

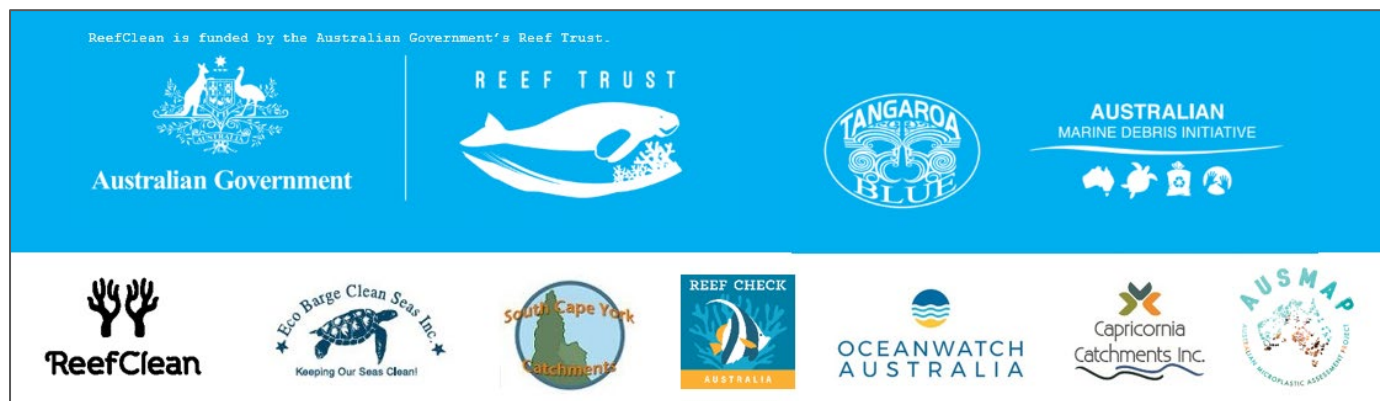


**Australian Microplastic Assessment Project**  
**Review of Microplastics across GBR Catchments - 2020**

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**We acknowledge the Traditional Custodians of the land on which we live, work & learn.**



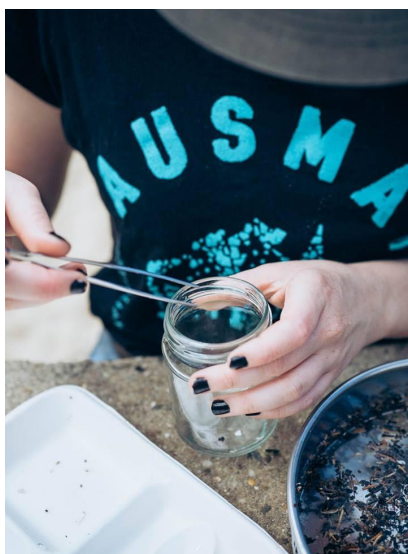
# Microplastic Identification in GBR Catchments

The ReefClean project is designed to implement a cost-effective program of targeted and integrated marine debris activities to:

- 
 reduce the volume of debris generated in or entering the Great Barrier Reef (GBR) that may impact listed threatened and migratory species, such as dugongs and turtles, as well as vital ecosystems of the GBR, and
- 
 increase awareness in Reef catchment communities about the issue of marine debris and actions they can undertake to prevent litter from entering Reef waterways.

Microplastic surveys formed part of community clean-up activities at coastal sites around the GBR, to improve awareness of the impacts of microplastics on the environment and contribute to mapping the extent of microplastic accumulation around waterways and beaches.

The AUSMAP methodology was used to collect rigorous and scientifically reliable data on microplastic particles (1-5 mm). This method, developed by Dr Scott Wilson from Macquarie University in conjunction with partners from University of Newcastle and University of Tasmania, involved replicate sediment sampling along shorelines and sieving for microplastics by the community across the GBR catchments (Refer to Table 1). Samples collected were then verified by university researchers.



*Table 1: Summary of Microplastic Sampling Activities in Year 1 and 2 of ReefClean*

