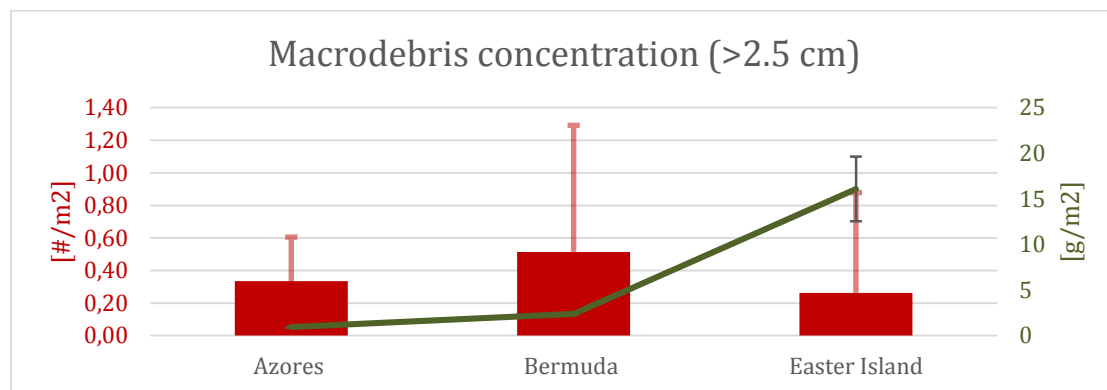


## Race for Water Odyssey Preliminary results from the Azores, Bermuda and Easter Island

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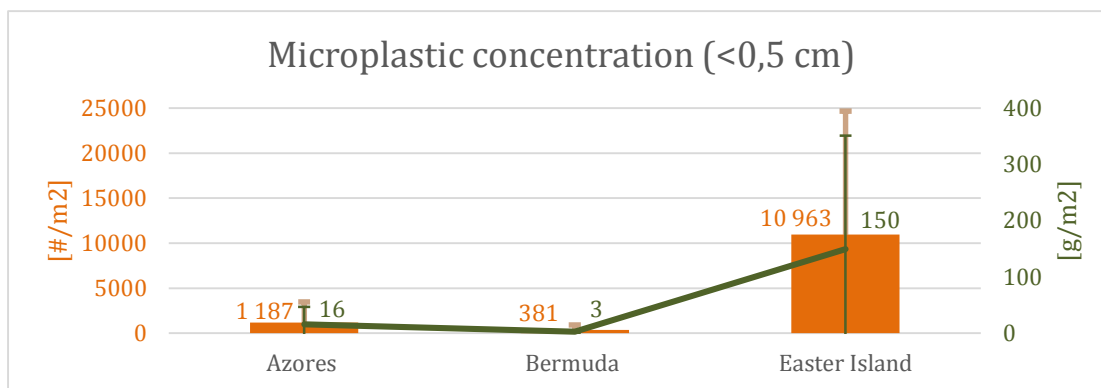
Institution: The results were obtained with the assistance of EPFL's Central Environmental Laboratory and with the support of Professors Felipe De Alencastro and Florian Faure

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Of the waste collected, plastic made up nearly 69% of all macro debris in the Azores, 79% in Bermuda and 92% on Easter Island. The average concentration at these three stopovers was between 0.26 and 0.51 pieces of waste of over 2.5cm in size (macro debris) per square metre of beach. Concentration was highly variable from beach to beach in any given place. The beaches sampled in Bermuda showed the highest average waste with 0.51 macro debris per square metre.

The concentration of macro debris by weight presented a different trend however with Easter Island outstripping Bermuda and the Azores. These preliminary results demonstrate that there is no correlation between macro debris quantity and weight. Specifically, Easter Island demonstrates that certain large items of debris, such as rope or containers, can significantly impact concentration on the smaller beaches. These results are relative however because the concentration of large waste is highly variable and dependent on the frequency of beach cleaning operations which are systematic across all three islands albeit with varying regularity.



