INTERIM RECOVERY PLAN NO. 214

BUSSELL'S SPIDER ORCHID (*CALADENIA BUSSELLIANA*)

INTERIM RECOVERY PLAN 2005-2010

Julie Patten[1], Andrew Webb[2] and Andrew Batty[3]
[1]Project Officer, Species and Communities Branch (SCB), CALM, PO Box 51 Wanneroo, 6946.
[2]Nature Conservation Officer, CALM's Blackwood District, 14 Queen Street, Busselton 6280.
[3]Research Scientist, Botanic Garden and Parks Authority, Fraser Avenue, West Perth 6005.

Photograph: Andrew Brown

September 2005
Department of Conservation and Land Management
Species and Communities Branch (SCB)
PO Box 51, Wanneroo, WA 6946

Government of Western Australia

DEPARTMENT OF Conservation AND LAND MANAGEMENT
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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.

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.

CALM is committed to ensuring that Critically Endangered taxa are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans and by ensuring that conservation action commences as soon as possible and always within one year of endorsement of that rank by the Minister.

This Interim Recovery Plan results from a review of, and replaces, IRP No.121 *Caladenia busselliana* and *Caladenia viridescens* (Stack *et al.* 2002).

This Interim Recovery Plan will operate from September 2005 to August 2010 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered, this IRP will be reviewed after five years and the need for a full recovery plan assessed.

This IRP was given regional approval on 21 November 2005 and was approved by the Director of Nature Conservation on 13 December 2005. The allocation of staff time and provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate at September 2005.

ACKNOWLEDGMENTS

The following people have provided assistance and advice in the preparation of this Interim Recovery Plan:

Mark Brundrett	Orchid Research Unit, Botanic Garden and Parks Authority
Leonie Monks	Research Scientist, CALM's Science Division

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and CALM 's Wildlife Branch for assistance.

SUMMARY

Scientific Name:	*Caladenia busselliana*	**Common Name:**	Bussell's spider orchid
Family:	Orchidaceae	**Flowering Period:**	September – October
CALM Region:	South West	**CALM District:**	Blackwood
Shire:	Busselton	**Recovery Team:**	South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT)

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds) (1998) *Western Australia's Threatened Flora.* Department of Conservation and Land Management, Perth; Elscot, S. (2001) *Carbunup Reserve Management Plan* Shire of Busselton. Western Australia; Hoffman, N. and Brown, A. (1992) *Orchids of South-west Australia.* University of Western Australia Press. Perth; Hopper, S.D. and Brown, A.P. (2001) Contributions to Western Australian Orchidology:2. New taxa and circumscriptions in *Caladenia* (Spider, Fairy and Dragon orchids of Western Australia). *Nuytsia* 14(1/2), 27-308.

Current status: *Caladenia busselliana* was declared as Rare Flora in September 1992 under the Western Australian *Wildlife Conservation Act* 1950 and ranked as Critically Endangered (CR) in September 1995. It is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act). It currently meets World Conservation Union (IUCN 2000) Red List Category 'CR' under criteria B1ab(iii,v)+B2ab(iii,v); C2a(i,ii) and D as there are less than 50 plants known, and populations have a very limited distribution and are severely fragmented, with continuing decline in the quality of the habitat and number of mature individuals. The main ongoing threats are further habitat degradation, inappropriate fire regimes and accidental destruction.

Description: *Caladenia busselliana* is between 20 to 30cm high and has a single hairy leaf, 10-20cm long and 5-10mm wide. Each plant displays one to three pale yellow flowers that are similar in size and shape to those of *C. viridescens* (Dunsborough spider orchid) and also the common *C. paludosa* (swamp spider orchid). *C. busselliana* differs from *C. viridescens*, its closest relative, in its paler yellow colouration, more ovate labellum lacking a dark maroon apex and longer, narrower clubs on the sepals (Hoffman and Brown 1992). Although the species is a perennial herb, plants are reduced to a below-ground storage organ (tuber) in summer, re-emerging in autumn and flowering from mid-September to late October.

Habitat requirements: *Caladenia busselliana* is currently known from a narrow range of less than 40km in the Vasse-Yallingup area. It grows in winter-wet swamps on sandy loam over clay soils in jarrah and marri woodland, with *Anigozanthos viridis*, *C. paludosa* and occasionally *C. viridescens*.

Guide for decision-makers: Section 1 provides details of current and possible future threats. Developments in the immediate vicinity of populations or within the habitat that is critical for the species' survival require assessment. Any on-ground works (clearing, firebreaks, roadworks, spraying of herbicides, burning, drainage etc) in the immediate vicinity of *Caladenia busselliana* will require assessment. Proponents should demonstrate that on-ground works will not have an impact on the species, or on its habitat or potential habitat.

Habitat critical to the survival of the species, and important populations: Habitat critical to the survival of the species includes the area of occupancy of known populations, similar habitat adjacent to known populations (within 200 m), and additional occurrences of similar habitat in nearby areas that do not currently contain the species but may have done so in the past. Given that this species is listed as Critically Endangered, it is considered that all wild and translocated populations are important populations.

