WWSP PROJECT 2.3: SEAGRASS RESTORATION

2024

Posidonia sinuosa meadow | Image: Rachel Austin

PROJECT OVERVIEW AND OBJECTIVES

This project aimed to enhance our ability to restore seagrasses on the Kwinana Shelf and Owen Anchorage to address historical and contemporary losses due to dredging and port infrastructure and improve ecosystem resilience in the region.

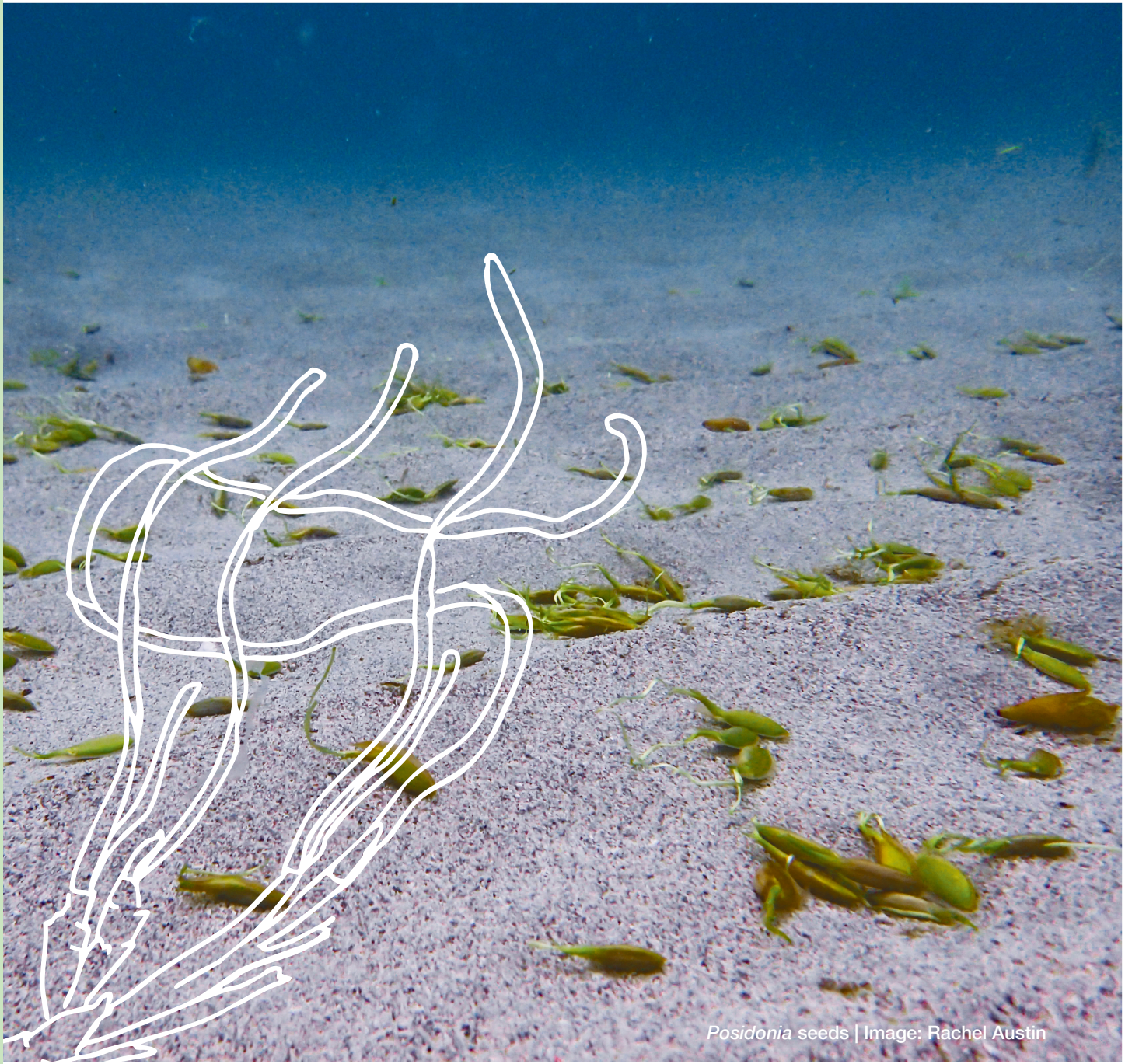
Specifically, this project aimed to:

1. Test effectiveness of seed-based and shoot-based methods for large-scale seagrass restoration.

2. Understand plant-scale environmental conditions to identify optimal locations, species, scales, and methods for restoration.