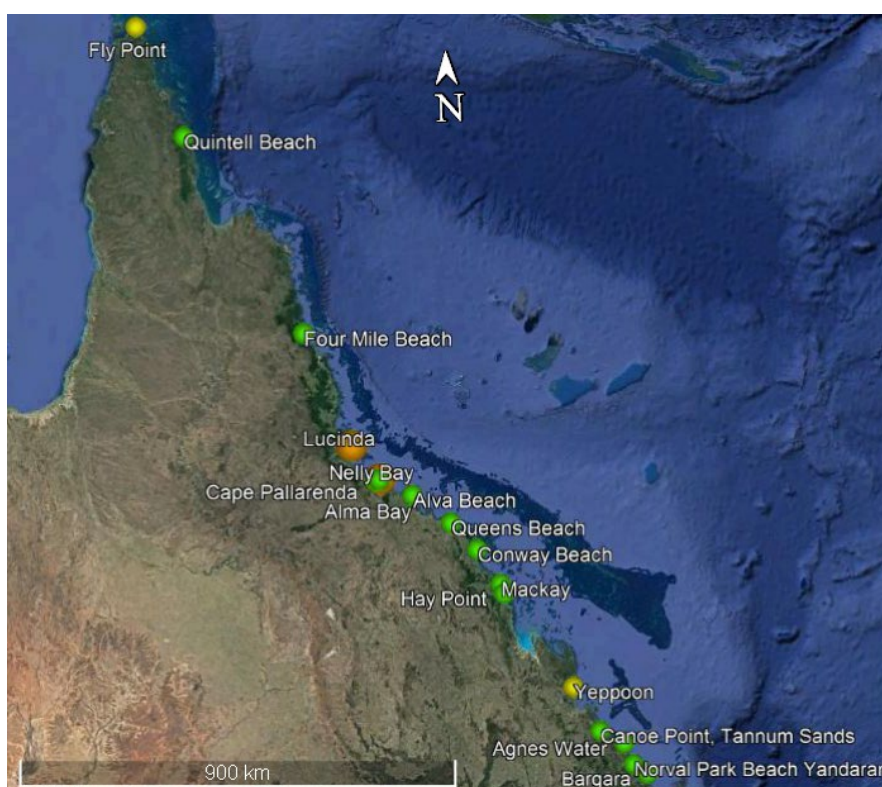


| Region of Sampling | 2019 Site & Microplastic Level<br>(items/m <sup>2</sup> ) |    | 2020 Site & Microplastic Level<br>(items/m <sup>2</sup> ) |                      |
|--------------------|---|----|---|----------------------|
| Cape York          | Thursday Island   | 4  | Fly Point   | 44                   |
|                    | Friday Island   | 5  | Quintell Beach  | 1                    |
|                    | Goods Island  | 21 |   |                      |
|                    | Quintell Beach  | 0  |   |                      |
|                    | Rocky Islet Reef  | 0  |   |                      |
|                    | North Shore Cooktown                                      | 23 |   |                      |
|                    | Walker Bay  | 7  |   |                      |
| Wet Tropics        | Michaelmas Cay  | 0  | Four Mile Beach, Port Douglas                             | 0 (Feb)<br>1 (Sept)  |
|                    | Holloways Beach   | 8  | Hinchinbrook Island                                       | 1                    |
|                    | Cairns Esplanade  | 0  | Lucinda   | 81 (Feb)<br>7 (Sept) |
|                    | Kurrimine Beach   | 0  |   |                      |
| Burdekin           | Orpheus Island  | 20 | Cape Pallarenda   | 0                    |
|                    | Cape Pallarenda, Townsville                               | 11 | Geoffrey Bay, Magnetic Island                             | 0                    |
|                    | Alma Bay, Magnetic Island                                 | 27 | Nelly Bay, Magnetic Island                                | 5                    |
|                    |   |    | Alma Bay, Magnetic Island                                 | 209                  |
|                    |   |    | Alva Beach  | 0                    |
|                    |   |    | Queens Beach, Bowen                                       | 0                    |
|                    |   |    |   |                      |
| Mackay Whitsunday  | Cannonvale  | 7  | Conway Beach  | 3                    |
|                    |   |    | Harbour Beach, Mackay                                     | 8                    |
|                    |   |    | Half Tide Beach, Hay Pt                                   | 1                    |
| Fitzroy            | Tannum Sands  | 16 | Yeppoon   | 23                   |
|                    |   |    | Tannum Sands  | 0                    |
| Burnett Mary       | Agnes Water   | 2  | Agnes Water   | 0                    |
|                    | Miara   | 0  | Yandaran  | 0                    |
|                    | Bargara   | 1  | Bargara   | 0                    |

## 2020 Microplastic Overview

Despite COVID-19 restrictions, 21 microplastic samples were collected from 19 locations across the GBR catchments during 2020 (Figure 1). AUSMAP rates each location based on microplastic loads (particles/m<sup>2</sup>) which is then illustrated on a map with the different coloured points representing the relative loads as follows:

|        |           |             |
|--------|-----------|-------------|
| Green  | Very Low  | < 10        |
| Yellow | Low       | 11 - 50     |
| Orange | Moderate  | 51 - 250    |
| Red    | High      | 251 - 1,000 |
| Black  | Very High | > 1,000     |



**Figure 1: ReefClean sample locations and microplastic loads (Green = Very Low; Yellow = Low, Orange = Moderate)**

The sites sampled in 2020, had **Very Low to Moderate** microplastic levels (ranging from 0 - 209 particles/m<sup>2</sup> Figure 1). This upper value, at Alma Bay on Magnetic Island, now represents a **new greatest amount of microplastics** recorded anywhere in Queensland, although more sampling is required on more remote locations to test this. To give some perspective on this higher load of microplastics recorded, some sites around major cities outside the GBR region are in the thousands, with the highest recorded site to date found around the country located on an estuary in South Australia at > 9,500 microplastics (mps)/m<sup>2</sup>.

Consistent with 2019, the Burdekin region had higher levels on average than those in the other regions, with the Burnett Mary recording the lowest values on average (Figure 2). Individual regional trends and more detailed analysis are discussed in the regional overviews below. Comparative levels of microplastics for the whole GBR in 2020 are on average close to two times higher (19.3 mps/m<sup>2</sup>) compared to 2019 (10.7 mps/m<sup>2</sup>). However, this difference was driven primarily by one site on Magnetic Island that recorded over 200 microplastics per m<sup>2</sup>. If this site is excluded from the analysis, then microplastic loads would be more comparable at 9.3 mps/m<sup>2</sup>.

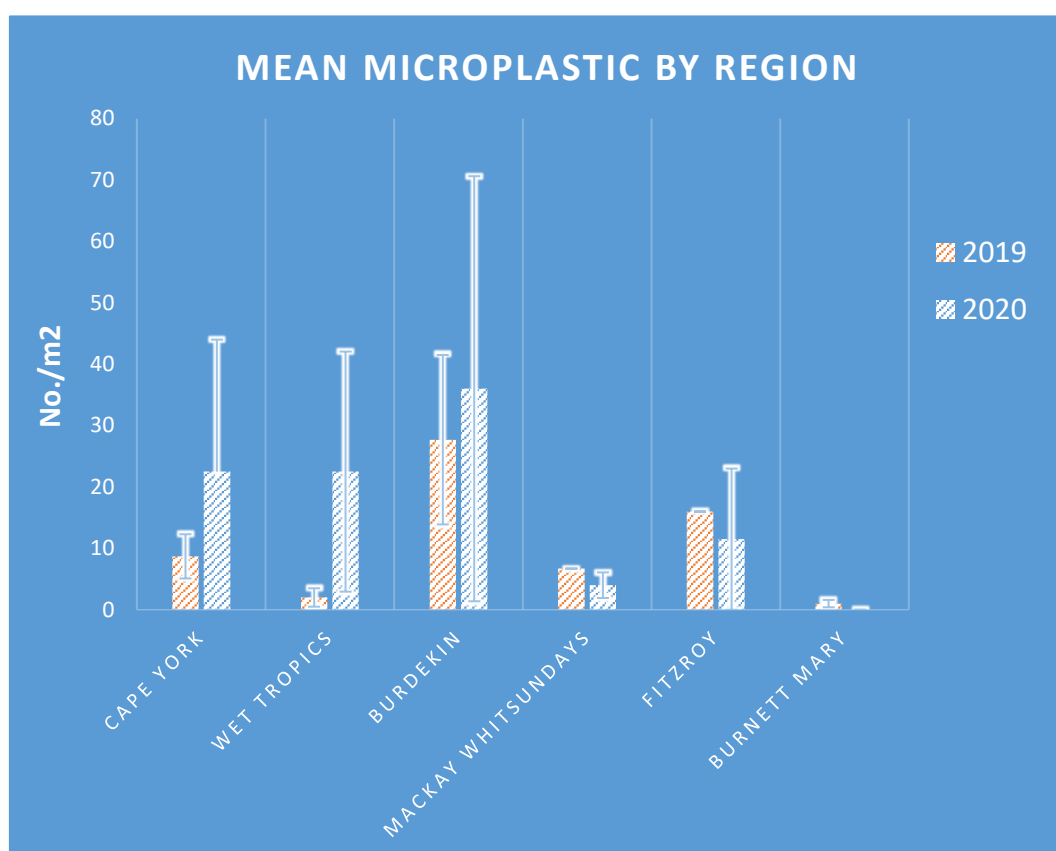
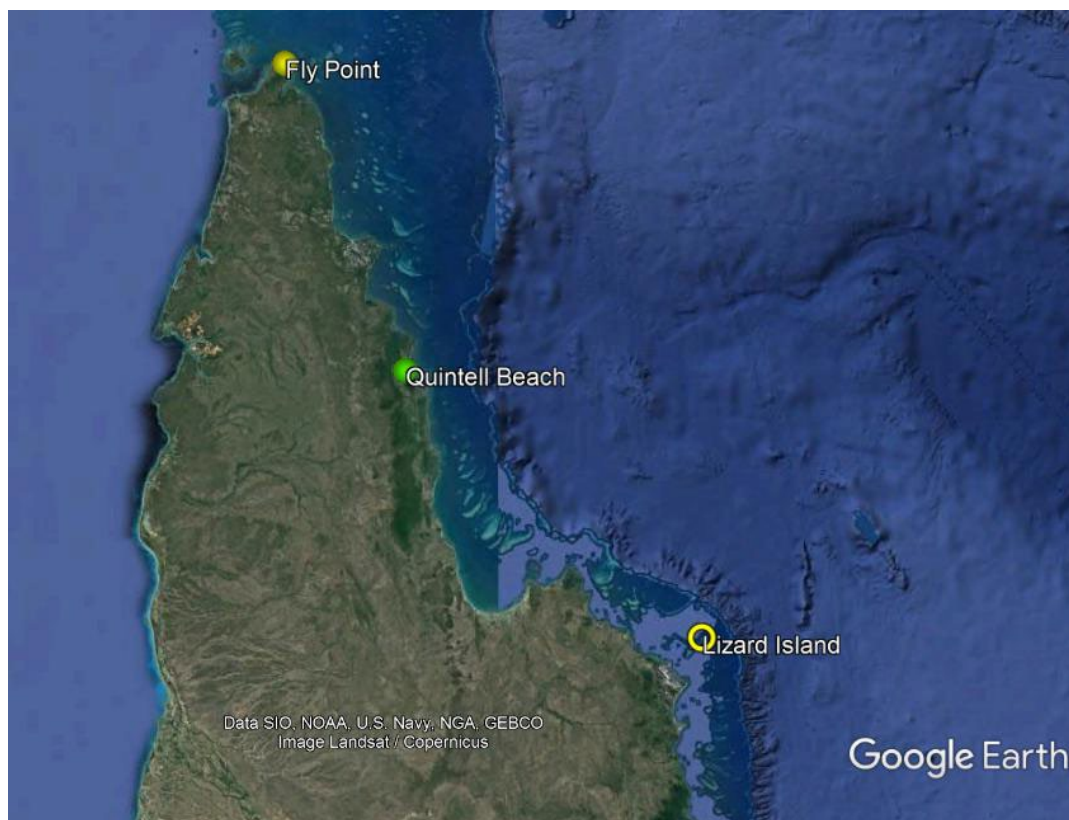


