Restoring critical habitat on Penguin Island

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Introduction

The transition from native shrublands to weedy grasslands following establishment of large colonies of gulls has been reported for floras of small islands across the world (Hogg and Morton 1983, Ellis 2005, Otero et al. 2015). In addition to causing extensive trampling, guano deposition and disturbance, gulls are effective carriers of weed seed, ejected from their crops in a viable form into soil and guano deposits around nesting colonies (Gilham 1956, Calvino-Cancela 2011). Sometime after 1961 a large colony of silver gulls (*Larus novaehollandiae*) became established on Penguin Island and current estimates put the population at around 4000 pairs. The gulls have had a particularly serious impact on the vegetation in north east section of the island, historically important nesting habitat for bridled terns (*Onychoprion anaethetus*). This part of the island, once native shrubland, is now largely a cover of weedy annual grasses and herbs in winter/spring (Figure 1) and bare ground in summer, the time of year terns return from Japan and Borneo to nest, lay eggs and raise young.

Under bilateral migratory bird agreements with Japan (JAMBA), the Australian Government has undertaken to provide for the protection and conservation of migratory birds. This includes bridled terns, and their important habitats. Accordingly, the objective of our ongoing management trials is to restore the north eastern *Rhagodia* shrublands on Penguin Island and reverse the decline in critical bridled tern habitat.

Figure 1) Weedy annual herblands in the northeast part of the Island are displacing native shrublands.

Summary of previous restoration trials at the site

2014

Trials to restore the *Rhagodia* shrublands through planting revealed that silver gulls consistently pulled out tube stock across sites. By December 2014, of the 490 plants that went into the ground in June, only three survived. The results indicated that to re-establish vegetation cover tubestock required protection from silver gulls until well established.

2015/16

In 2015, trials were established to investigate techniques to protect tube stock from silver gulls in the early stages of establishment. In addition, we investigated brushing and direct seeding with *Rhagodia baccata* as methods of establishing native vegetation cover. The capacity of soil-stored seed to return native vegetation cover if sites were weeded and protected from silver gulls was also investigated. The objective of all treatments was to replace dense stands of annual weeds with a resilient native vegetation cover that provided tern habitat.

Management implications and conclusions:

- Brushing using *Rhagodia baccata*, with no cost for plant material, is a cost effective rapid method of creating native cover within six months. Indications are that direct seeding with fresh fruits of *Enchylaena tomentosa* in June is also a cost effective and rapid method of creating native cover.
- Direct seeding with *Rhagodia baccata*, while creating cover after 18 months requires significantly more resources than brushing (seed collection, preparation and storage) and is not a recommended option.
- A native soil seed bank is still present in weed invaded sites. Simply hand removing annual weeds early in the season and placing weld mesh cages over weeded sites to protect germinating native seedlings from silver gulls is a cost-effective method of restoring native shrublands. Indications are that establishment of native cover is slow in the first 12 months but rapidly increases in the second growing season. Follow up weeding will be required at least over the first two years until a cover is established. A great project for volunteers.
- Establishment of *Tetragona implexicoma* is currently only possible through planting tubestock grown on from cuttings. Seed germination requirements are not well understood. The species creates a significant cover on Penguin Island and is important habitat for nesting seabirds including little penguins (*Eudyptula minor*). When funding is available planting tubestock and caging is a very effective method of establishing cover of this species.
- *Rhagodia* shrublands can be rapidly and effectively restored on Penguin Island if weeds are managed and protection from silver gulls provided in the initial 12 months of establishment.

For detailed results see Kate Brown[1], Aurelie Labbé[2] and Grazyna Paczkowska[1] (2017) Restoring critical habitat on Penguin Island. [1]Department of Parks and Wildlife [2]Murdoch University

https://www.dpaw.wa.gov.au/images/documents/conservation-management/off-road-conservation/urban-nature/research-papers/penguin_island_vegetation_restoration_reports_2017.pdf

2017

Over 2017 monitoring of trials established in 2015 continued. The cover of native vegetation was retained, stabilizing at 75–100% across all planted, brushed and direct seeded plots and across four of the five control sites (Figures 2 & 3).

