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## Our Marine Parks Grants - Round 3 - Marine Debris Clean-up Voyage 2022

Quantifying marine debris on remote islands of Diamond and Lihou Reefs, Coral Sea Marine Park



**Image: The Marine Debris Clean-up Voyage Crew. Image courtesy of Tideline Productions**

*Tangaroa Blue Foundation acknowledges the First Nations people as Traditional Custodians of Country across Australia, including the Land and Sea Country on which we live and work. We pay our respects to their Elders past, present and emerging, and acknowledge their continuous relationship to this land and the ongoing cultures of Aboriginal and Torres Strait Islander peoples across Australia.*



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**Image: GMY Rangers carrying marine debris. Image courtesy of Tideline Productions**



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## Summary

This report summarises the data outcomes from the 2022 Our Coral Sea Marine Park (OCSMP) Clean-up, delivered by Tangaroa Blue Foundation with funding from the Australian Government (Parks Australia's 'Our Marine Parks Grants - Round 3' program).

This data report will be provided to Parks Australia as well as other partners and stakeholders, including the Gunggandji-Mandingalbay Yidinji Peoples Prescribed Body Corporate RNTBC (GMYPPBC), the Australian Microplastic Assessment Project (AUSMAP), Department of Biosecurity, Australian Border Force, Australian Maritime Safety Authority, Reef Trust and Torres Strait Regional Authority. The data collected on this voyage by Tangaroa Blue Foundation will build on the evidence base of marine debris generated in or entering the Coral Sea Marine Park (CSMP) and assist in identifying and monitoring future impacts to the park.

A total of 22 islands and cays which form part of Lihou Reef and the Diamond Islets (central CSMP), were visited in November 2022, which exceeded the original project objective of 14 sites. The crew consisted of Tangaroa Blue Foundation (Tangaroa Blue) staff, GMYPPBC Rangers, Blue Planet Marine (BPM) staff and a Parks Australia representative, aboard BPM's vessel *Infamis*, over a period of 21 days. The voyage formed part of a training opportunity for the GMYPPBC Rangers, who have been long term Tangaroa Blue and AMDI partners, to expand their knowledge around marine debris collection skills.

The voyage was promoted on social media and in the media in the lead up to, during and after the voyage and included the production of a video.

For each of the 22 Islands and cays visited as part of the project, the volume, weight, number of items and types of items (as classified by the Australian Marine Debris Initiative® - AMDI Database) are provided and includes data on the number and type of Fish Aggregating Devices (FADs) and echosounder buoys.

The 2022 November Coral Sea voyage data contributes to 3 years of marine debris data collected in the Coral Sea Marine Park (CSMP) through Island Health Surveys and research conducted by Parks Australia.



## Project Objectives

The objectives of the Parks Australia's 'Our Marine Parks Grants - Round 3' (OMPG-3) program were to:

1. Support interested and capable organisations and community groups to engage in marine park management
2. Improve knowledge and understanding of Australian Marine Parks

The objectives of the OMPG-3 Marine Debris Clean-up Voyage 2022 were:

**Objective 1** - To undertake clean-up activities in November 2022 at 14 locations within the Diamond Islets and Lihou Reef, to reduce the volume of debris in the Coral Sea Marine Park and assist in restoring the islands of the Park to their natural state.

**Objective 2** - To provide the opportunity to engage regional and Indigenous communities with the AMDI by inviting Indigenous Ranger representatives to participate in the voyage, and providing the opportunity to improve knowledge of marine debris and standardised data collection strategies. This in turn can contribute to work that Traditional Custodians already do in the management of Sea Country.

**Objective 3** - To provide Parks Australia with a comprehensive dataset of marine debris impacting the islands of the CSMP, including a summary of the marine debris collected on the trip. All marine debris data recorded on the voyage to be entered into the AMDI Database and all microplastic data recorded and samples taken on the voyage to be submitted to AUSMAP.

**Objective 4** - To improve visitor experience through an immediate change to the visual, environmental and cultural health of the sites visited, maintaining the Coral Sea Marine Park as a world-class natural and cultural visitor experience.

**Objective 5** - To promote the project through the Tangaroa Blue Foundation network and work with stakeholders through community engagement projects to continue clean-up efforts and standardised data collection in the marine environment, both during and beyond the project. Includes the production of a promotional video about the clean-up voyage.

**Objective 6** - To build on the evidence base of marine debris generated in or entering the CSMP and assist in identifying and monitoring future impacts to the park. Data collected on the voyage will be used to inform decisions on marine debris reduction strategies in the CSMP Park into the future, for both Parks Australia and other stakeholders.



## Previous Research/Reasoning

One of the many pressures to the CSMP that impact marine park values is marine debris, which can be detrimental to marine life causing entanglement, contamination or can be ingested by marine species.

