Dwarf Spider Orchid

(*Caladenia bryceana* subsp. *bryceana*)

RECOVERY PLAN

Department of Environment and Conservation
Kensington

Australian Government

Government of Western Australia

Department of Environment and Conservation
Our environment, our future

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

DEC is committed to ensuring that Threatened taxa are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, always within one year of endorsement of that rank by the Minister.

This IRP replaces IRP No.39 (1999-2002), prepared by Emma Holland, Andrew Brown and Kim Kershaw.

This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. It is intended that, if the subspecies is still ranked Endangered or its status deteriorates to Critically Endangered, this IRP will be reviewed after five years and the need for a further recovery actions assessed.

This IRP was approved by the Director of Nature Conservation on the 30 April 2008. The allocation of staff time and provision of funds identified in this IRP is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate at April 2008.

This IRP was prepared with financial support from the Australian Government to be adopted as a National Recovery Plan under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

ACKNOWLEDGMENTS

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Cover photograph Sarah Barrett.

CITATION

Department of Environment and Conservation (2009). Dwarf Spider Orchid (*Caladenia bryceana* subsp. *bryceana*) Recovery. Commonwealth Department of the Environment, Water, Heritage and the Arts, Canberra.

SUMMARY

Scientific Name	*Caladenia bryceana* subsp. *bryceana*	**Common Name**	Dwarf Spider Orchid
Family	Orchidaceae	**Flowering Period**	August to early October
DEC Regions	South Coast, South West	**DEC Districts**	Albany, Wellington
Shires	Albany, Gnowangerup, Jerramungup and West Arthur	**Recovery Teams**	Albany District Threatened Flora Recovery Team and Wellington District Threatened Flora Recovery Team

Illustrations and/or further information: Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia*, Department of Environment and Conservation, Western Australia; Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; Western Australian Herbarium (2007) FloraBase - Information on the Western Australian Flora. Department of Environment and Conservation, Western Australia. http://www.calm.wa.gov.au/science/. Holland, E., Brown, A. and Kershaw, K. (1999) Dwarf Spider Orchid (*Caladenia bryceana* subsp. *bryceana* ms) Interim Recovery Plan 1999-2002. Department Conservation and Land Management, Western Australia.

Analysis of outputs and effectiveness of Interim Recovery Plan (IRP) No.39 (1999-2002), prepared by Emma Holland, Andrew Brown and Kim Kershaw.

The criteria for success in the previous plan (the number of individuals within populations and/or the number of populations have increased) has been met, as follows:

The number of individuals has increased from approximately 184 to over 900, and the number of populations has increased from 7 to 13. In 2003, it was recommended that the status of *Caladenia bryceana* subsp. *bryceana* be changed from Critically Endangered to Endangered.

Actions carried out in the previous plan include:
Action 4 Conduct further surveys. Further survey has lead to the location of new populations and subpopulations.
Action 5 Monitor populations. Populations have been regularly monitored
Action 6 Promote awareness. A newspaper article on the species was published in the Albany *Extra*.

Other recovery actions included in the previous plan are ongoing and are included in this revised plan.

New recovery actions included in this plan are:
Action 1 Coordinate recovery actions
Action 3 Liaise with stakeholders
Action 4 Minimise recreational impacts
Action 11 Map habitat critical to the survival of the subspecies

Current status: *Caladenia bryceana* subsp. *bryceana* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in March 1992 and is currently ranked as Endangered under World Conservation Union (IUCN 2001) Red List criteria C2a(i). There are 13 populations and over 900 plants known. The main threats are weed invasion, fauna and inappropriate fire regimes. The subspecies is listed as Endangered under the Commonwealth *Environment and Biodiversity Protection Act 1999* (EPBC Act).

Description: The petals, labellum (lip) and sepals are usually green but occasionally apricot. A distinctive band of glossy, dark globular calli (glands) runs down the centre of the labellum. The petals and sepals are not much larger than the column. The flower stem and leaf rarely exceed 5 cm.

Habitat requirements: *Caladenia bryceana* subsp. *bryceana* grows in open woodland of Wandoo, Yate, Flooded Gum or Sheoak with a sparse associate of low shrubs, sedges and herbs. Soils are sandy clays to red loam over granite. Currently, the subspecies is known from the Boyup Brook area, eastwards to Boxwood Hill. Associated species include *Allocasuarina huegeliana*, *Eucalyptus occidentalis*, *E. wandoo*, *Acacia dictyoneura*, *Hakea lissocarpha*, *Boronia scabra*, *Neurachne alopecuroidea*, *Lagenifera huegellii*, *Caladenia flava* and *Cheilanthes austrotenuifolia.*

Habitat critical to the survival of the subspecies, and important populations: The habitat critical to the survival of *Caladenia bryceana* subsp. *bryceana* comprises the area of occupancy of the known populations; similar habitat surrounding known populations; remnant vegetation that links populations; and additional nearby occurrences of similar habitat that do not currently contain the subspecies but may have done so in the past and may be suitable for translocations. Given that the taxon is listed as Endangered it is considered that all populations are important populations.

Benefits to other species/ecological communities: Five Declared Rare and three Priority flora, and five threatened and seven Priority fauna species occur in the vicinity of *Caladenia bryceana* subsp. *bryceana* populations. Recovery actions implemented to improve the quality or security of the habitat of the habitat of *C. bryceana* subsp. *bryceana* will benefit these species and reciprocally, recovery actions put in place for these species will benefit *C. bryceana* subsp. *bryceana*.

International obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity. The subspecies is listed under the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES). However, it is not listed under any other specific international treaty and this recovery plan does not affect Australia's obligations under those international agreements.

Role and interests of Indigenous people: According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, some forty-six registered sites occur in close proximity to *Caladenia bryceana* subsp. *bryceana* populations. The involvement of the Indigenous community is currently being sought to determine whether there are any issues or interests identified in the Plan. If no role is identified for Indigenous communities in the recovery of this subspecies, opportunities may exist through cultural interpretation and awareness of the subspecies.

