The Minister's delegate approved this Conservation Advice on 16/12/2016.

Conservation Advice

Caladenia audasii

McIvor spider-orchid

Conservation Status

Caladenia audasii (McIvor spider-orchid) is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) effective from the 16 July 2000. The species was eligible for listing under the EPBC Act as on 16 July 2000 it was listed as Endangered under Schedule 1 of the preceding Act, the *Endangered Species Protection Act 1992* (Cwlth).

Species can also be listed as threatened under state and territory legislation. For information on the 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 are the cause of the species being eligible for listing in the Endangered category are the species' very restricted geographic range, its fragmentation, extremely low number of mature individuals and projected decline due to the threats it is facing.

Description

The McIvor spider-orchid (Orchidaceae) is an herbaceous perennial geophyte which is 20 cm high, with a single leaf 10 cm long and a single flower. It is a deciduous orchid that dies back annually to a small, spherical, underground tuber. The single leaf is long and narrow, sparsely hairy and green or reddish (Backhouse & Jeanes 1995). The erect hairy flower stem grows 20 cm high and has a single, large, pale yellow to greenish flower to 8 cm across. There are red spots and stripes on the petals and sepals (Backhouse & Jeanes 1995). The sepals and petals are up to 6 cm long and slender, with long thin tips covered with sparse brown glands; the uppermost sepal is erect, the petals and lateral sepals spreading and drooping (Backhouse & Jeanes 1995). The central petal (labellum) is narrowly triangular with the tip rolled under. The expanded part of the labellum has four rows of short, widely spaced fleshy lumps and the sides of the labellum are entire or irregularly and shallowly toothed (Backhouse & Jeanes 1995).

Distribution

The McIvor spider-orchid is endemic to Victoria where it is found in several isolated sites between Bendigo and Stawell (Backhouse & Jeanes 1995; Jeanes & Backhouse 2006). There are six historic records of the McIvor spider-orchid between Bordertown and Kingston in South Australia but these have not been confirmed and are likely the result of misidentification (Duncan et al., 2010).

The McIvor spider-orchid has been recorded at three widely separated populations in 1995 (Backhouse & Jeanes 1995), 2000 (Todd 2000) and 2010 (Duncan et al., 2010). The populations identified in 2010 are found in the Greater Bendigo National Park, the Deep Lead Flora and Fauna Reserve and on council land near Kingower. The number of individuals has decreased from 10 in 1995 (Backhouse & Jeanes 1995) to five in 2010 (Duncan et al., 2010).

Relevant Biology/Ecology

The McIvor spider-orchid is found in open forests and woodlands on shallow, gravelly soil (Backhouse & Jeanes 1995). It is found in several different habitat types, including yellow gum woodlands with a sparse *Acacia pycnantha* (golden wattle) and *Austrodanthonia* spp. (wallaby grass) understorey, and box-ironbark forest comprising *Eucalyptus goniocalyx* (long-leaved box), *E. macrorhyncha* (red stringybark) and *E. polyanthemos* (red box), with a herb groundcover including *Cheilanthes* spp. (rock fern), *Pelargonium* spp. (stork's bill), *Brunonia australis* (blue pincushion) and *Rytidosperma pallidum* (silver-top wallaby grass) (Duncan et al., 2010). Plants generally occur in sites with a sparse shrub layer and a very sparse groundcover (Duncan et al., 2010).

The McIvor spider-orchid is a winter active geophyte with emergence occurring in concert with cooler conditions and onset of winter rainfall. Flowering in the McIvor spider-orchid occurs from August/September to October/November and is followed by summer dormancy (Entwisle 1994; Backhouse & Jeanes 1995). This species is not able to reproduce vegetatively (Department of the Environment 2005). There has been no natural pollination observed, with plants and/or pollinators probably being present in insufficient numbers to ensure adequate natural pollination rates (Department of the Environment 2005). The pollinator of the orchid is unknown. The McIvor spider-orchid's habitat is adapted to low frequency fire (Todd 2000).

The following general information applies to the biology and ecology of spider-orchids.

