

10 Re-introducing the Australian Hollyhock, (*Malva preissiana*) to Penguin Island

Kate Brown¹, Aurelie Labbé², Grazyna Paczkowska¹ and Leonie Monks¹
¹Department of Parks and Wildlife, ²Murdoch University

Introduction

Malva preissiana or Australian hollyhock only occurs on offshore islands around the western and southern coasts of Australia. Its life cycle is linked to that of nesting seabirds and it grows specifically in their guano deposits. The habitat is nutrient rich, continually disturbed by seabird trampling and highly susceptible to weed invasion.

Competition from weeds including the introduced *Malva dendromorpha*, *M. pseudolavatera*, annual grasses including *Lolium* spp., *Bromus* spp. and from ice plant *Mesembryanthemum crystallinum*, has had a major impact on populations on islands along Perth's coast including the Shoalwater Islands. Over the last 20 years *M. preissiana* has gone extinct on Rottnest, Green, Bird, Seal, and Penguin islands. Carnac and Shag islands now support the only population of *M. preissiana* in the region (Figure 1). Over the last five years seed has been collected from the Carnac Island population and stored at the Department of Parks and Wildlife Threatened Flora Seed Centre.

The type collection (the first collection of the species and the specimen for which the species is named) was from Penguin Island on 11th of November 1839 by German naturalist Ludwig Preiss. Unfortunately *M. preissiana* disappeared from Penguin Island sometime in the 1970s. There were many factors that may have led to the decline of the Penguin Island populations including increasing numbers of silver gulls (*Larus novaehollandiae*) and associated weed invasion, direct competition from the introduced *Malva dendromorpha*, establishment of large pelican (*Pelecanus conspicillatus*) rockeries and guano mining in the southern parts of the island.



Figure 1: *Malva preissiana* on Carnac Island.



Figure 2: Location of trial sites.

Our project aimed to evaluate establishment techniques for the reintroduction of *M. preissiana* to Penguin Island. As well as being the type location, it is the most accessible of the Shoalwater Islands allowing for consistent monitoring and management of trial sites. Once techniques have been established through small scale trials, the aim is to investigate the feasibility of establishing self-sustaining populations on Penguin Island. The Australian hollyhock once formed an important component of the island's vegetation and this reintroduction is part of a larger restoration program for the island.

Methods



Figure 3: Direct sowing *Malva preissiana* seed.

In June 2014 10 pairs of 50 x 50cm trial plots were established in old pelican nesting sites at the northern end of the island (Figure 3). All weeds were hand removed from one plot in each pair, in the other plot weeds were left in place. All plots were then direct seeded with *M. preissiana* from the Carnac Island collections. Each of the plots was sown with 48 seed.

Half of these seed (24) had been pre-treated by nicking the seed coat using a scalpel prior to planting (this was done under laboratory conditions the week before planting and then the nicked seed was transported to the island in paper envelopes). The remaining seeds (24) were not nicked. Seed were sown by hand 3–4mm below the surface. Seedling germination and survival were monitored each month through to December 2015. Follow up weeding (in the weed treatments) was also carried out as each plot was monitored.

Results and discussion

Nicking and weeding had an initial germination rate of only around 6% (average of 2.8 seedlings) and no treatment, (not nicked, not weeded) a little over 2% or just over one seedling per plot (Figure 4). Plots were trampled by gulls and pelicans in the month after sowing and this impacted on germinating seedlings. Some plots were more disturbed than others and there was high variation in survival rates across replicates. By December 2014 an average of less than one plant per plot survived in the nicked and weeded plots and none in the untreated plot.