The advice of the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs is being sought to assist in the identification of potential Indigenous management responsibilities for land occupied by threatened species, or groups with a cultural connection to land that is important for the subspecies' conservation.

Continued liaison between DEC and the Indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

Social and economic impacts: The implementation of this recovery plan has the potential to have some minimal social and economic impact as some subpopulations are located on private property, Shire Reserves, a Water Corporation Reserve, a Department of Planning and Infrastructure (DPI) Reserve and a Main Roads Department Reserve, as well as DEC-managed land. However, recovery actions refer to continued negotiations between stakeholders with regard to these areas.

Affected interests: Seven populations and twelve subpopulations occur on land managed by government departments including local government, DEC, Main Roads WA and DPI. One population and seven subpopulations occur on private property and three subpopulations in a reserve managed by the Water Corporation.

Evaluation of the plan's performance: The DEC will evaluate the performance of this recovery plan in conjunction with the Albany and Wellington Districts Threatened Flora Recovery Teams. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

Completed recovery actions

1. All land managers have been notified of the location and threatened status of the subspecies.
2. A rabbit-proof fence was erected around Populations 2 to protect the subspecies and its habitat.
3. A leaflet drop to all landowners within the area of the subspecies was undertaken.
4. An information sheet on the subspecies was produced and distributed.
5. A newspaper article on the subspecies was published in the Albany *Extra*.
6. Survey has located new populations.

Ongoing and future recovery actions

1. Staff and volunteers from the DEC Albany and Collie Work Centres monitor populations.
2. A grant application has been recently submitted for further research on seven orchid species including *Caladenia bryceana* subsp. *bryceana* and is currently pending approval.

Objectives
The objective of this Interim Recovery Plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the subspecies in the wild.

Criteria for success: The number of populations and individuals within populations remains stable or increases over the five years of the plan.
Criteria for failure: The number of populations or the number of individuals within populations decreases over the five years of the plan.

Recovery actions

1. Coordinate recovery actions.
2. Monitor populations.
3. Liaise with stakeholders.
4. Minimise recreational impacts.
5. Implement weed control.
6. Collect seed.
7. Obtain biological and ecological information.
8. Investigate the methodology for future translocation(s).
9. Conduct further surveys.
10. Promote awareness.
11. Map habitat critical to the survival of the subspecies.
12. Review the recovery plan and assess the need for further recovery actions.

1. BACKGROUND

History

Caladenia bryceana subsp. *bryceana* was first found at Gnowangerup in September 1914 by Miss Bryce MacIntyre, after whom it was named when described by R. S. Rogers in 1914. Following its discovery, the species was not collected again until Ron Oliver found it east of the Stirling Range in September 1962. The location of this population subsequently became well known and, within three years, most of the plants were dug up and the area burnt with no plants surviving. Because of its rarity, *Caladenia bryceana* was Declared as Rare Flora in 1982.

In 2001 *Caladenia bryceana* subsp. *cracens* was discovered. *Caladenia bryceana* subsp. *cracens* occurs in the Kalbarri region and is recognized as a distinct subspecies differing from *C. bryceana* subsp. *bryceana* in its larger leaf, slightly smaller flowers, taller, less globular labellum calli, and petals and lateral sepals that are curled at the margins.

Caladenia bryceana subsp. *bryceana* was declared as Rare Flora in 1992 and was ranked as Critically Endangered in September 1995. In 2003 the ranking of *Caladenia bryceana* subsp. *bryceana* changed from Critically Endangered to Endangered due to more populations and individuals being found.

Mary Sherwood collected the subspecies from Population 1 in 1979 but subsequent surveys have failed to locate plants and it is believed that clearing of the area in the early 1980s has resulted in the extinction of at least part of the population. In 2001 Subpopulations 1d, e, g and h were located and reported to be healthy. A new population (Population 10) was found nearby.

Erick Chapman discovered Population 2 in 1984. This population was surveyed the following year and was found to contain 100 individuals. However, from 1996 to 2005, the population size has remained under 25 individuals.

In 1989 Allan Rose, mapped Population 3 and found that it was larger than previously recorded with additional subpopulations located. In 2000 all subpopulations were resurveyed. However, only Subpopulations 3a and 3c were located. Subpopulation 3d was relocated five years later.

Population 4 was discovered in 1990 and in 1992 was thought to have 300-500 individuals. A survey in 2000 found the population to be healthy despite having just 10 or so remaining plants.

Chris Robinson discovered Population 5 in 1992 and described the orchid as being uncommon in the area. Subpopulation 5b has not been relocated since 1992, however, the remaining subpopulations are healthy.

Population 6 was discovered in 1997 with over 50 flowering individuals found. The number of flowering plants decreased to 11 in 2000 but then increased to 63 in 2003.

The only survey of Population 7 was in 1998, during which time four individuals were located in healthy condition.

Populations 8, 9 and 10 were discovered by Sarah Barrett and volunteers in 2001, and 11 and 12 in 2002.

In 2003 Population 13 was found by a volunteer and was said to consist of 115 individuals.

Description

Caladenia bryceana subsp. *bryceana* is one of the smallest spider orchids known in Western Australia. The leaf is 4-6 cm long, broadly lanceolate and semi-prostrate, and the flowering stem rarely exceeds 5 cm. The flowers are born singly (rarely two) on erect stems and are only about 1-1.5 cm across. The petals, labellum (lip) and sepals are usually green but occasionally apricot. A distinctive band of glossy, dark globular calli (glands) runs down the centre of the labellum. The petals and sepals are not much larger than the column. The two yellow glands that are commonly found at the base of the column in most ‘spider’ caladenias are not present in *C. bryceana* subsp. *bryceana.*

Distribution and habitat

Caladenia bryceana subsp. *bryceana* grows in open woodland of wandoo, yate, flooded gum or sheoak with a sparse understorey of low shrubs, sedges and herbs. Soils are sandy clays to red loam over granite. When first reported in 1914, the subspecies was growing in sandy soil near the back of a salt pool.

