The Minister approved this Conservation Advice on 29/09/2021.

Conservation Advice

Caladenia argocalla

White-beauty Spider-orchid

Conservation Status

Caladenia argocalla (White-beauty Spider-orchid) is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) effective from the 16 July 2000.

Species can also be listed as threatened under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

The main factors that make the species eligible for listing in the Endangered category are a restricted extent of occurrence (EOO) and area of occupancy (AOO) with fragmented distribution and a continuing decline in area of occupancy, extent and quality of habitat and the number of mature individuals. The number of mature individuals undergoes severe fluctuations.

Description

The White-beauty Spider-orchid is a terrestrial herb with a robust, rigid flowering stem that grows to 60 cm in height and is covered in white hairs. The leaves are linear-lanceolate, grow to 20 cm in length and have long silky hairs. There are usually one or two striking white flowers that grow to 10 cm in length but without a discernible scent. Sepals grow to 15 cm in length, are droopy and creamy, with tips dark and glandular for up to 5 cm and are not clubbed. Petals are similar but smaller. The labellum (lip) is broad (growing to 2 cm x 1.5 cm) and usually white, or rarely has a pink blush. Marginal calli are short and often dark, and the lamina has 6–8 rows of purplish or white-topped calli that vary in shape from club-shaped to linear. The column is approximately 1.5 cm in height, is broadly winged and has yellow basal glands with red markings (Bates 2011; Jones 1991b; both cited in DSEWPAC, 2012).

Distribution

The White-beauty Spider-orchid is endemic to the Mount Lofty Ranges region of South Australia (Southern and Northern Lofty Flora Regions) (Jones 1991b; Robertson & Bickerton 2000; both cited in DSEWPC, 2012). Historically the White-beauty Spider-orchid was known from 16 populations with an extent of occurrence of 8171 km^2 (Quarmby, 2010).

The type collection was from Kapunda Hills, Barossa Valley. Historically, it has been recorded at a number of locations in and around the Barossa Valley, on the Fleurieu Peninsula, in the hills just south of Adelaide, east of Beevor Estate Hill and north near Clare. The species' former range in this region, based on herbarium collections, was approximately 200 km from north to south (Robertson & Bickerton 2000, cited in DSEWPC, 2012).

The White-beauty Spider-orchid is now thought to be restricted to the Mount Lofty Ranges, due to its presence near Mount Crawford and Clare. However, the species is assumed to be extinct over the southern half of its former range (Bates 2011), such as south of Adelaide, where it has not been recorded since 1918 (DEH, 2008).

The total population size of the White-beauty Spider-orchid was estimated to be 1800 mature plants in 2006, based on the average number of flowering plants in each population per year (Quarmby, 2010). However, the number of flowering plants in many populations is known to fluctuate extremely from year to year, which makes determining population size very difficult.

This is demonstrated by comparing the total number of flowering plants recorded in 2006 (176) with the highest number of plants recorded from 1998 to 2006 (4687) (Davies, 2017). The main reason for these fluctuations is thought to be rainfall, but other unknown factors may also contribute.

The species is now known from 13 populations. The majority (88 percent) of these plants occur on road reserves or unreserved private land. Only 12 percent of these plants are in conservation reserves, with 171 plants occurring in Spring Gully Conservation Park, two in Kaiser Stuhl Conservation Park and 46 in a private Heritage Agreement area near Tanunda (Quarmby, 2010).

The largest populations are in the Clare Hills, north of Adelaide, where 95 percent of all plants occur. The remaining five percent of plants occur in the Adelaide-Mount Lofty Ranges region. Other than the Heritage Agreement population near Tanunda (Population 13) and another 17 plants along Cricksmill Road (Population two), all other populations in the Adelaide-Mount Lofty Ranges consist of fewer than five plants and are not viable without active management, such as translocation programs (Quarmby, 2010). These latter populations occur near Kersbrook (Population one), near Harrogate (Population four), in Kaiserstuhl Conservation Park (Population six) and near Springton (Population 12) (Davies, 2017). Population one appears to be in decline and at risk of extinction (Quarmby, 2010).

It is assumed that the population size has decreased significantly over the last 50 to 100 years, due to the extinction of historical populations. It is also assumed that many of the extant populations have contracted in size over the last 50 to 100 years (Quarmby, 2010).

