SCIENTIFIC AND TECHNICAL REPORT

CAPE VERDE ARCHIPELAGO

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Accelerator Lab
CABO VERDE

UNDP accelerator labs

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

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Table of Content

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"Together we will make the world a better place"

Cape Verde Archipelago

PROJECT IMPLEMENTATION 2021/2022

SCIENTIFIC AND TECHNICAL REPORT

Executive Summary

The Our Blue Hands Project through the UNDP Cabe Verde Accelerator Lab inform the results of the implementation of microplastic monitoring on the Islands of Santiago and Boa Vista, Cape Verde Archipelago, between November 2021 and September 2022. The sampling of microplastics alerts us to the problems associated with plastic degradation and accumulation on beaches around the world, and a particular emergency in insular countries. The development of a collaborative network to gather information about marine pollution based on citizen science brings together the dialogue between academia, local communities, and environmental management. The project converges with the sustainable development goals when it holds on to partnerships, capacity building, co-design, consumer awareness, and prevention of pollution on beaches and oceans. The ten-month pilot project developed actions around the two main axes; monitoring using a standardized methodology to provide high-quality data about microplastic pollution in the environment (e.g., beaches), and data management to ensure that all the data cycle is covered and transformed into meaningful information for decision-making. All steps of the project are supported by training efforts and network engagement tools to potentiate the positive impacts of the project on all sectors involved as well as leverage a transparent and participatory process.

Cape Verde has several initiatives focused on the conservation of biodiversity and seeks a solution to the waste that accumulates on the beaches of the various islands and islets, in addition to dealing with the issue of the flow of tourism in the region. The diversity of biotic and abiotic factors is a great challenge, but also an opportunity to change reality through unified efforts and to develop partnerships between the different sectors of society that put pressure on the environment in a certain way. Considering that building sustainable Blue communities require holistic assessment, the Our Blue Hands methodology also mapped the pressures and mitigation responses. This step was built uniting researchers, which have a more technical vision of the problem, and local residents of the islands, who follow development on a daily basis. As a result, the project produced matrixes of drivers and the impact of marine litter in Cape Verde and pointed out potential impacts on related marine ecosystem services.

"UNDP's Accelerator Labs were built in 2019 to change the way UNDP does development by learning what works and what doesn't in sustainable development to reach the Sustainable Development Goals (SDGs) in time and are designed to close the gap between the current practices of international development in an accelerated pace of change."

"The Ocean Biodiversity Information System is a global open-access data and information clearing-house on marine biodiversity for science, conservation, and sustainable development." These two initiatives joined forces through the Our Blue Hands Project in order to implement best practices of ocean monitoring in the Cape Verde Islands. This initiative showcased that it is possible to strengthen the means of implementation and revitalization of global partnerships for sustainable development, ensure quality inclusive and equitable education (SDG 17), promote lifelong learning for all (SDG 4) through the use of citizen science and ocean literacy tools for traditional communities, covering a representative portion of the various groups of society for the benefit of the Oceans (SDG 14; UN Ocean Decade vision).

The Marine Strategy Framework Directive (MSFD), an important reference guide for the Ocean, requires the European Member States to develop strategies that should lead to programmes of measures to achieve or maintain Good Environmental Status strategies. During 2011, the TSG-ML (Technical Subgroup on Marine Litter) focused on providing advice through the report "Marine Litter – Technical Recommendations for the implementation of MSFD requirements", which described the options and tools available for the monitoring of marine litter in the different environmental compartments. Thus, by supporting and engaging in the Our Blue Hands Project, Cape Verde and Brazil advanced in the sense of preparing to meet marine pollution regulatory targets, also anticipating data acquisition to understand and mitigate the related problems.

In the following chapters, you will find an overview of the eleven (11) months since the implementation of the Our Blue Hands project in Cape Verde, covering the project's *phase 1 - Engaging and Monitoring* at six sites, as proposed for the UN Acceleration Lab. Phase 1 included the articulation of the Citizen Science network and associated stakeholders; capacity building and training; and a bi-monthly microplastics monitoring surveys project. Additionally, the project's *phase 2 - Data management and sharing* was partially implemented in order to provide a diagnosis of microplastic pollution patterns at the monitored sites and provide insights into potential sources of these plastics. The results show that there are significant amount of micro and mesoplastics on the sandy beaches of Cape Verde, with marked spatial variation and temporal differences, and various types of residue. According to these findings, the monitored beaches are susceptible to the impact of marine litter and plastic pollution, even on the smaller compartment, and effects on ecosystem services should be expected in the log-term. In the end of this report, the Our Blue Hands provides important recommendations for long-term actions considering the results until now.

Chapter 1

A FUTURE VISION OF THE OCEAN AND ITS TERRITORIES

Chapter 1 A future vision of the Ocean and its territories

1.1. 2030 AGENDA, MOVING TOWARDS A CLEAN OCEAN

Considering all the problems that currently affect the Ocean, marine pollution is one of the most challenging, for which there is not yet a simple solution. Marine pollution has numerous sources, therefore, it is understood that it requires a synergy between the various sectors and diverse stakeholders involved in order to build a new and more sustainable paradigm (INE-CV; Sandu et al., 2020; Willis et al., 2020). The actions that follow the plans and projects aiming to prevent and combat marine litter cover topics such as innovative research and investment with the replacement of raw materials and harmful chemicals to more natural and biodegradable ones, formulation of public policies with a regulatory system that reduces the use of plastic and other materials that affect human and marine life; and, evaluation of market instruments, monitoring programs and mitigation and restoring actions (Biondi et al., 2002).

The 2030 Agenda represents a global action plan, and serves as a guide for all actors interested in the sustainable development of their place of operation, whether as an individual or as part of a network. The SDGs - Goals for Sustainable Development are strategies that address seventeen key themes (17) for Earth's future and one hundred and sixty-nine goals (169) covering three pillars for Sustainable Development: social, economy, and environment (The Sustainable Development Goals Report, 2016). In this context, the Decade of the Oceans (UN Decade of Ocean Science for Sustainable Development 2021-2030) emerges as an initiative integrated into the 2030 Agenda with the purpose of raising awareness and engaging the population in favor of the conservation of the Oceans through SDG 14 - Life on the water (UNDP, 2016). It advocates the Ocean flag to achieve those SDGs and relies on the ocean science community to raise awareness and take action. In addition, with the aim of “accelerating” the development of actions of the 2030 Agenda, it was proposed unification of funding, mentoring, and support efforts, where the different groups will work synergistically to promote *common goals for synergistic actions.* It is important to mention that the initiatives of the Ocean Decade and 2030 Agenda differ in dimensions, and sectors of society and focus on specific themes, but they complement each other and integrate into a united global vision.

Considering this common global vision, a Clean Ocean is one of society's main targets for 2030 (UN Ocean Conference, 2022). Reducing marine pollution, particularly, marine litter is a major concern of individuals and nations (UNEP, 2022). It was estimated that in 2015 " 60% of all plastic ever produced had already become waste, a significant part of which has ended up in the ocean. Estimates vary widely, but it's thought that between 86-150 million metric tonnes of plastic have accumulated in the oceans by now, at a continuously increasing rate" (WWF, 2019). This data evidences the magnitude of the problem we are facing and highlights the planetary crisis already in course. Recycling, reduction, and reuse rates are still small compared to the plastic that becomes waste (Schnurr, et al. 2018). And as more people adopt a development style based on single-use plastic products, the scenario moment becomes even more challenging and dramatic.

The increase in microplastics in coastal environments and in the ocean is a direct consequence of the increase in the presence of plastic litter within the continental and marine biomes (GESAMP, 2015). It seems that both correct and incorrect plastic disposal can be a source of microplastics in the ocean, for instance, simple domestic washing of clothes relieves an enormous amount of microplastics in the rivers and into the ocean (Falco et al., 2019). The largest sources of plastic fragments found in environments today are *microplastics from primary sources* used in cosmetics and nurdles (plastic resin), which in turn contain chemical additives that are extremely harmful to the environment and human health (Thompson, 2015). The choice to consume or not these products, in view of there being biodegradable alternatives on the market and informative information online (Hunt et al., 2020). The second largest source of microplastic in the environment is textile microfiber, the report Primary Microplastics in the Oceans (International Union for Conservation of Nature) pointed out that 6 kg of polyester (a washing machine) releases 496,000 microfibers, while acrylic releases 728,700 microfibers for every 6 kg of clothing, thus representing 35% of the microplastic in the oceans today. The recently released WHO report (2022) cites some of the most up-to-date research related to dietary and inhalation exposure to nano- and microplastic particles and potential implications for human health. They are all in unisonous to highlight an urgent need to unify efforts to prevent this plastic material from reaching degradation at sea or on the beaches.

The acquisition and measurement of ocean pollution-related data is a constant challenge and one of the primary data to be intensively acquired during the Ocean Decade. Many global initiatives and a network of partners are dedicated to building a large-scale marine litter information system, with clear aims and structure toward understanding the magnitude of the problem to guide efficient mitigation in the coming years (e.g., Global Partnership on Marine Litter). Communicating is key to fighting marine pollution and achieving the associated goals by 2030. It is crucial to make consumers aware of their purchasing power while the industry does not change the overall means of production (Okoe et al., 2023). High-quality information, a sense of belonging, and empowerment of people can be an efficient way to reduce marine litter and microplastics in the Ocean. There are several actions from local to global scales that have proved the potential of environmental change (Sandu et al., 2020). For instance, tools for raising awareness and disseminating using citizen science protocols to monitor strategic areas have been shown to be efficient for research by federal universities in Brazil. These initiatives also include society as part of the scientific approach and knowledge production, at the same time educating and communicating for sustainability and Ocean Culture (Cunha et al., 2017; Miranda et al., 2020).

Accessing and predicting changes in Ocean health from local to global scales is a high research priority and an urgent request from global communities (Ocean Panel, 2021a). Several marine observatories are incorporating marine pollution metrics to their current environmental monitoring programs in order to meet multiple-stakeholder needs (e.g., Borja et al., 2020). Easy-to-replicate protocols and science-based technology to improve and speed data collection are highlighted as strong solutions to assess coastal areas at large scales and with high temporal resolution. Finding current drivers of marine pollution across habitats will give us a better understanding of the patterns of environmental impacts and quality, and, in turn, guide us toward more efficient mitigation efforts (Ocean Panel, Jambeck et al., 2020). Projects like Our Blue Hands aim to provide structure, support, information, and tools for society to strengthen its participation, knowledge building, and transformation for a global change in behavior, development, and future vision. By collecting standardized high-quality data from coastal and marine areas and hydrographic basins, including beaches, rivers, and mangroves, Our Blue Hands and similar long-term monitoring programs not only provide essential information for decision-making, but communicate science in a tangible way, and promote deep public engagement.

It is certain that society will not advance into a sustainable Ocean without broad and massive investment (Ocean Panel, Sumalia et al., 2021). Along this pathway, the Acceleration laboratories and Innovation hubs are strategic offices that support innovative actions that can be reproduced in a staggered manner to the resolution of environmental, social, and economic problems. These initiatives are rich and open spaces for young minds to co-create and develop practical ocean solutions with high potential for application and economic development. Thus, the support of these organizations and their actions is of fundamental importance, since these bodies and institutes map and recognize the places with the greatest need for the implementation of these projects along with a funding program.

1.2. CAPE VERDE ARCHIPELAGO AND THE PROBLEM OF MARINE LITTER

The global concern with the resilience of islands and their ecosystems and human populations dates from at least three decades. During the Convention on Biodiversity in Rio de Janeiro, Brazil

(1992), small island countries were highlighted as important areas of the planet where conservation action is a priority (Kueffer & Kinney, 2017).

Small Island Development States (SIDS) "are recognized by the UN as a specific group of priority countries. Their small size, distance and limited resource bases mean they tend to share a number of unique challenges to sustainable development. SIDS are also particularly vulnerable to the impacts of climate change and natural disasters, which may become more frequent and intense in the future" (International Science Council).

The Republic of Cape Verde is located in an archipelago in the Central Atlantic Ocean consisting of ten volcanic islands and nine islets with a combined land and marine area of 4,033 km² (Fig. 1.1). Cape Verde islands are part of the Macaronesia ecoregion, which includes also the Azores, Canary Islands, Madeira, and the Savage Islands. For marine classifications, Cape Verde is considered a transitional zone between the areas with stronger upwelling and it is included within the West African Transition Marine Ecoregion (Spalding et al., 2007). St. Anthony, St. Vincent, Santa Luzia, and St. Nicholas are from the northwest group of islands; Santiago, Fogo, and Brava form the southern island cluster; and Sal, Boa Vista, and Maio define the eastern group of islands. Boa Vista is located about 570 km offshore Senegal (West African coast) while Santiago is about 1000 km, with a remote, wild, and offshore seascape. The islands are located at the eastern border of the North Atlantic Subtropical Gyre and near the southern limit of the Canary Current, experiencing a tropical climate and with an average sea surface temperature in Cape Verde ranging from 20 to 25 °C.

