RECOVERY PLAN
for
TWELVE THREATENED SPIDER-ORCHID *CALADENIA* R. Br. TAXA OF VICTORIA AND SOUTH AUSTRALIA
2000 - 2004

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Prepared by

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Natural Heritage Trust
Helping Communities Helping Australia

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Abbreviations used in the Plan

ANOS	Australasian Native Orchid Society
ANZECC	Australian and New Zealand Environment Conservation Council
BFNC	Bendigo Field Naturalists Club, Victoria
COM	Committee of Management
EH	Department of Environment and Heritage, South Australia
ESP	Endangered Species Program (Natural Heritage Trust)
FOBCCR	Friends of Betty Clift Conservation Reserve, Victoria
FOKFR	Friends of Kiata Flora Reserve, Victoria
FOMERP	Friends of Mount Eliza Regional Park, Victoria
FOWH	Friends of Wonthaggi Heathlands, Victoria
IUCN	World Conservation Union
KPBG	Kings Park and Botanic Gardens, Western Australia
NOGN	Native Orchid Growers Network
NRE	Department of Natural Resources and Environment, Victoria
NRE – Forests	NRE, Forests Service Division
NRE – NW	NRE, North West Region
NRE – PFF	NRE, Parks Flora and Fauna Division
NRE – PP	NRE, Port Phillip Region
NRE – SW	NRE, South West Region
NSW NPWS	National Parks and Wildlife Service, New South Wales
PA	Portland Aluminium, Victoria
PFNC	Portland Field Naturalists Club, Victoria
PIF	Department of Primary Industries and Fisheries, Northern Territory
PV	Parks Victoria
RBG	Royal Botanic Gardens, Victoria
RFA	Regional Forest Agreement
RMIT	Royal Melbourne Institute of Technology, Victoria
ROTAP	Rare or Threatened Australian Plants
SFNC	Stawell Field Naturalists Club, Victoria
SHSA	State Herbarium of South Australia
SPIFFA	Southern Peninsula Indigenous Flora and Fauna Association, Victoria
TFN	Trust for Nature, Victoria
UMILFR	University of Melbourne, Institute of Land and Food Resources (Burnley Campus), Victoria

Summary

Current Species Status

Ten of the twelve *Caladenia* taxa addressed in this plan are currently listed as **Endangered** under Commonwealth endangered species legislation, the list of threatened species maintained by the Endangered Flora Network of ANZECC and the IUCN Red List (Walter and Gillet 1998). The remaining two species are listed as **Vulnerable** under the same lists. Subsequent revisions of these lists will take account of the new information summarised in this plan, which recommends that *Caladenia tensa* be re-categorised from endangered to vulnerable and *Caladenia versicolor* be re-categorised from vulnerable to endangered.

Habitat Requirements and Limiting Factors

The threatened *Caladenia* taxa occupy a range of different habitats. Five of the taxa (*C. formosa*, *C. lowanensis*, *C. tensa*, *C. versicolor* and *C. xanthochila*) occupy dry woodlands of western Victoria and southeast South Australia mostly on Quaternary sand deposits. Three taxa (*C. amoena, C. audasii* and *C. rosella*) occupy box-ironbark forests and woodlands of inland Victoria on sandstone. Three taxa (*C. fragrantissima* ssp. *orientalis*, *C. robinsonii* and *C. hastata*) occupy near coastal heaths and heathy woodlands of eastern and western Victoria while *C. thysanochila* occupies grassy woodlands on granodiorite on the Mornington Peninsula.

A defining feature of most of the species is that they occupy uncommon habitats. These may have been naturally uncommon prior to European settlement, or more typically, because of clearing for agriculture and urbanisation since European settlement. Most species occur within severely fragmented ecosystems that are subject to a range of potentially threatening processes typical of such environments. These include weed invasions, grazing by native and introduced herbivores, inappropriate fire regimes and damage to populations by recreators.

Recovery Goals and Criteria

Short-term Goal: ensure that all existing populations are adequately protected; increase the numbers of plants in the wild; establish a genetically representative *ex-situ* collection of endangered taxa in cultivation; increase the number of populations in the wild; and raise public awareness and foster community involvement in this process.

Recovery Criteria

The criteria for assessing the achievement of this Goal are:

- Determination of the conservation status of all taxa in the wild;
- Establishment of a private and public land protected area network for threatened *Caladenia* taxa;
- A measurable decrease in the number and magnitude of identified threats to populations;
- An increase in the abundance of vulnerable taxa to at least twice current numbers;
- An increase in abundance of endangered taxa to at least 5x current numbers;
- Identification of key components of the biology and ecology of threatened *Caladenia* taxa;
- Development of successful propagation techniques and the establishment of at least 100 plants of each endangered taxon in the wild;
- Establishment of at least one additional population of each endangered taxon in a secure reserve in the wild; and
- Increased community involvement in pivotal aspects of criteria above.

Long-term Goal: to achieve secure, representative, self-sustaining metapopulations of all twelve threatened *Caladenia* taxa in the wild.

Recovery Criteria

The criteria for assessing the achievement of this Goal are:

- Achieving successful natural pollination, establishment of seedlings and recruitment at each population site for each taxon; and
- The protection of at least two populations of each taxon in nature conservation reserves.

Recovery Actions

Action1 Determine the conservation status of the twelve threatened *Caladenia* taxa in Victoria and South Australia

1.1 Identify and verify populations

Action 2 Protect identified *Caladenia* habitat

2.1 Identify key populations for protection

2.2 Protect key public land populations

2.3 Protect key private land populations

Action 3 Protect populations from high-risk threatening processes

3.1 Control high-priority weed species

3.2 Control animal pests and predators and investigate grazing impacts

3.3 Recover populations by fire and further investigate fire ecology

3.4 Control the spread of Cinnamon Fungus

Action 4 Develop and initiate fine-scale site management practices

4.1 Hand pollinate plants

4.2 Harvest and store seed

4.3 Manage microhabitat

Action 5 Measure population trends and responses against recovery actions

5.1 Conduct annual censusing

Action 6 Investigate the biology and ecology of threatened *Caladenia* taxa

6.1 Identify the pollinator and determine natural pollination levels

6.2 Determine the genetic relationships of disjunct populations

6.3 Investigate germination and seedling establishment

Action 7 Establish *ex-situ* collections of threatened *Caladenia* taxa with rapidly declining or critically low populations in the wild

7.1 Isolate and culture mycorrhizal fungi

7.2 Develop *in vitro* propagating techniques and establish seedlings in cultivation

7.3 Maintain a database on cultivated plants

Action 8 Establish new populations of endangered *Caladenia* taxa in the wild

8.1 Assess habitat preferences and select introduction sites

8.2 Prepare reintroduction plans and establish plants to the wild

Action 9 Develop a public education/community extension program

9.1 Prepare education material and undertake community extension

Action 10 Manage recovery plan implementation

10.1 Expand the Threatened Orchid Recovery Team (TORT)

10.2 Establish a regional recovery team for each taxon

10.3 Prepare and review the Victorian FFG Action Statements for various threatened *Caladenia* taxa

Estimated Cost of Recovery

Action	2000	2001	2002	2003	2004	Total
1	$20,170	$18,670	$0	$0	$0	$38,840
2	$0	$20,230	$15,400	$0	$0	$35,630
3	$32,840	$25,270	$21,300	$26,550	$26,550	$132,510
4	$16,630	$17,830	$17,580	$17,580	$17,580	$87,200
5	$33,360	$36,810	$36,810	$22,850	$22,850	$152,680
6	$0	$46,215	$46,215	$0	$0	$92,430
7	$1,000	$22,500	$22,700	$10,200	$1,200	$57,600
8	$0	$14,590	$14,590	$10,290	$10,290	$49,760
9	$42,100	$42,100	$0	$0	$0	$84,200
10	$10,950	$9,040	$14,040	$10,950	$10,950	$52,110
Total	$157,050	$255,256.00	$188,635	$96,510	$87,510	$782,960.00

(**Note:** the year refers to the financial year, not calendar year ie. 2000 refers to the 12 months from July 2000 until June 2001).

Biodiversity Benefits

The recovery of the twelve threatened *Caladenia* taxa has a number of potential biodiversity benefits for other species and vegetation communities in Victoria and South Australia. Principally, this will be through the protection and reservation of habitat that would be otherwise unreserved. The adoption of broad-scale management techniques will also benefit a number of other plant species growing in association with the threatened *Caladenia* taxa, particularly those species with similar life forms and/or flowering responses (eg. lilies, orchids).

The recovery of the twelve threatened *Caladenia* taxa will also form an important public education role as spider-orchids have the potential to act as 'flagship species' for highlighting broader nature conservation and biodiversity issues such as land clearing, weed invasions and habitat degradation. Germination and cultivation techniques developed during the recovery phase will be of use for other threatened *Caladenia* taxa elsewhere in southeast Australia while the requirement to recover taxa across state boundaries will better develop working relationships between state departments on a broader range of biodiversity conservation issues.

1 Introduction

Southeast mainland Australia, incorporating Victoria, southern New South Wales and southeast South Australia contains about 65 species of *Caladenia* (Harden 1993, Jessop and Toelken 1986, Walsh and Entwisle 1994). Approximately one half of these species are threatened with extinction (Backhouse and Jeanes 1995). The genus contains at least two species, which are presumed extinct while a further 15 species are considered endangered (Backhouse and Jeanes 1995).

Several Victorian *Caladenia* species, namely *Caladenia amoena* D. L. Jones*, Caladenia audasii* R. S. Rogers and *Caladenia hastata* (Nicholls) Rupp are currently the subject of federally-funded national recovery plans aimed at reducing the risk of extinction to these species in the wild. In addition, a draft recovery plan has been written for *Caladenia robinsonii* G. W. Carr and this will be a priority for implementation once a final plan has been prepared. One additional species *Caladenia rosella* G. W. Carr, was the subject of a national recovery plan prepared in 1992 and this plan is in need of review. South Australia has received Commonwealth funding to prepare national recovery plans for several orchid taxa including two southeast Spider-*Caladenia* species, *Caladenia calcicola* G. W. Carr and *C. richardsiorum* D. L. Jones (Adrian Stokes, EH, *pers. comm.*). New South Wales is preparing recovery plans under the New South Wales *Threatened Species and Communities Act 1995* for a number of *Caladenia* species, including *Caladenia concolor* Fitzg. and *Caladenia arenaria* Fitzg. (Stephen Clark and Geoff Robertson, NSW NPWS, *pers. comm.*).

The current recovery plan aims to provide a framework and guidelines for securing the conservation of a range of nationally-threatened Victorian and South Australian *Caladenia* taxa including and in addition to some of those Victorian species listed above. Additional species included are *Caladenia formosa* G. W. Carr*, Caladenia fragrantissima* D. L. Jones et G. W. Carr ssp. *orientalis* G. W. Carr*, Caladenia lowanensis* G. W. Carr*, Caladenia tensa* G. W. Carr*, Caladenia thysanochila* G. W. Carr*, Caladenia versicolor* G. W. Carr and *Caladenia xanthochila* D. et C. Beardsell. In all, the current recovery plan addresses the recovery of twelve taxa (see Table 1 below) including five taxa that have been the subject of past or current species-specific plans and seven taxa that are being considered under this plan for the first time.

Table 1: Summary of recovery planning for the twelve threatened Victorian and South Australian *Caladenia* taxa included as part of the current recovery plan.

Species name	Common name	Existing Recovery plan	Reference
Caladenia amoena D.L. Jones	Charming Spider-orchid	Yes - current	Backhouse *et al.* (1999a)
Caladenia audasii R.S. Rogers	Audas' Spider-orchid	Yes - current	Berwick *et al.* (1999)
Caladenia formosa G.W. Carr	Elegant Spider-orchid	No	
Caladenia fragrantissima D.L. Jones et. G.W. Carr ssp. *orientalis* G.W. Carr	Eastern Spider-orchid	No	
Caladenia hastata (Nicholls) Rupp	Mellblom's Spider-orchid	Yes - current	Hill *et al.* (1999)
Caladenia lowanensis G.W. Carr	Wimmera Spider-orchid	No	
Caladenia robinsonii G.W. Carr	Frankston Spider-orchid	Yes - draft	Backhouse *et al.* (1999b)
Caladenia rosella G.W. Carr	Rosella Spider-orchid	Yes – out of date	Beardsell and Muir (1992)
Caladenia tensa G.W. Carr	Rigid Spider-orchid	No	
Caladenia thysanochila G.W. Carr	Fringed Spider-orchid	No	
Caladenia versicolor G.W. Carr	Candy Spider-orchid	No	
Caladenia xanthochila D. et. C. Beardsell	Yellow-lip Spider-orchid	No	

Despite the fact that species-specific recovery plans exist for a number of Victorian *Caladenia* taxa, there is a reasonable ecological basis and economies of scale for including these species as part of the current generic recovery plan. The current plan is not meant to replace those existing plans but rather provide a context in which recovery of those taxa will occur. Directions and actions specified in the original species recovery plans remain current and have been fully integrated into this current plan. The species-specific plans should be referred to for more detailed information relating to the recovery of particular species (see Table 1 above).

It should be noted that a generic recovery plan of this nature is limited by the varying quality of information available on the constituent taxa covered by the plan. Some taxa have been the subject of intensive research over a number of decades while for other taxa, only basic distribution, habitat and morphological data exist. As a result, the recovery plan details a range of recovery actions considered necessary for the recovery of twelve threatened *Caladenia* taxa in

Victoria and South Australia. Not all actions will be necessary for any particular taxon and the importance of particular actions will vary from taxon to taxon. Nevertheless, it is hoped and anticipated that actions undertaken for any particular taxon will have positive spin-offs for other taxa.

It is also anticipated that the current plan could form the framework for the recovery of additional threatened Spider-*Caladenia* species that may warrant conservation measures in the future. There are a number of well-known Victorian taxa that urgently require recovery actions (eg. *Caladenia fulva* G. W. Carr, *Caladenia insularis* G. W. Carr) while there are also a number of newly described and undescribed threatened *Caladenia* taxa that should be the subject of national recovery efforts (Backhouse and Jeanes 1995, Jones 1999, G. Carr, Ecology Australia P/L, *pers. comm.*). Examples include *Caladenia cruciformis* D. L. Jones, *Caladenia maritima* D. L. Jones and *Caladenia pilotensis* D. L. Jones. It is anticipated that these could be easily incorporated into the generic plan if required, as could other threatened *Caladenia* taxa from other states in southeast Australia.

2 Spider-orchids (Genus: *Caladenia,* Section: *Calonema*)

2.1 Description

All taxa covered by the current recovery plan are members of the Genus *Caladenia*, Section *Calonema*, commonly referred to as spider-orchids. Taxa within this section are characterised by their large, attractive flowers with long filamentous segments often ending in fine, elongated tips, which may be conspicuously clubbed or densely covered, with dark-coloured glandular hairs. These organs are the source of sexual attractants for the pollinators, usually male thynnid wasps (Jones 1988).

Caladenia species are deciduous terrestrial orchids that die back annually to small, spherical subterranean tubers that are protected by a tough, fibrous tunic. They have a single green basal leaf, which is generally long, narrow and conspicuously hairy. Plants flower for only a very limited time each year.

Many spider-orchids have specific pollinators that are attracted to the flowers under the false pretence of copulating with what they believe to be a female of the species. Once pollination has occurred, the flower closes and a capsule is formed containing the microscopic seed (see *2.4 – Life History*).

Descriptions of all species addressed in this plan can be found in Backhouse and Jeanes (1995) and Walsh and Entwisle (1994).

2.2 Taxonomy

The taxonomy of *Caladenia* has been in a state of flux and confusion for some time despite recent efforts by various workers to resolve it (Carr 1991, Clements 1989, 1993, Jones 1991, 1994). In particular the *Caladenia carnea, Caladenia dilatata, Caladenia patersonii* and *Caladenia reticulata* complexes have been studied and split up into numerous new species, some of which have not yet been adequately described (Backhouse and Jeanes 1995). Revision of the genus is still currently being undertaken and many new species have been recently described. Further descriptions and name changes are likely in the future (Jones 1999).

Many of the species addressed in this recovery plan have been described in the last ten years. All species fall into one of three former complexes, namely the *Caladenia dilatata* group (*C. amoena, C. tensa*), the *Caladenia reticulata* group (*C. hastata, C. lowanensis, C. robinsonii, C. thysanochila, C. xanthochila*) and the *Caladenia patersonii* group (*C. audasii, C. formosa, C. fragrantissima* ssp. *orientalis, C. rosella, C. versicolor*). A number of other threatened species also occur within these groups including some newly described species (Jones 1999) and some as yet undescribed taxa (G. Carr, Ecology Australia P/L, *pers. comm.*).

There is believed to be some taxonomic confusion in South Australia relating to *C. tensa* and *C. clavula* (Peter Lang, EH, *pers. comm.*). At present these two taxa are listed as one entity on the South Australian flora database although herbarium records adequately differentiate between the two species on taxonomic and distributional grounds (R. Bates, SHSA, *pers. comm.*). Similarly, there has been some past taxonomic confusion between *C. formosa* and *C. colorata* in South Australia (Peter Lang, *pers. comm.*). Records of *C. formosa* in South Australia may need to be treated with some caution until accurate identification of populations can be confirmed.

2.3 Distribution and Habitat

The threatened *Caladenia* taxa occupy a wide distribution and a range of different habitats. Five of the taxa (*C. formosa*, *C. lowanensis*, *C. tensa*, *C. versicolor* and *C. xanthochila* occupy plains areas of western Victoria and southeast South Australia. The large proportion of known populations for these species occur within the Murray-Darling Depression and Naracoorte Coastal Plain interim bioregions of Victoria and South Australia (Commonwealth of Australia 1999). *C. hastata* also occurs in the Naracoorte Coastal Plain interim bioregion being restricted to coastal heathland environments in southwest Victoria. Three taxa (*C. amoena, C. audasii* and *C. rosella*) occupy box and ironbark forests and woodlands of inland Victoria within the Victorian Midlands interim bioregion. The three remaining taxa, *C. fragrantissima* ssp. *orientalis*, *C. robinsonii* and *C. thysanochila* are endemic to Victoria and occupy coastal areas to the southeast of Melbourne within the Southeast Coastal Plain interim bioregion.

Table 2 summarises the distribution and habitat of threatened *Caladenia* taxa of southeast Australia while Figures 1-12 illustrate known populations of these taxa in Victoria. Some populations have not been confirmed in the field in the last 10 years.

A defining feature of most of the species is that they occupy uncommon habitats. This may be due to these habitats having been naturally uncommon prior to European settlement or more typically because of clearing for agriculture and urbanisation since European settlement. Most species occur within severely fragmented ecosystems that are subject to a range of potentially threatening processes typical of such environments.

Table 2: Distribution, abundance and habitat of twelve threatened *Caladenia* taxa in Victoria and South Australia.

Species name	**Distribution**		**Abundance**	**Habitat/Ecological Vegetation Class***
	Past	**Present**		
Caladenia amoena	Restricted area to the north east of Melbourne in the Greensborough-Plenty-Hurstbridge area within the Victorian Midlands interim bioregion.	Two populations at Plenty (public land) and Wattle Glen (private land) – see Figure 1.	Approximately 45 plants remaining in two populations.	Grassy Dry Forest; Box Ironbark Forest Sandy loams derived from sandstone and mudstone.
Caladenia audasii	Disjunct distribution from central Victoria, near Bendigo to southeast South Australia near Bordertown.	Restricted to three populations in Victoria at Bendigo, Kingower and Deep Lead – see Figure 2.	Five plants remain in the wild. Extinct in South Australia.	Grassy Dry Forest; Box Ironbark Forest. Typically auriferous soils with "buckshot" gravel derived from sandstone and mudstone.
Caladenia formosa	Presumed to have occupied aeolian sand deposits in western Victoria (border to southern Grampians) & southeast South Australia in areas with generally 400-500 mm annual rainfall within the Naracoorte Plain bioregion.	Restricted to isolated public land forest blocks south of Edenhope and north of Cavendish and some adjoining private properties. May occur in the Grampians (Victoria) and is known from Mt Scott and Mt Monster Conservation Parks in South Australia (Briggs & Leigh 1995; Adrian Stokes EH pers. comm.) and from several private properties in the Naracoorte, Coonawarra and Kingston areas (Kath Alcock, Naracoorte, pers. comm.) – see Figure 3.	Highly restricted but locally abundant in Victoria (1000's of plants). Total population in South Australia is unknown.	Damp-sands Herb-rich Woodland; Plains Sedgy Woodland; Shallow Sands Woodland; Seasonally Inundated Shrubby Woodland. Typically occurs on sandy soils that are moist in winter and dry in summer, which often promotes annual and geophytic (seasonal) plants.
Caladenia fragrantissima ssp. *orientalis*	Near coastal habitats extending from the eastern shores of Port Phillip Bay to Wilsons Promontory in South Gippsland within the Southeast Coastal Plain bioregion.	Disjunct populations at Rosebud (Mornington Peninsula), Wonthaggi, Cape Paterson and Walkerville – see Figure 4.	Total number of plants <100.	Coastal Heathland; Heathy Woodland generally occurring on deep siliceous sands.
Caladenia hastata	Confined to a small area of southwest Victoria from south of Portland to Gorae, approximately 15km northwest of Portland and far southeast South Australia.	One naturally occurring population at Point Danger, south of Portland. One additional translocated population occurs at Nelson Bay. Extinct in South Australia – see Figure 5.	Total number of plants ca. 20.	Damp Heathland; Damp Heathy Woodland on aeolian sand deposits.
Caladenia lowanensis	Presumed to have occupied low sandy rises in the Murray-Darling Depression bioregion, north of the Little Desert, in areas with generally 300-400 mm annual rainfall. Also occurred in South Australia north of Bangham (R. Bates, pers. comm.).	Known with certainty from Kiata Flora Reserve and a nearby private land site. Unconfirmed population recorded at Glenlee Flora and Fauna Reserve, 10km north of Kiata and at West Wail Flora Reserve. May occur in southeast South Australia (Adrian Stokes, EH, pers. comm.) – see Figure 6.	Total number of plants ca. 240. Numbers unknown in South Australia	Cypress-pine/Yellow Gum Woodland on sandy loams derived from Tertiary and Quaternary aeolian deposits.