There have been a number of voyages undertaken in the CSMP targeted at Island Health surveys which also included marine debris removal and data collection efforts. These include:

- June 2016 - Diamond Islets (Central CSMP)
- 10-27 July 2021, 17 days - Diamond Islets and Lihou Reef (Central CSMP)
- 19 May - 9 June 2022, 21 days - Cato, Wreck, Kenn, Frederick, Marion, Tregosse, Holmes Reefs, Herald Cays, Willis Islets, Diane (Southern CSMP)
- 16-29 November 2022, 14 days - Diamond Islets and Lihou Reef (Central CSMP)

Marine debris analysis from this voyage provides a picture of the accumulation of marine debris over 16 months, on 11 of the islands and cays at Lihou Reef and 3 of the islands and cays in the Diamond Islets that had marine debris removed from them in July 2021. It also provides a picture of the accumulation of marine debris on East Diamond Islet just 4½ months after being cleaned in June 2022.





## Location

Diamond Islets and Lihou Reef are located in the Central CSMP, approximately 250 nautical miles from Mainland Australia (*Figure 1, Figure 2*). The clean-up sites included four islands in the Diamond Islets, which form part of Tregosse Reef, and 18 islands of Lihou Reef (*Table 1*).

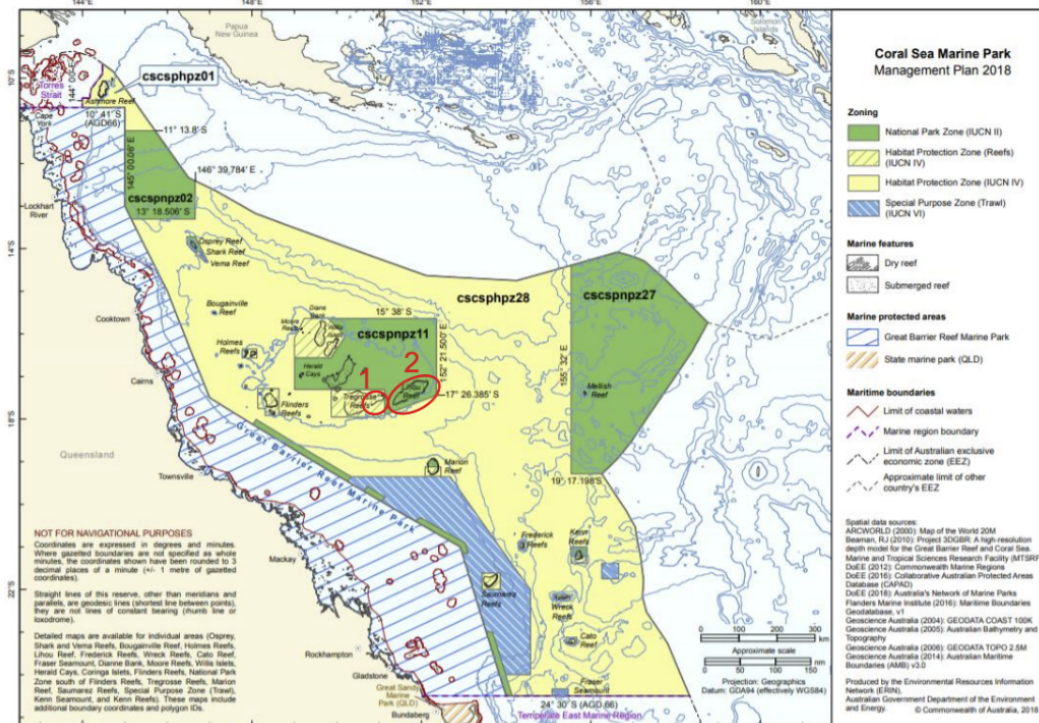


Figure 1. Coral Sea Marine Park boundaries as listed in the Coral Sea Marine Park Management Plan