The subspecies is found in scattered, mostly small populations between the Boyup Brook area and Boxwood Hill. It is believed to have been more abundant before extensive clearing for agriculture.

Habitat varies over the subspecies range. Populations 1 and 10 are in open woodland of *Eucalyptus wandoo* and *Allocasuarina huegeliana* while Population 2 is in open woodland of *E. rudis* over *Acacia acuminata, Xanthorrhoea preissii* and *Macrozamia riedlei*. Population 3 is in open woodland of *Eucalyptus wandoo* over very open low shrubs and grasses and Populations 4 and 5 are in open woodland of *E. occidentalis* over *A. acuminata* and low shrubs, sedges and herbs. Populations 7, 8, 9, 11 and 13 are in woodland of *Eucalyptus occidentalis* and *Allocasuarina huegeliana* and Populations 6 and 12 are in *A. huegeliana* woodland. Associated species include *Allocasuarina huegeliana, Eucalyptus occidentalis, E. wandoo, Acacia dictyoneura* (P4), *Hakea lissocarpha, Boronia scabra, Neurachne alopecuroidea, Lagenifera huegelii, Caladenia flava* and *Cheilanthes tenuifolia*.

Table 1. Summary of population land vesting, purpose and management

Population Number and Location	DEC District	Shire	Vesting	Purpose	Manager
1a. Pallinup River	Albany	Jerramungup	Freehold	Private Property	Landholders
1b. Pallinup River	Albany	Albany	Unvested	Other	Department of Environment and Conservation
1c. Pallinup River	Albany	Albany	Freehold	Private Property	Landholders
1d. Pallinup River	Albany	Albany	Conservation Commission of Western Australia	Conservation of Flora and Fauna	Department of Environment and Conservation
1e. Pallinup River	Albany	Albany	Freehold	Private Property	Landholders
1f. Pallinup River	Albany	Albany	Freehold	Private Property	Landholders
1g. Pallinup River	Albany	Albany	Unvested	Road Verge	Main Roads Department
1h. Pallinup River	Albany	Albany	Unvested	Unknown	Department of Environment and Conservation
2. Wild Horse Swamp	Wellington	West Arthur	Conservation Commission of Western Australia	Conservation of Flora and Fauna	Department of Environment and Conservation
3a. Stirling Range National Park	Albany	Gnowangerup	Conservation Commission of Western Australia	National Park	Department of Environment and Conservation
3b. Stirling Range National Park	Albany	Gnowangerup	Conservation Commission of Western Australia	National Park	Department of Environment and Conservation
3c. Stirling Range National Park	Albany	Gnowangerup	Conservation Commission of Western Australia	National Park	Department of Environment and Conservation
3d. Stirling Range National Park	Albany	Gnowangerup	Conservation Commission of Western Australia	National Park	Department of Environment and Conservation
4. Toompup South Rd	Albany	Gnowangerup	Freehold	Private Property	Landholders
5a. Toompup South Nature Reserve	Albany	Gnowangerup	Conservation Commission of Western Australia	Conservation of Flora and Fauna	Department of Environment and Conservation
5b. Toompup South Nature Reserve	Albany	Gnowangerup	Conservation Commission of Western Australia	Conservation of Flora and Fauna	Department of Environment and Conservation
5c. Toompup South Nature Reserve	Albany	Gnowangerup	Conservation Commission of Western Australia	Conservation of Flora and Fauna	Department of Environment and Conservation

Population Number and Location	DEC District	Shire	Vesting	Purpose	Manager
5d. Toompup South Nature Reserve	Albany	Gnowangerup	Conservation Commission of Western Australia	Conservation of Flora and Fauna	Department of Environment and Conservation
6. Kuch Rd	Albany	Albany	Unvested	Recreation and Parkland	Department of Planning and Infrastructure
7. Cowalellup Rd	Albany	Jerramungup	Shire of Jerramungup	Road Verge	Shire of Jerramungup
8. Toompup South Rd	Albany	Jerramungup	Shire of Jerramungup	Road Verge	Shire of Jerramungup
9a. Water Reserve	Albany	Albany	Unvested	Water	Water Corporation
9b. Water Reserve	Albany	Jerramungup	Unvested	Water	Water Corporation
9c. Water Reserve	Albany	Jerramungup	Unvested	Water	Water Corporation
10. Pallinup River	Albany	Albany	Unvested	Parklands and Recreation	Shire of Albany
11. Corackerup Creek	Albany	Jerramungup	Unvested	Unknown	Department of Environment and Conservation
12. Corackerup Nature Reserve	Albany	Jerramungup	Conservation Commission of Western Australia	Conservation of Flora and Fauna	Department of Environment and Conservation
13a. Cherininup Reserve	Albany	Jerramungup	Freehold	Private Property	Landholders
13b. Cherininup Reserve	Albany	Jerramungup	Freehold	Private Property	Landholders
13c. Cherrininup Reserve	Albany	Jerramungup	Freehold	Private Property	Landholders

Biology and ecology

The genus *Caladenia* (spider orchids, fairy orchids) is comprised of approximately 200 species, most of which are endemic to Australia. Western Australia has over 140 species, which form its largest single group of orchids (Hoffman and Brown 1998). *Caladenia bryceana* subsp. *bryceana* belongs to a section of *Caladenia* that includes species such as *C. doutchiae*, *C. roei*, *C. incrassata*, *C. cristata*, *C. voigtii* and *C. brevisura*. It is readily distinguished from these by its extremely small flower size and generally more south-western range of distribution.

