Summary report of The St Helena National Trust's Marine Debris and Microplastics Surveys

Conducted as part of the Defra funded project:
'Sustainably Managing Plastic Waste on St Helena to Minimize Marine Debris'



Marine Team

St Helena National Trust

Executive Summary

Plastic pollution is pervasive and has been identified as one of the three biggest threats facing the world's oceans along with overfishing and climate change.

This report assesses the amount and type of marine debris collected from four sites on the coastline of St Helena Island in the middle of the South Atlantic. The survey sites; Sandy Bay, Rupert's Beach, Lemon Valley and Shark's Valley, were selected for their geographic spread across the island, varying degrees of substrate (e.g. sand to pebble, to rocks) and their representation of varied local anthropogenic use on both the leeward and windward sides of the island.

A total of 12 DEFRA Marine Debris surveys were completed (three at each of the four survey sites), resulting in 127kg of marine debris being sorted, analysed and removed from St Helena's coastline. Data revealed that 94% of all marine debris found was plastic. Of this, 55% was microplastics in the size category ≤5cm.

Sandy Bay contained the highest quantity of microplastics (n = 8,913) across all four sites and was also the only survey location to receive deposits of nurdles (the rawest form of plastic).

The vast majority of marine debris was of external origin and did not harbour significant quantities of marine organisms, implying that the debris had not been at sea for years - most likely from international fishing vessels and ships passing by or through St Helena's EEZ.

While St Helena appears to be cleaner than other remote island locations around the world, this report recommends the continued monitoring of marine debris on St Helena's coastline, particularly as the tourism offering of the Island develops.

List of Acronyms

DEFRA – Department for Environment, Food and Rural Affairs

EEZ – Exclusive Economic Zone

EMD – Environmental Management Division of the St Helena Government

ICC – International Coastal Clean Up

IUCN – International Union for Conservation of Nature

IUU – Illegal, Unregulated and Unreported fishing activities

JOO – Just One Ocean

MCS – Marine Conservation Society

MMO – The Marine Management Organisation

MPA – Marine Protected Area

OC – Ocean Conservancy

SHAPE – St Helena's Participation in Enterprise

SHNT – The St Helena National Trust

1. Introduction

Plastic pollution is now recognised as one of the three biggest problems affecting the ocean, along with climate change and overfishing (Leonard, Melcer, Mallos, & Dove, 2018; Barnes, et al., 2018).

Due to the varying densities of plastic products, once in the ocean, this form of pollution becomes a truly ubiquitous issue, even found in the stomach contents of marine life at depths of >10,000m (Jamieson, Brooks, Reid, Piertney, Narayanaswamy, & Linley, 2019).

Oceanic currents can play a major role in the long distance dispersal of plastics and marine debris (e.g. wood, metal, etc). The island of St Helena, in the middle of the South Atlantic, receives cold, nutrient rich waters from the Benguela Current as it diverts northwest, upon meeting the Angola Current travelling down from the north (Peacock, 2016) (see Fig. 1). With this influx of nutrients, also comes an unknown quantity of marine debris deposited in St Helena's IUCN Category VI Marine Protected Area and along the Island's coastline.

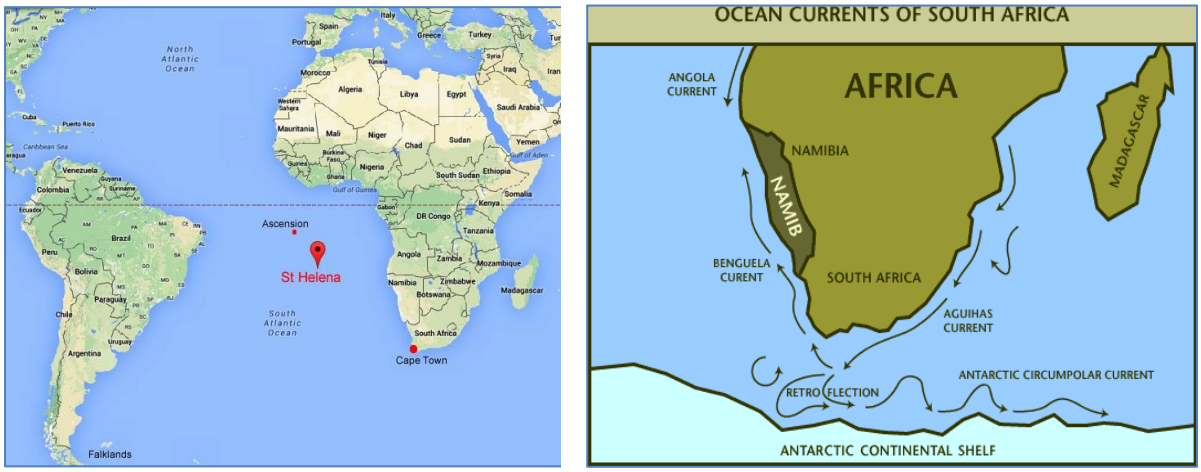


Figure 1: Maps of St Helena's location in the South Atlantic and the currents that bring nutrients and marine debris to the Island.

1.1 Context

St Helena's MPA designation in 2016 as an IUCN Category VI, means only sustainable use can take place. As such, the monitoring of waste streams, potential sources and quantities of pollution is vital to better inform current and future management measures.