Benefits to other species/ecological communities: Recovery actions implemented to improve the quality or security of the habitat of *Caladenia busselliana* will also improve the status of the Endangered giant spider orchid (*C. excelsa*) as well as the Critically Endangered Dunsborough spider orchid (*C. viridescens*) which occurs in the habitat of *C. busselliana* at Population 1.

International Obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. Although the taxon is listed under the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES) this IRP does not affect Australia's obligations under international agreements.

Role and interests of indigenous people: Indigenous communities interested or involved in the region affected by this plan have not yet been identified, however, implementation of recovery actions under this plan includes consideration of the role and interests of indigenous communities in the region. Input and involvement will be sought from any indigenous groups that have an active interest in areas that are habitat for *Caladenia busselliana*. The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of this population.

Social and economic impacts: The implementation of this recovery plan has the potential to have some social and economic impact, as one population is located on private property and others in unvested reserves and State Forest. Areas on private land that are considered to be 'habitat critical' may be regarded as having potential for uses other than conservation by landholders. Approaches that may minimise this potential impact could include covenants, the Land for Wildlife Scheme, or possibly land acquisition, and this is discussed in recovery actions.

Evaluation of the Plans Performance: CALM, in conjunction with the Recovery Team will evaluate the performance of this IRP. The plan is to be reviewed within five years.

Existing Recovery Actions: The following recovery actions have been or are currently being implemented:

1. Land managers have been notified of the location and threatened status of the taxon.
2. Declared Rare Flora (DRF) markers have been installed at all roadside populations.
3. Habitat restoration measures including deep-ripping, rubbish removal and weed control have been undertaken at Population 1.
4. A track at Population 1 has been closed.
5. Spot spraying of weeds has been carried out as appropriate.
6. The habitat of Populations 1 and 2a has been fenced to exclude grazing.
7. Staff from Botanic Garden and Parks Authority (BGPA) collected seed from Population 2 in 2001. This is stored in the BGPA's plant science lab at –196°C.
8. BGPA staff are assessing material from *Caladenia busselliana* to determine the genetic distinctiveness of the species.
9. Germination trials of *Caladenia busselliana* have been carried out on seed stored by BGPA Germination rates of around 60% were achieved.
10. A research burn was undertaken in December 1999 to investigate how this species responds to fire. Monitoring of this trial is ongoing.
11. A fire management strategy is being developed, and will be modified as appropriate when results of fire research are known.
12. The process of changing the vesting of the Shire Reserve, on which Population 1 occurs, to an "A" Class Nature Reserve under the care, control and management of the Conservation Commission has commenced.
13. An information sheet that describes and illustrates the species has been produced and distributed.
14. The importance of the species has been promoted through threatened flora displays at local wildflower shows and threatened flora field days.
15. A review of historic rainfall data was undertaken in 2001 to identify any correlation between rainfall patterns and orchid flowering.
16. A new population (Population 2b) was located during surveys for new populations undertaken in 1999 and 2000.
17. Staff from CALM's Blackwood District regularly monitor populations of this species.
18. The SWRTFCRT is overseeing the implementation of this IRP and will include information on progress in an annual report to the CALM's Corporate Executive and funding bodies.

IRP Objective: 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 species in the wild.

Recovery criteria

Criteria for success: The number of individuals within populations and/or the number of populations have increased by 10 percent or more over the period of the plan's adoption under the EPBC Act.

Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by 10 percent or more over the period of the plan's adoption under the EPBC Act.

Recovery actions

1. Coordinate recovery actions
2. Increase seed set
3. Collect seed and fungal material
4. Monitor populations
5. Conduct further surveys
6. Complete and implement fire management strategy
7. Obtain biological and ecological information
8. Undertake translocation
9. Stimulate flowering
10. Map critical habitat
11. Continue weed control
12. Control rabbits
13. Liaise with land managers
14. Seek to increase security of tenure
15. Promote awareness
16. Rehabilitate habitat as required
17. Review this Plan

1. BACKGROUND

History

There are 340 orchid taxa in the south west of Western Australia of which 300 are endemic to that corner of the state. Of these, 34 are Critically Endangered and 34 others are only known from a few locations and their status requires urgent investigation.

The first collection of *Caladenia busselliana* housed at the WA Herbarium was made in 1954 from an unknown location and exhibited in a flower show. The species then escaped detection until 1990 when it was rediscovered by Busselton orchid enthusiast Greg Bussell.

During surveys in 1990 more than 100 plants were recorded south east of Dunsborough (Population 1). Since then the number of plants in all populations has fluctuated but shown a general decline, with only six plants located in Population 1 in 2001.

