habitat requirements of the species; and

- maintain the current level of effort to minimise the frequency of fires in Namadgi National Park that are caused by people.

Protection

All known areas of suitable and potential habitat for *P. fumeus* occur within Namadgi National Park. Therefore no further reserved areas are required.

Socio- economic Issues

There are no current activities or land uses which are likely to conflict with achievement of the conservation objective during the term of this Action Plan.

Any predator control programs implemented for the conservation of this species will be beneficial for other species and for neighbouring rural lessees. Any predator control program will be managed to minimise non-target risk, for example current baiting procedures for foxes involve burial of baits to maximise risk to the target species while minimising risk to the spotted-tailed quoll, *Dasyurus maculatus*.

⇒ Environment ACT will undertake a community consultation and public education program if its proposals for protection of the species involve land use changes.

Legislative Provisions

The following legislation is relevant to conservation of flora and fauna in the ACT region:

AUSTRALIAN CAPITAL TERRITORY

Nature Conservation Act 1980

The Nature Conservation Act provides a mechanism to encourage the protection of native plants and animals (including fish and invertebrates), the identification of threatened species and ecological communities, and the management of Public Land reserved for nature conservation purposes. Specified activities are managed via a licensing system.

Native plants and animals may be declared in recognition of a particular conservation concern and increased controls and penalties apply. Species declared as endangered must

also be declared as having special protection status (SPS), the highest level of statutory protection that can be conferred.

P. fumeus is listed as a SPS species and any activity affecting such a species is subject to special scrutiny. Conservation requirements are a paramount consideration and only activities related to conservation of the species or serving a special purpose are permissible.

The Conservator of Flora and Fauna may only grant a licence for activities affecting a species with SPS where satisfied that the act specified in the licence meets a range of stringent conditions. Further information on licensing can be obtained from the Licensing Officer, Nature Conservation Regulation, Environment ACT, telephone (02) 6207 6376.

Land (Planning and Environment) Act 1991

The Land (Planning and Environment) Act is the primary authority for land planning and administration. It establishes the Territory Plan, which identifies nature reserves, national parks and wilderness areas within the Public Land estate.

The Land (Planning and Environment) Act establishes the Heritage Places Register. Places of natural heritage significance are to be identified and conservation requirements specified.

Environmental Assessments and Inquiries may be initiated in relation to land use and development proposals.

NEW SOUTH WALES

Threatened Species Conservation Act 1995

The Act came into effect on 1 January 1996 and requires the preparation of recovery plans for endangered species (other than those presumed extinct), endangered populations, endangered ecological communities and vulnerable species. Threat abatement plans are required to manage key threatening processes with a view to their abatement, amelioration or elimination. A Species Impact Statement is required when a development application is made on land which contains areas declared to be critical habitat under Part 3 of the Act or which is likely to significantly effect threatened species, populations or ecological communities or their habitats.

The preparation of a Recovery Plan for *P. fumeus* is mandatory as the species has been listed as endangered. Predation by the

European Red Fox (*Vulpes vulpes*) has been listed as a Key Threatening Process. The Final Determination was made in March 1998.

Consultation and Community Participation

It is appropriate that the conservation of *P. fumeus* and its associated heathy habitat be promoted through community liaison and public education, with the main objective being to foster protection of the species.

⇒ Environment ACT (ACT Parks and Conservation Service) will support national and regional recovery efforts.

⇒ Environment ACT (ACT Parks and Conservation Service) will encourage appropriate community participation in activities associated with the conservation of threatened species, including *P. fumeus*, in the ACT.

Implementation, Evaluation and Review

RESPONSIBILITY FOR IMPLEMENTATION

Environment ACT (Wildlife Research and Monitoring) will have responsibility for coordinating implementation of this Action Plan subject to government priorities and resources.

Actions will be implemented in consultation with regional and national recovery efforts, and will be consistent with regional programs. The ACT Parks and Conservation Service will be responsible for the on-ground implementation in areas under its control.