Figure 2: Average microplastic loads per region across GBR. Error bars = Standard Error of Mean.

## Region # 1 – Cape York

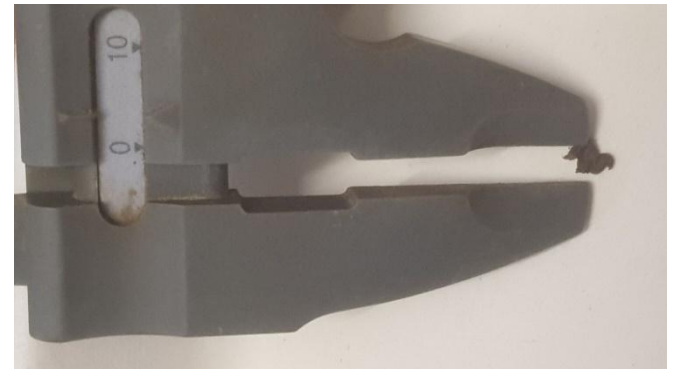
Two sites within this region were sampled during 2020 (Figure 3), with Fly Point on Cape York recording the highest levels of 44 microplastics per m<sup>2</sup>, a new record high for the region. The location of Quintell Beach near Lockhart River recorded a very low value of 1.3 particles per m<sup>2</sup>, compared with zero microplastics reported in 2019. On average, the region in 2020 reported more than double the amount reported in 2019 (Figure 2).



*Figure 3: Cape York and Torres Strait sample locations and microplastic loads (Green = Very Low; Yellow = Low; open circle indicates non-standard sample)*

A non-standard sample (e.g. not a shoreline sample) from Lizard Island was also collected during 2020 to account for any potential sources of microplastics generated from the island's activity. The levels were found to be at 14 microplastics per m<sup>2</sup> which consisted of predominantly hard fragments, of which 14% appeared to shavings from plastic infrastructure (Figure 4). These results, however, should be viewed with caution, as disturbance to the sample area cannot accurately guarantee original sources.





*Figure 4: Example of plastic shaving identified from a recycled plastic walkway at Watsons Bay, Lizard Island, November 2020*

The analysis of the plastics around Cape York during 2020 were similar to those identified in 2019 sampling, with the region was dominated by hard plastic fragments (79%), with fibres and film also found (Figure 5). There was only one piece of plastic found at the Quintell Beach site and this was a white foam ball. Most of the plastics found were white, clear/opaque or blue (Figure 6), consistent with the predominant colour of base plastic products. The microplastics found were a mixture of sizes with the larger size classes (Figure 7) associated with the fibres.