Species name	Distribution		Abundance	Habitat/Ecological Vegetation Class*
	Past	Present		
Caladenia robinsonii	Restricted to sandy areas on the eastern shores of Port Phillip Bay in the Southeast Coastal Plain bioregion.	Known with certainty from Rosebud. May also occur near Frankston and at Langwarrin – see Figure 7.	Approximately 20 plants within a single population.	Heathy Woodland; Damp Sands Herb-rich Woodland; Heathy Herb-rich Woodland on Tertiary siliceous sand deposits.
Caladenia rosella	Former distribution is uncertain but may have been scattered through the Box Ironbark woodlands and forests of the Victorian Midlands bioregion.	Disjunct populations north east of Melbourne at Cottlesbridge, Research and Christmas Hills and an unconfirmed record from near Stawell – see Figure 8.	Approximately 120 plants in four populations.	Grassy Dry Forest; Heathy Dry Forest on sandy clay loams derived from sandstone and mudstone.
Caladenia tensa	Widespread on aeolian sand deposits surrounding and including the Little Desert in western Victoria and southeast South Australia within areas of the Murray-Darling Depression biroegion with generally 300-400 mm annual rainfall.	Widespread in and surrounding the Little Desert in western Victoria. Also known from southeast South Australia where considered widespread but uncommon (Bob Bates, SHSA, pers. comm.). Examples include Telowie Gorge, Murray Bridge and Mt Boothby CP – see Figure 9.	Locally abundant in suitable habitat in western Victoria and eastern South Australia.	Cypress-pine/Yellow Gum Woodland, Heathy Woodland and Mallee on sands and sandy loams derived from aeolian sand deposits.
Caladenia thysanochila	May have occurred at several locations on the Mornington Peninsula including Mount Eliza, Mount Martha and Arthurs Seat within the Gippsland Plain bioregion.	Only known from a single site at Mount Eliza on the Mornington Peninsula – see Figure 10.	Only known from two specimens, both of which have not flowered since 1992.	Damp-sands Herb-rich Woodland Soils are generally fine-coarse granitic sands.
Caladenia versicolor	May have been scattered in low lying areas between the Grampians and St Arnaud and other low-lying areas on the plains to the west of the Grampians and into southeast South Australia in the Penola flats area (Briggs and Leigh 1995, R. Bates. pers. comm.).	Restricted to Lake Fyans (south west of Stawell, Victoria). Record from Deep Lead Flora and Fauna Reserve is unconfirmed. Known from three collections in South Australia, including one site southeast of Penola – present status of these populations is unknown – see Figure 11.	Locally abundant at Lake Fyans where several hundred plants occur. Presumed extinct in South Australia	Plains Sedgy Woodland; Shallow Sands Woodland. Soils are generally sandy/silty clay loams derived from Quaternary alluvial and swamp deposits.
Caladenia xanthochila	Restricted to low sandy rises and outwash areas in the Wimmera and Riverina bioregions in areas with generally 400-600 mm annual rainfall. Also occurred in South Australia and maybe NSW.	Known with certainty from two locations, Murtoa and Inglewood. A report of the species from NSW is awaiting confirmation. Presumed extinct in South Australia (Briggs and Leigh 1995; R. Bates pers. comm.)) – see Figure 12.	Total number of plants ca. 120. Only one plant from Inglewood has flowered in the recent past. Presumed extinct in South Australia	Shallow Sands Woodland; Alluvial Terraces Herb-rich Woodland. Occupies Quaternary alluvial or aeolian deposits derived from a variety of different geologies.

1 Refer to VicRFASC (1999) and ECC (in prep.) for descriptions of Ecological Vegetation Classes.

Past and present distribution of twelve threatened *Caladenia* taxa in Victoria and South Australia (sources: Victorian Flora Information System and South Australian Threatened Plant Population Database)

Figure 1 – *Caladenia amoena*

Figure 2 – *Caladenia audasii*

Extinct in South Australia

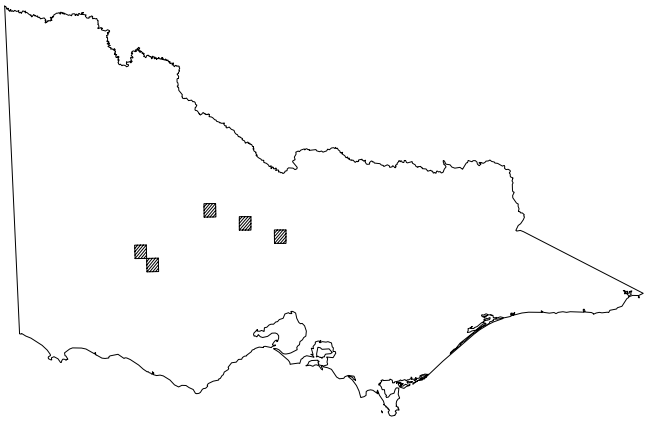
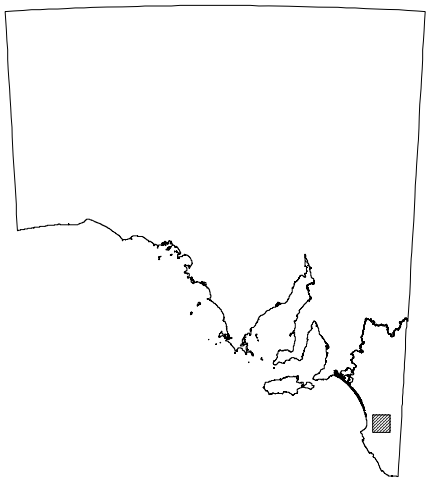


Figure 3 – *Caladenia formosa*



Caladenia formosa

Figure 4 – *Caladenia fragrantissima* ssp. *orientalis*

Figure 5 – *Caladenia hastata*

Past and present distribution of twelve threatened *Caladenia* taxa in Victoria and South Australia (source Victorian Flora Information System and South Australian Rare Plant Database)

Figure 6 – *Caladenia lowanensis*

May also occur in southeast South Australia

Figure 7 – *Caladenia robinsonii*

Figure 8 – *Caladenia rosella*

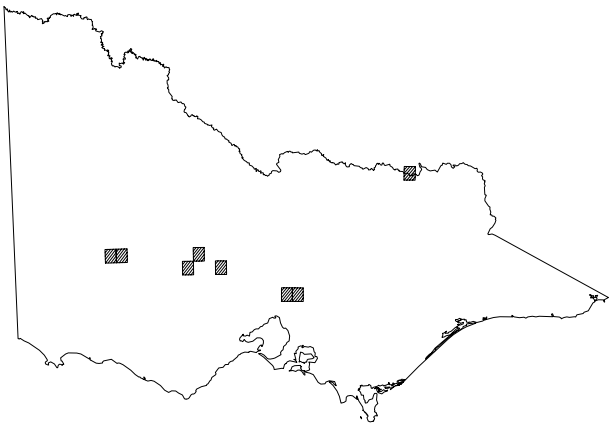
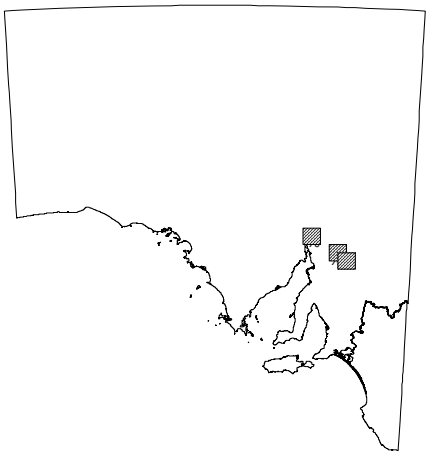


Figure 9 – *Caladenia tensa*



Caladenia tensa

Past and present distribution of twelve threatened *Caladenia* taxa in Victoria and South Australia (source Victorian Flora Information System and South Australian Rare Plant Database)

Figure 10 – *Caladenia thysanochila*

Figure 11 – *Caladenia versicolor*

Presumed extinct in South Australia

Figure 12 – *Caladenia xanthochila*

Presumed extinct in South Australia

2.4 Life History

All Spider-*Caladenia* species are terrestrial, deciduous herbs, emerging annually from spherical, subterranean tubers that are protected by a tough, fibrous tunic. Most plants shoot in response to soaking rains in early autumn, first producing only a leaf that remains almost dormant through the winter. All of the taxa covered by the current plan flower in late-winter to spring ranging from *C. amoena* that usually flowers in August to *C. versicolor* that may flower as late as early November. Table 3 details approximate flowering and fruiting times for threatened *Caladenia* taxa of Victoria and South Australia. Flowers may remain open for a few days to a few weeks depending on pollination and climatic factors.

Table 3: Approximate flowering and fruiting times for twelve threatened *Caladenia* taxa of Victoria and South Australia.

Species name	Flower numbers	Flowering time	Fruiting time
Caladenia amoena	One (rarely two)	August – early September	October
Caladenia audasii	One	September	November
Caladenia formosa	One or two	Late September – October	October – November
Caladenia fragrantissima ssp. *orientalis*	One or two	October – early November	November – December
Caladenia hastata	One to three	October	Late November
Caladenia lowanensis	One	September – October	October – November
Caladenia robinsonii	One (rarely two)	October	November – December
Caladenia rosella	One	August – September	October – November
Caladenia tensa	One (rarely two)	September – October	October – November
Caladenia thysanochila	One or two	October	November
Caladenia versicolor	One or two	Late September – November	October – November
Caladenia xanthochila	One (rarely two)	September	October

Fruits usually take 5-8 weeks to mature following pollination. Each mature capsule may contain tens of thousands of microscopic seeds that are dispersed by the wind when the capsule dries out.

Most spider-orchids are believed to grow in a complex relationship with mycorrhizal fungi (Warcup 1981). The fungus assimilates some nutrients for the orchid, but the degree of dependence upon the fungus is not known. Longevity of most spider-*Caladenia* species is not known, but there are examples of individuals of Mellblom's Spider-orchid *Caladenia hastata* having survived for at least 17 years in the wild (Carr 1999.).

Most members of the Spider-*Caladenia* group are pollinated by sexual deception through a process called pseudocopulation (Jones 1988). Spider-orchids are characterised by the often large, attractive flowers with long tapering sepals and petals ending in clubs or covered with dark glandular hairs that are the source of the sexual attractants for the pollinators, usually male thynnid wasps, attracted to the flowers by scent mimicking female thynnid wasp pheromone. Once it reaches the flower, the male attempts to copulate with the labellum of the flower, mistaking it for the female wasp, and effects pollination. The identities of the pollinator(s) for most species are not known. While thynnid wasps are the most likely pollinators, a small native calictid bee (*Neoproctus* species) has been reported as a pollinator of the Rosella Spider-orchid *Caladenia rosella* (C. Beardsell *pers. comm*.).

Observations suggest that the period available for effective pollination may be quite short, maybe only a few days. Successful pollination may be influenced by the receptivity of the stigma to pollen, the number of pollinators in an area, insect behaviour and climatic conditions. Higher rates of pollination usually occur immediately following wasp-emergence as inexperienced juvenile wasps attempt copulation with many flowers (G. Carr, *pers. comm.*). It has been suggested that pollinators may become habituated to the presence of flowers in their territory after a period of time and rates of pollination may decline as a result (C. Bower, *pers. comm.)*. Attempted copulation rates by wasps, a critical step for pollination, has been shown to be as low as 7.5% for some *Caladenia* species (Peakall and Beattie 1996) while anecdotal evidence suggests that non-synchronous flowering may prevent pollination in some taxa (G. Walker, FOBCCR, *pers. comm.*). These may be important factors when considering species with critically low population numbers in the wild.

The role of fire in the ecology of the various Spider-orchid species is not known, but is likely to be an important factor, at least for some species which have exhibited strong flowering responses in the years following fire (eg. *Caladenia fragrantissima sens. lat*.). Fire is an integral part of the physical environment of most vegetation types in southern

Australia (Gill in press), and is required to maintain plant diversity (Wark 1996). Vegetation response to fire is not directly known, but may be a combination of one or more factors initiated by fire. Fire removes surrounding vegetation, increasing light levels and temperature at ground level, and possibly increasing moisture levels with reduced plant competition for moisture (Purdie 1977). Soil ecology changes and mycorrhizal fungal symbionts become more prevalent. There is also a reduction or removal of the allelopathic inhibition by the surrounding vegetation (Gill *et al.* 1981). Seedling establishment may be critically dependent on fires.

The response of some *Caladenia* species to hot summer fires can be quite spectacular, with profuse flowering of *C. australis* at Anglesea, *C. fragrantissima* ssp. *fragrantissima* near Portland and *C. insularis* on French Island observed after hot summer fires. Timing of fire is important, with the best time for orchids during late summer or early autumn, after seed dispersal but prior to new shoot growth. Fuel reduction burning of state forests in spring and autumn is considered to be a threatening process for many orchid species. The variation in seasonal climatic conditions, most notably rainfall and temperature also influences flowering. Flowering is often aborted when periods of sustained hot, dry weather follow flower opening (J. Todd, unpubl. data).

3 Conservation Status

Table 4 summarises the current conservation status of the recovery species under various national and international listings. Entries under the Commonwealth *Endangered Species Act* 1992, the ANZECC Endangered Flora Network list and the 1997 IUCN Red List of Threatened Plants (Walter and Gillet 1998) are listed at January 2000. Entries under ROTAP are as reported by Briggs and Leigh (1996). In addition, assessments of conservation status were made for four taxa (*C. amoena*, *C. audasii*, *C. hastata* and *C. robinsonii*) as a part of their recovery planning. All four taxa were considered to be *critically endangered* using the 1994 IUCN Red List Criteria (Backhouse *et al.* 1999a, 1999b, Berwick *et al.* 1999 and Hill *et al.* 1999).

The recommended conservation status (Table 4) is based on verification of species distribution and abundance information gathered during the preparation of the current plan and represents the most up-to-date conservation assessment available for these taxa. This assessment was made prior to the announcement of new conservation reserves under the Victorian Environment Conservation Council Box-Ironbark study (ECC, in prep.) and the West Victoria Regional Forest Agreement process. Further refinements will be made as more information is collected on population sizes and distribution (see *Recovery Action 1.1*) and as reserve design is finalised for the two regions referred to above.

Table 4: Conservation status of twelve threatened *Caladenia* taxa of Victoria and South Australia.

Species name	**ROTAP 1995**	**ESP**	**ANZECC 1999**	**IUCN 1997 (Walter & Gillet 1998)**	**Conservation Status - recommended**
Caladenia amoena D.L. Jones	2E	E	E	E	E
Caladenia audasii R.S. Rogers	2ECi	E	E	E	E
Caladenia formosa G.W. Carr	3VCi	V	V	V	V
Caladenia fragrantissima ssp. *orientalis* G.W. Carr	3EC-	E	E	E	E
Caladenia hastata (Nicholls) Rupp	2ECi	E	E	E	E
Caladenia lowanensis G.W. Carr	2EC-t	E	E	E	E
Caladenia robinsonii G.W. Carr	2E	E	E	E	E
Caladenia rosella G.W. Carr	2E	E	E	E	E
Caladenia tensa G.W. Carr	2EC-	E	E	E	V
Caladenia thysanochila G.W. Carr	2ECit	E	E	E	E
Caladenia versicolor G.W. Carr	3VCi	V	V	V	E
Caladenia xanthochila D. & C. Beardsell	2E	E	E	E	E

V: vulnerable
E: endangered
ROTAP code 2: range < 100km
ROTAP code 3: range > 100km
ROTAP code C: reserved
ROTAP code -: reserved population size not accurately known
ROTAP code i: < 1000 plants are known to occur within a conservation reserve
ROTAP code t: total known population reserved

4 Decline and Threats

4.1 Decline

Most of the threatened *Caladenia* taxa covered in this plan have been described in the last ten years, the exceptions being *C. audasii, C. hastata* and *C. rosella*. For the recently described taxa, most have been split from larger complexes and hence little information is known of their former range, whether their range has declined and if so, the rate of decline. For some taxa, information on their current distributions is also lacking.

Inferences have been drawn in Table 2 about the past distributions of all taxa based on historic records, current distributions, extant population sizes and current habitat preferences. This information has been combined with pre-1750 Ecological Vegetation Class mapping where available (VicRFASC 1999, ECC in prep.) to estimate the former range of each taxon and hence the magnitude and rate of decline since European settlement. It is important to note that such inferences may be subject to large margins of error. This is particularly so for taxa that currently have small numbers of populations occupying a very narrow range. Such species are presumed to be occupying preferred habitat but in reality, they may be occupying habitat at the edge of their original range. Their survival at certain sites may be more attributable to disturbance history rather than any preference for a particular ecological niche.

For some taxa (eg. *Caladenia thysanochila*), it is likely that they once occupied a very restricted habitat and range while for other taxa (eg. *Caladenia formosa*), the species may have once been present over thousands of square kilometres. This information is important for assessing threats to known populations, when developing actions to counter-balance these threats and when looking at broader remedial actions such as plant re-introductions and trans-locations.

Table 2 lists the past and present distribution of twelve threatened *Caladenia* taxa of Victoria and South Australia and by inference a measure of the extent of decline since European settlement. Figures 1-12 show past and present records of the twelve threatened taxa within Victoria.

4.2 Threats

The *Caladenia* taxa are listed as threatened for varied reasons. Most of the taxa have small distributions, restricted habitats and a large proportion of their total population occurs at one or a few locations. Most taxa (*C. amoena, C. audasii, C. fragrantissima* ssp. *orientalis, C. hastata, C. lowanensis, C. robinsonii, C. rosella, C. thysanochila, and C. versicolor, C. xanthochila*) also have small total populations.

The single biggest issue for the decline of most of the taxa is habitat destruction. Five of the taxa (*C. formosa, C. lowanensis, C. tensa, C. versicolor* and *C. xanthochila*) occupy broad riverine plains habitats (of northern Victoria and western Victoria/south east South Australia) on reasonably fertile soils that have been cleared over large parts of their range for agricultural production. Extant populations tend to occupy fragmented forests and woodlands within agricultural landscapes and it is this fragmentation and the associated site degradation arising from it, that may now represent the greatest threat to the long-term conservation of these species. Habitat of *C. amoena*, C*. audasii* and *C. rosella* has been severely reduced and altered by historic mining activities and more recent urban development. For the remaining taxa (*C. fragrantissima* ssp. *orientalis*, *C. hastata, C. robinsonii* and *C. thysanochila*), habitat destruction has been caused by the urban and industrial development of their near-coastal habitat. These taxa now occupy areas close to and within urban development and the subsequent impacts associated with this and the management constraints placed on these sites are the largest threats to extant populations of these taxa.

Populations of the twelve threatened *Caladenia* taxa are currently under threat from a variety of sources of varying magnitude and concern (Table 5). The risk posed to extant populations by these threats may vary depending on geographical, environmental, biological and sociological factors. Threats may be acting singularly or in series to present a risk to populations. In addition to current threats, there are also potential threats that may place populations at risk at some time in the future if and when they occur.

Table 5 lists current and potential threats to the threatened *Caladenia* taxa of Victoria and South Australia.

Table 5: Current and potential threats and their risk to twelve threatened *Caladenia* taxa of Victoria and South Australia.