EVALUATION

The Action Plan will be reviewed after three years. The review will comprise an assessment of progress using the following performance indicators:

- completion of commitments that can reasonably be expected to be finalised within the review timeframe (e.g. introduction of a statutory protection measure for a species, development of a management plan);
- completion of a stage in a process with a time line that exceeds the review period (e.g. design or commencement of a research program);
- commencement of a particular commitment that is of a continuing nature (e.g. design or

commencement of a monitoring program for population abundance); and

- expert assessment of achievement of conservation objectives of the Action Plan.

The review will be reported to the ACT Flora and Fauna Committee. This will provide an opportunity for Environment ACT and the Flora and Fauna Committee to assess progress, take account of developments in nature conservation knowledge, policy and administration and review directions and priorities for future conservation action.

The following conservation actions will be given priority attention:

- ⇒ undertaking further survey and research work to gain a greater understanding of the distribution of the species;
- ⇒ development of management prescriptions to enhance the conservation status of the species, especially in regard to preferred fire regimes and predator control; and
- ⇒ co-operation with regional and national recovery efforts.

Acknowledgments

Linda Broome (NSW NPWS) for providing advice and oversighting successive drafts of this Action Plan.

Professor Andrew Cockburn, Head of the Division of Botany and Zoology, Australian National University, who has studied *P. fumeus* in the Grampians in western Victoria.

N. Jones, Department of Natural Resources and Environment, Victoria, who has undertaken surveys and found predator scats containing remnants of Smoky Mouse.

Garry Mayo, Division of Botany and Zoology, Australian National University, who has provided information to the ACT Flora and Fauna Committee to assist in the assessment of the species' status.

Graham Newell, senior wildlife scientist, Victorian Department of Natural Resources and Environment, who is responsible for state wide fauna surveys conducted as part of the Comprehensive Regional Assessment process.

C. Slade, ecologist, State Forests of NSW, who has undertaken surveys of Smoky Mouse.

The illustration of the species (Figure 1) was prepared for Environment ACT by Fiona Sivyer.

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- No. 8: Button Wrinklewort (*Rutidosis leptorrhynchoides*) - an endangered species.
- No. 9: Small Purple Pea (*Swainsona recta*) - an endangered species.
- No. 10: Yellow Box - Red Gum Grassy Woodland - an endangered ecological community.
- No. 11: Two-spined Blackfish (*Gadopsis bispinosus*) - a vulnerable species.
- No. 12: Trout Cod (*Maccullochella macquariensis*) - an endangered species.
- No. 13: Macquarie Perch (*Macquaria australasica*) - an endangered species.
- No. 14: Murray River Crayfish (*Euastacus armatus*) - a vulnerable species.
- No. 15: Hooded Robin (*Melanodryas cucullata*) - a vulnerable species.
- No. 16: Swift Parrot (*Lathamus discolor*) - a vulnerable species.
- No. 17: Superb Parrot (*Polytelis swainsonii*) - a vulnerable species.
- No. 18: Brown Treecreeper (*Climacteris picumnus*) - a vulnerable species.
- No. 19: Painted Honeyeater (*Grantiella picta*) - a vulnerable species.
- No. 20: Regent Honeyeater (*Xanthomyza phrygia*) - an endangered species.
- No. 21: Perunga Grasshopper (*Perunga ochracea*) - a vulnerable species.
- No. 22: Brush-tailed Rock-wallaby (*Petrogale penicillata*) - an endangered species.
- No. 23: Smoky Mouse (*Pseudomys fumeus*) - an endangered species.
- No. 24: Tuggeranong Lignum (*Muehlenbeckia tuggeranong*) - an endangered species.

