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Marine Plant assessment of the Townsville Breakwater *Duck Pond*

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Background & Scope

TropWATER, James Cook University (JCU) was commissioned to conduct a marine plant survey of the Townsville Breakwater *Duck Pond* to help inform a development application process in the area (Figure 1). The proposed development will require a permit for prescribed tidal works under the *Planning Act 2016*. The proposal requires an assessment against State Code 11 – Removal, destruction, or damage of marine plants.

The survey specifically set out to examine the presence and/or absence, type and extent of marine plants within the proposed development area. Objectives of this scope of works were to:

- Determine the presence/absence, type, distribution and density of marine plants that may occur within the area of interest.
- Provide a report and GIS layers that describe the result of the survey.

Figure 1. Proposed area of interest and marine plant assessment sites May 2022.

Sampling Approach & Methods

The sampling methods followed those used in the established annual seagrass monitoring program and previous whole of port surveys in the Port of Townsville area (Mckenna et al. 2022 for the latest monitoring reaport). These standard methods are based on the JCU TropWATER seagrass program for baseline assessment and monitoring in the Townsville area and for other areas of Queensland including the ports of Cairns, Mackay/Hay Point, Weipa, Gladstone, Abbot Point, Karumba and Thursday Island.

The survey was conducted in May when marine plants, such as seagrass are typically at their lowest density and distribution.

The following techniques were used to survey marine plants in the area of interest:

- Digital camera mounted to a drop frame that provided a live feed to a monitor on the surface. The transmitted image incorporated a 0.25m^2 view of a quadrat on the seafloor from which a researcher could estimate habitat cover, density and species/functional groups present (Figure 2). At each site, key seagrass, macroalgae and sediment information from three random placements of the quadrat were collected.

Figure 2. Benthic habitat assessments using live feed digital cameras and spatial referencing equipment.

Data recorded at each site included:

- **Seagrass -** presence/absence, species, density (biomass), per cent cover and species composition. For the seagrass communities present three density categories were used:

Density	Mean above ground-biomass (grams dry weight per metre square (g DW m^{-2}))				
	H. uninervis **(narrow)**	***H. ovalis*** ***H. decipiens***	***H. uninervis*** **(wide)** ***C. serrulata*** ***C. rotundata*** ***S. isoetifolium***	***T. hemprichii*** ***H. spinulosa***	***Z. muelleri***
Light	< 1	< 1	< 5	< 15	< 20
Moderate	1.1 – 3.9	1.1 – 4.9	5.1 – 24.9	15 - 35	20.1 – 59.9
Dense	> 4	> 5	> 25	> 35	> 60

- **Algae** - Presence/absence, algae type and per cent cover. For each site an algal community density category were determined.

  Algae were identified into the following five functional groups:

Erect macrophytes -	Macrophytic algae with an erect growth form and high level of cellular differentiation e.g. *Sargassum*, *Caulerpa* and *Galaxaura* species.
Erect calcareous -	Algae with erect growth form and high level of cellular differentiation containing calcified segments e.g. *Halimeda* species.
Filamentous -	Thin thread-like algae with little cellular differentiation.
Encrusting -	Algae growing in sheet like form attached to substrate or benthos e.g. coralline algae.
Turf Mat -	Algae that forms a dense mat or "turf" on the substrate.

  Six community density categories will be used:

Very low -	algae covered less than 1% of the substrate;
Low -	algae covered between 1% and 5% of the substrate;
Low/moderate -	algae covered between 5% and 20% of the substrate;
Moderate -	algae covered 20-80% of the substrate;
High -	algae covered more than 80% of the substrate.

All survey data were entered into a Geographic Information System (GIS) using ArcGIS 10.8®. GIS layers were created to describe the survey and each of the habitat components (seagrass, macroalgae) within the survey area. For each habitat component the following GIS layer was created:

- **Seagrass:**
  - Presence/absence of seagrass at survey sites;
  - Area data for seagrass meadows and information on community characteristics and biomass.
- **Macro-algae:**
  - Presence/absence of algae at survey sites;
  - Area data for algae and information on community characteristics and density.

Results & Discussion

Marine plant surveys in the area of interest were conducted on the 7th May 2022. Favourable weather and sea state conditions provided good in-water visibility for the assessment of benthic habitats using a live-feed camera. Thirty seven (37) sites were assessed in the larger area of the *Duck Pond* with eight (8) sites assessed immediately within the area of interest (Figure 3).