Spider-orchids use either food deception or sexual deception for pollination (Jones 1988; Bishop 2006). The usual pollinators for spider-orchids are male wasps from the family Thynnidae. A scent that mimics female thynnid wasp pheromone is produced by the glandular tips of the sepals and acts as a sexual attractant for the pollinators (Backhouse & Jeanes 1995; Bishop 2006). Once the pollinator reaches the flower, it attempts to copulate with the labellum of the flower, mistaking it for the female wasp, and effects pollination (Todd 2000). The life cycle and ecological requirements of pollinators involved in sexual deception and food deception is generally unknown and represents a major risk in managing the long-term reproductive capability of orchids with this dependency.

Spider orchids generally reproduce from seed (Backhouse & Jeanes 1995). Fruits of spider-orchids take five to eight weeks to reach maturity following pollination and each mature capsule may contain tens of thousands of microscopic seeds that are dispersed by the wind when the capsule dries out (Todd 2000). Most spider-orchids grow in a complex relationship with mycorrhizal fungi (Warcup 1981). The fungus assimilates some nutrients for the orchid, but the degree of nutritional dependence upon the fungus by spider-orchids is not clearly understood (Todd 2000). The long term persistence of a suitable mycorrhiza is however critical for growth and development of the orchid yet little is known of the ecological requirements for long-term maintenance of the mycorrhizal fungus in soil.

Longevity of most spider-orchids is not known but there are examples of individuals of one species having survived for at least 17 years in the wild (Carr 1999).

Most terrestrial orchids have evolved under conditions of hot summer fires, generally when the plants have been dormant (Backhouse & Jeanes 1995). Some *Caladenia* species flower vigorously following hot summer fires (Backhouse & Jeanes 1995; Todd 2000). However, this may be as much the result of the removal of surrounding vegetation and reduced competition as any chemical effect of the fire (Backhouse & Jeanes 1995). The timing of fire for orchids is important, with the best time during late summer or early autumn, after seed dispersal but prior to new plant emergence. The variation in seasonal climatic conditions, most notably rainfall and temperature also influences flowering. Flowering is often aborted when periods of sustained hot, dry weather follow flower opening (Todd 2000).

Threats

The McIvor spider-orchid is at risk from a combination of threats across its three known populations, including grazing, invasive species and habitat disturbance. Risk posed by each of these threats may vary depending on geographical, environmental, biological and sociological factors.

Table 1 – Threats impacting the McIvor spider-orchid in approximate order of severity of risk, based on available evidence.

Threat factor	Threat type and status	Evidence base
Grazing		
Grazing by rabbits	known current	Grazing by feral herbivores, including rabbits (*Oryctolagus cuniculus*), on orchids can be devastating (Duncan et al., 2005). Grazing by rabbits was a known threat for all populations of the McIvor spider-orchid in 2010 (Duncan et al., 2010).
Grazing by native herbivores and white-winged choughs	known current	Grazing by native herbivores such as eastern grey kangaroos (*Macropus giganteus*) can be threat to orchids in highly fragmented habitats, where herbivores exert a significantly increased grazing pressure on the remnant vegetation, including any orchids present (Duncan et al., 2005). Grazing by eastern grey kangaroos was a known threat for all populations of the McIvor spider-orchid in 2010 (Duncan et al., 2010). Predation of tubers by *Corcorax melanorhamphos* (white-winged choughs) was known to be a serious problem at the Greater Bendigo National Park in 2010 (Duncan et al., 2010).
Invasive species		
Weed invasion	known current	Weed invasion is a risk to orchids because weeds directly out-compete orchids for resources and change the vegetation type and structure of the habitat. They can also alter microhabitats, which may indirectly cause a negative impact on orchid species (Duncan et al., 2005). Weed invasion was known to be a moderate threat to the McIvor spider-orchid in 2010. Problem weeds included freesia (*Freesia* spp.) and wild watsonia (*Watsonia meriana* var. *bulbillifera*) at the Kingower site and fescue (*Vulpia* spp.) and other annual grasses present at the Deep Lead site (Todd 2000; Duncan et al., 2010).
Habitat loss, disturbance and modification		
Habitat disturbance	known current	The population near Kingower occurs in a cemetery and as such was known to be and subject to maintenance work such as slashing and hand-weeding in 2010 (Todd 2000; Duncan et al., 2010). These activities may lead to accidental damage to individual plants and/or seedlings.
Rubbish dumping	known current	Garden escapee weeds from dumping of rubbish and garden refuse are a threat at the Deep Lead site (Todd 2000).