Description

Caladenia busselliana is between 20 to 30cm high and has a single hairy leaf, 10-20cm long and 5-10mm wide. Each plant displays one to three pale yellow flowers that are similar in size and shape to those of *C. viridescens* and also the common *C. paludosa* (Swamp Spider Orchid). *C. busselliana* differs from *C. viridescens*, its closest relative, in its paler yellow colouration, more ovate labellum lacking a dark maroon apex and longer, narrower clubs on the sepals (Hoffman and Brown 1992). Although it is a perennial herb, plants are reduced to a below-ground storage organ (tuber) in summer, re-emerging in autumn and flowering from mid-September to late October.

Distribution and habitat

Caladenia busselliana is currently known from a narrow geographic range of less than 40 linear kilometres near the northern end of the Leeuwin-Naturaliste Ridge, between Vasse and Yallingup. It occurs in winter-wet swamps on sandy loam over clay soils in marri (*Eucalyptus calophylla*) and jarrah (*Eucalyptus marginata*) woodland with *Anigozanthos viridis* and *C. paludosa* (Brown *et al*. 1998; Hoffman and Brown 1992).

Biology and ecology

Caladenia species such as *C. busselliana* typically have a growing phase from March through to late November. Early in the growing season the orchid remains below ground as a newly sprouted shoot from the dormant tuber. Following the first seasonal rains a single leaf appears above ground and mycorrhizal associations with soil fungi are active. Orchid seedlings are dependent on one specific, or range of, specific mycorrhizal fungi for seed germination and nutrition. During winter the replacement tuber, which is essential for survival until the following year, is initiated and continues to develop until late in the growing season. The survival of the plant to the following growing season is dependent on the presence of this tuber at the end of the growing season and no tuber mortality during the period of summer dormancy. Further research is needed into understanding what stimulates tuber production and the interactions between leaves and tubers as ‘sinks’ for resources. It seems likely that tubers must reach a critical size to sustain dormancy throughout the summer (Batty *et al.* In prep A, B).

Not all plants in a population will produce flowers in any one year. Generally, for every plant in flower, a number of vegetative plants will be present. The proportion of flowering to non-flowering individuals is influenced by environmental conditions including the presence or absence of summer fire and the amount of rainfall received during winter and spring (Batty *et al.* In prep A, B).

Flowering individuals will produce a bud mid-way through the growing season that continues to grow until flowering. Plants flower for approximately two weeks or until pollination occurs, after which flowers collapse and if pollination was successful a seed capsule develops. The capsule swells as seed matures, and this can take from six to eight weeks to develop depending on climatic conditions. If temperatures are higher than average seeds may mature faster. Prior to seeds being released the green capsule turns yellow and then brown. Small slits develop in the capsule from which the seed is dispersed. Up to 30,000 seeds can be produced in the one capsule (Batty *et al.* In prep A, B).

Seeds will remain dormant in the soil over summer until the break of the season the following year. Once wet, the seeds imbibe water and the seed coat splits. At this point infection by a suitable fungus is required for germination to occur, which will result in a protocorm and subsequent seedling. Not all of these seedlings will mature, as those that fail to produce a tuber will not survive dry summer conditions. If no fungus is present, seed remains in the soil throughout the growing season, and those that are not predated are killed by dry summer conditions (Batty *et al.* 2000, 2001).

Orchid seedlings are very small for the first growing season and are difficult to locate. Leaves are typically less than 20mm long and only a few millimetres wide. It appears that leaf and tuber size will then increase over the next four to five years until adult plants capable of flowering are present.

Threats

Caladenia busselliana was declared as Rare Flora in September 1992 under the Western Australian *Wildlife Conservation Act* 1950, and ranked as Critically Endangered (CR) in September 1995. It is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act). It currently meets World Conservation Union (IUCN) Red List Category 'CR' under criteria B1ab(iii,v)+B2ab(iii,v); C2a(i,ii) and D (IUCN 2000) as there are less than 50 plants known, and populations have a very limited distribution and are severely fragmented, with continuing decline in the quality of the habitat and number of mature individuals. The main ongoing threats are further habitat degradation through weed infestation in particular. Other threats include grazing, accidental destruction, road maintenance activities, soil disturbance, inappropriate fire regimes, and poor recruitment.

- **Weed invasion** is a potential threat to all populations as it degrades the habitat of the species. Weeds suppress early plant growth by competing with the orchids and associated species in their habitat for soil moisture, nutrients and light. They also exacerbate grazing pressure and increase the fire hazard due to the easy ignition of high fuel loads, which are produced annually by many grass weed species.

- **Grazing** by rabbits, kangaroos or stock has impacted on all *Caladenia busselliana* populations. Grazing by insects has also been observed at some populations. The only bud found at Population 2 in October 2001 was grazed before flowering. The high level of palatable weeds near these populations and in adjacent farming properties attract herbivorous animals, which are often unselective in their grazing.

- **Diggings** by small mammals including rabbits and Quendas (Southern Brown Bandicoots; *Isoodon obesulus*), are a potential threat to all populations as they dig burrows or seek orchid tubers as a food source. Population 2 has been particularly affected.

