What we learned

- The species translocated can be re-established with high survival rates using the direct transplanting method.
- Results of the Slender Marsdenia experiment supported the hypothesis that addition of fertiliser negatively affects growth and survival in translocated plants of this species.
- Other aspects of Slender Marsdenia life cycle and response to transplanting remained enigmatic. Twelve different response syndromes in transplanted individuals were identified, but are difficult to explain. Seedlings grew much more strongly than vegetatively propagated plants.
- Floyds Grass is relatively easy to translocate, although a poor competitor with the native grass *Ottochloa gracillima* which limits its spread locally; survives flooding and king tide inundation.
- An effective method was developed for translocating epiphytic orchid species.
- Koala Bells is a disturbance regenerator with an annual or occasionally short-lived, perennial life cycle.

References and further reading

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Figure 7. Koala Bells. This is a propagated population enhancement plant, which typically flowered within 3 months of being introduced. Recruitment was recorded at one of the recipient sites with sections of bare soil. Photo: Andrew Benwell

Threatened plant translocation case study:

Involvement in the Royal Botanic Gardens Victoria's Orchid Conservation Program by volunteers from the Australasian Native Orchid Society Victoria Group

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Orchids

Orchids are one of the most charismatic and diverse plant families with over 26,000 species worldwide (WSPF 2018). Australia is home to more than 1800 (Backhouse *et al.*, 2016) species and subspecies of orchid, with the majority being terrestrial species found predominately in the temperate south. Victoria has in excess of 400 species of native orchids with many occurring nowhere else on Earth. Orchid habitat in Victoria varies from alpine peaks to semi-arid mallee, swamps, native grasslands, heath lands, and eucalypt forests of all types. The majority of our native orchids emerge from an underground tuber in autumn, flower in late winter-spring and set seed before the summer, when they retreat back to their underground tuber. All orchids are reliant on one or more species of mycorrhizal partner (Rasmussen 1995) to germinate in the wild, and are often pollinated by only one or a few species of insect (Tremblay *et al.* 2005). Successful conservation translocations (supplementations, reintroductions and introductions) of these plants typically require a thorough understanding of their ecology including pollinators and mycorrhizal fungi (Reiter *et al.* 2016).

Reasons for conservation translocation

Orchids represent only 6% of all plants in Australia, yet alarmingly 17% of all plants listed under the *Environment Protection Biodiversity and Conservation Act 1999* (*EPBC Act*) are orchids, more than any other plant family. While some species were naturally rare, the majority have had wider distributions and have undergone range declines over the past 100 years. The causes of decline include: historic land clearing, competition by introduced weeds, grazing by introduced and native animals and historically illegal poaching (Reiter *et al.* 2016). Due to reduced numbers, many species are now vulnerable to inbreeding depression, climate change and inappropriate fire regimes. Without targeted conservation efforts, including conservation translocation, many of these species are likely to become extinct.

Aims of the Royal Botanic Gardens Victoria (RBGV) Orchid Conservation Program

The RBGV Orchid Conservation Program aims to prevent extinction by:

- Storing a genetically diverse representation of seed and mycorrhizal fungi of all Victorian threatened orchids.
- Propagating suitable numbers of each of our threatened orchids for conservation translocation.
- Undertaking conservation translocations including supplementation, reintroduction and introduction of these species when species have declined to unsustainable levels.

The Orchid Conservation Program conducts research on all aspects of orchid ecology, including pollination, mycorrhizal associations, propagation, demographics and conservation translocation techniques. RBGV works with stakeholders and partners to provide advice on the conservation of orchids.

The stakeholders and partners

The Orchid Conservation Program is a collaboration between many stakeholders and partners. Working across multiple levels of government, not for profit organisations and community groups enhances the outcomes of the program. Partners include: Royal Botanic Gardens Victoria, Adelaide Botanic Gardens, Parks Victoria, Department of Environment Land Water and Planning, Trust for Nature, Australian Network for Plant Conservation, The Australian National University, Office of Environment and Heritage, Murray Local Landcare Services, Wimmera Catchment Management Authority, Nillumbik Shire, Project Platypus, Australasian Native Orchid Society Vic Branch (ANOS) and many volunteer groups.