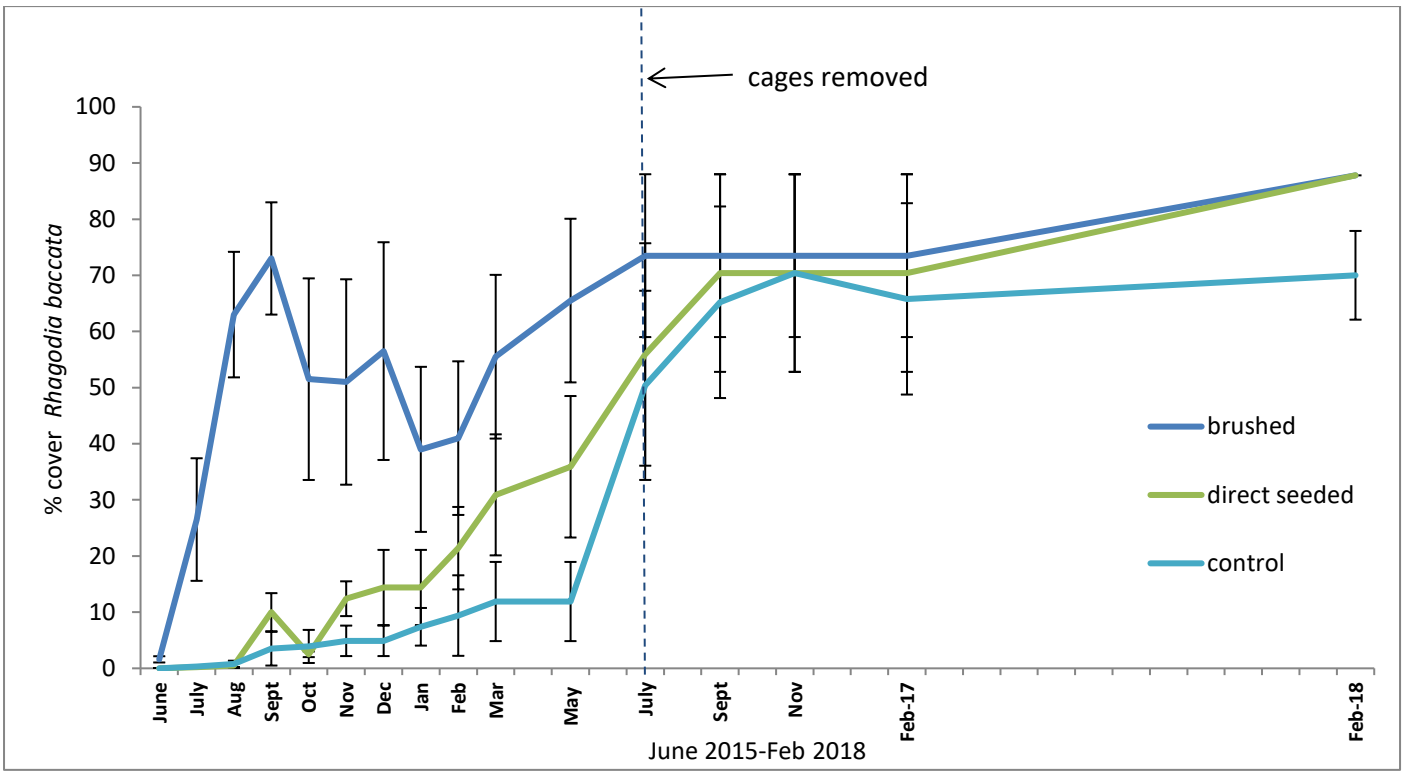

Figure 2) Average per cent cover *Rhagodia baccata* June 2015 to February 2018 in treatment plots (1mx1m) n=5.