Species name	Current threats/perceived risk						Potential threats/perceived risk		
	Weed invasion	**Grazing**	**Inappropriate fire regimes**	**Site disturbance**	**Reservation status**	**Illegal collection**	**Timber harvesting**	**Other disturbance**	**Stochastic event/accidental damage**
Caladenia amoena	Medium – current management is proving successful against annual weeds	Medium – rabbit and kangaroo grazing and predation by slugs and snails – presently being managed by fencing/caging	Low – low fuel levels and infrequent fires	High – soil disturbance from kangaroos and rabbits; also disturbance by walkers and mountain bike riders	Unreserved – Occurs on unreserved public land managed by PV as part of Plenty Gorge Parklands	Medium – no evidence but plants are close to urban development	Low – private land site may be subject to cutting for fire wood	Medium – increasing soil disturbance with increasing kangaroo numbers	High – one population is unprotected on private land and at risk of unsympathetic future landholders; total plant numbers are low
Caladenia audasii	Medium/High – depending on site. Kingower site is heavily invaded by exotic herbs (eg. *Freesia*, annual grasses). Garden escapees from rubbish dumping is a growing problem at Deep Lead	High – rabbits and kangaroos although all plants are protected	Low – generally low fuel loads and infrequent fires. Habitat adapted to low fire frequency	High – all sites occur in areas heavily utilised by visitors. One population (Kingower) is in a cemetery subject to maintenance works, gold fossicking and raking	Reserved - One Tree Hill Regional Park at Bendigo	High – past evidence at Deep Lead	Low – one population (Deep Lead) occurs within State Forest (proposed Special Protection Zone)	Medium – High – depending on future visitation; gold prospecting	High – critically low population numbers leave this species very susceptible to extinction from stochastic events
Caladenia formosa	Low – mostly annual species at low levels	Low – generally low numbers of kangaroos and rabbits	High – Fuel reduction burning in autumn	Medium – low level timber harvesting (Nov-April); some rabbit burrow ripping; recreation (eg. horse riding, trail bikes) mostly restricted to tracks	Reserved in South Australia – Mt Monster CP, Mt Scott CP (<10 plants?); believed unreserved in Victoria - may be reserved in small Bushland Reserve and Grampians NP	Low – infrequently visited area	Medium – occurs in state forest used for timber production (generally occupies habitat with "non-preferred" timber species – proposed Special Protection Zone)	Medium – may be increasing soil disturbance with increasing kangaroo/rabbit numbers or recreational users	Low – total population > 1000 plants with disjunct populations over a wide range

Species name	Current threats/perceived risk						Potential threats/perceived risk		
	Weed invasion	**Grazing**	**Inappropriate fire regimes**	**Site disturbance**	**Reservation status**	**Illegal collection**	**Timber harvesting**	**Other disturbance**	**Stochastic event/accidental damage**
Caladenia fragrantissima ssp. *orientalis*	Medium – largest threat from Coast Tea-tree, Coast Wattle and Maritime Pine	Presumed Low – grazing pressures largely unknown	High – Burning in autumn and winter	Low – largely inaccessible coastal heathland areas; track slashing	Unreserved – Wonthaggi Heathland "Reserve" is proposed as a nature conservation reserve	Medium – no evidence but plant no's are low and close to urban areas	Nil	Medium – slashing of fire breaks may cause soil disturbance; the presence of Cinnamon Fungus should be monitored	High – total population < 100 plants known from only a few sites – plant numbers have declined dramatically in recent years
Caladenia hastata	High – large threat from introduced shrubs (eg. Boneseed) and invasive native shrubs (eg. Coast Tea-tree, Coast Wattle) (Carr et al. 1992)	Medium – some evidence of past grazing by rabbits – most plants are presently caged	High – Recent burning in autumn and winter may be adversely affecting populations	High – small site that is frequently visited; altered site hydrology; fluoride emissions from smelter	Reserved – Point Danger Coastal Reserve; Discovery Bay Coastal Park	High – no evidence but well known site with easy access	Nil	Low-Medium – close to dirt road – increasing traffic could deposit large amounts of dust on habitat; the presence of Cinnamon Fungus should be monitored	High – small population in a restricted area
Caladenia lowanensis	High – large threat from Perennial Veldt Grass and a range of other, mostly annual species	High – rabbit and wallaby grazing on public land and sheep grazing on private land	Low/medium – known sites have not been burnt for many years – habitat is most likely adapted to low fire frequency although further research is needed to determine appropriate fire regime.	High – soil disturbance from rabbits; disturbance along and adjoining vehicle tracks and close to cemetery and rubbish tip	Reserved – Kiata Flora Reserve; Glenlee Flora Reserve; ?West Wail Flora Reserve	Medium – no evidence but well known site and easy access	Low – some illegal firewood collection	Low–High – depending on control of rabbits	High – total population < 200 plants known from only three sites

Species name	Current threats/perceived risk						Potential threats/perceived risk		
	Weed invasion	**Grazing**	**Inappropriate fire regimes**	**Site disturbance**	**Reservation status**	**Illegal collection**	**Timber harvesting**	**Other disturbance**	**Stochastic event/accidental damage**
Caladenia robinsonii	High – large threat from introduced shrubs (eg. Boneseed) and invasive native shrubs (eg. Coast Tea-tree, Coast Wattle) (Carr et al. 1992) – control program in place	Low-Medium – some rabbit grazing	High – burning in autumn and winter	High – area is close to urban development and used as a children's "adventure" area; weed control measures have resulted in changes to site conditions	Unreserved – Betty Clift Reserve is owned by the Mornington Peninsula Shire Council and zoned Public Conservation and Resource; No conservation agreement in place	Medium – no evidence but highly visible populations close to walking tracks	Low	Medium-High – large-scale weed control activities have the potential to alter habitat and impact on populations; Cinnamon Fungus has been recorded in nearby areas	High – small population occupying a very restricted area
Caladenia rosella	Medium – threat from mostly annual grasses and herbs – presently being managed at most sites	Medium – rabbit grazing and tubers often dug up by White-winged Choughs – many plants are caged; One population is fenced.	Low – semi-urban areas with very infrequent fires	Low-Medium – most sites are not well known but are sometimes heavily visited in spring	Reserved – One Tree Hill Bushland Reserve; 3 private properties protected by TFN Conservation Covenants	Medium – no evidence but some sites are well known	Nil	Low	Medium – small populations (with a number of colonies) occupying restricted habitat
Caladenia tensa	Low – High – dependent on site – introduced perennial grasses (eg. Perennial Veldt Grass) pose the largest threat to known populations.	Medium – High – rabbit and/or kangaroo grazing at most sites	May vary depending on area	Low – High – dependent on site – populations at West Wail are under threat from use of recreational vehicles in reserve	Reserved in Victoria – Kiata FR, Lt Desert NP (numerous plants); Reserved in South Australia – Cape Gantheaume CP, Billiat CP, Mt Boothby CP	Low – no evidence	Low	Low–High – depending on site – rabbits are a major issue at Kiata; illegal firewood collection at West Wail	Low – many plants distributed over a broad range

Species name	Current threats/perceived risk						Potential threats/perceived risk		
	Weed invasion	**Grazing**	**Inappropriate fire regimes**	**Site disturbance**	**Reservation status**	**Illegal collection**	**Timber harvesting**	**Other disturbance**	**Stochastic event/accidental damage**
Caladenia thysanochila	High – major threat from perennial grasses (eg. Sweet Vernal Grass, Yorkshire Fog Grass, Brown-top Bent)	Medium – rabbits present in area but fencing is controlling this at present	High – area has suffered from long-term absence of fire, low fire intensity and inappropriate timing	Medium – Site is fenced but is highly visible and close to urban development	Unreserved – Mt Eliza Regional Park is owned by the Mornington Peninsula Shire Council and zoned Public Conservation and Resource; No conservation agreement in place	High – extremely low numbers of plants make them vulnerable to collection – rarity of taxon makes it a desirable 'collector's item'	Nil	Medium – Control of introduced grasses may lead to soil erosion and/or further weed invasion of other species	High – Only two plants have ever been observed at a single site and these have not flowered for several years
Caladenia versicolor	Low – very few weed species occur in the known habitat	Medium – some grazing by wallabies/kangaroos and maybe rabbits	Low – habitat is adapted to low fire frequencies and area has not been burnt for some time	Low/Medium – uncontrolled access; vehicle and walking tracks	Unreserved – Lake Fyans is uncommitted crown land that is currently subject to a Native Title Claim	Low	Medium – area has been used for timber harvesting in the past (proposed Special Protection Zone)	Low – High – depending on future land use and reservation	Medium – total population < 1000 plants and confined to a narrow range at a single site
Caladenia xanthochila	High – major threat from annual grasses and herbs	High – grazing by rabbits and maybe kangaroos	Low – High – depending on site (Inglewood has been unburnt for some time and the vegetation has closed over)	High – some past dumping of green waste and soil disturbance from rabbits and site works	Unreserved – one site (Murtoa) is private land, the other (Inglewood) is state forest	Medium – Murtoa is a well known site with easy access	Medium – Inglewood site is within state forest used for timber harvesting	High – Murtoa site may be subject to disturbance from recreational users	High – total population < 120 plants in two disjunct populations

5 Existing Conservation Measures

5.1 Reservation

Representation of the *Caladenia* taxa in conservation reserves varies from well represented to not reserved. Examples include *C. lowanensis* and *C. tensa* which, have a very high proportion of their total population represented within conservation reserves while *C. formosa* is reserved in South Australia but believed to be unreserved in Victoria. *C. fragrantissima* ssp. *orientalis, C. xanthochila* and *C. versicolor* are unreserved across their range. Table 6 summarises the representation of the threatened *Caladenia* taxa in southeast Australia.

Taxa are considered reserved if they are contained within reserves established with a primary aim of nature conservation as defined by the former Victorian Land Conservation Council. Reserves which qualify under this definition include Reference Areas, National and State Parks, Flora Reserves, Flora and Fauna Reserves, Wildlife Reserves, Wildlife Management Cooperative Areas, Streamside Reserves, Bushland Reserves and Education Areas. In addition, Conservation Parks in South Australia are also included as reserved areas.

Taxa within local government reserves are also considered reserved if the particular reserve has a primary aim of nature conservation and there is a current agreement between local and state governments referring to conservation and management of threatened *Caladenia*. Taxa occurring on private land protected by a conservation covenant (Victoria) or heritage agreement (South Australia) are also considered reserved. This is in line with current thinking about biodiversity conservation that suggests a range of tenures and protection mechanisms are required to adequately address reservation objectives across bioregions (Bedward *et al.* 1992, Pressey *et al.* 1995).

Table 6: Representation of twelve threatened *Caladenia* taxa in conservation reserves in Victoria and South Australia.

Species name	Reserved		Unreserved		% plants reserved
	Sites	Plants	Sites	Plants	
Caladenia amoena	0	0	2	45	0
Caladenia audasii	1	3	2	2	60
Caladenia formosa	?3	?<10	?<10	1000's	<0.01
Caladenia fragrantissima ssp. *orientalis*	0	0	4	<100	0
Caladenia hastata	2	20	0	0	100
Caladenia lowanensis	?3	230	1	10	96
Caladenia robinsonii	0	0	1 (?2)	20	0
Caladenia rosella	2	110	2	10	92
Caladenia tensa	?>10	many	?	?	ca. 75
Caladenia thysanochila	0	0	1	2	0
Caladenia versicolor	0	0	?4	>200	0
Caladenia xanthochila	0	0	2	117	0

Caladenia fragrantissima ssp. *orientalis* is considered unreserved despite occupying the Wonthaggi Heathland Reserve, Wonthaggi managed by Parks Victoria. Wonthaggi Heathland Reserve was proposed as a nature conservation reserve under the proposed Melbourne Land Conservation Council recommendations (LCC 1993) however reservation under the Victorian *Crown Land (Reserves) Act* 1978 is yet to proceed. *C. amoena* is also considered unreserved despite occurring on public land managed by Parks Victoria as part of Plenty Gorge Parklands. This area is unreserved public land, which is part of a former road easement.

Caladenia robinsonii and *C. thysanochila* both occur in reserves owned and managed by the Mornington Peninsula Shire Council. These areas are zoned *Public Conservation and Resource* but are not protected by any formal management or conservation agreement and therefore both taxa are considered unreserved.

Under the West Victoria Regional Forest Agreement, the presence of several of these taxa in state forest is likely to be recognised by the creation of Special Protection Zones, which will be managed for conservation and where timber harvesting will be excluded. These areas have no legislative protection but they are incorporated into the forest planning process and this is likely to be reinforced in the upcoming Forest Management Plan for Portland and Horsham Forest Management Areas (J. Cook, NRE Forests, *pers. comm.*). Taxa likely to be included under this

zoning include *C. formosa* and *C. versicolor*. The final configuration of forest management zones was yet to be finalised at the time of writing of this plan.

5.2 On-ground works

Rabbit-proof guards have protected a significant proportion of the total population of *C. lowanensis* at Kiata Flora Reserve. These were erected by the Gerang Landcare Group (Friends of Kiata Flora Reserve) in conjunction with a PhD research project being undertaken at the site, which is investigating the population biology and cultivation of *C. lowanensis* (J. Anthony, University of Melbourne, *in prep.*). Plants were hand-pollinated in 1998. The landcare group has also undertaken removal of woody weeds in the reserve, repaired an existing internal fence and removed hard rubbish from the area. They have also been involved in a joint exercise with Parks Victoria to control rabbits in the reserve through warren identification and fumigation. Populations of *C. tensa* within the Kiata Flora Reserve have also benefited from some of these activities. The Friends group has received funding from Parks Victoria to construct a rabbit-proof boundary fence around the reserve and this is expected to be completed by mid-2000.

Seed was collected from *C. xanthochila* plants at Murtoa in spring 1999 and sent to Kings Park Botanic Gardens (KPBG) in Perth, Western Australia for cryostorage. Some of this seed originated from plants that had been hand pollinated earlier that year. This seed will remain at KPBG until such a time as propagation from seed techniques have been perfected for other *Caladenia* species. Negotiations have commenced with the land owners to protect and manage the site.

Management of Mount Eliza Regional Park, the only known site for *C. thysanochila* has been actively promoted and closely monitored by a local environment group for several years. Mornington Peninsula Shire liaises with the group and NRE with respect to the management of the reserve. One plant was hand-pollinated in 1990 and set seed. Unfortunately, the capsule opened unexpectedly and dispersed its seed before any could be saved for *ex-situ* conservation. An area surrounding the two known plants was fenced in 1992. Areas within the fence were slashed in April 1993 and burnt in April 1994 and April 1997 to stimulate flowering of the orchid but no flowering has been observed. On-going experimental trials using fire are being conducted in the area to determine the most effective means of grassy weed control.

Monitoring transects were established in spring 1999 for five taxa (*C. formosa, C. lowanensis, C. tensa, C. versicolor* and *C. xanthochila*). Data were collected on species abundance and distribution, flowering, rates of pollination and fruit production. Additional information on habitat preferences and identified threats were also collected. *C. fragrantissima* ssp. *orientalis* was not monitored during 1999 due to a poor flowering response at previously known sites, while *C. thysanochila* failed to flower at its one known locality.

Various on-ground works have been undertaken for those taxa already subject to recovery planning. Actions have included site and plant protection through fencing and/or caging of plants, predator control, monitoring and hand-pollinating plants, seed collection and weed control. Table 7 provides a summary of on-ground works undertaken for all taxa across all known populations.

Table 7: On-ground works at sites containing populations of threatened *Caladenia* taxa in Victoria and South Australia.

Species name	Population	On-ground works	Start date
Caladenia amoena	Plenty Gorge Parklands	Fencing, weed control, micro-site management, hand-pollination	1996- on-going
Caladenia amoena	Wattle Glen	Caging, weed control, micro-site management, hand-pollination, capsule collection	1995 – on-going
Caladenia audasii	Deep Lead	Monitoring	1997 – on-going
Caladenia audasii	Bendigo	Caging, hand-pollination, capsule collection	1997 – on-going
Caladenia audasii	Kingower	Caging	1997 – on-going
Caladenia formosa	Meereek	Monitoring	1999
Caladenia hastata	Point Danger	Monitoring, caging, weed control, hand-pollination, capsule collection, endophyte collection	1980 – on-going
Caladenia hastata	Discovery Bay	Monitoring, caging, hand-pollination, capsule collection	1980 – on-going
Caladenia lowanensis	Kiata	Caging, hand-pollination, capsule collection, monitoring	1998 – on-going
Caladenia lowanensis	Glenlee	Caging	1999
Caladenia robinsonii	Rosebud	Weed control, fire management, hand-pollination, capsule collection, fungus hygiene, monitoring	1993 – on-going
Caladenia rosella	Cottlesbridge	Caging, micro-site management, hand pollination, capsule collection	Late 1980's – on-going
Caladenia rosella	One Tree Hill	Fencing, caging, weed control, micro-site management, hand pollination	1992 – on-going
Caladenia tensa	Kiata	Caging, monitoring	1998
Caladenia tensa	West Wail	Hand-pollination, seed collection, fencing	1994 - 1998
Caladenia thysanochila	Mount Eliza	Fencing, fire management, hand-pollination, weed control	1992 – on-going
Caladenia versicolor	Lake Fyans	Monitoring	1999
Caladenia xanthochila	Murtoa	Hand-pollination, monitoring	1999

6 Strategy for Recovery

This recovery plan will run for a term of five years from the time of implementation. The strategy for conservation of threatened *Caladenia* taxa will include three approaches: specific management actions for key populations; broader identification, protection and habitat management actions for all taxa across their range; and *ex-situ* cultivation and conservation of endangered taxa with critically low wild populations. A need to better understand the biology and ecology of all taxa is also an inherent part of the recovery process. Key populations for each taxon are identified in Table 8. Their selection is based on population size, habitat condition, representation of environmental range within the taxon, understanding of the threats posed to the population and practicality of management. These key populations are selected irrespective of their land tenure or reservation status. It may be necessary to revise the list of key populations as new data become available, as the status of threatening processes changes or is better understood and as negotiations with land managers progress.

Table 8: Key populations for the conservation of twelve threatened *Caladenia* taxa in Victoria and South Australia.

Species name	**Population**	**State**	**Land tenure**	**Land manager/ management agency**
Caladenia amoena	Plenty Gorge Park	V	Public	Parks Victoria
Caladenia amoena	Wattle Glen	V	Private	Landholder
Caladenia audasii	Deep Lead	V	Public	NRE Forests/Parks Victoria
Caladenia audasii	Kingower	V	Public	Committee of Management
Caladenia audasii	Bendigo, One Tree Hill	V	Public	Parks Victoria
Caladenia formosa	Longbottom's Track, Meereek State Forest	V	Public	NRE Forests
Caladenia formosa	Shilcock's Road, Beear State Forest	V	Public	NRE Forests
Caladenia formosa	Mt Monster CP, Keith	SA	Public	EH
Caladenia formosa	Mt Scott CP, Kingston	SA	Public	EH
Caladenia fragrantissima ssp. *orientalis*	Wonthaggi Heathland Reserve	V	Public	Parks Victoria
Caladenia fragrantissima ssp. *orientalis*	Cape Paterson Township*	V	Private	Various private land owners
Caladenia fragrantissima ssp. *orientalis*	Tarwin Lower-Waratah Rd, Walkerville	V	Public	South Gippsland Shire
Caladenia hastata	Point Danger, Portland	V	Public/ Private	NRE/Portland Aluminium
Caladenia hastata	Discovery Bay, Portland	V	Public	Parks Victoria/NRE
Caladenia lowanensis	Kiata Flora Reserve, Kiata	V	Public	Parks Victoria
Caladenia lowanensis	Glenlee Flora and Fauna Reserve, Glenlee	V	Public	Parks Victoria
Caladenia lowanensis	Private land, Kiata	V	Private	Land owner
Caladenia robinsonii	Betty Clift Conservation Reserve, Rosebud	V	Public	Mornington Peninsula Shire
Caladenia rosella	Cottles Bridge	V	Private	various
Caladenia rosella	One Tree Hill, Christmas Hills	V	Public	Parks Victoria
Caladenia tensa	Kiata Flora Reserve, Kiata	V	Public	Parks Victoria
Caladenia tensa	West Wail Flora and Fauna Reserve, West Wail	V	Public	Parks Victoria
Caladenia tensa	Barabool Flora and Fauna Reserve, Murtoa	V	Public	Parks Victoria
Caladenia tensa	Red Gum Walk, Lt. Desert National Park	V	Public	Parks Victoria
Caladenia tensa	Broken Bucket Campsite, Big Desert National Park	V	Public	Parks Victoria
Caladenia tensa	Camp Ground, Red Gum Track, Lt Desert National Park	V	Public	Parks Victoria
Caladenia thysanochila	Mt Eliza Regional Park, Mt Eliza	V	Public	Mornington Peninsula Shire
Caladenia versicolor	Lake Fyans Reserve, Pomonal	V	Public	NRE Forests; Wimmera-Mallee Water
Caladenia xanthochila	Murtoa Golf Club	V	Private	Committee of Management
Caladenia xanthochila	Spring Creek Track, Glenalbyn	V	Public	NRE Forests

* Known from various private land allotments within the Cape Paterson township. It is presumed that this population will become extinct as allotments are sold and properties are developed for housing.

Management of key populations will aim to mitigate threatening processes relevant to each site and thereby secure the populations from extinction. The major threats requiring attention include accidental destruction, weed invasion, inappropriate fire regimes and grazing by introduced and possibly native herbivores. A range of *in situ* conservation measures will be necessary to mitigate these threats including weed control, fire management, fencing, rabbit control and research on key aspects of fire ecology, native herbivore numbers, pollination ecology and plant biology. Monitoring of selected sites will be necessary to gather life history information and to evaluate the success of particular management actions. In addition to the above, *ex situ* conservation measures will be required for key populations under threat of extinction either at present or in the future. Such measures may include hand pollination, seed collection and storage, mychorrizal fungi collection, identification and research, seed germination, plant cultivation and transplantation into suitable areas.

Broader protection measures applicable to all populations include legal protection of sites and habitat retention, management of fire regimes and liaison with land managers including private landholders. In addition, searches of known and potential habitat should continue to better define taxa distribution and abundance. Additional protective measures should be implemented for non-key populations whenever opportunities arise, except where this precludes similar actions being implemented for key populations listed for priority action in Table 8 or future updated key population lists.

7 Community Involvement

Community involvement will continue to be encouraged for all threatened *Caladenia* taxa populations. This will include maintaining and upgrading links with community groups where they already exist for particular taxa and fostering the involvement of local communities in the conservation of all taxa. Table 9 lists examples of community participation and the types of activities undertaken for all threatened *Caladenia* taxa.

Damage to orchid populations by visitors and illegal collection has occurred in Victoria and for this reason community involvement will be restricted to groups having demonstrated ability and commitment to *in situ* orchid conservation. Private landholders will be encouraged to protect and manage populations of threatened *Caladenia* taxa where these occur on private land.

Table 9. Community involvement and representative activities for twelve threatened *Caladenia* taxa in Victoria and South Australia.

Species name	**Community Group**	**Location**	**Activities**
Caladenia amoena	None		
Caladenia audasii	Stawell Field Naturalists Club; Bendigo Field Naturalists Club	Deep Lead, Kingower, One Tree Hill	Plant censusing, protection.
Caladenia formosa	None		
Caladenia fragrantissima ssp. *orientalis*	Friends of Wonthaggi Heathlands	Wonthaggi	Plant searches, plant censusing.
Caladenia hastata	Point Danger Committee of Management	Portland	Pollination, seed collection and cultivation
Caladenia lowanensis	Gerang Landcare Group (Friends of Kiata Flora Reserve)	Kiata, Glenlee	Weed control, rabbit control, searching, plant censusing, plant pollination, seed collection, and site security.
Caladenia robinsonii	Southern Peninsula Indigenous Flora and Fauna Association (Friends of Betty Clift Conservation Reserve)	Rosebud	Plant censusing, pollinating, weed control, habitat management, searching and seed collection
Caladenia rosella	Dunmoochin Landcare Group	Cottles Bridge	Plant protection and general habitat management
Caladenia tensa	Gerang Landcare Group (Friends of Kiata Flora Reserve)	Kiata	Weed control, rabbit control, searching and site security.
Caladenia thysanochila	Friends of Mt Eliza Regional Park	Mt Eliza	Weed control, fire management.
Caladenia versicolor	Stawell Field Naturalists Club	Stawell	Plant censusing.

Caladenia xanthochila	Bendigo Field Naturalists Club	Inglewood	Searching, plant censusing.
Caladenia xanthochila	Murtoa Golf Club Committee of Management	Murtoa	Site protection, weed control and rabbit control.