There has been little research to date on the reproductive biology and development of this subspecies. However, pollination studies of orchids show that, in the Western Australian *Caladenia* species, pollination has diverged to using either sexual lures or food advertisement. The species using sexual attraction, these including *C. bryceana* subsp. *bryceana*, can be identified by the correlated presence of relatively dull colour, lack of humanly-detectable odour, modified sepal structure and often insect-like structures associated with the mobile labellum. Species of male thynnid wasp are attracted to these species and may attempt copulation with the labellum of the flower and in doing so remove or deposit pollinia. In contrast, food-advertising *Caladenia* species have brightly coloured flowers, often odorous and bearing relatively unmodified sepals and non-mobile labella (Stoutamire 1983). After the stigma receives the pollen, numerous grains grow down through the style, fertilising the ovules. The flower withers as the seed develops and the ovary increases in size. Depending on the species, each flower will produce hundreds or thousands of very fine, dust-like seeds that are dispersed by wind. However, very few of these seeds actually develop into mature plants (Hoffman and Brown 1998).

Specific soil fungi are required for the seed to germinate. Following germination, the seedling develops into a protocorm that subsequently sends out a leaf and dropper shoot. A tuber that develops at the end of the shoot becomes dormant during the dry summer period and resprouts the following year. A new, larger tuber is developed each year until the plant is large and mature enough to produce a flowering stem. This can take a few or a number of years, depending on the growing conditions. Plants are particularly vulnerable in the early stages of growth as both the protocorm and tuber are near the soil surface. Each year, the new tuber is developed at a lower level until it is at a safe depth (Hoffman and Brown 1998).

It is likely that the orchid would be killed by fire during its active growing period in late May to early November. The response of *Caladenia bryceana* subsp. *bryceana* to summer fire (December to early-May) is

unknown. However, as it near cleared farmland, summer fire is likely to be followed by loss of habitat due to invasive weeds (Robinson and Coates 1995).

Threats

Caladenia bryceana subsp. *bryceana* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in March 1992 and is currently ranked as Endangered under World Conservation Union (IUCN 2001) Red List criteria C2a(i). There are 13 populations and over 900 plants known. The main threats are weed invasion, fauna and inappropriate fire regimes. The subspecies is also listed as Endangered under the Commonwealth *Environment and Biodiversity Protection Act 1999* (EPBC Act).

- **Weed invasion:** Over 70% of *Caladenia bryceana* subsp. *bryceana* subpopulations are impacted by weeds to some extent, although most populations have only minor infestations. Weeds specifically recorded within populations include *Arctotheca calendula*, *Asparagus asparagoides*, *Avena* species, *Briza minor*, *Echium plantagineum*, *Anagallis arvensis*, *Oxalis* species and various grasses. Weeds suppress early plant growth by competing for soil moisture, nutrients and light and are often blown in from adjoining pasture (Panetta and Hopkins 1991). Weeds can out-compete the orchid and a high level of palatable weeds will attract herbivorous animals, which are often not selective in their grazing. Weeds also increase the risk of fire by modifying the native habitat to produce a higher level of flammable fuels at shorter intervals than the natural vegetation.

- **Fauna:** Grazing impacts from native and introduced fauna has resulted in the erection of a fauna proof fence around the known extremities of Population 2. The impact of herbivore grazing on the subspecies is unclear. Grazing in Populations 1, 2, 9b and 12 in particular, has caused notable damage to the subspecies.

- **Inappropriate fire regime:** Fire is known to have a significant effect on orchid species, though it is not fully understood (Hoffman and Brown 1998). Some species will fail to flower if their habitat has not been burnt, however *Caladenia bryceana* subsp. *bryceana* is likely to be sensitive to fire particularly during the growing, flowering and reproductive phase. Thirty-four individuals were found in Subpopulation 3C before the 2000 fire. After the fire, only five individuals were seen in moderately burnt vegetation and none were found in areas burnt more intensely under wandoo trees (the increase in the subpopulation's numbers in 2004 is due to the area of occupancy being extended by further survey). Fire is thought to kill the parent plant and limit or prevent seedling recruitment. High fire frequency may also lead to the degradation of the orchid's habitat.

- **Recreation:** A high level of tourist visitation at Population 3, which is adjacent to a car park and information bay in the Stirling Range National Park, is leading to the accidental destruction of the orchids and their habitat. The location is a popular tourism area and is a well known location for orchid species. Numerous orchid tours are run in this area throughout the season. As a result, the habitat is being degraded as small tracks used for the tours are widening and new tracks are being formed. Picking of the orchids has also been reported by neighbours to the park.

- **Small population size:** With the largest population consisting of only 115 individuals and over 75% of subpopulations consisting of less than 50 individuals, small population size is a significant threat to this subspecies. As population size decreases, the population may become more vulnerable to extinction for three main reasons. Firstly, loss of genetic variation and increased inbreeding are considered to be associated with a reduction in the ability of a population to adapt to short-term environmental change. Secondly, small populations are more susceptible to chance events associated with demographic and environmental stochasticity. Finally, Allee effects may occur, whereby at some density or population size, reproductive capacity drops below a threshold and the organism can no longer replace itself (Hobbs and Yates 2003).

- **Change in hydrology:** The immediate impact of changed hydrology on *Caladenia bryceana* subsp. *bryceana* is not known. However, some populations may be at risk due to their location in the landscape. Significant changes in hydrology will potentially impact on populations over time by limiting the amount of suitable habitat or changing the conditions required for its growth, flowering and seed

germination. Population 2 has a shallow water-table beneath it which has ranged from 30 cm to 70 cm beneath ground level over the last 3 years with a slight upward trend. The salinity of this water ranges from 8 mS cm^{-1} to 23 mS cm^{-1} (moderately to very saline). Both values are prohibitive to the survival of the orchids.

- **Climate change:** Long-term climate change may stress *Caladenia bryceana* subsp. *bryceana* populations given the predicted decrease in rainfall and increases in temperature and evaporation. It has been considered that those groups likely to be most affected by climate change include geographically localised taxon, peripheral or disjunct populations, specialised species, poor dispersers, genetically impoverished species, and coastal communities (Peters & Darling 1985).

