

- Kangaroos browse ramets, but less so older plants. Their impact is substantially less than that of rabbits or snails.
- The prospect of a good conservation story attracted a corporate partner, ensuring media attention and improving community engagement.

References

Adams, M. (2013). *An assessment of the extent of clonal reproduction in the Melrose population of spiny daisy (Acanthocladium dockeri)*. Report for Natural Resources Northern and Yorke. Evolutionary Biology Unit, SA Museum.

Clarke, A. and Haase, B. (2012). *Acanthocladium dockeri (Spiny Daisy) Monitoring Manual*. Natural Resources Northern and Yorke, Clare, SA.

Clarke, A., Robertson, M.A. and Pieck, A. (2013). *Recovery Plan for Acanthocladium dockeri (Spiny Daisy)*. Department of Environment, Water and Natural Resources, Clare, SA.

Moritz, K., Tourenq, C., Field, T and Trezise, J. (2017). *Translocation Proposal for Spiny Daisy Acanthocladium dockeri Translocation site: Banrock Station 2013 – 2017*. Natural Resources SA Murray-Darling Basin, Mount Barker, SA.

Vallee, L., Hogbin, T., Monks, L., Makinson, B., Matthes, M. and Rossetto M. (2004). *Guidelines for the Translocation of Threatened Plants in Australia* (2nd ed), Australian Network for Plant Conservation, Canberra.

Threatened plant translocation case study:

Caladenia hastata (Nicholls) Rupp (Melbloms Spider-orchid), Orchidaceae: Pollinator rarity limits conservation translocation sites in a rare orchid

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The Species

Caladenia (Figure 1) is a diverse genus, with over 350 species recognised in Australia (Phillips *et al.* 2009). *Caladenia* are deciduous terrestrial orchids that die back annually to small, spherical subterranean tubers that are protected by a tough, fibrous tunic. *Caladenia hastata* (Melbloms Spider-orchid) has a single green, linear-lanceolate, sheathing, basal leaf, which is approximately 15 cm long, 10 mm wide and conspicuously hairy (Todd 1999). Plants flower for approximately four weeks each year between late September and late November. Flowering scapes grow to 30 cm in height, bearing one or rarely two, cream-coloured flowers approximately 80 mm in width. The petals are 25–45 mm in length with dark

red osmophores that exhibit a characteristic club-like swelling. The labellum has a strongly recurved apex.

Previously widespread across western Victoria and adjacent parts of South Australia (Hill *et al.* 1999), *C. hastata* is currently known from only five small populations (four natural and one failed relocation) and is highly vulnerable to extinction from a range of threats. The current number of known mature individuals is only 379, with the majority of these individuals occurring at only two populations. The remaining three populations support only one or two individuals. *Caladenia hastata* is listed as:

- Endangered under the DELWP Advisory List of Rare and Threatened Plants.
- Threatened under the Victorian *Flora and Fauna Guarantee Act 1988*.

- Endangered under the Federal legislation: *Environment Protection Biodiversity and Conservation Act 1999*.
- Critically Endangered IUCN.

Threatening Processes

Over the last hundred years, *C. hastata* has suffered from a variety of threats including:

- Habitat destruction.
- Invasion of *Acacia longifolia* into previously suitable habitat.
- Small population size and limited populations.
- Lack of natural recruitment at some sites.
- Inappropriate fire regimes.

Deciding to translocate

The National Recovery Plan (Todd 1999) for *C. hastata* identifies conservation translocation, and in particular creating new populations, as a recovery action. All five populations, particularly the three populations supporting only one or two individuals, are highly vulnerable to extinction. Creating additional self-sustaining populations will reduce the species vulnerability to demographic and environmental stochasticity, and decrease extinction risk.

This conservation translocation project broadly has two objectives:

- To increase the number of populations and individuals.
- To increase the knowledge of biology, ecology and management requirements.

This conservation project also provides a valuable opportunity to involve the community and raise public awareness regarding the conservation of *C. hastata* and threatened species recovery in general.