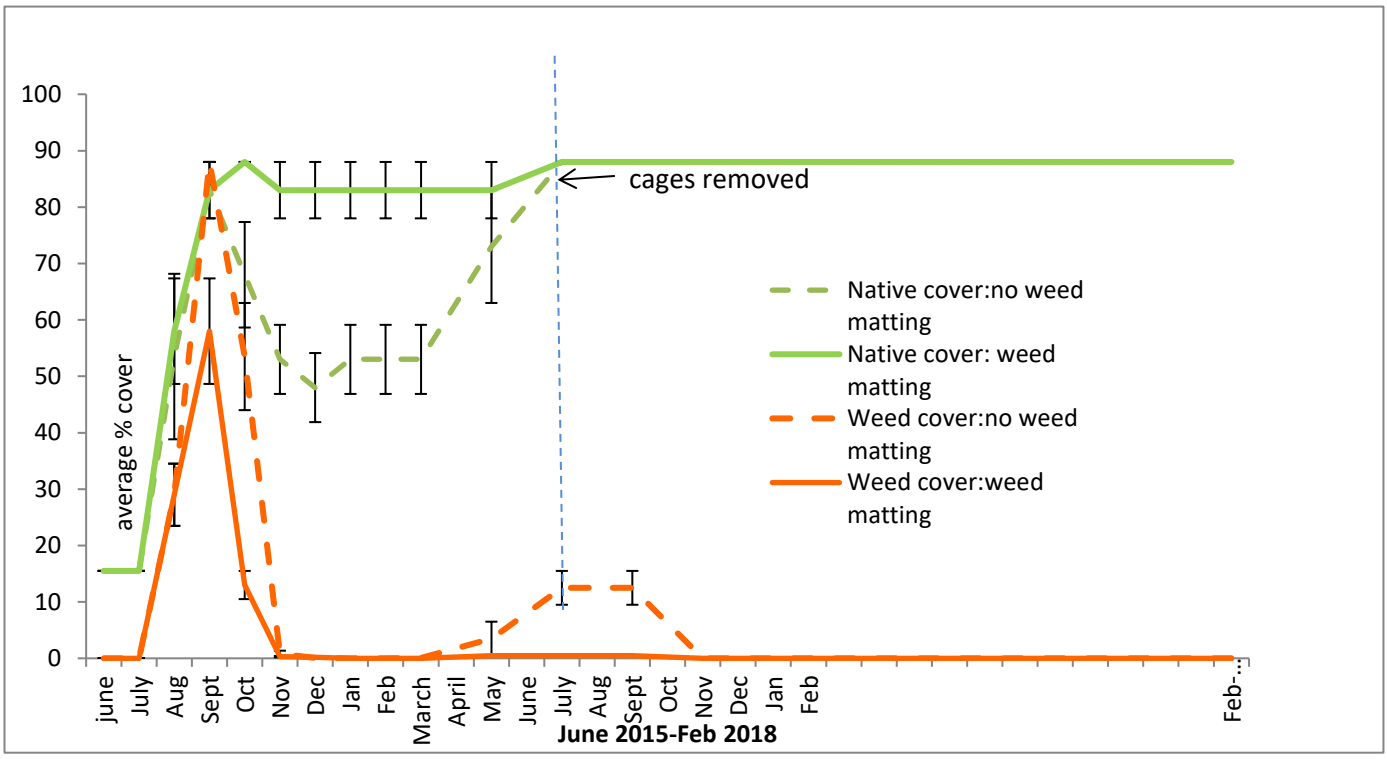

Figure 3) Average per cent cover of natives and weeds in matted and unmatted plots (2mx2m) June 2015 to February 2018. n=5