- **Habitat fragmentation:** The habitat in which the subspecies occurs has been subject to extensive land clearing over many years. The direct effects of fragmentation can be summarised as: 1) the creation of small patches of remnant vegetation; 2) the alteration of landscape processes; 3) the isolation of patches in a more or less altered matrix and 4) the reduction of population sizes (Hobbs and Yates 2003). The probability of one or more of these effects leading to local extinction of populations may be dependent on a number of factors such as patch configuration and size, matrix quality, dispersal success and reproductive rate. In plants, the consequences of fragmentation depends on a large number of factors relating to the demography and reproductive biology of a species (breeding system, degree of pollination specialisation, pollinator abundance, seed dispersal and germination and seedling establishment and survival (Hobbs and Yates 2003). The effect of habitat fragmentation on the survival of *Caladenia bryceana* subsp. *bryceana* is unclear.

Table 2. Summary of population information and threats

Population Number and Location	Land Status	Year/No. plants	Condition	Threats
1a. Pallinup River	Private Property	?/30		
1b. Pallinup River	Unallocated Crown Land	?/5 1999/0	Not Found	Weeds (minimal), Change in hydrology
1c. Pallinup River	Private Property	?/0	Reported to have been destroyed by clearing	
1d. Pallinup River	Nature Reserve	2002/0 2001/27+ 1999/0	Not Found Healthy Not Found	Fauna, Weeds
1e. Pallinup River	Private Property	2001/9+ 1999/0	Healthy Not Found	Weeds
1f. Pallinup River	Private Property	1999/0	Not Found	Weeds
1g. Pallinup River	Road Verge	2006/27 2005/12 (south side) 2003/13 (north side) 2002/8 2001/52+ 1999/0	Moderate Healthy Healthy Poor Healthy Unsure of Location	Fauna, Weeds
1h. Pallinup River	Unallocated Crown Land	2006/33 2001/37+	Moderate Healthy	Weeds, Change in hydrology
2. Wild Horse Swamp	Nature Reserve	2007/5 2006/5 2004/28 2003/17 2002/12 2001/21 2000/7 2000/0 1995/23 1992/0 1988/20 1986/20 1985/100		Weeds. Salinity, Change in hydrology
3a. Stirling Range National Park	National Park	2006/ 11 2005/18+ 2004/17 2003/7 2002/3	Poor Moderate Healthy Moderate Moderate	Recreation / trampling

Population Number and Location	**Land Status**	**Year/No. plants**	**Condition**	**Threats**
		2000/11 1998/27 (all subpops included) 1993/90 1992/56 (partial survey) ?30	Healthy Moderate Not Noted Healthy	
3b. Stirling Range National Park	National Park	2006/0 2000/0 1988/?	Not Found	
3c. Stirling Range National Park	National Park	2004/44+/- 2003/5 2000/34 1993/10 1989/5	Healthy Moderate Healthy Recently Burnt Not Noted	Fauna
3d. Stirling Range National Park	National Park	2005/4+ 2000/0 1993/9	Moderate Not Found Recently Burnt	Weeds, Recreation
4. Toompup South Rd	Private Property	2006/125+ 2000/10+ 1995/Not Noted 1992/300-500 1990/?	Healthy Healthy Healthy Healthy	Weeds
5a. Toompup South Nature Reserve	Nature Reserve	2006/16 2003/20+ (includes 5c) 2000/26 1997/0	Healthy Healthy Healthy Not Found	
5b. Toompup South Nature Reserve	Nature Reserve	2006/0 2000/0 1997/0 1992/26	Not found Not Found Not Found Healthy	Weeds
5c. Toompup South Nature Reserve	Nature Reserve	2006/ 32 2003/as for 5a above 2001/4+ 2000/10	Healthy Healthy Healthy Healthy	Weeds
5d. Toompup South Nature Reserve	Nature Reserve	2006/0 2000/11 1992/38	Not found Healthy Healthy	Weeds
6. Kuch Rd	Unvested Reserve	2006/30 2003/63 2000/11 1997/50+	Healthy Moderate Healthy Healthy	Weeds, Change in hydrology
7. Cowalellup Rd	Road Verge	2006/5 1998/4+	Healthy Healthy	Change in hydrology, Fauna
8. Toompup South Rd	Road Verge	2006/29 2001/56+	Healthy Healthy	Weeds, Change in hydrology
9. Water Reserve	Water Reserve	2006/18 2001/25	Moderate Healthy	Weeds, Change in hydrology, fauna
10. Pallinup River	Shire Reserve	2001/88+	Healthy	Weeds, Change in hydrology
11. Corackerup Creek	Unallocated Crown Land	2002/6	Healthy	Weeds, Change in hydrology
12. Corackerup Nature Reserve	Nature Reserve	2006/30 2002/85+	Healthy Healthy	Fauna, Change in hydrology
13a. Cherininup Reserve	Private Property	2006/356 (includes all sub-pops) 2003/115 (includes all sub-pops)	Healthy Healthy-Moderate	Weeds, Change in hydrology
13b. Cherininup Reserve	Private Property	Included in 13a.		
13c. Cherrininup Reserve	Private Property	Included in 13a.		

Guide for decision-makers

Table 2 provides details of current and possible future threats. Developments in the immediate vicinity of the populations or within the defined habitat critical to the survival of *Caladenia bryceana* subsp. *bryceana* require assessment for the potential for a significant level of impact.

Habitat critical to the survival of the subspecies, and important populations

Given that this subspecies is listed as Endangered it is considered that all known habitat is habitat critical to the survival of the subspecies. In addition, all populations, including any translocated populations, are considered important to the survival of the subspecies. Habitat is defined as the biophysical medium or media occupied (continuously, periodically or occasionally) by an organism or group of organisms, or once occupied (continuously, periodically or occasionally) by an organism or group of organisms, and into which organisms of that kind have the potential to be reintroduced (EPBC Act). The area of occupancy of the currently known *Caladenia bryceana* subsp. *bryceana* populations has been mapped. However, other parts of the habitat critical to the survival of the subspecies have not been mapped and an action outlined in this Interim Recovery Plan is to map all habitat as defined above.