In February 2018, Ocean Conservancy and Georgia Aquarium conducted the first quantitative assessment of the amount and type of marine debris washing up on St Helena's beaches. This study complemented that of Barnes et al. (2018) which investigated the impact of plastic on South Atlantic Marine Reserves (Leonard, Melcer, Mallos, & Dove, 2018).

Following the aforementioned studies, the St Helena National Trust (SHNT) began weekly beach surveys and cleans utilising the Marine Conservation Society methodology at two key sites, Sandy Bay and Rupert's Bay. The main focus of these weekly surveys was the analysis marine debris and macroplastics (**>5cm**) and the removal of marine debris from these sites.

Under the Defra funded project, ***'Sustainably Managing Plastic Waste on St Helena to Reduce Marine Debris'*** (hereinafter referred to as the DEFRA Marine Debris Project) the SHNT expanded upon these weekly baseline surveys, by including two additional survey sites, Shark's Valley and Lemon Valley and incorporating the analysis of microplastics (**≤ 5cm**). For continuity and data sharing purposes, the DEFRA Marine Debris Project utilised the same MCS methodology for the overall beach assessments and incorporated The Big Microplastic Survey methodology for detailed analysis of microplastics.

These four sites were chosen for their geographic spread across the island, their varying degrees of substrate (e.g. sand to pebble, to rocks) and to represent various degrees of local anthropogenic use on both the leeward and windward sides of the island (see Fig. 2).

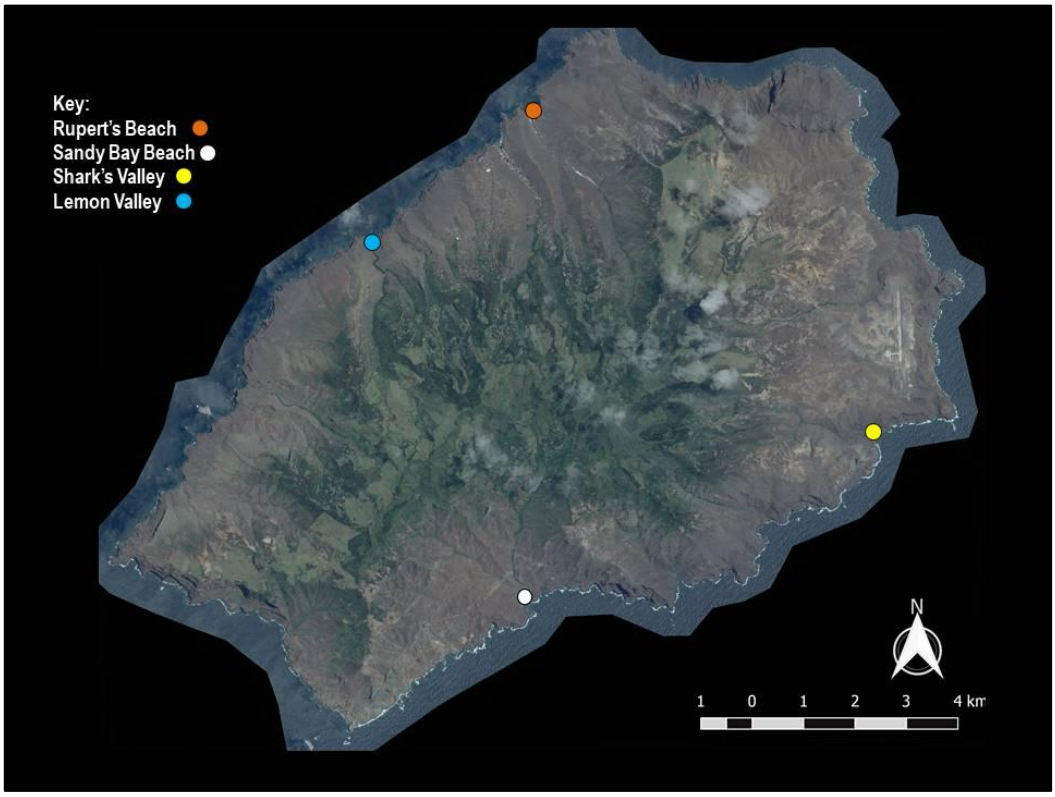


Figure 2: Map showing the four beaches used in this DEFRA project

All data collected during these surveys was collated and disseminated to key local partners within this project. External recipients of marine debris data were: Marine Conservation Society (MCS), Ocean Conservancy (OC) and Just One Ocean (JOO). Data can be found on the St Helena National Trust's Website.

2. Results

Over the course of one year, the SHNT conducted 50 beach cleans, twelve of which fell directly under the DEFRA Marine Debris Project timeline. From these 50 surveys, 17,984 pieces of marine debris (244kg) have been recorded and removed from St. Helena's coastlines. Plastics comprised 94% of this marine debris - and 55% of this plastic was microplastics in the ≤ 5cm size category (see Fig. 3).

Table 1: Weekly SHNT beach surveys and DEFRA surveys.