8 Recovery Objectives

The **overall goal** of Recovery is to minimise the probability of extinction of the twelve threatened *Caladenia* taxa in the wild and to increase the probability of each population of each taxon becoming self-sustaining in the long term.

Within the life span of this Recovery Plan (2000-2004 inclusive), the **specific objectives** of recovery for the twelve threatened *Caladenia* taxa are to:

1. Ensure that all existing populations are adequately protected;
2. Increase the numbers of plants in the wild;
3. Establish a genetically representative *ex-situ* collection of endangered taxa in cultivation;
4. Increase the number of populations in the wild; and
5. Raise public awareness and foster community involvement.

9 Recovery Criteria

The criteria for assessing the achievement of these objectives are the:

1. Determination or update of conservation status for all taxa for inclusion on state and national threatened species lists;
2. Establishment of a protected area network within the range of threatened *Caladenia* taxa incorporating a range of public land and private land protection mechanisms and management agreements involving a range of public land management agencies, statutory authorities and private landholders;
3. A measurable decrease in the number and magnitude of identified threats to populations;
4. An increase in the abundance of vulnerable taxa to twice current numbers;
5. A measurable increase in the reproductive output and recruitment of endangered *Caladenia* taxa and an increase in abundance to at least 5x current numbers;
6. Identification of key components of the biology and ecology of threatened *Caladenia* taxa;
7. Development of successful propagation techniques and successful establishment of an *ex situ* collection of endangered taxa consisting of 100 plants of each taxon to be held in cultivation;
8. Establishment of at least one additional population of each endangered taxon in a secure reserve in the wild; and
9. Increased community involvement in pivotal aspects of criteria above.

10 Recovery Actions

1. Determine the conservation status of the twelve threatened *Caladenia* taxa in Victoria and South Australia.
2. Protect identified threatened *Caladenia* habitat.
3. Protect populations from high-risk threatening processes.
4. Develop and implement fine-scale *in-situ* site management practices.
5. Measure population trends and responses against recovery actions.
6. Investigate the biology and ecology of threatened *Caladenia* taxa.
7. Establish an *ex-situ* collection of threatened *Caladenia* taxa with rapidly declining or critically low populations in the wild.
8. Establish new populations of endangered *Caladenia* taxa in the wild.

9. Develop a public education/community extension program.

10. Manage Recovery Plan implementation.

Table 10. Summary of proposed recovery actions as they apply to various threatened *Caladenia* taxa of Victoria and South Australia (see *Actions 1 – 10* below for further description).

	Recovery Actions									
Species name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Caladenia amoena		✕	✕	✕	✕	✕	✕	✕		✕
Caladenia audasii		✕	✕	✕	✕	✕	✕	✕	✕	✕
Caladenia formosa	✕	✕	✕	✕	✕	✕	✕		✕	✕
Caladenia fragrantissima ssp. *orientalis*	✕	✕	✕	✕	✕	✕	✕	✕		✕
Caladenia hastata	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕
Caladenia lowanensis	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕
Caladenia robinsonii	✕	✕	✕	✕	✕	✕	✕	✕		✕
Caladenia rosella		✕	✕	✕	✕	✕	✕	✕		✕
Caladenia tensa	✕	✕	✕		✕	✕	✕		✕	✕
Caladenia thysanochila	✕	✕	✕	✕	✕	✕	✕	✕		✕
Caladenia versicolor	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕
Caladenia xanthochila	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕

Action 1 Determine the conservation status of the twelve threatened *Caladenia* taxa in southeast Australia

There is a reasonable understanding of the habitat requirements and current and former ranges for some the twelve threatened *Caladenia* taxa in southeast Australia, particularly where recent and historic population locality records exist (Backhouse *et al.* 1999a, 1999b, Berwick *et al.* 1999, Hill *et al.* 1999, C. Beardsell, *unpubl. data*). For other taxa, typically those recently described ones, there is a poor understanding of former and current ranges and a corresponding lack of current population data.

Accurate base line data is required in order to identify the current conservation status of various taxa, for identifying key populations and prioritising recovery actions. A more accurate determination of current population numbers will also aid in assessing the success of recovery actions in the future.

1.1 Identify and verify populations

Numbers of plants within known populations and the locations of additional populations of certain taxa need to be accurately determined. Some interim censusing and verification of populations has already been undertaken as part of the preparation of this recovery plan but further work is required. Examples include widespread and locally abundant species such as *C. formosa* and *C. tensa,* whose distribution extends to South Australia, and species lacking current population data across their range such as *C. versicolor* (see Table 2). Following population censusing, the reservation status of threatened *Caladenia* taxa and their populations will be determined.

A cooperative strategy between Victorian and South Australian state government departments, orchid groups, naturalist groups, landholders and the general public will be adopted in the first two years of the recovery plan to collect this important base line information. This action will be closely linked and will be reliant upon *Action 9.1 – Prepare education material and undertake community extension.* An expert contractor will be required to assist field staff and volunteer groups with taxonomically difficult or confusing taxa such as *C. formosa*, C*. fragrantissima* ssp. *orientalis*, *C. lowanensis* and *C. versicolor*. In some cases, detailed taxonomic assessment may be required.

Activities, which are best conducted in spring, will include censuses of known populations (part of *Action 5.1 – Annual censusing of populations*), identifying suitable habitat, searching for and censuses of additional populations and data collation and storage. Data on population numbers will be stored in a centralised database such as VrotPop, Victoria's rare or threatened plant database managed by NRE.

Funds are required in the first two years of recovery to cover the salary and associated travel/field costs of a Victorian-based project officer who will be responsible for coordinating and conducting searches and censusing of nine taxa

across Victoria and South Australia. The project officer will also be responsible for collating and entering data on a central database and preparing conservation status assessments of each taxon for inclusion on national and state lists. Funds are also required in the first two years to contract an orchid taxonomist to assist with identification and verification of taxonomically difficult taxa and to appoint contractors to undertake survey and censusing work on an *as needs* basis. Regional naturalist groups and other volunteers will make in kind contributions and state government departments will manage the work and provide support staff in regional areas to assist with searches and censusing.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 1.1			X	X	X	X	X		X	X	X	X
Responsibility			NRE – PFF/ SW, EH	NRE –PFF/ PP, PV, FOWH	NRE – PFF/ SW, PFNC	NRE –PFF/ NW, PV, FOKFR	NRE – PFF/ PP, PV, FOBCCR		NRE – PFF/ NW, EH, PV	NRE – PFF/ PP, FOMERP	NRE – PFF/ NW, BFNC, SFNC	NRE – PFF/ NW, BFNC, COM

Source	2000	2001	2002	2003	2004	Total
Total	$20,170	$18,670	$0	$0	$0	$38,840

Action 2 Protect identified threatened *Caladenia* habitat

Populations of many threatened *Caladenia* taxa remain unprotected by state, regional or local government legislation and/or planning mechanisms. A number of taxa are unreserved across their range and are in urgent need of appropriate protection.

2.1 Identify key populations for protection

From the data collected in *Action 1.1*, key populations of threatened *Caladenia* taxa will be determined as priorities for recovery. Key populations will be based on population size, habitat condition, representation of biological and environmental variation within the taxon and the practicality of management.

Requisite information will be collected during, but in addition to activities undertaken in *Action 1.1.* Funds are required in the second year to cover the salary of a Victorian-based project officer who will be responsible for coordinating and undertaking the collection and storage of key population assessment information across Victoria and South Australia. Travel costs are covered by *Action 1.1*.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 2.1	X	X	X	X	X	X	X	X	X	X	X	X
Responsibility	NRE - PFF	NRE - PFF	NRE – PFF, EH	NRE –PFF	NRE - PFF	NRE –PFF	NRE – PFF	NRE - PFF	NRE – PFF' EH	NRE - PFF	NRE – PFF	NRE – PFF

Source	2000	2001	2002	2003	2004	Total
Total	$0	$750	$0	$0	$0	$750

2.2 Protect key public land populations

Key populations on public land identified in *Action 2.1* will be protected under relevant state legislation. All Victorian populations are already protected under the *Victorian Flora and Fauna Guarantee Act* 1988 but many need further protection through more adequate reservation. Examples of Victorian legislation that may be invoked include the *Crown Land (Reserves) Act* 1978 and the *Catchment and Land Protection Act* 1994. South Australian populations are listed under the *National Parks and Wildlife Act* 1972. This is also the primary legislation for including areas within the state reserve system. Other acts that may be utilised include the proclamation of Conservation Reserves under the *Crown Lands Act* 1929, Native Forests Reserves under the *Forestry Act* 1950 and various forms of protection and responsibility under the *Local Government Act* 1934.

Additional public land populations not protected under the above mechanisms will be incorporated into relevant public land planning frameworks and managed under service agreements or Public Authority Management Agreements (under the *Flora and Fauna Guarantee Act* 1988). Identified areas will be protected from potentially threatening processes such as timber harvesting, domestic stock grazing and various recreational activities through appropriate conservation zoning and management guidelines put in place that deal with issues such as site protection, pest plant and animal control and fire management. Identified habitat within commercial forest areas in Victoria will be protected within Special Protection Zones, which remain in perpetuity as long as conservation values are maintained.

Funds are required to in the second year of recovery to cover the salary and travel costs of a Victorian-based project officer to collate available information, prepare briefings and/or background information, and make recommendations to the relevant state reserve planning and land management agencies. The Victorian Department of Natural Resources and Environment (NRE) and the South Australian Department of Environment and Heritage (EH) will be responsible for initiating subsequent protection mechanisms for populations on public land in years 2 and 3 of recovery.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 2.2	X	X	X	X	X		X	X		X	X	X
Responsibility	NRE – PFF/ PP	NRE-PFF/ NW	NRE – PFF/ SW, EH	NRE –PFF/ PP	NRE – PFF/ SW, COM		NRE – PFF/ PP, Shire	NRE – PFF/ PP, Shire		NRE – PFF/ PP, Shire	NRE – PFF/ NW	NRE – PFF/ NW

Source	2000	2001	2002	2003	2004	Total
Total	$0	$4,790	$3,750	$0	$0	$8,540

2.3 Protect key private land populations

Key populations on private land identified in *Action 2.1* will be protected under various private land management agreements. These agreements will be developed in consultation with the relevant landholders and will be designed to meet landholder and threatened *Caladenia* taxa recovery planning objectives. Voluntary, binding nature conservation agreements are available in Victoria under the *Victorian Conservation Trust Act 1972,* the *Conservation Forests and Lands Act 1987* and the *Wildlife Act 1975* while landholders can enter into binding Heritage Agreements in South Australia under the *Heritage Act 1978*.

Consultation and negotiation with private landholders will be the responsibility of state departments and other relevant statutory authorities. Various incentive packages will be offered to landholders based on their preparedness to enter into long-term management agreements such as those already identified. Such incentives may include fencing, local government rate relief, water rate relief and the provision of habitat management advice and management plans to private landholders. The range of incentives available will be negotiated by the relevant state department and statutory or local government authorities and will be decided upon on a case-by-case basis.

Funds are required to in the second year of recovery to cover the salary and travel costs of a Victorian-based project officer to collate available information, prepare background information, and make recommendations in various reports to the relevant authorities on key private land sites for protection. The cost of incentives offered to landholders

will be borne by the relevant agencies in years 2-4 of recovery. Fencing labour costs will be provided in kind by the landholder.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 2.3	X		X	X	X	X		X				X
Responsibility	NRE – PFF/ PP, TFN		NRE – PFF/ NW	NRE – PFF/ PP, Shire	NRE- PFF/ NW, PA	NRE – PFF/ NW, TFN		NRE – PFF/ PP, TFN				NRE – PFF/ NW, TFN

Source	2000	2001	2002	2003	2004	Total
Total	$0	$14,690	$11,650	$0	$0	$26,340

Action 3 Protect populations from high-risk threatening processes

Protection of populations from high-risk threatening processes will require a combination of broad-scale habitat management practices and finer-scale plant protection strategies. Wherever possible, the strategies adopted should aim to complement any other nature conservation objectives where these have been clearly defined as part of a current park or site management plan (Carr *et al.* 1993, Gordes and Gordes 1994, NRE 1996, Parks Victoria 1998).

3.1 Control high-priority weed species

Weed invasions represent a high risk threatening process to a number of different taxa (see Table 5) while weeds are a potential threat to all populations of all taxa. Generally, the risk posed by weeds is related to the size of the threatened *Caladenia* population, the number of sites at which the taxon is known and the biology, life form and population size of the weed species present. *Caladenia* taxa known from very few sites with low total population numbers are generally at higher risk of extinction from weed invasions. Examples include *C. audasii, C. hastata*, *C. lowanensis*, *C. robinsonii*, *C. rosella, C. thysanochila* and *C. xanthochila*.

In some cases, weed control will be achieved by adopting broad-scale habitat management approaches such as the periodic use of fire. In other cases, target species will need to be controlled using more direct methods. The use of standard weed control measures such as herbicide application and hand-pulling will need to be assessed against their potential impact on *Caladenia* populations and in some cases, alternative techniques may need to be developed. Weed identification and control plans will be prepared for each key population in the second year of recovery.

Funds are required in the first two years of recovery to cover the salary of a project officer to assist land managers with preparing weed control strategies for sites containing threatened *Caladenia* taxa. Weed species distribution and abundance data will be collected as part of *Action 1.1* and travel and field expenses will also be covered under this action. Additional weed data already held on the Victorian Flora Information System will be made available as part of NRE contribution to the project. Funds are also sought in the first year of recovery to engage an expert weed-control contractor to develop protocols for land managers wishing to control weeds in highly sensitive areas containing threatened orchid taxa. The cost of weed control will be borne by the relevant land managers in years two to five inclusive. In some cases, volunteer labour through the use of *Friends Groups* will be used to undertake weed control (see Table 9).

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 3.1	X	X	X	X	X	X	X	X	X	X	X	X

Responsibility	NRE-PFF/ PP, PV, land owners	NRE-PFF/ NW, PV, COM	NRE – PFF/ SW/Forests, EH	NRE – PFF/ PP, PV	NRE – PFF/ SW, PV	NRE – PFF/ NW, PV, land owner	NRE – PFF/ PP, Shire	NRE – PFF/ PP, PV, land owners	NRE – PFF/ NW, PV, EH	NRE – PFF/ PP, Shire	NRE – PFF/ NW/Forests	NRE – PFF/ NW/Forests, Land owner

Source	2000	2001	2002	2003	2004	Total
Total	$22,060	$16,200	$14,700	$14,700	$14,700	$83,360

3.2 Control animal pests and predators and investigate grazing impacts

There are a number of animal pests and predators that pose a risk to the twelve threatened *Caladenia* taxa in Victoria and South Australia. Impacts include grazing by introduced and native herbivores, digging up of tubers by introduced Blackbird and the native White-winged Chough and predation of shoots and flowers by slugs, snails and other invertebrates.

Grazing by introduced and in some cases, native herbivores, has been identified as a high-risk threatening process for a number of threatened *Caladenia* taxa (see Table 5). In particular, those taxa that occupy grassy or herb-rich habitat and which also have a low total number of plants consisting of a few populations within a restricted range. Examples include *C. amoena*, *C. audasii, C. lowanensis*, *C. rosella, C. thysanochila* and *C. xanthochila*. Plant protection, using caging or fencing, has already been undertaken for a number of these taxa (see Table 9). For other taxa occupying habitat with heathy understoreys or with larger populations over a wider range, grazing represents a lesser threat to populations.

It is proposed that numbers of hares/rabbits and kangaroos/wallabies at various sites will be estimated using spotlight counts and dung pellet transects respectively (D. Morgan, University of Melbourne, *pers. comm.*). The results of these studies will help determine the risk posed by grazing at these sites and the methods required to control grazing impacts.

The threat posed by bird species and invertebrate species will need to be assessed on a site by site basis and control measures undertaken accordingly. Insect exclusion using cages and insecticide has been shown to greatly increase seed production and plant survival in rare plant species populations in the United States (Bevill *et al.* 1999) and similar techniques may need to be adopted for endangered *Caladenia* populations as part of the current recovery program. Techniques used for endangered orchid species elsewhere in Victoria include caging and baiting and these techniques will be adopted where necessary

For all sites containing threatened *Caladenia* taxa, there is a need to develop environmentally sensitive methods of pest animal control that minimise soil and site disturbance and control only target species. Both fine-scale and broad-scale techniques will need to be developed. This will be the responsibility of the state departments working in conjunction with the relevant land managers who will be responsible for on-ground pest animal control.

Funds are required in the first year of recovery for the supply and construction of urgent rabbit-proof fencing of *C. xanthochila* populations on private land at Murtoa and public land at Inglewood. Parks Victoria will control rabbits and fence smaller reserve areas containing threatened *Caladenia* taxa (eg. Kiata Flora Reserve, Glenlee Flora and Fauna Reserve).

Other areas within state forest will be fenced if required. Land managers will be responsible for undertaking pest animal control. State government departments will cover the costs of labour to conduct herbivore surveys and construct fences and regional staff time to assist with the development of pest animal management plans.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 3.2	X	X	X	X	X	X	X	X	X	X	X	X
Responsibility	NRE-PFF, PV, land owner	NRE-PFF/ NW, PV, COM	NRE – PFF/ SW/Forests, EH	NRE – PFF/ PP, PV	NRE – PFF/ SW, PV	NRE – PFF/ NW, PV, land owner	NRE – PFF/ PP, Shire	NRE – PFF/ PP, land owner	NRE – PFF/ NW, PV, EH	NRE – PFF/ PP, Shire	NRE – PFF/ NW/ Forests	NRE – PFF/ NW, Land owner

Source	2000	2001	2002	2003	2004	Total
Total	$4,960	$3,250	$2,250	$2,250	$2,250	$14,960

3.3 Recover populations by fire and further investigate fire ecology

The inappropriate use of fire poses a risk to all threatened *Caladenia* taxa in southeast Australia. The preferred fire regimes for most taxa are poorly known but there is evidence that the population biology of some species may be heavily influenced by fire frequencies, season of burning, time since fire and fire intensity (Backhouse and Jeanes 1995).

Existing imposed fire regimes pose a high risk to several threatened *Caladenia* taxa at various sites (see Table 5). Examples include *C. formosa, C. fragrantissima* ssp. *orientalis, C. hastata, C. robinsonii* and *C. thysanochila* where the timing of past burns and in some cases, low fire frequency is placing populations at risk. Fire management plans will need to be prepared and implemented for these taxa. To assist with the preparation of these plans, a series of experimental fire regimes will be adopted for some taxa (eg. *C. fragrantissima* ssp. *orientalis, C. hastata, C. lowanensis/tensa, C. robinsonii, C. xanthochila*) and vital attribute data (*sensu.* Noble and Slatyer 1980, Tolhurst 1999) will be collected on the responses of threatened *Caladenia* taxa and a range of other plant taxa to these fire regimes. From this information, predictive models of species responses and successional patterns will be developed and appropriate fire regimes implemented (NRE 1999). Where possible, additional biotic and abiotic fire data will also be collected in accordance with guidelines for ecological burning (NRE 1999). Examples include site fire histories from the Victorian Integrated Fire Information System (Gordon Friend, NRE, *pers. comm.*), forest fuel loads, climatic data and fire intensity. The responses of threatened *Caladenia* taxa to unplanned wildfire will also be recorded where populations are affected. All data will be stored in the Victorian Vital Attributes Database held at the University of Melbourne and later included in the Victorian Integrated Fire Information System (K. Tolhurst, University of Melbourne, *pers. comm.*).

Funds are required in the first three years of recovery to cover the salary and associated travel/field costs (eg. vehicle hire, travel allowance, marker pegs) of a project officer to collect and collate vital attribute data on threatened *Caladenia* taxa and a range of other plant taxa following planned and unplanned fire events. Funds will also be required in years 4 and 5 to prepare fire management plans for key populations of all fire-dependent taxa. State department staff and volunteers will be trained in vital attribute data collection and they will be responsible for longer-term monitoring and data entry of burn sites. This information will be used to devise long-term fire regimes for these and related taxa in various habitats throughout southeast Australia.

NRE will be responsible for negotiating planned burns with the relevant land management agencies and/or land owners while burns will be implemented and conducted by NRE with the assistance of PV and the Country Fire Authority. NRE and PV will cover the salaries of regional staff used to assist with the collection of vital attribute data and conducting burns.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 3.3			X	X	X	X	X		X	X		X
Responsibility			NRE – PFF/ SW/Forests	NRE – PFF/ PP, PV	NRE – PFF/ SW, PV	NRE – PFF/ NW, PV	NRE – PFF/ PP, Shire		NRE – PFF/ NW, PV	NRE – PFF/ PP, Shire		NRE – PFF/ NW/ Forests

Source	2000	2001	2002	2003	2004	Total
Total	$5,470	$5,470	$4,000	$9,250	$9,250	$33,440

3.4 Control the spread of Cinnamon Fungus

Cinnamon Fungus (*Phytophthora cinnamomi*) generally poses a larger threat to sites containing a large proportion of heathland plant species and hence threat management will largely involve protecting sensitive and vulnerable heath and heathy woodland habitat from the effects of Cinnamon Fungus. Examples of such habitat include sites containing *C. fragrantissima* ssp. *orientalis*, *C. hastata, C. robinsonii* and *C. tensa.* The threat posed by Cinnamon Fungus to the twelve threatened *Caladenia* taxa is not well understood but there is anecdotal evidence to suggest that some *Caladenia* species may be sensitive to the fungus (Geoff Carr, *pers. comm.*).

At present, Cinnamon Fungus is not known to be present at any sites containing threatened *Caladenia* populations although hygiene measures have been implemented at the Betty Clift Conservation Reserve, Rosebud (*C. robinsonii* site) in an attempt to prevent its introduction to the reserve from nearby areas where it is known to occur (Backhouse *et al.* 1999).