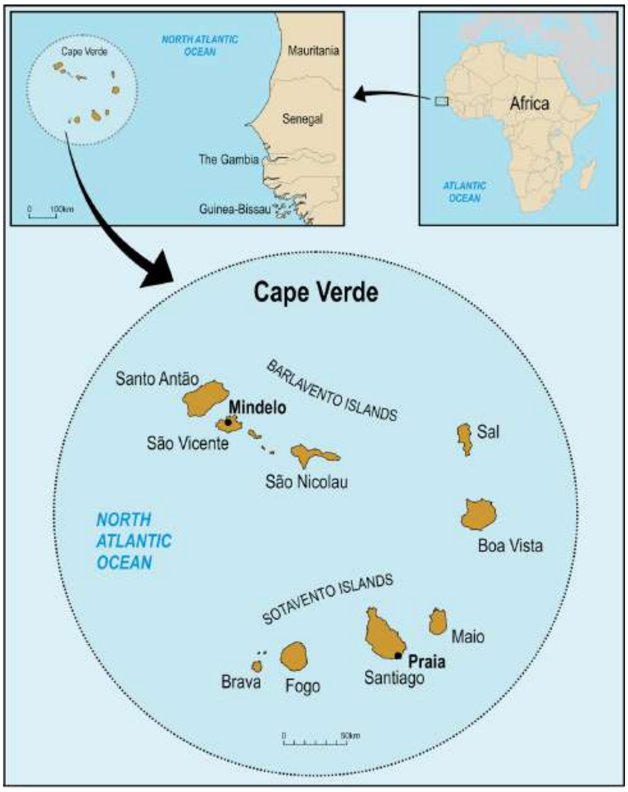

Figure 1.1. Map of Cape Verde showing the location of the main islands. Source: https://doi.org/10.1371/journal.pone.0192595.g001

Due to geographic isolation, the Macaronesian biogeographic region of Cape Verde hosts several endemic terrestrial and marine species and is home to a unique marine fauna as coastal fishes (7.3%), gastropods (44.1%), among others, that represent the importance of endemic species of the archipelago. According to Freitas et al. (2019), from the 465 marine species found in Macaronesia, 39 of them occur on all islands, with Cape Verde and the Canary Islands being the most biodiverse archipelagos, where, for example, 22 species of fish are endemic to Cape Verde.This rich biodiversity provides numerous services to local communities, which lifestyle and economy are intrinsically dependent on its natural resources. Thus, all efforts to preserve and monitor the conditions of Cape Verde habitats are of significant socio-cultural, economic, and environmental importance.

Currently, plastic waste and micro solid plastic particles are found in all compartments of terrestrial and marine habitats. Unfortunately, offshore islands may be human waste accumulators when located in the pathway of certain sea currents with more potential for marine litter transport, difficulty in managing waste, and many other factors linked to socio-cultural aspects of insular nations (CBD, 2014). As marine pollution in oceanic areas increases, it is expected that these offshore islands will receive more litter into their territory, and will be forced to deal with not only residuals produced by their own populations, but manage what comes from international waters (Paul, 2021). Fighting this global problem should also start at the island level by understanding the magnitude of marine plastics in their habitats and discriminating between local and allochthonous sources. This data is crucial to building a matrix of marine pollution indicators to guide public policies and mitigation programs. It is important to highlight that all efforts to strengthen solid waste monitoring and management on islands are of meaningful value because they will improve the quality of life of the islanders and the health of these unique ecosystems in the long term.

Cape Verde archipelago is located in the middle of the Sahelian zone under the dominance of the northeast trade winds, between the high Atlantic subtropical pressure and the equatorial low pressures of the intertropical front Meteorological conditions are also strongly impacted by these large-scale oceanic circulation patterns, mainly the North and the South Equatorial Currents. The northeast winds dominate the regime (63.9% incidence) followed by eastern winds (21.6% of incidence). Because of its location and regional oceanic current patterns, Cape Verde is highly susceptible to marine litter coming from the coast of Africa (to the E) and potentially from the European coast (to the NE) (Medina, 2008). The rain events are torrential and irregular and are concentrated between the months of August and September (60% to 90% of the total annual precipitation) depending on topography and altitude (De Brum Ferreira, 1986). The seasonality of meteo-oceanographic conditions on these islands should be included in the analyses and discussions of waste management and marine litter resolution. For instance, incorrect waste disposal could be enhancing the number of plastics on Cape Verde beaches (e.g., plastics being carried out by strong winds) or the transport and accumulation in underwater habitats (e.g., plastics carried out by streams in the monsoon season). Population dynamics and its relationship with consumption and waste also represent an important pillar in this approach. The recognition of activities that put pressure on the environment according to their conduct is the open tap of waste in Cape Verde.

1.3. THE POTENTIAL OF LONG-TERM MONITORING AND CITIZEN SCIENCE

The importance that the Ocean represents to society has made its conservation a priority. In the pre- and post-pandemic world, the Ocean represents a route of trade and transport of goods and people, and now, an economic recovery with a Blue stamp. Marine environments are the primary source of income and subsistence for a major portion of the human population (FAO, 2014). Numerous are the services and opportunities provided by the ocean, such as food and other resource supply, living habitat, economic enhancement, and sociocultural connection (Bindoff et al, 2019). The borders between the Ocean and the continents and islands are of intense historical use, where not only the most populated areas of the world are located but are common temporary spaces for the immense flux of tourism, leisure, and sports (IPCC, 2019). It is common sense that contaminating and polluting ocean waters has negatively impacted many communities and societies for decades. Thus, we are facing a moment in which decision-making requires high-resolution large-scale simultaneous data to formulate powerful public policies to reduce marine litter. Assuming accessibility to increasingly remote locations on the planet and the increase in purchasing power that consumption provides, the project understands that the reaction to this socio-cultural phenomenon not linked to the increase in campaigns and projects aimed at reducing litter at sea, will extend the problem rather than reduce it.

Citizen science has given voice to a movement that has existed for decades when the local and traditional groups have been responsible for the sustainable management of the environments in which they live. Traditional people and communities know environmental and local aspects in a profound way, which tends to be very beneficial for the management and monitoring of biodiversity in protected areas (Comandulli et al., 2015). Citizen Science produces a link of engagement by inserting methodological innovations to fight environmental problems that can be replicated by anyone anywhere in the world.

In order for this knowledge to be disseminated and applied in a fair way, there needs to exist a two-way flow of interactions, where both the local population and the scientific community benefit from this partnership. Besides, it is important that the structuring of the projects covers beyond the acquisition of data and the sampling effort to obtain them. These processes must add collaborative preparation and community empowerment, offering the necessary capacity-building activities, tools, and feedback, as well as provision of income and application of the knowledge built together whenever possible.

Fig. 1.2. Flow chart representing the exchange of knowledge between science and traditional communities and local population

Chapter 2

THE OUR BLUE HANDS PROJECT

Chapter 2 The Our Blue Hands project

2.1. BACKGROUND

During the Ocean Decade regional preparation workshops, the local and international communities identified huge gaps in data, information, and knowledge about the Ocean that must be filled in order to achieve the sustainable development goals (SDGs), particularly SDG 14 and the vision of a Healthy, Clean, and Accessible Ocean. Across all the ocean science disciplines and blue economy and society sectors, it was highlighted that there should be an agreement on best practices and unified methodologies to monitor coastal and marine habitats, to provide inter-comparable indicators for decision-making. Simultaneously, the Our Blue Hands initiative has focused on disseminating a standardized and replicable framework to monitor the accumulation of microplastics on sandy beaches, using a network of engaged citizens as the core of data collection, public awareness, and solution co-creation. The project's best practices were built based on the methodology developed by the National Ocean and Atmospheric Administration of the United States of America (NOAA-USA), the European Marine Strategy Framework Directive (MSFD), and the Just One Ocean methodology developed by Portsmouth University (Jones, D., Mohamed, H.), adapted to local needs. Pilot sampling began on three coastal islands located between the Southeast and South of Brazil (São Sebastião Island, Santa Catarina Island, and Campeche Island) in order to understand the challenges and improvements required to sustain long-term monitoring relying on limited resources and diversified partnerships.

In a two-year period, the Our Blue Hands expanded the monitored sites to the mainland, adding Ubatuba (north coast of São Paulo State), Itajaí (northern coast of Santa Catarina State), and two islands in the Cape Verde archipelago (Santiago and Boa Vista). This marine plastic pollution monitoring network has been articulated and actively engaged, generating biweekly, monthly, or sporadic standardized high-quality data for a period of 1 and half years. Some pilot monitoring sites are still active, and new ones are being designed for the continuity of the project and the deepening of the analysis. A monitoring network was articulated and more than 15 organizations and institutes joined the project to observe the impact of microplastics on priority areas for conservation. The network was built with the premise that gathering data on microplastic and marine litter pollution will help locals, managers, and conservationists to move towards a Clean Ocean by taking action driven by information, engagement, and advocacy. The project understands that citizen science monitoring networks are one of the most efficient ways to raise awareness about the current environmental crises and that the products delivered by this type of project (e.g., as actions with schools, beach cleanings, and reports for managers) have a high impact on local reality.

2.2. SOLUTION

Considering the 2030 Agenda and the UN Decade vision of a Clean Ocean, the Our Blue Hands project aims to create a network of citizen scientists engaged in the monitoring of microplastic pollution and plastic waste, using low-cost infrastructure and easy-to-replicate methodology to acquire high-quality standardized data about different marine sites of the world. This standardized and adaptable methodology contributes to building a local and regional database of marine litter (focused on micro and mesoplastics) to be further analyzed and converted into marine pollution indicators of multiple uses in decision-making. The data library and documentation of best practices are planned to assist the management of urban waste, identification of temporal and spatial variation in pollution, assessment of environmental and social drivers, and guide change in consumer behavior, product use, and manufacturing (e.g., food and beverage packaging, fishing gear, civil construction supplies). By involving local communities, the network aims to promote engagement and co-design of creative applicable solutions to the problem of marine litter. The project has the potential to promote associated initiatives, build technical capacity, and generate income flux through partnership, work as a monitor, grants, and projects that can actively participate in the network. The Our Blue Hands project hopes to find in the managing bodies the guarantee of the applicability of this information in order to reduce marine litter and improve the environmental quality at the monitoring sites.

Figure 2.1. The Our Blue Hands solutions.

The project core consists of 5 solutions (Fig. 2.1), covering the entire data cycle with the co-design of actions meeting network objectives and local needs:

Solution 1. Training - Monitor Network

Empowerment is a way to engage citizens interested in being part of the solution. The core of this solution is to promote space for the exchange of knowledge and leveling of it, by providing courses, moments to share theoretical and practical experience and a collaborative safe basis for the implementation of the pilot project. The project's theme is introduced months before the practical experience, creating an alert and conscious mind of the issue.

Solution 2. Data Acquisition

The acquisition of data about the abundance, occurrence, and distribution of micro and mesoplastics at marine habitats (e.g sandy beaches) during a predetermined period is the guide of this second solution. The data matrix is based on standardized methodologies applied at several sites around the world and is planned to provide enough information to answer basic marine pollution queries. The implementation and sustaining of these monitors in the long term allow a more complex time series and a better understanding of the problem and habitat dynamics, increasing markedly the possibility of resolution. In this phase, all previously acquired knowledge is put into practice, highlighting the importance of training for the quality of the data acquisition and successful articulation of partners.

Solution 3. Curation and Quality Control - Database

Standardized databases at multiple scales (local, regional, and global) solve a very important gap in Ocean research and decision-making toward sustainability. Ensuring that data from various parts of the world are being collected in the same way and safely stored, facilitates the comparison of information across different conditions, and thus, the development of indicators of high applicability and a baseline for marine microplastics. Based on this premise, this project includes a plan for data management, data curation, and quality control after the acquisition phase (solution 2). The local teams are responsible for taking action in the first phases of the data cycle from the field to the cloud, and may potentially engage in the more complex data system as he/she feels capacitated. The main product of solution 3 is to create a micro and mesoplastics database that will feed analytical proceedings to generate information. The archive is dynamically being prepared to integrate further international marine litter databases, as the project and partners agree on.

Solution 4. Information Transformation

The transformation of the database into meaningful information is one of the most valuable contributions that this project can offer. Through the various analyses and correlations with the management tools, it is possible to think about the response measures together with managers and the local population. Through science-based statistical analysis and visualization methodologies, the data is transformed into information that can be reproduced in environmental actions, infographics, and reports. This solution framework can be updated to meet local information needs and be compared to similar observatories around the world.

Solution 5. Decision-making

The information delivered by the other solutions generates indicators of plastics' source, site exposure to marine litter, and potential impact of micro and mesoplastics in the monitoring sites. This set of information and indicators must be aligned with current plans for combating and preventing litter in the Ocean. The core role of the Our Blue Hands monitoring is to create a baseline prior to the implementation of management and conservation regulations, defining key parameters that may interfere with the quality of that environmental compartment. In the longer term, this information can be used to evaluate the efficiency and effectiveness of the local and regional action plans.