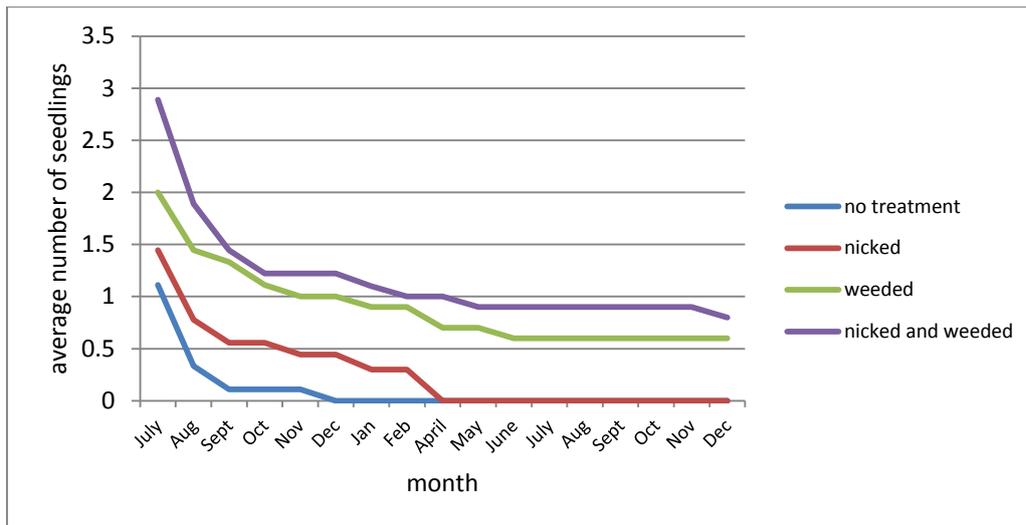


Figure 4: Average number of *Malva preissiana* seedlings in 50cm x 50cm treatment plots (n=10) on Penguin Island over winter/spring/summer 2014 and 2015.

While germination and establishment rates were not high, the trials provided information on survival rates of seed and establishment rates of reproductive individuals under natural conditions including trampling and disturbance by gulls and pelicans.

In addition, 60% of weeded plots and only 20% of unweeded plots contained flowering and fruiting individuals by December 2014. Removal of competition from weeds does appear to be important for establishment of populations (Figure 5). Of the plants that did survive most went onto flower and produce fruit. In addition a number of 50cm x 50cm plots were filled by a single individual (Figure 5). The decreasing number of plants per plot over time may partly be explained by competition from adjacent *M. preissiana* seedlings (self-thinning). Most plants that survived the 2014/15 summer and made it through to spring 2015 flowered and seeded prolifically (Figure 6).



Figure 5: Weeded (left) and unweeded plots (centre) and an individual in a 50cm x 50cm plot flowering in October 2014.

All fruit examined on plants in 2014 appeared to be heavily predated and on the December 2014 monitoring trip invertebrate samples were collected. They were identified as seed bug, *Oxycarenus arctatus*, also commonly known as the coon bug, a ladybird beetle in the genus *Telsimia*, most likely an undescribed species, and a beetle larvae. Heavy seed predation has been observed on populations of *M. preissiana* in most seasons. Some years though, for example 2014 on Carnac and 2015 on Penguin Island, little predation was evident.

Management implications

- The results indicate direct seeding combined with weed control is a useful technique for reintroducing *M. preissiana* to Penguin Island and that plants can go on to flower and set seed in the first year.
- Based on the results of these trials if 5000 seed are directly sewn across a 20m by 20m area where weeds are controlled, around 100 plants should become established, a figure close to the natural densities on Carnac Island.
- While nicking seed appeared to result in higher germination rates seed germinated without nicking. Nicking is an expensive pre-treatment. Sowing higher numbers of seed rather than nicking could be an option. If seed is limited other pre-treatments such as hot water could be investigated.
- Disturbance by trampling birds impacted on successful establishment. We did attempt to discourage seagulls using fishing line strung across the plots. This was unsuccessful. One option is to cage the sites. However given there was survival without caging and trampling is a part of the system and habitat, it is not a preferred option.

Conclusion

These trials have provided a management framework for the reintroduction *M. preissiana* to Penguin Island, an important part of the larger restoration plan for the island. The next phase of the project will involve acquiring resources to scale up the trials and through an adaptive management process, establish self-sustaining populations on the island.

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Figure 6: Individual of *Malva preissiana* flowering and setting seed 17 months after germination, October 2015 Penguin Island.

Natural history and management of the Shoalwater Islands and Marine Park



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