Illegal collection	known past	There was evidence that illegal collection had occurred at the Deep Lead site in the past (Todd 2000).
Land clearance for agriculture and urban development	known past	The habitat where the McIvor spider-orchid occurred suffered a long history of disturbance. Seventy-five percent of the box-ironbark forests were cleared (Duncan et al., 2010). It is highly likely that populations of the McIvor spider-orchid have been lost due to this landscape clearing. Much of the remaining habitat has been extensively disturbed (Duncan et al., 2010).
Trampling	known current	Public visitation is allowed at all three sites and as such trampling, including the accidental damage to individual plants and/or seedlings, by visitors may occur. Trampling was a known threat for all populations in 2010 (Duncan et al., 2010).
Fire		
Timing and frequency	potential	The role of fire for the McIvor spider-orchid is unknown. However, fires that occur in autumn, winter and spring, after the species shoots but before seed is set, may pose a threat. Too frequent fire may pose a threat by altering the habitat, removing organic surface materials and negatively impacting pollinators and mycorrhizal agents. The McIvor spider-orchid's habitat is adapted to low fire frequency (Todd 2000).
Other		
Low reproductive rates	known current	Due to the extremely low number of plants it is unlikely that natural pollination is occurring at any site. Seed viability testing conducted in 1998 showed very low viability rates, most likely as a result of tiny population size and possible inbreeding (Duncan et al., 2010).

Conservation Actions

Conservation and Management priorities

Grazing

- Manage total grazing pressure by herbivores such as rabbits and kangaroos through exclusion fencing and other barriers.
- Control rabbits using appropriate methods in accordance with the 'Threat abatement plan for competition and land degradation by rabbits' (refer to DEWHA 2008), which may include undertaking a range of control techniques (e.g. poisoning and warren destruction).
- Manage predation of tubers by white-winged choughs by caging all known plants.

Invasive species

- Collaborate with public and private land managers to control and reduce the spread of invasive species, particularly freesia, wild watsonia, fescue and other annual grasses. Consult with local experts in determining the most appropriate physical or chemical control methods for these weeds that will not have a detrimental effect on the McIvor spider-orchid.

Habitat loss, disturbance and modifications

- Ensure public and private land managers are aware of the presence and location of the McIvor spider-orchid on their land and provide protection measures against known and potential threats to the species.
- Manage access to known locations of the McIvor spider-orchid to prevent the accidental trampling of plants.
- Remove rubbish and rehabilitate degraded habitat where rubbish dumping has occurred. Ensure appropriate signage is erected to help deter the dumping of rubbish and garden refuse.
- Ensure confidentiality of the known locations of the McIvor spider-orchid is maintained to reduce the potential threat from illegal collection.

Fire

- Fires must be managed to ensure prevailing fire regimes do not disrupt the life cycle of the McIvor spider-orchid, they support rather than degrade the habitat necessary to the McIvor spider-orchid, they do not promote invasion of exotic species, and they do not increase impacts of grazing.
- Physical damage to the habitat and individuals of the McIvor spider-orchid must be avoided during and after fire operations. Ensure retention of surface soil organic material and leaf litter on soil as it is important for many terrestrial orchids that rely on these materials for regeneration from seed.
- Physical damage to the habitat and individuals of the McIvor spider-orchid must be avoided during and after fire operations.
- Fire management authorities and land management agencies should use suitable maps and install field markers to avoid damage to the McIvor spider-orchid.

