TECHNICAL REPORT

PART 7: Litter Results

Reporting on data collected 2022 - 2023

14 Litter

The litter index is comprised of a single indicator to assess the "pressure" that the amount of litter and/or marine debris (from here referred to as litter) present in a location may be having on that environment. The data used to derive the scores and grades for the litter index is from Tangaroa Blue Foundation's (TBF) Australian Marine Debris Initiative Database (AMDI). The data is collected by volunteers, and partners through the Reef Clean program which is funded through the Australian Government's Reef Trust.

A model has been developed for the combined regions of the Wet Tropics Waterways Partnership, Healthy Waters Partnership for the Dry Tropics, Healthy Rivers to Reef Partnership, and the Gladstone Healthy Harbours Partnership from 'baseline' data from the period ~2009 to June 2019 available from the AMDI following the method developed by Venables and Whitehead (2019). The litter collected at sites each year is compared with this baseline to determine their score and grade.

The model developed by Venables and Whitehead (2019) was based on a smaller dataset of 2016–2019 data that had been pre-cleaned by TBF. As more data has now become available, the model has been re-fitted using a negative binomial distribution (rather than Gaussian) to take the additional data into account. Further, as the model was also fitted to data for the Wet Tropics Waterways Partnership, the Healthy Rivers to Reef Partnership, and the Gladstone Healthy Harbours Partnership, the zones included in the model were redefined based on a combination of the location and the landuse category included within the AMDI data (refer Methods). During the current reporting period, the score function used during the development for the previous year became unstable. A thorough investigation into a more stable score function has been conducted (refer Methods Appendix I). The recalculated results for the model, and the 2019–2020, 2020–2021, 2021-2022 years are provided in the Methods Appendix J and in Section 14.2 below respectively.

