Seagrass Restoration Nursery Trial

Project overview

Seagrasses are important, habitat-forming marine plants, providing a wide range of ecosystem services to coastal communities, as well as adjacent habitats such as mangroves and saltmarshes (e.g. Hemminga & Duarte 2000, Duarte et al. 2013). Despite their clear importance, seagrasses are being lost at an accelerated rate of decline (Waycott et al. 2009), with a reported loss of 5.5% of seagrass cover in Australia since the 1930s (Statton et al. 2018). Efforts to reverse some of these losses have been made through seagrass restoration, however, the source for material for restoration programmes has been a topic of debate as the collection of fragments or seeds can potentially negatively impact the donor site (Verduin et al. 2012). One alternative to harvesting of wild material is the development of a nursery where restoration material can be propagated. To date, there have been few published studies on seagrass nurseries, with none currently on *Zostera mulleri*. However, seedling culture has been shown to be feasible in the closely related species *Z. marina* (Tanner & Parham 2010), and also in other seagrass species such as *Posidonia australis* (Statton et al. 2013).

The feasibility of a *Z. muelleri* nursery in association with a seagrass restoration programme in Western Port Bay will be investigated by Deakin University researchers, in association with Melbourne Water. The Seagrass Restoration Nursery Trial will investigate the viability of propagating *Z. muelleri* from seed under varying conditions for out-planting in the bay. Vegetative fragments of *Z. muelleri* will also be collected from Western Port Bay and propagated in a nursery prior to transplantation to investigate transplantation success compared to direct transplantation from the field.

The details of the project and infrastructure requirements are outlined below. The study is planned to commence in the second half of 2019 and if the findings are successful, the program has the potential to be ongoing into the future.

Seed-based trials

The study will investigate the success of seed propagation and seedling growth in a nursery. The seeds will undergo two levels of treatment, sediment type (artificial or natural) and container type (biodegradable pot, biodegradable tray or hessian bag) totalling 6 different treatment combinations (bag-natural, bag-artificial, pot-natural etc.). The use of biodegradable pots is to allow for the whole unit to be out-planted, reducing transplantation shock and maximising survival, and also ensuring synthetic waste is not introduced into the natural environment. Natural sediment will be collected from Western Port, while artificial sediment will consist of either playground sand (bought from Bunnnings or Mitre 10) or horticulture growth mediums (e.g. peat or coir substrate mixes).

Each treatment combination will have 3 replicates. 4000 seeds have been allocated (collected Feb 2019) to the nursery trials, with 180 *Z. muelleri* seeds per replicate (totalling 3240 seeds), and the remaining 760 to be used in mesocosm trials in Queenscliff, prior to commencing larger scale trials. An example of each experimental unit is shown in Figure 1, and these will be placed in a larger basin inundated with seawater mimicking natural settings (**Error! Reference source not found.**).

Figure 1 Representation of the different treatments, each containing 180 seed dispersed over equivalent surface area of pots (12), trays (2) and bags (12).

Seedling emergence will be recorded (number of seedlings counted weekly/fortnightly), and survival of seedlings tracked over time. Seedlings will then be planted in the spring (approximately 3 months after development) and autumn (approximately 9 months), during the main growing and recruitment season for this species. In the field, plant survival and growth (shoot height, rhizome length, number of shoots) will be tracked for at least a year.

Shoot-based trials

Vegetative fragments of seagrass (including shoot, stem and leaf) will be collected from two locations, Newhaven beach (eastern Western Port) and Jack's Beach (western Western Port). These will be planted in the nursery in trays of either artificial sediment or natural sediment. Salt water will inundate the seagrass to mimic their natural environment. Various measurements will be taken over time to determine growth success in nursery settings under the two treatments (location and sediment type). Environmental conditions (water temperature, ambient temperature, phytophthora presence) will also be monitored to account for any extraneous effects on the seagrass shoot growth. Nursery propagated seagrass will be transplanted into restoration trial sites within Western Port Bay and monitored for survival and growth, compared with direct transplantation (no nursery maturation).

Figure 2 Representation of collected Z. muelleri shoots (from two local) planted into various sediments (artificial or natural)

Infrastructure Required

Illustrated in Figure 3 is the ideal layout for the nursery trials. The nursery facility currently has a single tank system flowing through multiple basins, and we suggest the addition of another tank to isolate the two basins, improving flexibility for experimentation and reducing the risk of external contaminants from collected shoots into the seed-based trials.

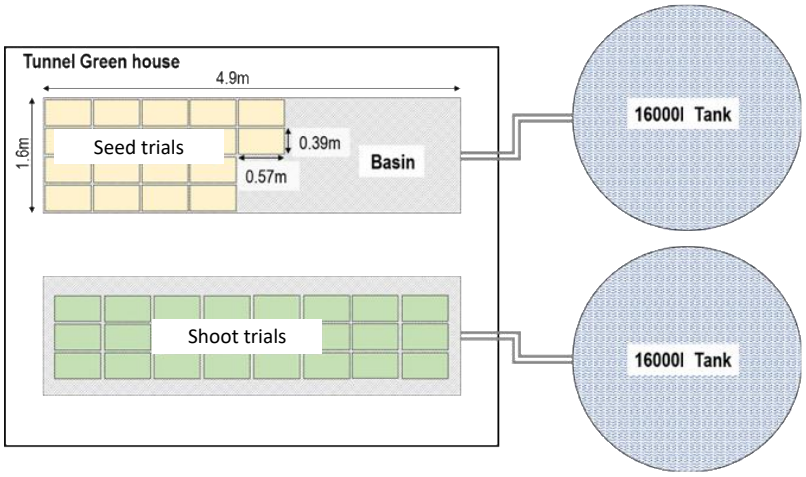

Figure 3 Representation of Ideal greenhouse layout with two independent header tanks feeding salt water through independent basins containing seed-based trials in one, shoot-based trials in the other.