



THEME 4 MARINE DEBRIS MONITORING REPORT

JANUARY 2023 - DECEMBER 2023

Annual report on the BCSS Ocean Observatory marine debris collections conducted in collaboration with Universal Plastic.





LOCATIONS BENGUERRA ISLAND

LOCATIONS

QUICK FACTS

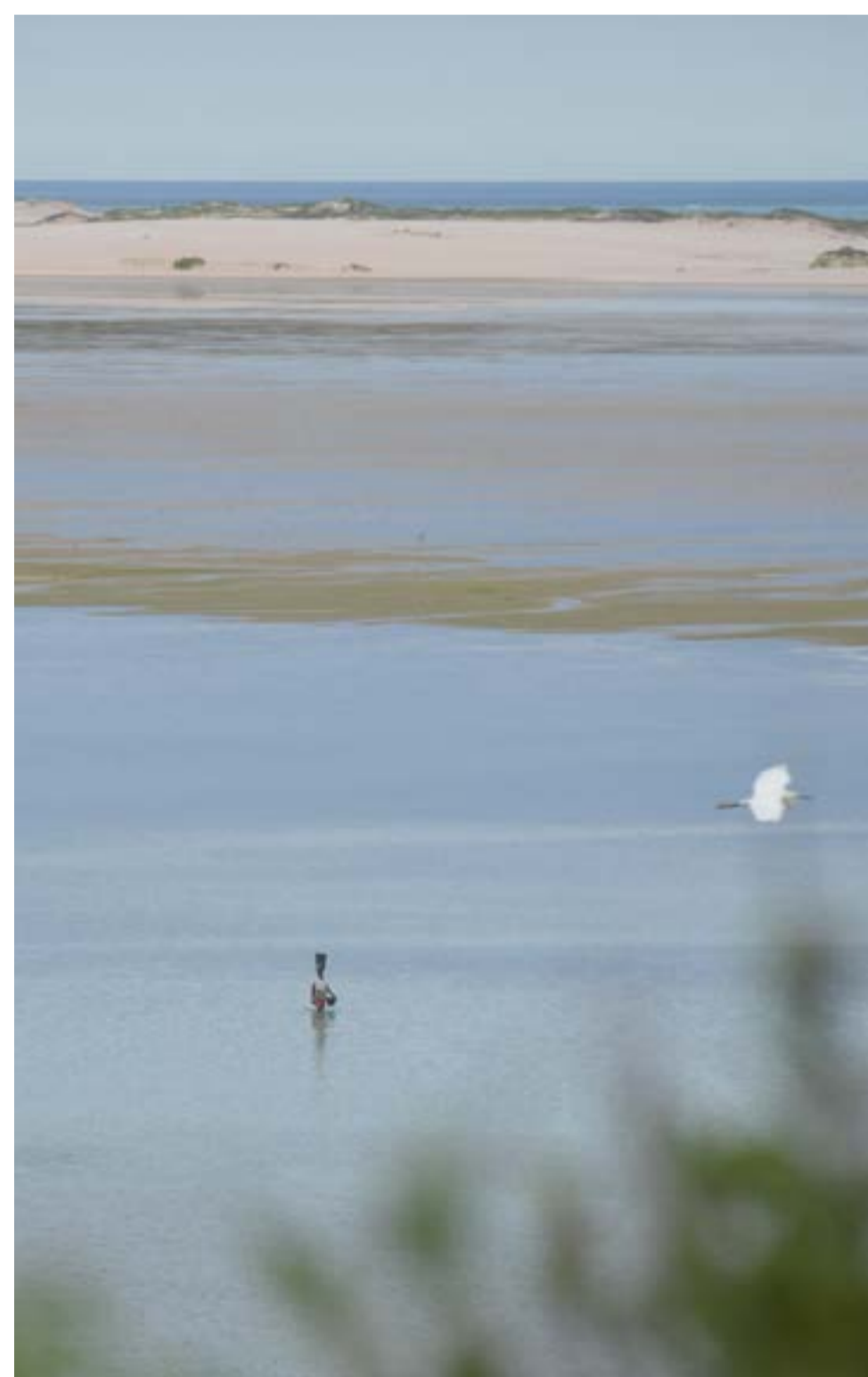
TOTAL WEIGHT

PLASTICS

Benguerra Island

A nearly untouched environmental paradise, the Bazaruto Archipelago is often referred to as the 'Hidden Gem' of the Indian Ocean. The waters surrounding the archipelago host the last viable population of dugongs in East Africa, along with five species of sea turtles, numerous sharks and rays species, mantas, whales and dolphins, and other iconic megafauna. Encompassing several tropical marine ecosystems, the BANP plays a crucial role in supporting the diverse wildlife found in the park's waters and on its islands.

Benguerra island contains large white beaches, coastal sand dunes, savannah grassland, marshes, evergreen dune forests, wetland eco-systems, freshwater lakes, mangrove forests and seagrass meadows. In this wide range of habitats live around 140 bird species, multiple species of reptiles and amphibians, and a few mammals, including red squirrels and antelope suni. The Archipelago is home to a population of approximately 3,000 people living in traditional fishing villages.



MUDFLATS ●



MANGROVES ●



BEACH ● ●



SEAGRASS ●



SITE A: 168 000 m²

SITE C: 40 000 m²

SITE E: 40 000 m²

SITE B: 168 000 m²

SITE D: 40 000 m²

● SITE A: BEACH

● SITE B: BEACH

● SITE C: MUDFLATS

● SITE D: MANGROVES

● SITE E: SEAGRASS

LOCATIONS

METHODOLOGY

The marine debris monitoring program is a collaborative initiative between BCSS and the Bazaruto Archipelago National Park on Benguerra Island. Monthly accumulative surveys on pre-determined study sites reflect the main approach of data collection. Acquired information helps to shed light on how debris enter and accumulate in different ecosystems of Benguerra Island (Mangrove, Seagrass, Mudflats and Sandy beach), enabling better understanding and linking the waste pollution problem to socioeconomic and local community activities, as well as its environmental drivers. To ensure consistency in data collection, surveys are done by a trained group of surveyors that include: the BANP beach clean-up crew, BCSS staff, students, and interns. All debris collected are removed from the island and sent to Mozambique mainland for recycling.