The Australasian Native Orchid Society involvement

ANOS Vic has been a key community partner in the Orchid Conservation Program since its inception (Reiter *et al.* 2012). On a yearly basis volunteers contribute over 2500 skilled hours of work on the RBGV Orchid Conservation Program and many more on local community orchid conservation activities with other partner organisations. Many of the volunteer's field activities are co-ordinated through ANOS Vic's own volunteer Orchid Conservation Officer. Potential volunteer involvement activities are taken to ANOS Vic's committee at the start of the year to allow adequate planning of events. Volunteers have varying levels of skills when starting with the program and an important part of their induction is therefore training. Training of the volunteers includes not only the tasks that they are performing but providing background knowledge on the species they are working with. Learning continues during the activities and sharing of knowledge between volunteers and stakeholders is ongoing. Activities onsite at the RBGV laboratory and nursery include: germination counts, data entry, flasking seedlings, and potting orchids. Field activities include: surveys, monitoring, planting for translocations, weeding at important sites, and surveys for orchid pollinators. Importantly, with translocations we make a concerted effort to take volunteers back to these sites to assist with monitoring and post-translocation maintenance, allowing everyone to see the results of their hard work. Below are three examples of ANOS Victoria's involvement with conservation and translocation of over thirty species of threatened orchids as an integral part of the Victorian Orchid Conservation Program.

Figure 1. A) *Caladenia fulva*, B) *Thelymitra mackibbinii*, C) *Caladenia colorata*. Photos: Noushka Reiter

Figure 2. A) Monitoring set up *Caladenia colorata* conservation translocation, B) volunteers caging *Caladenia fulva* conservation translocations, C) volunteers potting orchids in the RBGV nursery, D) volunteer hands planting *Caladenia fulva*, E) volunteers planting *Caladenia versicolor*. Photos: Noushka Reiter (A, C, D, E) and Charles Young (B)

The Colourful Spider-orchid (*Caladenia colorata* D.L.Jones)

Caladenia colorata has a single green leaf, and produces one to two flowers between late August and mid-October (Figure 1 C). Flowers are usually a pale yellow, though red, pink and multi-coloured forms can be observed. There are fewer than 1,000 plants occurring in five wild populations within western Victoria. In South Australia there are 851 plants known from 11 populations and only two of these populations contain more than 100 individuals. All populations, and in particular populations supporting only small numbers of individuals, are highly vulnerable to extinction. In Victoria , *C. colorata* inhabits *Eucalyptus incrassata* Labil. woodland (Lowan Sands Mallee) and *Eucalyptus leucoxylon* F.Muell. dominated open woodland (Shallow Sands Woodland). Creating additional self-sustaining populations will reduce the species vulnerability to demographic and environmental stochasticity, thereby decreasing extinction risk. *Caladenia colorata* is listed as endangered under the federal legislation: *EPBC Act 1999* and threatened under state legislation *Flora and Fauna Guarantee Act 1988 (FFG Act)*. There is no current national recovery plan for this species across its known range, the recovery plan was placed on the commenced list in 2009. The regional recovery plan (Obst 2005) for *C. colorata* identifies research on life stages, long term monitoring, supplementation, and in particular creating new populations, as recovery actions.

The Orchid Conservation Program initiated work on this species in 2009 at which time the species was only know from one site in Victoria. ANOS Vic have taken part in community surveys (Figure 2) for this species in western Victoria between 2009 and 2016, with these surveys leading to the discovery and mapping of an additional four populations. Symbiotic propagation work was commenced along with pollinator surveys (Reiter *et al*. in review) and threat mitigation including Veldt grass control by partner organisations. The species was introduced back into four sites between 2013 and 2017 on private Trust for Nature covenanted property with the help of enthusiastic volunteers from ANOS Vic, landholders and stakeholders. ANOS Vic volunteers assisted with tagging individual plants (for later monitoring) (Figure 2), caging and site maintenance. To date 772 plants have been introduced since 2013.