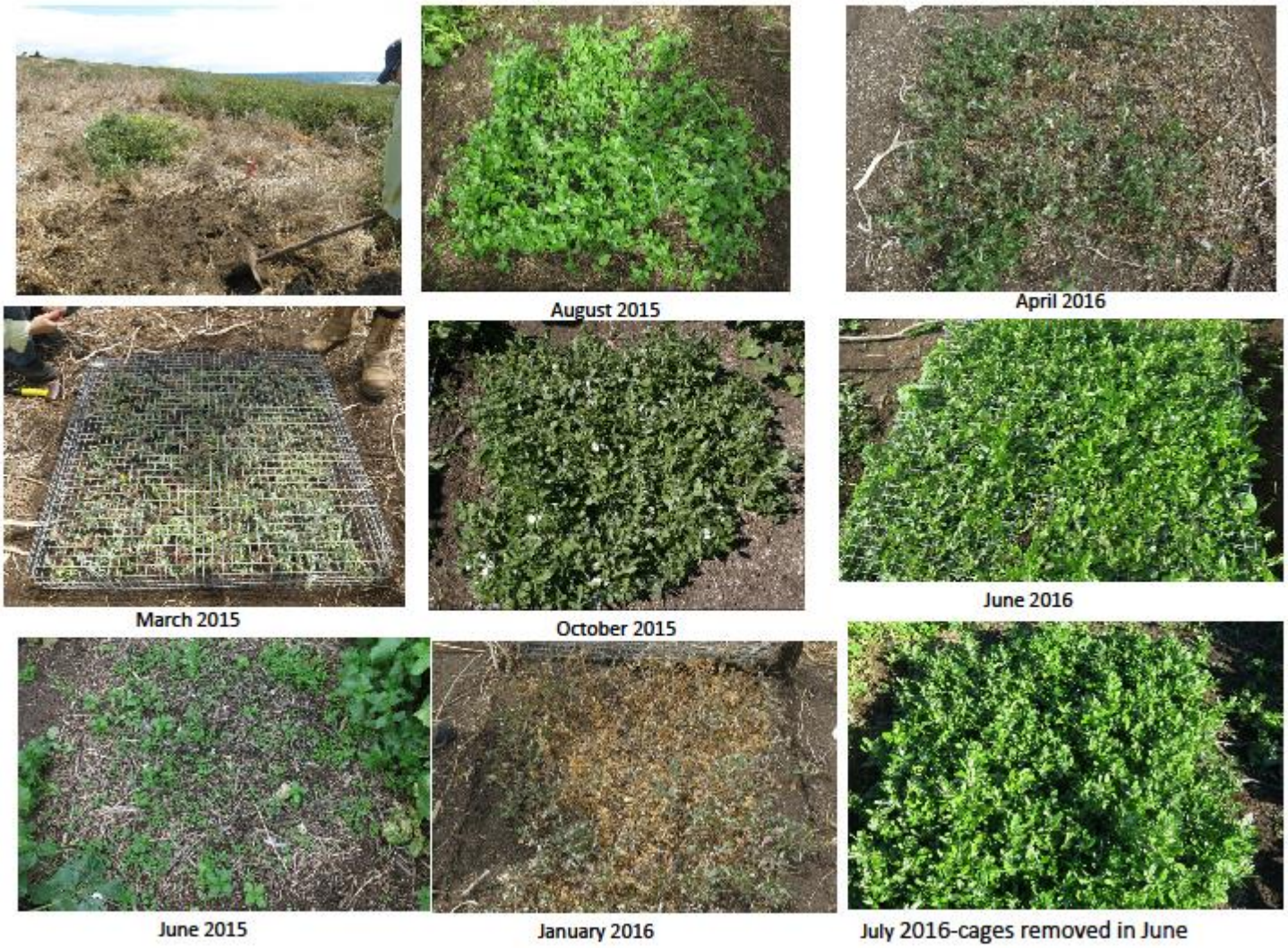

Figure 4) Brushing using *Rhagodia baccata*, with no cost for plant material, is a cost effective rapid method of creating native cover.

In addition direct seeding trials of *Enchylaena tomentosa* established in 2016, created an average cover of 75–100% by February 2018 (Figures 5a&b).