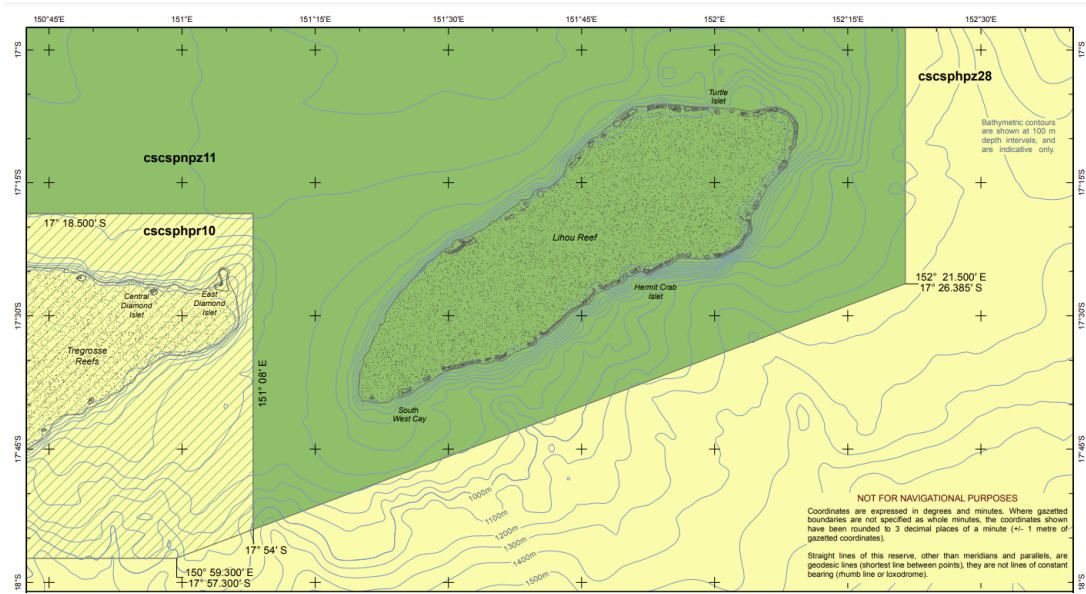


Figure 2. Chart of Lihou Reef as listed in the Coral Sea Marine Park Management Plan

Table 1. List of sites visited in Lihou Reef and Diamond Islets as part of the OMPG-3 Marine Debris Clean-up Voyage 2022

Diamond Islets (Tregosse Reefs)	Lihou Reef	
Central Diamond Islet	Phoenix Cay	Juliette Cay
East Diamond Islet	Betty Cay	Kathy Cay
South Diamond Islet	Carol Cay	Little Lorna Cay
West Diamond Islet	Dianna Cay	Lorna Cay
	Edna Cay	Middle Cay
	Fanny Cay	Observatory Cay
	Georgina Cay	South West Cay
	Helen Cay	Margaret Cay
	Hermit Crab Islet	Turtle Islet



## Marine Debris Data/Results

### Macro Marine Debris

A total of 27,215 items weighing 2,687kg were collected from 22 islands and cays throughout the Diamond Islets and Lihou Reef, covering over 25 km of coastline. This equates to 15,624L or 15.6m<sup>3</sup> of marine debris. All islands/cays that were visited in Diamond Islets and Lihou Reef, aside from Phoenix Cay, had marine debris recorded.

### Quantities:

There are two metrics in measuring the marine debris levels of pollution on an island or cay. One option is the total number of marine debris items on a cay/islet. This is more accurate than the weight (kg) of marine debris removed as there is a large disparity in the weight of individual items (for example a plastic water bottle versus a metal gas cylinder). There is also variation in the weight of one object depending on if it is wet weight, dry weight, sandy weight or muddy weight.

The second metric is the density of debris which is calculated as the number of items per square metre, using an average site width of 45m. This width was chosen so data is comparable to other programs led by Tangaroa Blue Foundation.

- Out of the islands that returned debris loads, the most amount of debris was collected from Lorna Cay (5,708 items, 20.98% of the total marine debris removed, which equated to 136.4kg). (*Table 2*).
- Aside from Phoenix Cay, which returned no marine debris load, the least amount of debris was collected from Helen Cay (21 items, 0.08% of the total marine debris removed, equating to 2.1kg)
- 71.06% of all marine debris collected on this voyage can be attributed to 5 sites (Lorna Cay, Dianna Cay, Georgina Cay, East Diamond Islet and Edna Cay (*Figure 3*).
- Marine debris was most dense on Dianna Cay (0.064 pieces/m<sup>2</sup>). Aside from Phoenix Cay, debris was least dense on Helen Cay (0.0001 pieces/m<sup>2</sup>).
- There was no pattern in the dispersal of the marine debris around the Diamond Islets and Lihou Reef cays and islets according to location (*Figure 4*).





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***Image: Tangaroa Blue Coordinator and GMY Rangers remove a bundle of rope buried in the sand.  
Image courtesy of Tideline Productions***



***Image: Tangaroa Blue Coordinator and GMY ranger weighing marine debris for data collection.  
Image courtesy of Tideline Productions***



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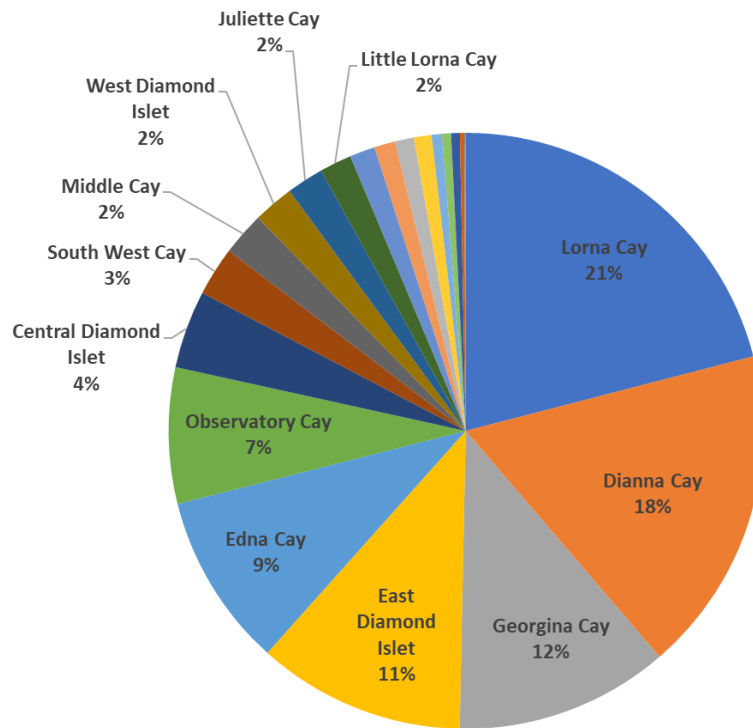
Table 2. Summary of marine debris loading site statistics from 22 islands and cays in Lihou Reef and Diamond Islets