Vulnerable habitat will need to be monitored annually to identify the presence of Cinnamon Fungus. Plant and soil material will need to be collected and analysed from sites suspected of containing Cinnamon Fungus. Infected sites will need to be quarantined and treated accordingly. Monitoring of sites for Cinnamon Fungus (and collection of plant material and/or soil samples) will be conducted during annual censusing of key populations (*Action 5.1*). Treatment and quarantine of infected areas will be the responsibility of the appropriate land manager.

Funds will be sought for the life of the recovery plan to cover the cost of analysis of plant and/or soil material from sites suspected of Cinnamon Fungus infection on an *as needs* basis.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 3.4				X	X		X		X			
Responsibility				NRE – PFF/ PP, PV	NRE – PFF/ SW, PV		NRE – PFF/ PP, Shire		NRE – PFF/ NW, PV			

Source	2000	2001	2002	2003	2004	Total
Total	$350	$350	$350	$350	$350	$1,750

Action 4 Develop and initiate fine-scale site management practices

Endangered *Caladenia* taxa with critically low total population numbers will require urgent fine-scale management to ensure the survival of wild populations. Many suitable techniques have been successfully trialed for some endangered taxa (eg. *C. amoena, C. audasii, C. hastata* and *C. rosella*) and will be adapted and developed to suit other endangered taxa through an experimental approach.

4.1 Hand pollinate plants

Flowering and seed set are influenced by a number of factors and cannot be reliably predicted from year to year. Irregular flowering in orchid populations has been widely observed and information collected to date implies that poor flowering years tend to occur alternately, or following periods of dry weather (Hutchings 1987, Kindlemann and Balounova 1999, Light and MacConaill 1994). However, observations also suggest that climatic factors may not affect all taxa equally and that some taxa may be advantaged by abnormal weather patterns. In addition, it has also been observed that rates of natural pollination may be low in some *Caladenia* species (Peakall and Beattie 1996, J.Todd unpubl. data). Consequently, natural seed set and recruitment may be non-existent in some years and this represents a very serious threat to taxa with critically low population numbers.

To maximise seed production and hence the potential for recruitment during critical years, hand pollination of plants will occasionally be necessary, particularly within small populations. This will be determined for the various endangered taxa in spring during censusing. Pollen will be manually transferred between flowers on separate plants and records kept of cross-pollination.

Funds are required in the first two years of recovery to cover the salary and associated field costs of a project officer to carry out the work and to provide training to state department staff and volunteers who will be responsible for on-going hand pollination of plants. Travel costs will be covered by *Action 5.1.* Additional funds will also be required during the life of the recovery plan to contract a botanist to undertake the work on an *as needs* basis and in the first year of recovery to engage a suitably qualified and experienced contractor to develop threatened *Caladenia* hand-pollination guidelines and protocols as a reference for land managers and volunteers. State government agencies will cover the costs of salaries of regional staff responsible for on-going hand-pollination.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 4.1	X	X	X	X	X	X	X	X		X		X
Responsibility	NRE – PFF/ PP, PV	NRE – PFF/ NW, PV, BFNC, SFNC	NRE – PFF/ SW, EH	NRE – PFF/ PP, PV, FOWH	NRE – PFF/ SW, PV, Volunteers	NRE – PFF/ NW, PV, FOKR	NRE – PFF/ PP, Shire, FOBC	NRE – PFF, PV		NRE – PFF/ PP, Shire, FOMERP		NRE – PFF/ NW, BFNC

Source	2000	2001	2002	2003	2004	Total
Total	$4,810	$3,010	$4,130	$4,130	$4,130	$20,210

4.2 Harvest and store seed

Caladenia taxa produce capsules containing tens of thousands of microscopic seeds. Low levels of recruitment in the face of such high seed production suggests germination rates are low and/or plants fail to progress beyond protocorm or seedling stages. Information collected to date indicates that a high proportion of *Caladenia* seed may be predated by invertebrates and soil biota, presumably during summer (F. Coates, Parks Victoria, unpubl. data).

A percentage of the seed bearing capsules from each population of endangered *Caladenia* taxon will be harvested annually in late spring and re-released back onto the collection site (in the vicinity of existing plants) in late summer-early autumn. The number of capsules harvested will depend upon total capsule numbers and will be assessed on an annual basis when population monitoring occurs. Additional capsules will be collected for cryogenic storage and *ex situ* cultivation (see *Action 7*).

Seed will be dried and stored at RBG, UMILFR, SHSA or other suitable facilities over summer until required for use. This action will be the responsibility of state department staff and/or volunteers, however funds are required for the life of the recovery plan to engage a contractor to undertake the work on an *as needs* basis and to pay for the cost of cryogenic storage consumables.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 4.2	X	X	X	X	X	X	X	X		X	X	X
Responsibility	NRE – PFF/ PP, PV, RBG, UMILFR	NRE – PFF/ NW, PV, RBG, BFNC, SFNC, UMILFR	NRE – PFF/ SW, EH, SHSA, UMILFR	NRE – PFF/ PP, RBG, UMILFR, FOWH	NRE – PFF/ SW, PA	NRE – PFF/ NW, UMILFR, FOKR	NRE – PFF/ PP, RBG, UMILFR, FOBCCR	NRE – PFF, UMILFR, RBG		NRE – PFF/ PP, RBG, UMILFR, FOMERP	NRE – PFF/ NW, UMILFR, RBG	NRE – PFF/ NW, RBG, UMILFR, COM

Source	2000	2001	2002	2003	2004	Total
Total	$5,400	$6,600	$6,600	$6,600	$6,600	$31,800

4.3 Manage microhabitat

Recent trials indicate that good seedling germination of endangered *Caladenia* taxa can be achieved by microhabitat management (C. Beardsell, unpubl. data, A. Govanstone and A. Pritchard, unpubl. data.). A number of techniques for *C. amoena, C. audasii, C. hastata* and *C. rosella* have been developed that will be trialed with other endangered taxa as part of this recovery plan.

Examples include careful hand weeding, seedbed establishment and scattering of leaf litter around plants and the watering of plants during extended dry spring periods. Sites will be visited at least three times a year. The techniques adopted will be decided on a case-by-case basis and further techniques will be developed and implemented through an experimental approach.

Funds are required in the first three years of recovery cover the salary of a project officer to carry out the work and to train state department staff and volunteers who will be responsible for on-going microhabitat management. Travels costs will be covered by *Action 5.1.* Initially work will focus on endangered taxa (*C. amoena, C. audasii, C. fragrantissima* ssp. *orientalis, C. hastata, C. lowanensis, C. robinsonii, C. rosella, C. thysanochila* and *C. xanthochila*) and vulnerable taxa where populations are critically low (*C. formosa* at Beear (Victoria) and Mt Scott (South Australia)). Funding will also be required for the life of the recovery plan to contract expert botanists to undertake microhabitat management on an *as needs* basis. Funds are also sought in the second year of recovery to engage a suitably qualified and experienced contractor to develop microhabitat management guidelines and protocols as a reference for land managers and volunteers. NRE-PFF will coordinate the action and liaise with all relevant land managers as required.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 4.3	X	X	X	X	X	X	X	X		X		X
Responsibility	NRE – PFF/ PP, PV	NRE – PFF/ NW, PV, BFNC, SFNC	NRE – PFF/ SW, EH	NRE – PFF/ PP, PV, FOWH	NRE – PFF/ SW, PA, COM	NRE – PFF/ NW, PV, FOKR	NRE – PFF/ PP, Shire, FOBCCR	NRE – PFF		NRE – PFF/ PP, Shire, FOMERP		NRE – PFF/ NW, BFNC, SFNC

Source	2000	2001	2002	2003	2004	Total
Total	$6,420	$8,220	$6,850	$6,850	$6,850	$35,190

Action 5 Measure population trends and responses against recovery actions

In line with the theory and practice of *adaptive or experimental management* (Hopkins and Saunders 1987), the results of recovery actions will need to be assessed against recovery goals to determine whether objectives are being achieved. Recovery criteria have been established to assess the success of recovery actions. A critical part of this process will be the collection of annual censusing data by which longer-term population trends can be predicted and fine-tuning of recovery actions can be made if required.

5.1 Conduct annual censusing

Detailed population data going back several years is available for a few endangered taxa (eg. *C. amoena* – Beardsell and French, unpubl. data*, C. audasii* – NRE, unpubl. data*, C. hastata* – Hill and Pritchard, unpubl. data*, C. rosella* – Beardsell, unupub. data) while other endangered and vulnerable taxa have varying degrees of censusing data available. Monitoring transects were established in 1999 for key populations of several taxa including *C. formosa, C. tensa, C. versicolor* and *C. xanthochila. C. lowanensis* has been intensively censused over 1998 and 1999 at Kiata as part of a PhD research project and this is likely to continue into 2000 and perhaps beyond (J. Anthony, University of Melbourne, *in prep.*).

Information collected at all sites includes demographic and life history data recorded on a regular basis to record the timing of life history stages, leaf, stem and flower dimensions, population fecundity and the effect of predation and climatic events. In addition, general habitat information and associated plant species have also been recorded for different populations of various taxa.

The seasonality of flowering times, variation in flowering between years and the observed dormancy of many orchid taxa dictates that longer-term monitoring beyond the life of this recovery plan will be required before population trends for any taxon can be easily determined. It is anticipated that monitoring will need to be conducted by a suitably trained project officer in the first three years of recovery while state department staff and trained volunteers will be encouraged to collect annual censusing data following this. Due to seasonal constraints, some censusing may need to be conducted annually under contract by expert botanists on an *as needs* basis.

Censusing will be conducted four times a year for most taxa depending on seasonal variations. Leaf emergence will be recorded in early autumn, leaf dimensions measured in late winter and during the flowering period and flower and capsule numbers and dimensions recorded in early and late spring respectively. Comparisons of life history states between years and transitions between states within and between years (Hutchings 1987) will be interpreted from these data.

Funds are required in the first three years of recovery to cover the salary and associated field/travel costs (eg. vehicle hire, travel allowance, pegs, marking tape, permanent-ink marking pens, film, consumables) of a project officer to collect and collate annual censusing data from key populations. Part of the travel costs will be covered by *Action 1.1.* The project officer will also provide training to state department staff, land management agency staff and volunteers who will be responsible for longer-term censusing. Funds are also sought for years 1–5 of recovery for contracting a botanist to undertake some of the tasks on an *as needs* basis.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 5.1	X	X	X	X	X	X	X	X	X	X	X	X
Responsibility	NRE – PFF/ PP	NRE – PFF/ NW, PV, BFNC, SFNC	NRE – PFF/ SW, EH	NRE – PFF/ PP, PV, FOWH	NRE – PFF/ SW, PV, COM	NRE – PFF/ NW, FOKR	NRE – PFF/ PP, FOBCCR	NRE – PFF/ PP	NRE _ PFF/ NW	NRE – PFF/ PP, FOMERP	NRE – PFF/ NW, SFNC	NRE – PFF/ NW, BFNC, COM

Source	2000	2001	2002	2003	2004	Total
Total	$33,360	$36,810	$36,810	$22,850	$22,850	$152,680

Action 6 Investigate the biology and ecology of threatened *Caladenia* taxa.

Very little is known of the biology and ecology of most of the threatened *Caladenia* taxa of southeast Australia, and for many endangered taxa, low population numbers in the wild present little opportunity to implement any meaningful research on these taxa. However, for a number of the more 'common' taxa, there is an opportunity to investigate their biology and ecology and to better understand their life histories.

Much of the focus of this work will be on the conservation of plants in the wild but some aspects will also be important for *ex situ* conservation measures (see *Action 7*) and for establishing new populations in the wild (see *Action 8*). Actions 6.1 – 6.3 below relate specifically to the 'unknowns' associated with the population biology and reproduction of the twelve threatened *Caladenia* taxa. Life history data will be collected as part of *Action 5.1* while mycorrhizal investigations are included under *Action 7.1.*

The major focus will be on taxa with populations of greater than 100 plants (*C. formosa, C. rosella, C. tensa, C. versicolor* and *C. xanthochila*) but other taxa with smaller populations will be researched as opportunities arise. Some population and reproduction research is already being conducted on *C. lowanensis* and this information will be incorporated into the recovery plan for this species where appropriate.

6.1 Identify the pollinator and determine natural pollination levels

Natural pollination levels and the identity of the pollinator will be determined to assist in recovery management of wild populations and as an aid in establishing new populations of some taxa (eg. *C. xanthochila*). The project will have important management implications, such as determining the number of flowers in a group required to attract the pollinator and effect pollination, the synchronicity between pollinator appearance and flower opening/receptivity, the visitation/pollination rates by the pollinator and the habitat requirements of the pollinator.

The work will be managed under contract to NRE and will require expert input from pollination researchers and wasp taxonomists to enable identification of the pollinator(s) associated with the each taxon. The techniques adopted will be based on similar work undertaken elsewhere in Australia (Bower 1996). Funds are required in years 2 and 3 to enable the appointment of a specialist contractor to conduct wasp-baiting trials in the field and to provide training to departmental staff and volunteers on assessing pollination rates and pollinator capture techniques. Funds are also required in years 2 and 3 to contract the Department of Primary Industries and Fisheries, Northern Territory (PIF) to undertake the taxonomic work. Laboratory facilities and consumables will be provided in kind by PIF.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 6.1			X	X		X			X		X	X
Responsibility			NRE – PFF/ SW, PIF	NRE – PFF/ PP, PIF, FOWH		NRE – PFF/ NW, PIF, FOKR			NRE – PFF/ NW, PIF, FOKR		NRE – PFF/ NW, PIF	NRE – PFF/ NW, PIF, COM

Source	2000	2001	2002	2003	2004	Total
Total	$0	$8,500	$8,500	$0	$0	$17,000

6.2 Determine genetic relationships of disjunct populations.

Many threatened *Caladenia* taxa are known from a small number of disjunct populations that may be many hundreds of kilometres apart. Determining the genetic differences or similarities between and within these populations will be important when trying to determine the former ranges and magnitude of decline of these taxa, when cultivating *ex situ* collections of plants for re-introduction and when implementing re-introduction plans (see *Action 8.2*). Some genetic research may also help resolve some of taxonomic uncertainties surrounding a number of closely related taxa.

Several widespread taxa with disjunct populations will be targeted for genetic analysis including *C. formosa, C. rosella, C. tensa, C. versicolor* and *C. xanthochila.* The work will be undertaken by a specialist geneticist based at the Royal Botanic Gardens, Melbourne under contract to NRE. The genetic analysis will use the ALFP technique (Amplified Fragment Length Polymorphism). This technique has been used successfully for the analysis of genetic diversity in a number of rare species. The contractor will provide laboratory facilities, equipment and research-management salaries in kind.

Funds are required in years 2 and 3 of recovery to contract an expert geneticist to undertake the work and to cover the cost of consumables (eg. chemicals). Costs are based on the analysis of up to 6 populations and 15 plants per population. Plant material will be collected by the project officer, regional staff, land management agency staff, volunteers and contractors as part of annual censusing (see *Action 5.1*) and forwarded to the geneticist for analysis.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 6.2			X					X	X		X	X
Responsibility			NRE – PFF/ SW, EH, RBG					NRE – PFF/ PP/NW, RBG	NRE – PFF/ NW, EH, RBG, FOKR		NRE – PFF/ NW, EH, RBG	NRE – PFF/ NW, RBG, COM

Source	2000	2001	2002	2003	2004	Total
Total	$0	$26,215	$26,215	$0	$0	$52,430

6.3 Investigate germination and seedling establishment.

Rates of seed germination will be assessed under a range of conditions and factors affecting seedling establishment will be investigated to determine preferred methodologies for establishment of different threatened taxa. Propagation techniques will be further investigated as part of *Action 7.2.*

This work will be important in developing actions designed to optimise recruitment of existing populations and establishing new populations of endangered taxa. Target taxa will initially include *C. amoena, C. audasii, C. fragrantissima* ssp. *orientalis, C. hastata, C. lowanensis, C. robinsonii, C. rosella, C. thysanochila, C. versicolor* and *C. xanthochila.*

The work will be conducted by contractors and coordinated by NRE. Funds are sought in years 2 and 3 to enable the appointment of the University of Melbourne, Institute of Land and Food Resources to undertake the project and to cover the costs of laboratory consumables. Laboratory facilities will be provided in kind by the contractor as will project supervision in conjunction with the Royal Melbourne Institute of Technology and RBG. Capsules/seeds will be collected by the project officer, state department regional staff, land management agency staff, volunteers and contractors as part of *Action 4.2 – Harvest and store seed.*

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 6.3	X	X		X	X	X	X	X		X	X	X
Responsibility	NRE – PFF, UMILFR, , RBG, RMIT	NRE – PFF, UMILFR, , RBG, RMIT		NRE – PFF, UMILFR, , RBG, RMIT	NRE – PFF, UMILFR, , RBG, RMIT	NRE – PFF, UMILFR, , RBG, RMIT	NRE – PFF, UMILFR, , RBG, RMIT	NRE – PFF, UMILFR, , RBG, RMIT		NRE – PFF, UMILFR, , RBG, RMIT	NRE – PFF, UMILFR, , RBG, RMIT	NRE – PFF, UMILFR, , RBG, RMIT

Source	2000	2001	2002	2003	2004	Total
Total	$0	$11,500	$11,500	$0	$0	$23,000

Action 7 Establish *ex-situ* collections of threatened *Caladenia* taxa with rapidly declining or critically low populations in the wild.

Populations of endangered *Caladenia* taxa need to be established and maintained in cultivation as insurance against catastrophe and further loss in the wild, and to provide plants for introduction to additional habitat or reintroduction to known or assumed former habitat. A number of spider-orchid taxa have been successfully propagated and cultivated in the past (eg. Carr 1988; D. Tonkinson, NRE, *pers. comm*.) and techniques are now available that ensure a reasonable level of confidence with respect to *ex-situ* cultivation of threatened taxa (K. Dixon, KPBG, *pers. comm.*).

Caladenia species can be successfully grown from seed and maintained in cultivation, although this is not an easy task, requiring specialist equipment and expertise.

A current collaborative project between RBG, RMIT, UMILFR and NRE to look at strategies for increasing population sizes of threatened *Caladenia* in Victoria, is focussing on developing techniques to improve survival of deflasked *Caladenia* seedlings. The PhD research project is also conducting seed viability trials and attempting to isolate various mycorrhizal fungi (Ruth Raleigh, University of Melbourne, *in prep.*). The results of this research will be used for developing *ex-situ* populations of various threatened *Caladenia* taxa for re-introduction to the wild.

Some commercial nurseries and private growers have an excellent record in keeping *Caladenia* species in cultivation. NRE is overseeing the operation of the Native Orchid Growers Network (NOGN) to bring together horticultural expertise amongst the orchid growing community to assist in the cultivation of threatened orchids for recovery programs. The involvement of NOGN in the recovery effort for various threatened *Caladenia* taxa will be instrumental in achieving this objective.

7.1 Isolate and culture mycorrhizal fungi

Techniques are being developed by a number of different institutions for isolating and culturing mycorrhizal fungi species associated with *Caladenia* taxa. Kings Park Botanic Garden, Perth has been able to successfully culture the mycorrhizal fungus associated with *Caladenia hastata* while research has been undertaken at the University of Melbourne and Royal Botanic Gardens, Melbourne to isolate and culture the fungi associated with a number of threatened and non-threatened *Caladenia* taxa. Work on isolating and culturing mycorrhizal fungi associated with all threatened *Caladenia* taxa will continue as part of the current recovery plan.

The project will provide information to assist with management of field populations, reintroductions and will enhance propagation and cultivation outcomes. The work will require specialist expertise in mycology, particularly the identification and culture of fungi in the laboratory. The University of Melbourne, Institute of Land and Food Resources, Burnley will undertake the work for all taxa. Portland Aluminium and Kings Park Botanic Gardens, Perth will continue their fungal involvement with *C. hastata*.

Funding is required for years 2 and 3 of recovery inclusive to enable the purchase of laboratory consumables and to pay for a contractor to collect, culture, store and supply fungal replicates. Laboratory facilities will be donated in kind by UMILFR as part of their contribution to the recovery of threatened *Caladenia* taxa as will staff time for project supervision (see *Action 7.2*). The project will be managed under contract to NRE, which will also provide staff to assist with the collection of collars or root tips and/or the laying of fungal baits in the field as required. Senior research staff from the University of Melbourne, the National Herbarium of Victoria and the Royal Melbourne Institute of Technology will provide project supervision in kind.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 7.1	X	X	X	X	X	X	X	X	X	X	X	X
Responsibility	NRE – PFF/ PP, UMILFR , RBG, RMIT, EH	NRE – PFF/ NW, UMILFR , RBG, RMIT, EH	NRE – PFF/ SW, UMILFR , RBG, RMIT, EH	NRE – PFF/ NW, UMILFR , RBG, RMIT, EH	NRE – PFF/ SW, KPBG, PA, RBG, RMIT	NRE – PFF/ NW, UMILFR , RBG, RMIT, EH	NRE – PFF/ PP, UMILFR , RBG, RMIT, EH	NRE – PFF/ PP, UMILFR , RBG, RMIT, EH	NRE – PFF/ NW, UMILFR , RBG, RMIT, EH	NRE – PFF/ PP, UMILFR , RBG, RMIT, EH	NRE – PFF/ NW, UMILFR , RBG, RMIT, EH	NRE – PFF/ NW, UMILFR , RBG, RMIT, EH

Source	2000	2001	2002	2003	2004	Total
Total	$1,000	$13,500	$12,500	$0	$0	$27,000

7.2 Develop *in vitro* propagating techniques and establish seedlings in cultivation

While *Caladenia* seed can be collected and germinated, techniques for deflasking seedlings and establishing in pots for growing-on prior to reintroduction to the wild have proved problematic in the past. Tuberisation techniques currently being developed by KPBG and RBG are expected to greatly improve propagation success rates for various threatened *Caladenia* taxa (K. Dixon, KPBG, *pers. comm.*, R. Cross, RBG, *pers. comm.*) and these techniques will be adapted for the recovery plan.