List of Action Plans - October 1999

In accordance with Section 23 of the *Nature Conservation Act 1980*, the following Action Plans have been prepared by the Conservator of Flora and Fauna:

- No. 1: Natural Temperate Grassland - an endangered ecological community.
- No. 2: Striped Legless Lizard (*Delma impar*) - a vulnerable species.
- No. 3: Eastern Lined Earless Dragon (*Tympanocryptis lineata pinguicolla*) - an endangered species.
- No. 4: A leek orchid (*Prasophyllum petilum*) - an endangered species.
- No. 5: A subalpine herb (*Gentiana baeuerlenii*) - an endangered species.
- No. 6: Corroboree Frog (*Pseudophryne corroboree*) - a vulnerable species.
- No. 7: Golden Sun Moth (*Synemon plana*) - an endangered species.

FURTHER INFORMATION

Further information on this Action Plan or other threatened species and ecological communities can be obtained from:

Environment ACT
(Wildlife Research and Monitoring)
Phone: (02) 6207 2126
Fax: (02) 6207 2122

Environment ACT Homepage:
<http://www.act.gov.au/enviro>

This document should be cited as:
ACT Government, 1999. *Smoky Mouse* (*Pseudomys fumeus*): *An endangered species*. Action Plan No. 23. Environment ACT, Canberra.

ACTION PLAN No. 30

In accordance with section 38 of the *Nature Conservation Act 1980*, the **Spotted-tailed Quoll** (*Dasyurus maculatus*) was declared a **vulnerable** species on 4 September 2003 (Instrument No. 265 of 2003). Section 40 of the Act requires the Conservator of Flora and Fauna to prepare an Action Plan in response to each declaration. This is the Action Plan for:

Spotted-tailed Quoll *Dasyurus maculatus*

Preamble

The *Nature Conservation Act 1980* establishes the ACT Flora and Fauna Committee with responsibilities for assessing the conservation status of the ACT's flora and fauna and the ecological significance of potentially threatening processes. Where the Committee believes that a species or ecological community is threatened with extinction or a process is an ecological threat, it is required to advise the responsible minister, and recommend that a declaration be made accordingly.

Flora and Fauna Committee assessments are made on nature conservation grounds only and are guided by specified criteria as set out in its publication '*Threatened Species and Communities in the ACT*', July 1995.

In making its assessment of the Spotted-tailed Quoll, the Committee concluded that it satisfied the criteria indicated in the adjacent table.

An Action Plan is required in response to each declaration. It must include proposals for the identification, protection and survival of a threatened species or ecological community, or, in the case of a threatening process, proposals to minimise its effect.

This Action Plan was prepared by the Conservator of Flora and Fauna in accordance with the *Nature Conservation Act 1980*, in consultation with the Flora and Fauna Committee.

While the legal authority of this Action Plan is confined to the Australian Capital Territory, management considerations are addressed in a regional context.

Criteria Satisfied

2.1 The species is known or suspected to occur in the ACT region and is already recognised as vulnerable in an authoritative international or national listing.

Species Description and Ecology

DESCRIPTION

The Spotted-tailed Quoll (or Spot-tailed Quoll, Tiger Quoll, Spotted-tailed Native Cat, Tiger Cat) *Dasyurus maculatus* is the largest of the six living quoll species (including subspecies) and the largest marsupial carnivore on mainland Australia. Other quoll species such as the Northern, Eastern and Western Quolls, have all declined on mainland Australia, and the related Tasmanian Devil and Thylacine have become extinct in the last few thousand years.

There are two described subspecies of the Spotted-tailed Quoll: *Dasyurus maculatus gracilis*, confined to northern Queensland, and *Dasyurus maculatus maculatus* described here. There is also a distinct Evolutionarily Significant Unit restricted to Tasmania that has been proposed for reclassification as another subspecies (Firestone *et al.* 1999 and Firestone *et al.* 2000).

Male quolls have a head and body length of 380–760 mm, a tail length of 370–550 mm and weigh up to 7 kg (average 3 kg). Females have a head and body length of 350–450 mm, a tail length of 340–420 mm and weigh up to 4 kg (average 2 kg). The fur ranges from rich rufous brown to dark above, pale below, with conspicuous white spots of varying size over the body and tail (Edgar and Belcher 1995).



ACT Government





Figure 1: Spotted-tailed Quoll
Dasyurus maculatus maculatus.