Reef/ Cay, Islet	Weight (kg)	Total # Items	% of Total Based on # Items	Density (pieces per m2)	Ranking based on # Items	Ranking based on density
Lorna Cay	136.4	5708	20.98	0.063	1	2
Dianna Cay	159.8	4821	17.72	0.064	2	1
Georgina Cay	120.9	3166	11.63	0.035	3	4
East Diamond Islet	146.7	3076	11.30	0.037	4	3
Edna Cay	104.2	2566	9.43	0.034	5	5
Observatory Cay	72.3	2008	7.38	0.030	6	6
Central Diamond Islet	290.1	1150	4.23	0.023	7	8
South West Cay	78.1	726	2.67	0.016	8	9
Middle Cay	36.4	641	2.36	0.011	9	10
West Diamond Islet	250	601	2.21	0.010	10	12
Juliette Cay	110.1	547	2.01	0.011	11	11
Little Lorna Cay	17	475	1.75	0.026	12	7
Hermit Crab Islet	41.5	376	1.38	0.004	13	18
Carol Cay	16.1	310	1.14	0.005	14	16
Betty Cay	25.9	278	1.02	0.008	15	13
Kathy Cay	115.7	264	0.97	0.006	16	14
Fanny Cay	8.6	154	0.57	0.006	17	15
South Diamond Islet	71.7	132	0.49	0.003	18	19
Turtle Islet	20	129	0.47	0.004	19	17
Margaret Cay	3.4	64	0.24	0.002	20	20
Helen Cay	2.1	21	0.08	0.001	21	21
Phoenix Cay	0	0	0.00	0.000	22	22



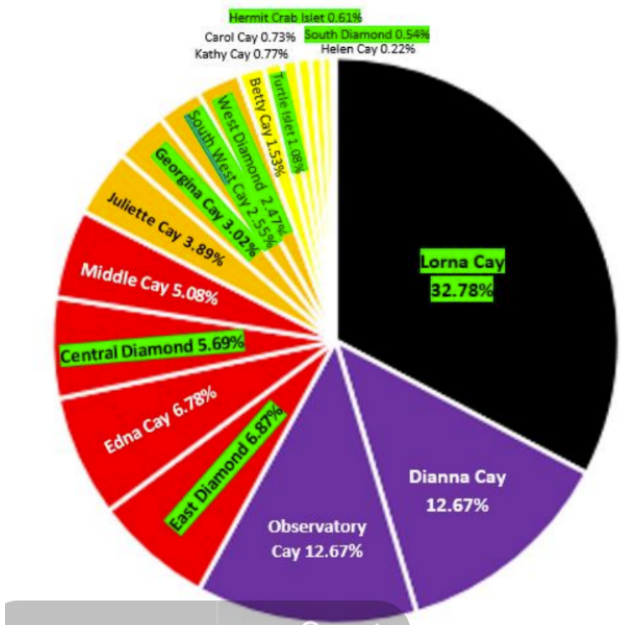
Figure 3. A) Marine debris load from islands and cays in Lihou Reef and Diamond Islets in 2022, displayed as a percentage of total marine debris load, based on the number of marine debris items.

B) Marine debris load from islands and cays in Lihou Reef and Diamond Islets in 2021, displayed as a percentage of total marine debris load, based on the number of marine debris items. Note graph is from a Parks Australia presentation.