Aim of the translocation

The overall objective of the project is to create two new self-sustaining populations and reduce the species vulnerability to demographic and environmental stochasticity and decrease extinction risk. This project refines the strategies for *Caladenia* conservation translocations based on knowledge of the ecology and distribution of pollinators. The project contributes to key actions of the National Recovery Plan including:

- Developing site management practices.
- Measuring population responses against recovery actions.
- Investigating the biology and ecology of *Caladenia* species.
- Establishing *ex-situ* collections of threatened *Caladenia* taxa.
- Establishing new populations of threatened *Caladenia* taxa in the wild.



Figure 1. Flowering *Caladenia hastata* 12 months after conservation translocation: Photo: Noushka Reiter

Translocation working group and key stakeholders

The stakeholders involved in the translocation of *C. hastata* are: the Royal Botanic Gardens Victoria, the Victorian government Department of Environment Land Water and Planning (DELWP), Australian Network for Plant Conservation, Wimmera Catchment Management Authority, Portland Field Naturalists, Parks Victoria, Australasian Native Orchid Society (Vic Branch), and Portland Aluminium/Alcoa.

Biology and Ecology

Pollination

Caladenia hastata is a sexually deceptive orchid reliant upon a single wasp species *Lestrichthynnus hastata* (Brown and Vlcek 2010) for pollination. In order to establish new populations the presence of the pollinator at potential translocation sites needs to be confirmed. Without the pollinator translocation populations will not be viable in the long term.

Mycorrhizal associations

Caladenia hastata, like most terrestrial orchids, is a mycoheterotroph (Rasmussen, 1995, 2002; Warcup 1971) and is dependent on a mycorrhizal association

to complete its lifecycle. Mycorrhizal sampling of populations of *Caladenia hastata* have revealed orchids from both populations associate with undescribed *Serendipita* sp. (Reiter *et al.* unpublished data). Plants for conservation translocation were grown from seed with their mycorrhizae following methods of Reiter *et al.* (2016).

Site selection

The criteria for *C. hastata* conservation translocation sites were:

- Pollinator is found at the translocation sites.
- Reserved or permanently protected land managed for ecological purposes.
- Vegetation is a match with known sites of the species.
- Located within the natural range of the species.
- Low or no weed/invasive species present.
- Accessible for monitoring.
- Vegetation appears healthy and intact.
- Naturally occurring wild fires are still a possibility.
- Location is not impinged on by man-made infrastructure.
- The site is large enough to support a self-sustaining population.

Translocation proposal

A translocation proposal was developed with stakeholders and reviewed by the DELWP Translocation Evaluation Panel. The proposal was subsequently approved and permits for conservation translocation granted by DELWP and the land manager Parks Victoria.

Pre-translocation preparation, design, implementation and ongoing maintenance

Pre-translocation sites were assessed between 2008 and 2014 against the above selection criteria. A total of 233 sites were assessed for the presence of the pollinator species, *Lestricothynnus hastata* (Reiter *et al.* 2017). Pollinator presence was assessed using the standard baiting method for sexually deceptive orchids (Bower 1996). Of the 233 sites baited, the pollinator was only detected at five sites. Of the five sites with the pollinator present only two sites had similar vegetation structure and composition to existing wild extant populations (Reiter *et al.* 2017). These two sites were chosen as the conservation translocation recipient sites.

Subsequent actions

In total, 446 plants were planted across the two sites where the pollinator was present. Plantings were a group effort with all the key stakeholders and community involved between 2014 and 2016 (Figure 2).

Supplementation – ongoing monitoring

The conservation translocation populations are monitored on an annual basis, with data recorded on leaf emergence, flowering, pollination and recruitment. This data is used to describe the overall health of the population against the long-term criteria outlined in Reiter *et al.* (2016).

Site vegetation management

As *C. hastata* occurs in heathland sites, active management of translocation sites if fenced and caged is required to prevent biomass build up. For the two sites:

- Plants were caged and sites were fenced.
- Fences were erected with double gates allowing for opening of the gates and grazing over the summer months.
- Biomass build up is manually removed within cages while plants are establishing (long term cages are to be removed).