HABITAT

The Spotted-tailed Quoll is recorded from a wide range of forested habitats, including rainforests, wet sclerophyll forest, lowland forests, River Red Gum forests, dry 'rainshadow' woodland, sub-alpine woodlands, coastal heathlands and inland riparian forests (Edgar and Belcher 1995; Green and Scarborough 1990; Jones and Rose 1996; Mansergh 1995).

The species appears to favour areas with a relatively complex understorey, often in association with complex rock formations, hollow-bearing trees, rocky escarpment and/or fallen logs or burrows for den sites.

BEHAVIOUR AND BIOLOGY

The Spotted-tailed Quoll is primarily a carnivore, that preys on medium-sized mammals including possums, gliders and rabbits. Other prey includes small mammals, birds, reptiles and invertebrates (Belcher 1995). It is also known to prey on domestic poultry and to scavenge on carrion (Edgar and Belcher 1995).

It is usually nocturnal, but will bask in the sun and on occasions has been known to be diurnally active (Edgar and Belcher 1995). The species is generally solitary and occupies large home ranges, in the order of many hundreds to a few thousand hectares (Belcher and Darrant 2004; Claridge *et al.* 2005). Within its home range, this species has 'latrines'

where it defecates, which are likely to define territories (Edgar and Belcher 1995) and also act as places of 'advertisement' (Kruuk and Jarman 1995).

Mating takes place from April to July. The average litter size is five, and the young remain in the pouch for about seven weeks, becoming fully independent at around 18 weeks (Edgar and Belcher 1995).

DISTRIBUTION

The former distribution of the Spotted-tailed Quoll was south-eastern Queensland (Bundaberg to Chinchilla), eastern NSW (including the ACT), Victoria, South Australia and Tasmania (including some Bass Strait Islands), (Mansergh and Belcher 1992).

The current distribution includes:

- *Queensland*—south-eastern Queensland, restricted to Blackall/Conondale Ranges, southern Darling Downs (Stanthorpe to Wallangarra), Main Range (Goomburra to Spicer Gap), Lamington Plateau and McPherson/Border Ranges (Springbrook to Mt Lindsay) (Maxwell *et al.* 1996).
- *Victoria*—several disjunct populations including:
 - eastern Victoria (from the foothills and ranges north and east of Melbourne through to the NSW border);
 - north-eastern Victoria;
 - north-western Victoria;
 - south-western Victoria (centred on Mt Eccles National Park);
 - lowland East Gippsland and South Gippsland;
 - Otway Ranges; and
 - Central Victoria (including records from 1991 at Macedon Ranges) (NRE 2001).
- *New South Wales*—several disjunct populations occur between the Border Ranges and Blue Mountains/Illawarra; several populations between Grafton and Taree in north-east NSW through to the gorges and escarpments of the New England tablelands; numerous records in the coastal forests between Ulladulla and Bermagui. Intensive survey work has identified locally abundant populations in some areas of the Tallaganda and Badja State Forests and south-east forests, and forests of the coastal escarpment and the rainshadow woodland of Kosciuszko National Park (South East Forests Spotted-tailed Quoll Working Group 2003).

Isolated records also exist from near Hay in Southern NSW, near Brewarrina in Northern NSW and Walgett (Long and Nelson 2004).

- *Tasmania*—in wet forests and scrub in the west and north of the island, although absent from the Tasman Peninsula (Rounsevell *et al.* 1991). The Tasmanian populations apparently form a separate Evolutionarily Significant Unit and have been proposed to be reclassified as a separate subspecies (Firestone *et al.* 1999 and Firestone *et al.* 2000).

Distribution in the Australian Capital Territory

In the mid 1800s, both *D. maculatus* and *D. viverrinus* (Eastern Quoll) were present in the ACT region and quolls were regularly seen in the Tidbinbilla Valley.