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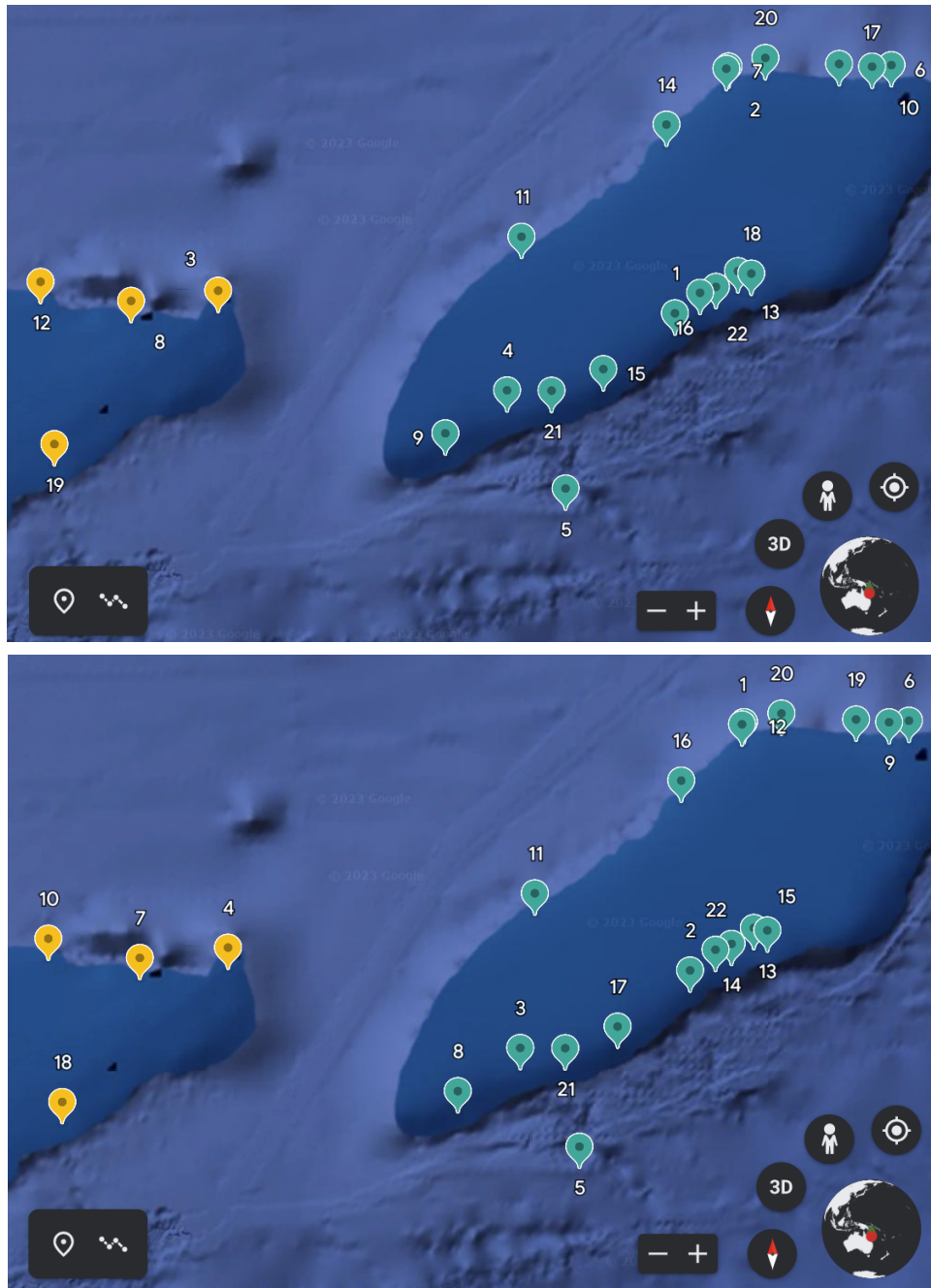




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Figure 4. Distribution of marine debris around Diamond Islets and Lihou Reef in numerical order of descending marine debris loads, based on (A) Density (pieces per m2) and (B) Number of Items. 1 is the highest rating and 22 is the lowest.







Material Types:

- Plastic was the most common type of material found across the islands (24,081) - 88.5% of the total (Figure 5).
- Plastic remnants are the most common sub-category (14,178), followed by plastic packaging items (6,110) and plastic fishing items (2,384) (Figure 6).
- Rubber was the second most common type of material found (1,621), which primarily consisted of rubber footwear and thongs (1,165) - 6% of the total.
- Glass and ceramic items were the third most common type of material found (578), and included broken pieces of glass (224), wine and spirit bottles (123) and beer/pre-mixed alcohol bottles (101) - 2% of the total.
- The least common material category was paper and cardboard items (9), which consisted of paper and cardboard packaging and tetra packs and drink cartons - 0.03% of the total.

Figure 5. Number and percentage of marine debris material types found on the Diamond Islets and islands and cays of Lihou Reef in November 2022