14.1 Monitoring Sites

There were 26 litter collection sites for the 2022–2023 period, and these are shown in (Figure 27 and Figure 28) where the colours indicate the grade. There were twelve sites in Cleveland Bay, eight sites in the Halifax Bay, and twelve sites in the Ross Basin. There were no sites defined as the Black Basin. Beach sites are defined by the AMDI landuse category where the volunteers collecting the litter have indicated whether the litter is largely sourced from direct deposit onto the land or washed up from the sea. It was considered that this was the best proxy available to define the boundary between a freshwater basin and the adjacent estuarine or inshore zone.
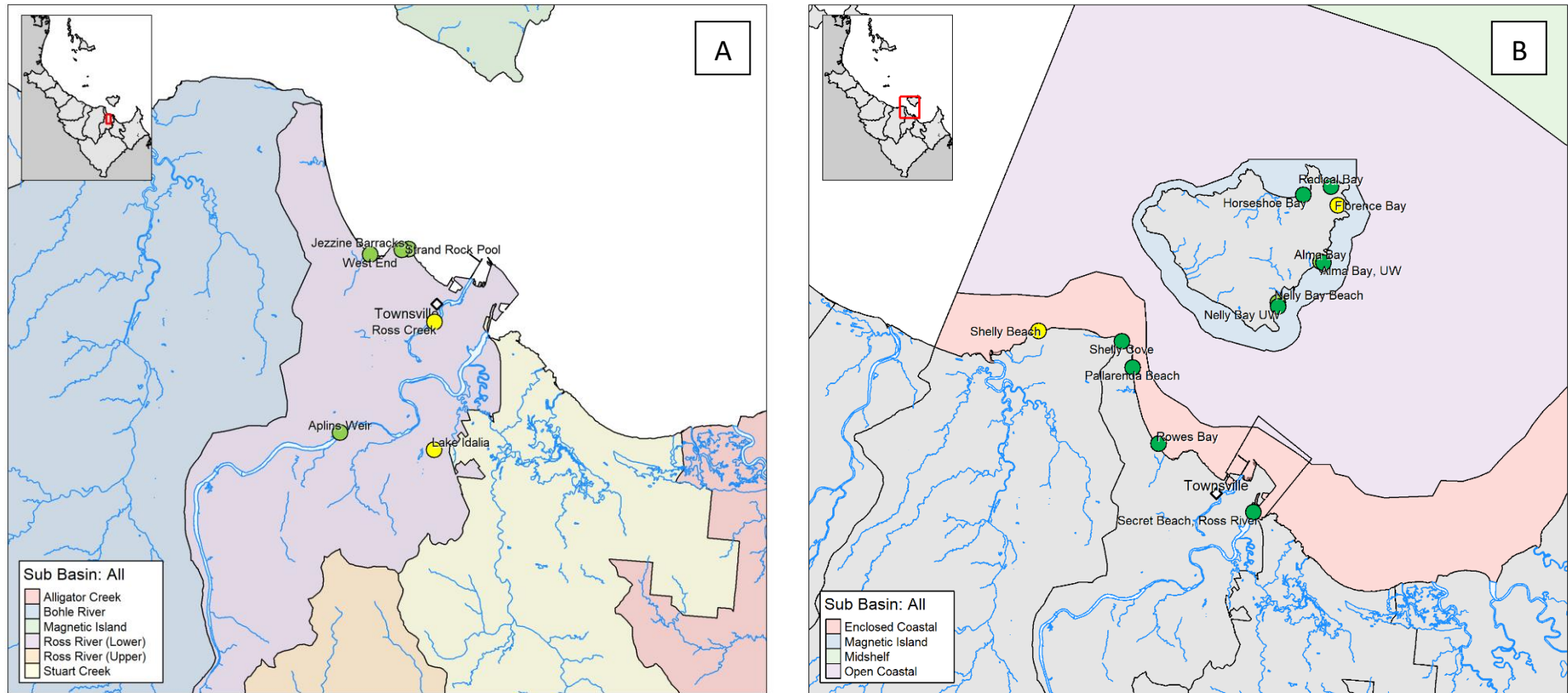
Figure 25. (A) Ross Basin and (B) Cleveland Bay Litter collection locations for the 2022-23 reporting period.
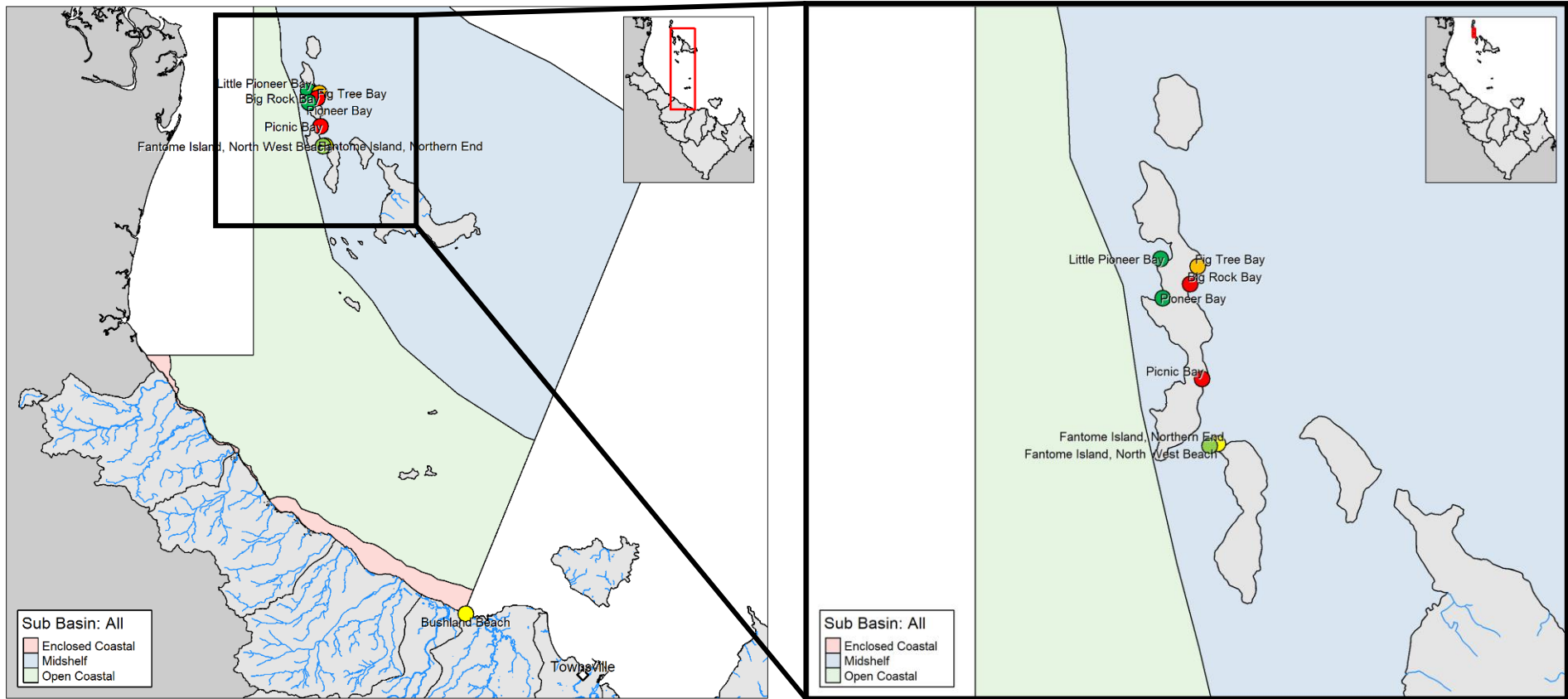
Figure 26. Halifax Bay litter collection locations for the 2022-23 reporting period.