The introduction of strychnine to the Canberra district in 1861 is believed to have led to quolls being widely poisoned (Allan Fox & Associates, 1987). By 1971, *D. viverrinus* was considered to be extinct in the district (National Parks Association of the ACT 1971) and on the mainland as a whole (Maxwell *et al.* 1996). At this time, *D. maculatus* was recorded as occurring mostly in the timbered ranges of the ACT, including Tidbinbilla Nature Reserve.

There have been ten specimen records (animal (live or dead), hair, scats or DNA (ACT Vertebrate Atlas)) of the Spotted-tailed Quoll in the ACT since the 1950s, the most recent in 2004. These records are widely distributed across the ACT and include three within the suburban area. A survey conducted in 1999 and 2000 by Environment ACT failed to record the species in the ACT (Nelson *et al.* 2001). The species was recorded in May 2002, as part of a regional survey in Kosciusko National Park, on the NSW-ACT border at Sentry Box mountain at the southern end of Namadgi National Park (James Dawson pers. comm.). In 2003 and 2004 a search for Quoll latrine sites confirmed the occurrence of the species at three locations in Namadgi National Park (two sites in the Gudgenby Valley and Orroral Valley) (Mark Dunford pers. comm.). Occasional sightings of the Spotted-tailed Quoll continue to occur across the ACT and surrounding region.

The limited confirmed records in the ACT probably reflect the elusive nature of the Spotted-tailed Quoll, rather than its actual distribution.

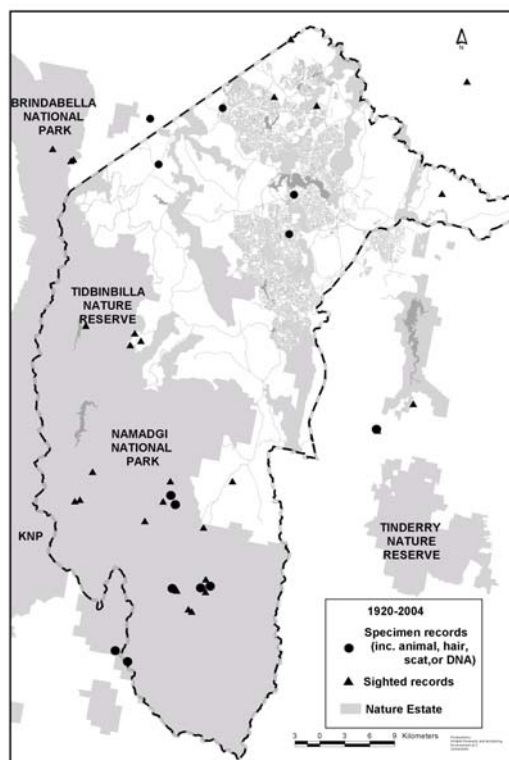


Figure 2: Records of the Spotted-tailed Quoll in the ACT region.

Conservation Status

Dasyurus maculatus maculatus is recognised as a threatened species in the following:

International

Vulnerable—IUCN (2000).

National

Endangered—Environment Protection and Biodiversity Conservation (EPBC) Act 1999.
Vulnerable—(Tasmanian population).

Australian Capital Territory

Vulnerable—Section 21 of the *Nature Conservation Act 1980*, Disallowable instrument No. 256 of 2003.

Queensland

Vulnerable—Threatened Species List 2000.

Victoria

Endangered—Schedule 2 of the Flora and Fauna Guarantee Act 1988.

New South Wales

Vulnerable—Schedule 2 of the NSW Threatened Species Conservation Act 1995.

South Australia

Endangered—Schedule 7 of the National Parks and Wildlife Act 1972 (although considered by state authorities to be extinct in SA).

Threats Across the Species Distribution

Habitat Loss, Fragmentation and Degradation

The loss, fragmentation, disturbance and degradation of habitat through clearing of native vegetation, timber harvesting and other forest management practices are probably the greatest threats to Spotted-tailed Quolls. It is not clear to what extent wildfires and prescribed burns are a threat to the species. It is likely that fire can have both a positive and negative influence, in that the availability of prey and refugia may be limited in the short term, but that in the longer term, fire may also accelerate the formation of tree hollows used by quolls and their prey (Long and Nelson 2004).