2.3. PARTNERS

Considering that plastic pollution in the Ocean is transboundary, tackling this problem requires the engagement and commitment of different sectors of society in coastal areas, islands, as well as stakeholders living within the continents (Ocean Panel, Jambeck et al., 2020). The Our Blue Hands is an open space for collaboration, co-design, and partnership based on the premise that the network shares similar principles and works together for a Clean Ocean, particularly, for the monitoring and reduction of microplastics in marine and coastal habitats. Besides SDG 14 (Life in the water), Our Blue Hands contributes to SDG 17 which aims to strengthen the means of implementation and revitalize the global partnership for sustainable development. It implies that multi-sectoral partnerships are a potential strategy to mobilize solutions and share knowledge, experience, technology, and financial resources are the pieces that make the gear of the advance of SDGs. SDG 17 is of particular importance for developing countries, which rely on local, regional, and international partners to develop sustainable solutions (Leal Filho et al, 2022). The articulation of a network of stakeholders and parties allows each necessary function to be performed by multiple competent hands called focal points (nodes within the network), which communicate with each other through multiple pipelines supporting a more decentralized harmonic governance. In the Our Blue Hands, each focal point multiplies knowledge and carries out monitoring, and in turn, being both supporters and financiers. In general, all the partners involved have a sense of belonging to the place where they live or were born and are naturally attracted to this work as a way of preserving the coastal marine environment.

In Cape Verde, the network of partners included several organizations actively engaged in the conservation of the island's biodiversity, which participated in the project from the theoretical phase to microplastics monitoring (Table 2.1), as well as environmental activists and locals with prior knowledge about the marine litter problem (Kebra). Undergraduate students from courses in Oceanography and Biology at the Universidade Pública de Cabo Verde (Unicv) were invited to be part of the network. Tourists and locals present on the beach during the monitoring approached the project team and collaborators interested in understanding the project and potentially joining the actions on the day.

Table 2.1. List of partners of the Our Blue Hands in Cape Verde actions.

Partner	***General aims and environmental targets***	**Location**	**role in the project**
Latuna	Sea turtle conservation	Tarrafal - Tarrafal	Focal Point - monitoring Tarrafal each 15 days
Kebra Kanela Beach	Beach conservation Beach cleaning	Kebra Kanela - Praia	Focal Point - clean up beach/ monitoring Kebra Kanela e
Bios Cv	Sea turtle conservation	Sal Rei -Boa Vista Beaches	Focal Point
Turtle Foundation	Sea turtle conservation/ Environmental conservation	Boa Esperança -Boa Vista Beaches	Focal Point - training new volunteers
Associação Caretta caretta	Sea turtle conservation	Santa Cruz- Praia	Volunteer
Kebra	Civil Society Activism	Kebra Kanela - Praia	Focal point and volunteer
UNICv	Research and Knowledge	Tarrafal, Calhetona, Kebra Kanela	Fellowship

2.4. CONTRIBUTIONS

The main objective of the Our Blue Hands project in Cape Verde was to enable a collaborative monitoring network to assess the occurrence, distribution, and abundance of microplastics at sites and regions considered environmentally strategic by the population and managers of Santiago Island. During the development of the project, the priority of conservation of the coastal ecosystem and marine biodiversity became evident, taking into account all the socio-cultural and environmental complexity of the archipelago.

The use of the The Driver-Pressure-State-Impact-Response (DPSIR; Abalansa, Samuel et al.,2020) framework was of great value to validate the discussions and problems encountered during the face-to-face training and samplings. In addition to clarifying shifts in the ecosystem state, the DPSIR provides a diagnosis of the impact of human activities on ecosystem services and identifies the connections between possible solutions for marine litter based on Cape Verde's environmental legislation. The DPSIR is a dynamic tool that is closely linked to the environmental compartment to which it is applied. For instance, as the beach environment is subject to a great meteo-oceanographic variation, it is expected that these changes will influence the DPSIR outcomes, which require updates accordingly. These loops and new connections enable this framework to address both current and future environmental needs, enabling the DPSIR to provide guidance to immediate actions as well as predictions. According to the schedule established in the initial phase of the project in Cape Verde, the focus was on questions such as: (1) What types and amounts of microplastic waste are currently found at the monitored sites? (2) How does the use of the beach impact the environment?

From the biweekly monitoring over 3 months, the Our Blue Hands identified that the use of the beach by tourism and associated activities markedly interferes with the visual quality of the beach and landscape. The increase of waste in the containers and in the sand itself is driven by wind action during the dry season and rain flux represents a direct source of waste. The project identified that it is fundamental to think together with the local municipal managers so that campaigns, programs, and continuous monitoring for the implementation of the Strategic Plan for Waste Prevention and Management can give proper attention to the sources of marine litter. Another issue raised by the monitoring surveys was the possibility of carrying out a joint protocol to cover both micro and macro waste at these sites.

The Our Blue Hands explored various aspects of microplastic pollution during its development in Cape Verde. The partnership with universities (Federal University of Santa Catarina, Republic University Uruguay, and Cape Verde University) brought a scientific basis of knowledge and also enriched the exchange between students and researchers. Despite being a work that applies a scientific methodology, it was extremely important to hear and understand the local context from the point of view of the residents of these islands and professionals who work in conservation in the region. These inputs provide deep knowledge and meaningful information about the local reality, engaging those who know and face the problem of marine pollution on a daily basis. Strengthening the dialogue between civil society and academia through the citizen science framework proved to be an opportune way to raise environmental awareness in Cape Verde, going beyond the application of communication plans. The entire collaborative construction process, from the knowledge outreach, data acquisition, and information transformation, made it clear to all participants that it is possible to implement the marine litter mitigation plan at strategic and priority maintenance sites and communities.

Chapter 3

PROJECT IMPLEMENTATION

PHASE 1 - ENGAGING AND MONITORING

Chapter 3 Project Implementation
Phase 1 - Engaging and Monitoring

3.1. PREPARATION

The project schedule was divided into phases according to the proposed activities. During 1 month (30 days), a communication plan was active to engage the collaborators and residents of Cape Verde for the first preparatory course on the introduction of the microplastic theme. The Our Blue Hands communication laboratory was responsible for publicizing the online course on thematic *Marine plastic pollution: from drivers to management*, offered by the Conosur agreement between the Universidade Federal de Santa Catarina and the Universidad de la República of Uruguay. The online course integrated the Ocean Teacher Global Academy platform which was publicly broadcasted to participants from at least 20 countries (Fig. 3.1). Keynote speakers and experts on the various subjects from Portugal, Brazil, Uruguay, and Cape Verde dedicated 30 days to share experiences and information. The main objective of this course was to train participants on the DPSIR (Drivers-Pressure-State-Impact-Response) framework, preparing them to be able to develop and reproduce its tools from their own study areas. The course covered the following topics: (1) Strategy from DAPSI(W)R(M) for analysis of marine plastic pollution; (2) Plastic Pollution: definitions, characterization, classification; (3) Plastic Pollution: Sources and Destinations; (4) Plastic pollution and change of state in coastal and oceanic ecosystems; (5) Plastic Pollution and Impact on Ecosystem Services; (6) Management response to combat plastic pollution: legislation and strategies; (7) Management response to fight Plastic Pollution: monitoring. A total of 07 classes and 36 hours of asynchronous activities, 12 hours of synchronous activities were dedicated to its conclusion.

At the end of the course, the second phase of the communication and engagement plan was implemented, with the opening of registration of those interested in the in-person training for microplastic monitoring. There were a total of 32 applicants from Santiago, Brava, Boa Vista, and Santo Antão islands. Unfortunately, the viability of participants from other islands was restricted in the first moment of the project, which did not receive enough funding to support outside travelers. Consequently, only residents of Boa Vista and Santiago were allowed to participate in the in-person training.

3.2. ARTICULATION OF CITIZEN SCIENCE NETWORK AND ASSOCIATED STAKEHOLDERS

After identifying and receiving the registration of potential collaborators in Cape Verde, the project team and partners defined an area to carry out the pilot monitoring survey and begin network engagement. The project focused on articulating a network of volunteers that would be able to promote monitoring of the defined beaches over 15 days during the face-to-face training and had the potential to be prepared and maintain additional unsupervised monitoring over 3 months. The network basically consisted of non-governmental organizations (NGOs) which became in charge of the bimonthly microplastic surveys at strategic sites, chosen based on their affinity and/or there were current biodiversity monitoring which the Our Blue Hands protocol could be associated with. The chosen sites were: Praia, Tarrafal, and Calhetona on Santiago Island; and Lacacao and Boa Esperança on Boa Vista Island, with the possibility of adding another site in Boa Vista as the monitoring progressed. The proposed idea was that the NGOs could count on each other, alternating the sampling fortnights, and thus, there would be a continuous exchange of knowledge and information within the regional network. Each partner received a sampling kit at the end of the face-to-face training, had an assigned role within the network, and agreed to a specific site/area to continue monitoring (Fig. 3.1).

The face-to-face workshops in Cape Verde were very constructive due to the exchange with each participating initiative. The Our Blue Hands protocol was introduced based on what each organization could offer within the scope of the project itself. The geography of Santiago Island is particularly rugged, so the displacement to the sample required a great sampling effort therefore the articulation of the stakeholder and the work together between them is very important to reach the goal. Communication and financial support from the beginning was the counterpart of the acceleration laboratory of the United Nations Development Program in Cape Verde. Structural support for classes and scientific-technical support was provided by the University of Cape Verde. The construction was organic based on several meetings with all the partners involved.

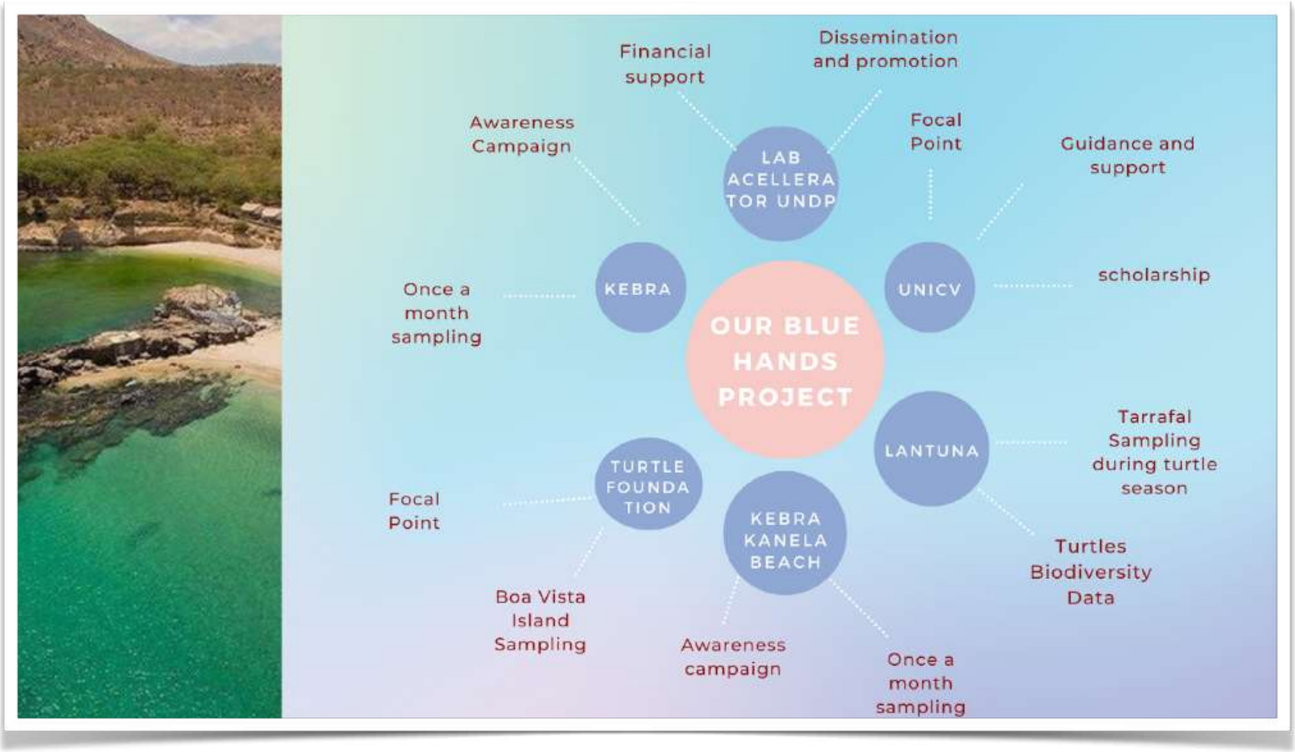

Figure 3.1: Network schema in Cape Verde, including partners (purple circles), roles, and monitored sites (red).

3.3. CAPACITY BUILDING AND FACE-TO-FACE TRAINING

The project followed the agenda (Fig. 3.2) defined together with Prof. Mara Castro from the Universidade Pública de Cabo Verde, and sought to be flexible in the hours so that the members could participate, and included the project's coordinator visit to Cape Verde in November 2021.

These capacity-building activities had as their main objective to guarantee that the network of collaborators would have the minimum amount of information about the project, its background, the monitoring methodology, and the data flows. The activities required in-person training in order to increase standardization of monitoring surveys and that the volunteer efforts would provide meaningful and reliable data about micro and macroplastic waste in support of future management actions and the formulation of public policies.