14.2 Comparison with previous years

Table 75 presents a comparison of the 2022–2023 year for the litter index with previous years.

Table 75: Comparison of Litter Index for 2022–2023 with previous years

Zone	Site	Scores and Grades			
		2019-2020	2020-2021	2021-2022	2022-2023
Halifax Bay	North West Beach, Pelorus Island	95 (VLP)	NA	NA	NA
	West Beach, Pelorus Island	80 (VLP)	NA	NA	NA
	North Beach, Orpheus Island	4 (VHP)	NA	NA	NA
	Little Pioneer Bay, Orpheus Island UW	NA	NA	NA	91 (VLP)
	Fig Tree Bay, Orpheus Island	NA	NA	NA	28 (HP)
	Big Rock Bay, Orpheus Island	21 (HP)	7 (VHP)	7 (VHP)	7 (VHP)
	Fig Tree Beach, Orpheus Island	NA	16 (VHP)	19 (VHP)	NA
	Pioneer Bay, Orpheus Island	NA	NA	NA	84 (VLP)
	Picnic Bay, Orpheus Island	0 (VHP)	11 (VHP)	2 (VHP)	5 (VHP)
	Boulder Beach North, Orpheus Island	NA	NA	14 (VHP)	NA
	Yanks Jetty, Orpheus Island	74 (LP)	76 (LP)	NA	NA
	Boulder Beach, Orpheus Island	NA	NA	1 (VHP)	NA
	South Beach, Orpheus Island	42 (MP)	NA	10 (VHP)	NA
	Fantome Island, Northern End	NA	12 (VHP)	36 (HP)	57 (MP)
	North West Beach, Fantome Island	NA	NA	NA	61 (LP)
	Ollera Beach	39 (HP)	NA	NA	NA
	Rollingstone Beach	50 (MP)	NA	NA	NA
	Toomulla Beach	53 (MP)	NA	83 (VLP)	NA
	Saunders Beach	71 (LP)	NA	NA	NA
	Bushland Beach, Townsville	NA	62 (LP)	NA	55 (MP)
Cleveland Bay	Myrmidon Reef	NA	98 (VLP)	NA	NA
	Radical Bay, Magnetic Island	NA	NA	NA	96 (VLP)
	Horseshoe Bay, Magnetic Island	NA	NA	34 (HP)	83 (VLP)
	Florence Bay, Magnetic Island	NA	NA	NA	51 (MP)
	Arthur Bay, Magnetic Island	NA	43 (MP)	NA	NA
	Alma Bay, Magnetic Island	45 (MP)	63 (LP)	71 (LP)	60 (LP)
	Alma Bay, Magnetic Island UW	97 (VLP)	98 (VLP)	NA	100 (VLP)
	Geoffrey Bay, Magnetic Island	NA	80 (VLP)	NA	NA
	Geoffrey Bay Reef, Magnetic Island UW	93 (VLP)	NA	NA	NA
	Nelly Bay Beach, Magnetic Island	53 (MP)	77 (LP)	73 (LP)	77 (LP)
	Nelly Bay, Magnetic Island UW	100 (VLP)	99 (VLP)	99 (VLP)	99 (VLP)
	Shelly Beach, Pallarenda	63 (LP)	29 (HP)	NA	44 (MP)
	Shelly Cove, Cape Pallarenda Conserv. Park	67 (LP)	70 (LP)	91 (VLP)	92 (VLP)
	Pallarenda Beach	NA	NA	72 (LP)	84 (VLP)
	Rowes Bay	75 (LP)	75 (LP)	87 (VLP)	89 (VLP)
	Kissing Point	NA	79 (LP)	NA	NA
	Strand Park	62 (LP)	74 (LP)	NA	NA
	Strand Waterpark Beach	NA	86 (VLP)	NA	NA
	Secret Beach, Ross River	NA	NA	NA	81 (VLP)
Ross	Three Mile Creek, Pallarenda	NA	37 (HP)	NA	NA
	Strand Rock Pool	NA	47 (MP)	NA	74 (LP)
	Jezzine Barracks, TSV Heritage Precinct	NA	NA	NA	63 (LP)
	West End	NA	NA	NA	66 (LP)
	Ross Creek	NA	NA	46 (MP)	59 (MP)