Methodology

Weekly surveys are conducted at one site at a time using GPS and an [artificial intelligence mobile application](#). Surveyors traverse the site in a zig-zag pattern, collecting visually identifiable debris into 60 L empty sacks. The debris is transported to a facility for sorting into categories: PET bottles, soft plastics, hard colorful plastics, foam/polystyrene, rubber/flip-flops, clothing, fishing gear, aluminum cans, other metals, and glass. The total weight is recorded for each category. Ten items are randomly selected from each category for additional data collection, including origin/users, sector/industry, brand, and country. Unusual observations are documented with comments and photographs. AI calibration for the specific plastic groups is being done via photographing collected waste. Data are entered onto the master database along with weather and ocean variables. Collated datasets are compared with the AI-generated data for further calibration of the application's algorithms. The marine debris database can be linked to other environmental databases for continuous or monthly analysis. By coupling plastic data with multiple weather and ocean parameters, we are trying to understand environmental drivers besides the human dimension.

SECTOR	ECOSYSTEM	DISTANCE (m) area (m ²)	START LAT (S)	START LONG (E)	END LAT (S)	END LONG (E)
A	Beach (North)	4000	21°50'59.38"	35°27'24.85"	21°49'56.18"	35°27'40.95"
B	Beach (South)	4000	21°52'07.11"	35°27'14.32"	21°50'59.38"	35°27'24.85"
C	Mudflats	2000	21°50'42.89"	35°27'03.92"	21°49'57.39"	35°27'24.85"
D	Mangrove	16025	21°52'54.44"	35°25'26.52"	21°53'09.17"	35°25'29.15"
E	Seagrass	39708	21°50'42.06"	35°27'04.15"	21°50'39.54"	35°26'53.84"