Seedlings will be grown on to mature plants for additional seed production, genetic management and for introduction to the wild using the fungal isolates derived from *Action 7.1.* At least 100 plants of each endangered taxon will be produced and then distributed to State and National Botanic Gardens in Melbourne, Adelaide and Canberra and other NOGN member growers to minimise the loss of all cultivated plants through a single catastrophe. Target taxa will initially include the endangered taxa, *C. amoena, C. audasii, C. fragrantissima* ssp. *orientalis, C. hastata, C. lowanensis, C. robinsonii, C. rosella, C. thysanochila, C. versicolor* and *C. xanthochila.*

The University of Melbourne, Institute of Land and Food Resources will be contracted to undertake work on nine endangered *Caladenia* taxa. Portland Aluminium and KPBG will maintain their involvement with propagating and cultivating *C. hastata* and information sharing between the groups will be encouraged and facilitated by NRE.

Funding is required in years 2, 3 and 4 of recovery to contract the University of Melbourne to carry out the work. Growth chambers and glasshouse space will be donated in kind by UMILFR as part of their contribution to the threatened *Caladenia* recovery plan as will staff project supervision time. NRE will coordinate the project.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 7.2	X	X		X	X	X	X	X		X	X	X
Responsibility	NRE – PFF, UMILFR	NRE – PFF, UMILFR		NRE – PFF, UMILFR	NRE – SW, KPBG, PA	NRE – PFF, UMILFR	NRE – PFF, UMILFR	NRE – PFF, UMILFR		NRE – PFF, UMILFR	NRE – PFF, UMILFR	NRE – PFF, UMILFR

Source	2000	2001	2002	2003	2004	Total
Total	$0	$9,000	$9,000	$9,000	$0	$27,000

7.3 Maintain a database on cultivated plants

A central database of threatened orchids in cultivation has been established by NOGN. The purpose of the database is to maintain all records of cultivated plants, including seed source, locations, numbers and movements of plants, growing conditions and other information to keep track of plants amongst growers participating in the recovery program. Individual growers will maintain their own records to contribute to the central database. The information will be available to other organisations or agencies contributing to objectives and actions in this Recovery Plan and the conservation of threatened orchids in southeast Australia. NOGN will be responsible for maintaining the database. NRE will provide project coordination.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 7.3	X	X		X	X	X	X	X		X	X	X
Responsibility	NRE – PFF, NOGN.	NRE – PFF, NOGN.		NRE – PFF, NOGN	NRE – PFF, NOGN	NRE – PFF, NOGN	NRE – PFF, NOGN.	NRE – PFF, NOGN.		NRE – PFF, NOGN.	NRE – PFF, NOGN.	NRE – PFF, NOGN.

Source	2000	2001	2002	2003	2004	Total
Total	$0	$0	$1,200	$1,200	$1,200	$3,600

Action 8 Establish new populations of endangered *Caladenia* taxa in the wild

For many endangered *Caladenia* taxa known from single or very few populations, the risk of extinction in the wild from lack of population vigour or from a stochastic disturbance event remains very high. This is particularly so for taxa that are unreserved. In order to reduce this risk it will be necessary to establish new populations at other sites.

Techniques are currently being developed at KPBG that are expected to greatly improve the probabilities of success of plant transfer into new areas (K. Dixon, KPBG, *pers. comm.*). It is intended that these techniques will be further

developed as part of the current recovery plan. The aim of recovery will be to develop at least one additional self-maintaining population of each endangered *Caladenia* taxon in at least one protected reserve area.

8.1 Assess habitat preferences and select introduction sites

There are good quality habitat data available for several taxa but more detailed habitat information will be collected for other taxa from present and known former sites to define habitat preferences for each taxon. Data to be collected will include associated species, vegetation structure, geology and soils, rainfall and disturbance history.

The selection of suitable sites for introduction will need to consider a range of variables including site size, habitat, threats, management, land tenure and security. Where applicable, a range of introduction sites will be selected across the former range of the taxon to enable maintenance of regional genetic diversity pending the results of *Action 6.2*. 1: 100 000 Ecological Vegetation Class mapping (NRE in prep.) exists for the majority of sites containing populations of the twelve threatened *Caladenia* in Victoria as does floristic vegetation mapping of South east South Australia (Croft *et al.* 1999). These sources will be used to identify potential habitat and re-introduction sites.

Funds are required in years 2 and 3 of recovery to cover the salary and associated field/travel costs (eg. vehicle hire, travel allowance, consumables) of a project officer to collect and collate key data for the selection of introduction sites for each endangered *Caladenia* taxon. Land management agencies will cover the cost of staff involved with the selection of appropriate sites within reserves while state departmental staff will assist with the collection and collation of regional datasets such as disturbance histories.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 8.1	X	X		X	X	X	X	X		X	X	X
Responsibility	NRE – PFF, PV	NRE – PFF, PV		NRE – PFF, PV	NRE – PFF, PV	NRE – PFF, PV, EH	NRE – PFF, PV	NRE – PFF, PV		NRE – PFF, PV	NRE – PFF, PV, EH	NRE – PFF, PV, EH

Source	2000	2001	2002	2003	2004	Total
Total	$0	$5,590	$5,590	$0	$0	$11,180

8.2 Prepare reintroduction plans and establish plants at sites

A reintroduction plan will be prepared for each endangered *Caladenia* taxon, detailing any preparation of cultivated plants prior to reintroduction, methods of reintroduction (including using seed, tubers, seedlings or mature plants), timing, numbers of plants, experimental design, permanent marking grids and photo-points, monitoring techniques and frequency and other information as required.

Plants will be introduced to re-introduction sites following the guidelines set out in the reintroduction plans. The action requires the successful integration of horticultural and ecological experience, and will be undertaken by a specialist contractor, under contract to NRE. The contractor will be required to fully consult with all relevant land management agencies (eg. Parks Victoria) and interest groups.

Funding will be sought for years 4 and 5 of recovery to cover the costs of appointing a contractor to prepare reintroduction plans for all endangered taxa and to oversee the establishment of new populations, including site protection works such as weed control, pest animal control and/or fencing. Some funding will also be required in years 2 and 3 to implement re-introduction of taxa that are ahead of this general schedule (eg. *C. amoena*). Relevant land management agencies and regional threatened *Caladenia* community groups will be involved in the site preparation, planting, future monitoring and management of sites as detailed in the introduction plans.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 8.2	X	X		X	X	X	X	X		X	X	X
Responsibility	NRE – PFF, PV	NRE – PFF, PV, EH		NRE – PFF, PV	NRE – PFF, PV	NRE – PFF, PV, EH	NRE – PFF, PV	NRE – PFF, PV		NRE – PFF, PV	NRE – PFF, PV, EH	NRE – PFF, PV, EH

Source	2000	2001	2002	2003	2004	Total
Total	$0	$9,000	$9,000	$10,290	$10,290	$38,580

Action 9 Develop a public education/community extension program

By necessity, the recovery of threatened *Caladenia* taxa in southeast Australia in the short-term will rely heavily on input from expert botanists, ecologists and horticulturists. However, the responsibility for long-term survival of these taxa will ultimately rest with members of the community. Failure to educate the public about orchid conservation or a lack of public enthusiasm for orchid conservation will almost certainly result in the extinction of a number of currently threatened taxa.

Conversely, involving the community in key stages of the recovery process will dramatically increase the chances of survival of these taxa in the wild. A number of community groups are already involved with the recovery of threatened *Caladenia* taxa in Victoria (see Table 9) but greater awareness in the wider community will need to be fostered through the production and delivery of threatened orchid public education and community extension programs that focus on threatened *Caladenia* taxa.

9.1 Prepare educational material and undertake community extension

A range of promotional and educational material on threatened *Caladenia* taxa will be made available for public consumption. These materials will include printed information such as colour pamphlets, posters and information sheets and electronic information on state department web pages. These media will be used to provide information on rare and threatened orchids of southeast Australia, with a focus on threatened *Caladenia* species. Colour photographs, distribution maps and key identification features will be included.

Individuals will be encouraged to report sightings of threatened *Caladenia* taxa to local state agency personnel for verification. Information on where to access further information or how to make contact with interest groups and regional recovery teams (see *Action 10.1*) will also be provided. Educational material will also be used as part of on-going community extension work conducted by state government departments and to generate regional media interest as a way of promoting orchid conservation and raising public awareness in regional areas. Public education and community extension projects will endeavour to build on existing activities already being conducted in regional areas by other organisations.

It is intended to run a pilot program in southeast South Australia/southwest Victoria in the first three years of recovery. This will involve a number of organisations including field naturalists clubs, Catchment Management Authorities, Trust for Nature (Victoria), orchid groups, NRE and EH and will build on an existing landowner/community threatened orchid network project being conducted in southeast South Australia and managed by EH. The success of this pilot program will determine whether similar projects are attempted in the other regions in subsequent years of recovery.

Funds are sought in the first three years of recovery to cover the salary and associated field costs (eg. vehicle hire, travel allowance, consumables) of a regionally-based (eg. Hamilton) project officer to coordinate and undertake the threatened orchid education program in south west Victoria and south east South Australia. Funds are also sought in years 1 and 2 of recovery to cover the cost of designing and producing a range of promotional and educational materials including a colour poster and pocket identification guide of threatened orchids of south east South Australia/south west Victoria. If considered successful, further funding will be sought in subsequent years for other areas of southeast Australia.

NRE or the Glenelg-Hopkins CMA will provide office space and computer/telecommunications facilities for the regional project officer and both NRE/EH will cover the cost of developing electronic information on department web pages and implementing on-going community extension programs.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 9.1		X	x		X	X			X		X	X
Responsibility		NRE – PFF, local groups – see above	NRE – PFF, local groups – see above		NRE – PFF, local groups – see above	NRE – PFF, local groups – see above			NRE – PFF, local groups – see above		NRE – PFF, local groups – see above	NRE – PFF, local groups – see above

Source	2000	2001	2002	2003	2004	Total
Total	$42,100	$42,100	$0	$0	$0	$84,200

Action 10 Manage Recovery Plan implementation

Recovery of most of the threatened *Caladenia* taxa of southeast Australia will likely be a complex, difficult operation involving a high degree of uncertainty. Many different disciplines will be required for effective implementation of the Recovery Plan. Recovery program planning and management needs to be addressed to ensure effective and efficient implementation of the recovery program, through communication and coordination amongst all participants. This will be particularly important when dealing with such a large number of taxa spread over a wide geographic range and across state boundaries.

10.1 Expand the Threatened Orchid Recovery Team (TORT)

NRE formed the Threatened Orchid Recovery Team in 1999 to oversee orchid recovery in Victoria. This group is made up of various NRE representatives, botanists, orchid taxonomists, horticulturists and land management agency representatives, each with an active role in threatened orchid conservation and management in Victoria.

The TORT will be expanded to include representatives of EH, NSW NPWS and other regional organisations involved with the recovery of threatened orchids in southeast Australia. The Recovery Team will coordinate and maintain day to day operational implementation of the Recovery Plan, and develop targets and performance measures for actions under the Plan. Interstate consultation and site visits will be required in the first year of implementation, followed by one consultative Recovery Team meeting and one telephone conference meeting in subsequent years. Government agencies will be responsible for covering their own costs of participation in the recovery team.

Funding will be sought in years 1-5 of recovery to cover the cost of travel for community representatives attending Threatened Orchid Recovery Team meetings.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 10.1	X	X	x	X	X	X	X	X	X	X	X	X
Responsibility	The Threatened Orchid Recovery Team will have a rotating chair and will include representatives of a number of stakeholder groups.											

Source	2000	2001	2002	2003	2004	Total
Total	$4,810	$2,900	$2,900	$2,900	$2,900	$16,410

10.2 Establish a regional recovery team for each taxon

Regional threatened *Caladenia* recovery teams will be established for each taxon. These teams will be facilitated by NRE/EH and include representatives of land management agencies, private landholders, local government, catchment management authorities, field naturalists clubs, NOGN, ANOS and other interested parties.

Teams already in existence for particular taxa will continue to be encouraged and supported by involvement in key recovery actions as set out in this plan. These groups will also be encouraged to take on the recovery of additional taxa that may occur in their geographic area. New groups will be established by approaches through existing regional natural history clubs and associations and through contact with the public via *Action 9.1.* Regional recovery teams may be responsible for one taxon in a particular area, one taxon across its range or a number of taxa within a particular area. The aim of recovery will be to ensure that each taxon has a regional recovery team that has delegated custodial and on-ground action responsibilities.

Links between regional recovery teams will be conducted through the Threatened Orchid Recovery Team (TORT – see *Action 10.1*) managed by NRE. These links will enable more efficient flow of information between and within groups and key regional recovery team members will be invited to join TORT. Recovery team members will be trained in the various aspects of threatened *Caladenia* conservation and recovery.

Funds are required in years 1-5 of recovery to cover travel costs of community group members attending key recovery actions and regional recovery team meetings. Community group members will provide their labour 'in kind' as their contribution to threatened *Caladenia* recovery. NRE will facilitate the establishment of new groups in Victoria and South Australia with the assistance of EH.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 10.2	X	X	x	X	X	X	X	X	X	X	X	X
Responsibility	NRE – PFF/ PP, PV	NRE – PFF/ NW, PV, BFNC, SFNC	NRE – PFF/ SW, EH	NRE – PFF/ PP, PV	NRE – PFF/ SW, PV, PA, WGAC	NRE – PFF/ NW, PV, UMILFR, FOKR	NRE – PFF/ PP, Shire, FOBCCR	NRE – PFF/ PP	NRE – PFF/ NW, PV, EH, FOKR	NRE – PFF/ PP, Shire, FOMERP	NRE – PFF/ NW, SFNC	NRE – PFF/ NW, BFNC, COM

Source	2000	2001	2002	2003	2004	Total
Total	$6,140	$6,140	$6,140	$6,140	$6,140	$30,700

10.3 Prepare and review the Victorian FFG Action Statements for various threatened *Caladenia* taxa

An Action Statement under the Victorian *Flora and Fauna Guarantee Act* 1988 exists for *C. audasii* while a number of draft action statements are in preparation for some other taxa (*C. amoena, C. hastata, C. robinsonii, C. rosella* and *C. thysanochila*). The remaining six taxa have no first draft Action Statement prepared.

Information and actions under the national recovery plan will be collated for inclusion in a generic Action Statement for threatened Victorian *Caladenia* taxa. This Action Statement will be an abbreviated version of the Recovery Plan and will fill a need for public information on the various taxa and recovery actions. The costs of preparing and publishing the Action Statement will be met by NRE.

	C. amoena	*C. audasii*	*C. formosa*	*C. fragrantissima* ssp. *orientalis*	*C. hastata*	*C. lowanensis*	*C. robinsonii*	*C. rosella*	*C. tensa*	*C. thysanochila*	*C. versicolor*	*C. xanthochila*
Action 10.3	X	X	x	X	X	X	X	X	X	X	X	X
Responsibility	NRE – PFF	NRE – PFF	NRE – PFF	NRE – PFF	NRE – PFF	NRE – PFF	NRE – PFF	NRE – PFF	NRE – PFF	NRE – PFF	NRE – PFF	NRE – PFF

Source	2000	2001	2002	2003	2004	Total
Total	$0	$0	$5,000	$0	$0	$5,000

11 Bibliography

Backhouse, G., Bramwells, H., Musker, R., Walker, G. and Lester, K. (1999a). Draft Recovery Plan for the Frankston Spider-orchid, *Caladenia robinsonii* G.W. Carr, 1999-2003. Department of Natural Resources and Environment, Melbourne.

Backhouse, G.N., Beardsell, C., Tonkinson, D. and French, G. (1999b). Draft Recovery Plan for the Charming Spider-orchid, *Caladenia amoena* (Orchidaceae: Caladeniinae) 1998-2002. Department of Natural Resources and Environment, Melbourne.

Backhouse, G.N. and Jeanes, J.A. (1995). *The Orchids of Victoria*. The Meigunyah Press, Melbourne.

Beardsell, C.M. and Muir, A.M. (1992). A recovery plan for Rosella Spider-orchid (*Caladenia rosella* G.W. Carr). Unpublished report to the Australian National Parks and Wildlife Service, Canberra.

Bedward, M., Pressey, R.L. and Keith, D. (1992). A new approach for selecting fully representative networks: addressing efficiency, reserve design and land suitability with an iterative analysis. *Biological Conservation* **62:** 115-125.

Berwick, S., Moorrees, A. and Backhouse, G. (1999). Draft Recovery Plan for Audas' Spider-orchid *Caladenia audasii* (Orchidaceae: Caladeniinae) 1998-2002. Department of Natural Resources and Environment, Melbourne.

Bevill, R.L., Louda, S.M. and Stanforth, L.M. (1999). Protection from natural enemies in managing rare plant species. *Conservation Biology* **13**(6): 1323-1331.

Bower, C.C. (1996). Determination of the pollinators of sexually deceptive orchids in the subtribe Caladeniinae. Unpublished report to the Australian Orchid Foundation, NSW.

Briggs, J.D and Leigh, J.H. (1995). *Rare or Threatened Australian Plants*. 1995 Revised edition. CSIRO Publications, Melbourne.

Carr, G.W. (1988). Portland Aluminium Smelter Environmental Design Report No. 4: Mellblom's Spider-orchid Conservation. Part A: Status and Conservation. Kinhill Planners, Melbourne.

Carr, G.W. (1991). New taxa in *Caladenia* R. Br., *Chiloglottis* R. Br. and *Gastrodia* R. Br. (Orchidaceae) from southeast Australia. Miscellaneous Paper No. 1, Indigenous Flora and Fauna Association.

Carr, G.W. (1999). Mellblom's Spider-orchid. *Nature Australia* **26**(4): 18-19.

Carr, G.W., Temby, I.D., Muir, A.M. and McMahon, A.R.G. (1993). Flora, fauna and management of Dunmoochin Conservation Area, Shire of Eltham, Victoria. Unpublished report to the Victorian Conservation Trust, Melbourne. Ecology Australia P/L, Melbourne.

Carr, G.W., Yugovic, J.V. and Robinson, K.E. (1992). *Environmental weed invasions in Victoria. Conservation and management implications.* Department of Conservation and Environment and Ecological Horticulture P/L, Melbourne.

Clements, M.A. (1989). Catalogue of Australian Orchidaceae. *Aust. Orch. Res.* **1**: 1-160.

Clements, M.A. (1993). The status of recently named orchids from southeast Australia. *Muelleria* **8**(1): 69-72.

Commonwealth of Australia (1992). Endangered Species Protection Act.

Commonwealth of Australia (1999). An interim bioregionalisation of Australia. Environment Australia, Canberra.

Commonwealth of Australia (2000). *West Victoria Regional Forest Agreement Consultation Paper.* Prepared by the Joint Commonwealth/Victorian RFA Steering Committee, Barton ACT.

Croft, T., Carruthers, S., Possingham, H. and Inns, B. (1999). *Biodiversity Plan for the South East of South Australia*. Department of Environment, Heritage and Aboriginal Affairs, South Australia.

ECC (in prep.). ECC Box Ironbark Investigation Draft Report. Environment Conservation Council, Melbourne.

Gill, A.M., Groves, R.H. and Noble, I.R. (1981). *Fire and the Australian biota.* Australian Academy of Science, Canberra.

Gill, A.M. (in press). Biodiversity and Bushfires: An Australia-wide perspective on plant-species changes after fire. Environment Australia, Canberra.

Gordes, C and Gordes, F. (1994). Save the Bush Management Plan for Frankston Spider-orchid (*Caladenia robinsonii*) and Widdop Reserve, Frankston. Unpublished report to the Mornington Peninsula Shire Council.

Harden, G.J. (1993). *Flora of New South Wales.* Volume 4. Royal Botanic Gardens, Sydney.

Hill, J., Carr, G., Pritchard, A., Govanstone, A. and Backhouse, G. (1999).Draft Recovery Plan for Mellblom's Spider-orchid *Caladenia hastata* (Orchidaceae: Caladeniinae) 1998-2002. Portland Aluminium and Department of Natural Resources and Environment, Melbourne.

Hopkins, A.J.M. and Saunders, D.A. (1987). Ecological studies as the basis for management. In: *Nature Conservation: The role of remnants of native vegetation.* (eds. D.A. Saunders, G.W. Arnold, A.A. Burbidge and A.J.M. Hopkins) pp. 15-28. Surrey Beatty and Sons, Chipping Norton, NSW.

Hutchings, M.J. (1987). The population biology of the early spider orchid, *Ophyris sphegodes* Mill. I. A demographic study from 1975 to 1984. *Journal of Ecology* **75:** 711-727.

Jessop, J.P. and Toelken, H.R. (1986). *Flora of South Australia*. Part IV Alismataceae – Orchidaceae. 4th Edition. South Australian Government Printer, Adelaide.

Jones, D.L. (1988). *Native Orchids of Australia.* Reed, Melbourne.

Jones, D.L. (1991). New taxa of Australian Orchidaceae. *Australian Orchid Research* **2**: 1-207.

Jones, D.L. (1994). New species of Orchidaceae from southeast Australia. *Muelleria* **8**(2): 177-92.

Jones, D.L. (1999). Eight new species of *Caladenia* from Eastern Australia. *The Orchadian* **13**(1): 5-24.

Kindlemann, P. and Balounova, Z. (1999). Flowering regimes of terrestrial orchids: unpredictability or regularity? *Journal of Vegetation Science* **10**: 269-273.

LCC (1993). *Melbourne Area, District 2 Review.* Proposed Recommendations. Land Conservation Council, Melbourne.

Light, M.H.S. and MacConaill, M. (1994). Climate correlations with patterns of appearance of *Epipactis helleborine* (L.) Crantz. *Eurorchis 92. Proceedings of the International Symposium on European Orchids* (eds. P. Brederoo and D.W. Kapteyn den Boumeester). Stichting Uitgeverij Koninkliijke Nederlandse Natuuhistorische Vereniging in cooperation with the Stichting Europese orchideen van de KNNV. Utecht/Haalem, February 1994.

Noble, I.R. and Slatyer, R.O. (1980). The use of vital attributes to predict successional changes in plant communities subject to recurrent disturbances. *Vegetatio* **43**: 5-21.