Table 1: Summary of population information including population location, landholder and reservation status, number of flowering plants and population trend data (Quarmby, 2010).

Population number	Location	Land tenure	Mean no. of flowering plants	Population trend
1	Bagshaw Road	Adelaide Hills Council (unreserved)	3	Decline
2	Cricksmill Rd/ Altmann Rd	ForestrySA/Barossa Council (unreserved)	17	Fluctuating
3	Emu Flat	Clare and Gilbert Valleys Council (unreserved)	15	Fluctuating
4	Harrogate	Private (unreserved)	4	Fluctuating
5	Hughes Park Rd	Clare and Gilbert Valleys Council/Private (unreserved)	371	Fluctuating
6	Kaiserstuhl CP	Department of Environment and Natural Resources, SA (reserved)	2	Fluctuating
7	Leighton Rd	Clare and Gilbert Valleys Councils/Private (unreserved)	151	Fluctuating
8	Sevenhill	Private (unreserved)	1029	Fluctuating
9	Spring Gully CP	Department of Environment and Natural Resources, SA (reserved)	153	Fluctuating

10	Spring Gully CP	Department of Environment and Natural Resources, SA (reserved)	17	Fluctuating
11	Spring Gully CP	Department of Environment and Natural Resources, SA (reserved)	1	Unknown
12	Springton	Private (unreserved)	1	Fluctuating
13	Tanunda	Private (reserved)	46	Fluctuating

Relevant Biology/Ecology

The White-beauty Spider-orchid usually produces a leaf in April or May, coinciding with the onset of cool, wet weather. However, it has been found that the White-beauty Spider-orchid does not always produce a leaf or spike every year (DEH 2006a, cited in Quarmby, 2010), and the number of flowering plants can fluctuate extremely from year to year. During mid-August to mid-September, the White-beauty Spider-orchid produces buds, followed by flowering in late September to October. By late October the leaves shrivel and the pollinated flowers develop into seed capsules. In November, the capsules dry and dehisce. Tubers are replaced annually (during winter – spring) and are dormant over the hot, dry summer months (December to March) (Quarmby, 2010).

The average longevity of the White-beauty Spider-orchid is not known, but is assumed to be more than fifteen years (Quarmby 2010), with the juvenile stage lasting two to five years (Bickerton 2001, cited in Davies, 2017). However, according to one study, an individual is unlikely to survive if it has not emerged for more than three years (Tremblay et al. 2009a, cited in Davies, 2017). Plants have the ability to remain dormant some years (DEWNR 2016, cited in Davies, 2017), with numbers of flowering plants subject to extreme fluctuations from year to year (Davies, 2017).

The pollination of the White-beauty Spider-orchid has not been properly studied, but it is thought that thynnid wasps and native bees may be possible pollinators. The species is known to hybridise with *Caladenia behrii* (Pink-lipped Spider-orchid), *C. cardiochila* (Thick-lipped Spider-orchid) and *C. tensa* (Rigid Spider-orchid). Some of the hybrids are known to have been fertile and will backcross with the White-beauty Spider-orchid. Often the progeny of such crosses will have a red tip to the labellum (Bates 2008, cited in Quarmby, 2010).

The White-beauty Spider-orchid grows in symbiosis with mycorrhizal fungi, although fungal isolation and identification is yet to be determined for this species. Mycorrhizal fungi are known to play an important role in seedling germination and plant growth in many *Caladenia* species (Quarmby, 2010).

The White-beauty Spider-orchid does not require fire to flower. There is anecdotal evidence from a fire at Harrogate in January 2007 that suggests the species may be fire sensitive (Quarmby 2010).

While all populations of the White-beauty Spider-orchid are important, the four largest populations (five, seven, eight and nine) are considered to be the most important for conservation of the species, because they are most likely to contain high levels of intra-population genetic diversity and are therefore least likely to suffer from loss of genetic diversity through genetic drift and inbreeding. All of these populations are situated within 10 km² of Clare, and comprised 94 percent of the total population size in 2006 (Quarmby, 2010). Populations two and 13 are also very important for conservation because they are the largest populations in the Southern Lofty region and may contain genetic diversity not found within the populations in the Northern Lofty region (Quarmby, 2010). Populations one, three and four are also important because of their outlying distribution. Loss of any of these populations would result in a significant reduction in the extent of occurrence and potential loss of genetic diversity (Quarmby, 2010).