UNIVERSAL PLASTIC PARTNERSHIP

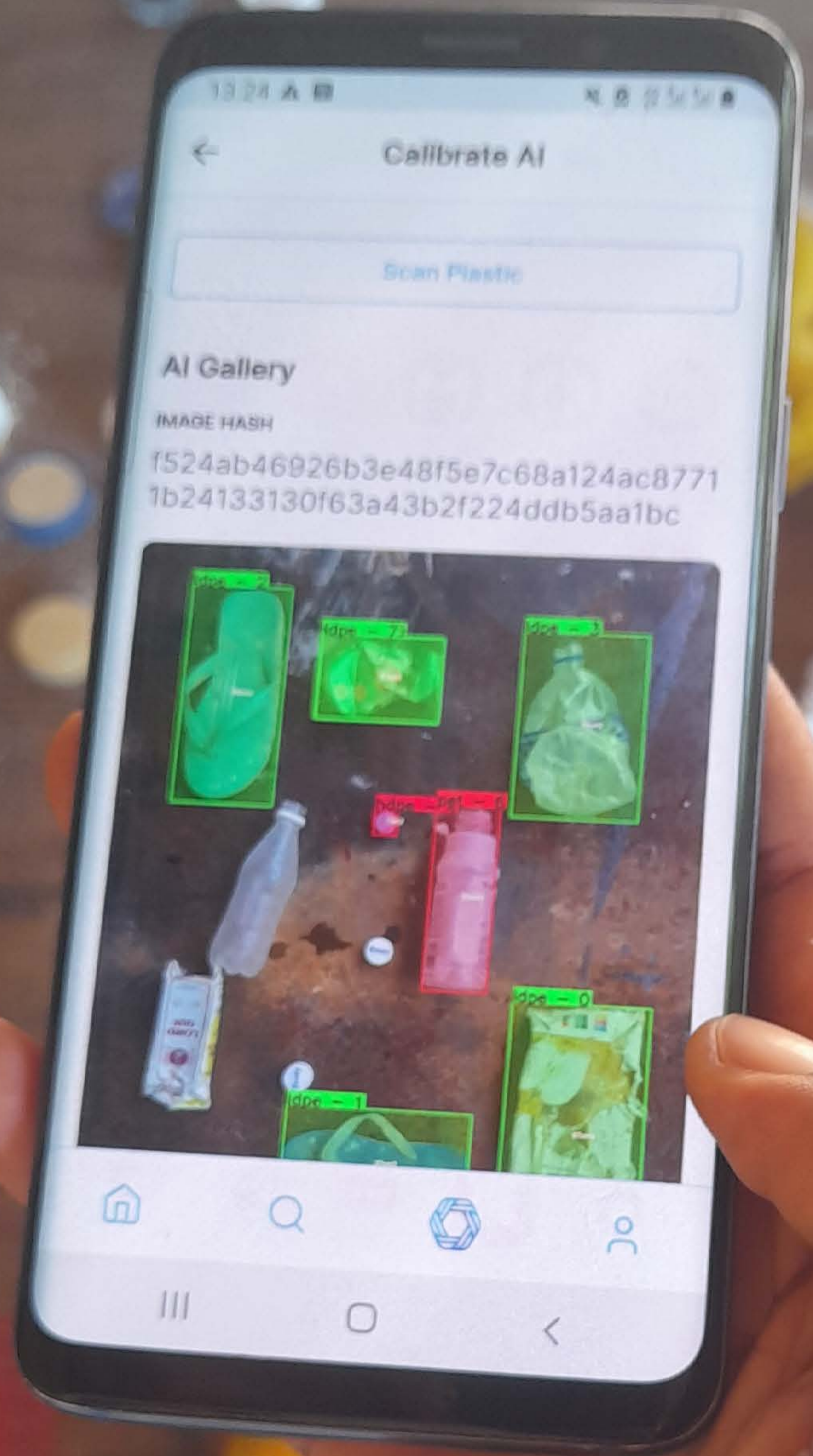
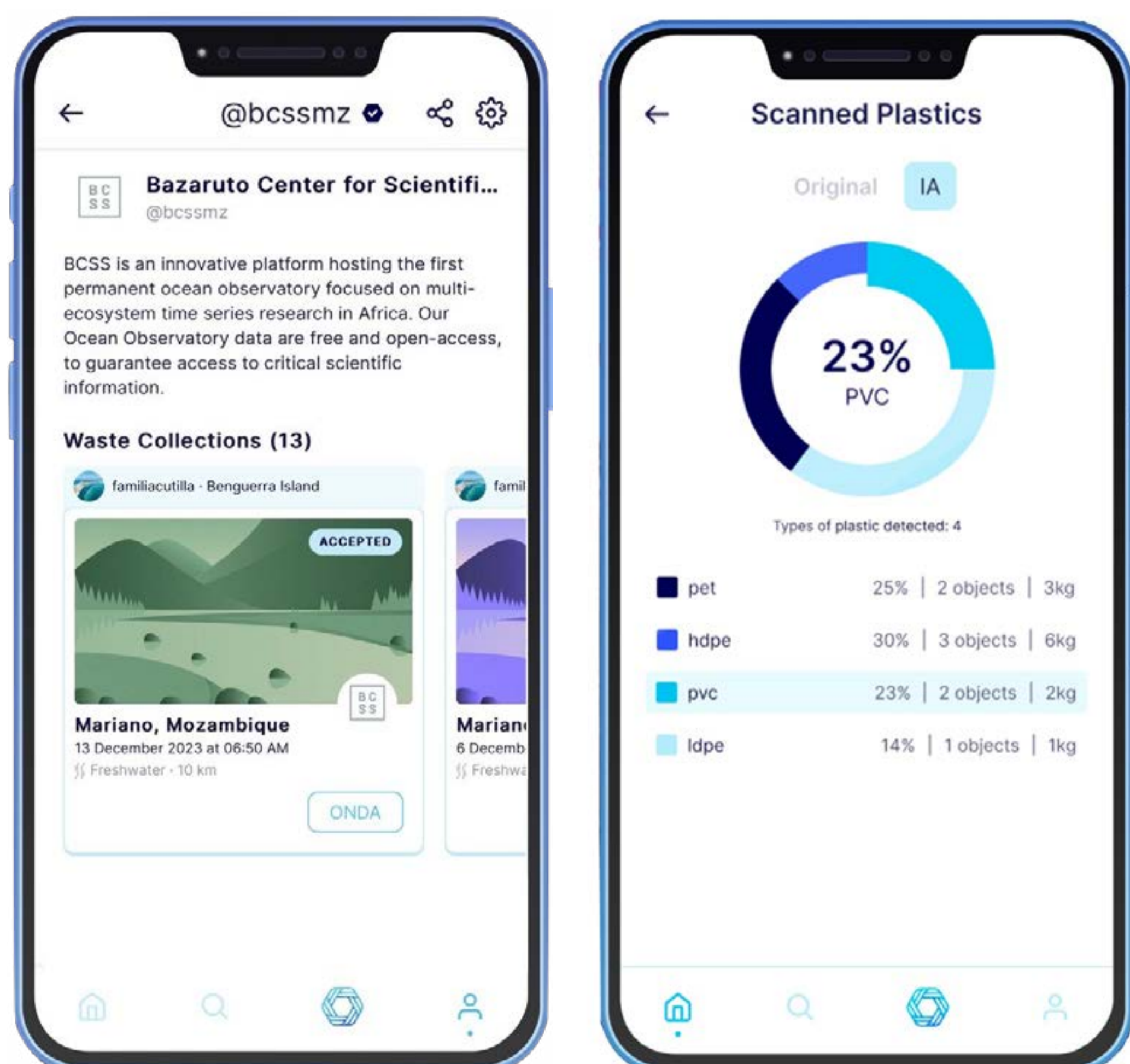
BCSS started working with [Universal Plastic](#) in 2023, a new organisation contributing to insights into the transparency and traceability of marine debris on a global scale using AI algorithms and blockchain technology. Their tracking system aims to close the plastic waste circle. The Memorandum of Understanding was signed in March 2023. Traced data reveals the true uses and routes of plastic waste globally, facilitating data and therefore greater control over the CO2 footprint of plastic waste. With the scientific advisory from BCSS UP will leverage BCSS's data towards quantification of the pollution impact on the environment in general and marine ecosystems in particular.

Using the app

Collaboration between BCSS and Universal Plastic allows anyone who wants to be part of a change to play an important role in better understanding the pollution issue via contributing valuable data and helping us to tackle this global problem. You can become an [Ocean Defender](#) by joining the Universal Plastic platform and helping the planet to better manage plastic waste issues. Every clean up organized through this platform contributes data to the research and generates funds for science around the marine environment.