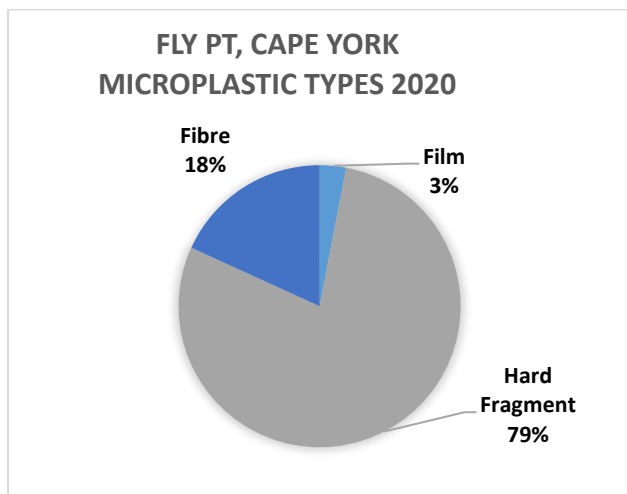


Figure 5: Plastic types recorded at Cape York

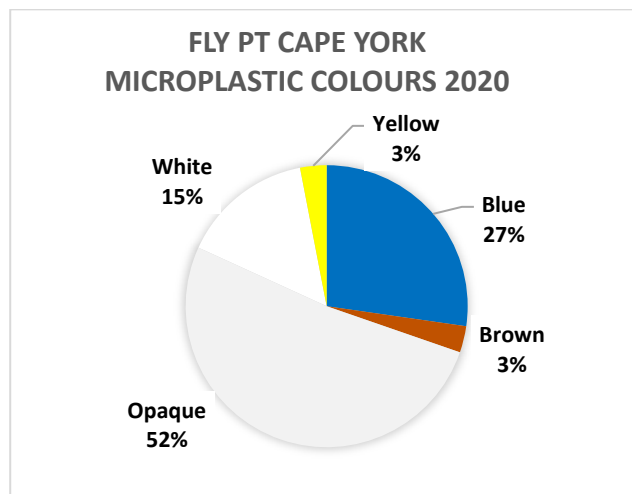


Figure 6: Plastic colours recorded at Cape York

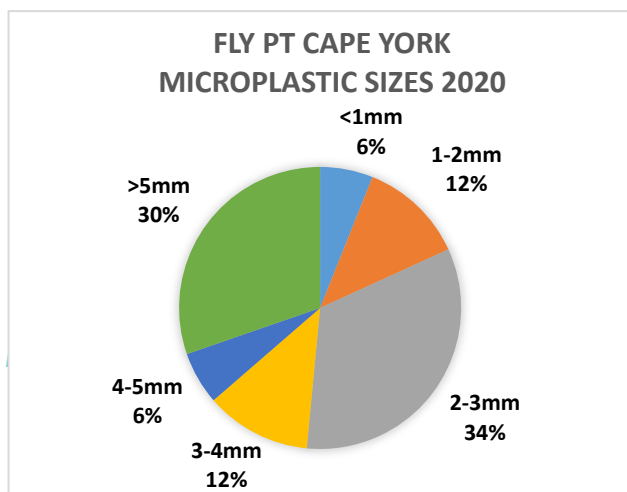
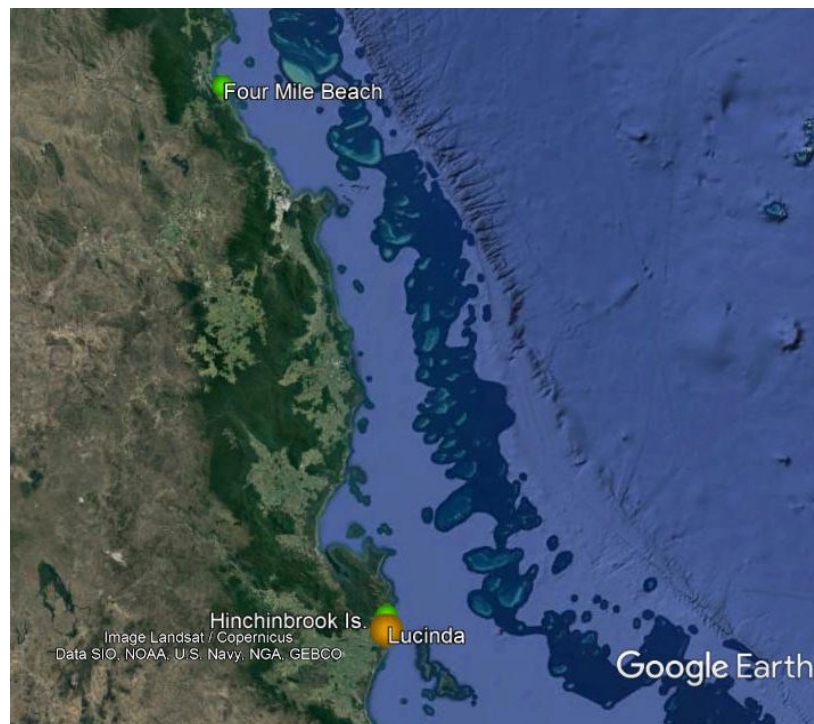


Figure 7: Plastic sizes recorded at Cape York

## Region # 2 – Wet Tropics

Three locations and five samples were collected within the region (Figure 8) in 2020, with all but one recording **very low levels** of microplastics. These were all new locations for 2020.

In February 2020, sampling at Lucinda recorded 81 particles per m<sup>2</sup> this was a new high for the region. A second sample in September 2020 at this same location, however, only found seven microplastics per m<sup>2</sup>. Seasonal differences may be responsible for these differences in numbers. Both samples were dominated by hard fragments, with industrial pellets also being found (Figure 9). There were a mixture of plastic colours and sizes found with blue fragments of 2-3 mm being the most common (Figures 10 and 11).



*Figure 8: Wet Tropics sample locations and microplastic loads  
(Green = Very Low, Yellow = Low)*

For the other sites within the region, **very low levels** of microplastics were found. The Four Mile Beach location near Port Douglas recorded a zero reading in February 2020, and one white foam piece in September. Similarly, only one hard plastic fragment (blue) was found on the mainland side of Hinchinbrook Island.