Site:	Number of weekly SHNT Beach Surveys	Total weight for SHNT Surveys	Number of DEFRA Beach Surveys	Total weight for DEFRA Marine Debris Surveys	Total Weight
Sandy Bay Beach	21	32.5 kg	3	15 kg	47.5 kg
Rupert's Beach	16	84.5 kg	3	7 kg	91.5 kg
Shark's Valley	0	0	3	82 kg	82 kg
Lemon Valley	0	0	3	23 kg	23 kg
TOTAL:	**38**	**117kg**	**12**	**127kg**	**244kg**

Shark's Valley and Lemon valley were the most remote sites studied in this project. The greatest *quantity* of marine debris was recorded from Shark's Valley (82kg), where large, relatively intact items were recovered from between large boulders. Lemon Valley was found to have the least amount of marine debris (23kg).

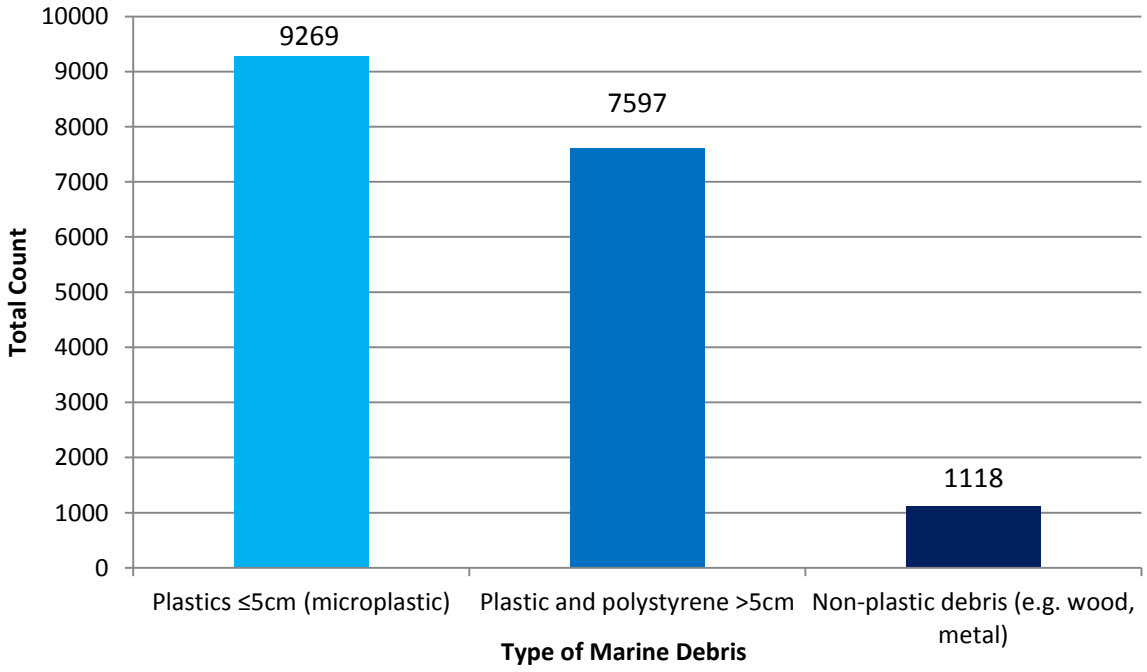


Figure 3: Total count of Marine Debris collected by type

For Sandy Bay and Rupert's Beach, multiple surveys and cleans were conducted per month, therefore averages of the marine debris counts were taken for overall monthly comparisons (see Fig.4). Rupert's Beach on the leeward side of the island received less marine debris in

the Atlantic 'summer', during the months of November-February, when seas are usually calmer. Seasonality was less easy to interpret for Sandy Bay on the windward side of the island, which received the highest amounts of marine debris in July, October and November.