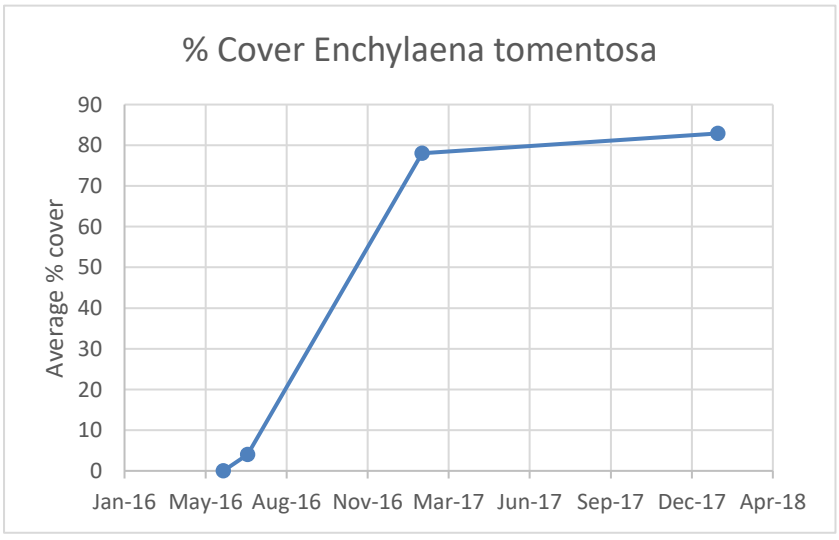

Figure 5a) Average percent cover of *Enchylaena tomentosa* direct seeded into 1m x 1m plots, May 2016 to February 2018. n=5

Figure 5b) Direct seeded plot February 2018.

In 2017 trials were established to gain an understanding of the impacts silver gulls were having on natural regeneration. While 2014 planting trials established that silver gulls consistently remove and destroy tube stock there was no quantitative evidence that they were impacting natural regeneration – seedlings that germinated from the native soil seed bank once the weeds are removed. In February 2017 ten caged (protected from gulls) and ten uncaged (not protected) sites were established with an aim to hand weeding these sites on a monthly basis through 2017. Adverse weather conditions meant it was not possible to visit the island each month and so sites were weeded opportunistically over 2017. By November 2017 seedling establishment had only occurred in sites protected from silver gulls. While seedlings germinated in unprotected sites they did not survive though to November.

In February 2017 trials were also implemented to investigate direct seeding as a technique for establishing nitre bush (Nitraria billardierii) on the eastern boundary of the restoration site. Nitre bush is an important component of the vegetation forming dense stands on limestone cliffs around the edge of the island. It is important habitat for nesting sea birds and for king skinks, often seen feeding on the purple fruits in late summer. The dense stands of this woody shrub effectively displace weeds making it particularly useful in restoration. Summer 2016/17 was an exceptional season for flowering and fruiting of nitre bush on Penguin Island (Figure 6) and fruits were collected in February and directly sown into 20 caged sites, however by November 2017 no germination had occurred in any of the sites. The species is understood to have physical and physiological dormancy mechanisms and there is hope that aging and leaching in the guano enriched soil might bring about germination over 2018.

Figure 6) Flowers, fruits and direct seeded plot of nitre bush.

In December 2017 the distribution and density of bridal tern nesting sites was mapped across the restoration area (Figure 5). The objective was to gain an understanding of how bridal terns were using restored vegetation and to establish a baseline that can be used to determine if nest density increases as native shrublands are restored over time (Figure 8 - please note the orthophoto is dated Feb 2017 and vegetation cover has increased since that time). Nests were found almost exclusively under the shelter of *Rhagodia/Tetragona implexicoma* shrubs or limestone crevices on the cliff line. Some nests were recorded in restored vegetation (Figure 8).

Figure 7) Mapping bridled tern nesting sites December 2017.