Briefly, the training visit included 3 days in the classroom and another 3 days traveling around Santiago Island. The departures took place from the University to Tarrafal (approximately 1/2 hour), Calheta de São Miguel (1 hour), and Kebra Kanela (30 minutes). Each point needed recognition to choose the best point for sampling. For each sampled point, 1 day was spent in the laboratory to analyze the residues found and discussion about the activities that put pressure on the environments, totaling another 8 days of work. All groups had the opportunity to meet in laboratories for integration and sharing of results. The Our Blue Hands monitoring methodology was replicated at each beach by the partner's team and the project's coordinator. It's an opportunity to identify the need for adaptations, gather a first diagnosis of the plastic waste at each site (e.g., types, abundance), and establish group goals. The group also sought to understand in a systematic way the main differences between the beaches studied, including the identification of the uses and major activities happening at each site, the flow of tourism between November/ December, and the association with the increase or decrease of waste accumulation, and spatial variability of these patterns. During the development of the agenda defined for the groups, important concepts were introduced for the execution of the monitoring, such as recognition of the properties of plastic, strategic locations for data collection, types of sand grains, the influence of climatic factors, the different tide lines, paths from waste to arrival at sea, types of plastics found on the beach and, most importantly, how to collect and enter data into tables. Those conversations (Fig. 3.3) aimed to engage collaborators in observing their sites while conducting the monitoring. Information about natural and human-driven conditions is of high value in the interpretation of the monitoring results.

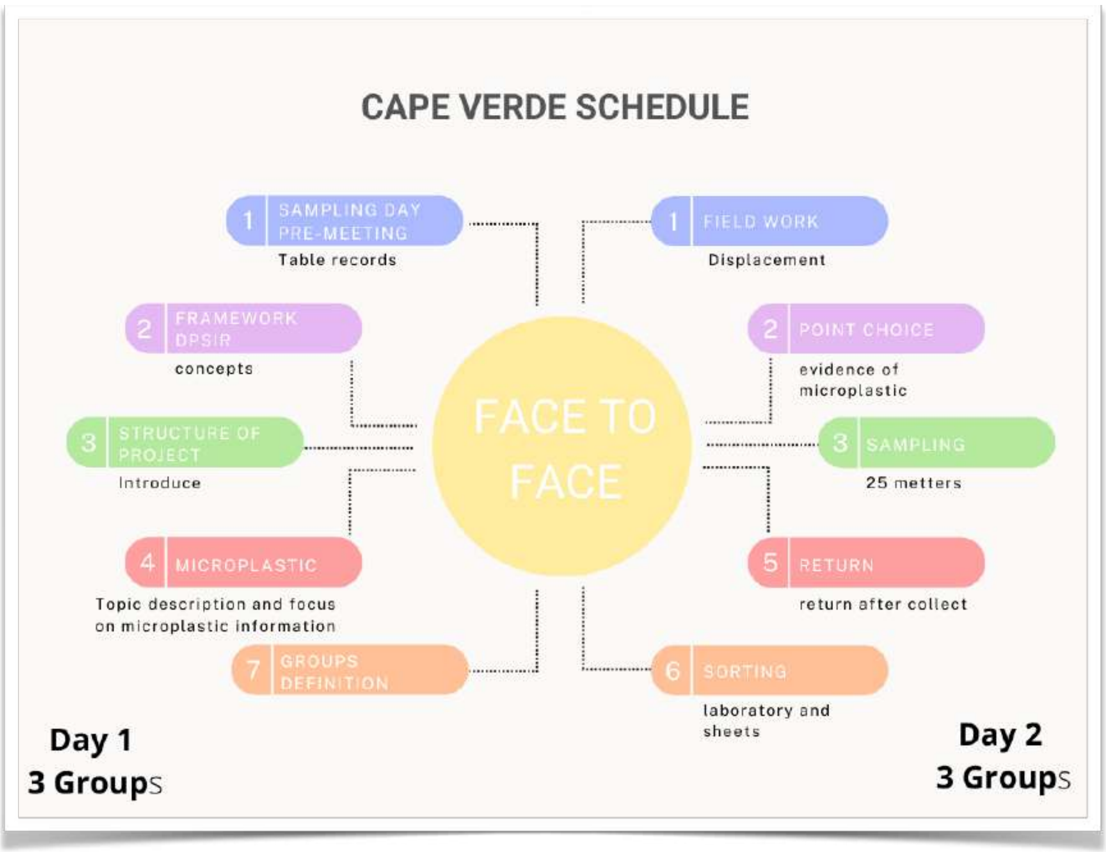

Figure 3.2. Capacity building and face-to-face training workflow in Cape Verde.

The main challenges encountered during the training were the locomotion of interested parties, the geographical distance between the collection sites, and internet access. These challenges could be overcome by planning and adding partners interested in providing regular support to the monitoring teams.

Figure 3.3. Meeting with the network before the sampling in Kebra Kanela Beach.

3.4. MONITORING SITES

Santiago Island is located about 1000 km from the West Coast of Africa and is in the Leeward Islands group, it has approximately 1,005 km² in length and 29 km of maximum width. It has a population density of 234,940 inhabitants/km, representing 31% of the national population of Cape Verde. The Our Blue Hands monitoring included 3 of the 8 municipalities in Santiago Island (Praia (capital), São Miguel, and Tarrafal; Fig. 3.5).

Figure 3.4. Location of the sampling sites.

Tarrafal is located in the north of Santiago Island and hosts 5.9% of its population. The literacy rate in this region is 82.2%, and according to the 2018 census, 64.7% of the population uses containers for garbage disposal. 68.7% of the Tarrafal population have access to TV and 49.1% to the internet. It is a region majorly composed of a young population. Tarrafal is key to the conservation of sea turtle populations. The nesting season takes place between June and November with peaks from July to September. and Tarrafal is one of the beaches sought after for spawning, and therefore, a strategic location for the implementation of a long-term marine litter monitoring program.

Calheta de São Miguel is located further northeast of Santiago Island and is home to 4.7% of its population. The population's literacy rate in São Miguel is 81.3% and only half (47.3%) of the population uses containers for garbage disposal. 60.9% have access to TV and 40.4% to the internet. The community also consisted of a young population. It is a regional nursery area for several marine species and is commonly used for fishing.

Kebra Kanela beach is located south of the municipality of Praia (capital), in Santiago Island. It represents 29.6% of the population of Cape Verde. The literacy rate is 90.7%. Regarding access to information media, 89.3% have access to television, and 49% have access to a computer. And for the recent census, we did not find data on access to containers in the city of Praia. Kebra Kanela is a small beach with accessibility and is very frequented by all the people of the region because it is a clean beach and calm waters. Among the active activities in the region are tourism, bars, recreation, leisure, fishing, and swimming. It was one of the most voted beaches for monitoring microplastic and waste by training participants.

Within the local context of Cape Verde, this project sought to first understand how the positioning of the Islands could be affected by the continent according to the exposure of winds and currents. Although more detailed and thorough work needs to be applied, it is possible to observe and hear reports from residents that the north/northeast sides of the islands are the most affected by waste, including on uninhabited islands.

3.5. DPSIR - FRAMEWORK

The DPSIR, whose acronym refers to Driver-Pressure-State-Impact-Response (European Environmental Agency, 1999) is a methodological framework used to describe and analyze complex environmental problems in a conscious and strategic way, and yet it provides a simplified view of a cause-effect relationship between society and the environment, including the economy. This analytical framework is expected to link causes and consequences in the causal chain from the driving forces to the impacts on ecosystem services, establishing quantitative indicators for the different elements of the chain. DPSIR allows the evaluation and type of integrated monitoring for a given system, revealing temporal trends in the same area, or if standardized for application in other areas and comparison with other socio-environmental systems (Bandeira, 2021). The Our Blue Hands project dedicated part of the online training and face-to-face moments in Cape Verde to map these indicators and work together with the participants of the Plastic Pollution of Conductors to Management course to develop information matrixes referring to the islands of Boa Vista and Santiago. This exercise generated a focused and strategic diagnosis of the environmental situation at those habitats and human settlements. The main results are described below. This report applied the nomenclature used by the CICES table to classify the impact on ecosystem services in the Boa Vista region. CICES is developed to standardize the use of terminology of ecosystem services to improve comparability of environmental accounting and ecosystem assessments. The classification is developed by the European Environment Agency (EEA). In CICES, ecosystem services are divided into three sections; provisioning, regulating and maintenance, and cultural services. In short, the provisioning services are the tangible products that people obtain from ecosystems. These include food, water, raw materials, energy, and genetic resources. Regulating services consist of ecosystem processes that maintain environmental conditions favorable to life. Cultural ecosystem services are those "benefits" that we get from nature that we cannot touch: recreation, experiences, spiritual sustenance, a sense of place, and so on. At large, they refer to the significance of nature in our cultures and for our well-being.

3.5.1 SANTIAGO ISLAND

Identification of the waste problem

Santiago is a more densely populated island, which has grown over the years facing practically the same development problems as most coastal-marine regions of the world (e.g., facilitation of access, increase in tourism, the introduction of industrial activities) and all the socio-environmental issues that accompany this accelerated projection of the city. According to the participants of the Plastic Contamination of Conductors and Management course, some of the most common pressures in the region are the repair of vessels and boats in the sand on the beach, identified by the paint pieces in the sand;, disposal of solid and liquid waste, including wastewater and domestic sewage; proximity to the port and fishing pier; and management of streams. In addition to these issues that cover the municipality and affect coastal areas, the fact that Praia is located in an industrial zone raises the attention to the potential environmental risks and vulnerability, being the incorrect disposal of both industrial and urban waste identified by the locals as one of the most urgent issues to be solved. These multiple uses reflect the various stakeholders identified for the region (Fig. 3.5.), which somehow should be included in the marine litter discussions in the long term.

Overall, the stakeholder mapping pointed out key sectors that still need to incorporate advances in national/regional regulation, such as plastic packaging (including metal and glass packaging) by the food and beverage industries. Logistics issues could also be improved to reduce local waste or enable recycling, for instance, by synchronizing the collection and disposal of the disposable material distributed by bars such as cups, straws, and glasses. The regulation of the use of this material and its disposal is key to triggering awareness and reducing the accumulation of this waste on the beach and in the sea of Praia region**.** Large numbers of plastic water bottles are commonly found in the sand in Karakas, which sale also should be avoided through regulatory change. The participants highlighted that a communication plan that supports the sensitization and awareness of the population would be fundamental to building a faster transition of cultural habits and mitigating the problem as more and more people in Santiago migrate to the reusable.

Change in the Ecosystem State

According to the DPSIR results, the visual quality of the studied areas in Santiago is directly affected by the large amount of small and medium-sized waste accumulated on the beach. This waste accumulation extends from the "supra coast" to the low tide line, with apparent significant spatio-temporal variation and contribution to the transport of waste from the sand to the sea. The quality of the beach habitat is also compromised by the change in the physical conditions, for instance, with the decrease in light in the water column due to the increase in turbidity and floating objects, and the alteration of soil characteristics, directly affecting the ability of crustaceans and other benthic macrofauna to penetrate the muddy part due to the amount of waste. There is no consistent data about how those biodiversity patterns and endemic fauna populations have been impacted by solid pollution in Santiago islands.