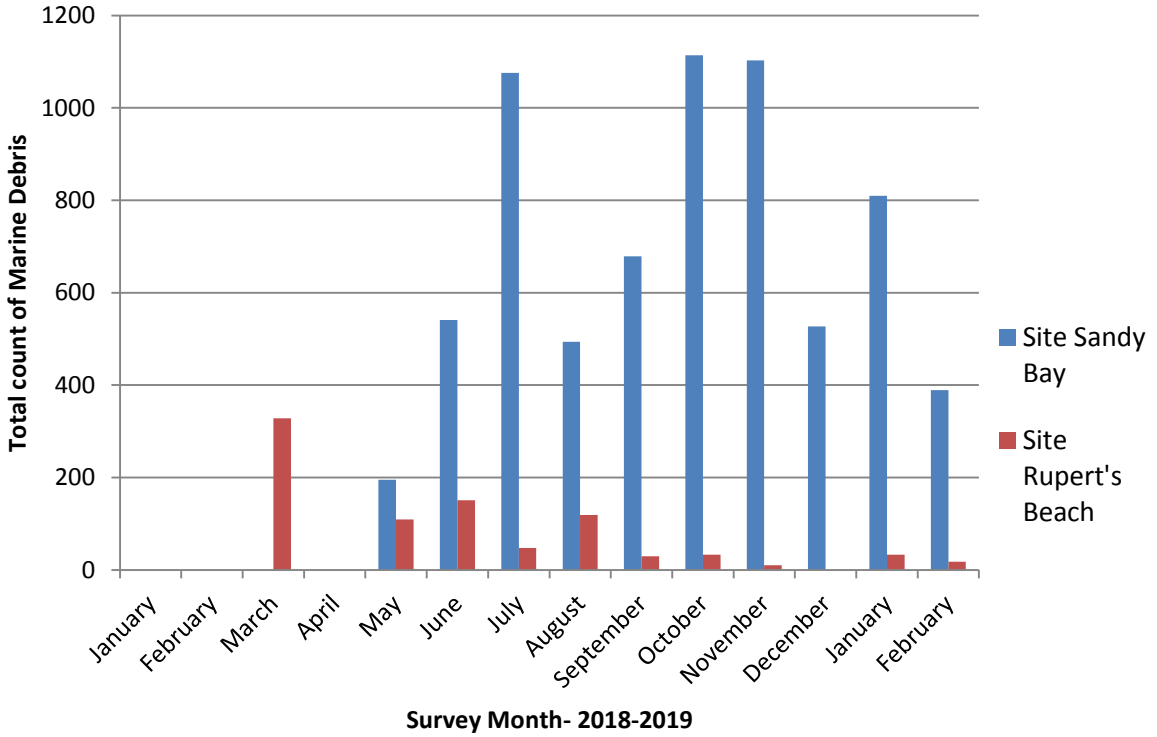


Figure 4: Monthly breakdown of marine debris counts from Sandy Bay and Rupert's Beach

2.3 Microplastics overview

While evidence of microplastics (≤5cm) was found at all sites except Lemon Valley, Sandy Bay was found to have the largest quantity of microplastics in both the SHNT surveys and during the DEFRA Marine Debris Project (n = 8,913). Sandy Bay is also the only beach where nurdles were recorded. The nurdles found have thus far totalled approximately 5kg in weight and are predominantly in the medium size class, aligning with the data published by Leonard, et al., (2018) (see Fig.5).

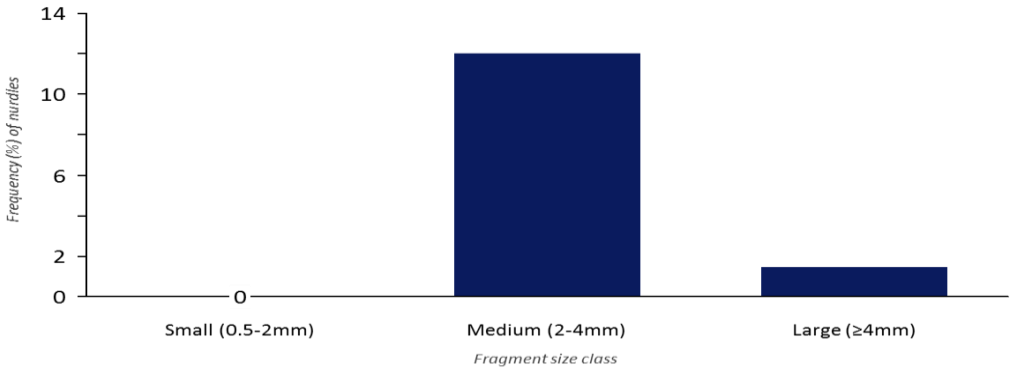


Figure 5: Percentage of nurdle composition in each size class.
Source: (Leonard, Melcer, Mallos, & Dove, 2018)



Figure 6: Using quadrats to collect samples of substrate and microplastics. Bottom L/R: Sharks Valley beach sample and analysed samples ready for the microscope.



Figure 7: examples of microplastic categorisation for Sandy Bay

2.1 Marine debris breakdown by site

Sandy Bay

While this location is difficult to get to without an off-road vehicle, and the waters are unsafe to swim in, this site receives a fair amount of local anthropogenic use for recreational purposes. However, the majority (66%) of marine debris found on Sandy Bay was not locally sourced 'in-tact' pollution (i.e. litter dumped by users), but microplastics (≤5cm), washing up from the ocean (see Fig. 8).

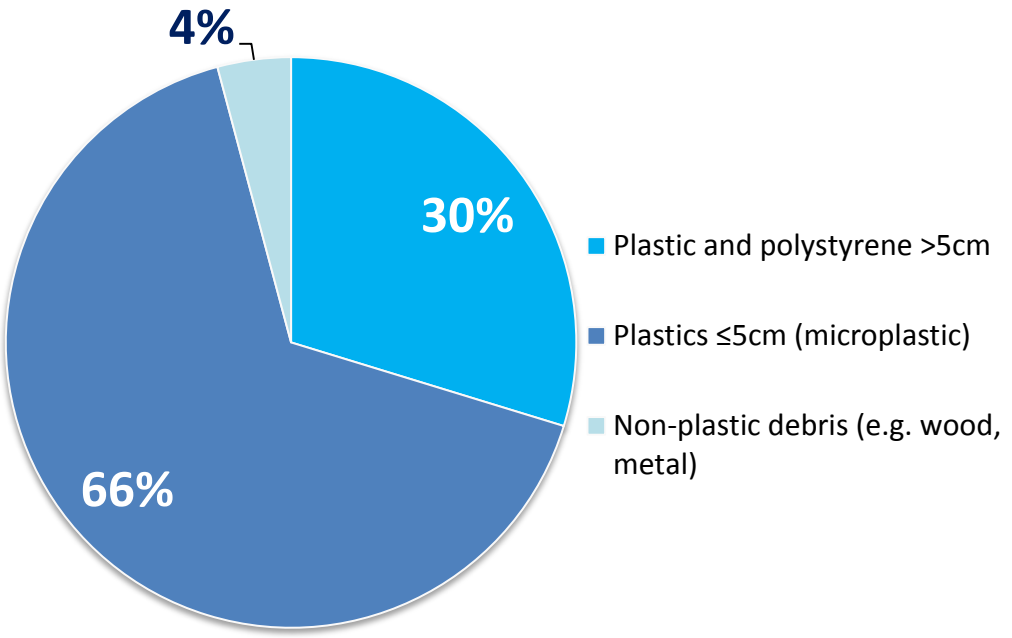


Figure 8: Sandy Bay - breakdown of marine debris by type and quantity



Figure 9: nurdles washed up on Sandy Bay beach.
Insert: Sieve filled with nurdles and handful of plastic fragments > 5cm.