NRE (1996). *Little Desert National Park Management Plan*. National Parks Service. Department of Natural Resources and Environment, Melbourne.

NRE (1999). *Interim guidelines and procedures for ecological burning on public land in Victoria.* Fire Ecology Working Group. Department of Natural Resources and Environment and Parks Victoria, Melbourne.

NRE (in prep.). A typology of vegetation in Victoria: Towards a census of Victorian plant communities. Department of Natural Resources and Environment, Melbourne.

Parks Victoria (1996). *Discovery Bay Parks Draft Management Plan.* Parks Victoria, Melbourne.

Peakall, R. and Beattie, A.J. (1996). Ecological and genetic consequences of pollination by sexual deception in the orchid *Caladenia tentaculata. Evolution* **50**(6): 2207-2220.

Pressey, R.L., Ferrier, S., Hutchinson, C.D., Siverston, D.P. and Manion, G. (1995). Planning for negotiation: using an interactive geographic information system to explore alternative protected area networks. In: *Nature Conservation 4: the role of networks.* D.A. Saunders, J.L. Craig and E.M. Matiske (eds.). Surrey Beatty & Sons, Chipping Norton, NSW.

Purdie, R.W. (1977). Early stages in regeneration after burning in dry sclerophyll vegetation. 1: Regeneration of understorey of vegetative means. *Aust. J. Botany.* **25**(1): 21-34.

Tolhurst, K.G. (1999). Towards the implementation of ecologically based fire regimes in the Grampians National Park. In: *Management of Fire for the Conservation of Biodiversity – Workshop Proceedings.* G.R. Friend, M. Leonard, A. Maclean and I. Sieler (eds.). pp 30-38. Department of Natural Resources and Environment, Melbourne.

VicRFASC (1999). *West Victoria Comprehensive Regional Assessment*. Volume 2. Commonwealth of Australia, Canberra and the Victorian Regional Forest Agreement Steering Committee, Melbourne.

Walsh, N.G. and Entwisle, T.J. (1994). *Flora of Victoria Vol 2*. Inkata, Melbourne.

Walter, K.S. and Gillet, H.J. (eds.) (1998). *1997 IUCN Red List of Threatened Plants.* IUCN, Gland, Switzerland and Cambridge, United Kingdom.

Warcup, J.H. (1981). The mycorrhizal relationships of Australian orchids. *New Phytology* **87**: 371-381.

Wark, M.C. (1996). Regeneration of heath and heathy woodland in the north-eastern Otway Ranges three to ten years after wildfire of February 1983. *Proceedings of the Royal Society of Victoria* **108**(2): 121-142.

12 Glossary

bioregion	Biogeographic regions that capture the patterns of ecological characteristics in the landscape
box	Group of eucalypts with persistent, short-fibred, tessellated bark
community	Vegetation – an assemblage of plant species or life-forms that occur commonly together in the wild
dicot	Dicotyledon – group of plants that produce two seed leaves when they germinate (does not include orchids, lilies, grasses, sedges and rushes) – see *monocot*
Ecological Vegetation Class	A vegetation classification unit based on similarities in plant life-form, environmental conditions, reproductive biology and landform – widely used in Victoria as part of the Regional Forest Agreement process
ex-situ	Refers to activities conducted in a laboratory, glasshouse or other "non-natural" area - see *in-situ*
herb	A plant with fleshy (not woody) stems – applied usually to dicots (non-grasses, rushes, sedges)
heathland	Dense, often low-growing, shrubby vegetation dominated by tough, wiry-stemmed, small-leaved (often prickly) plants
heathy woodland	Woodland dominated by trees with usually short, crooked and/or spreading trunks and a groundcover of mostly heathland plants
herbivore	A grass (herb) eating animal
in-situ	Refers to activities undertaken in the wild - see *ex-situ*
ironbark	Type of eucalypt with persistent, deeply fissured bark
monocot	Monocotyledon – Group of plants that produce one seed leaf when they germinate (includes orchids) – see *dicot*
mycorrhiza	A root modified by its association with a symbiotic fungus; or the relationship between the root and the fungus
pseudocopulation	The mechanism employed when a flower mimics a female insect in order to be pollinated by the male insect attempting copulation with the flower
taxon	(pl. taxa) Term used to describe any taxonomic group (eg. species, sub-species, variety etc.)
tuber	Thickened underground storage organ

13 Implementation Schedule

Task	*Description*	*Priority*	*Feasibility*	*Responsibility*	*Cost estimate*					
			%		2000	2001	2002	2003	2004	Total
	Conservation status									
1.1	Verify/identify populations	1	100%	**NRE**	**$20,170**	**$18,670**	**$0**	**$0**	**$0**	**$38,840**
2	**Protect habitat**									
2.1	Determine key populations	2	100%	NRE	**$0**	**$750**	**$0**	**$0**	**$0**	**$750**
2.2	Reserve public land	2	80%	NRE	**$0**	**$4,790**	**$3,750**	**$0**	**$0**	**$8,540**
2.3	Protect private land	2	25%	NRE	**$0**	**$14,690**	**$11,650**	**$0**	**$0**	**$26,340**
3	**Protect populations**									
3.1	Control weeds	1	80%	NRE	**$22,060**	**$16,200**	**$14,700**	**$14,700**	**$14,700**	**$83,360**
3.2	Control pest animals	1	80%	NRE	**$4,960**	**$3,250**	**$2,250**	**$2,250**	**$2,250**	**$14,960**
3.3	Fire management	1	75%	NRE	**$5,470**	**$5,470**	**$4,000**	**$9,250**	**$9,250**	**$33,440**
3.4	Cinnamon Fungus control	2	90%	NRE	**$350**	**$350**	**$350**	**$350**	**$350**	**$1,750**
4	**Fine-scale management**									
4.1	Hand pollinate	1	100%	NRE	**$4,810**	**$3,010**	**$4,130**	**$4,130**	**$4,130**	**$20,210**
4.2	Harvest and store seed	1	100%	NRE	**$5,400**	**$6,600**	**$6,600**	**$6,600**	**$6,600**	**$31,800**
4.3	Manage microhabitat	2	75%	NRE	**$6,420**	**$8,220**	**$6,850**	**$6,850**	**$6,850**	**$35,190**
5	**Population monitoring**									
5.1	Annual censusing	1	100%	NRE	**$33,360**	**$36,810**	**$36,810**	**$22,850**	**$22,850**	**$152,680**
6	**Biology, ecology**									
6.1	Pollination	3	70%	NRE	**$0**	**$8,500**	**$8,500**	**$0**	**$0**	**$17,000**
6.2	Genetics	2	70%	NRE	**$0**	**$26,215**	**$26,215**	**$0**	**$0**	**$52,430**
6.3	Germination	3	50%	NRE	**$0**	**$11,500**	**$11,500**	**$0**	**$0**	**$23,000**
7	**Cultivation**									
7.1	Mycorrhizal Fungus	2	75%	NRE	**$1,000**	**$13,500**	**$12,500**	**$0**	**$0**	**$27,000**
7.2	Propagation and cultivation	2	75%	NRE	**$0**	**$9,000**	**$9,000**	**$9,000**	**$0**	**$27,000**
7.3	Database	3	100%	NOGN	**$0**	**$0**	**$1,200**	**$1,200**	**$1,200**	**$3,600**
8	**Reintroduction**									
8.1	Select sites	2	80%	NRE	**$0**	**$5,590**	**$5,590**	**$0**	**$0**	**$11,180**
8.2	Introduction plan	2	100%	NRE	**$0**	**$9,000**	**$9,000**	**$10,290**	**$10,290**	**$38,580**
9	**Education**									
9.1	Community education	3	90%	NRE	**$42,100**	**$42,100**	**$0**	**$0**	**$0**	**$84,200**
10	**Recovery management**									
10.1	TORT	2	90%	NRE	**$4,810**	**$2,900**	**$2,900**	**$2,900**	**$2,900**	**$16,410**
10.2	Regional recovery teams	2	90%	NRE	**$6,140**	**$6,140**	**$6,140**	**$6,140**	**$6,140**	**$30,700**
10.3	Action Statements	3	100%	NRE	$0	$0	$5,000	$0	$0	$5,000
				Grand Totals	**$157,050**	**$257,505**	**$188,635**	**$96,510**	**$87,510**	**$787,210**

Appendix 1

Relationship between Specific Objectives, Progress Criteria and Actions for the recovery of twelve threatened *Caladenia* taxa of Victoria and South Australia.

Specific Objectives (short-term)		Progress Criteria	Actions	
Ensure that all existing populations are protected	→	A. Determination of the conservation status of taxa in the wild	1.1	Verify and identify populations
	→	B. Establishment of Protected Area Network	2.1	Determine key populations
			2.2	Reserve key public land populations
			2.3	Protect key private land sites
Increase the numbers of plants of each taxon in the wild	→	C. Decrease in threats to populations	3.1	Control weeds
			3.2	Control animal pests
			3.3	Fire management
			3.4	Control Cinnamon Fungus
	→	D. Increase in abundance of each population	4.1	Hand pollinate
			4.2	Harvest and store seed
			4.3	Manage microhabitat
			5.1	Conduct annual censusing
	→	E. Identification of key components of biology and ecology	6.1	Pollinator, pollination
			6.2	Genetics
			6.3	Seed germination, seedling establishment
Establish endangered taxa in cultivation	→	F. Development of successful propagation techniques and establishment of plants in cultivation	7.1	Isolate and culture mycorrhizal fungus
			7.2	Establish seedlings
			7.3	Maintain database
Increase the number of populations in the wild	→	G. Establishment of at least one population of each endangered taxon in a secure area in the wild	8.1	Select introduction sites
			8.2	Prepare re-introduction plans and establish plants
Raise public awareness and foster community involvement	→	H. Increased community involvement in pivotal aspects of recovery	9.1	Education, extension
All of the above	→	A-H Manage recovery program	10.1	Regional recovery teams
			10.2	Expand TORT
			10.3	Action Statement

Appendix 2: Summary of recovery actions for twelve threatened *Caladenia* taxa of Victoria and South Australia

Charming Spider-orchid *Caladenia amoena*

Conservation status: Critically Endangered (IUCN Red List)

Current distribution: Plenty, Wattle Glen - north east of Melbourne – Victorian Midlands Bioregion

Current abundance: Approximately 45 plants in the wild

Habitat: Box-Ironbark Forest; Grassy Dry Forest (*sensu* NRE, in prep.)

Reservation status: Unreserved

Management: Parks Victoria, private landowner

Recovery objectives: Protection and fine-scale management of populations and *ex situ* cultivation/re-introduction of plants

Recovery actions undertaken:

- Control of annual and perennial exotic grasses at Plenty
- Fencing of populations at Plenty to control grazing
- Caging of plants at Wattle Glen to control pests and predators
- Control of visitor access to Plenty site
- Hand pollination of plants at both sites
- Collection and storage of capsules (seed) at KPBG, Perth, WA
- Fine-scale habitat management at both sites – leaf litter scattering etc.
- Population monitoring
- Production of information brochure

Recovery actions required:

1.1 Identify and survey potential habitat in the Plenty Valley for other populations

2.2 Reserve populations on public land at Plenty under appropriate state legislation

2.3 Protect populations on private land at Wattle Glen through appropriate land management agreements

3.1 Control high-priority weed species at known sites (eg. Perennial Veldt-grass, annual grasses)

3.2 Control animal pests and predators through fencing and/or caging of populations or habitat

4.1 Hand pollinate plants annually

4.2 Harvest and store seed annually

4.3 Manage micro-habitat using litter scattering and seed-bed preparation techniques

5.1 Conduct annual censusing of populations

6.1 Identify pollinator and determine natural pollination levels of both populations

6.3 Investigate seed viability, germination and seedling establishment

7.1 Isolate and culture the mycorrhizal fungus

7.2 Establish seedlings in cultivation and maintain a number of plants *ex situ*

7.3 Maintain a database of cultivated plants

8.1 Select introduction sites in the Plenty Valley

8.2 Prepare an introduction plan and introduce plants to at least one reserved site in the Plenty Valley

10.2 Support and maintain Charming Spider-orchid Recovery Team made up of NRE – PFF, NRE – PP, PV, private landholders and one expert botanist

10.3 Prepare and review the Victorian FFG Action Statement for *C. amoena*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, PP; Parks Victoria

Bibliography:

Backhouse, G.N., Beardsell, C., Tonkinson, D. and French, G. (1999). Draft Recovery Plan for the Charming Spider-orchid *Caladenia amoena* (Orchidaceae: Caladeniinae) 1998-2002. Department of Natural Resources and Environment, Melbourne.

Carr, G.W. (1991). New taxa in *Caladenia* R. Br., *Chiloglottis* R. Br. and *Gastrodia* R. Br. (Orchidaceae) from south eastern Australia. Miscellaneous Paper No. 1. *Indigenous Flora and Fauna Association.*

Audas' Spider-orchid *Caladenia audasii*

Conservation status: Critically Endangered (IUCN Red List)

Current distribution: Bendigo, Deep Lead & Kingower – Victorian Midlands Bioregion

Current abundance: Five plants in the wild

Habitat: Box-Ironbark Forest; Grassy Dry Forest (*sensu* NRE, in prep.)

Reservation status: Reserved at Bendigo (One Tree Hill Regional Park)

Management: Parks Victoria, Kingower Cemetery Committee of Management, NRE - Forests

Recovery objectives: Protection and fine-scale management of populations and *ex situ* cultivation/re-introduction of plants

Recovery actions undertaken:

- Caging of plants at Bendigo and Kingower
- Weed control at Bendigo and Kingower
- Hand pollination of plants at all sites
- Collection and storage of capsules (seed) at KPBG, Perth, WA
- Fine-scale habitat management at all sites – leaf litter scattering, summer watering etc.
- Population monitoring
- Survey of likely habitat in all areas
- Establishment of regional recovery team

Recovery actions required:

1.1 Further identify and survey potential habitat in the Victorian Midlands Bioregion for other populations

2.1 Reserve populations on public land at Kingower (PAMA) and Stawell (Crown Land (Reserves) Act 1978

3.1 Control high-priority weed species at all sites (eg. annual grasses, *Freesia* sp.)

3.2 Control animal pests and predators at Bendigo through re-designed caging of populations

4.1 Hand pollinate plants annually

4.2 Harvest seed from cross-pollinated plants and store seed annually

4.3 Manage micro-habitat using litter scattering and seed-bed preparation techniques

5.1 Conduct annual censusing of populations

6.1 Identify pollinator (low probability – see *Implementation Schedule*)

6.2 Determine genetic relationship of three populations

6.3 Investigate seed viability, germination and seedling establishment

7.1 Isolate and culture the mycorrhizal fungus

7.2 Establish seedlings in cultivation and maintain a number of plants *ex situ*

7.3 Maintain a database of cultivated plants

8.1 Select introduction sites dependent on findings from 6.2 above.

8.2 Prepare an introduction plan and introduce plants to at least one reserved site in the Victorian Midlands

9.1 Prepare education material and undertake community extension

10.2 Maintain and support the Audas' Spider-orchid Recovery Team consisting of NRE – PFF, NRE – NW, NRE – SW, PV

10.3 Review the Victorian FFG Action Statement for *C. audasii*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, NW, Forests; Parks Victoria; *C. audasii* Recovery Team; Bendigo Field Naturalists Club; Stawell Field Naturalists Club

Bibliography:

Berwick, S., Moorrees, A. and Backhouse, G. (1999). Draft Recovery Plan for Audas' Spider-orchid *Caladenia audasii* (Orchidaceae: Caladeniinae) 1998-2002. Department of Natural Resources and Environment, Melbourne.

Venn, D.R. (1992). Action Statement No. 24 – Audas' Spider-orchid *Caladenia audasii.* Department of Conservation and Environment, Melbourne.

Elegant Spider-orchid *Caladenia formosa*

Conservation status: Vulnerable (IUCN Red List)

Current distribution: SW Victoria/SE South Australia – Naracoorte Plain Bioregion

Current abundance: 1000's of plants in Victoria; <100 plants in South Australia

Habitat: Damp Sands Herb-rich Woodland; Shallow Sand Woodland, Plains Sedgy Woodland (*sensu* NRE, in prep.)

Reservation status: Unreserved in Victoria (proposed for protection within Special Protection Zones under the West Victorian RFA – Commonwealth of Australia 2000); Reserved in South Australia at Mt Monster and Mt Scott CP's

Management: NRE – Forests (Meereek, Beear State Forests), EH

Recovery objectives: Reservation, protection and broad-scale habitat management

Recovery actions undertaken:

- Population monitoring
- Preliminary surveys of potential habitat in Victoria

Recovery actions required:

1.1 Identify and survey potential habitat in the Naracoorte Plain Bioregion for new populations and accurately determine plant numbers within known populations

2.1 Identify key populations in Victoria and South Australia

2.3 Protect populations on public land in south west Victoria through appropriate legislation or planning mechanisms

2.4 Protect identified populations on private land in Victoria and South Australia through appropriate land management agreements

3.1 Identify high-priority weed species for control at all sites and control through use of broad-scale habitat management techniques and targeted control of high-risk species

3.2 Control animal pests and predators at all sites and investigate grazing impacts by macropods and rabbits at sites south of Edenhope

3.3 Collect Vital Attribute Data following planned fires to determine appropriate fire regimes for *C. formosa* habitat and prepare a fire management plan for key populations

5.1 Conduct annual censusing of populations

6.1 Identify pollinator and determine natural pollination levels

6.2 Determine genetic relationship of Victorian and South Australian populations

7.1 Isolate and culture the mycorrhizal fungus

9.1 Prepare education material and undertake community extension

10.1 Establish a regional *C. formosa* recovery team consisting of NRE – PFF, NRE – SW, NRE - Forests, EH, Hamilton & Casterton Field Naturalists Clubs

10.2 Prepare Victorian FFG Action Statement for *C. formosa*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, NW, SW, Forests; Parks Victoria; Department of Environment and Heritage, South Australia

Bibliography:

Carr, G.W. (1991). New taxa in *Caladenia* R. Br., *Chiloglottis* R. Br. and *Gastrodia* R. Br. (Orchidaceae) from south eastern Australia. Miscellaneous Paper No. 1. *Indigenous Flora and Fauna Association.*

Eastern Spider-orchid *Caladenia fragrantissima* ssp*. orientalis*

Conservation status: Endangered (IUCN Red List)

Current distribution: Wonthaggi (SE Victoria) – South East Coastal Plain Bioregion

Current abundance: <100 plants in the wild

Habitat: Coastal Heathland; Heathy Woodland (*sensu* NRE, in prep.)

Reservation status: Unreserved (occurs on unreserved crown land at Wonthaggi)

Management: Parks Victoria, Shire of South Gippsland, private land holders

Recovery objectives: Reservation, protection, broad-scale habitat management and fine-scale habitat management if required

Recovery actions undertaken:

- Population identification

Recovery actions required:

1.1 Identify and survey potential habitat in the South East Coastal Plain Bioregion for new populations and accurately determine plant numbers within known populations

2.1 Identify key populations

2.3 Reserve populations on public land at Wonthaggi (under the *Crown Land (Reserves) Act 1978*) and Walkerville (PAMA *under Flora and Fauna Guarantee Act 1988*)

2.4 Protect populations on private land at Cape Paterson under appropriate land management agreements

3.1 Control high-priority weed species at all sites through use of broad-scale habitat management techniques and targeted control of high-risk species (eg. Coast Tea-tree, Coast Wattle, Maritime Pine)

3.2 Control animal pests and predators at all sites and investigate grazing impacts by macropods and rabbits at Wonthaggi after fire

3.3 Collect Vital Attribute Data following planned fires to determine appropriate fire regimes for *C. fragrantissima* ssp. *orientalis* habitat and prepare a fire management plan for key populations

3.4 Monitor sites for the presence of Cinnamon Fungus

4.1 Hand-pollinate plants where necessary

4.2 Harvest and store seeds

5.2 Conduct annual censusing of populations

6.1 Identify pollinator and determine natural pollination levels

7.1 Isolate and culture the mycorrhizal fungus

7.2 Establish seedlings in cultivation

7.3 Maintain a database on cultivated plants

8.1 Assess potential habitat and select introduction sites

8.2 Prepare an introduction plan and establish *C. fragrantissima* ssp. *orientalis* in at least one reserve

10.2 Establish a regional *C. fragrantissima* ssp. *orientalis* Recovery Team consisting of NRE – PFF, NRE – PP, PV, FOWH

10.3 Prepare Victorian FFG Action Statement for *C. fragrantissima* ssp. *orientalis*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, PP; Parks Victoria; Friends of Wonthaggi Heathlands

Bibliography:

Carr, G.W. (1991). New taxa in *Caladenia* R. Br., *Chiloglottis* R. Br. and *Gastrodia* R. Br. (Orchidaceae) from south eastern Australia. Miscellaneous Paper No. 1. *Indigenous Flora and Fauna Association.*

Mellblom's Spider-orchid *Caladenia hastata*

Conservation status: Critically Endangered (IUCN Red List)

Current distribution: SW Victoria, near Portland – Naracoorte Plain Bioregion

Current abundance: 20 plants in the wild

Habitat: Heathy Woodland; Damp Heathy Woodland; Damp Heathland (*sensu* NRE, in prep.)