- **Inappropriate fire regimes** may affect the viability of populations. Undergrowth can get excessively dense and orchids can be out-competed if an area is unburnt too long. However, fire that occurs when the orchid has above-ground growth will prevent seed set and possibly kill the tuber through a lack of opportunity to build up starch reserves. Most orchid species emerge from

the soil by mid April and dehisce their seed by late November. The optimum time for fire in orchid populations is therefore from December to March. The orchids become dormant at this time when climatic conditions are typically hot and dry. However there is a risk of fires at this time becoming uncontrolled and risking lives and property. People conducting any approved controlled burn in orchid populations need to consider the timing of summer rainfall or other conditions that reduce those risks. In addition to the detrimental effects of inappropriate fire on the vegetative stages of the species, a proliferation of weeds often follows burning, partly due to a temporary increase in the availability of nutrients (Panetta and Hopkins 1991).

- **Recreational impacts** such as trampling, picking of orchid flowers, soil compaction and habitat fragmentation by establishment of paths by visitors may exert further pressure on populations of the orchids.

- **Road maintenance** has the potential to impact on the species at Population 1b. Threats to roadside populations include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Several of these actions also encourage weed invasion.

- **Poor recruitment** threatens all populations with few plants developing seed without artificial assistance. It is suspected that low orchid recruitment rates from seed dispersed in their natural environment may in part be due to the patchy distribution of mycorrhiza in soils (Scade *et al*. in prep.). It is also possible that natural recruitment of terrestrial orchids may only occur in years when a longer growing season results from above average spring rainfall prior to the onset of summer dormancy. Climatic conditions during this time are more conducive to the formation of tubers.

- **Rubbish dumping** has occurred in the past in the habitat of Population 1. Track closure was completed in 1999 and this has restricted vehicle access and hence, further rubbish dumping.

Summary of population information and threats

Pop. No. & Location	Land Status	Year / No. plants	Condition	Threats
1a. SE of Dunsborough	Unvested Reserve	1990 100+* 1991 30* 1993 63* 1994 15* 1997 1* 1998 5* 1999 16* 2000 6* 2001 6* 2002 5* 2003 6*	Healthy	Weed invasion, grazing, trampling, inappropriate fire regimes, poor recruitment, rubbish dumping
1b. SE of Dunsborough	Shire Road Reserve	(See above)	Healthy	Road maintenance, weed invasion, grazing, inappropriate fire regimes, poor recruitment
1c. SE of Dunsbrough	Private Property	2002 3	Healthy	Weed invasion, grazing, inappropriate fire regimes, poor recruitment
2a. Carbunup	Shire Reserve (Parks and Recreation)	1991 2 1993 0 1997 1 1998 0 1999 0 2000 0 2001 1 2002 3*	Healthy	Weed invasion, grazing, quenda diggings, inappropriate fire regimes, poor recruitment
2b. Carbunup	Shire Reserve (Parks and Recreation)	2000 2 2001 2 2002 3*	Healthy	Firebreak maintenance, weed invasion, grazing, quenda diggings, inappropriate fire regimes, poor recruitment
3. Capel	State Forest	1991 1	Disturbed	Clearing, weed invasion, grazing, inappropriate fire regimes, poor recruitment

* = total for subpopulations a and b combined.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Any on-ground works (clearing, firebreaks, roadworks, spraying of herbicides, burning, drainage etc) in the immediate vicinity of *Caladenia busselliana* will require assessment. Proponents should demonstrate that on-ground works will not have an impact on the species, or on its habitat or potential habitat.

Critical habitat

Critical habitat is habitat identified as being critical to the survival of a listed threatened species or listed threatened ecological community. 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 critical habitat for *Caladenia busselliana* comprises:

- the area of occupancy of known populations;
- areas of similar habitat within 200 metres of known populations, i.e. sandy loam over clay soils in winter-wet swamps in jarrah, marri and peppermint woodlands or coastal heath (these provide potential habitat for natural range extension);
- corridors of remnant vegetation that link populations (these are necessary to allow pollinators to move between populations and are usually road and rail verges);
- additional occurrences of similar habitat that do not currently contain the species but may have done so in the past (these represent possible translocation sites); and
- the local catchment for the surface water that provides the wetland habitat of the species (the species occurs in winter wet areas and this habitat is dependent on maintenance of local surface hydrology).

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

Habitat critical to the survival of the species includes the area of occupancy of known populations, similar habitat adjacent to known populations (within 200 m), i.e. sandy loam over clay soils in winter-wet swamps in jarrah, marri and peppermint woodlands or coastal heath (these provide potential habitat for natural expansion) and additional occurrences of similar habitat in nearby areas that do not currently contain the species but may have done so in the past (these represents possible future translocation sites). 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). Given that this species is listed as Critically Endangered, it is considered that all wild and translocated populations are important populations.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Caladenia busselliana* will also improve the status of the Endangered Giant Spider Orchid (*C. excelsa*) as well as the Critically Endangered Dunsborough spider orchid (*C. viridescens*) which occurs in the habitat of *C. busselliana* at Population 1, as well as the remnant vegetation in which it is located.

International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. Although the taxon is listed under the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES) this IRP does not affect Australia's obligations under international agreements.