Rupert's Bay

As the only safe and accessible beach for members of the community wanting to use the sea recreationally, this predominantly sandy beach is the most heavily impacted by local anthropogenic pressures (see Fig. 10). It was therefore unsurprising that this site was documented as having the most locally sourced pollution (minimum 46%) (e.g. beer bottles, cigarette stubs), aligning again with data published by Leonard, et al., (2018).



Figure 10: School children from Pilling Primary School assisting with Rupert's Beach marine debris categorisation

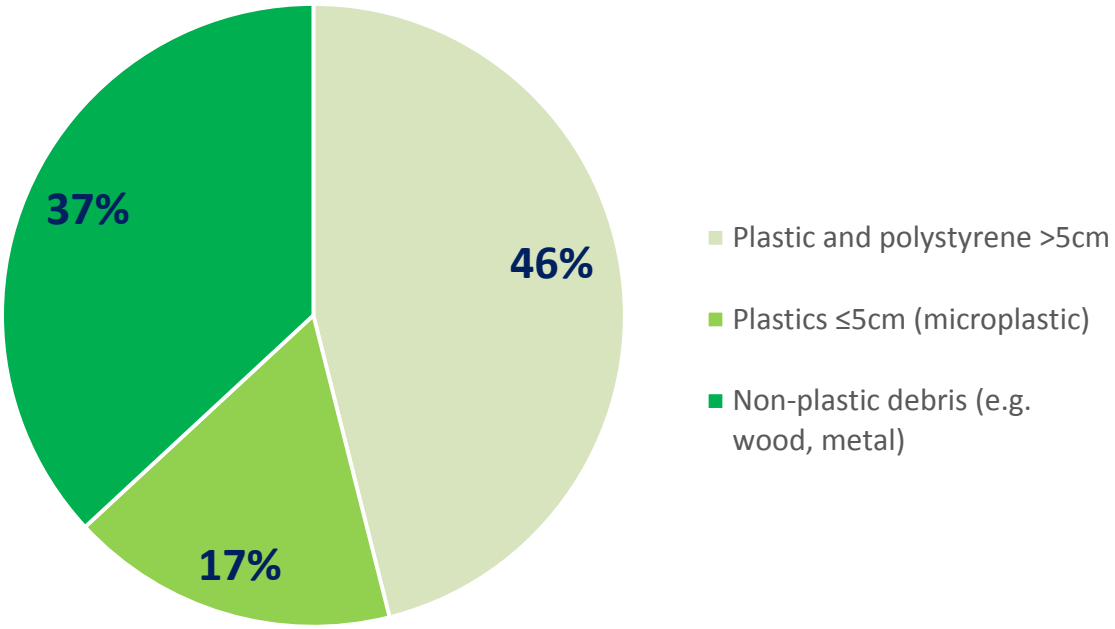


Figure 11: Rupert's Beach - breakdown of marine debris by type and quantity

Lemon Valley

Rotten disposable BBQ pits and old cigarette stubs were the most common items recorded at this site which is occasionally used for recreational purposes by the community and accessible via boat and foot. When compared to the other three survey sites, Lemon Valley was the cleanest out of all four beaches surveyed, contributing to only 9% of the total marine debris (244kg) recorded and removed during this entire project. As previously mentioned, the site also had no visible evidence of microplastics.



Figure 12: setting a quadrat on the pebbly beach of Lemon Valley. (R) view of Lemon Valley beach.