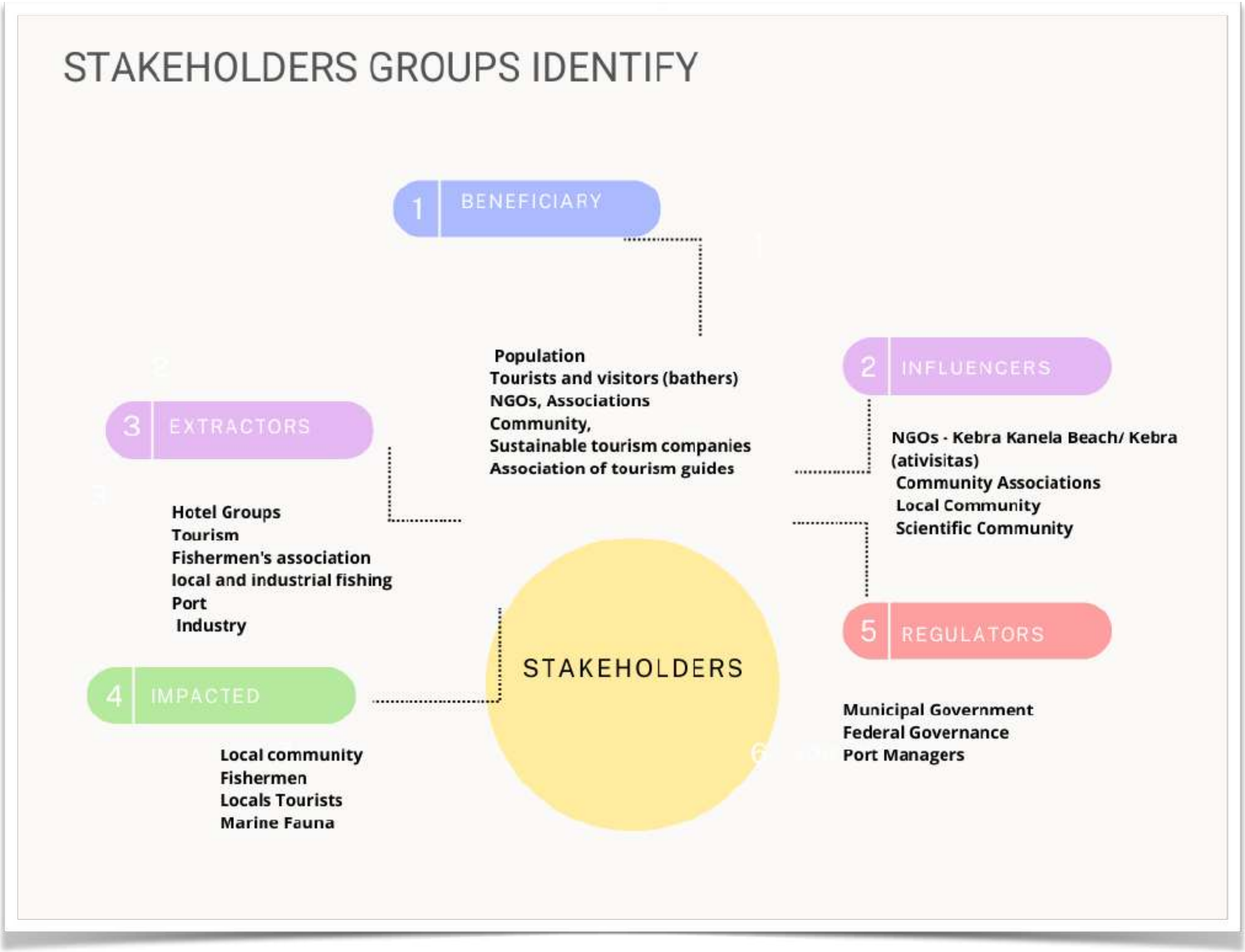

Figure 3.5: Stakeholders groups Santiago Identify

Impact on Ecosystem Services

The project produced a matrix listing the ecosystem services potentially impacted by marine pollution, specifically the accumulation of marine litter and solid waste in Santiago (Table 3.1). According to this result, at least three types of ecosystem services are being degraded: habitat provisioning (in yellow), ecosystem regulation and maintenance (in green), and cultural services (in blue).

Table 3.1. Impact on Ecosystem Services on the Island of Santiago

Filter	Section	Division	Group	Class	Code	Class Type
CICES	Provisioning (Biotic)	Biomas	Wild animals (terrestrial and aquatic) for nutrition, materials or energy	Wild animals used for nutritional purposes	1.1.6.1	Animals by amount, type
CICES	Regulation & Maintenance (Biotic(	Transformation of biochemical or physical inputs to ecosystems	Mediation of wastes or toxic substances of anthropogenic origin by living process	Bioremediation by microorganisms, algae, plants, and animals	2.1.1.1	By type of living system or by waste or subsistenc e type
CICES	Regulation & Maintenance (Biotic)	Transformation of biochemical or physical inputs to ecosystems	Mediation of wastes or toxic substances of anthropogenic origin by living process	Filtration/ sequestration/storage/ accumulation by microorganisms,algae, plants and animals	2.1.1.2	By type of living system or by water or substance type.
CICES	Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection	Maintaining nursery population and habitats (including gene pool protection)	2.2.2.3	By amount and source
CICES	Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Physical and experiential interactions with natural environment	Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through active or immersive interactions	3.1.1.1	By type of living or environme ntal setting
CICES	Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Physical and experiential interactions with natural environment	Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through passive or immersive interactions	3.1.1.2	By type of living system or environme ntal setting

3.5.2 BOA VISTA ISLAND

A lecture about the waste management

Boa Vista Island is the easternmost island of the Cape Verde archipelago, and represents 15.6% of the national territory. The Complex of Protected Areas on the East of the Island of Boa Vista (CAPLBV) consolidates a mosaic of seven terrestrial, coastal, and marine protected areas established through Decree-Law n°3/2003 of 24 February 2003.

Due to its great geomorphological and biological richness, the Island is a priority point for nature conservation. It is a permanent and temporary home for unique biodiversity, with many endemic species of birds, turtles, dolphins, whales, and gastropods. It is precisely in this region that the Caretta caretta sea turtle finds its main spawning area in Cape Verde. Despite the evident abundance and record of this species, it was assigned by the World Union for Conservation of Nature (IUCN) the status of "vulnerable" or "endangered". The island has rocky coastlines practically all around it, it is also made up of bays (Sal Rei, Derrubado, Ponta Antônia, Gatas) and islets (Curral Velho, Baluarte, Birds).

Its land area covers approximately 620 km² and the National Statistical Institute of Cape Verde (INE) projections describe that approximately 18,793 inhabit Boa Vista (2019 census). Also according to INE, Boa Vista and Sal have been developing at a fast-growing pace. Despite being mostly constituted of territorial units with a small resident population, these islands host the most expressive numbers of floating populations (e.g., tourists). Sociodemographic data play a fundamental role in the understanding of waste production and scale on beaches, whether generated by local or tourist communities. The project also identified the different environmental forcings that interact with human activities in Boa Vista, using a spatial schematic representation (Fig. 3.6). There seems to exist a negative association between environmental factors such as winds and rains and the disposal of waste in the environment, resulting in the accumulation of litter in the beach sand and sea interface.

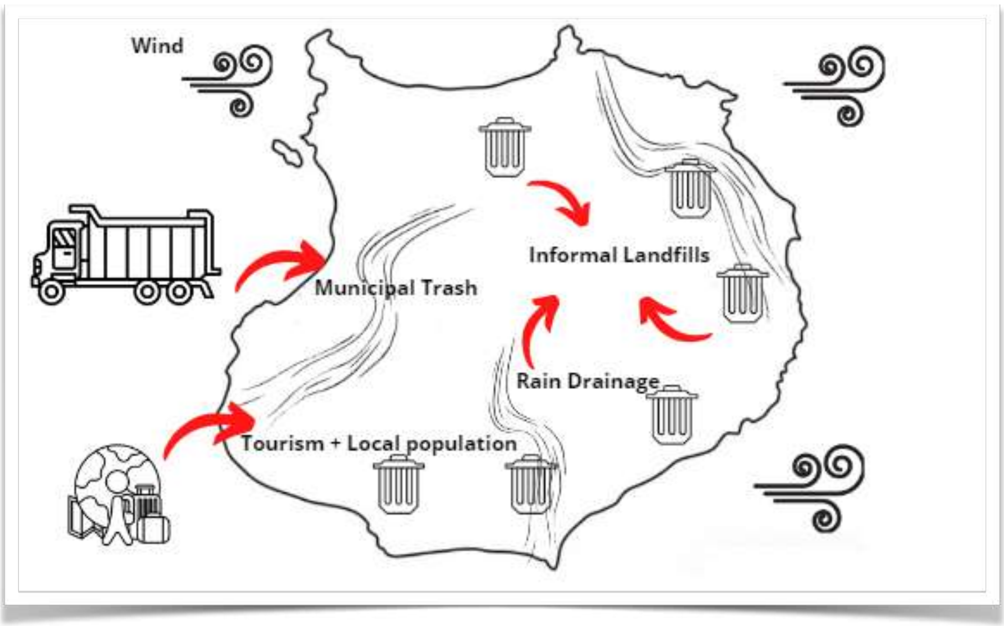

Figure 3.6: Schematic representation of environmental factors and human factors in the accumulation of waste on Boa Vista Island.

Mapping interested sectors and active stakeholders is an essential step in the process of building a plan or even of reviewing existing strategies to combat garbage at sea. A player/sector/ stakeholder is considered any person or group that influences or is directly/indirectly influenced by a theme and also that who has the ability or interest to impact the outcome of a given project or theme. The participants also suggested a list of the main stakeholders involved somehow in the subject of marine litter in the island of Boa Vista (Fig. 3.7). The stakeholder groups are not fixed in time and space, and should increase as the plan and project development and more detailed information are generated by the project

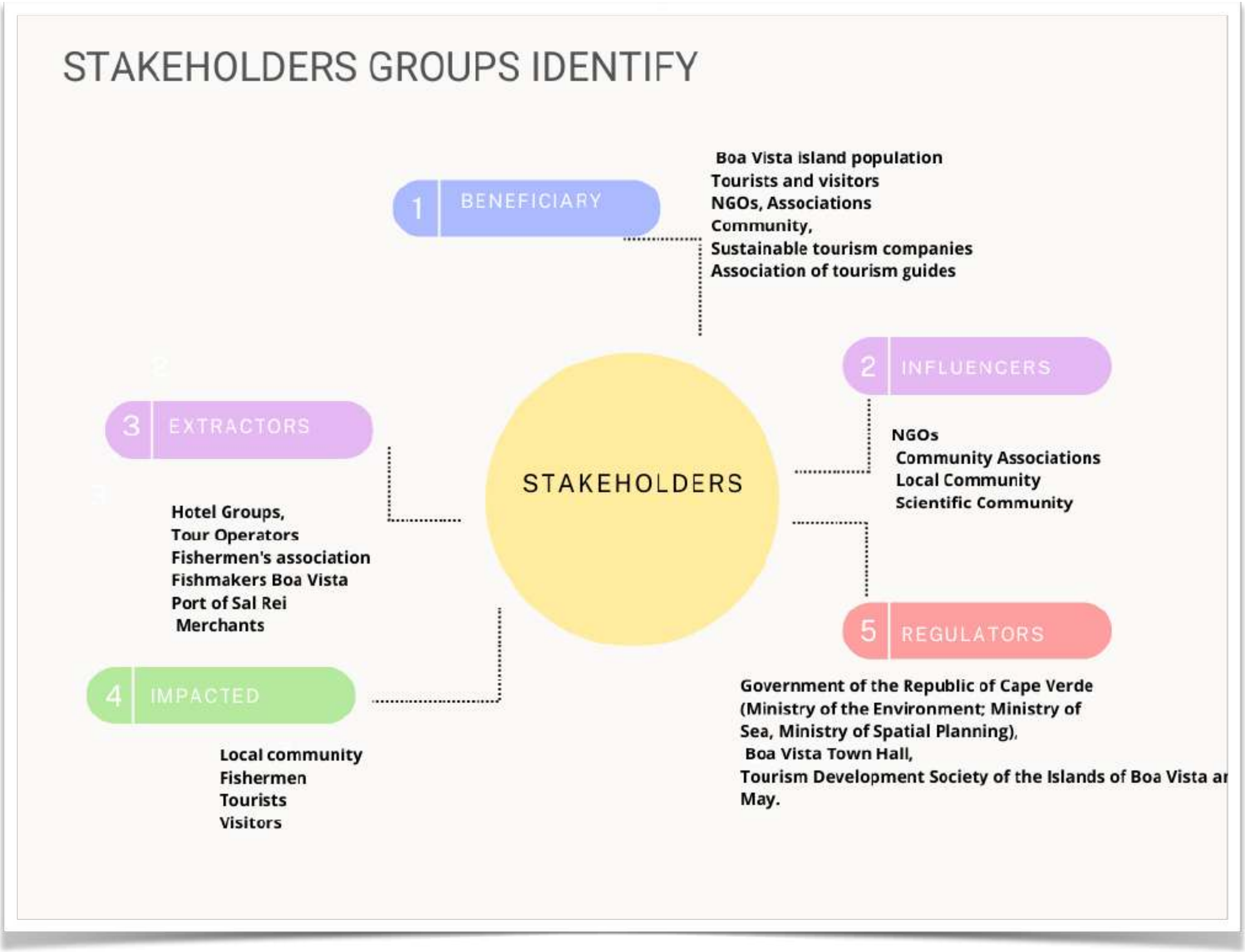

Figure 3.7. Stakeholders Groups Identify for Boa Vista Island

Change in the Ecosystem State

Four aspects were taken into account when considering the changes of Ecosystem State (STATE), , including the visual quality of the area, habitat quality, impacted Species, and biodiversity Loss. The visual changes identified by the project concerns the amount of waste found on the beach, including plastic packaging, tires, PET bottles and gallons, fishing nets, and fishing traps. According to the students of the OTGA Conosur course, this residue can be found in all environmental compartments in Boa Vista (e.g., shoreline, surface and water column, seabed, and biota), thus altering the quality of the habitat. Records from the Directorate General for the Environment and NGOs operating in Boa Vista reported that the capture of sea turtles on these beaches and at sea still represents a big threat to the conservation of the species on both Sal and Boa Vista islands, despite the reduction in poaching over the last few years. Any change in the ecosystem may lead to the loss of biodiversity, which historically represents a threat to the balance of the planet, economies, and humanity. These environmental changes impact first the local and traditional fishing communities, which are already under-resourced and vulnerable in terms of development and environmental crisis, and whose livelihood depends entirely on coastal ecosystems. The local NGOs are aware of those risks and engaged in fighting the problem:

"Plastic can affect sea turtles in a variety of ways, the most well-known and studied being the ingestion with turtles mistaking plastic objects for food leading to starvation, blockages or poisoning, entanglement in nets and ropes leading to suffocation, predation or starvation or injury through various forms. All of these scenarios are frequently observed in juvenile and adult sea turtles and any of these can easily lead to sea turtle deaths.