Zone	Site	Scores and Grades			
		2019-2020	2020-2021	2021-2022	2022-2023
	Queensland Country Bank Stadium	NA	23 (HP)	21 (HP)	NA
	South Townsville Recreational Boat Park	NA	33 (HP)	NA	NA
	Anderson Park	NA	NA	91 (VLP)	NA
	Sherriff Park	NA	NA	73 (LP)	NA
	Aplins Weir Rotary Park	41 (MP)	35 (HP)	69 (LP)	74 (LP)
	Lake Idalia Wetland Foreshore	NA	NA	NA	45 (MP)
	Apex Park, Condon	NA	NA	62 (LP)	NA

Standardised scoring range: ■ = Very High Pressure: 0 to <20 | ■ = High Pressure: 20 to <40 |
■ = Moderate Pressure: 40 to <60 | ■ = Low Pressure: 60 to <80 | ■ = Very Low Pressure: 80 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

As there are a small number of sites where litter collections occur each year, it is difficult to obtain a picture of whether improvement is occurring or not. There are a number of factors that are not included in the metric that could have a bearing on the amount of litter collected at sites, particularly land based sites, such as, the frequency of TCC emptying bins, the location of bins (ease of use to main trafficked areas), the number of people using the area on a daily, weekly, or monthly basis, proximity of the collection to a public holiday, or regional event. The variance associated with Zone, Site and Year accounted for a proportion of the total variance, however, the residual variance of the model indicates that there are potentially several variables that have not been identified.

14.3 Key Messages

- The east coast of Orpheus Island continues to have the highest litter pressure in the region.
- The litter pressure at Fantome Island appears to be decreasing which may be associated with regular collection as well as local factors.
- Florence Bay had the highest litter pressure on Magnetic Island and Shelley Beach had the highest litter pressure on the mainland for Cleveland Bay.
- There were no sites with very low pressure within the Ross Basin, with the Lake Idalia Wetland Foreshore having the highest litter pressure.

14.4 Results

Litter pressure results are presented in Table 76. In the Ross Freshwater Basin, there were no sites with very low litter pressure with Ross Creek and the Lake Idalia Wetland Foreshore having moderate pressure, which was the highest measured within the basin.

For the Magnetic Island sites within Cleveland Bay, Florence Bay had the highest pressure (MP) and Radical Bay had the lowest pressure of the land based sites (VLP), with the underwater sites at Alma Bay and Nelly Bay being the lowest pressure of all sites. Horseshoe Bay showed a vast improvement going from high pressure in 2021-2022 to very low pressure in 2022-2023. For the Townsville sites within Cleveland Bay, Shelly Beach had moderate pressure whilst all other sites had very low pressure. Whilst Shelly Cove and Rowes Bay maintained their very low pressure, while Pallarenda Beach improved from low pressure to very low pressure.