Reservation status: Reserved (Point Danger Coastal Reserve; Discovery Bay Coastal Reserve)

Management: Parks Victoria, Point Danger Coastal Reserve Committee of Management

Recovery objectives: Site and plant protection, broad-scale and fine-scale habitat management

Recovery actions undertaken:

- Population monitoring at both sites
- Habitat monitoring at Point Danger
- Caging of plants at both sites
- Biomass removal/weed control using mechanical techniques and fire
- Hand-pollination of plants
- Conduction of seed establishment trials at both sites
- Description of habitat (in part)
- Searching of potential habitat for new populations
- Ecological burning of suitable habitat to promote flowering of *C. hastata*
- Search of burn sites for plants
- Identification of the mycorrhizal fungal associate
- Establishment of a regional recovery team

Recovery actions required:

1.1 Identify and further survey potential habitat in the Naracoorte Plain Bioregion for other populations

3.1 Control high-priority weed species at all sites through use of broad-scale habitat management techniques and targeted control of high-risk species (eg. Boneseed, Coast Wattle)

3.2 Control animal pests and predators at all sites using cages

3.3 Collect Vital Attribute Data following planned fires to determine appropriate fire regimes for *C.hastata* habitat and prepare a fire management plan for Point Danger

3.4 Monitor sites for the presence of Cinnamon Fungus

4.1 Hand-pollinate plants

4.2 Harvest and store seeds

4.3 Implement fine-scale microhabitat management such as scattering leaf litter, seed-bed preparation, maintenance of open space around plants, watering during dry spring periods and scattering of seeds near parent plants in late summer

5.1 Conduct annual censusing of populations

6.1 Identify pollinator and determine natural pollination levels

6.3 Investigate seed viability, germination and seedling establishment

7.2 Establish seedlings in cultivation

7.3 Maintain a database on cultivated plants

8.1 Assess habitat and select introduction sites

8.2 Prepare an introduction plan and establish at least one population of *C. hastata* in the wild

9.1 Prepare educational material and undertake community extension

10.2 Maintain and support the Mellblom's Spider-orchid Recovery Team consisting of NRE – PFF, NRE – SW, PV, PA and one expert botanist

10.3 Review Victorian FFG Action Statement for *C. hastata*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, SW; Portland Aluminium; Parks Victoria; Point Danger Coastal Reserve Committee of Management; *C. hastata* Recovery Team

Bibliography:

Hill, J., Carr, G., Pritchard, A., Govanstone, A. and Backhouse, G. (1999). Draft Recovery Plan for Mellblom's Spider-orchid *Caladenia hastata* (Orchidaceae: Caladeniinae) 1998-2002. Portland Aluminium and Department of Natural Resources and Environment, Melbourne.

Carr, G.W. (1980). *Alcoa Portland Aluminium Smelter Environmental Design Report No. 4: Mellblom's Spider-orchid Conservation.* Part A: Status and conservation. Kinhill Planners, Melbourne.

Carr, G.W. (1988). *Portland Aluminium Smelter Environmental Design Report No. 4: Mellblom's Spider-orchid Conservation.* Parts B and C: Programme 1980 – mid 1988. Kinhill Planners, Melbourne.

Wimmera Spider-orchid *Caladenia lowanensis*

Conservation status: Endangered (IUCN Red List)
Current distribution: Kiata & Glenlee, Western Victoria – Murray Darling Depression Bioregion
Current abundance: 240 plants at three sites
Habitat: Cypress-pine/Box Woodland
Reservation status: Reserved at Kiata Flora Reserve and Glenlee Flora and Fauna Reserve
Management: Parks Victoria, private land holder
Recovery objectives: Protection of plants and broad-scale habitat management (fine-scale management where necessary)

Recovery actions undertaken:

- Population monitoring
- Hand pollination
- Capsule (seed) collection
- Preliminary surveys of potential habitat
- Rabbit control
- Woody weed control

Recovery actions required:

1.1 Identify and survey potential habitat in the Murray Darling Depression Bioregion for new populations and accurately determine plant numbers within known populations

2.1 Identify key populations in Victoria and South Australia (if present)

2.3 Protect identified populations on private land through appropriate land management agreements

3.1 Control high-priority weed species at all sites through use of broad-scale habitat management techniques and targeted control of high-risk species (eg. Perennial Veldt Grass, annual grasses)

3.2 Control animal pests and predators at Kiata Flora Reserve and Glenlee Flora and Fauna Reserve through rabbit-proof fencing and the use of targeted control of pest species (eg. rabbits)

3.3 Collect Vital Attribute Data following planned fires to determine appropriate fire regimes for *C. lowanensis* habitat and prepare a fire management plan for key populations

3.4 Prevent disturbance and damage to populations by controlling access to and within Kiata Flora Reserve and Glenlee Flora and Fauna Reserve by appropriate fencing and track closures

4.1 Hand pollinate plants where populations reach critically low numbers

4.2 Harvest and store seed

5.1 Conduct annual censusing of populations

6.1 Identify pollinator and determine natural pollination levels

6.3 Investigate seed viability, germination and seedling establishment

7.1 Isolate and culture the associated mycorrhizal fungus

7.2 Establish seedlings in cultivation

7.3 Maintain a database of *C. lowanensis* plants in cultivation

8.1 Assess habitat preferences and select introduction sites

8.2 Prepare an introduction plan and establish one additional reserved population of *C. lowanensis* in the wild

9.1 Prepare education material and undertake community extension

10.2 Establish a regional *C. lowanensis* Recovery Team consisting of NRE – PFF, NRE – SW, PV, Friends of Kiata Flora Reserve, University of Melbourne

10.3 Prepare Victorian FFG Action Statement for *C. lowanensis*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, NW; Parks Victoria; Gerang Landcare Group (Friends of Kiata Flora Reserve)

Bibliography:

Carr, G.W. (1991). New taxa in *Caladenia* R. Br., *Chiloglottis* R. Br. and *Gastrodia* R. Br. (Orchidaceae) from south eastern Australia. Miscellaneous Paper No. 1. *Indigenous Flora and Fauna Association.*

Frankston Spider-orchid *Caladenia robinsonii*

Conservation status: Critically Endangered (IUCN Red List)

Current distribution: Rosebud, south east of Melbourne – South East Coastal Plain Bioregion

Current abundance: Approximately 20 plants in the wild

Habitat: Heathy Woodland, Damp Sands Herb-rich Woodland, Heathy Herb-rich Woodland (*sensu* NRE, in prep.)

Reservation status: Unreserved (occurs on land owned and managed by Mornington Peninsula Shire Council)

Management: Mornington Peninsula Shire Council

Recovery objectives: Protection and fine-scale management of populations and *ex situ* cultivation/re-introduction of plants

Recovery actions undertaken:

- Establishment of permanent orchid-monitoring plot
- Fencing of reserve and construction of pedestrian walking paths
- Construction of a visitor foot bath and scrub to help reduce the risk of Cinnamon Fungus introduction
- Burning of the eastern half of the reserve
- Woody and herbaceous weed control
- Hand pollination of plants
- Collection and storage of capsules (seed) at KPBG, Perth, WA
- Population monitoring
- Production of a draft Public Authority Management Agreement
- Identification and searching of potential habitat both near the current population and known former habitat near Frankston
- Establishment of the *C. robinsonii* Recovery Team

Recovery actions required:

1.1 Identify and further survey potential *C. robinsonii* habitat on the Mornington Peninsula

2.3 Reserve populations on public land at Rosebud through a Public Authority Management Agreement (under Flora and Fauna Guarantee Act 1988)

3.1 Control high-priority weed species through broad-scale habitat management techniques and targeted control of high-risk species (eg. Coast Tea-tree, Coast Wattle, Mirror Bush, Perennial Veldt Grass)

3.2 Control animal pests and predators through caging of plants and targeted pest animal control

3.3 Collect Vital Attribute Data to help determine appropriate burning regimes for Betty Clift Reserve and prepare a fire management plan for the area

3.4 Monitor the reserve for the presence of Cinnamon Fungus and implement a quarantine strategy if necessary

4.1 Hand pollinate plants annually

4.2 Harvest and store seed annually

4.3 Manage micro-habitat using litter scattering and seed-bed establishment techniques

5.1 Conduct annual censusing of populations

6.1 Identify pollinator and determine natural pollination levels

6.3 Investigate seed viability, germination and seedling establishment

7.1 Isolate and culture the mycorrhizal fungus

7.2 Establish seedlings in cultivation and maintain a number of plants *ex situ*

7.3 Maintain a database of cultivated plants

8.1 Assess habitat and select introduction sites

8.2 Prepare an introduction plan and establish a new population in at least one reserved site on the eastern shores of Port Phillip Bay

10.2 Maintain and support the Frankston Spider-orchid Recovery Team consisting of NRE – PFF, NRE – PP, MPSC, SPIFFA, FOBCCR

10.3 Prepare and review the Victorian FFG Action Statement for *C. robinsonii*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, PP; Parks Victoria; Mornington Peninsula Shire Council; Southern Peninsula Indigenous Flora and Fauna Association; Friends of Betty Clift Conservation Reserve

Bibliography:

Backhouse, G.N., Bramwells, H., Musker, R., Walker, G. and Lester, K. (1999). Draft Recovery Plan for the Frankston Spider-orchid *Caladenia robinsonii* (Orchidaceae: Caladeniinae) 1999-2003. Department of Natural Resources and Environment, Melbourne.

Carr, G.W. (1991). New taxa in *Caladenia* R. Br., *Chiloglottis* R. Br. and *Gastrodia* R. Br. (Orchidaceae) from south eastern Australia. Miscellaneous Paper No. 1. *Indigenous Flora and Fauna Association.*

Rosella Spider-orchid *Caladenia rosella*

Conservation status: Critically Endangered (IUCN Red List)

Current distribution: Cottles Bridge, Research and Christmas Hills, north east of Melbourne and Deep Lead near Stawell (unconfirmed for several years) – Victorian Midlands Bioregion

Current abundance: Approximately 130 plants in the wild in four populations

Habitat: Box-Ironbark Forest; Grassy Dry Forest (*sensu* NRE, in prep.)

Reservation status: Reserved (One Tree Hill BR, covenanted properties)

Recovery objectives: Protection and fine-scale management of populations and *ex situ* cultivation/re-introduction of plants

Recovery actions undertaken:

- Control of annual and perennial introduced herbs
- Caging of plants at Cottlesbridge to control pests and predators
- Hand pollination of plants
- Collection and storage of capsules (seed) at KPBG, Perth, WA
- Fine-scale habitat management – leaf litter scattering etc.
- Population monitoring

Recovery actions required:

1.1 Identify and survey potential habitat for other populations (eg. Deep Lead)

3.1 Control high-priority weed species

3.2 Control animal pests and predators through caging of populations or habitat

4.1 Hand pollinate plants annually

4.2 Harvest and store seed annually

4.3 Manage micro-habitat using litter scattering techniques

5.1 Conduct annual censusing of populations

6.2 Determine genetic relationship between Cottlesbridge and Deep Lead populations (if latter able to be located)

6.3 Investigate seed viability, germination and seedling establishment

7.1 Isolate and culture the mycorrhizal fungus

7.2 Establish seedlings in cultivation and maintain a number of plants *ex situ*

7.3 Maintain a database of cultivated plants

8.1 Select introduction sites

8.2 Prepare an introduction plan and introduce plants to at least one reserved site in northeast Melbourne

9.2 Establish a regional guardian group made up of NRE – PFF, NRE – PP, TFN, private landholders and one expert botanist

10.2 Prepare and review the Victorian FFG Action Statement for *C. rosella*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, PP; Parks Victoria; Trust for Nature (Victoria); The Dunmoochin Foundation

Bibliography:

Beardsell, C.M. and Muir, A.M. (1992). A recovery plan for Rosella Spider-orchid (*Caladenia rosella*). Unpublished report to the Australian National Parks and Wildlife Service, Canberra. Department of Natural Resources and Environment, Melbourne.

Carr, G.W. (1991). New taxa in *Caladenia* R. Br., *Chiloglottis* R. Br. and *Gastrodia* R. Br. (Orchidaceae) from south eastern Australia. Miscellaneous Paper No. 1. *Indigenous Flora and Fauna Association.*

Rigid Spider-orchid *Caladenia tensa*

Conservation status: Vulnerable (IUCN Red List)

Current distribution: SW Victoria/SE South Australia – Murray Darling Depression Bioregion

Current abundance: 1000's of plants in Victoria; 1000's of plants in South Australia

Habitat: Pine/Box Woodland; Sand Mallee; Heathy Woodland (*sensu* NRE, in prep.)

Reservation status: Reserved in Victoria (Lt Desert NP, Kiata FR, West Wail FR); Reserved in South Australia (Cape Gantheaume CP, Billiat CP, Mt Boothby CP)

Management: Parks Victoria, EH

Recovery objectives: Taxon distribution/abundance estimates and broad-scale habitat management

Recovery actions undertaken:

- Population monitoring
- Preliminary surveys of potential habitat in Victoria
- Hand pollinating of plants at West Wail in 1994

Recovery actions required:

1.1 Identify and survey potential habitat in the Murray Darling Depression Bioregion for new populations and accurately determine plant numbers within known populations

2.1 Identify key populations in Victoria and South Australia

3.1 Control high-priority weed species at key population sites through use of broad-scale habitat management techniques and targeted control of high-risk species (eg. Perennial Veldt Grass)

3.2 Control animal pests and predators at key populations sites using suitably designed fences or targeted pest animal control techniques

3.3 Collect Vital Attribute Data following planned fires to determine appropriate fire regimes for *C. tensa* habitat and prepare a fire management plan for key populations. Ensure that protection of key populations forms an integral part of park management plans

5.1 Conduct annual censusing of populations

6.1 Identify pollinator and determine natural pollination levels

6.2 Determine genetic relationship of Victorian and South Australian populations

7.1 Isolate and culture the mycorrhizal fungus

9.1 Prepare education material and undertake community extension

10.2 Establish a regional *Caladenia tensa* Recovery Team consisting of NRE – PFF, NRE – SW, PV, EH, Friends of Kiata Flora Reserve

10.3 Prepare Victorian FFG Action Statement for *C. tensa*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, NW; Parks Victoria; Department of Environment and Heritage, South Australia

Bibliography:

Carr, G.W. (1991). New taxa in *Caladenia* R. Br., *Chiloglottis* R. Br. and *Gastrodia* R. Br. (Orchidaceae) from south eastern Australia. Miscellaneous Paper No. 1. *Indigenous Flora and Fauna Association.*

Fringed Spider-orchid *Caladenia thysanochila*

Conservation status: Critically Endangered (IUCN Red List)

Current distribution: Mount Eliza, south east of Melbourne – South East Coastal Plain Bioregion

Current abundance: No plants observed in wild since 1996

Habitat: Damp Sands Herb-rich Woodland (*sensu* NRE, in prep.)

Reservation status: Unreserved (occurs on land owned and managed by Mornington Peninsula Shire Council)

Management: Mornington Peninsula Shire Council

Recovery objectives: Protection and fine-scale management of population and *ex situ* cultivation/re-introduction of plants

Recovery actions undertaken:

- Fencing of site (botanical reference area)
- Burning of the botanical reference area
- Woody and herbaceous weed control
- Hand pollination of plants
- Population monitoring

Recovery actions required:

1.1 Identify and further survey potential *Caladenia thysanochila* habitat on the Mornington Peninsula

2.3 Reserve populations on public land at Mount Eliza through a Public Authority Management Agreement (under Flora and Fauna Guarantee Act 1988)

3.1 Control high-priority weed species through broad-scale habitat management techniques and targeted control of high-risk species (eg. Sweet Vernal Grass, Yorkshire Fog Grass, Brown-top Bent, Flatweed)

3.2 Control animal pests and predators through caging of plants and targeted pest animal control

3.3 Collect Vital Attribute Data to help determine appropriate burning regimes for Botanical Reference Area within Mount Eliza Regional Park and prepare a fire management plan for the site

4.1 Hand pollinate plants (if they appear)

4.2 Harvest and store seed

4.3 Manage micro-habitat using litter scattering and seed-bed establishment techniques and orchid-sensitive herbaceous weed control techniques

5.1 Conduct annual censusing of populations

6.3 Investigate seed viability, germination and seedling establishment

7.1 Isolate and culture the mycorrhizal fungus

7.2 Establish seedlings in cultivation and maintain a number of plants *ex situ*

7.3 Maintain a database of cultivated plants

8.1 Assess habitat and select introduction sites

8.2 Prepare an introduction plan and introduce plants to at least one reserved site on the Mornington Peninsula

10.2 Establish a *Caladenia thysanochila* Recovery Team (if plants are located) consisting of NRE – PFF, NRE – PP, MPSC, FOMERP and one expert botanist

10.3 Prepare and review the Victorian FFG Action Statement for *C. thysanochila*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, PP; Mornington Peninsula Shire Council; Friends of Mount Eliza Regional Park

Bibliography:

Carr, G.W. (1991). New taxa in *Caladenia* R. Br., *Chiloglottis* R. Br. and *Gastrodia* R. Br. (Orchidaceae) from south eastern Australia. Miscellaneous Paper No. 1. *Indigenous Flora and Fauna Association.*

Candy Spider-orchid *Caladenia versicolor*

Conservation status: Endangered (IUCN Red List)

Current distribution: SW Victoria near Stawell/SE South Australia – Naracoorte Plain and Victorian Midlands Bioregions

Current abundance: Several hundred of plants in Victoria; Status of taxon in South Australia is unknown

Habitat: Plains Sedgy Woodland (*sensu* NRE, in prep.)

Reservation status: Unreserved in Victoria (proposed for protection within Special Protection Zones under the West Victorian RFA – Commonwealth of Australia 2000)

Management: NRE – Forests, Wimmera Mallee Water

Recovery objectives: Reservation, protection and broad-scale habitat management

Recovery actions undertaken:

- Population monitoring
- Preliminary surveys of potential habitat in Victoria

Recovery actions required:

1.1 Identify and survey potential habitat in the Victorian Midlands and Naracoorte Plain Bioregions for new populations and accurately determine plant numbers within known populations

2.1 Identify key populations in Victoria and South Australia

2.2 Reserve populations on public land at Lake Fyans (under the **Crown Land (Reserves) Act 1978**) pending the current Native Title Claim over the area.

3.1 Assess and control high-priority weed species at all sites through use of broad-scale habitat management techniques and targeted control

3.2 Control animal pests and predators at all sites and investigate grazing impacts by macropods and rabbits at Lake Fyans using suitably designed animal exclosures

3.4 Prevent disturbance and damage to populations by controlling access to public land sites and rationalising vehicle tracks at Lake Fyans Reserve

4.2 Harvest and store seed

5.1 Conduct annual censusing of populations

6.1 Identify pollinator and determine natural pollination levels

6.2 Determine genetic relationship of Victorian and South Australian populations (if located)

6.3 Investigate seed viability, germination and seedling establishment

7.1 Isolate and culture the mycorrhizal fungus

7.2 Establish seedlings in cultivation and maintain a number of plants *ex situ*

7.3 Maintain a database of *C. versicolor* plants in cultivation

8.1 Assess habitat preferences and select one introduction site

8.2 Prepare an introduction plan and establish at least one additional reserved population in the wild

9.1 Prepare education material and undertake community extension

10.2 Establish a regional *Caladenia versicolor* Recovery Team consisting of NRE – PFF, NRE – SW, NRE – Forests, Wimmera Mallee Water, Stawell Field Naturalists Club

10.3 Prepare Victorian FFG Action Statement for *C. formosa*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, NW, Forests; Wimmera Mallee Water; Parks Victoria; Department of Environment and Heritage, South Australia; Stawell Field Naturalists Club

Bibliography:

Carr, G.W. (1991). New taxa in *Caladenia* R. Br., *Chiloglottis* R. Br. and *Gastrodia* R. Br. (Orchidaceae) from south eastern Australia. Miscellaneous Paper No. 1. *Indigenous Flora and Fauna Association.*

Yellow-lip Spider-orchid *Caladenia xanthochila*

Conservation status: Endangered (IUCN Red List)

Current distribution: Western Victoria near Murtoa and central Victoria near Kingower/SE South Australia – Murray Darling Depression Bioregion

Current abundance: 120 plants in Victoria; Status of taxon in South Australia is unknown

Habitat: Shallow Sand Woodland, Alluvial Terraces Herb-rich Woodland (*sensu* NRE, in prep.)

Reservation status: Unreserved in Victoria

Management: Murtoa Golf Club Committee of Management, NRE - Forests

Recovery objectives: Reservation, protection and broad and fine-scale habitat management

Recovery actions undertaken:

- Population monitoring
- Preliminary surveys of potential habitat in Victoria
- 2 x collars collected in 1994 for fungal isolation

Recovery actions required:

1.1 Identify and survey potential habitat in the Murray Darling Depression Bioregion for new populations and accurately determine plant numbers within known populations

2.1 Identify key populations in Victoria and South Australia

2.2 Reserve populations on public land in southeast Victoria under *the Crown Land (Reserves) Act* 1978

2.3 Adequately protect populations on private land through appropriate land management agreements

3.1 Control high-priority weed species at all sites through use of broad-scale habitat management techniques and targeted control of high-risk species (eg. annual grasses, indigenous shrubs)

3.2 Control animal pests and predators at all sites using suitably designed animal exclosures and targeted pest animal control techniques

3.3 Collect Vital Attribute Data from habitat containing *C. xanthochila* populations to determine appropriate fire regimes and from this develop a fire management strategy for key populations

4.1 Hand pollinate plants when necessary

4.2 Harvest and store seed

5.1 Conduct annual censusing of populations

6.1 Identify pollinator and determine natural pollination levels

6.2 Determine genetic relationship of Victorian and South Australian populations (if latter is able to be located)

6.3 Investigate seed viability, germination and seedling establishment

7.1 Isolate and culture the mycorrhizal fungus

7.2 Establish seedlings in cultivation and maintain a number of plants *ex situ*

7.3 Maintain a database of *C. xanthochila* plants in cultivation

8.1 Assess habitat preferences and select one introduction site

8.2 Prepare an introduction plan and establish one additional reserved population in the wild

9.1 Prepare education material and undertake community extension

10.2 Establish a regional *C. xanthochila* Recovery Team consisting of NRE – PFF, NRE – SW, NRE – Forests, Murtoa Golf Club COM, Bendigo Field Naturalists Club

10.3 Prepare Victorian FFG Action Statement for *C. xanthochila*

Responsible agencies/organisations:

Department of Natural Resources and Environment, Victoria – PFF, NW, Forests; Department of Environment and Heritage, South Australia; Murtoa Golf Club Committee of Management; Bendigo Field Naturalists Club

Bibliography:

Beardsell, D. and Beardsell, C. (1992). A rare new *Caladenia* species from central Victoria, and its relationship with other recently described taxa in south eastern Australia. *Australian Systematic Botany,* **5:** 513-519.