The app can be used for:

- Capturing plastic waste data
- AI measurement & classification
- Sharing your social experience
- Initiating a waste collection & inviting others to join you
- Joining already scheduled waste collections



UNIVERSAL
PLASTIC



Bazaruto Center for Scientific Studies

LOCATIONS

QUICK FACTS

TOTAL WEIGHT

PLASTICS

QUICK FACTS

2023

LOCATIONS

QUICK FACTS

TOTAL WEIGHT

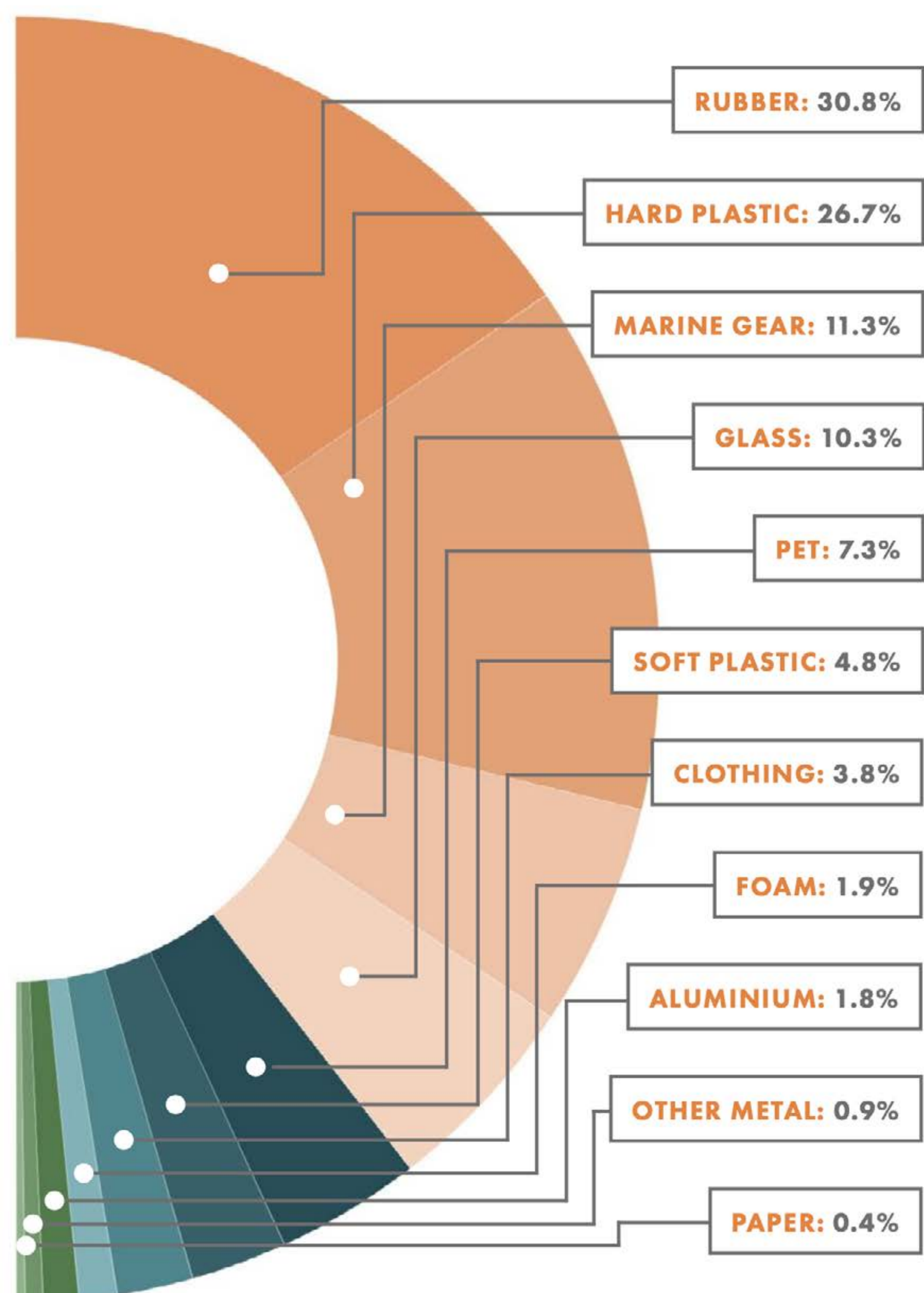
PLASTICS

TOTAL WEIGHT	Nº OF COLLECTIONS
1.629 kgs	42
HOURS SPENT	FREQUENCY
125 hours	av. 1 x week

At the Waste Management Facility of the BCSS station, marine debris is first weighed, then sorted into different categories, including various types of plastic, glass, paper, and metal. Data on type of product and - if traceable - origins are collected while the team sorts through the debris. After this process, the marine debris is sent to the Bazaruto Archipelago National Park's recycling facility on Benguerra, where as much plastic as possible is transformed into construction materials.

Almost one out of three items collected is categorized as rubber (30.8%), making it the most prevalent material among the marine debris, closely followed by hard plastics (26.7%). Marine gear, such as fishing nets and lines, lures and discarded hooks, takes the third place with 11.3%. Glass takes up 11.3% of the total, but this may be due to the weight - the volume of the material might be comparably smaller than other categories.

Marine debris (cumulatively)



