Gladstone Healthy Harbour Partnership 2022 Report Card Summary, ISP011: Seagrass

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Gladstone Harbour seagrass meadows were in good overall condition in 2022 for the third consecutive year. This is the first time that seagrass has maintained good condition over three consecutive years since 2009, prior to large flooding events that led to significant seagrass declines in 2010-2011. Gradual improvements in seagrass condition have occurred since 2017 and most meadows recovered by 2020, when biomass and area peaked in many meadows. Seagrass in the Western Basin continued to be in good condition and there were improvements in the large meadows in the Mid Harbour but some declines in Rodds Bay.

Nine of the 14 seagrass monitoring meadows overall grades were good or very good condition in 2022 (Table 1). There was a general improvement in meadow condition with four meadows in the Western Basin and one in the Mid Harbour improving to be in good or very good condition (Figure 1). These improvements were driven by increases in biomass and improved species composition. The South Trees Inlet Zone was in very good condition for the fifth consecutive year and the Black Swan meadow for the first time in more than a decade (Figure 1). Increase in biomass led to the Pelican Banks meadow (Meadow 43) being in satisfactory condition for the first time since 2014 leading to an improvement in the Mid Harbour zone score to good. Declines in meadow health were seen in the Inner Harbour as a result of poor species composition and in Rodds Bay where there were large declines in area and biomass of a single meadow (Meadow 94) (Figure 1).

Table 1. Grades and scores for seagrass sub-indicators (biomass, area and species composition), overall meadow, zone, and Gladstone Harbour scores for the GHHP 2022 reporting year. Scores are on 0 – 1 scale; cells are coloured according to grade, where dark green = very good, light green = good, yellow = satisfactory, orange = poor, red = very poor. Note, 2022 scores may differ slightly to those reported by Smith et al. (2022) due to bootstrapping used to calculate GHHP report card and scores.

Zone	Meadow	Biomass	Area	Species composition	Overall meadow	2021
1. The Narrows	21	0.94	0.98	0.98	0.94	0.94
3. Western Basin	4	1.00	1.00	0.93	0.98	0.82
	5	0.93	1.00	0.86	0.89	
	6	0.89	0.93	0.74	0.81	
	7	0.61	0.77	1.00	0.61	
	8	0.92	0.73	0.77	0.73	
	52–57	0.87	0.99	1.00	0.87	
5. Inner Harbour	58	0.77	0.89	0.00	0.39	0.39
8. Mid Harbour	43	0.54	0.81	0.78	0.54	0.67
	48	0.85	0.80	0.89	0.80	
9. South Trees Inlet	60	1.00	1.00	0.99	1.00	1.00
13. Rodds Bay	94	0.38	0.17	0.00	0.09	0.42
	96	0.65	1.00	1.00	0.65	
	104	0.53	0.57	0.88	0.53	
Harbour score						0.71

*Meadow 52-57 consists of a number of small meadows surrounding the Passage Islands in the Western Basin Zone (see Figure 1). These meadows are grouped for reporting purposes.