Role and interests of indigenous people

Indigenous communities interested or involved in the region affected by this plan have not yet been identified, however, implementation of recovery actions under this plan includes consideration of the role and interests of indigenous communities in the region Input and involvement will be sought from any indigenous groups that have an active interest in areas that are habitat for *Caladenia busselliana*. The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of this population.

Social and economic impacts

The implementation of this recovery plan has the potential to have some social and economic impact, as one population is located on private property and others in unvested reserves and State Forest. Areas on private land that are considered to be 'habitat critical' may be regarded as having potential for uses other than conservation by landholders. Approaches that may minimise this potential impact could include covenants, the Land for Wildlife Scheme, or possibly land acquisition, and this is discussed in recovery actions.

Evaluation of the Plan's Performance

CALM, in conjunction with the South West Region Threatened Flora and Communities Recovery Team will evaluate the performance of this IRP. 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.

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 species in the wild.

Criteria for success: The number of individuals within populations and/or the number of populations have increased by ten percent or more over the period of the plan's adoption under the EPBC.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more over the period of the plan's adoption under the EPBC.

3. RECOVERY ACTIONS

Existing recovery actions

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

DRF markers have been installed to mark the locations of all road reserve populations of the species to help prevent future damage from road maintenance activities. Pegs have also been placed at an internal

firebreak within the reserve habitat of Population 2b. These markers alert people working in the area to the presence of rare flora and help avoid damage to the habitat.

Habitat restoration measures including restriction of vehicle access, deep-ripping, rubbish removal and weed control were instigated in 1996 and 1997 at Population 1. The site has been fenced to reduce grazing pressure and will now be allowed to regenerate naturally. Tracks were closed at Population 1 in 1999 to restrict access. This was required, in particular, to help prevent illegal dumping of rubbish.

In 1999, spot spraying of watsonia, flat weed and other weed species was carried out in the habitat of Population 1. Some hand weeding was also subsequently undertaken around individual plants. Many of the weeds still in close association with the orchids are very small grassy weeds. These would require very labour intensive hand weeding to remove, but the negative effects of disturbance to soil (disturbance to fine root systems of orchids, increased weed invasion) would probably outweigh the benefits of weed removal.

Grazing was noted during monitoring in 2000 at Population 1 and the site has now been fenced to reduce this pressure. Some digging was also observed at Population 2a in 2000, and a fence was erected before the flowering season in the immediate vicinity of the last plant located. No flowering plants were observed there in 2000, but one was located in 2001. One plant at Population 2b was grazed in 2001 shortly after flowering and this site was caged in 2002.

Botanic Garden and Parks Authority (BGPA) staff artificially pollinated flowers and collected seed for storage from *Caladenia busselliana* in 1999. They also collected material to evaluate genetic distinctiveness and for isolation of endophytic material (the orchid's associated fungi). This fungus was successfully isolated, and seed and fungi are now stored in liquid nitrogen at the BGPA facility. The genetic distinctiveness of these species is also being evaluated. BGPA staff collected additional seed from Population 2 in 2001 and eight seed capsules were also collected from Population 1c in 2002. Germination trials have been carried out by BGPA and germination rates of around 60% were achieved.

A research burn was undertaken to investigate the response of the orchids to summer fire. This burn was undertaken on 12th December 1999 in habitat adjoining Population 1 where no plants had been previously located. The last known previous burn was in spring/summer 1989. A 20m x 20m plot was burnt under mild conditions in an area in which the orchids were previously recorded but had not been recorded in flower for several years. Surface moisture was between 14-16% and the maximum temperature recorded at 5cm depth in the soil was 35°C and at 10cm depth was 27.8°C. The burn plot was monitored in 2000, 2001 and 2003 but no orchids were located. However, the area has been fenced and regrowth of other native species is good, with little weed invasion. Monitoring of this site will continue. A controlled fire went through Population 1 on 19th October 2002 and one plant was burnt.

A fire response plan has been produced for the species and incorporated into the Fire Control Working Plan. This is to ensure appropriate actions are undertaken during wildfire suppression to protect the orchid habitat. The response plan includes production of maps and information detailing seasonally specific responses, and the marking of Fire Management Services Co-ordination Boards to highlight population locations. Information sessions with personnel involved with wildfire suppression also occurred in 2000, 2001 and 2002 Current management practices recommend restricting prescribed burns to at least 10-15 year intervals and not burning during the growing phase of March to November each year.

Negotiations have been initiated to transfer the care, control and management of the reserve that contains Population 1 to the Conservation Commission as an "A" Class reserve for Conservation of Flora and Fauna. It is further proposed to include a site that adjoins the reserve to provide a vegetated buffer to the population and a possible future translocation site. This proposal is supported by

Department of Mineral and Petroleum Resources and the Shire of Busselton. The Department of Land Information (DLI) is seeking clarification of the Native Title Act before making a final determination on the vesting and amalgamation of this reserve.