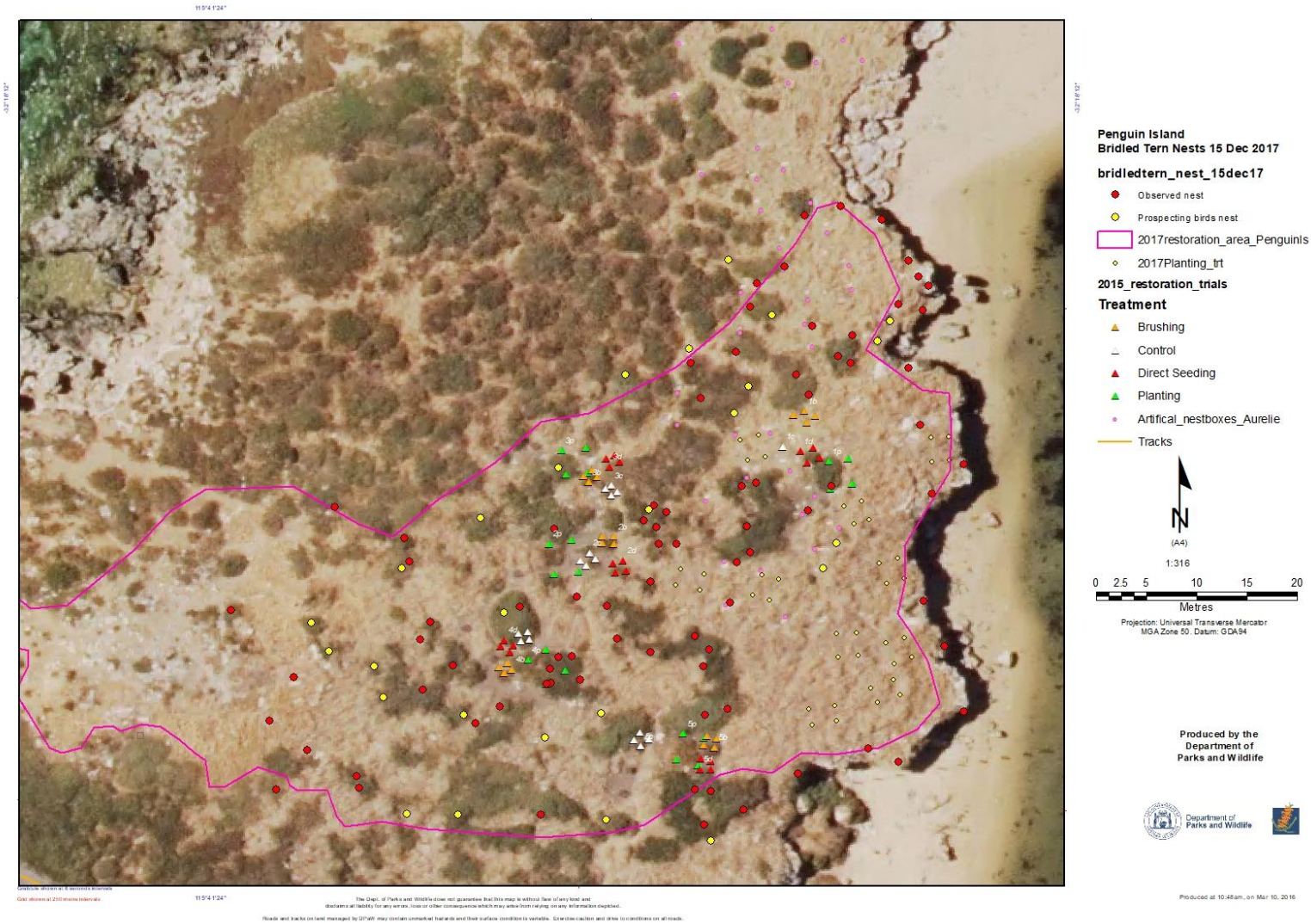

Figure 8) Location of bridled tern nesting sites and trials across restoration site

In addition to the establishment of further restoration trials the results of previous trials were implemented on a broader scale across the restoration site including planting and brushing under cages and opportunistic hand removal of weeds across the designated restoration site (Figure 8, pink boundary, Figure 9).

Figure 9) Over 2017 the results of previous years trials were implemented across the restoration site at a broad scale. Photo: Grazyna Paczkowska

Management implications and conclusions:

- While restoration works need protection from silver gulls for the initial 12 months, eighteen months after removal of weld mesh cages restored vegetation (all treatments) retained 75–100% cover and was not being impacted by silver gulls.
- *Enchylaena tomentosa* is a species that can be restored to the shrublands rapidly and effectively though direct seeding using fresh seed collected from intact shublands on Penguin Island.
- Early results from our natural regeneration trials indicate seedling establishment is much more likely to occur in sites protected from silver gulls. Although seedlings germinated in winter in unprotected sites, none survived though to November.
- Early results indicate bridled terns will use restored vegetation as nesting sites.

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References and further reading

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Figure 10) Transporting weeds off Penguin Island. Weedee is a Noongar word for little penguin.