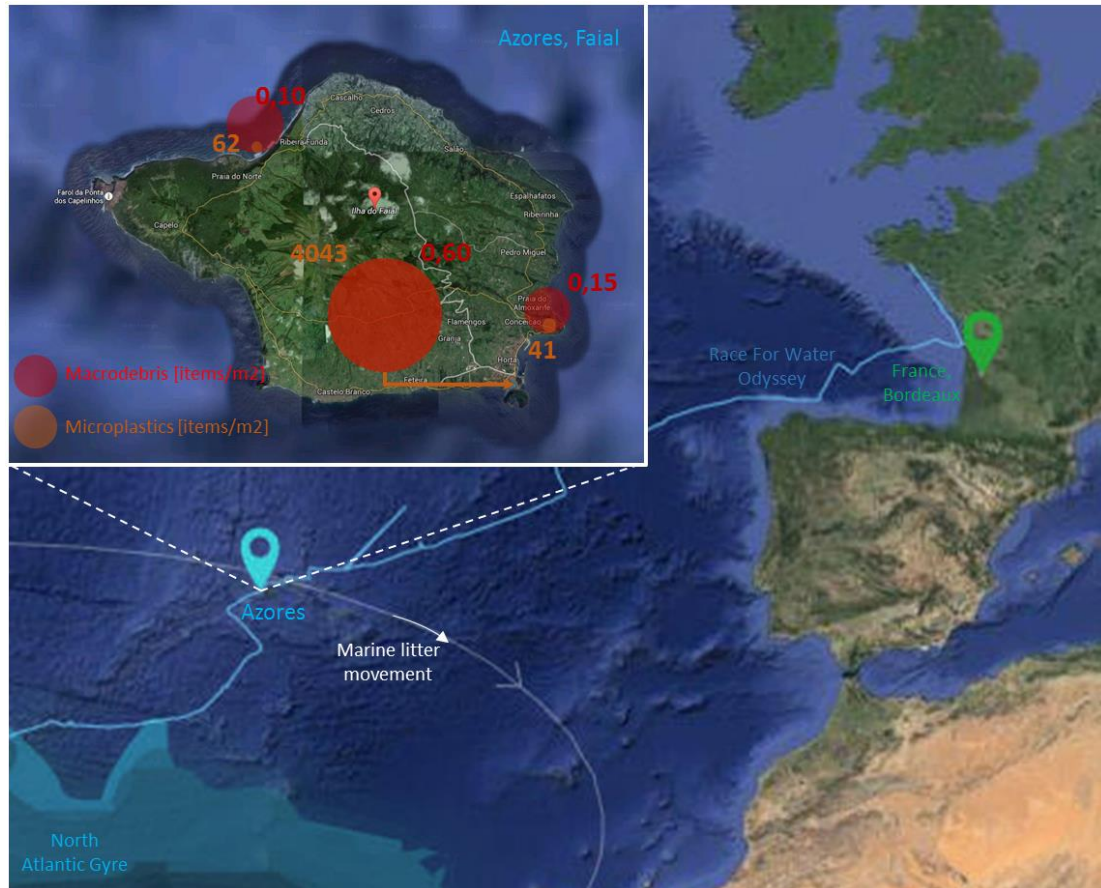
Micro plastic concentration (<5mm) was highly variable between beaches on the same island. But tests demonstrated that the Easter Island beaches (Ovahe and Anakena) have 10 times the concentration of plastic than the Azores beaches (Norte, Porto Pim, Almoxarife, Conceição) both in terms of quantity and weight per square metre sampled.

Contrary to the macro debris results, Bermuda appears less exposed to micro plastic pollution than the Azores and Easter Island.