Plant numbers and threats are monitored annually during the flowering season. Global Positioning System (GPS) locations of all populations have been recorded in CALM's Blackwood District Geographic Information System database. Further, the differential GPS locations of all individual *Caladenia busselliana* plants were recorded in 1999 and 2001. Plants at Population 1 appear to be occurring further west than previously recorded.

Surveying for new populations was undertaken near Population 2 in 1999 and 2000, and two new plants were located (Population 2b).

Funding was received to carry out preliminary research into seed baiting for fungi for translocation work for *Caladenia busselliana* and *C. viridescens*. This work will be carried out by an Honours student. Once this preliminary research is complete then a translocation proposal will be written. This translocation will aim to enhance population numbers of the two species by planting them back into the existing site, and possibly introducing them into new sites.

Threatened flora displays occurred at the Busselton Wildflower Show in 1999 and 2000. Two Threatened Flora Field Days were held in 1999, one for CALM staff and one for the Bunbury Naturalists Club. CALM Blackwood District field workers have been provided with scanned colour photographs of the species to help with recognition of new populations. An information sheet, which includes a description of the plant, its habitat, threats, recovery actions and photos has been produced and distributed for the species. These information sheets are also available on the internet.

A review of historic rainfall data was undertaken in 2001 to identify any correlation between rainfall patterns and orchid flowering. Initial results indicate that years where the rainfall is more than 150mm during April and/or May rather than June or later, are years of greater orchid flowering (personal communication M. Spencer[1]). However, these data have not been statistically analysed.

The South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) is overseeing the implementation of this IRP and includes information on progress in its annual report to CALM's Corporate Executive and funding bodies.

Future recovery actions

Where populations occur on lands other than those managed by CALM, 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 of the priorities if funding is available for 'lower' priorities and other opportunities arise.

1. Coordinate recovery actions

The SWRTFCRT will continue to oversee the implementation of the recovery actions for *Caladenia busselliana* and will include information on progress in its annual report to the CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: CALM (Blackwood District) through the SWRTFCRT

[1] Meredith Spencer, Former Project Officer, CALM's Blackwood District

Cost: $700 per year

2. Stimulate seed set

Flowers will be artificially hand pollinated to increase seed set. This is necessary to allow for *in-situ* germination and to produce enough seed for collections. Less than half of the flowers in any given population will be pollinated this way, and records kept as to which plants have been treated. In particular, this process will indicate whether low recruitment is due to low pollen viability, or to the natural rate of pollination for these species.

Action: Increase seed set
Responsibility: BGPA and CALM (Blackwood District) through the SWRTFCRT
Cost: $800 per year

3. Collect seed and fungal material

Preservation of germplasm is essential to guard against extinction if wild populations are lost. Such collections are also needed to propagate plants for translocations. Some seed and endophytic material has been collected from Populations 1c and 2 but further collections are required from all other populations.

In addition, seed and fungal material collection is necessary to enable DNA studies of the fungal diversity present at each population.

Action: Collect seed and fungal material
Responsibility: BGPA and CALM (Blackwood District) through the SWRTFCRT
Cost: $2,000 per year the first two years

4. Monitor populations

Annual monitoring of factors such as habitat degradation (including weed invasion, plant diseases such as *Phytophthora cinnamomi* and salinity), population stability (expansion or decline), pollination activity, seed production, recruitment, longevity and predation is essential. Where possible, the position of each individual plant will be mapped when in flower using a differential GPS. This is to give a truer indication of the size of each population even though a small proportion of the plants in the population are likely to flower in any one season.

The effects of the research burn undertaken in 1999 and wildfires of 2002 will also be closely monitored, particularly for any evidence of recruitment. Although no flowers have been recorded yet, seedlings are very small and indistinct for the first few years.

Action: Monitor populations
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $2,500 per year

5. Conduct further surveys

Community volunteers will be encouraged to participate in further surveys supervised by CALM staff that will be conducted during the flowering period of the species (September-October).

Action: Conduct further surveys
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $1,000 per year

6. Complete and implement the fire management strategy

A coordinated fire response plan has been developed for the South West Region and incorporated into the Fire Control Working Plan. It includes strategies for fire control for the habitat of each population of the species. The information will also be communicated to other fire response organisations.

It is thought that a fire in autumn/spring kills terrestrial orchids, but summer fire is unlikely to affect adult plants in their dormant phase as underground tubers. Little is known about the effects of fire on orchid fungi. Fire encourages weed invasion, so it is necessary to monitor burnt areas and undertake any weed control that is indicated. The habitat of this species is generally programmed for summer or early autumn burns (December – March) on a 10 to 15 year rotation.

Action: Complete and implement the fire management strategy
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $2,600 in first year and $1,000 in subsequent years

7. Obtain biological and ecological information

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

1. The diversity of fungi present in the soil at each site, and their ecological specificity (some fungi serve as appropriate symbionts in laboratory conditions, but not in the field situation).
2. Ecological requirements of *C. busselliana* and associated fungi; e.g. pollinators, association between leaf litter depth and flowering.
3. Effects of fire, competition, rainfall and grazing in recruitment and survival of orchids and associated fungi.
4. The pollination biology of the species.
5. The requirements of pollinators.
6. The population genetic structure, levels of genetic diversity and minimum viable population size.