The White-beauty Spider-orchid grows in a diversity of *Eucalyptus* woodland communities, usually containing *Eucalyptus leucoxylon* (Yellow Box). The populations in the Northern Lofty region typically grow in *E. leucoxylon* subsp. *pruinosa, E. goniocalyx* (Long-leaved Box) and *Allocasuarina verticillata* (Drooping She-oak) open woodland. The understorey vegetation is predominantly herbaceous, often comprising *Lomandra densiflora* (Mat-rush), *Arthropodium strictum* (Chocolate Lily), *Plantago gaudicaudii* (Black Plantain), *Austrostipa* (Speargrass) spp. and *Austrodanthonia* (Wallaby Grass) spp. The shrub layer is typically sparse and often includes *Acacia pycnantha* (Golden Wattle), *Bursaria spinosa* (Sweet Bursaria), *Exocarpos cupressiformis* (Native Cherry) and *Hibbertia exutiacies* (Spiky Guinea-flower) (Quarmby, 2010).

The populations in the Southern Lofty region grow in *Eucalyptus leucoxylon* subsp. *leucoxylon, Hibbertia exutiacies, E. goniocalyx and E. camaldulensis* (Red River Gum) woodland. Common understorey species include *Acacia pycnantha, Xanthorrhoea semiplana* (Grass Tree), *Hibbertia exutiacies*, *Plantago gaudicaudii*, *Austrostipa* spp., and *Austrodanthonia* spp (Quarmby, 2010).

The White-beauty Spider-orchid generally grows on gentle hill slopes, often with a southerly aspect. Soils are typically clay loams with high humus content in the surface layer (Quarmby 2010).

Threats

Table 2: Threats impacting the White-beauty Spider-orchid in approximate order of severity of risk, based on available evidence

Number	Threat factor	Threat type and status	Evidence base
1.0	Invasive species		
1.1	Competition with invasive weeds	known current	Weeds have a significant impact on the habitat quality through direct competition for resources including light, nutrients, space and moisture. Weeds can also alter hydrological cycles, fire regimes and microclimate conditions (Quarmby 2010). Topped Lavender (*Lavandula stoechas*) is a serious threat to all populations in the Northern Lofty region, particularly populations three, five, seven and eight. Watsonia (*Watsonia meriana var. bulbillifera*), Cape Tulip (*Moraea flaccida* and *Moraea miniata*), Soursob (*Oxalis Pes-caprae*) and St John's Wort (*Hypericum perforatum*) are also threats to populations in the Northern Lofty region. Gorse (*Ulex europaeus*), Salvation Jane (*Echium plantagineum*; also known as Paterson's curse), Quaking Grass (*Briza maxima*), Bearded Oat (*Avena barbata)* and other introduced grasses are threats to populations two and four in the Southern Lofty region (Quarmby 2010).
2.0	Lack of recruitment		

2.1	Lack of pollination	known current	The decline or extinction of pollinators is thought to be the main cause of lack of pollination. The decline has been attributed to habitat loss, modification and fragmentation, pesticide drift and competition from honey bees (*Apis mellifera*). Small populations are at greater risk due to their reduced ability to attract pollinators. The average rate of pollination for the White-beauty Spider-orchid is less than ten percent. Populations three, four and seven have the lowest known levels of pollination. Populations one, six, 11 and 12 are at risk from low pollination rates due to small population sizes (Quarmby, 2010). Surveys indicate that there has been no increase in the size of the population due to seedling recruitment. Lack of recruitment can be due to a number of factors including low seed viability, herbivory, lack of pollination, lack of mycorrhizal fungi and other germination requirements (Quarmby, 2010). Small populations are unable to effectively exchange genetic material with other populations, leading to decreased levels of genetic variation, with the potential for inbreeding depression and higher rates of deleterious mutations. This can lead to impacts on reproduction, recruitment, susceptibility to disease and ability to adapt to climate change. The very small populations, those with less than five mature individuals, include populations one, four, six, 11 and 12 (Quarmby, 2010).
2.2	Illegal collection	known past and potential	It is thought that illegal collections have occurred at population six, and other populations are potentially at risk due to their close proximity to public roads and tracks (Bates & Weber 1990; cited in Quarmby, 2010).
3.0	Herbivory		
3.1	Grazing by feral species	known current	Herbivory can kill plants with the tubers being dug out or eaten. Herbivory also reduces or prevents flowering and seed set by the removal of vegetation. Rabbits (*Oryctolagus cuniculus*) and Hares (*Lepus* sp.) are widespread in the area and are likely to be responsible for some herbivory (Quarmby 2010). Herbivory is particularly threatening to small populations. The populations known to be under the most risk are one, two, nine and 12 (Quarmby 2010).
4.0	Grazing by native species		