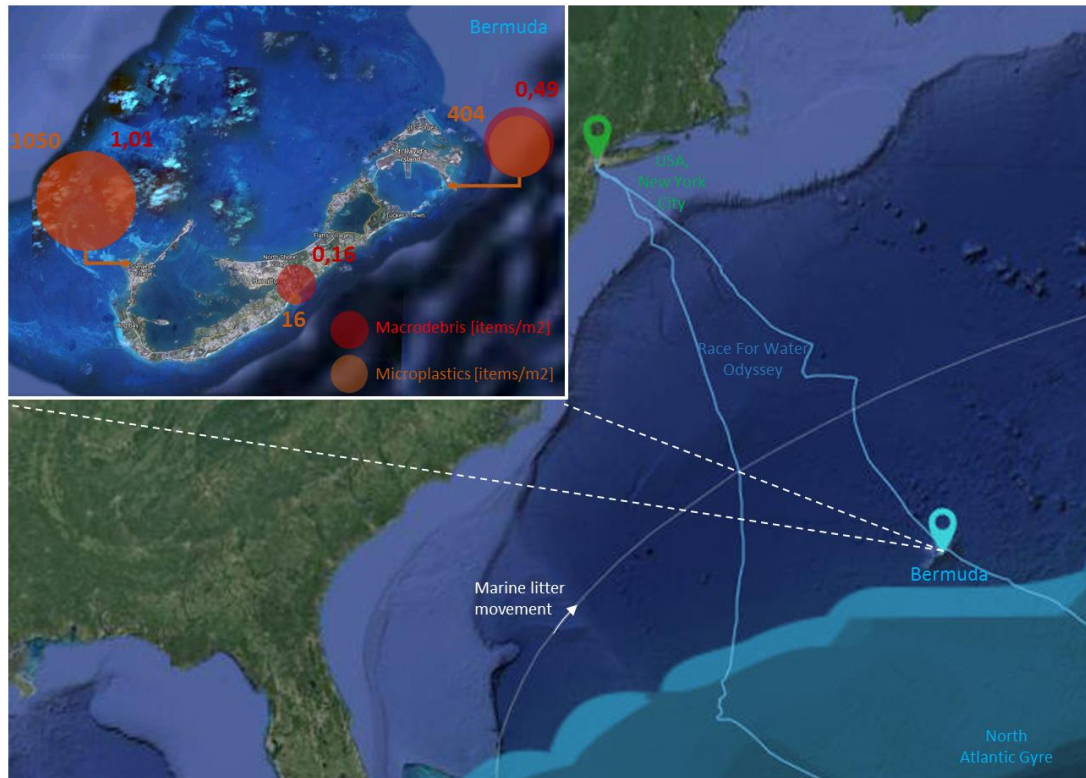
In terms of data gathered on the micro debris mass, the figures correlate with a resulting average weight of 13.5mg in the Azores, 7.8mg in Bermuda and 13.7mg of micro plastics on Easter Island. Beyond the consistency of the data, the most striking conclusion is that the concentration in mass of micro plastics per square metre is much higher than that of macro plastics. Although it is important to note that these results are relative as the concentration of macro debris is dependent on beach cleaning operations whereas micro debris is rarely cleaned up.

The concentration of macro debris is directly connected to local awareness of waste management. Locally generated waste needs to be considered in some cases. Marine debris is generally broken down by the sea or ocean.