Competition and Predation

Competition and predation involving foxes, feral cats and wild dogs are suspected to suppress quoll populations (Edgar and Belcher 1995; Maxwell *et al.* 1996; Murray and Poore 2004), although the frequency or degree of impact on populations is unknown and it is possible that some interactions are positive for quoll populations. The distribution and abundance of foxes appears to be associated with patterns of land disturbance (Catling and Burt 1995), which combined, could have major impacts on quoll populations.

Poisoning

Spotted-tailed Quolls are carnivorous, and may be at risk during feral animal control programs through primary and secondary poisoning (Belcher 2000). However, there is currently considerable debate regarding the impact of these pest control programs on quoll populations (Department of Sustainability and Environment 2003). Belcher (1998), Glen and Dickman (2003) established that quolls could detect, remove and consume non-toxic FOXOFF baits. However, Körtner *et al.* (2003) demonstrated that while quolls regularly remove baits they rarely consume FOXOFF toxic baits. Murray and Poore (2004) showed that normal aerial baiting for dingoes and wild dogs with fresh meat baits resulted in high rates of bait uptake by Spotted-tailed Quolls. Control programs for all vertebrate pests must be managed to minimise risks of either primary or secondary poisoning to non target species.

Killing by Humans

Quolls have been known to be deliberately killed in rural areas due to their predation on domestic poultry (Maxwell *et al.* 1996). Road mortality is also a threat in some areas of the species range. However, it is not known to

what extent these two threats affect quolls at the population level and it is unlikely that these play a significant role in the ACT.

Major Conservation Objectives

The major conservation objectives of this Action Plan are:

- to contribute to regional and national conservation of the species; and
- to maintain in the long-term, viable, wild population(s) of the Spotted-tailed Quoll *Dasyurus maculatus* as a component of the indigenous biological resources of the ACT.

This objective is to be achieved through the following strategies:

- co-operating with, and contributing to regional and national networks to ensure coordination of research, survey and monitoring programs;
- identifying and protecting habitat critical to the survival of the species in the ACT; and
- where appropriate, implementing management actions or methods required to protect the species and its habitat in the ACT.

Conservation Issues and Intended Management Actions

SURVEY/MONITORING/RESEARCH

Environment ACT has conducted surveys for Spotted-tailed Quolls in Namadgi National Park and a number of nature reserves (Tidbinbilla, Rob Roy Range and Googong Foreshores in NSW). A variety of techniques have been used during these surveys including searches for Quoll latrine sites and scats, searches for scats of other predators (which may contain Quoll remains) and the use of hair sampling tubes. Trapping has also been undertaken at a number of locations of likely Quoll habitat. Recent efforts have resulted in confirmation of the presence of the species, evidenced by scats, at two locations in Namadgi National Park.

- ⇒ Environment ACT will continue to co-operate with and contribute to regional and national networks to ensure coordination of research, survey and monitoring programs.
- ⇒ Environment ACT will conduct further surveys in likely Quoll habitat to gain an understanding of the species distribution in the ACT, and the feasibility of establishing monitoring programs for the species in the ACT.

⇒ Environment ACT will survey rural lease holders to gain information about Quoll sightings in rural areas adjoining potential Quoll habitat.

REQUIRED MANAGEMENT ACTIONS

Targeted feral animal control programs may benefit the Spotted-tailed Quoll through reduction of competition. However, due to the uncertainty about the uptake of poisoned baits by Quolls and the risk of secondary poisoning (and the degree to which individual animals are affected or killed) vertebrate pest control programs need to be implemented cautiously, with consideration of the possible effects on non-target species, including Quolls.

- ⇒ Environment ACT will ensure that all pest animal control activities in areas of known Quoll populations (or areas with high potential for Quoll occurrence) comply with current best practice prescriptions to minimise the risks of baiting programs on Quolls.
- ⇒ Environment ACT will incorporate into its Vertebrate Pest Management Strategies a consideration of the possible benefit to Quoll populations of control programs targeted at the Feral Cat and Fox.