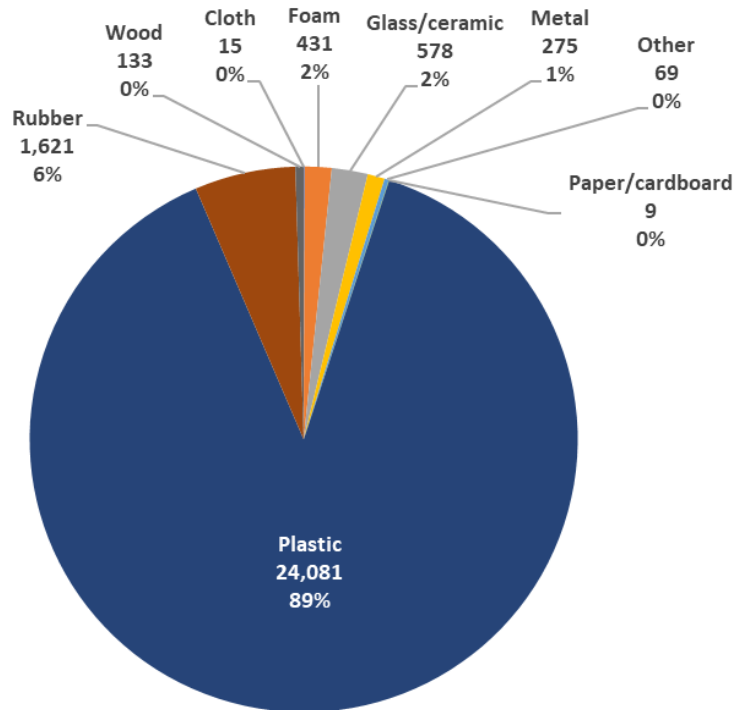
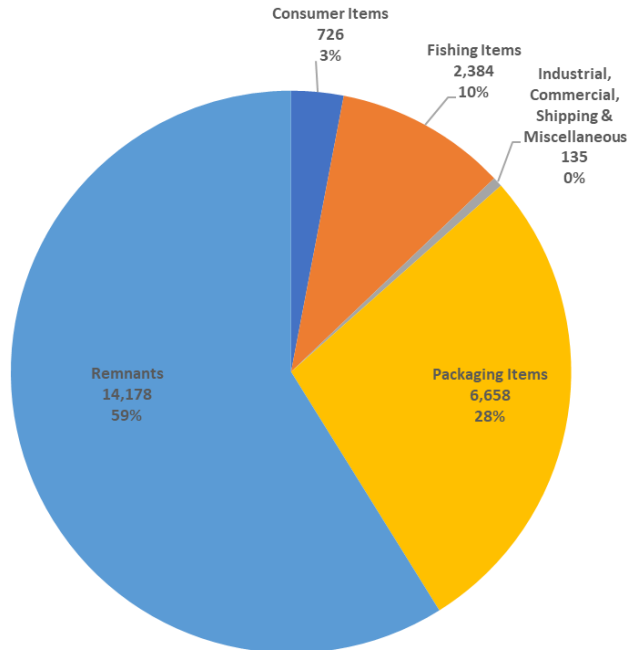




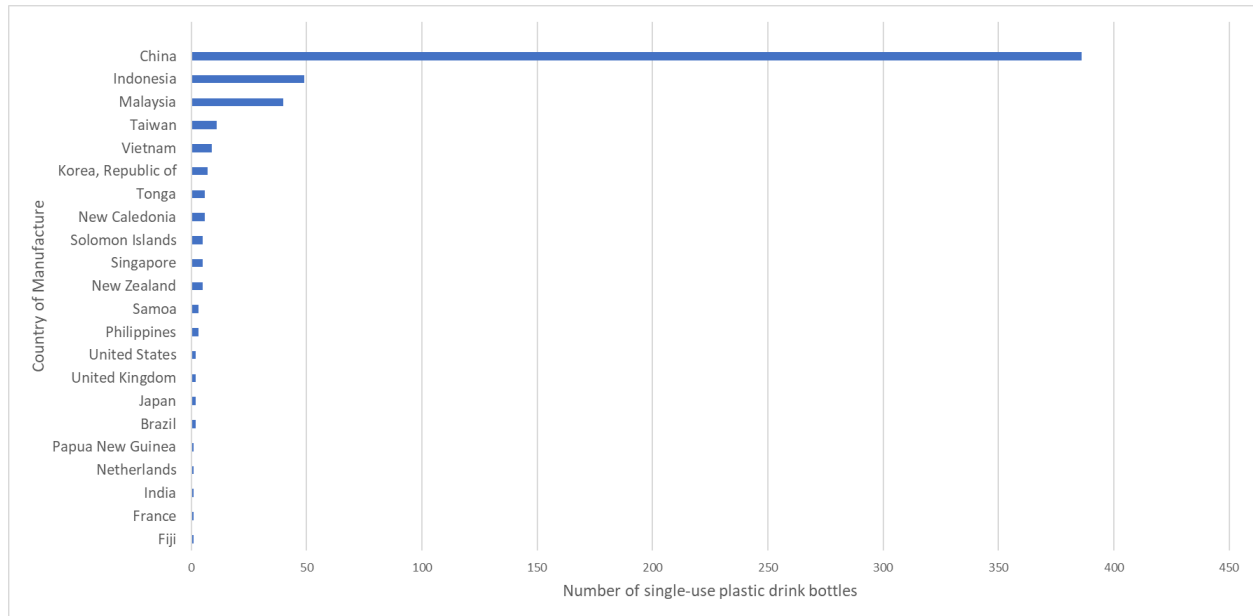
Figure 6. Number of items in each plastic category across the Diamond Islets and islands and cays of Lihou Reef in November 2022



- 204 floats were collected, consisting of foam drift net floats (2), plastic commercial fishing remnants (143), plastic buoys and floats (28), plastic recreational fishing items (30) and metal buoys and floats (1)
- 5 Fish Aggregating Devices (FADs) and 4 echosounder buoys were collected.
- Out of the 1,484 plastic drink bottles that were collected, 548 (36.95%) were identifiable brands. Branded bottles were manufactured in 23 different countries (Figure 7), including Australia.
- 936 bottles were of unknown origin.