TOTAL WEIGHT OVER TIME

LOCATIONS

QUICK FACTS

TOTAL WEIGHT

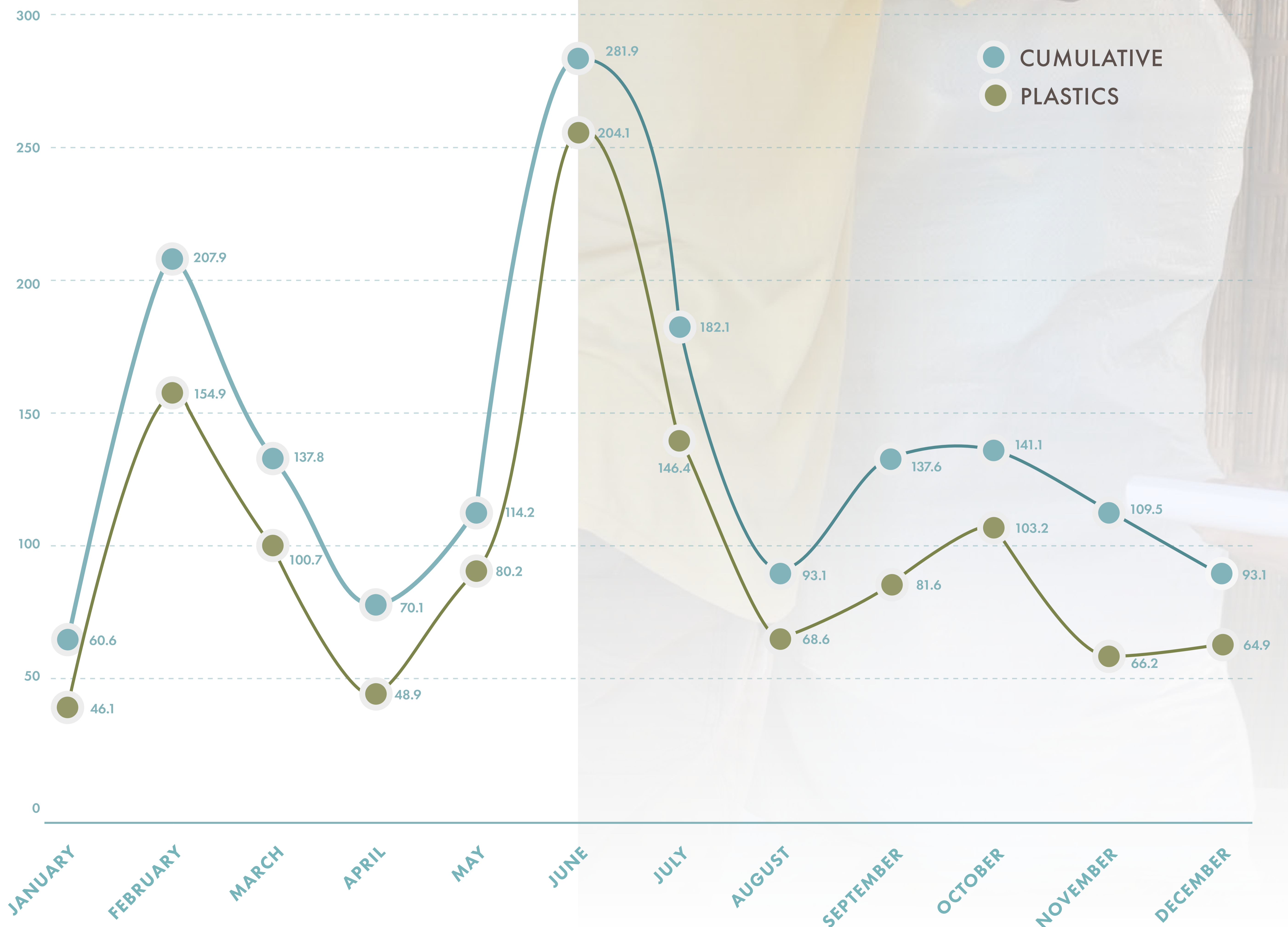
PLASTICS

Total weight of collections

The monthly marine debris collected in 2023 averages 135.8 kg per month, with the highest amount collected in June (281.9 kg) followed by February (207.9 kg) and July (182.1 kg). The least marine debris found was in the months of January, April August and November - averaging roughly 50kg of waste collected in those months. The big contrast between January and February might be due to the weather conditions, as strong winds are typically present in the Bazaruto Archipelago during February. Winds create stronger ocean surface surge, which in turn may increase the amount of marine debris ending up in Benguerra Islands ecosystems including the mangrove forests, beaches seagrass meadows and mudflats monitored by BCSS.

Making up averagely 72,3% of all marine debris collected, plastics are the most common found material during beach-clean ups. Most plastics found are either rubber (30,8%), hard plastic (26,7%) or marine gear (11,3%).

Cumulative marine debris collected (kg) per month



PLASTICS PER TYPE

LOCATIONS

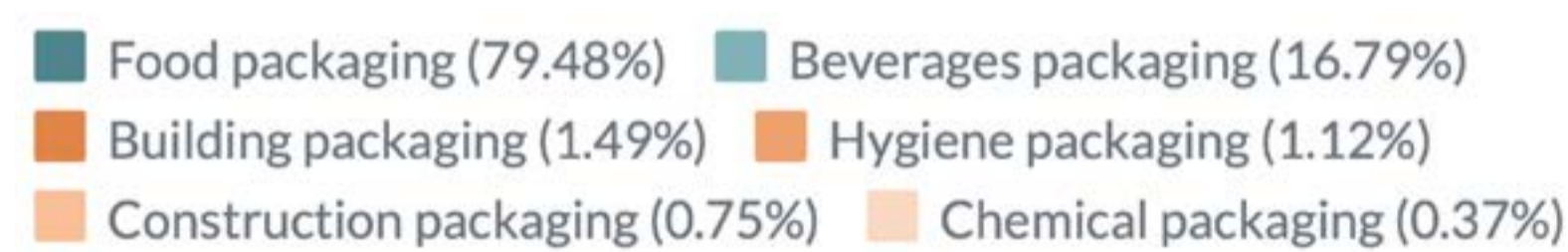
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Soft plastics

Soft plastics are thin, single-use plastic materials, typically used for sanitary reasons, to protect the product or to conserve food for a longer time. Food packaging was found the most during marine debris collections, covering nearly 80% of all soft plastics found in 2023. Food packaging includes single used plastic around snacks such as biscuits, crisps or ice cream. The thin plastic label around (hard plastic) drinking bottles were also found often, making up for almost 17% of all soft plastics. Other types of soft plastics found include building and construction packaging, chemical packaging and hygiene packaging.