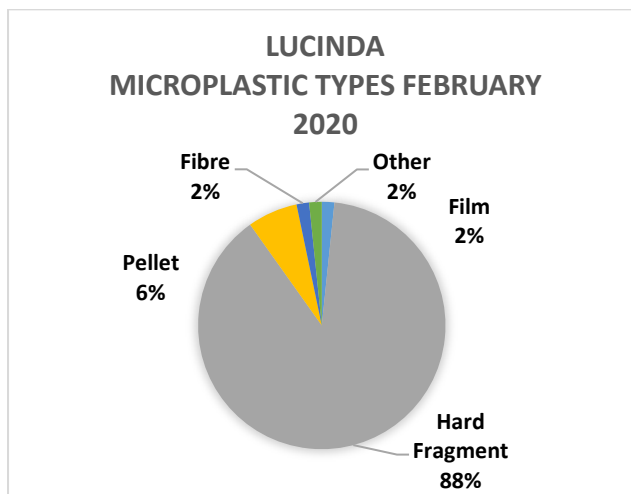


Figure 9: Plastic types recorded at Lucinda, February 2020

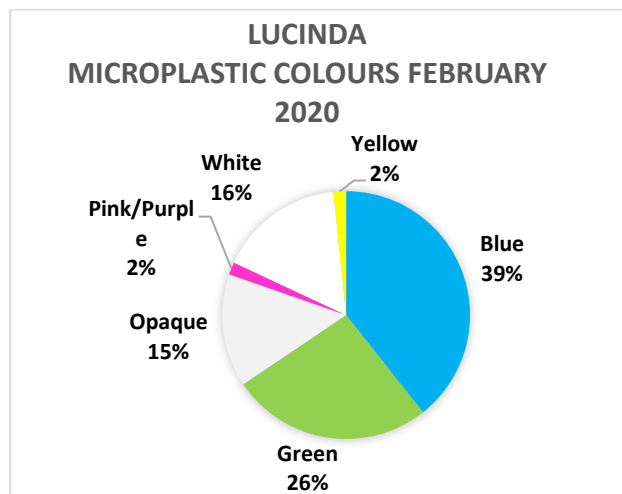


Figure 10: Plastic colours recorded at Lucinda, February 2020

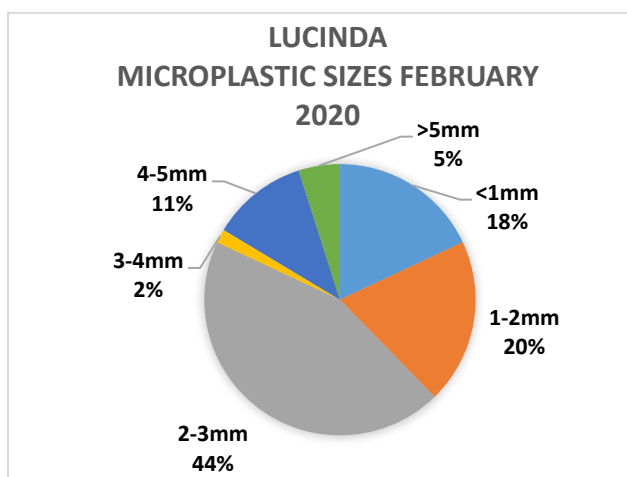


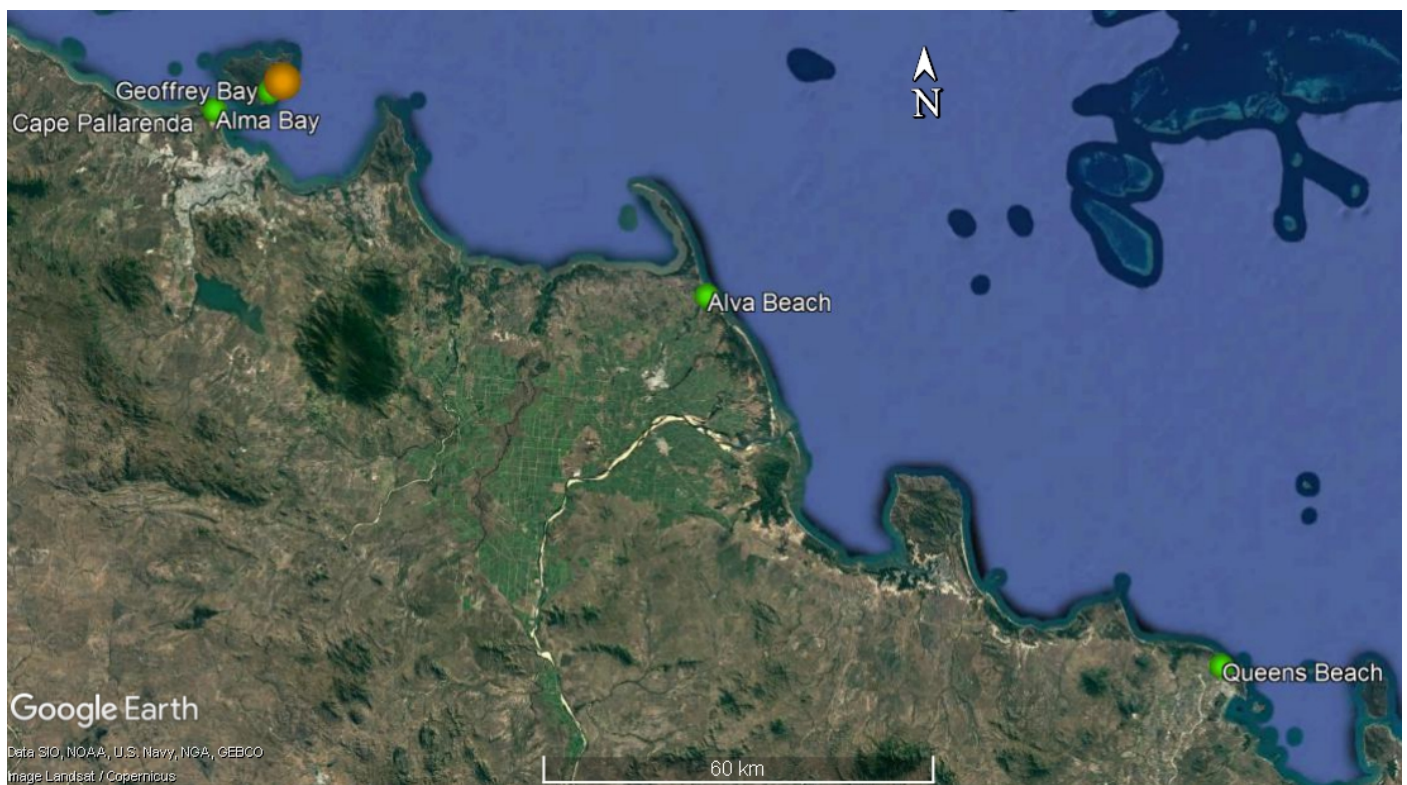
Figure 11: Plastic sizes recorded at Lucinda, February 2020

## Region # 3 – Burdekin

Six sites were sampled across the Burdekin region in 2020 (Figure 12), three on Magnetic Island, plus one each at Cape Pallarenda, Alva Beach and Queens Beach, Bowen. Alma Bay was sampled in 2019 and recorded 27 microplastics per m<sup>2</sup>. When sampled again in 2020, Alma Bay recorded the **highest levels of microplastics** with 209 particles per m<sup>2</sup>, a new high for the region and the whole of the GBR. Conversely, the Cape Pallarenda area had 11 microplastics per m<sup>2</sup> in 2019 but zero in 2020, although the sites were in different locations on the headland.

Plastics in the region were predominantly hard fragments (Figure 13), mostly white or opaque (Figure 14) and in the smaller size classes (Figure 15). While hard plastic fragments also dominated in 2019, there was a greater presence of other plastics, consisting of mostly blue and larger in size.

More sampling over time will help explain whether these characteristics are linked to seasonal trends. Interestingly, the other neighbouring sampled sites on Magnetic Island, Geoffrey Bay and Nelly Bay had very low microplastics levels, zero and five respectively, suggesting aspect, currents and bathymetry are important in determining local deposition factors.



**Figure 12: Burdekin sample locations and microplastic loads (Green = Very Low, Yellow = Low)**



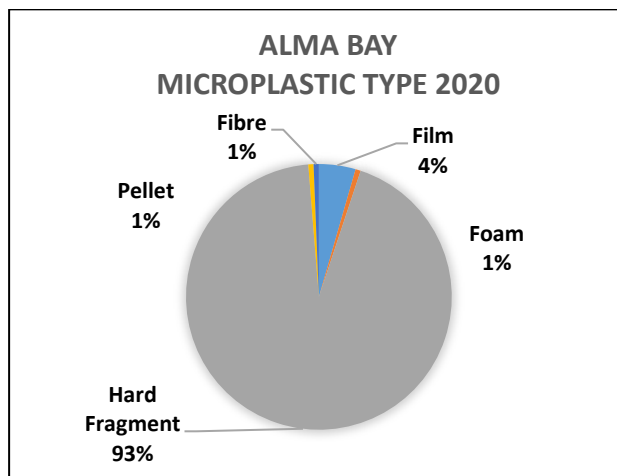
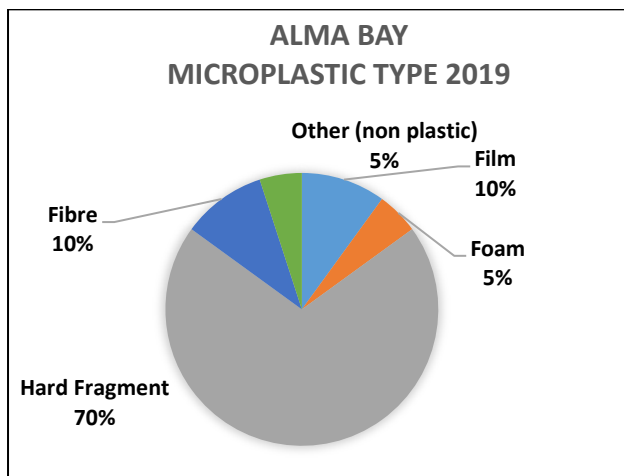