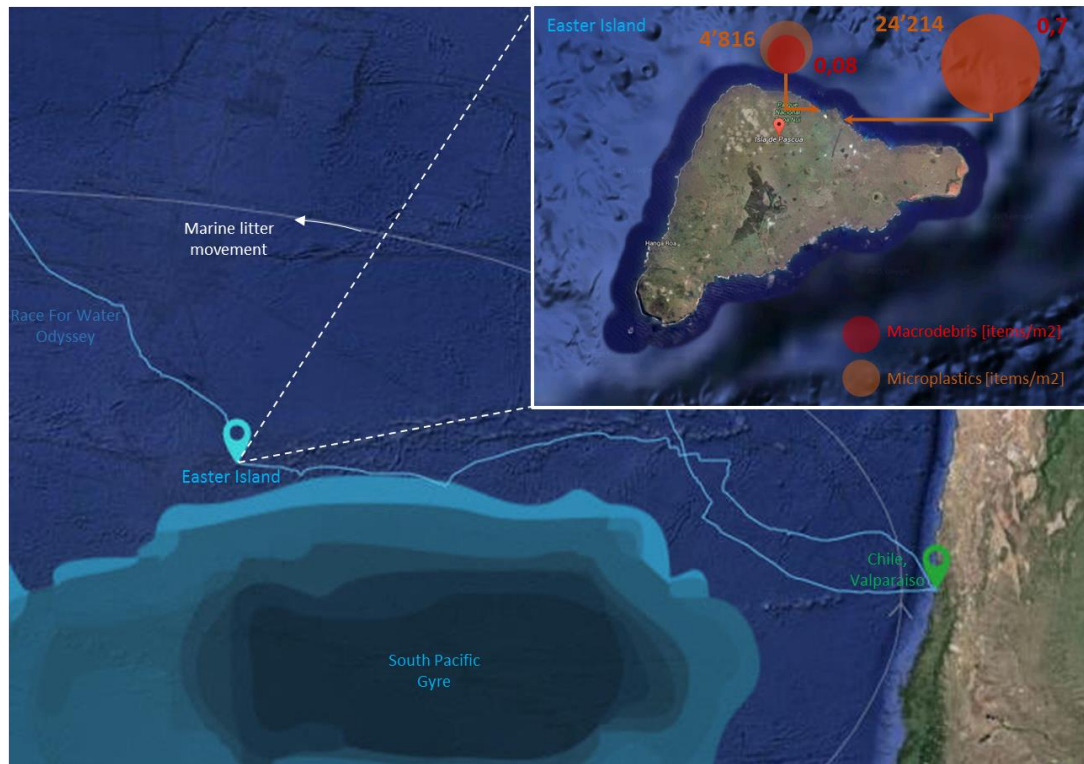
In other words, the geographic location of the islands studied by R4WO relative to continents or urban hubs could be a parameter that explains why there is a higher concentration of macro debris on islands close to continents. Conversely, distance from continents and proximity to ocean gyres where waste collects and breaks down could be a parameter that explains the greater concentration of fragmented debris, or micro plastic, on Easter Island. Due to the small number of islands studied and sampled at this stage of the research, these theories require further analysis.



Locally, the concentration of waste is extremely variable and is based on geographic location. This finding is logical as waste patterns rely on ocean currents. In this context, the southern tip of Faial Island, which has a southwest facing beach, acts as a natural waste trap for debris drifting from west to east. The Norte beach has some particular characteristics; it faces northwest, is sloped and has a regular swell with powerful waves and a sandy beach. This may explain the low quantity of micro plastics. It is also regularly cleaned. On Do Norte and Conceição beaches, large plastic debris (>2.5cm) is widespread. The nearby landfill site in the case of Do Norte and an urban centre near Conceição could explain the locally generated macro plastic found on these two beaches. Frequent cleaning of Almozarife beach may explain the absence of any macro plastics.



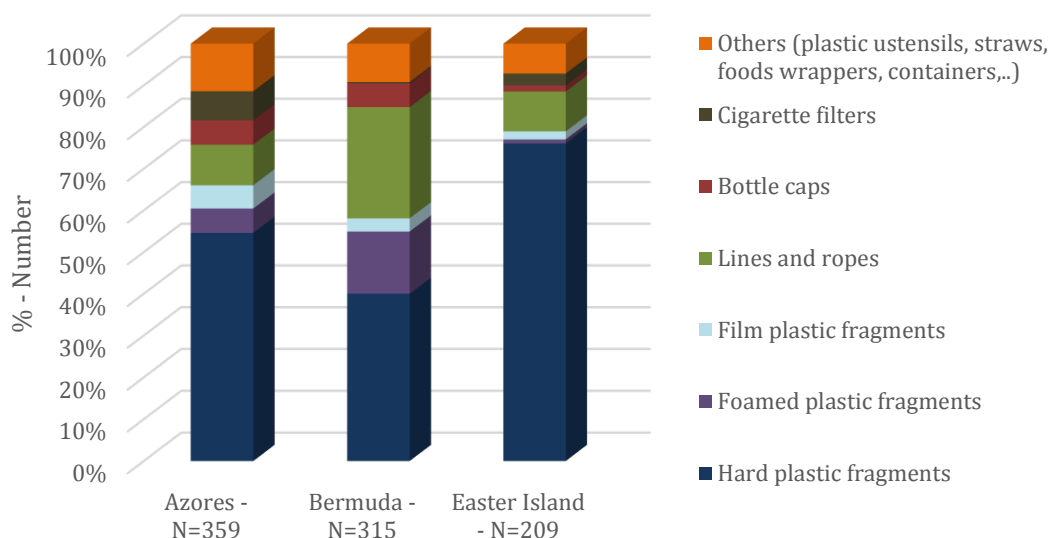
In Bermuda, R4WO recorded the highest amount of micro and macro debris on Somerset Long Bay beach in the southwest. Local residents contest this saying that the majority of the waste comes in from the east. The conflict between the R4WO results and local testimony is likely due to a recent clean up operation on the beaches in the east of the island. In addition to the local testimony, the fact that Well Bay beach, situated on the north eastern coast, forms a small south westerly facing cove that acts as a waste trap for debris drifting from southwest to the northeast may explain the significant concentrations of debris despite a recent clean up. According to local experience, Well Bay beach is the most affected by marine debris.