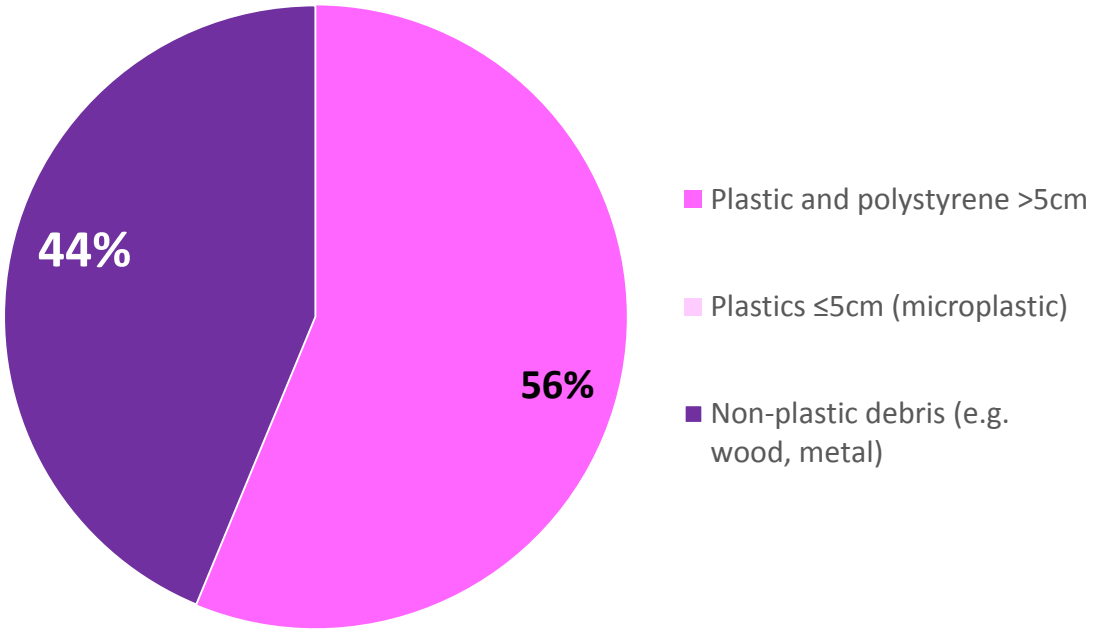


Figure 13: Lemon Valley - breakdown of marine debris by type and quantity

Sharks Valley

This pebble/boulder beach is the most remote of all four survey sites, accessible only via a challenging walk; meaning that recreational use is minimal. The majority of marine debris found (95%) was large and relatively intact; including drift wood, fishing buoys, shoes and single use plastics bottles. Only 4% of marine debris was microplastics ≤ 5cm. One very large item, A NewStar Radio Buoy, weighing approximately 15kg, was found trapped in between large boulders.



Figure 14: (L) picking up plastic bottles (R) plastic bottle top indicating external origin

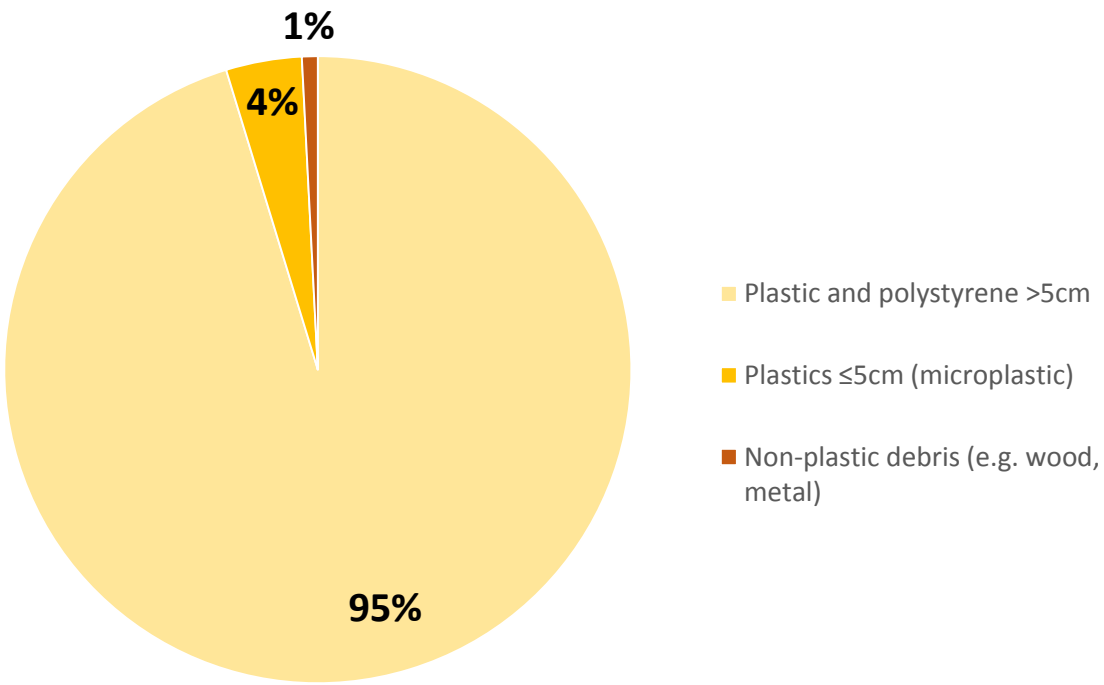


Figure 15: Shark's Valley - breakdown of marine debris by type and quantity

2.2 Opportunistic sampling

Sole Beach

Sampling at Sole Beach was conducted twice (June and October 2018). This site is readily accessible by the community and of the 1,101 pieces of marine debris recorded and removed, there were 540 shoes, 31 port security locks and 97 cigarettes stubs. The remaining 433 pieces of debris, were sea glass and Sole Beach is the only location on island where sea glass can be found in these quantities (see Fig. 17).



Figure 16: Hundreds of shoe soles washed up on Sole beach



Figure 17: Sea glass fragments collected from Sole Beach.

James Bay

In September 2018, the SHNT, in collaboration with Ocean Conservancy, hosted the Island's first International Coastal Clean-up (ICC). SHNT, EMD Marine Section and more than 30 volunteers, counted and sorted 2,521 pieces of litter, which resulted in 151kg of marine debris being removed from James Bay. As a heavily used area, both recreationally (yacht club, SCUBA diving, snorkelling) and industrially (offloading of freight), it is perhaps unsurprising that the majority of marine debris found was of local, single use origin including: 1000 cigarette stubs, 114 metal drink cans, 77 crisp and sweet packets, 67 freight locks, 66 glass beer bottles and 45 plastic bottles.