4.1	Grazing by native species	known current	Kangaroos (*Macropus* sp.) are thought to be the major threat based on field observations. Herbivory is particularly threatening to small populations. The populations known to be under the most risk are one, two, nine and 12 (Quarmby 2010).
5.0	Habitat loss, disturbance and modifications		
5.1	Track maintenance	known current	Populations one, two, three, five and seven occur on road reserves and all are at risk form road management activities such as grading, upgrades, herbicide spraying, and road sealing, slashing and mowing. Populations six and nine occur near park management tracks and are at risk from grading, turnout drains, vegetation pruning and slashing. These activities can also cause an increase in weed and pathogens. Population two is close to underground powerlines and may be at risk from utilities management activities (Quarmby, 2010). Incremental native vegetation clearance is a potential threat to populations in road reserves (one, two, three, five and seven) and on unreserved private land (four, five, seven, eight and 12). Legal and illegal vegetation clearance is a potential threat (e.g. clearance for residential development, fencing, fire management and grazing) (Quarmby, 2010).
5.2	Trampling	known current and potential	All populations are at risk from accidental trampling as most occur in dense herbaceous understorey vegetation which makes detection difficult until flowering. The understorey vegetation itself is highly sensitive to trampling (Quarmby, 2010). In addition, this activity can cause soil compaction, habitat degradation and be a potential vectors for weeds and pathogens. Humans, macropods and hard hoofed animals can all cause significant damage by trampling (Quarmby, 2010).
6.0	Fire		
6.1	Fire during growing and flowering period	possible current	Burning during the active growth season (April to November), or for general fire management, can destroy or damage plants (Quarmby, 2010). Elevated fire frequencies will reduce soil organic matter that is important for supporting soil mycorrhizal fungi. The relationship between the mycorrhizal fungi is critical to the germination and growth of the orchid..

7.0	Disease		
7.1	Infection by *Phytophthora*	suspected current	*Phytophthora* are soil and waterborne fungi that cause disease and death to a wide variety of native plant species. For the White-beauty Spider-orchid, 14 percent of the populations occur in moderate risk zone and 86 percent in a low risk zone for *Phytophthora*. Many of the plants which grow in association with the White-beauty Spider-orchid are known to be susceptible to *Phytophthora* (Quarmby, 2010).

Conservation Actions

Conservation and Management priorities

Invasive species

- Undertake weed control including for Watsonia (*Watsonia meriana var. bulbillifera*), Cape Tulip (*Moraea flaccida* and *Moraea miniata*), Soursob (*Oxalis Pes-caprae*) and St John's Wort (*Hypericum perforatum*) in the Northern Lofty region. This action is linked to 1.1 in the Threats table.
- Undertake weed control for Gorse (*Ulex europaeus*), Salvation Jane (*Echium plantagineum*; also known as Paterson's curse), Quaking Grass (*Briza maxima*), Bearded Oat (*Avena barbata)* and other introduced grasses at populations two and four in the Southern Lofty region (Quarmby 2010).This action is linked to 1.1 in the Threats table.

Ex situ strategies

- To manage the risk of losing genetic diversity, undertake appropriate seed and associated mycorrhizal fungi and storage in long term custodial collections until no longer needed and undertaking periodic determination of the viability of stored seed. Best practice seed storage guidelines and procedures should be adhered to, to maximise seed viability and germinability. Seeds from all natural populations to be collected and stored. This action is linked to 2.1 in the Threats table.
- Develop and implement measures to increase recruitment, such as hand-pollination and collect seed from each population and preserve in vitro. This action is linked to 2.1 in the Threats table.
- Cage all plants in small and/or declining populations with high rates of herbivory. This action is linked to 2.1 in the Threats table.
- Undertake in vitro seed germination and plant cultivation for potential translocation. This action is linked to 2.1 in the Threats table.
- Prepare and implement translocation proposals for selected populations. This action is linked to 2.1 in the Threats table.
- Ensure population locations are not made publically available. This action is linked to 2.2 in the Threats table.