Action: Obtain biological and ecological information
Responsibility: CALM (Blackwood District), BGPA through the SWRTFCRT
Cost: $20,000 per year for the first three years

8. Undertake translocation

As the number of extant plants is very low and populations are not secure from threats, a translocation proposal is currently being developed. Suitable translocation sites have been selected and orchid seed baiting has also commenced at these sites in preparation for the translocation. The translocation will coordinated by the SWRTFCRT. Information on the translocation of threatened animals and plants in the wild is provided in CALM's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. All translocation proposals require endorsement by CALM's Director of Nature Conservation.

Action: Undertake translocation
Responsibility: CALM (Blackwood District), BGPA through the SWRTFCRT
Cost: $3,000 in the first year (proposal development, germination trials); $5,000 in second year (planting, monitoring); $2,000 per year thereafter (monitoring)

9. Stimulate flowering

Numbers of flowering specimens in most populations have been declining recently. Where the species occurs in habitat that has not been subject to recent disturbance, such as fire, and numbers of flowering individuals has declined, selected areas will be subject to small trial recovery burns or to other disturbance such as raking. This will be undertaken between mid November and mid April to ensure that above ground parts of the orchids are not damaged.

Action: Stimulate flowering
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $2,000 for the first and second years.

10. Map critical habitat

It is a requirement of the EPBC Act that spatial data relating to critical habitat be determined. Although critical habitat is described in Section 1, the areas as described have not yet been mapped and that will be redressed under this action. If any additional populations are located, then critical habitat will also be determined and mapped for these locations.

Action: Map critical habitat
Responsibility: CALM (Blackwood District, SCB) through the SWRTFCRT
Cost: $500 in the first year

11. Continue weed control

As a consequence of weed control in previous years, the current level of threat from weeds is low. If monitoring indicates that the threat from weeds has increased, weed control will be undertaken in consultation with the relevant landholders. This will be through hand weeding or spot spraying during the appropriate season to minimise the effect of herbicide on the orchids and the surrounding native vegetation. All weed control will be followed by a report on the method, timing and success of the treatment against weeds, and the effect on *Caladenia busselliana* and associated native plant species.

Action: Continue weed control
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $700 per year

12. Control rabbits

Population 1 has been fenced to prevent grazing. However, if monitoring indicates that the rabbits are impacting on other populations through grazing and digging, they will be controlled using appropriate control methods, in consultation with the landholders.

Action: Control rabbits
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $600 per year

13. Liaise with land managers

Staff from CALM's Blackwood District will continue to liaise with land managers and landowners to ensure that populations are not accidentally damaged or destroyed. Input and involvement will also be sought from any indigenous groups that have an active interest in areas that are habitat for *Caladenia busselliana*.

Action: Liaise with land managers
Responsibility: CALM (Blackwood District) through the SWRTFCRT

Cost: $1,200 per year

14. Seek to increase security of populations

Population 1 is currently located in a Shire reserve. CALM will continue to seek to have the care, control and management of the reserve transferred to the Conservation Commission to be managed by CALM as an A class Nature Reserve. CALM will also seek to amalgamate an adjoining site into this reserve. This action has been endorsed by the Department of Minerals and Energy and the Shire of Busselton. The Department of Land Information (DLI) are currently seeking clarification of the Native Title Act before making a final determination. Staff from the CALM's Blackwood District will continue to liaise with DLI and other relevant groups to facilitate this change.

Population 1c is located on private land. Ways and means of improving the security of this subpopulation will be sought, and may include covenants, the Land for Wildlife Scheme, or possibly land acquisition.

Action: Seek to increase security of populations
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $200 per year

15. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of the species 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.

Information sheets have been produced for the species. These will be reprinted and will continue to be distributed in an effort to identify new populations.

Action: Promote awareness
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $1,500 in first two years and $900 in subsequent years

16. Rehabilitate habitat as required

CALM will undertake habitat restoration if it is identified as being required during monitoring. This may include modifying the distribution of leaf litter and possibly the re-introduction of local provenance plants of species native to the site, particularly if species can be identified that provide other needs of pollinators (for example, habitat).

Action: Rehabilitate habitat as required
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $2,900 in first two years and $1,000 in subsequent years

17. Review this Plan

If the taxon is still ranked as Critically Endangered at the end of the fourth year of the five-year term of this Interim Recovery Plan, the need for further recovery actions, or to review this IRP will be assessed and a revised plan prepared if necessary.

Action: Review the need for a full Recovery Plan
Responsibility: CALM (SCB, Blackwood District) through the SWRTFCRT
Cost: $20,300 in the fifth year (if required)

4. TERM OF PLAN

This Interim Recovery Plan will operate from September 2005 to August 2010 but will remain in force until withdrawn or replaced. If the taxon is still ranked as Critically Endangered after five years, the need for further recovery actions, or to review this IRP will be determined.