Protection

Within the ACT, it is probable that most of the suitable habitat for this species exists in reserved areas such as Namadgi National Park, Tidbinbilla Nature Reserve, Googong Foreshores and the Murrumbidgee River Corridor. It is therefore unlikely that further areas will be required for the conservation of this species.

- ⇒ Environment ACT will manage or avoid habitat disturbance in reserved areas known to support Quoll populations. Particular care will be taken to protect areas around known latrine sites.
- ⇒ Environment ACT will incorporate the protection of rocky outcrops, riparian zones (and other critical habitat features) into fire management prescriptions within areas of known Spotted-tailed Quoll habitat.

Socio-economic Issues

Given that the species is most likely to occur mainly within nature reserves in the ACT, there are no foreseeable socio-economic issues associated with the protection of this species and its habitat.

⇒ Environment ACT will undertake a community consultation and public education program if its proposals for protection of the species involve land use changes.

Legislative Provisions

The following legislation is relevant to conservation of flora and fauna in the ACT:

Nature Conservation Act 1980

The *Nature Conservation Act* provides a mechanism to encourage the protection of native plants and animals (including fish and invertebrates), the identification of threatened species and communities, and the management of Public Land reserved for nature conservation purposes. Specified activities are managed via a licensing system.

Native plants and animals may be declared in recognition of a particular conservation concern and increased controls and penalties apply. Species declared as endangered must also be declared as having special protection status (SPS), the highest level of statutory protection that can be conferred.

Other Relevant Provisions

The *Nature Conservation Act* provides authority for the Conservator of Flora and Fauna to manage Public Land reserved for conservation of the natural environment. Activities that are inconsistent with nature conservation objectives are controlled. Special measures for conservation of a species or community of concern can be introduced in a reserved area, including restriction of access to important habitat.

Land (Planning and Environment) Act 1991

The *Land (Planning and Environment) Act* is the primary authority for land planning and administration. It establishes the Territory Plan, which identifies nature reserves, national parks and wilderness areas within the Public Land estate.

The *Land (Planning and Environment) Act* establishes the Heritage Places Register. Places of natural heritage significance may be identified and conservation requirements specified.

Environmental Assessments and Inquiries may be initiated in relation to land use and development proposals.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Commonwealth)

The endangered status of the species under the *EPBC Act* means that the species is recognised by the Commonwealth as a matter of national environmental significance. Any action that is likely to have a significant impact on the species will need to be referred to the Australian Government Environment Minister for a decision as to whether assessment and approval is required. It is an offence for any person to undertake an action that is likely to have a significant impact on the south-eastern mainland population of the Spotted-tailed Quoll without approval.

Consultation and Community Participation

It is appropriate that the conservation of the Spotted-tailed Quoll and its habitat be promoted through provision of information to the public.

- ⇒ Environment ACT will maintain links with regional and national conservation networks.
- ⇒ Environment ACT will encourage appropriate community participation in activities associated with the conservation of the Spotted-tailed Quoll.

Implementation, Evaluation and Review

RESPONSIBILITY FOR IMPLEMENTATION

Environment ACT will have responsibility for coordinating the implementation of this Action Plan subject to government priorities and resources.

EVALUATION

The Action Plan will be reviewed after three years. The review will comprise an assessment of progress using the following performance indicators:

- completion of commitments that can reasonably be expected to be finalised within the review timeframe (e.g. introduction of a statutory protection measure for a species; development of a management plan);
- completion of a stage in a process with a time line that exceeds the review period (e.g. design or commencement of a research program);
- commencement of a particular commitment that is of a continuing nature (eg. design or commencement of a monitoring program for population abundance); and
- expert assessment of achievement of conservation objectives of the Action Plan.