Grazing from feral species

- Manage sites by controlling population numbers of Rabbits and Hares using appropriate control methods. This action is linked to 3.1 in the Threats table.
- Implement and maintain caging and/or fencing around White-beauty Spider-orchid populations as appropriate for the location conditions. This action is linked to 3.1 in the Threats table.

Grazing from native species

- Manage sites by controlling population numbers of macropods and bandicoots using appropriate control methods. This action is linked to 4.1 in the Threats table.
- Implement and maintain caging and/or fencing around White-beauty Spider-orchid populations as appropriate for the location conditions. This action is linked to 4.1 in the Threats table.

Habitat loss, disturbance and modifications

- Ensure land managers are aware of the species' occurrence and provide protection measures against key and potential threats including road management. This action is linked to 5.1 in the Threats table.
- Implement legal mechanisms to protect and manage habitat, for example, protecting land under Heritage Agreements or conservation covenants, where possible. This action is linked to 5.1 in the Threats table.
- Develop and implement protocols to manage access, where possible and as appropriate, including through fencing, notifications and registrations, and signage, in liaison with relevant authorities and landholders. This action is linked to 5.1 in the Threats table.
- Close or re-align inappropriate trails that dissect populations. This action is linked to 5.2 in the Threats table.
- Register all populations that occur within road sides into the Roadside Significant Sites Database and local government databases, and install Roadside Markers. This action is linked to 5.1 and 5.2 in the Threats table.
- Develop protocols for road and track management activities on public land. This action is linked to 5.1 in the Threats table.

Fire

- Fires must be managed to ensure that prevailing fire regimes do not disrupt the life cycle of the threatened species that they support rather than degrade the habitat necessary to the threatened species, that they do not promote invasion of exotic species, and that they do not increase impacts of grazing/predation. This action is linked to 6.1 in the Threats table.
- Physical damage to the habitat and individuals of the threatened species must be avoided during and after fire operations. This action is linked to 6.1 in the Threats table.
- Fire management authorities and land management agencies should use suitable maps and install field markers to avoid damage to the threatened species. This action is linked to 6.1 in the Threats table.
- Undertake active weed control after fire management along urban roadsides. This action is linked to 6.1 in the Threats table.

- Ensure that prescribed fires occur only within the habitat during the dormant phase of the threatened species life cycle. This action is linked to 6.1 in the Threats table.

Disease

- Implement a *Phytophthora cinnamomi* management plan to ensure that the fungus is not introduced into locations of the threatened species and that the spread in areas outside of, but adjacent to population is mitigated (DoE 2014). This action is linked to 7.1 in the Threats table.
- Ensure that appropriate hygiene protocols are adhered to when entering or exiting the known locations of the threatened species, such as those outlined in Podger et al. (2001).
    - Implement a hygiene management plan and risk assessment to protect known populations from further outbreaks of *P. cinnamomi*. This may include but is not limited to:
    - Contaminated water is not used for firefighting purposes,
    - Contaminated soil is not introduced into the area as part of restoration, translocation, infrastructure development or revegetation activities,
    - Ensure that areas where the threatened species is known to occur that are *P. cinnamomi* free are sign posted and hygiene stations are implemented and maintained. This action is linked to 7.1 in the Threats table.
- Implement mitigation measures in areas that are known to be infected by *P. cinnamomi*, this may include but is not limited to;
    - Application of phosphite (H3PO3), noting the potential deleterious effects as a fertiliser with prolonged usage. This action is linked to 7.1 in the Threats table.

Stakeholder Engagement

- Undertake activities to inform, encourage and support landholders and the community, including volunteer groups, in understanding and participating in conserving the species.
- Develop materials to raise awareness of the species more broadly, including through the Internet and media.
- Encourage private landholders to enter into Heritage Agreement or other conservation covenants.
- Enable implementation of recovery actions, including governance, through development of a recovery team for the species.

Survey and Monitoring priorities

- Undertake surveys of historical and potential habitat for populations, evaluating the suitability of potential habitat and ensuring that all new records are updated in relevant databases.
- Undertake regular monitoring of populations to determine population size, number of flowering plants in each population and trends over time.

Information and Research priorities

- Undertake research to determine the germination and cultivation requirements.
- Undertake genetic analysis to inform improvements in recruitment.

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