Pioneer Bay and Little Pioneer Bay underwater had the lowest pressure of the sites within the Palm Island group of Halifax Bay. The remainder Orpheus Island sites (Table 76) continued to have very high pressure except Fig Tree Beach which had high pressure. Discussion with K-M Coulter-Atkins (TBF, 2022) found that the litter at Orpheus Island is largely sourced from the sea and was found to

be washing onto the beach whilst the litter collection was occurring. The Fantome Island northern end site has shown a year on year improvement from initially very high pressure to most recently moderate pressure. The only main land site in Halifax Bay for the Townsville Dry Tropics region was Bushland Beach, which had moderate pressure.

Table 76: Litter Index Results for 2022–2023

Zone	Site	Score (Grade)
Halifax Bay	Little Pioneer Bay, Orpheus Island UW	91 (VLP)
	Fig Tree Bay, Orpheus Island	28 (HP)
	Big Rock Bay, Orpheus Island	7 (VHP)
	Pioneer Bay, Orpheus Island	84 (VLP)
	Picnic Bay, Orpheus Island	5 (VHP)
	Fantome Island, Northern End	57 (MP)
	North West Beach, Fantome Island	61 (LP)
	Bushland Beach, Townsville	55 (MP)
Cleveland Bay	Radical Bay, Magnetic Island	96 (VLP)
	Horseshoe Bay, Magnetic Island	83 (VLP)
	Florence Bay, Magnetic Island	51 (MP)
	Alma Bay, Magnetic Island	60 (LP)
	Alma Bay, Magnetic Island UW	100 (VLP)
	Nelly Bay Beach, Magnetic Island	77 (LP)
	Nelly Bay, Magnetic Island UW	99 (VLP)
	Shelly Beach, Pallarenda	44 (MP)
	Shelly Cove, Cape Pallarenda Conservation Park	92 (VLP)
	Pallarenda Beach	84 (VLP)
	Rowes Bay	89 (VLP)
	Secret Beach, Ross River	81 (VLP)
Ross	Strand Rock Pool, Townsville	74 (LP)
	Jezzine Barracks, Townsville Heritage Precinct	63 (LP)
	West End, Townsville	66 (LP)
	Ross Creek, Townsville	59 (MP)
	Aplins Weir Rotary Park	74 (LP)
	Lake Idalia Wetland Foreshore	45 (MP)

Standardised scoring range: ■ = Very High Pressure: 0 to <20 | ■ = High Pressure: 20 to <40 |

■ = Moderate Pressure: 40 to <60 | ■ = Low Pressure: 60 to <80 | ■ = Very Low Pressure: 80 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

14.5 Confidence Scores

The overall confidence score for the litter index was low with a score of 2 out of 5, this is an improvement on the previous score of 1 following the further development of the litter index method. The maturity is scored at 2, as a generalised linear negative binomial mixed model for data across a much larger region than solely the Townsville Dry Tropics has been developed. This has improved the robustness of the metric applying a distribution appropriate to the data and using a much larger dataset from which to derive the model. Validation is scored as 1 as modelling is used to derive an estimate of the amount of litter one might expect to collect in a one-hour period at each

location at any time that location might be visited. This expected value considers the variability of the data available. Representativeness is scored at 1 as there is variation in the frequency of the data collection at each site, and variation in the way the data is reported. For example, some sites are cleaned up four times per year, whilst others may be cleaned once every few years. Whilst the model can consider the frequency of the collection by volunteers contributing to the AMDI in an individual year, it does not consider the last time litter was collected at each location (by anyone). It is not possible to do so as this information is not available. Some collectors may include the time they spend sorting the litter, whilst others may not. This brings variation into the data that is difficult to account for within the model. The measured error has been scored at 2 as the model provides estimates based on the variability of the data, however, there is also error associated with the transformation of the data to score and grade.

Table 77: Confidence scores for the Litter Index

Indicator Category	Maturity (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Score (Rank)
Litter	2	1	1	3	2	2 (low)

Rank based on score: 1 (very low) = 4.5 to 6.3; | 2 (low) = >6.3 to 8.1; | 3 (moderate) = >8.1 to 9.9; | 4 (high) = >9.9 to 11.7; | 5 (very high) = >11.7 to 13.5.