Figure 18: ICC Volunteers together with the 151 kilos of marine debris found at James Bay



Figure 19: locally sourced marine debris

2.7 Origins overview – where was marine debris from?

Throughout our weekly beach cleans, including those conducted during the DEFRA Microplastics survey, we found that very little of the marine debris collected and removed was locally sourced or produced. The majority of the single-use PET plastic bottles (e.g. for drinking and cleaning) were from brands of Asian origin, such as from Malaysia, Thailand and China, conforming with findings by Leonard, et al., (2018).



Figure 20: Examples of marine debris found that are not locally sourced on Island.

3. Discussion

With St Helena Government already taking positive steps towards sustainability through its ten year Sustainable Development Plan 'Altogether Greener', this project highlighted the Island's commitment to reducing pollution on its beaches and in its waters. This project has enabled the first long term analysis and collection of marine debris to take place on St Helena.

The documentation of a large quantity of *non-local*, single-use plastics, such as drinks and cleaning bottles, corresponds to the study of Leonard et al., (2018) and could suggest that fishing trawlers, yachts, and ships are dumping litter into the ocean while passing through or near the Island's EEZ. Furthermore, the relative 'cleanliness' (i.e. lack of marine organisms) of the external marine debris suggests that the items have not been at sea for a long [period of time otherwise they would most likely have been colonised. Rupert's Bay Beach and James Bay Beach were found to have the most locally sourced pollution and are also the sites where local anthropogenic use is heaviest (Leonard, Melcer, Mallos, & Dove, 2018).

Sandy Bay was found to consistently have the most marine debris, including microplastics (≤5cm). Sandy Bay is on the windward side of St Helena and is known for having strong currents within the bay itself, which could be assisting in the pull of marine debris of all sizes from the open inshore waters, to the beach. Since May 2018, SHNT has been documenting nurdles washing up on Sandy Bay. After investigation into the potential origin of these nurdles, it was established that they had drifted to St Helena from a nurdle spill in Durban in November 2017 (Guastella, 2018). SHNT continue to work with scientists from the University of Cape Town (UCT) that are studying nurdle dispersion rates as part of the Durban Nurdle Spill assessment.

Large waves are channelled into Shark's Valley – also on the windward side of the island – enabling the deposits of larger, heavier items, such as a NewStar Radio Buoy weighing approximately 15kg. This buoy is used in commercial longlining operations. St Helena has a pole and line only heritage – hence this find could give strength to the argument of using marine debris within illegal fishing assessments for marine protected areas (see section 2.1).

Overall, beaches made up of large pebble/boulders (e.g. Shark's Valley and Lemon Valley) were found to have far more intact forms of marine debris than those sites made from sand and small pebbles (e.g. Sandy bay and Rupert's Bay). The substrate make-up of Shark's and Lemon Valley's (large pebbles and boulders) has a two-fold impact on marine debris; the substrate traps large marine debris, inhibiting further break down from wave action and secondly, it makes the identification of microplastics inherently more difficult, as this debris can become cryptic (e.g. hidden/covered by large heavy boulders).

SHNT found no obvious seasonal changes in the type and/or quantity of marine debris recorded at any of the four sites; however this is most likely due to the relatively short survey period. The study found that in comparison to other heavily polluted island nations, such as Hawai'i and Indonesia, St Helena's shorelines are actually relatively clean.

3.1 Sampling difficulties

In March 2019 surveying was challenging and often postponed due to rough sea and weather conditions. Allowances also had to be made for the monthly visits of the cargo ship, MV Helena, which would result in the closure of Rupert's Beach study site for several days.

3.2 Uses of Marine Debris

IUU intelligence

The NewStar Radio Buoy found on Shark's Valley in June 2018, is now being used as evidence within the Marine Management Organisation's (MMO) assessment of Illegal, Unregulated and Unreported (IUU) fishing in St Helena's waters, under the UK Government Blue Belt Programme. The MMO has encouraged the community to report such findings so that the MMO can better inform enforcement assessments for St Helena.



Figure 21: NewStar Radio Buoy from Shark's Valley.

Sea glass up cycling

A successful partnership was established between SHNT and local Jeweller, G-Unique, to upcycle the sea glass collected from the opportunistic surveys at Sole Beach. Each item has a unique design and a donation from every purchase goes to the Marine Debris work of SHNT.



Figure 22: Recycled Sea glass jewellery and the Marine team accepting a donation from G-Unique designs

Precious Plastics machines

The recycling of the less photo-degraded marine debris collected under this project has been conducted in collaboration with SHAPE, utilising the Precious Plastics machines.

SHAPE aims to create key rings, coasters, cups and bowls with this marine debris, to further promote the concept of recycling and the importance of removing marine debris to both locals within the community and visiting tourists. Long term visions include the development of park benches, traffic cones, fencing and play areas out of recycled marine debris.



Figure 23: examples of recycled products using Precious Plastics Machines

Sea Rescue Training

As a remote island nation, Sea Rescue plays a vital role in the safety of the community on St Helena. Old fishing buoys found at Shark's Valley have been donated to the Sea Rescue Services for use within their training programmes.