Outcomes

There was an average survival rate of 83% across the two sites. Flowering and seed set has been recorded at both sites and the conservation translocations are on track against long-term performance goals for each site.

What we learned

The pollinator for *C. hastata* is the main limiting factor for selecting sites for conservation translocation of this species. We have shown an essential step prior to translocation is ensuring the presence of the pollinator in any potential translocation site.



Figure 2. *Caladenia hastata*. Noushka Reiter watering plants after translocation. Photo: Gail Pollard

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References and further reading

Bower, C. (1996). Demonstration of pollinator-mediated reproductive isolation in sexually deceptive species of *Chiloglottis* (Orchidaceae: Caladeniinae). *Australian Journal of Botany* 44: 15-33.

Brown, G. and Vlcek, K. (2010). *Pollination biology of the Sexually Deceptive Threatened Orchids* *Caladenia richardsiorum*, and *Caladenia hastata*, and their pollinators. Report to the Australian Orchid Foundation.

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

Phillips, R.D., Backhouse, G., Brown, A.P. and Hopper, S.D. (2009). Biogeography of *Caladenia* (Orchidaceae), with special reference to the South-west Australian Floristic Region. *Australian Journal of Botany* 57: 259-275.

Rasmussen, H.N. (1995). *Terrestrial orchids: from seed to mycotrophic plant*. Cambridge University Press, Cambridge.

Rasmussen, H.N. (2002). Recent developments in the study of orchid mycorrhiza. *Plant and Soil* 244: 149-163.

Reiter, N., Whitfield, J., Pollard, G., Bedggood, W., Argall, M., Dixon, K., Davis, B. and Swarts, N. (2016). Orchid re-introductions: an evaluation of success and ecological considerations using key comparative studies from Australia. *Plant Ecology* 217: 81-95.

Reiter, N., Vlcek, K., O'Brien, N., Gibson, M., Pitts, D., Brown, G.R., Bower, C.C. and Phillips, R.D. (2017). Pollinator rarity limits reintroduction sites in an endangered sexually deceptive orchid (*Caladenia hastata*): implications for plants with specialized pollination systems. *Botanical Journal of the Linnean Society* 184: 122-136.

Todd, J. (2000). *Recovery plan for twelve threatened Spider-orchid* *Caladenia* taxa (Orchidaceae: Caladeniinae) of Victoria and South Australia 2000-2004. Department of Natural Resources and Environment, Melbourne.

Warcup, J. (1971). Specificity of mycorrhizal association in some Australian terrestrial orchids. *New Phytologist* 70: 41-46.

Threatened plant translocation case study:

Ricinocarpos brevis, Euphorbiaceae

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The Species

- Non-lignotuberous, long-lived upright shrub.
- Endemic to Western Australia, classified Endangered (WA Wildlife Conservation Act 1950; Environment Protection and Biodiversity Conservation Act 1999).
- Three extant natural populations that occur over 100 km range to the north-east of Perth.

Threatening Processes

- Mining and exploration (direct removal, indirect effects).
- Weed invasion.
- Predation (foliage and seed).
- Inappropriate fire regimes.

Deciding to translocate

As part of an offset package to mine and subsequently remove *R. brevis* individuals from banded ironstone habitat, Cliffs Asia Pacific Iron Ore (Cliffs) were required to undertake research with the aim of contributing a scientific understanding of the ecology and conservation of this threatened species.

Cliffs commenced field translocations (2010 and 2011) on natural and disturbed landforms (drilling areas) with limited success (Cliffs 2011, 2012). In 2013, a comprehensive research program commenced, undertaken in collaboration with Department of Biodiversity, Conservation and Attractions (Kings Park Science; formerly Botanic Gardens and Parks Authority) and The University of Western Australia.

Further translocation research on establishing *Ricinocarpos brevis* on waste rock landforms was