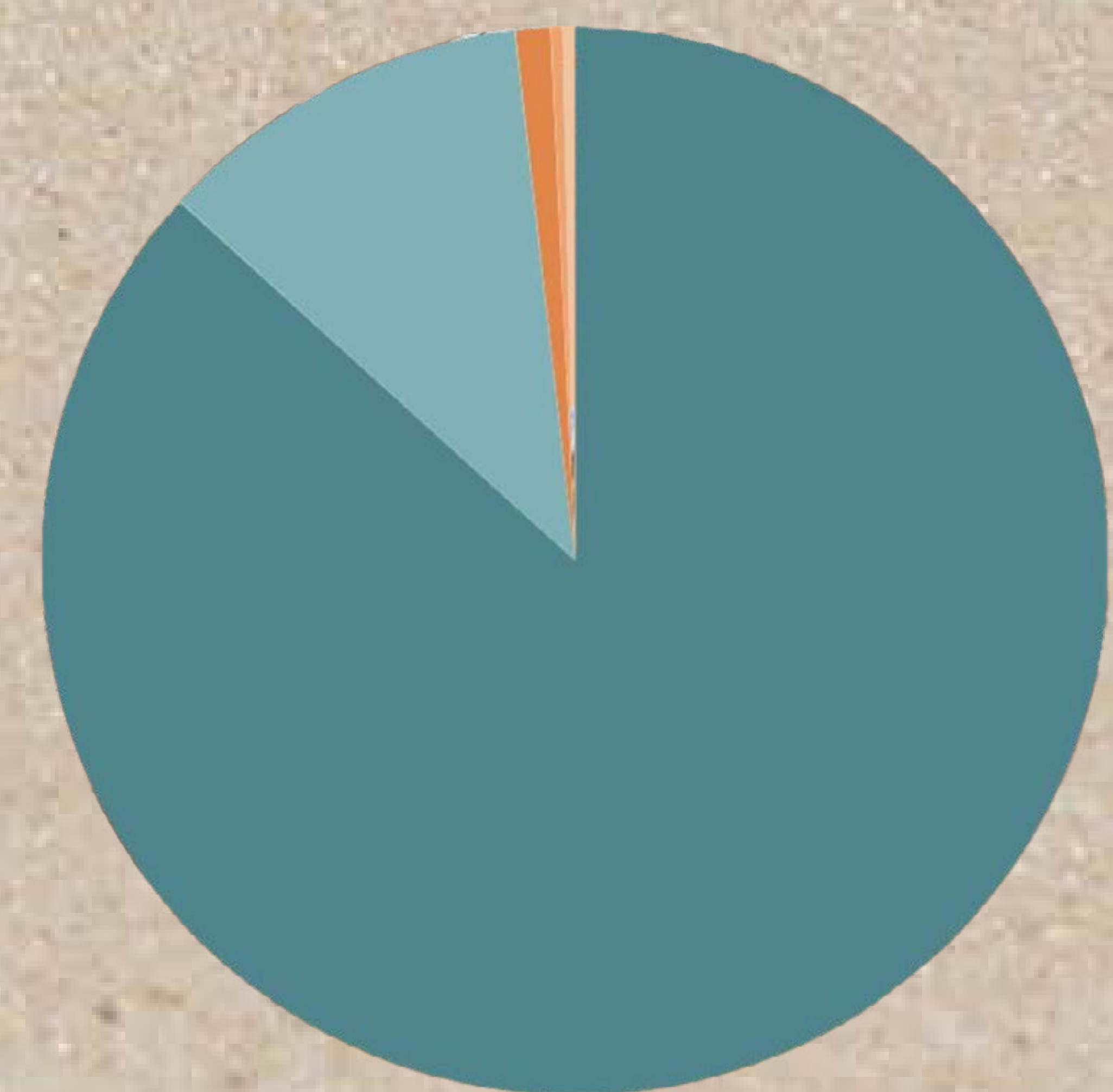
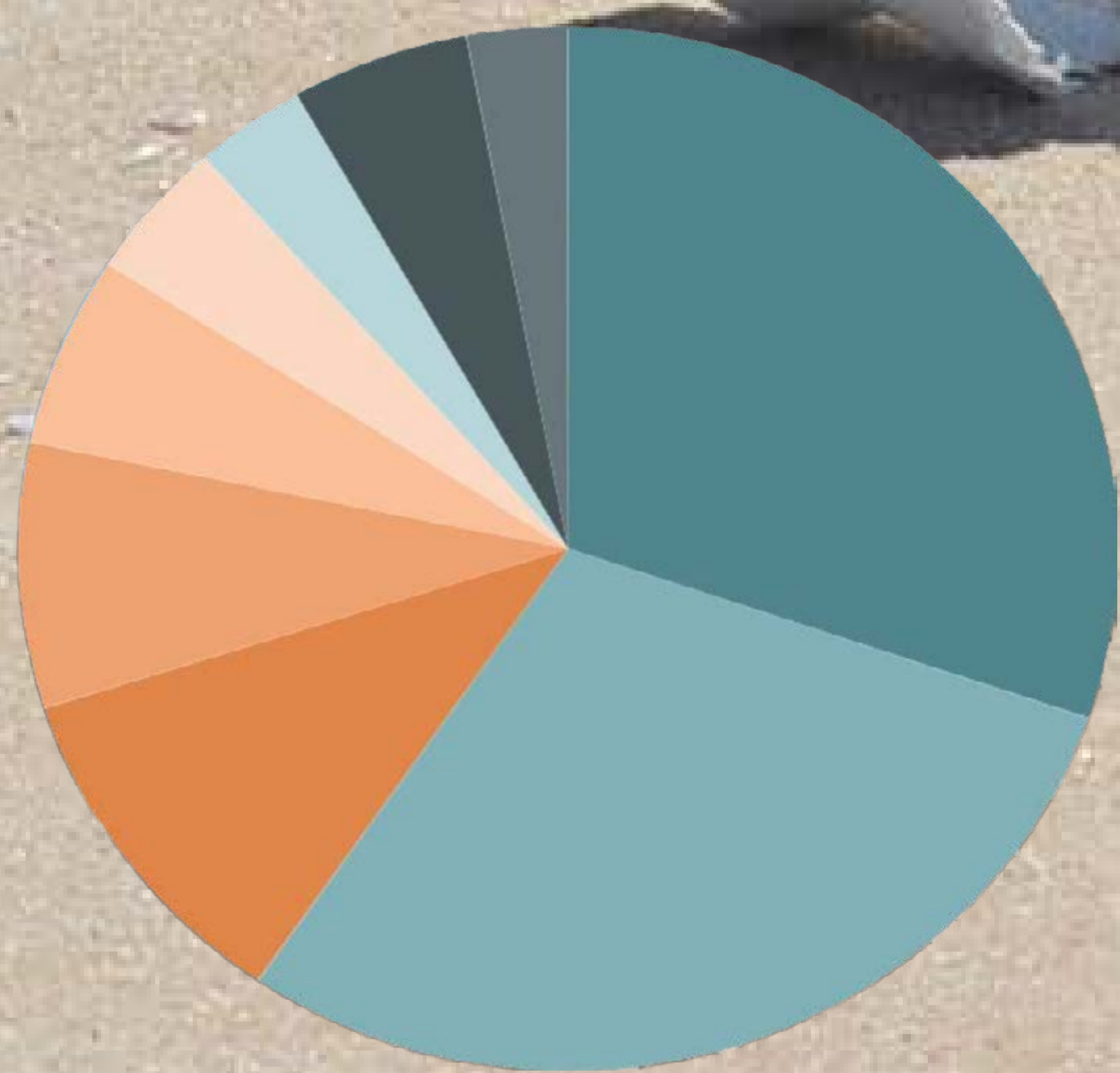