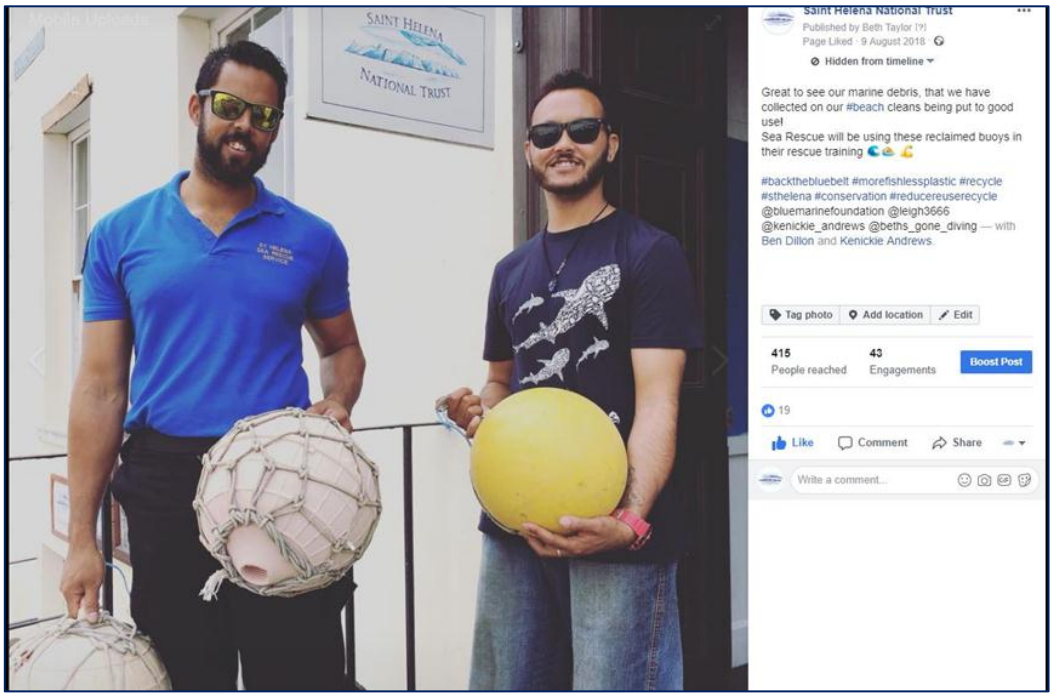


Figure 24: SHNT team donating buoys to Sea Rescue

Art for schools and tourists

The SHNT visited all four schools on the island to lead recycled plastic art lessons, under DEFRA outputs 3.1 and 3.4. Marine debris found during both the weekly beach surveys and the DEFRA Marine Debris Project was used to make recycled plant pots and ocean themed art. Recently, SHNT also partnered with the Art and Crafts Store in Jamestown to showcase marine debris artwork. Pieces of art have been bought by visiting tourists, with each item raising awareness about the DEFRA Marine Debris Project and the ongoing sustainability work of SHNT and St Helena Island.



Figure 25: Top L/R: School children making recycled art out of bottle tops found on beach cleans.

3.3 Recommendations & Future Research Priorities

Continued weekly monitoring of marine debris should take place on Sandy Bay and Rupert's Bay, with surveys of St Helena's less accessible beaches conducted when possible. Any nurdles found should be sampled and sent to colleagues at UCT for analysis.

Efforts should also be made to assess the potential presence and abundance of marine invasives that are utilising marine debris as a vector for entering St Helena's waters.

From a practical perspective, the provision of outreach material and additional bins at Rupert's Bay, Sandy Bay and James Bay could encourage an increase in the correct disposal of localised rubbish, however it may not lead to an increase in people correctly disposing of *external* marine debris already deposited on the beaches. Discussions with the Harbour Master and Port Security/Operations should take place to tackle the issue of incorrect disposal of single use freight locks.

Information collected under this summary report should be examined in conjunction with the results from outputs 2.2, 3.4 and 4.6 and incorporated in to both schools education programmes and wider community outreach.

4.0 Conclusion

It is clear that St Helena is affected by marine debris of various types and sources that washes ashore from the ocean. Barnes, et al., (2018) described a ten-fold increase in plastics pollution within remote areas of the South Atlantic. However, it is encouraging to find that when compared to other locations around the world, such as Indonesia, Maldives and Hawai'i, the shorelines of St Helena are in fact relatively clean.

The overwhelming majority of marine debris recorded in this project was plastic and was not from activities on St. Helena but rather from external marine sources, such as international fishing and shipping.

As the tourism offering of St Helena develops, future increases in the amount of plastic on the beaches of St Helena should be considered as a threat and appropriate action should be taken to minimize this impact (Leonard, Melcer, Mallos, & Dove, 2018).

As the myriad of threats to marine ecosystems (and their relating compounding impacts) continue to worsen globally, we advise that St Helena, particularly when developing its IUCN Category VI Marine Protected Area, should be viewed as an important site for global monitoring of the ocean plastics crisis (Leonard, Melcer, Mallos, & Dove, 2018).

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Appendix

Marine Debris breakdown by site, taken from Ocean Conservancy's and Georgia Aquarium's initial quantitative assessment in February 2018.