The average leaf emergence across the four populations in 2017, of those plants first introduced, is 61% +/- SE (standard error) [14%], with flowering (many had double flowers) at 101% +/- SE [27%] and a pollination rate of 30%+/- SE [5%]. Since 2016, the populations have had recruits (through seedlings and tuber reproduction), with the proportion of recruits compared to those plants originally planted at 33% +/- SE [19%] of the origin populations.

The Tawny Spider-orchid (*Caladenia fulva* G.W.Carr)

Caladenia fulva has a single leaf and produces one to two cream-coloured flowers in August to early October (Figure 1 A). *Caladenia fulva* is known from between 600-1000 plants in the wild. Prior to landscape-scale disturbance from gold exploration and mining, *C. fulva* is likely to have been more abundant with numbers in the thousands in the Stawell-Ararat Box Ironbark area. *Caladenia fulva* is listed as threatened under the *Flora and Fauna Guarantee Act 1988* and endangered under the *Environment Protection Biodiversity and Conservation Act 1999*. The National Recovery Plan (Duncan and Coates 2010) for *C. fulva* identifies re-introduction, and

in particular creating new populations, as a recovery action. Conservation objectives for this species include:

- Measure population trends and responses against recovery actions.
- Establish a seed bank and determine seed viability.
- Establish plants in cultivation to safeguard against destruction of wild population.
- Select and evaluate potential conservation translocation sites.
- Translocate and monitor plants from cultivation.
- Identify opportunities for community involvement.

ANOS Vic has been involved in surveys for new populations, monitoring, assistance with propagation onsite at the RBGV, planting and maintenance at translocation sites (Figure 2). The species was introduced back into five subpopulations between 2015 and 2016 on private Trust for Nature covenanted property with the help of enthusiastic volunteers from ANOS Vic, Stawell Field Naturalist members, landholder and stakeholders. So far 451 plants have been introduced since 2015, with a leaf emergence in 2017 (across the five populations) of 92 % +/- SE [3%] with flowering, natural pollination and seed set observed across all introduced subpopulations.

The Brilliant Sun-orchid (*Thelymitra mackibbinii* F.Muell)

Thelymitra mackibbinii has one dark green leaf and produces one to two dark purple flowers (Figure 1 B) between September and October. *Thelymitra mackibbinii* inhabits the Box-Ironbark forests of Victoria and was more abundant in the Stawell–Bendigo-Ararat area, prior to landscape-scale disturbance from gold exploration and mining. *Thelymitra mackibbinii* is known from just 36 naturally occurring wild plants spread across three disjunct sites. *Thelymitra mackibbinii* does not self-pollinate and requires the aid of bees to transfer pollen (N. Reiter pers. obs). All known populations are reserved. *Thelymitra mackibbinii* is listed as threatened under *FFG Act 1988* and Vulnerable under the *EPBC Act 1999*. The national Recovery Plan (Duncan and Coates 2010) for *T. mackibbinii* identifies reintroduction, and in particular creating new populations, as a recovery action. Recovery actions include:

- Measure population trends and responses against recovery actions.
- Establish a seed bank, and improve seed viability through outcrossing trials.
- Establish plants in cultivation to safeguard against destruction of wild population.
- Selecting potential reintroduction sites.
- Introduce and monitor plants from cultivation.
- Identify opportunities for community involvement.

ANOS Vic and local volunteers have been involved in surveys for new populations, assistance with propagation at the RBGV, applying for funding, monitoring, fencing conservation translocation sites, caging, monitoring translocated plants, and planting new populations of *Thelymitra mackibbinii* grown from seed. The species was introduced back into two sites in the Stawell area (over three translocations) between 2013 and 2017 on a Parks Victoria Reserve, with the help of enthusiastic volunteers from ANOS Vic, Stawell Field Naturalist members, landholders and stakeholders. To date 147 plants have been introduced since 2013, with a leaf emergence in 2017 over the three translocations of 73% +/- SE [13%] with 31%+ /-SE [9%] flowering and 32% +/- SE [11%] pollination.

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For further information about the Orchid Conservation Program go to: https://www.rbg.vic.gov.au/science/projects/orchid-conservation

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