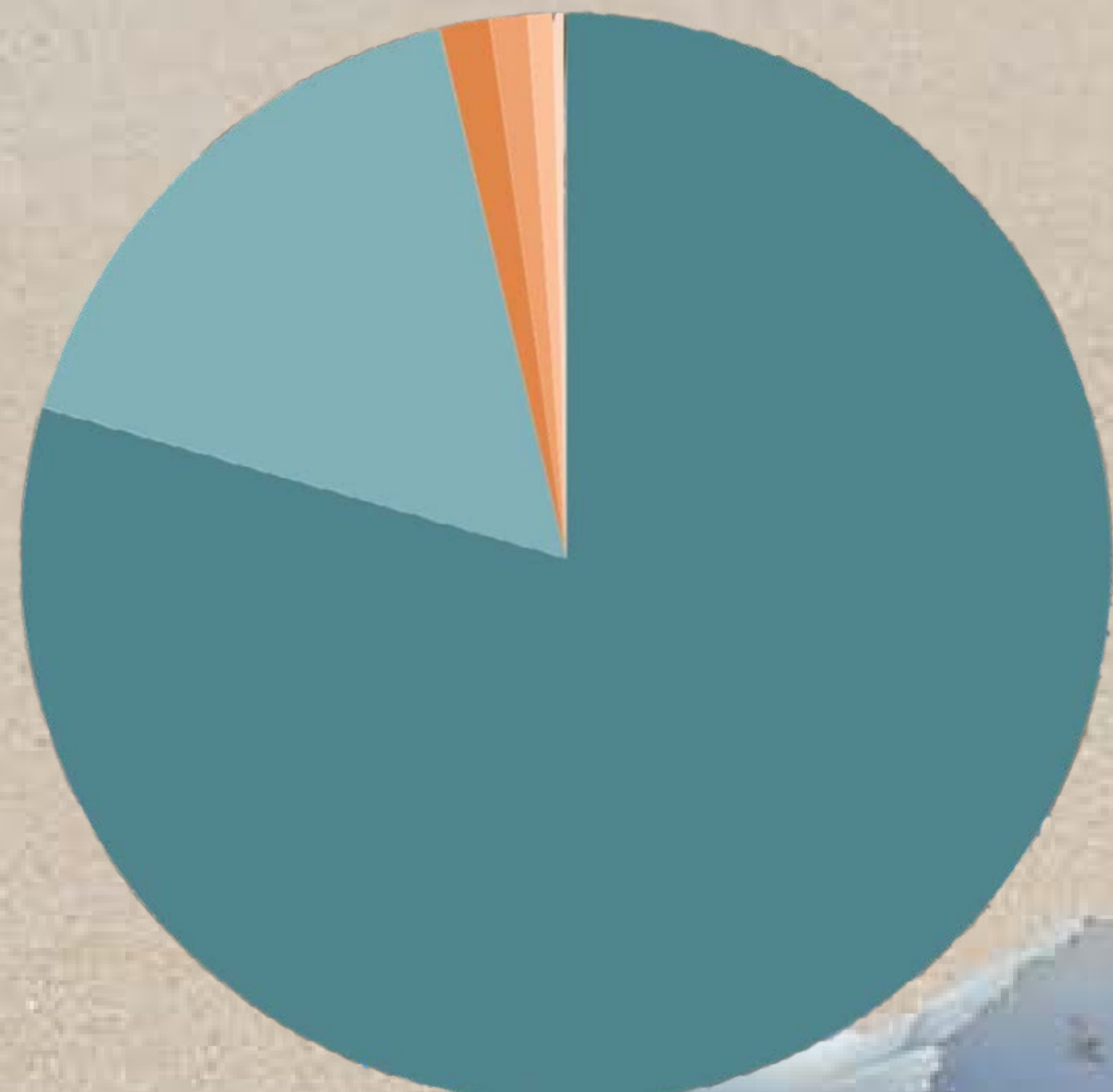
Hard plastics