Figure 13: Plastic types recorded on Magnetic Island during 2019 and 2020

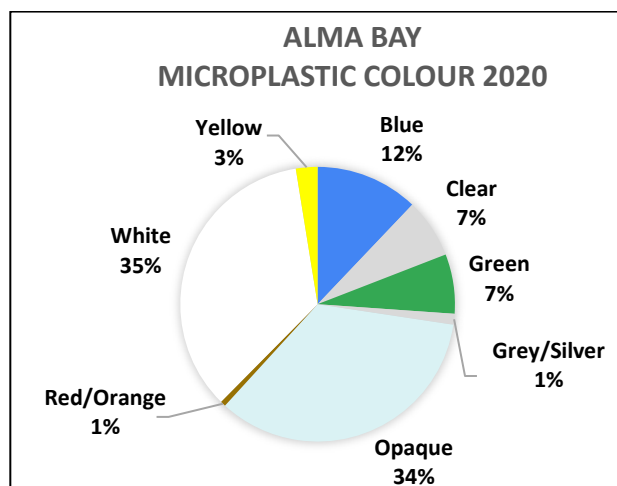
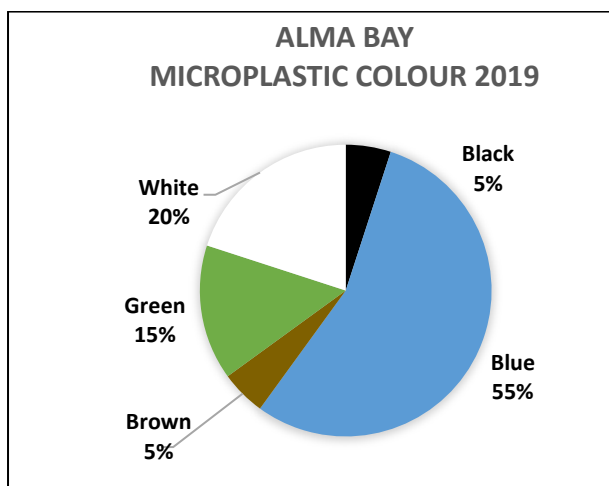


Figure 14: Plastic colours recorded on Magnetic Island during 2019 and 2020

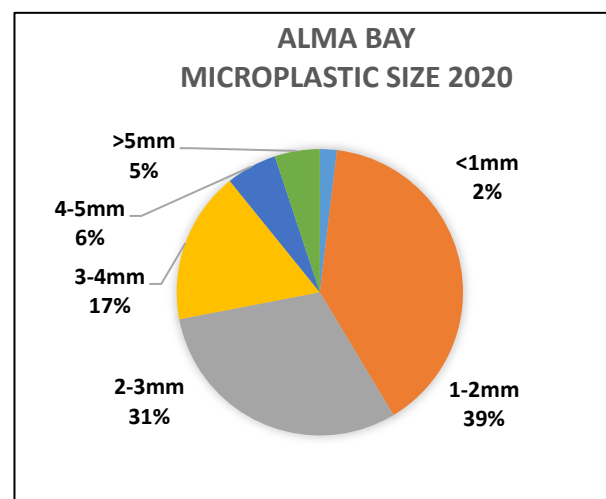
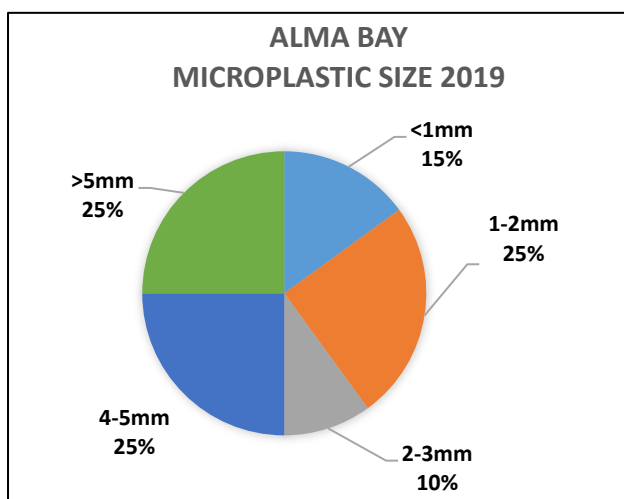
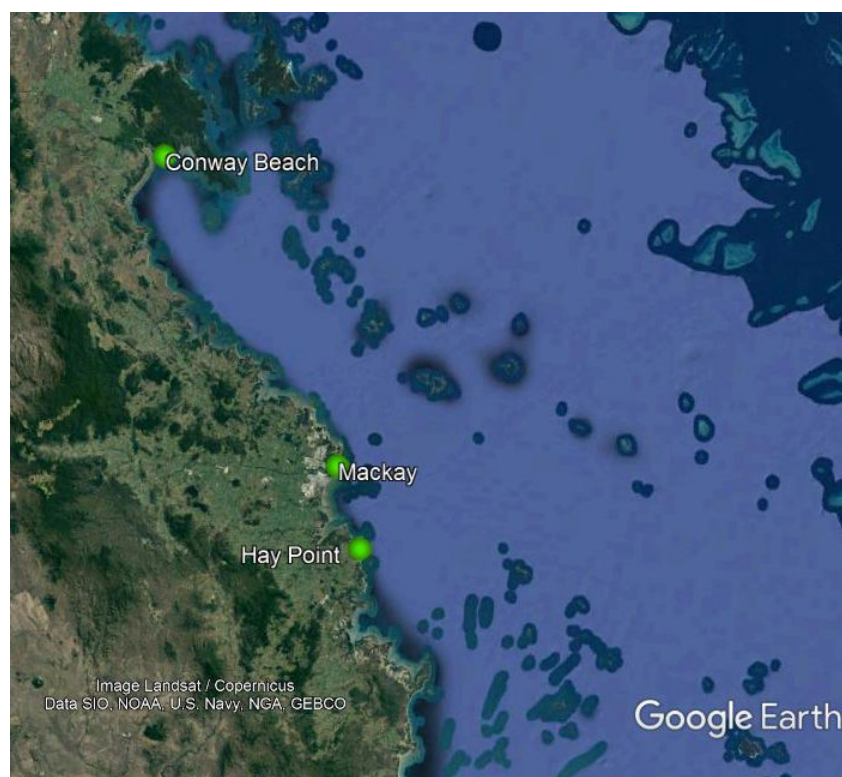