The review will be reported to the ACT Flora and Fauna Committee. This will provide Environment ACT and the Flora and Fauna Committee an opportunity to assess progress, take account of developments in nature conservation knowledge, policy and administration and review directions and priorities for future conservation action. The following conservation actions will be given priority attention:

- ⇒ maintaining links with national and regional networks to ensure coordination of research, survey and monitoring programs;
- ⇒ supporting and contributing to national and regional recovery efforts;
- ⇒ undertaking surveys in the ACT to identify suitable quoll habitat and establishing the species presence in those habitats, thereby gaining an understanding of the species distribution;
- ⇒ ensuring that all pest animal control activities in areas of known or potential Quoll populations comply with current best practice prescriptions to minimise the risks of baiting programs on Quolls; and
- ⇒ where appropriate, implementing any other identified management actions or methods required to protect the species and its habitat.

Acknowledgments

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List of Action Plans—August 2005

In accordance with Section 23 of the *Nature Conservation Act 1980*, the following Action Plans have been prepared by the Conservator of Flora and Fauna:

- No. 1: Natural Temperate Grassland—an endangered ecological community.
- No. 2: Striped Legless Lizard (*Delma impar*)—a vulnerable species.
- No. 3: Eastern Lined Earless Dragon (*Tympanocryptis lineata pinguicollis*)—an endangered species.
- No. 4: A leek orchid (*Prasophyllum petilum*)—an endangered species.
- No. 5: A subalpine herb (*Gentiana bauerlenii*)—an endangered species.
- No. 6: Corroboree Frog (*Pseudophryne corroboree*)—a vulnerable species.
- No. 7: Golden Sun Moth (*Synemon plana*)—an endangered species.
- No. 8: Button Wrinklewort (*Rutidosis leptorrhynchoides*)—an endangered species.
- No. 9: Small Purple Pea (*Swainsona recta*)—an endangered species.
- No. 10: Yellow Box-Red Gum Grassy Woodland—an endangered ecological community.
- No. 11: Two-spined Blackfish (*Gadopsis bispinosus*)—a vulnerable species.
- No. 12: Trout Cod (*Maccullochella macquariensis*)—an endangered species.
- No. 13: Macquarie Perch (*Macquaria australasica*)—an endangered species.
- No. 14: Murray River Crayfish (*Euastacus armatus*)—a vulnerable species.
- No. 15: Hooded Robin (*Melanodryas cucullata*)—a vulnerable species.
- No. 16: Swift Parrot (*Lathamus discolor*)—a vulnerable species.
- No. 17: Superb Parrot (*Polytelis swainsonii*)—a vulnerable species.
- No. 18: Brown Treecreeper (*Climacteris picumnus*)—a vulnerable species.
- No. 19: Painted Honeyeater (*Grantiella picta*)—a vulnerable species.
- No. 20: Regent Honeyeater (*Xanthomyza phrygia*)—an endangered species.
- No. 21: Perunga Grasshopper (*Perunga ochracea*)—a vulnerable species.
- No. 22: Brush-tailed Rock-wallaby (*Petrogale penicillata*)—an endangered species.
- No. 23: Smoky Mouse (*Pseudomys fumeus*)—an endangered species.
- No. 24: Tuggeranong Lignum (*Muehlenbeckia tuggeranong*)—an endangered species.
- No. 25: Ginninderra Peppercress (*Lepidium ginninderrense*)—an endangered species.
- No. 26: Silver Perch (*Bidyanus bidyanus*)—an endangered species.
- No. 27: ACT Lowland Woodland Conservation Strategy. (*Supersedes Action Plans 4, 9, 10, 15, 16, 17, 18, 19, 20*).
- No. 28: ACT Lowland Native Grassland Conservation Strategy. (*Supersedes Action Plans 1, 2, 3, 7, 8, 21, and 25*).

FURTHER INFORMATION

Further information on this Action Plan or other threatened species and ecological communities can be obtained from:

Environment ACT
(Wildlife Research and Monitoring)
Phone: (02) 6207 2126
Fax: (02) 6207 2122
Website: www.cmd.act.gov.au

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