However, there are many ways in which were do not fully understand how sea turtles are impacted by plastics. One theme is microplastics which are littering our shores and oceans and can affect turtles during every single life cycle stage:

- *The nesting habitat of sandy beaches and dune systems which are subjected to microplastic deposition can lead to:*
    - *changes in temperature of the sand leading to skewed sex ratios, or in more extreme cases, death of the eggs.*
    - *Production and leakage of toxic chemicals into the eggs.*
    - *Increase in porosity of the beaches, changing composition, granulometry, humidity, and moisture content of the nesting habitat.*
    - *Greater physical obstacles for hatchlings to reach the sea.*
- *For juvenile and adult sea turtles, microplastics are ingested through eating and drinking which can accumulate in their digestive systems, causing blockages or further health complications.*
- *PCBs (polychlorinated biphenyls) are hazardous industrial chemicals which were banned from being produced in the 1970s. However, due to their longevity they are still vastly abundant at present in the air, soil and water. They attach readily onto the surface of plastics including microplastics and can be easily absorbed by animals through the digestive system and infiltrate all other bodily systems. They have been proven to cause a range of health conditions in many species including cancer and affect the immune system, reproductive system, nervous system, endocrine system and other health effects.*

Kate Yeoman - Fundação Tartaruga

Impact on Ecosystem Services

See below is the classification of the CICES Table on the impact on ecosystem services in the Boa Vista Island. Four categories were identified: food provisioning (in yellow), habitat provisioning (in red), ecosystem regulation and maintenance (in green), and cultural services (in blue).

Table 3.2. Impact on Ecosystem Services on the Boa Vista Island

Filter	Section	Division	Group	Class	Code	Class type
CICES	Provisioning (Biotic)	Biomas	Wild animals (terrestrial and aquatic) for nutrition, materials or energy	Wild animals used for nutritional purposes	1.1.6.1	Animals by amount, type
CICES	Provisioning (Biotic)	Water	Surface Water used for nutrition, materials or energy	Surface water for drinking	4.2.1.1	By amount, type, source
CICES	Regulation & Maintenance (Biotic)	Transformation of biochemical or physical inputs to ecosystems	Mediation of wastes or toxic substances of anthropogenic origin by living process	Filtration/ sequestration/ storage/accumulation by microorganisms,algae ,plants and animals	2.1.1.2	By type of living system or by water or substance type.
CICES	Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Regulation of baseline flows and extreme events	Control of erosion rates	2.2.1.1	By reduction in risk, area protected
CICES	Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Regulation of baseline flows and extreme events	Hydrological cycle and water flow regulation (including flood control and coastal protection)	2.2.1.3	By depth/ volumes
CICES	Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection	Maintaining nursery populations and habitats (including gene pool protection)	2.2.2.3	By amount and source
CICES	Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Water conditions	Regulation of the chemical condition of freshwaters by living processes	2.2.5.1	By type of living system

CICES	Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Water conditions	Regulation of the chemical condition of salt waters by living process	2.2.5.2	By type of living system
CICES	Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Atmospheric composition and conditions	Regulation of chemical composition of atmosphere and oceans	2.2.6.1	By contributi on of type of living system to amount, concentra tion or climatic parameter
CICES	Regulation & Maintenance (Biotic)	Regulation of physical, chemical, biological conditions	Atmospheric composition and conditions	Regulation of temperature and humidity, including ventilation and transpiration	2.2.6.2	By contributi on of type of living system to amount, concentra tion or climatic parameter
CICES	Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Physical and experiential interactions with natural environment	Characteristics of living system that enable activities promoting health, recuperation or enjoyment through active or immersive interactions	3.1.1.1	By type of living system or environme ntal setting
CICES	Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Physical and experiential interactions with natural environment	Characteristics of living system that enable activities promoting health, recuperation or enjoyment through passive or observational interactions	3.1.1.2	By type of living system or environme ntal setting

CICES	Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Intellectual and representative interactions with natural environment	Characteristics of living system that enable education and training	3.1.2.2	By type of living system or environmental setting
CICES	Cultural (Biotic)	Direct, in-situ and outdoor interactions with living systems that depend on presence in the environmental setting	Intellectual and representative interactions with natural environment	Characteristics of living system that are resonant in terms of culture or heritage	3.1.2.3	By type of living system or environmental setting

Response

Cape Verde already has a Legal Basis to deal with solid waste, which facilitates and opens the way for the implementation of allied plans and programs to fight marine litter according to the view of all the issues mapped by the DPSIR. Advances in regional and local regulation systems have a high potential to reduce the accumulation of plastics on beaches and other marine habitats, particularly, it can influence the use and disposal plastics in one of the major sources. Some of the projects for the Regulation of the Use of Plastic can be cited as the National Strategic Plan for Waste Prevention and Management 2016-2030 (PENGer) which provides for 60% of municipalities with selective collection by 2030 and a reduction of 80% by 2030, the same date as the fine plastics fraction (plastic bags). Gradually, Cape Verde is following the global movement to replace plastic with alternative materials. The biggest challenge is synchronizing and strengthening the dialogue between the government sector and the industrial sector, where market instruments can be applied in order to contain the financial losses that a sudden transition could cause to the economy.

Among the issues mapped by the DPSIR is understanding that the application of Beach Cleanings as a public policy instrument is urgent. It is fundamental that the governments and cities provide enough subsidies for NGOs that already carry out this work to keep it in the long term and enable new initiatives to integrate this intervention, including Recycling Cooperatives, that can be combined with the country's Recycling and Reverse Logistics Programs. The Legal Regime for Urban Waste Management Services (Decree-Law No. 26/2020), which came into force on March 19, regulates and establishes key concepts (see Table 3.3.) such as the solid waste system and its technical components is conferred (such as production, place of production, removal, collection, transport, storage, transfer, recovery, treatment, disposal), the exploration and management of the solid waste system, the inter-municipal solid waste system and the solid waste system (PENGer, Cape Verde). PENGeR points out various low to high-cost solutions that could be implemented immediately or integrate a medium to long-term waste management strategy (Table 3.3). Additionally, the regulation of the use of single-use plastic near beaches is a way to raise awareness among the local population and tourists and reduce the incidence of these same residues in an environment vulnerable to climatic actions, such as wind, rain, and tidal variations.

Table 3.3. Response and Management Measures identified as the legal basis for the solution of the fight against waste at sea

Action	Cost	Period	Interest	Legal Base
Clean up Beach	Low cost	Immediate application	Social Interest	PENGeR Review - 32/2016 - approves the Plan National Strategic Strategy for The Management of > (PENGeR), horizon 2015-2030.
Restriction of use of single-use plastic packaging	Medium cost	Mid-term	Political interest, represents a strategic option to reduce the use of plastic.	Law No. 99/VIII/ 2015 August 27 prohibition of production, import marketing and use of bags conventional plastic for the packing; *Drafting a new plastics diploma in Cape Verde
Implementation Plan for combating garbage at sea	High Cost	mid-term	Political interest At the public level of NGOs and associations implementing projects aimed at combating garbage at sea	Policy Charter for the Economy Blue In Cape Verde, Resolution No. 172/2020, of 21 December.
Regime applicable to prevention - Solid Urban Waste Management Plan -	High Cost	mid/long- term	Political and Social Interest	Decree Law 21/2003 Decree Law 56/2015

Waste management: Prevention, Reduction and Recycling	High Cost	mid/long-term	Political interest, non-governmental institutions. Civil society projects.	Law No. 76/VII/2010 - Ecological tax, which focuses on non-packaging biodegradable metal, glass, or matter synthetic or artificial plastic Several projects implemented
Programs for evaluation and monitoring of policies implemented	Medium Cost	mid/long-term	Political interest, non-governmental institutions. Civil society projects.	Implementation of prevention plans and characterization of sources and destinations through active monitoring in strategic points of the Islands.
Deposit Return Scheme	Medium Cost	mid-term	Industrial, governmental and society interested	________

Chapter 4

PROJECT IMPLEMENTATION

PHASE 2 - DATA MANAGEMENT AND SHARING

Chapter 4 Project Implementation

Phase 2 - Data management and sharing

4.1. AIMS AND SOLUTION

Understanding the impact of microplastics in the Ocean and its ecosystems and moving toward an effective solution requires long-term standardized data with broad coverage from local to global (Andrady et al., 2011; Napper & Thompson, 2020; Lamichhane et al., 2022). In this sense, the Our Blue Hands Project has included in its practices not just data acquisition, but robust analyses and indicators that provide a quali-quantitative comparative ground to assess microplastic pollution on sandy beaches. In the short-term, the Our Blue Hands data analysis rationale aims to develop a rapid census of microplastic pollution at the monitored sites, including information about the occurrence, abundance, and composition of plastic fragments and compare geographical and temporal differences in pollution impact. In the longer term, the information obtained from the microplastic occurrence time-series can be used to determine trends in coastal pollution, including insights into potential sources and environmental drivers (e.g. Cole et al., 2011). This data is crucial to assess marine pollution impacts on coastal areas and it is an efficient indicator of management and mitigation actions (Ogunola et al., 2018).

The analytical design, statistical techniques, and visualization tools applied to the microplastic data are endorsed by a long list of scientific literature from environmental and marine sciences (e.g., Balthazar-Silva et al., 2020; Jiang et al., 2020). These metrics and their corresponding analyses were chosen in order to fit the database, accounting for variability among datasets, sites, and collaborators. Besides, they were designed to allow robust comparison and identification of spatio-temporal differences according to the response variables (Underwood, A.J., 1992; Anderson & Walsh, 2013), in this case, related to micro and mesoplastics. At the bottom of the analytical chain is the data acquisition protocol, which is based on international standards (GESAMP, 2019).

In the following sections of this chapter, you will find: the results of the citizen science training course developed for this project (section 4.2); a brief description of the sampling protocol focused on data acquisition (section 4.3); detailed data analysis procedures (section 4.4); a description of the monitoring results until now (section 4.5); and insights discussing the main information acquired and recommendations for next steps (section 4.6).

4.2. TRAINING COURSE

Ocean Data is a new field of both "Blue" science and economy. With the great advance of ocean observations and monitoring of marine ecosystems, an immense amount of data is being generated by multiple sources and systems (Abbott, 2015; Qian et al., 2021). Transforming data into meaningful information requires improvement of current digital and physical infrastructure, and urgently, high-quality investment in training of data providers and users (Buck et al., 2019). In Citizen Science initiatives, such as the Our Blue Hands, it is important that the collaborators involved in the monitoring have the minimum knowledge about the project scope as well as the particularities of the data they are acquiring. This process of learning is two-way. First, the collaborators will improve their understanding of the dynamics of the habitat that they are monitoring and the environmental problem they are helping to fight. Second, the project coordinators and data managers will be able to better visualize the needs of that community and set the appropriate indicators for decision-making and community change. Training workshops are fundamental tools to ensure the quality and standardization of the data in the long term and can be a moment to identify and capacitate new experts to integrate the data team. Besides, engaging all participants in the data discussions and processes leads to a more decentralized and democratic Ocean governance (Drakopulos et al., 2022).

Considering the issues above, Our Blue Hands developed the first training course about marine data for citizen scientists held open, free of charge, online, and in Portuguese. The Ocean Data for Citizen Science course gathered 68 participants that had the opportunity to watch specific content about ocean data systems and observations. Those participants were from Cape Verde, Brazil, Angola, and other Portuguese-speaking countries, and included undergrad students, project collaborators, young scientists, and even renowned university professors. The course provided video classes, synchronous discussion meetings, practical exercises, and reference materials. The course took place from February 14th to March 11 2022 and was volunteer-led by Dr. Ana Carolina Mazzuco and other Brazilian scientists. Participants dedicated approximately 6 hours per week covering 6 major topics (credits: 24 hours plus exercises):

(1) *Course Introduction*, and *Coastal Monitoring* - sampling design, hypothesis testing, and environmental impact protocols for observing changes in coastal marine ecosystems;
(2) *Ocean Data source*s - available online global databases and data systems that provide free access to marine data;
(3) *Ocean Data Management* - organization, curation, quality control, vocabularies and standards, regulations, and agreements focused on general Essential Ocean Variables, Marine Biodiversity, and Microplastics.

(4) *Sharing pipelines* - guided practices from ocean data providers to digital systems.
(5) *Data analysis* - basic statistical tools and data processing environments to assess marine data for decision-making.
(6) *Outreach strategies* - information sharing and science communication principles to the next Ocean Decade.

During the course, the participants were able to interact and access resources through a the digital platform Slack. After the course just prior to the development of this report, all videos were uploaded to YouTube (see the section Digital resources), and course material is available to be accessed in GoogleDrive, soon to be posted on Deep Blue's webpage.