Hard plastics are thicker than soft plastic, and not easily bendable. Examples are discarded buckets, toys and tooth brushes. In 2023, the most commonly found hard plastics were beverage-related, for example drinking bottles and their caps and water gallons (nearly 30%). Cleaning products, such as bottles of bleach, take up the second place on the chart with just over 10%. Residue in the cleaning products is typically highly chemical, causing damage to the (reef) ecosystems surrounding Benguerra Island as it enters the ocean. Hygiene, food and mechanic products were also commonly found, but unfortunately most of the hard plastics were not traceable (>30%).



PET bottles

PET bottles are recyclable single-use drinking bottles, which unfortunately most often end up in landfill or, like on Benguerra Island, in (coastal) ecosystems. The vast majority of the PET bottles collected in these ecosystems were beverages (>85%). Because the sun bleaches the label, making it unreadable, or the label has fallen off the bottle by the time it is picked up by the BCSS team, it is often hard to determine the original product, resulting in more than one out of ten found bottles being categorised 'not traceable'. Sporadically, upon inspection the PET bottle is classified as a food product (1%), or cleaning (>1%) / hygiene (>1%) packaging.



LOOKING AHEAD

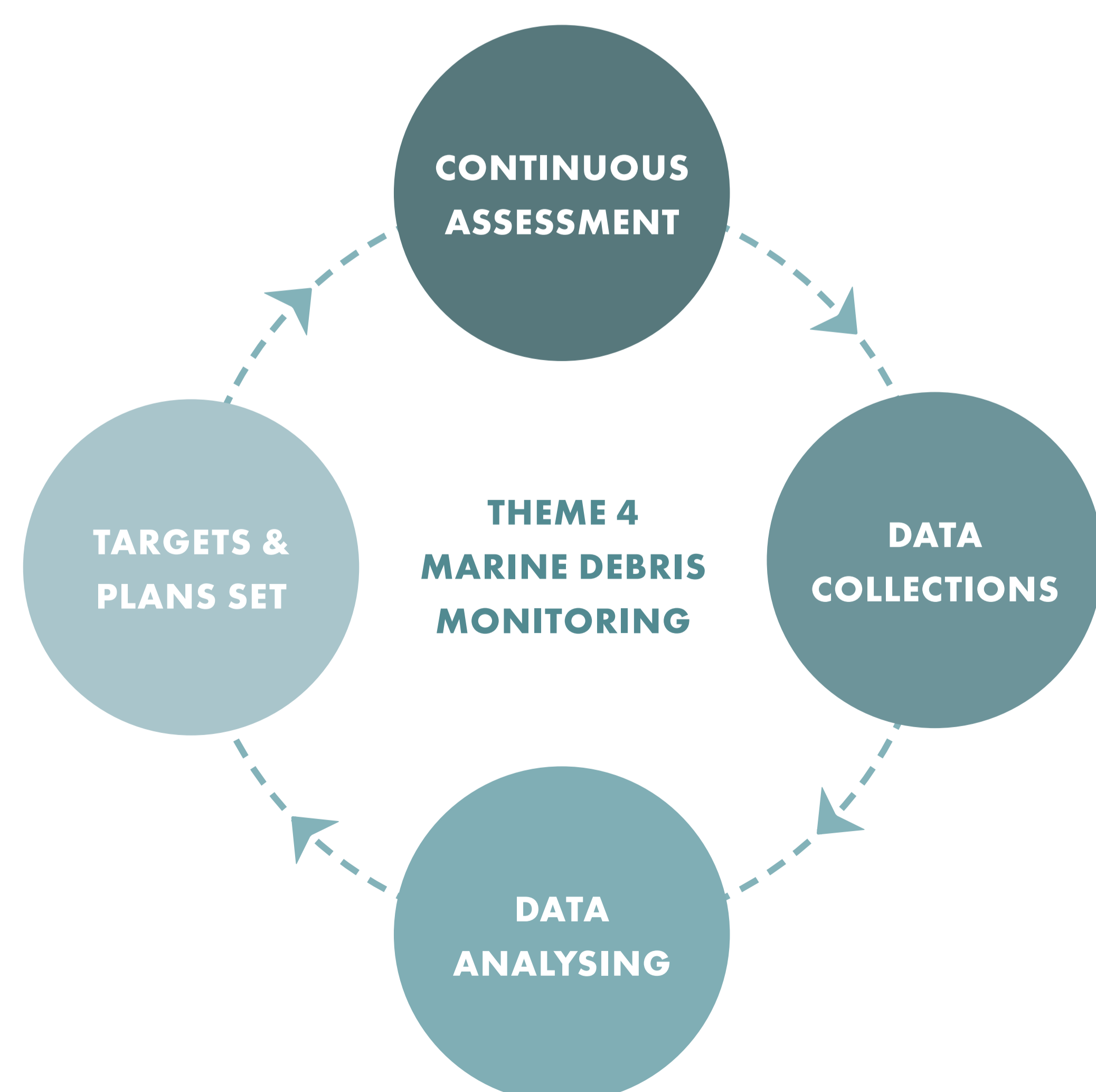
Coupling data

In parallel to the marine debris data, BCSS gathers weather and ocean-related data. This information is cross-referenced, and the BCSS team is currently looking at external factors and pairing them with the marine debris, aiming to provide more detailed information later this year. BCSS currently has the capability to receive in-situ data via a new set of models and API work to collect up to 500 variables simultaneously. The data is global as it is retrieved via GPS, of which some nearby the BCSS station. Coupling data such as air humidity, cloud coverage, precipitation, wind, swell, waves, tides and currents with marine debris collections can provide unique insights in to the journey of the plastic waste and more. Examples of the 110 mixed models used to obtain these data are radar altimetry, ROMS, Mm-euro1k, Arome and Meteosat.

For precision balance, subsets of the marine debris collections are sent to the BCSS's on-site laboratory to calibrate against the Universal Plastic AI results. The marine debris items are weighted and measured individually.

Prospects

Our prospects are to realise longevity of the current data-sets, processes (through the Waste Management Facility, Universal Plastic application and laboratory work). Through consistent and precise data collections over time, the team hopes that valuable insights into plastic waste will become evident, which in turn may inspire (governmental) waste management strategies to be written to combat the plastic pollution crisis marine environments are coping with.



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