3. Evaluate the potential of sediment and dredging byproducts to enhance seagrass restoration.

4. Grow local community programs aimed at restoring seagrasses through existing (OzFish Seeds for Snapper) and other planned restoration activities across Cockburn Sound and Owen Anchorage.



Posidonia seeds | Image: Rachel Austin

SEAGRASS LOSS AND RESTORATION IN COCKBURN SOUND

Rapid industrial development and uncontrolled effluent release between the 1950s and late 1970s led to 80% loss of seagrasses (about 3,000 ha) in Cockburn Sound. This loss triggered changes in fisheries, declining water quality, and a shift to a pelagic-dominated ecosystem. After nutrient loads were reduced and water quality improved, large investments in seagrass restoration occurred, testing multiple methods with varying success and scale (Fig 1).

A key rationale for the **WWSP Project 2.3: seagrass restoration** is to transition seagrass restoration from an experimental phase to active management, while addressing challenges related to scale, environmental limitations, and community perceptions. This project will also inform the Environmental Impact Assessment process, the port construction and dredging and the post dredging rehabilitation and environmental monitoring required to reclaim the seabed utilising seagrass restoration.

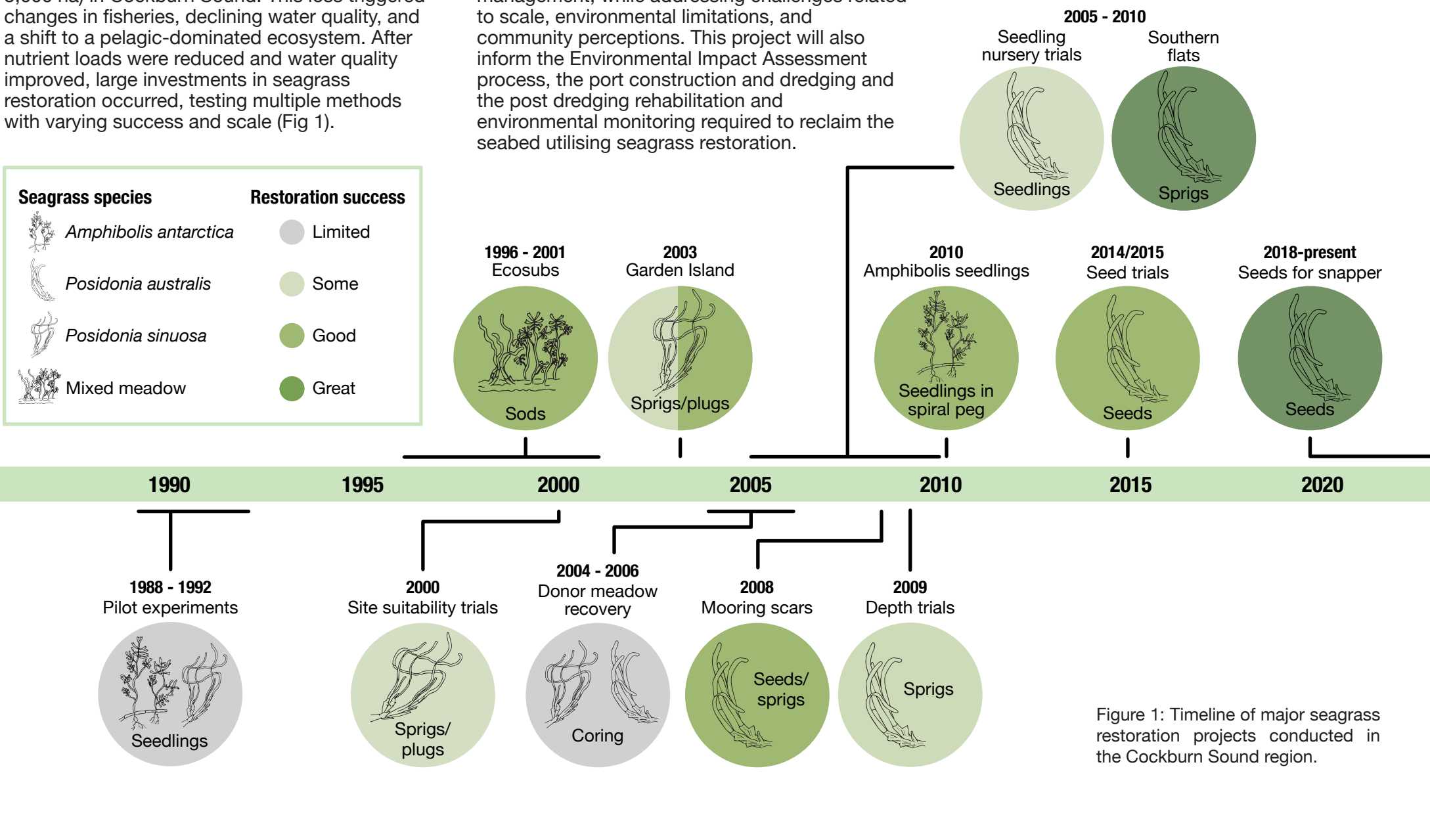


Figure 1: Timeline of major seagrass restoration projects conducted in the Cockburn Sound region.

MAIN FINDINGS

Extensive literature reviews, field studies and modelling scenarios were completed to assess the effectiveness of various seagrass restoration methodologies across Cockburn Sound and Owen Anchorage. The main findings are as follows:

Key factors influencing restoration success:

- **Environment:**
  Environmental conditions are promising for successful restoration in most of the Cockburn Sound study region (up to 8 m depth). However, the transplant unit (sprigs, seedlings or seeds) must be selected with consideration of local biological and physical environmental drivers.

- **Timing:**
  Timing of restoration activities should be considered in context of seasonal changes with early spring (September) recommended for sprigs and late spring (November) recommended for seeds. Bottlenecks in the seagrass life history also need to be considered, where predicted effects on survival of transplant units should determine the milestones and targets for restoration.

Community led seed-based restoration:

- Community-based citizen science using seed-based restoration programs are the most cost-effective approaches to increasing scale of restoration.

- The significant increase in seedling density between natural seed recruitment and seeded areas suggests the region is supply-side limited, with increased seed settlement boosting seedling colonization and recruitment for up to 3 years.

Sprig-based restoration:

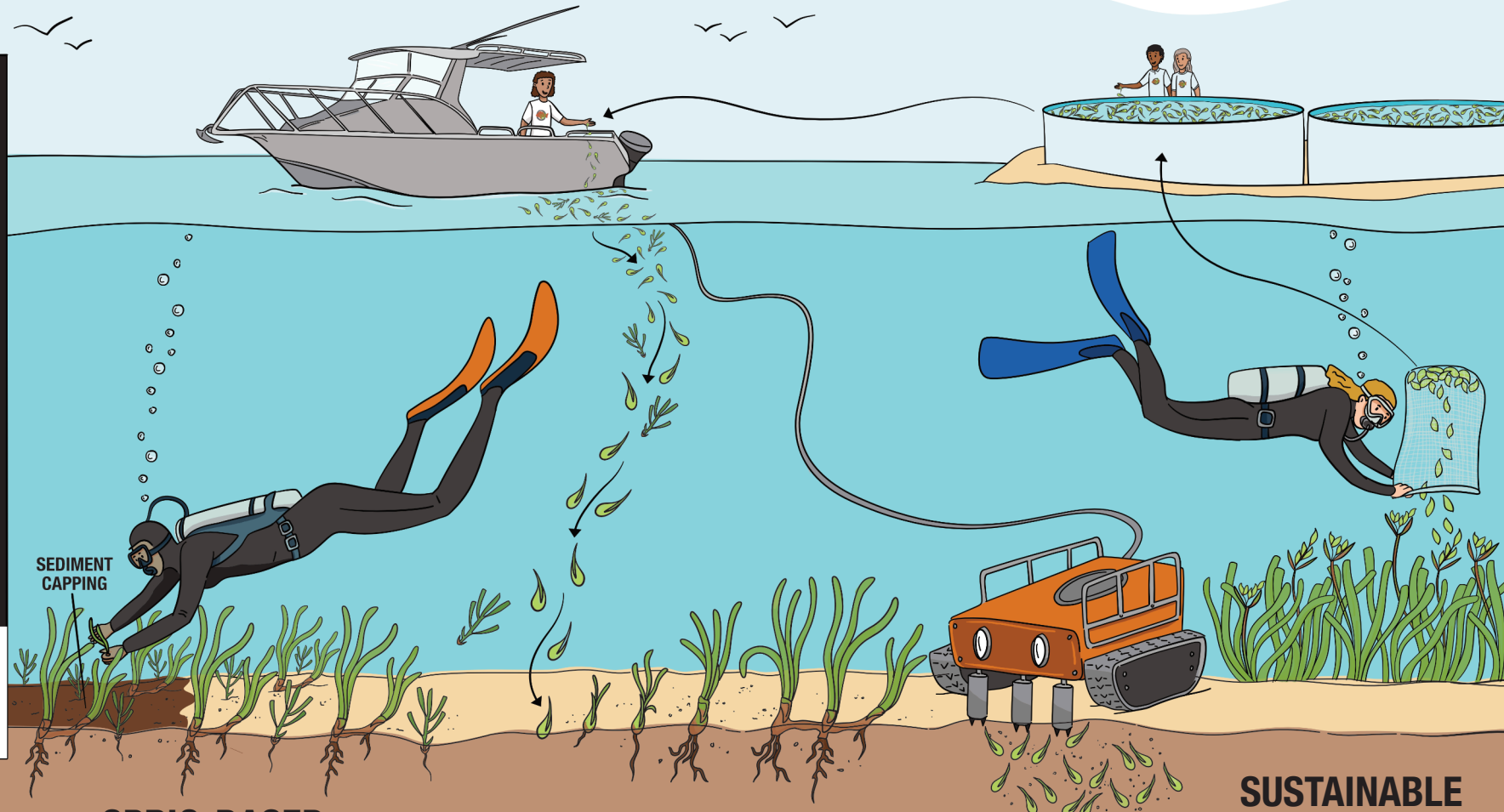
- Sprig-based restoration programs are also successful at scale, cost effective and can be used to target areas of high intrinsic value, areas where more environmental modification is required (e.g. sediment capping using dredge spoil) or to increase the retention of seedlings (both *Posidonia* spp. and *Amphibolis* spp.) from seed-based restoration and from natural recruitment.

Environmental modification:

- Hessian bags and tubes can be used to break up flow velocities through wake interference, potentially promoting seed and seedling settlement.

- Seed injection of *Posidonia* seeds is a promising technique to increase seedling survival. However, further research and development is needed to a) confirm that field injection does not reduce seed survival and seedling growth *in situ*, and b) the injection mechanism needs further development using robotics allowing for scaling without significant labour and associated costs.

- Capping sediment using dredge spoil in a subtidal environment (8 m) is feasible, but there is evidence that using dredged materials will have adverse effects on seagrass health within 12 months. The quality and suitability of the dredged materials need to be thoroughly assessed prior to being repurposed for seagrass restoration.



HABITAT SUITABILITY

Modelling and field studies suggest environment in most of the study area suitable for seagrass restoration down to 8m.

SPRIG-BASED RESTORATION

Scalable, cost-effective, and can target high-value areas and areas where environmental modifications are needed (like sediment capping). Can enhance seedling retention and survival when combined with seed-based restoration but ‘capped’ sediment suitability and scale needs to be assessed prior to application.

COMMUNITY LED SEED-BASED RESTORATION

Most cost-effective approach to increasing scale of restoration. Ongoing investment is essential for continuation and future expansion.

SEED INJECTION

Seed injection shows promise for further improving seedling survival and scalability of restoration projects, but more research is needed.

SUSTAINABLE HARVEST

Further monitoring and research are needed to identify drivers of flower and fruit production for sustainable seed collection.

Posidonia flowers with fruits | Image: Rachel Austin

THE WAY FORWARD

- Given the success of community-based seagrass restoration in Cockburn Sound, it is imperative that these programs continue to receive investment so their activities can be continued and expanded into the future, including the development of year-round onshore facilities for seed-storage and handling.
- Further monitoring and research are needed to determine the dominant drivers of site and seasonal variability in inflorescence, flower and fruit production to ensure targeted and sustainable seed-collection for seed-based restoration.
- Combining sprig and seed-based restoration showed promise and further mechanisation of sprig planting requires investigation to scale up present methodologies to match historical and contemporary losses.