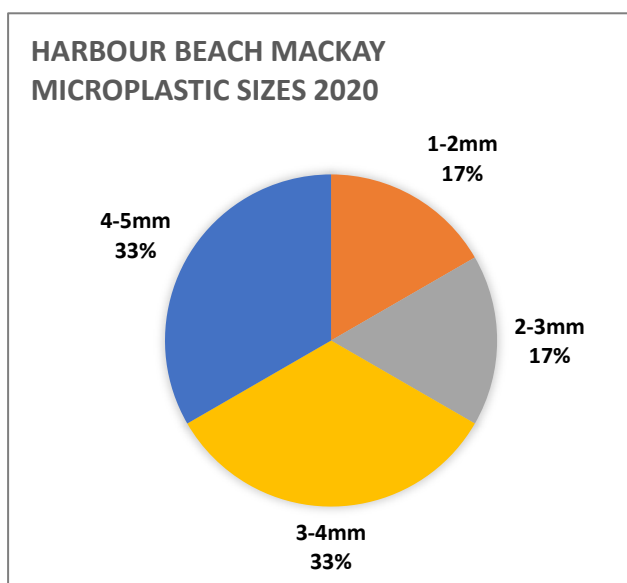
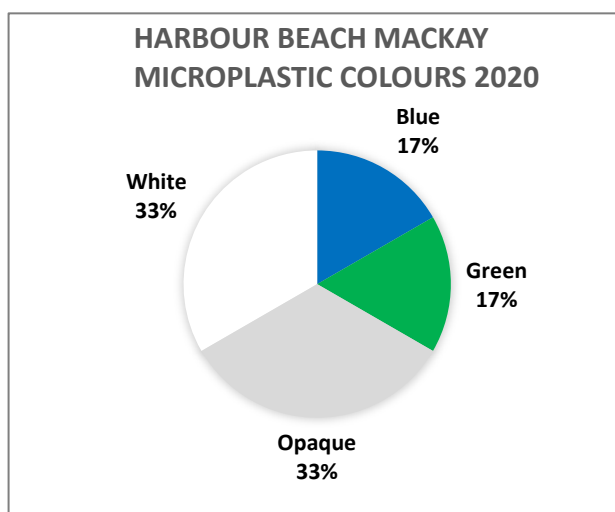
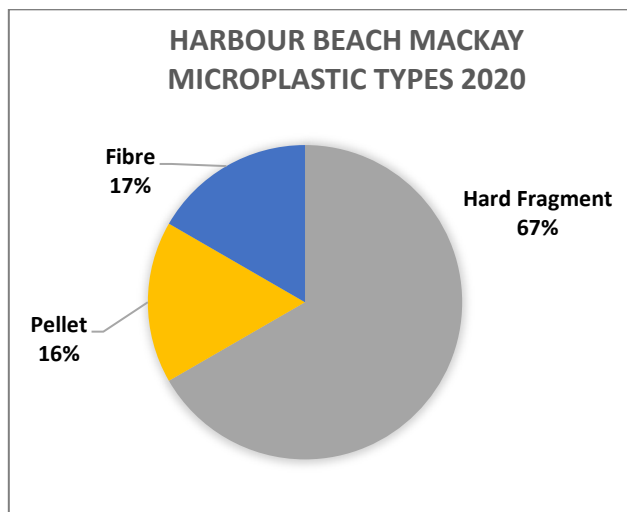
Figure 15: Plastic sizes recorded on Magnetic Island during 2019 and 2020

## Region # 4 – Mackay Whitsunday

Three locations were sampled within this region during 2020, all of which were classed as **very low**. Harbour Beach in Mackay recorded a new high for the region with eight microplastics per m<sup>2</sup> (Figure 16). Other sites at Hay Point and Conway Beach had 1 and 3 microplastics per m<sup>2</sup>, respectively. Plastics were predominantly hard fragments with one fibre and one industrial pellet also found. These plastics were in line with the most common plastic item colours and were a range of size classes (Figure 17).



**Figure 16: Mackay Whitsunday sample location and microplastic loads (Green = Very Low)**



*Figure 17: Microplastic type, colour and size for the Mackay site, 2020*

## Region # 5 – Fitzroy

Two samples, at Farnborough Beach, Yeppoon and Canoe Point, Tannum Sands was collected from the region in 2020 (Figure 18). The level of 23 microplastics per m<sup>2</sup> at the Yeppoon site, giving the site a ranking of **low**, but was the highest recorded to date for the region. No microplastic were found at Tannum Sands, where in 2019, there were 16 microplastics per m<sup>2</sup>, although these were not the same beaches. All of the microplastics collected in 2020 were hard fragments of a mixture of size classes that were predominantly white in colour (Figure 19).

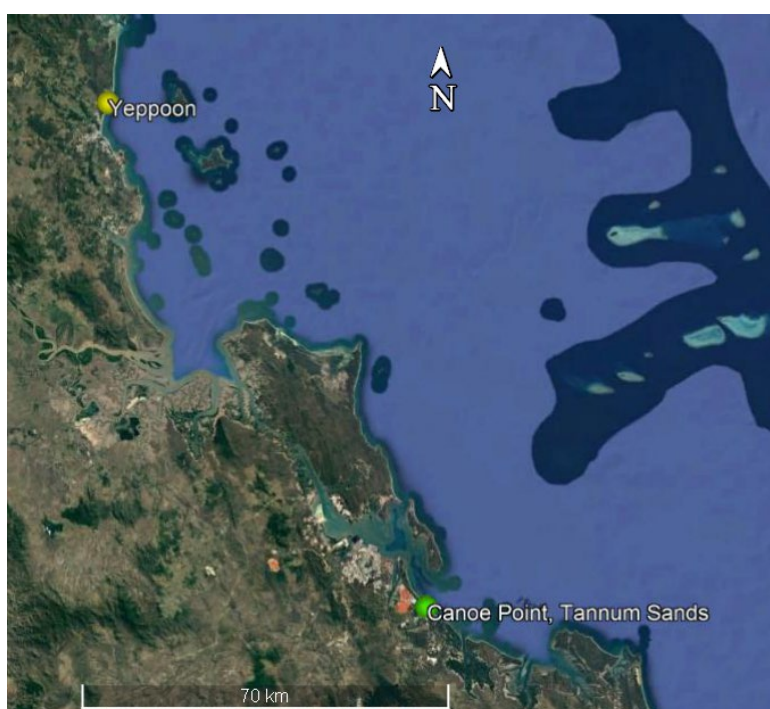


Figure 18: Fitzroy sample location and microplastic loads (Green = Very Low, Yellow = Low)