Seed collection, propagation and other ex-situ recovery action

- Seed should be appropriately sourced and stored in a seed bank facility using best practice seed storage guidelines and procedures to maximise seed viability and germinability.
- To manage the risk of losing genetic diversity, undertake appropriate seed and mycorrhizal fungi collection and storage in appropriate institutions, such as the Victorian Conservation Seedbank, Royal Botanic Gardens Victoria, and determine viability of stored seed. Seeds from all natural populations to be collected and stored.
- Establish plants in cultivation in appropriate institutions such as the Royal Botanic Gardens Victoria.

Stakeholder Engagement

- Identify partners including traditional owners, landholders, community-based organisations and conservation management organisations that may be associated with recovery of the McIvor spider-orchid.
- Promote opportunities for partners to participate in recovery for the McIvor spider-orchid, as appropriate.

Survey and Monitoring priorities

- Undertake survey work, when plants are flowering from August to November, in suitable habitat and potential habitat to locate any additional occurrences.
- Undertake survey work, when plants are flowering from August to November known populations to establish baselines where required to identify changes (if any) in population size, distribution, ecological requirements and relative impacts of threatening processes.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
- Monitor the size, structure and reproductive status of populations of the McIvor spider-orchid at different stages in the fire cycle. Opportunities to monitor after planned and unplanned fires should be undertaken where they occur in order to improve understanding of the fire response of this species.
- Precise fire history records must be kept for the habitat and extant populations (confirmed and suspected) of the McIvor spider-orchid.

Information and research priorities

- Investigate options for linking, enhancing or establishing additional populations.
- Investigate reproductive status, longevity, fecundity and recruitment levels for this species and adjust conservation actions as required.
- Continue to undertake seed germination and/or vegetative propagation trials to determine the requirements for successful establishment, including disturbance and mycorrhizal fungi requirements.
- Improve understanding of the mechanisms of response to different fire regimes and identify appropriate fire regimes for conservation of this species by undertaking appropriately designed experiments in the field and/or laboratory.
- Where appropriate, use understanding and research on fire response among related (e.g. congeneric) or functionally similar species to develop fire management strategies for conservation.
- Identify optimal fire regimes for regeneration (vegetative regrowth and/or seed germination), and response to other prevailing fire regimes.
- Undertake research into pollinator activity and the ecological requirements to support pollinator communities of the orchid.

References cited in the advice

Backhouse, G. & Jeanes, J. (1995). The orchids of Victoria. Melbourne University Press, Melbourne, Victoria.

Bishop, T. (2006). Field guide to the orchids of New South Wales and Victoria. Second Edition. UNSW Press, Sydney, New South Wales.

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

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2008). Threat abatement plan for competition and land degradation by rabbits. Department of the Environment, Water, Heritage and the Arts, Canberra, Australia.

Duncan, M., Pritchard, A. & Coates, F. (2005). Major Threats to Endangered Orchids of Victoria, Australia. *Selbyana* 26, 189–195.

Duncan, M., Pritchard, A., Todd, J. (2010). National Recovery Plan for Twelve Threatened Spider-orchids (Caladenia R. Br.) in South-eastern Australia. DRAFT for public comment. Department of Sustainability and Environment, Melbourne, Victoria.

Entwisle, T.J. (1994). Orchidaceae. In 'Flora of Victoria Vol. 2, Ferns and Allied Plants, Conifers and Monocotyledons' (eds N G Walsh & T J Entwisle). Inkata Press, Melbourne, Victoria.

Jeanes, J. & Backhouse, G. (2006). Wild orchids of Victoria, Australia. Aquatic Photographics, Melbourne, Australia.

Jones, D.L. (1988). Native Orchids of Australia. Reed Natural History Australia, Melbourne, Victoria.

Todd, J.A. (2000). Recovery Plan for Twelve Threatened Spider-orchids Caladenia taxa of Victoria and South Australia 2000 - 2004. Department of Natural Resources and Environment, Melbourne, Victoria.

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

Other sources cited in the advice

Department of the Environment (2005). Species Profile and Threats Database: *Caladenia audasii* – McIvor Spider-orchid.
Viewed: 20 June 2016
Available on the Internet at:
http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=11727