The habitat critical to the survival of *Caladenia bryceana* subsp. *bryceana* therefore comprises:

- the area of occupancy of known populations;
- areas of similar habitat surrounding known populations that provide potential habitat for natural recruitment;
- remnant vegetation that surrounds and links populations; and
- additional occurrences of similar habitat that do not currently contain the subspecies but may have done so in the past (these represent possible translocation sites).

Benefits to other species/ecological communities

Threatened flora that occur within or adjacent to populations of *Caladenia bryceana* subsp. *bryceana* include the Critically Endangered species *Grevillea maxwellii*, the Endangered *Myoporum cordifolium* and the Vulnerable *Acacia awestoniana* and *Lepidium aschersonii* as well as a translocated population of the Critically Endangered *Rulingia sp.* Trigwell Bridge (R.Smith s.n. 20/6/1989) WA Herbarium. Priority species present consist of *Laxmannia grandiflora* subsp. *stirlingensis* (P3), *Villarsia submersa* (P4) and *Acacia dictyoneura* (P4).

Threatened fauna that may occur in or nearby habitat occupied by *Caladenia bryceana* subsp. *bryceana* include the Endangered Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and the Vulnerable Baudin's Cockatoo (*Calyptorhynchus baudinii*), Malleefowl (*Leipoa ocellata*), Numbat (*Myrmecobius fasciatus*) and Western Rosella (*Platycercus icterotis xanthogenys*). Priority fauna in the vicinity of *Caladenia bryceana* subsp. *bryceana* include the Bush Stonecurlew (*Burhinus grallarius*) (P4), Crested Shrike-tit (*Falcunculus frontalis leucogaster*) (P4), Shy Heathwren (*Hylacola cauta whitlocki*) (P4), Western Brush Wallaby (*Macropus irma*) (P4), Crested Bellbird (*Oreoica gutturalis gutturalis*) (P4), White-browed Babbler (*Pomatostomus superciliosus ashbyi*) (P4) and Western Whipbird (*Psophodes nigrogularis oberon*) (P4).

Recovery actions implemented to improve the quality or security of the habitat of the habitat of *Caladenia bryceana* subsp. *bryceana* will benefit these species and reciprocally, recovery actions put in place for these species will benefit *C. bryceana* subsp. *bryceana*.

International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity that was ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. The subspecies is listed under the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species

(CITES). However, it is not listed under any other specific international treaty and this recovery plan does not affect Australia's obligations under these international agreements.

Role and interests of indigenous people

According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, the sites of Aboriginal significance Amelup North, Amelup South, Betts Rockhole, Browns Paddock 1, Chillilup Cliffs, Chittowurup Creek 1, Chittowurup Creek 2, Chittowurup Creek, Cobomup Creek, Field Site 3, Gairdner 1, Gnianup 3, Gnianup Junction, Kojaneerup, Marningerup Road Burial, Moingup Springs, Moort-Lea 1, Moort-Lea 2, Moort-Lea 3, Needilup River 01, Needilup River 02, Needilup River 03, Needilup River 04, Needilup River 05, Needilup River 06, Needilup River 07, Needilup River 08, Needilup River 09, Needilup River 10, Needilup River 11, Needilup Tributary 1, Needilup Tributary 2, Needilup, Nyerilup Creek, Peniup 1, Peniup 2, Pingamup Creek, Pixie Spring, Reynolds Hill Peak, Reynolds Hill, Rockhole Paddock 1, Sand Quarry, Smithfield, Stock Road Burials, Toompup Burial 1, Site no. S02361 and Wirrup Hill are known at or near populations of the subspecies covered by this recovery plan. The involvement of the Indigenous community is currently being sought to determine whether there are any issues or interests identified in the Plan. If no role is identified for Indigenous communities in the recovery of this subspecies, opportunities may exist through cultural interpretation and awareness of the subspecies.

The advice of South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs is being sought to assist in the identification of potential Indigenous management responsibilities for land occupied by threatened species, or groups with a cultural connection to land that is important for the subspecies conservation.

Continued liaison between DEC and the Indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

Social and economic impacts

The implementation of this Interim Recovery Plan has the potential to have some minimal social and economic impact as five populations and eight known subpopulations are located on private property, Shire Reserves, a Water Corporation reserve, a Department of Planning and Infrastructure (DPI) reserve and Main Roads Department Reserves; with all others occurring on DEC-managed land. The recovery plan also has the potential to impact upon tour operators that include the subspecies in their tours. Recovery actions refer to continued negotiations between stakeholders with regard to these areas.

Affected interests

One population and seven subpopulations (almost one-third) occur on private property, three subpopulations occur in a reserve managed by the Water Corporation, two populations occur in reserves managed by the Shire of Jerramungup, one population occurs in a reserve managed by the City of Albany, one population occurs in a reserve managed by DPI and one subpopulation occurs on a road verge managed by the Main Roads Department. The remaining three populations and eleven subpopulations (almost half) occur on land managed by the DEC, of which one population and ten subpopulations are vested in the Conservation Commission of Western Australia and one population and two subpopulations occur on unallocated Crown land.

Evaluation of the Plan's Performance

DEC will evaluate the performance of this recovery plan in conjunction with the Albany and Wellington Districts Threatened Flora Recovery Teams. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

The objective of this Interim Recovery Plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the subspecies in the wild.

Criteria for success: The number of populations and individuals within populations remains stable or increases over the five years of the plan.
Criteria for failure: The number of populations or the number of individuals within populations decreases over the five years of the plan.

3. RECOVERY ACTIONS

Completed recovery actions

All land managers have been notified of the location and threatened status of *Caladenia bryceana* subsp. *bryceana*. The notification details the Declared Rare status of the subspecies and the legal responsibility to protect it.