Sampling on Easter Island is less representative than the other two locations as only two beaches, Ovahe and Anakena, were studied on the northeast coast of the island. This was due to the steep and rocky nature of the rest of the coastline. Ovahe beach faces east and Anakena faces northwest, the concentration of waste suggested that the debris flow is from east to west.

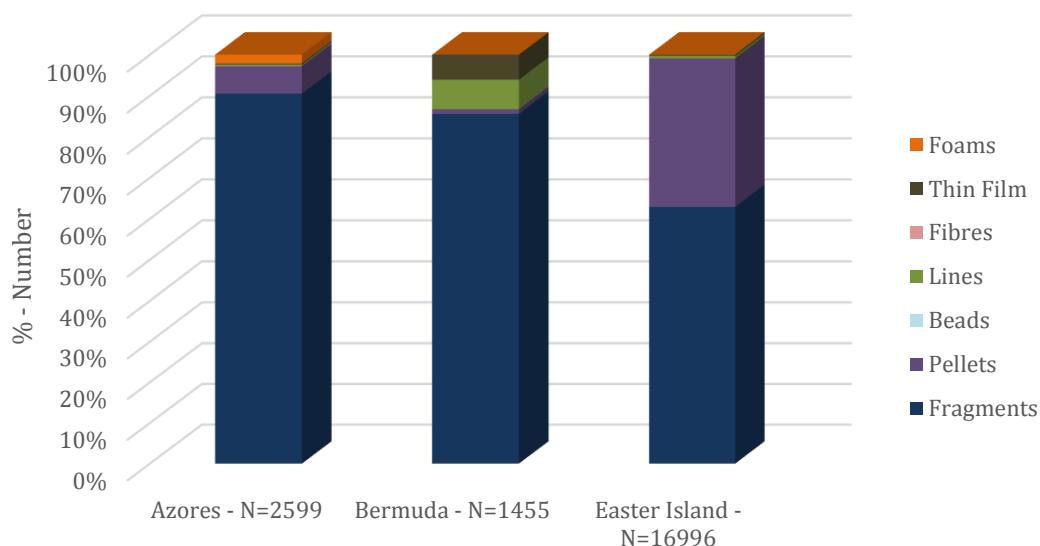


### Macroplastic distribution (>2.5 cm) by category



Of the macro plastics collected on the beaches, between 40 and 74% was hard plastic. The second major category was fishing line and pieces of plastic rope, then foam and bottle caps, plastic film and cigarette filters. Fishing and boating activity is logically at the source of the bits of rope and fishing line and Bermuda is more exposed to this type of debris than the Azores and Easter Island.

### Microplastic distribution (<0,5 cm) by category



The micro plastic findings were also dominated by hard plastic, which is logical given that the macro plastic findings were also in majority hard plastic (bottle caps, containers, utensils) and the micro plastics result from the degradation of the macro plastics. These micro plastic findings most likely originate from human activities on the continent. In Bermuda, fishing line ranks second after the hard plastic. A significant part of the debris therefore comes from the sea. In the Azores and on Easter Island however, the next largest category after hard plastic

waste is pellets. Pellets are at the origin of all industrial plastic production, they are a primary micro plastic as opposed to the micro plastic that derives from the breakdown of larger plastic waste. On Easter Island the concentration of plastic pellets is high making up over 36% of the total. The pellets could be the result of container ships losing their cargo in bad weather; they could also originate from the continent through badly managed production. Pellets discharged into an uncontrolled environment can easily end up in rivers carried by rain runoff, for example, and then in the seas and oceans.