4.3. SAMPLING PROTOCOL

The Our Blue Hands monitoring protocol carried out on sandy beaches in Cape Verde acquired data by *in situ* samplings, which consisted of sieving sand along a standardized area of the beach (25m transect) looking for micro and mesoplastic fragments. Along each transect, smaller areas were defined as the sand samples ($1m^2$, n = 5). The protocol was replicated approximately each 15-days at different coastal sites, providing 5 to 7 sampling events (a test in November 2021, and continuous monitoring from June to August 2022). One of the sites (Areia Grande) was monitored only once.

Fragments found in each quadrant were separated into micro or mesoplastics based on size, according to sieve mesh and/or manual measurements (micro 1 to 5 mm; meso 5 to 25 mm). *Microplastics* were then classified based on shape into primary microplastics, which corresponded to nurdles (round/spherical nurdles, cylindrical nurdles, cube-shaped nurdles, disk-shaped nurdles, and other nurdles), or secondary microplastics (Expanded PolyStyrene EPS, and others). *Mesoplastics* were divided into EPS, fragments, or other types. Others, for both secondary microplastics and mesoplastics could be fiber, film, foam, or rubber.

The full monitoring protocol is published open access in the Ocean Best Practices System (OBPS-UNESCO) repository (Our Blue Hands, 2021), and the corresponding references from which it was adapted are cited in the text.

4.4. DATA ANALYSIS

The data obtained from the monitoring surveys provided the following response variables: (1) *record the* number of micro/mesoplastic occurrences observed in the samples, considered as unique records for the different categorizations (type, format, and color); 2. *abundance*, amount of micro/mesoplastics fragments sampled per transect or per square; 3. *composition*, considering the multivariate matrix of micro/mesoplastic abundance for the different categories. We used two types of sampling units, transect (one per survey, n = 1 to 7 surveys depending on the beach) or square (n = 5, per transect per campaign). All comparative analyses were carried out including similar sample units.

Differences between beaches (sites) and between monitorings (surveys) were evaluated by analysis of variance (ANOVA; Underwood, 1997) for record and abundance, and by multivariate permutational analysis of variance (PERMANOVA; Anderson, 2014) for composition. The analyzes tested the factors separately as the difference in the number of sampling units and monitoring replications still does not allow for multilevel hierarchical assessments for ANOVA and PERMANOVA. Specific contrasts were identified with Tukey's a posteriori tests (Tukey, 1977) and pairwise PERMANOVA (Anderson, 2014).

Data were transformed (log x+1; square root) when necessary to meet the assumptions of the analyzes (i.e., normality and homoscedasticity in ANOVA; linearity and null values in PERMANOVA). Graphic and analytical processing was performed by Numbers (Apple Inc.) for graphics and R environment (R core team 2022) for statistics.

4.5. RESULTS

The project surveys registered 779 records of micro and mesoplastics in a total of 27 monitoring campaigns in Cape Verde between November 2021 and August 2022. A total of 2240 units of these plastic fragments were found on the 5 beaches monitored, with an average of 82 units per sampling campaign (Table 4.1).

The project detected differences in the total abundance and occurrence of micro and mesoplastic per transect between the monitored beaches ($p < 0.05$; Tables 4.2, Fig. 4.1). The greater amount of plastics per survey and a significantly higher occurrence was registered in Boa Esperança beach, where there was an average of 146 fragments of micro and mesoplastics per transect per survey ($p = 0.001$; Table 4.1 and 4.2, Fig. 4.1). The least amount of plastics was registered in Tarrafal compared to the other beaches within Santiago Island, where there was an average of 16 fragments per survey during the monitored season (p = 0.0028; Table 4.1 and 4.2, Fig. 4.1). Overall, Calhetona and Kebra Kanela showed similar patterns of plastics abundance and occurrence, with no statistical differences detected by the analyses (Table 4.2, Fig. 4.1). Areia Grande was not included in these statistical comparisons because of the lack of replication, but visually it seems to have a less impact on plastics as Tarrafal.

Table 4.1. Summary of micro and mesoplastic records obtained in the monitoring surveys in Cape Verde in 2021 and 2022.

Country	State	Site	Surveys	Records	Total Abundance	Average abundance per survey
Cape Verde	Santiago	Calhetona	7	243	853	121
Cape Verde	Santiago	Kebra Kanela	7	124	480	69
Cape Verde	Santiago	Areia Grande	1	17	34	34
Cape Verde	Santiago	Tarrafal	7	58	111	16
Cape Verde	Boa Vista	Boa Esperança	5	329	729	146

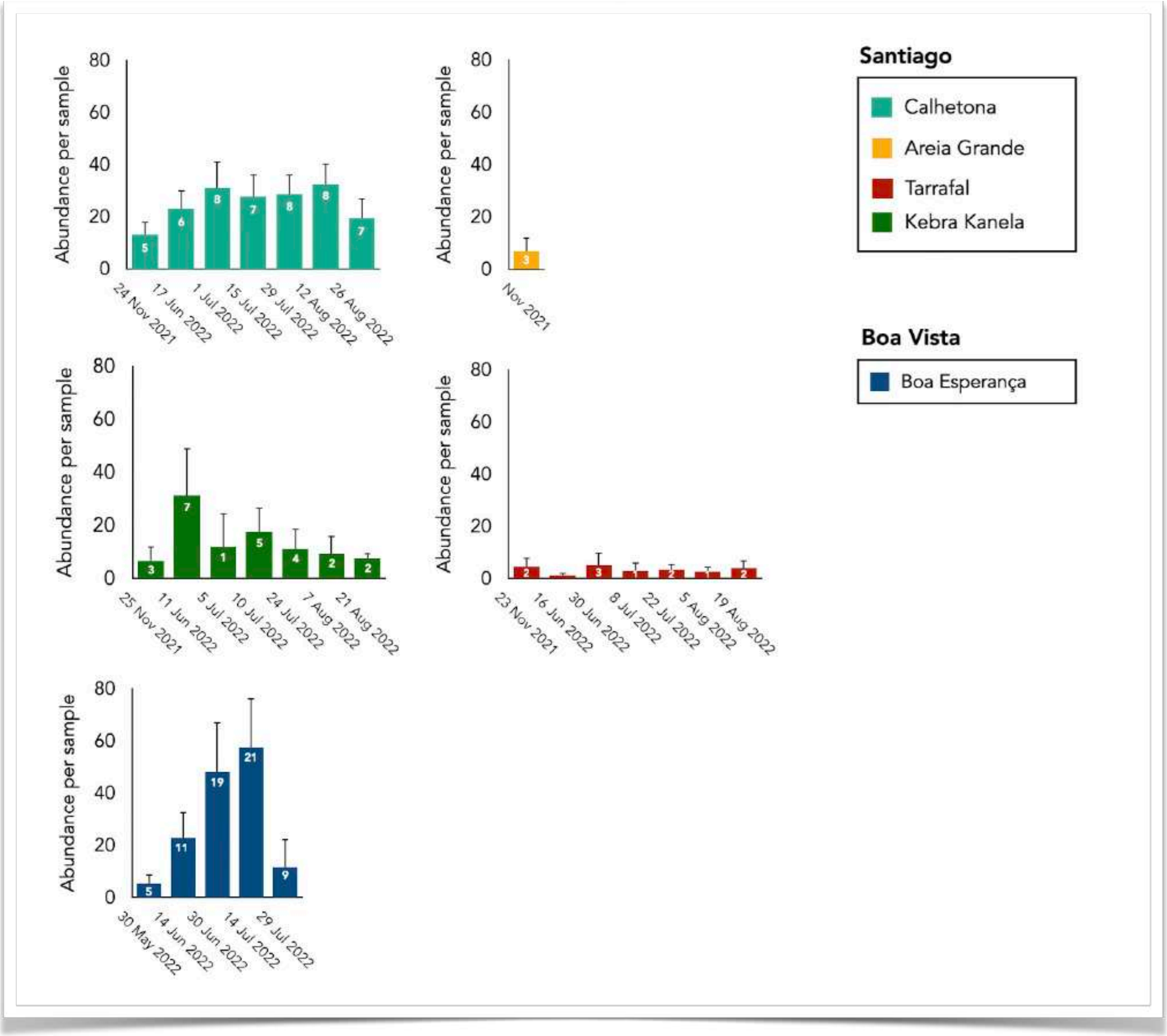

Figure 4.1. Variation in the total abundance (per sample in each transect) and occurrence of micro and mesoplastic sampled on Cape Verde beaches during the Our Blue Hands monitoring surveys.

Table 4.2. Results of ANOVAs comparing the variability in the total abundance and records of micro and mesoplastics between beaches, using monitoring surveys as sampling units. Note: df, degrees of freedom; SS sum of squares; MS mean square; F for statistics. Significant results (p < 0,05) are highlighted* and TukeyHSD post hoc results are added to the analyses.

records	***df***	**SS**	**MS**	**F**	***p***
Site	3	10895	3632	15.5	**0.0001***
Residuals	22	5147	234		
TukeyHSD: Boa Esperança ≠ Calhetona, Kebra Kanela, Tarrafal Tarrafal ≠ Calhetona, Kebra Kanela					
abundace	***df***	**SS**	**MS**	**F**	***p***
Site	3	63294	21098	6.4	**0.0028***
Residuals	22	72468	3294		
TukeyHSD: Tarrafal ≠ Boa Esperança, Calhetona					

Table 4.3. Results of ANOVAs comparing the variability in the total abundance and records of micro and mesoplastics between monitoring surveys, using quadrats as sampling units. Note: df, degrees of freedom; SS sum of squares; MS mean square; F for statistics. Significant results (p < 0,05) are highlighted* and TukeyHSD pos hoc results added to the analyses.

Calhetona	***df***	**SS**	**MS**	**F**	***p***
Survey	6	1440	239.9	3.9	**0.0058***
Residuals	28	1719	61.4		
TukeyHSD: Survey 1 ≠ 3, 5, 6					
Kebra Kanela	***df***	**SS**	**MS**	**F**	***p***
Survey	6	2205	367.5	3.6	**0.0079***
Residuals	28	2784	99.4		
TukeyHSD: Survey 2 ≠ 1, 3, 5, 6, 7					
Tarrafal	***df***	**SS**	**MS**	**F**	***p***
Survey	6	52.4	8.7	0.9	482
Residuals	28	260.0	9.3		
Boa Esperança	***df***	**SS**	**MS**	**F**	***p***
Survey	4	10411	2602.7	14.1	**0.0001***
Residuals	20	3704	185.2		
TukeyHSD: Survey 3,4 ≠ 1, 2, 5					

The monitoring identified significant temporal variations in the presence of plastic on Cape Verde beaches, highlighted for three sites, Calhetona, Kebra Kanela, and Boa Esperança ($p < 0.05$; Table 4.3, Fig. 4.1). In Calhetona, the greatest difference was observed during survey 1 (24-Nov-2021) when the least amount of plastics was registered (< 20 fragments average; Table 4.3, Fig. 4.1). In Kebra Kanela, survey 2 (11-Jun-2022) differed from the others as the largest amount of plastics were identified (> 30 fragments average; Table 4.3, Fig. 4.1). In Boa Esperança, surveys 3 (30-Jun-2022) and 4 (14-Jul-2022) contrasted with maxima in the abundance of plastics (Table 4.3, Fig. 4.1).

The composition of micro and mesoplastics also showed marked contrasts between beaches ($p < 0.05$; Tables 4.4 and 4.5, Fig. 4.2 and 4.3). All types of primary and secondary microplastics and mesoplastics were registered during the monitoring, and, accordingly, Boa Esperança beach had the most variety of types (Fig. 3).

Overall, primary microplastics (nurdles) were found in very small amounts on the beaches of Cape Verde compared with the other types of plastics (Fig. 4.2) An exception was Boa Esperança beach, where plastic nurdles (approximately 9 to 14 fragments per transect per event) were registered during 3 of the 5 monitoring surveys, accounting for the main variability among sites ($p < 0.05$; Table 4.4, Fig. 4.3).

A significant amount of secondary microplastics was found in the monitoring sites during practically all surveys (Fig. 4.2 and 4.3). The number of secondary microplastics overcame 150 fragments per transect during some surveys and was mostly dominated by EPS balls. A great amount of plastic fiber was detected in the sand of Boa Esperança (Fig. 4.3). Mesoplastics were often present in larger amounts compared to the other categories, mainly dominated by fragments and foam (Fig. 2 and 3). Tarrafal was the least impacted by both secondary microplastics and mesoplastics pollution (Table 4.4; Fig. 4.2 and 4.3).

Table 4.4. ANOVA Results comparing the variability in the abundance of primary microplastics, secondary microplastics, and mesoplastics between monitored beaches, using monitoring survey as sampling unit. Note: df, degrees of freedom; SS sum of squares; MS mean square; F for statistics. Significant results ($p < 0,05$) are highlighted* and TukeyHSD post hoc results added to the analyses.

