# Monitoring marine debris in two sandy beaches at Faial Island - Azores

Thesis submitted for the Degree of Master of Science


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# Dedication

I dedicate every single minute of effort, devotion, enthusiasm, self-conflicts, battles, laughing, tears and thoughts that this work took of me, to a person I miss every single day.

I hope I make you proud, wherever you might be.

To my grandfather.

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**“I just want to say one word to you – just one word.”**
**“Yes sir.”**
**“Are you listening?”**
**“Yes sir, I am.”**
**“Plastics.”**
**“Exactly how do you mean?”**
**“There’s a great future in plastics…”**

Mr. McGuire to Ben

*The graduate*, 1969

## Abstract

Marine debris are part of a global environmental issue that causes effects not only in the world's oceans, but also in coastal areas. Therefore, it is possible to visualize waste even at the most remoteness islands, as in the case of the Azores. In order to evaluate data that allows access to loads of debris and their possible fluctuations along time and location, a total of 30 transects at two different beaches (Conceição and Porto Pim) was sampled during seven months (November to May). Items within 2 to 30 cm, were organized in 7 different categories, showing that densities of debris varied from 0 to 1.940 items/$m^2$, and that plastic was the most predominant type of beached waste (96% at Porto Pim and 82% at Conceição). During February, prevailing wind and swell conditions from WSW and W, respectively, seem to have provided ideal conditions to achieve the highest abundance of debris in general at both beaches ($M_{\text{Conceição}}$ = 1.973 ± 0.103; $M_{\text{Porto Pim}}$ = 2.726 ± 0.103). It was possible to validate that location and time of the year, while monitoring, influenced the presence of certain categories of debris, subjecting a relation between physical and environmental factors in their abundance. This pioneer study will continue to supply the type of data that is crucial for further understanding of debris dynamics and fluctuations in the North Atlantic Ocean, enabling comparisons to similar researches at different sites. Obtained results also suggest that there is a huge need to raise awareness and consciousness to local citizens and population in general, due to unthoughtful habits that are still practiced in everyday life.



## Resumo

Os resíduos marinhos constituem parte de um problema ambiental global, causador de impactes não apenas nos oceanos, mas também nas áreas costeiras. Deste modo, torna-se possível visualizar resíduos mesmo em ilhas mais remotas, como é o caso dos Açores. De forma a avaliar dados que permitam um acesso rápido à quantidade de resíduos e às suas flutuações ao longo do tempo e do local, um total de 30 transectos foram amostrados em duas praias distintas (Conceição e Porto Pim), num período de sete meses (Novembro a Maio). Itens entre 2 a 30 cm foram organizados em 7 categorias distintas, mostrando que a sua densidade variou desde 0 a 1,940 itens/$m^2$, e que o plástico representou o tipo de resíduos arrojados com maior predominância (96% em Porto Pim e 82% na Conceição). No mês de Fevereiro, as condições prevalecentes de vento e ondulação dos quadrantes WSW e W, respectivamente, parecem ter providenciado as condições ideais para atingir a maior abundância de resíduos em geral, em ambas as praias ($M_{\text{Conceição}}$ = 1.973 ± 0.103; $M_{\text{Porto Pim}}$ = 2.726 ± 0.103). Foi possível validar que o local e a altura do ano, durante a monitorização, influenciaram a presença de determinadas categorias de resíduos, fazendo sugerir

uma possível relação entre factores físicos e ambientais na abundância dos mesmos. Este estudo pioneiro poderá continuar a contribuir na obtenção de dados com informação crucial para aumentar o conhecimento acerca da dinâmica e flutuações de resíduos no Norte do Oceano Atlântico, o que permitirá comparações com estudos semelhantes, realizados em locais distintos. Os resultados obtidos também sugerem que existe uma grande necessidade de sensibilizar e consciencializar os cidadãos locais, assim como a população em geral, de modo a alterar a práticas e hábitos enraizados na vida quotidiana.

# General Index

# Index of tables

# INDEX OF FIGURES

# INDEX OF APPENDICES

# 1. Introduction

The Monitoring of marine debris in two sandy beaches at Faial Island - Azores, is a master project that took place at the Department of Oceanography and Fisheries (Horta), during the academic year of 2012-2013, and is submitted for the title of Master of Science in Integrated Studies of the Ocean. This is a pioneering study, capable to fill out a gap of information about local coastal debris, their abundance and seasonal fluctuations. In addition, further research might link this knowledge to possible major input sources in large and meso-scale circulation, along with its behaviour and durability in the water column. These understandings allow the possibility to create more and better defined laws of waste management in order to diminish and prevent drastic impacts of pollution, in a local and overall context.

## 1.1 Organization of contents

The arrangement of contents is outlined in 8 more chapters, where meticulous information about the state of the art, sampling and statistical methodologies, along with their further discussion and conclusions are disclosed in more detail. The obtained results of this field investigation, make available a high amount of information, which is capable to enhance knowledge about marine pollution in general, plus, possible major sources that contribute to this state, in addition to the fact that there is a huge need to raise awareness of the deleterious effects that this unthoughtful production and disposal of waste causes.

## 1.2 Objectives

The main objectives of this study consist in monitoring the quantity and types of debris that have been washed up on the shoreline of two beaches (Porto Pim (PP) and Conceição (PC)) with different exposure to the sea's actions, localized in Faial Island (Azores). These findings will enable the development of a standing-stock data base, with the total quantity of debris, as well as its density, in a 7 month period. These results will serve as a possible long-term basis, allowing analysis of the balance among input and output taxes of debris, and thus, recognizing the impacts of this sort of anthropogenic pollution.

Other pertinent issues that may also be discussed based in our results are:

- Does the density and types of items vary between beaches? Is there any change along the sampling months?
- Is it possible to diagnose the key-sources (e.g. domestic waste, fishing fleet) of marine debris?
- Does the surrounding environment affect the presence of debris?