Figure 7. Countries of Manufacture of Single-use Plastic Bottles Collected on the OCSMP Voyage. Note: 936 bottles were of unknown origin



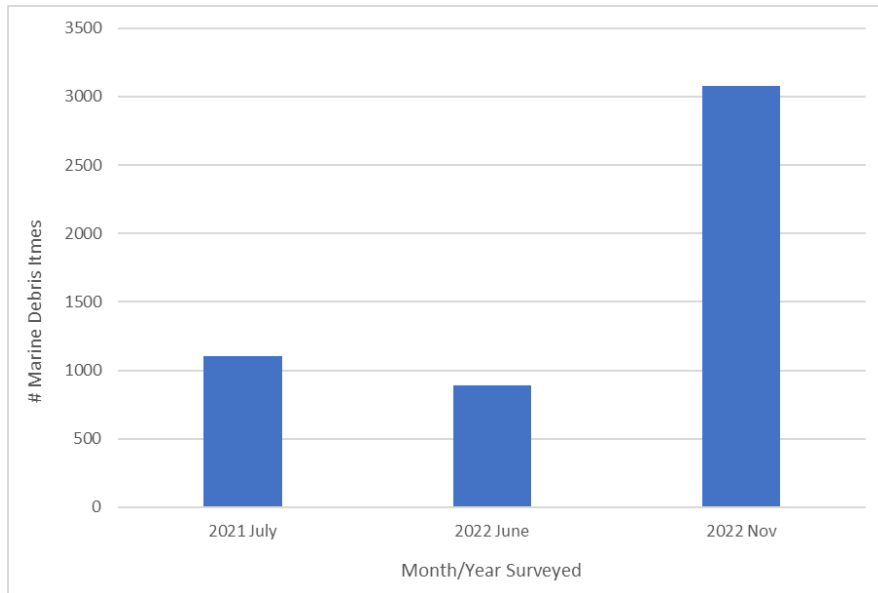
The number of items of marine debris collected on East Diamond Islet decreased in June 2022 compared to July 2021 (*Figure 8*). However, in November 2022 this figure almost tripled the amount collected in July 2021 and June 2022. This indicates that there are a variety of influences to the marine debris loads found throughout the year, but more data is needed to identify trends.



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Figure 8. Number of items of marine debris on East Diamond Islet in July 2021, June 2022 and November 2022



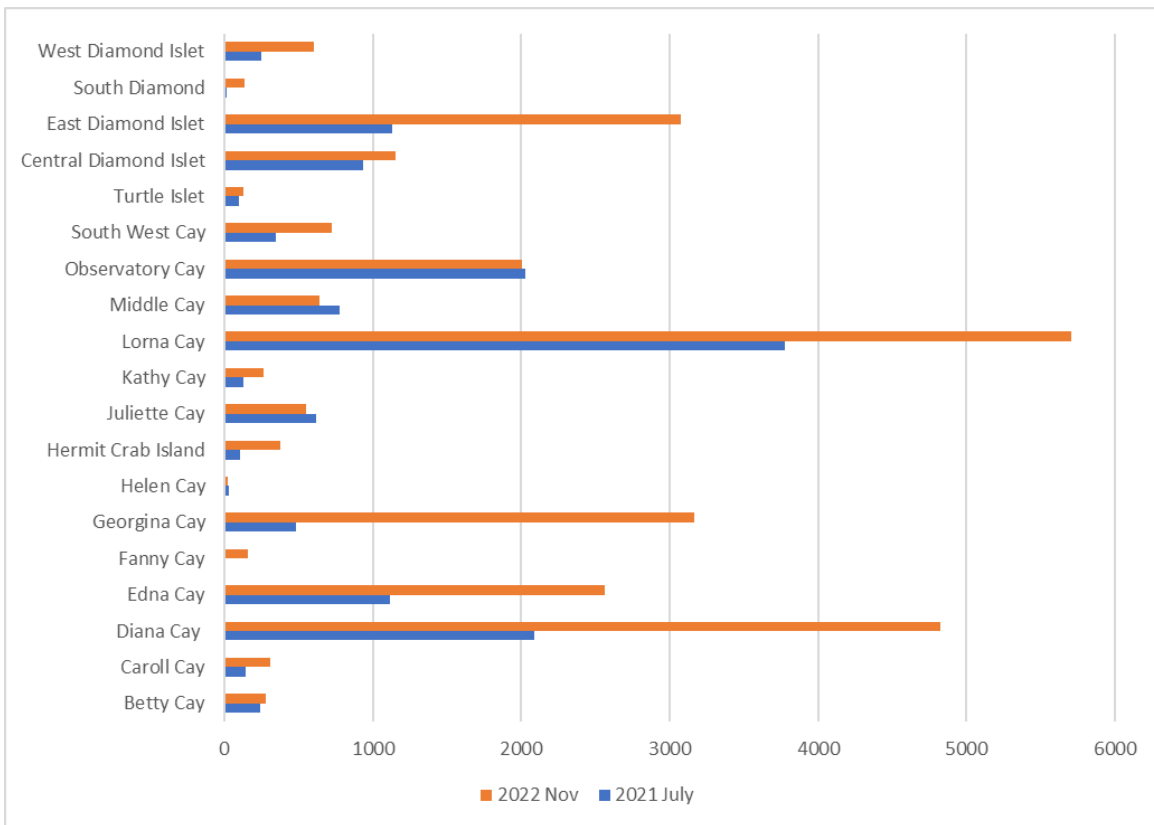
**Image: GMY Rangers assist in sorting through marine debris for collection into the AMDI Database. Image courtesy of Tideline Productions**