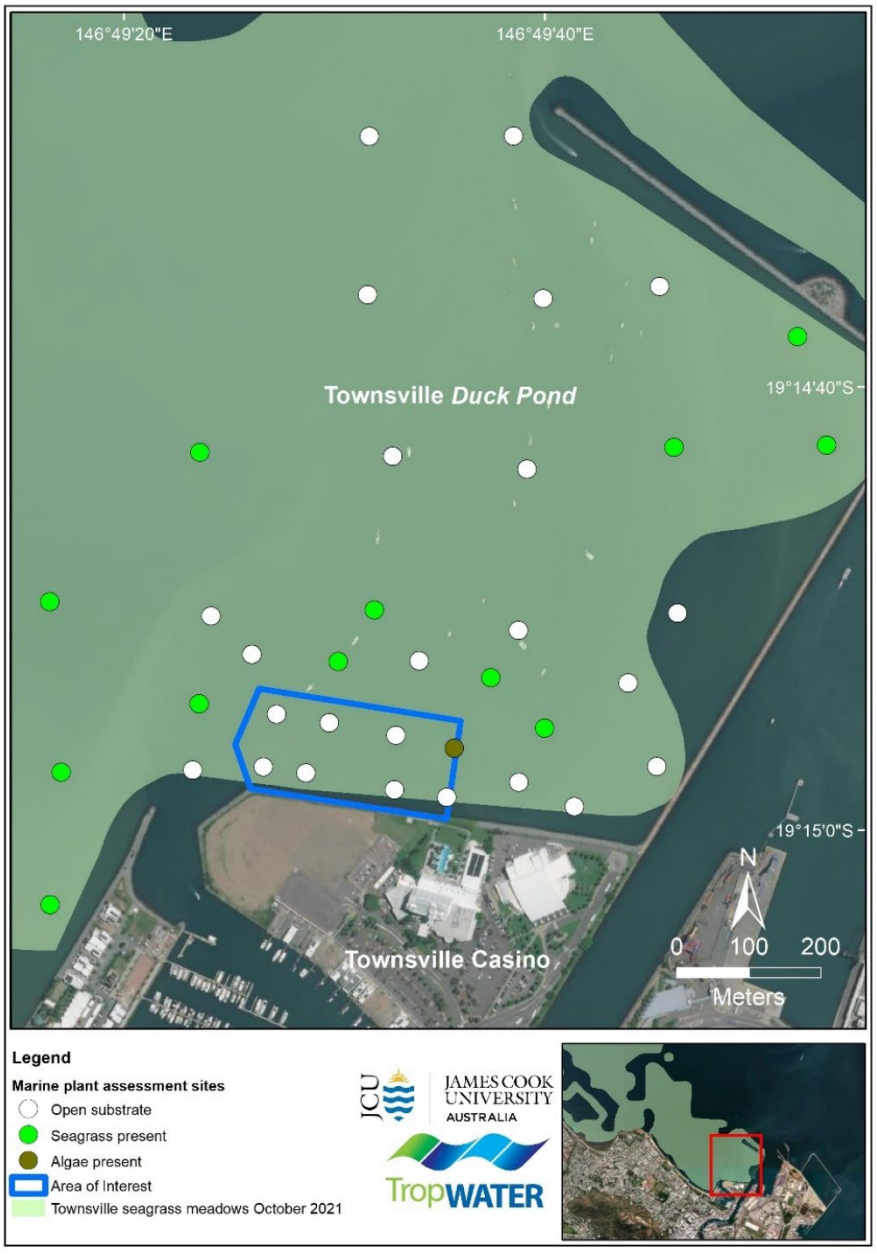

Figure 3. Assessment sites showing where marine plants (seagrass and algae) were present and absent.

Seagrass was not observed within the area of interest, however, seagrass was present in the surrounding area (Figure 3). Macroalgae was observed on the eastern border of the area of interest.

Overall, three species of seagrass were recorded in the survey area; *Halophila ovalis, Halophila decipiens* and *Halophila spinulosa*. Seagrass habitat was estimated to cover an area of approximately 60 ha in the survey area and was a light density cover. A further ~0.3 ha of the survey area was estimated to be covered with very low density of *Erect macrophyte* algae.

Figure 4. Location of marine plants (seagrass and algae) in the survey area.

Seagrass habitat in the Townsville region, including the *Duck Pond* has been monitored regularly since 2007 as part of a series of annual (bi-annual since 2019) monitoring programs undertaken by TropWATER on behalf of the Port of Townsville (PoTL) (McKenna et al. 2022). Seagrass in and around the *Duck Pond* have always been dominated by *Halophila* species. These species are colonisers characterised by high turnover of leaves and shoots, low resistance to disturbance and short lifecycles (Kilminster et al. 2015).

Tropical seagrasses generally follow a seasonal pattern where above-ground biomass and meadow extent (area) diminish in the wet/post-wet season ("low" season), reaching a peak in distribution and density in the late spring (i.e. growing season) (Chartrand et al. 2018; Erftemeijer and Herman 1994; McKenzie 1994; Rasheed 2004; Unsworth et al. 2010; York et al. 2015). This seasonal cycle is influenced by a range of stressors such as episodic coastal flooding and cyclones, wind, rainfall and river flow that effect light availability; one of the primary drivers of seagrass condition (Petus et al. 2014; Bainbridge et al. 2012; Chartrand et al. 2012).

The findings of the bi-annual PoTL/TropWATER Seagrass Monitoring Program show the clearest seasonal signal occurs in the meadows that are dominated by *Halophila* species, with area and biomass of these meadows driven by the growth and expansion of colonising *Halophila* species in the peak season (late spring) surveys. The high variability of these meadows means their extent, distribution and density is likely to be at their lowest at the time this survey was conducted (May 2022) and are likely to change over the coming months. The October 2021 bi-annual survey found seagrass in the area of interest (McKenna et al. 2022).

Macroalgae has also been assessed through the PoTL/TropWATER Seagrass Monitoring Program. These surveys have shown that algal distributions are also highly variable in presence and distribution throughout the region. The *Duck Pond* has had both macroalgae and filamentous algae present in all annual/bi-annual surveys. The largely absence of macroalgae in the May 2022 survey indicates that these assemblages are also likely to be highly variable in presence and distribution in the area.

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