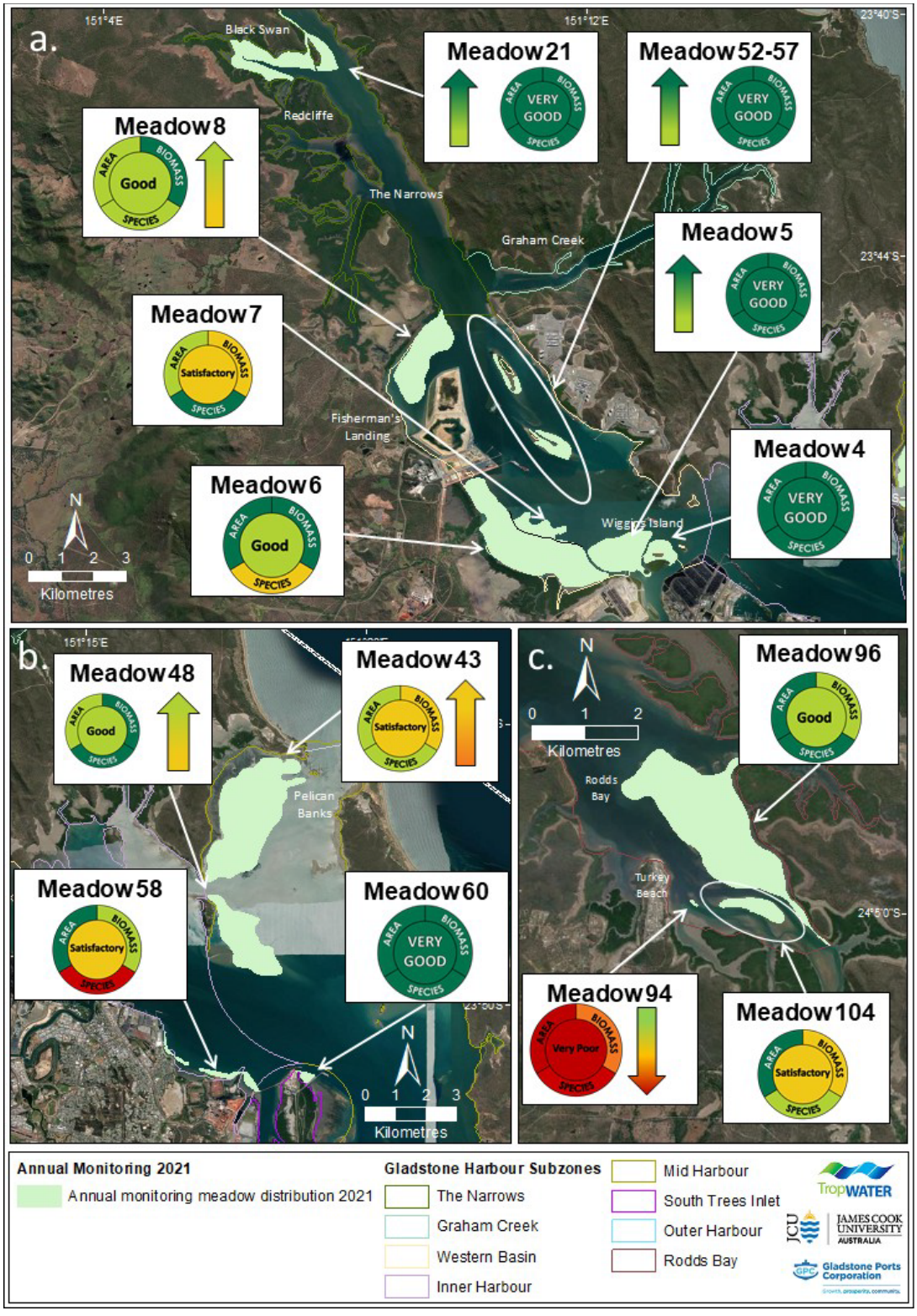

Figure 1. Seagrass distribution and meadow condition in the The Narrows and Western Basin Zones (a), Inner Harbour, Mid Harbour, and South Trees Inlet Zones (b) in Gladstone Harbour, and in Rodds Bay (c) in November 2021 (this report card). Arrows indicate an overall grade change from the previous year.

Improvement in seagrass condition and meadow recovery over the past three years has been facilitated by environmental conditions that promote seagrass growth. Available light plays a major role in seagrass condition and turbidity from flood and dredge plumes can result in large-scale seagrass losses (Erftemeijer 2006, McCormack et al. 2013, York et al. 2015, Chartrand et al. 2016). Analysis of the long-term patterns of seagrass condition from annual monitoring reveal a strong relationship with rainfall and Calliope River flow including major losses in 2010-2011 (McCormack et al. 2013, Office of Public Affairs 2013). Flow from the Calliope River over the past four years has been below average, and outflow was very low again during the 2021 wet season. Rainfall also has been below average since 2017. Increased benthic light as a result of reduced rainfall and river flow over the last four years has created ideal conditions for seagrass growth. Favourable growth conditions have also seen a change in species composition in many meadows, with the most persistent species *Zostera muelleri* returning as the dominant species in some meadows.

The largest seagrass meadow in Port Curtis, Pelican Banks meadow (Meadow 43) in the Mid Harbour has improved to be in satisfactory condition after 6 years in poor condition. Pelican Banks is historically the largest, high biomass seagrass meadow in Port Curtis. The contribution of *Z. muelleri* to the meadow biomass improved to 90% and good condition for species composition after consistent declines over the past 6 years. Increases in *Z. muelleri* across the meadow had a direct impact on meadow biomass which increased to be satisfactory for the first time since 2014. *Zostera muelleri* has much greater biomass than the other species in the meadow (e.g. *H. uninervis*, *H. ovalis*) and therefore biomass should continue to improve as the contribution of *Z. muelleri* improves. Seagrass at Meadow 43 is subject to high levels of herbivory from green turtles and dugongs, with recent studies indicating these animals have a major influence on seagrass condition in the Gladstone region (Scott et al. 2020, 2021). High herbivory rates may be restricting seagrass recovery at Meadow 43, altering the seagrass community and preventing improvements in biomass. Improvements in seagrass biomass and species composition at Pelican Banks may have occurred as megaherbivores move to other locations in search of substitute feeding options reducing the grazing pressures on Pelican Banks or some other environmental factors.

While seagrass biomass and area generally increased in Port Curtis, seagrass in Rodds Bay had a general decline in biomass and area. There were slight decreases in biomass and area in Meadow 96 and 104 but there was a large decrease in all metrics in the smaller Meadow 94 which was in very poor condition. Meadow 94 is a small sand bar meadow where biomass and area have undergone large fluctuations since large scale seagrass loss in 2010. Ongoing monitoring is required to determine if low biomass and area of this meadow is permanent, or it recovers rapidly as in previous years.

Good overall seagrass condition across Gladstone Harbour and Rodds Bay in the 2022 reporting year indicates seagrasses are likely to be resilient to future pressures. Continuing high levels of resilience mean seagrasses should be well placed to cope with large rainfall events recorded in March and May of 2022 that may cause low light conditions detrimental to seagrass health.

References

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ADDITIONAL MATERIAL PROVIDED BY GLADSTONE HEALTHY HARBOUR PARTNERSHIP

2022 scores may differ slightly to those reported by Smith et al. (2022) due to a bootstrapping process that is used to calculate GHHP report card and scores. The bootstrapping method resamples the original data many times to yield multiple means which are used to develop a series of distributions for measures, sub-indicators, indicators and indicator groups, instead of simply calculating average values. By aggregating distributions (rather than individual means), the rich distributional properties could be preserved, sample bias could be avoided, and means (the report card score) and variances could be calculated for reporting.

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