A rabbit-proof fence was erected around Population 2 in 1996 to protect *Caladenia bryceana* subsp. *bryceana* and its habitat. Prior to the fence being erected, known individuals were caged for their protection.

A leaflet drop to all landowners in the area of known *Caladenia bryceana* subsp. *bryceana* populations in the Albany District was undertaken and resulted in the finding of Population 6 and an increased awareness within the community.

An information sheet, which includes a description of the plant, its habitat, threats, recovery actions and photos has been produced and distributed.

An article in the Albany newspaper *Extra* which included a description of the subspecies and its habitat and gave information for anyone interested in getting involved, was published on Saturday August 25, 2001.

Ongoing and future recovery actions

Staff and volunteers from the DEC Albany and Wellington Districts regularly monitor populations.

Where populations occur on lands other than those managed by DEC, permission has been or will be sought from appropriate land managers prior to recovery actions being undertaken. The following recovery actions are roughly in order of descending priority; however this should not constrain addressing any action if funding is available and other opportunities arise.

1. Coordinate recovery actions

The Albany District Threatened Flora Recovery Team and South West Region Threatened Flora and Communities Recovery Team are coordinating recovery actions for *Caladenia bryceana* subsp. *bryceana* and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Action:	Coordinate recovery actions
Responsibility:	DEC (Albany and Wellington Districts) through the Threatened Flora Recovery Teams
Cost:	$3,000 per year

2. Monitor populations

Continue regular monitoring of *Caladenia bryceana* subsp. *bryceana* populations.

Action: Monitor populations
Responsibility: DEC (Albany and Wellington Districts)
Cost: $5,804 per year

3. Liaise with stakeholders

As a number of populations occur on lands not managed by DEC, close liaison with land managers is essential in ensuring good and cooperative management of the subspecies. Input and involvement will also be sought from any Noongar groups that have an active interest in areas that are habitat for *Caladenia bryceana* subsp. *bryceana*.

Action: Liaise with land managers
Responsibility: DEC (Albany and Wellington Districts)
Cost: $1,200 per year

4. Minimise recreational impacts

Recreational impacts on *Caladenia bryceana* subsp. *bryceana* Population 3 need to be addressed as tourism pressure is increasing. Methods that can be used to minimise these impacts include the installation of railing to discourage entry to area, rehabilitation of walk tracks and signage such as the DEC "Let It Grow" signs already used in the national park. A current PhD project will investigate the effect of recreational impacts on flora, and Population 3 is being considered as a study site. Such data will enable DEC and involved parties to make informed management decisions. Close liaison with tour operators is imperative to ensure that all parties are informed of the impacts and actions that can be taken to minimise them.

Action: Minimise recreational impacts
Responsibility: DEC (Albany Work Centre)
Cost: $1,710 in the first year and $510 each year thereafter

5. Implement weed control

Over 70% of *Caladenia bryceana* subsp. *bryceana* populations are threatened by weeds. The weed control program will involve:
i - identification and mapping weed species, quantification of impact and prioritisation of target areas;
ii - selection of appropriate control methods, such as selective herbicides or manual removal;
iii - assessing the need for planting of native flora;
iv - close monitoring and repetition of weed control techniques if necessary.

Action: Implement weed control
Responsibility: DEC (Albany and Wellington Districts)
Cost: $ 2,540 per year

6. Collect seed

Seed collection (and collection of mycorrhizae) will be ongoing to obtain seed from as wide a range of individuals as possible.

Action: Collect seed
Responsibility: DEC (Kings Park and Botanic Gardens and Albany and Wellington Districts)
Cost: $5,930 per year

7. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Caladenia bryceana* subsp. *bryceana* will provide a better scientific basis for management of the wild populations. An understanding of the following is particularly necessary for effective management:

1. Reproductive biology and the role of mycorrhizal fungi, competition, rainfall and various disturbances in recruitment and survival.
2. The population genetic structure, levels of genetic diversity and minimum viable population size.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division and Albany and Collie Work Centres)
Cost: $24,000 per year for the first three years

8. Investigate the methodology for future translocation(s) and plant propagation

Within the 5-year time frame of the plan, the best methods for future propagation for translocations or re-stocking of *in situ* populations should be investigated and a decision made on the most appropriate translocation site and procedure.

Action: Investigate propagation methodology and translocation procedures for future translocation(s)
Responsibility: DEC (Science Division and Albany and Wellington Districts)
Cost: $2,500 per year

9. Conduct further surveys

Surveys supervised by DEC staff, with assistance from local naturalists and wildflower society members, are to be conducted during the subspecies flowering period (August to October). Similar habitat has not been extensively surveyed. Information on soil and vegetation types will be used to identify similar habitat to target for further survey.

Action: Conduct futher survey
Responsibility: DEC (Albany and Wellington Districts)
Cost: $5,804 per year

10. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of this subspecies will be promoted to the community through poster displays and the local print and electronic media. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action: Promote awareness
Responsibility: DEC (Albany and Wellington Districts) through the RTs
Cost: $900 per year

11. Map habitat critical to the survival of the subspecies

Spatial data relating to critical habitat has been completed for Population 3 and habitat critical to the survival of remaining populations, and any additions populations that are located, will also be determined and mapped.

Action: Map habitat critical to the survival of the subspecies
Responsibility: DEC (Albany and Wellington Districts)
Cost: $400 in first year

12. Review the recovery plan and assess the need for further recovery actions

If *Caladenia bryceana* subsp. *bryceana* is still ranked as Endangered (WA) at the end of the five-year term of this recovery plan, the plan will be reviewed and the need for further recovery actions assessed.