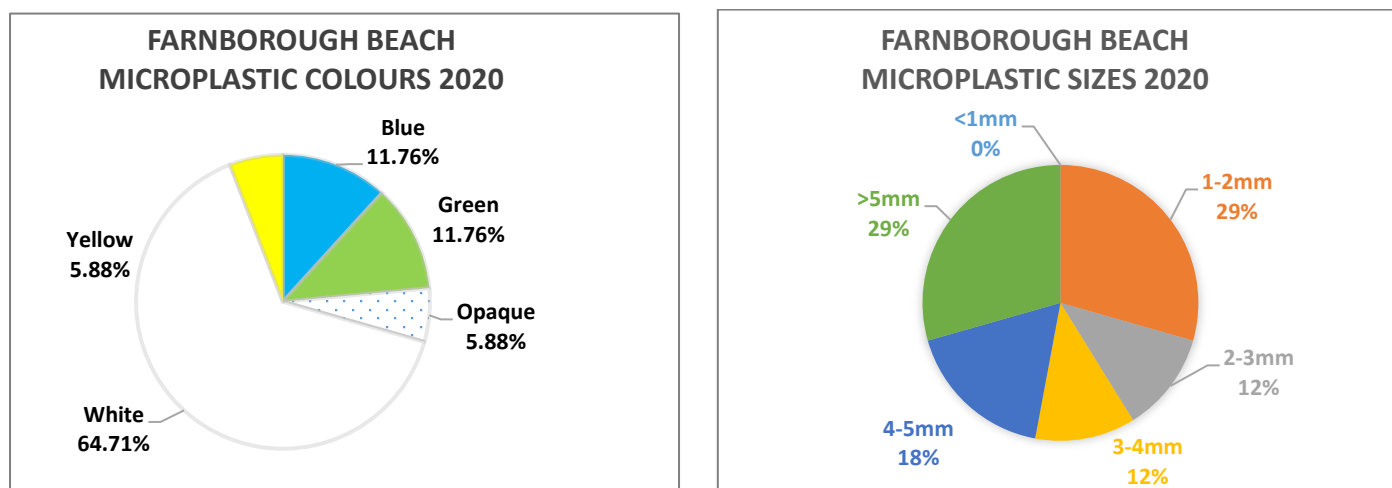
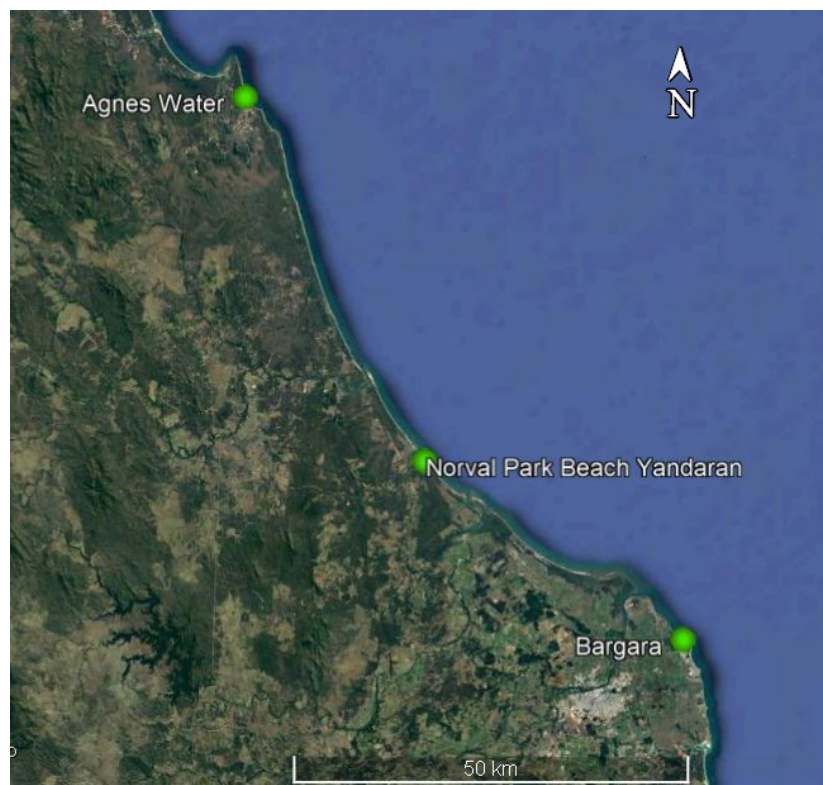


Figure 19: Microplastic colour and size for Yeppoon 2020



## Region # 6 - Burnett Mary

Three samples were collected from the Burnett Mary region in 2020 (Figure 20). No microplastics were found at any of the sites, Agnes Water, Bargara and Yandaran. While the two former sites were sampled in 2019, the levels were still **very low** (2 and 1 respectively) indicating that the region has consistent low levels of microplastics.

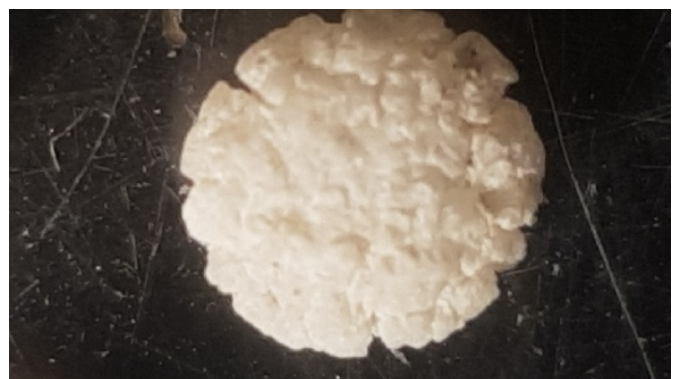


*Figure 20: Burnett Mary sample locations and microplastic loads (Green = Very Low)*

## Potential Sources of Microplastics

Microplastics found during 2020 were predominantly hard fragments of selected colours (mostly white, clear/opaque and blue). These results were similar to the 2019 data and indicate that sources are consistent. These hard fragments originate from whole products that break up due to UV degradation and wave action. While it is often difficult to determine where these plastics originate, a few features, such as colour, shape, ageing, fouling or newness can give us a clue. For instance, pieces from Cape York site were well worn and faded, indicating the plastic had spent long periods in the environment and were likely to have originated from distance sources transported by ocean currents.

There was an increased number of resin pellets (nurdles) found this year, mostly at Lucinda. Some of these pellets were relatively new, indicating nearby inputs, possibly from plastic manufacturers 130 km south in Townsville or further afield (Figure 21). The predominant current in the GBR lagoon is northward with a previous study finding drift cards moved over 1,000 km within the lagoon (Wilson, unpublished). Weather patterns and local activities prior to sampling can influence what plastics are found, hence more data over time is required to provide a better indication of the microplastic source trends.



*Figure 21: Some of the nurdles collected around Lucinda, QLD (L). Eroded nurdle (R).*

## Interim Conclusions

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**Year 2 of the ReefClean Microplastic project** was a building phase, with increased sampling effort from 2019. All regions bar the Burnett Mary recorded new high levels of shoreline microplastics and therefore a new high for the GBR was also recorded at Alma Bay on Magnetic Island with 209 microplastics per m<sup>2</sup>.

These trends maybe more reflective of seasonal loads of debris rather than longitudinal patterns. Further sampling over time will elucidate this. What is evident though is that microplastic is transported and data may not be reflective of local inputs, but more one of region scale sources.

As such the Burdekin region has shown for both 2019 and 2020 to have the highest levels on average and that the major urban centre of Townsville could be a contributing factor. Other regions in the northern parts of the GBR also had increased levels in 2020 while those in the central and southern regions were slightly lower in 2020.

Following on from this, more extensive sampling both spatially and temporally within the GBR region is planned to cover gaps and re-survey those sites that had previously been sampled. Further AUSMAP training days are planned in mid-2021, to allow more data to be gathered along the GBR. A re-engagement of trained volunteers will also occur to encourage more sampling within the targeted areas.