5. REFERENCES

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6. TAXONOMIC DESCRIPTION

Hopper, S.D. and Brown, A.P. (2001) Contributions to Western Australian Orchidology: 2. New taxa and circumscriptions in *Caladenia* (Spider, Fairy and Dragon orchids of Western Australia). *Nuytsia* 14(1/2), 27-308.

Caladenia busselliana

Typus: near Quindalup, Western Australia, 20 October 1990, *G. Bussell s.n.* (*holo*: PERTH 02648733; *iso*: AD!, CBG!, K!).

Plant solitary or in loose clumps. *Leaf* 10-20cm x 5-10mm, linear, erect, pale green, basal third usually irregularly blotched with red-purple. *Scape* 20-30cm tall. *Flowers* 1 or 2(3), *c.* 5-8cm across, creamy-yellow with occasional suffusions, lines and spots of dull maroon to pink; floral odour absent. *Sepals and petals* stiffly held, linear-lanceolate in basal third, then abruptly narrowing to a long-acuminate apex; osmophore narrowly tumescent, 10-20mm long on sepals, absent from petals, light brown, consisting of minute densely packed globular sessile glandular cells. *Dorsal sepal* erect and slightly incurved, 3-4.5cm x 3-4mm. *Lateral sepals* spreading and downcurved, 5-5.5cm x 4-5mm. *Petals* horizontal to somewhat downcurved, 3-4.5cm x 3-4mm. *Labellum* 3-lobed (sometimes obscurely), uniformly coloured or occasionally suffused pink, with pink to red radiating stripes, stiffly articulate on a claw *c.* 2 mm wide; lamina cordate in outline when flattened, 15-20 x 10-12mm, basal third curving from erect to horizontal, middle third nearly horizontal, apical third sharply recurved, margins at widest point curved upwards and terminated by obliquely ascending calli; lateral lobes erect with entire margins within 2 mm of the claw, becoming fimbriate with slender clubbed narrowly fusiform dark maroon to pink (sometimes white-tipped) calli to 6mm long which are abruptly decrescent near midlobe; midlobe margins with short narrow forward-facing obtuse calli decrescent towards the apex. *Lamina calli* in 4 rows extending at least 2/3 the length of the labellum, pink, sometimes white at base, golf stick-shaped, the longest *c.* 1.5mm tall, decrescent towards apex and becoming sessile. *Column* 15-18 x 6-8mm, broadly winged, creamy yellow with pink blotches. *Anther c.* 2.5 x 2.5mm, pale yellowish pink. *Pollinia c.* 2mm long, flat, yellow. *Stigma c.* 3mm wide, yellow-green. *Capsule* not seen.

Selected specimens examined. WESTERN AUSTRALIA: W of Capel, 10 Oct. 91 *S.D. Hopper* 8210 (PERTH 1829351); Vasse/Yallingup area, 11 Oct.91, *S.D. Hopper* 8213 (PERTH); Flower Show, Sep.1954, *R.D. Royce* 4849 (CBG, PERTH 00260959).

Distribution and habitat. Poorly known. Apparently confined to two sites at the northern end of Leeuwin-Naturaliste Ridge and another location further north near Capel. Southern populations grow in winter-wet swamps and acidic grey sandy loam beneath Marri with *Anigozanthos viridis* and *Caladenia paludosa*. Near Capel, the single plant seen was with dense weedy herbs and *C. lorea*, *C. flava, C. latifolia* and *Diuris* aff. *Amplissima* in Tuart woodland with a Peppermint understorey. Soils there were calcareous grey sandy loam with scattered limestone rock. Flowers best after summer fire.

Flowering period. Late September to October.

Etymology. Named after Mr Greg Bussell (1945-), a descendent of the pioneering family after whom Busselton was named, and a keen orchid enthusiast who discovered and made the first collections of this rare species. Greg and his wife Mary have greatly assisted our research, particularly on orchids of the Leeuwin-Naturaliste Ridge where they have farmed and more recently become chalet owners.

Notes. *Caladenia busselliana* is a recently recognised and very rare orchid (Declared Rare) first collected from an unknown location for a flower show in 1954. The species subsequently escaped detection by orchid enthusiasts until 1990. It is one of only three members of the *C. huegelii* complex in Western Australia known to us that lack a red apex to the labellum. Of the other two, *C. busselliana* differs from *C. interjacens* in having smaller less robust flowers that are creamy-yellow, and shorter narrower osmophores. From *C. lodgeana, C. busselliana* differs in its petals lacking osmophores, its smaller creamy-yellow flowers, and earlier (September to October) flowering season.

Caladenia busselliana has flowers also similar to *C. viridescens*, but differs in its paler yellow colouration, the labellum more ovate with a yellow, not dark maroon, apex, its longer osmophores on the sepals, and its preference for winter-wet swamps rather than the dry slopes and woodlands occupied by *C. viridescens*.

However, the two species do occur in close sympatry at the type locality of *C. busselliana*, together with *C. paludosa*, *C. chapmanii*, and *C. ferruginea*.