Action: Review the recovery plan and assess the need for further recovery actions
Responsibility: DEC (Species and Communities Branch and Albany and Wellington Districts) through the Albany District Threatened Flora Recovery Team
Cost: $4,000 in the fifth year (if required)

Summary of recovery actions

Recovery Actions	Priority	Responsibility	Completion date
Coordinate recovery actions	High	DEC (Albany and Wellington Districts) through the Threatened Flora Recovery Teams	Ongoing
Monitor populations	High	DEC (Albany and Wellington Districts)	Ongoing
Liaise with stakeholders	High	DEC (Albany and Wellington Districts)	Ongoing
Minimise recreational impacts	High	DEC (Albany Work Centre)	Ongoing
Implement weed control	High	DEC (Albany and Wellington Districts)	Ongoing
Collect seed	High	DEC (Kings Park and Botanic Gardens and Albany and Wellington Districts)	Ongoing
Obtain biological and ecological information	High	DEC (Science Division and Albany and Collie Work Centres)	2011
Investigate the methodology for future translocation(s) and plant propagation	High	DEC (Science Division and Albany and Wellington Districts)	2013
Conduct further surveys	High	DEC (Albany and Wellington Districts)	Ongoing
Promote awareness	High	DEC (Albany and Wellington Districts) through the Threatened Flora Recovery Teams	Ongoing
Map habitat critical to the survival of the subspecies	Moderate	DEC (Albany and Wellington Districts)	2009
Review the recovery plan and assess the need for further recovery actions	Moderate	DEC (Species and Communities Branch and Albany and Wellington Districts) through the Albany District Threatened Flora Recovery Team	2013

4. TERM OF PLAN

Western Australia

This Interim Recovery Plan will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. If the taxon is still ranked as Endangered (WA) after five years, this IRP will be reviewed and if necessary, further recovery actions put in place.

Commonwealth

In accordance with the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) this adopted recovery plan will remain in force until revoked.

The recovery plan must be reviewed at intervals of not longer than 5 years.

5. REFERENCES

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6. TAXONOMIC DESCRIPTION

Caladenia bryceana R.S. Rogers, *Trans. & Proc. Roy. Soc. South Australia* 54: 46 (1930). *Type*: Gnowangerup, Western Australia, 3 September 1914, *B. MacIntyre s.n.* (*holo*: AD).

Plant solitary or in loose clumps. *Leaf* erect to horizontal, linear, 4-8 cm x 5-12 mm, pale green. *Scape* 3-10 cm tall. *Flowers* 1(2), *c*. 1-2 cm across, pale green, sometimes with variable suffusions, lines and spots of dull maroon to pink; floral odour absent. *Sepals and petals* stiffly held, lacking an osmophore, apex obtuse. *Dorsal sepal* erect to slightly incurved, linear, 0.8-1.1 cm x 1.5-2 mm. *Lateral sepals* straight, spreading obliquely downwards and curving inwards to meet distally, broadly lunate, 0.7-1.0 cm x 2-3 mm. *Petals* thrust sharply downward or spreading and curved forward, linear, 0.9-1.1 cm x 1.0-1.5 mm. *Labellum* 3-lobed with a tiny apical midlobe, prominently 2-coloured, pale green, lacking stripes, terminating in a uniformly dark maroon sharply recurved apex, stiffly articulate on a claw *c*. 1 mm wide; lamina cordate with a small obtuse apex in outline when flattened, 5-6 x 5-6 mm, basal third curving from erect to horizontal, middle third horizontal, apical third horizontal to downcurved terminating in the last 1 mm in a sharply recurved apex, margins at widest point scarcely curved upwards at first and then becoming horizontal; lateral lobes erect to horizontal with entire margins; midlobe margins entire. *Lamina calli* aggregated in a dense central continuous or discontinuous band extending at least ¾ the length of the labellum and stopping short of the dark maroon apex, erect, dark purplish black (rarely green or fawn) with a white base, linear, capitate with a shiny broadly to narrowly globular head, the longest *c*. 1 mm tall, slightly decrescent towards apex. *Column* 1-10 x 5-7 mm, broadly winged, greenish-yellow with maroon blotches. *Anther c*. 1.5 x 1.5 mm, yellow-green. *Pollinia c*. 1 mm long, yellow. *Stigma c*. 2 mm wide, yellow-green. *Capsule* not seen.

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Caladenia bryceana subsp. bryceana *Leaf* 4-6 cm x 5-7 mm. *Lamina calli* in a continuous band (always present in the middle of labellum lamina), capsule with a broadly globular head.

Table 3. SUMMARY OF RECOVERY ACTIONS AND COSTS

Recovery Action	Year 1			Year 2			Year 3			Year 4			Year 5		
	DEC	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**
Coordinate recovery actions	1800	600	600	1800	600	600	1800	600	600	1800	600	600	1800	600	600
Monitor populations	3864	600	1340	3864	600	1340	3864	600	1340	3864	600	1340	3864	600	1340
Liaise with stakeholders	1200			1200			1200			1200			1200		
Minimise recreational impacts	600	600	510	200	200	110	200	200	110	200	200	110	200	200	110
Implement weed control	1000	600	940	1000	600	940	1000	600	940	1000	600	940	1000	600	940
Seed collection	5000	600	330	5000	600	330	5000	600	330	5000	600	330	5000	600	330
Obtain biological and ecological information	24000			24000			24000								
Investigate the methodology for future translocation(s) and plant propagation	2,500			2,500			2,500			2,500			2,500		
Conduct further surveys	3864	600	1340	3864	600	1340	3864	600	1340	3864	600	1340	3864	600	1340
Promote awareness	600		300	600		300	600		300	600		300	600		300
Map habitat critical to the survival of the species	400														
Review the IRP and assess the need for further recovery actions													1000		3000
Total	44828	3600	5360	44028	3200	4960	44028	3200	4960	20028	3200	4960	21028	3200	7960
Yearly Total	**57,388**			**52,188**			**52,188**			**28,188**			**32,188**		

NHT = External funding (funding to be sought), Other = in-kind contribution and BGPA

Total Department:	$173,940
Total Other:	$16,400
Total External Funding:	$28,200
TOTAL COSTS:	**$218,540**