Trends over time:

More items of marine debris were collected on Observatory Cay, Middle Cay and Juliette Cay in July 2021 than November 2022 (*Figure 9*). All other sites returned a higher number of marine debris items in November 2022 in comparison to July 2021.

*Figure 9. Number of items of marine debris across sites in the Diamond Islets and Lihou Reef in July 2021 compared to November 2022*







## Microplastics

The Australian Microplastic Assessment Project (AUSMAP) is designed to document and analyse microplastic pollution in Australian aquatic environments. The Total Environment Centre (TEC) and Macquarie University are the project leaders, working with a consortium of research, environment, education, government and sustainable business organisations, including Tangaroa Blue Foundation.

Tangaroa Blue Foundation coordinators used the AUSMAP sampling methodology to collect data on microplastic particles (1-5 mm), which involved replicate sediment sampling along the most recent high tide of each shoreline. These samples were then sieved for microplastics and verified by AUSMAP staff. Microplastic loads are reported as microplastics per metre squared (mp/m<sup>2</sup>). Data on typology (resin pellets, hard plastic fragments, foam, fibre, film, or rubber), colour, size and weathering are also collated.

A total of 7 microplastic surveys were conducted on 7 islands, concentrating on the vegetated cays that had substrate suitable for sampling (*Table 2*). 2 sites returned no microplastics in the samples collected (South Diamond Islet and West Diamond Islet). Georgina Cay had the highest microplastic loading of 18.67 mps/m<sup>2</sup>, with 65% consisting of hard fragments. The second highest rating was Turtle Islet (8 mps/m<sup>2</sup>), followed by Lorna Cay (4 mps/m<sup>2</sup>), South-West Cay (2.67 mps/m<sup>2</sup>) and Central Diamond Islet (1.33 mps/m<sup>2</sup>).

This was the first time that any microplastic samples had been collected from this region for AUSMAP. research of this kind is particularly important in monitoring the impacts of microplastics on bird and turtle populations in the CSMP.



Table 2. Microplastic loadings on three sites in the Diamond islets and four sites in Lihou Reef, reported as microplastics per metre squared (mp/m<sup>2</sup>)

Diamond Islets (Tregrosse Reefs)	mps/m <sup>2</sup>	Lihou Reef	mps/m <sup>2</sup>
Central Diamond Islet	1.33	Georgina Cay	18.67
South Diamond Islet	0	Lorna Cay	4
West Diamond Islet	0	South West Cay	2.67
		Turtle Islet	8



**Image: Tangaroa Blue Coordinator and Blue Planet Marine Skipper collect microplastic samples. Image courtesy of Tideline Productions**



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## Recommendations

Further analysis of the data from this clean-up and prior/future Coral Sea Island Health Voyages would provide more information on land based sources versus sea based sources of marine debris. To investigate whether policy interventions are effective, data on marine debris is needed before, during and after their implementation to measure their impact (for example changes to MARPOL legislation and policies and mitigation strategies implemented in the Coral Sea Marine Park Management Plan. Tangaroa Blue Foundation recommends that Parks Australia continue to support the collection of AMDI data to record marine debris on Island Health surveys and through projects such as this. The information collected will be critical in monitoring the impact of the Plastics Treaty.

Tangaroa Blue Foundation also suggests that a scientific paper, in partnership with Parks Australia, is produced for further analysis, and to contribute to the scientific research conducted in the marine debris space. These analyses can be used to inform decisions on marine debris reduction strategies in the Coral Sea Marine Park into the future, for both Parks Australia and other stakeholders.

## Acknowledgments

Tangaroa Blue would like to acknowledge and thank the Australian Government for the opportunity to collect vital data through this project, funded through the Our Marine Parks Grants program. We would also like to thank the Gunggandji-Mandingalbay Yidinji Peoples Prescribed Body Corporate RNTBC Rangers, the Blue Planet Marine crew and Tideline Productions for their contributions on the voyage.



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***Image: The Marine Debris Clean-up Voyage Crew upon their return to Cairns. Image courtesy of Tideline Productions***