Primary Microplastics	***df***	**SS**	**MS**	**F**	***p***
Site	3	167.9	55.9	6.3	**0.0029***
Residuals	22	194.2	8.8		
TukeyHSD: Boa Esperança ≠ Calhetona, Kebra Kanela, Tarrafal					
Secondary Microplastics	***df***	**SS**	**MS**	**F**	***p***
Site	3	21610	7203	5.9	**0.0038***
Residuals	22	26538	1206		
TukeyHSD: Tarrafal ≠ Boa Esperança, Calhetona, Kebra Kanela					
Mesoplastics	***df***	**SS**	**MS**	**F**	***p***
Site	3	10527	3509	5.7	**0.0046***
Residuals	22	13463	612		
TukeyHSD:					

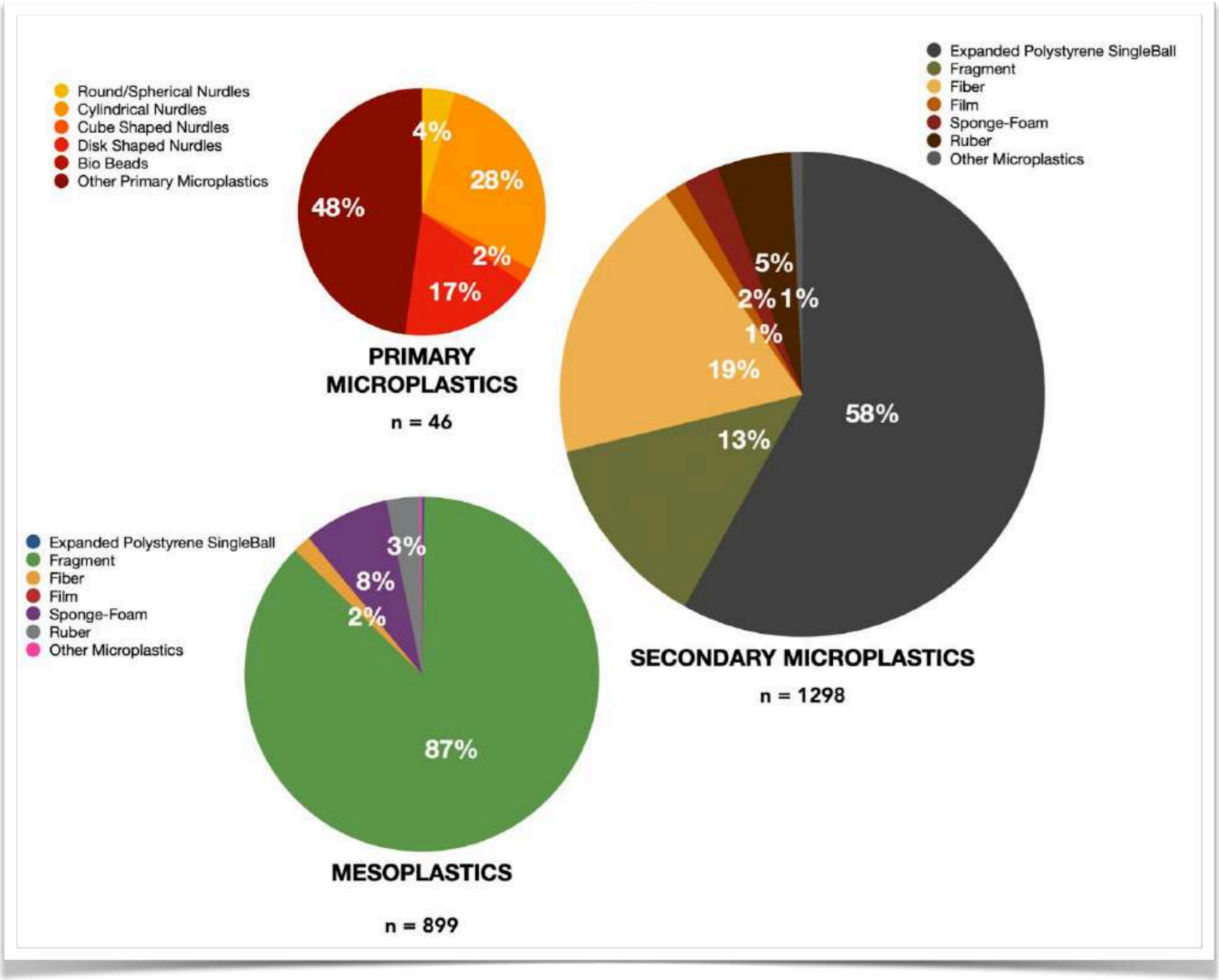

Figure 4.2. Composition of micro and mesoplastics identified by the Our Blue Hands project on the beaches of Cape Verde. Note: relative % of averages per survey, highlighted values refer to the averages per category.

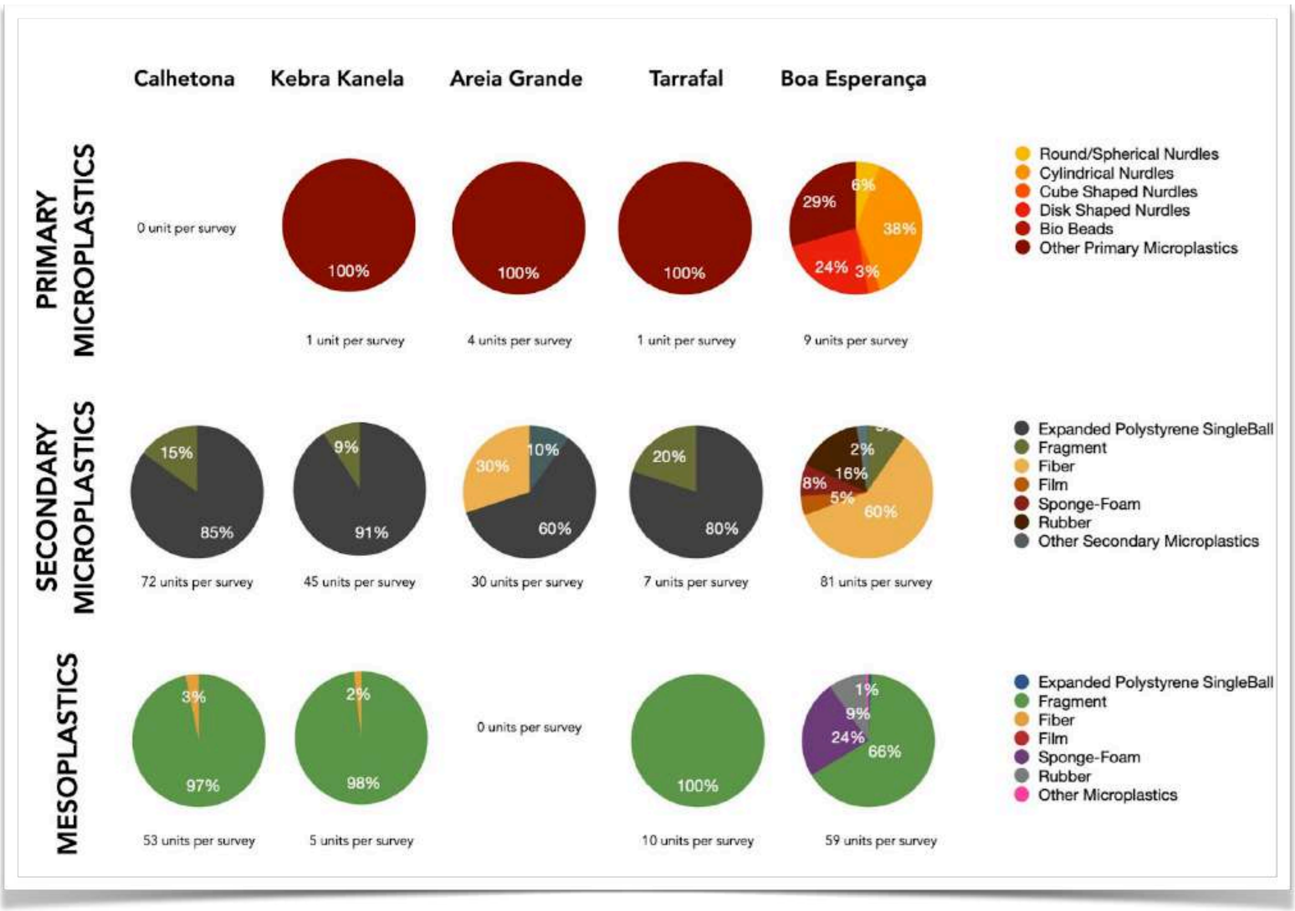

Figure 4.3. Variation of micro and mesoplastic composition between sites in Cape Verde. Note: relative % of averages per survey, highlighted values refer to the averages per category.

Table 4.5. PERMANOVA results compare the variability in the composition of micro and meso plastics between beaches, using monitoring surveys as sampling units. Note: df, degrees of freedom; SS sum of squares; MS mean square; F for statistics. Significant results (p < 0,05) are highlighted* and TukeyHSD post hoc results added to the analyses.

records	***df***	**SS**	**MS**	**F**	***p***	**R2**
Site	3	2.5	0.8	11.5	**0.01**	**0.61**
Residuals	22	1.6	0.1			0.39
Total	25	4.1				1.00
PERMANOVA pairwise results: Calhetona ≠ Kebra Kanela ≠ Tarrafal ≠ Boa Esperança						

4.6. INSIGHTS

The Our Blue Hands monitoring built an important baseline to help understand the impacts of microplastic pollution on the beaches of Cape Verde. The results showed that plastic fragments (micro and meso) are present in the sand of the surveyed sites in significant numbers, indicating that these residuals are an important source of marine pollution on the coast of Cape Verde. Like many other islands, coastal sites, and marine habitats, Cape Verde beaches reflect the serious problem that plastic pollution is posing to the health of our planet (Ocean Panel, Jambeck et al. 2020). Plastic fragments are found everywhere in the world, and, particularly, have been accumulated in the ocean for the past decades (Andrady et al., 2011). This plastic is not easily visible to humans, but has a multivariate impact on sea life, habitats, and the services they provide to society. According to our findings, although there is spatio-temporal variability in the abundance and occurrence of plastics on monitored beaches, these fragments were present at all the surveys and indicate a constant pollution source.

As highlighted above, the patterns of micro and mesoplastic pollution changed depending on the site. The monitoring surveys identified that Tarrafal beach in Santiago Island is the least impacted by plastics. Boa Esperança beach in Boa Vista Island, on the other hand, is greatly affected by a greater number of fragments of many different forms and origins. The recent marine litter assessments have identified that the geographical component is an important variable when addressing this problem. The proximity to pollution sources and the position within the route of pollution transportation by ocean currents tend to be major forces in the accumulation of microplastics on beaches (e.g., Sandu, C. et al. (2020). . Understanding the regional patterns in Cape Verde will require data integration, with environmental, meteo-oceanographic, and demographic information. Likewise, there was a significant difference between the sampling events for some of the beaches, highlighting the relevance of seasonality on those patterns of marine litter (e.g., Balthazar-Silva et al., 2020).

There are several environmental and health risks associated with the presence of plastic fragments in sand or seawater. Plastic even in small pieces can be toxic to the organisms living in those marine compartments and magnify through the trophic web. Those effects are yet to be measured and require specific ecotoxicological. Monitoring data is fundamental to guide those efforts and to provide information on the type and amount of those plastic fragments. Cumulatively, the negative effects of microplastics on coastal and marine ecosystems are expected to pose serious harm to Ocean health. Many projects throughout the world are starting to evidence the impacts of those tyne plastics on the quality of seafood and water.

FUTURE RECOMMENDATIONS AND PERSPECTIVES

Future recommendations and perspectives

Plastic pollution continue to accumulate in the oceans and fragment into different environmental compartments. There is a real probability, according to several scientific reports, that the harmful effects of plastic pollution will cross the threshold of an acceptable level and pose an unprecedented risk to society, species and ecosystems. Solving the problem of marine litter consists of applying global, regional, and local systemic actions simultaneously to provide indicators for the management and improvement of environmental quality and ocean health. The Sustainable Development Goals play an extremely strategic part in this action plan, as it fosters national and international alliances and partnerships and showcases the degradation or recovery of ecosystems.

Sharing information between governments and NGOs in the Cape Verde Archipelago is extremely important for understanding the issue of litter at sea. Thus, the Our Blue Hands Project recommends that there is a continuous work of articulation and promotion of possible partnerships for monitoring actions aimed at the periodic provision of data on marine litter and microplastics. The organization of a monitoring program linked to the National Strategic Plan for Waste Management, in addition to strengthening a permanent communication channel between science and management is fundamental to amplify the impacts of the Our Blue Hands actions. In other words, it is important to target the the implementation of this evaluation protocol with other existing public policies focusing on priority areas for conservation, where there is greater vulnerability.

We also strongly recommend building a collaborative plastic and microplastic pollution data platform and sustaining the ongoing engagement with the other Island Developing States, as well as active participation in collectively building the governance of plastic use and production. This implies common definitions, methods, standards, and regulations for an efficient system to combat plastic pollution throughout the life cycle of plastic. Besides, there should be an elaboration of an ongoing communication plan for environmental awareness with campaigns focused on periods of greater tourist flow, seasons related to climatic factors (rainy season) or turtle spawning, and stimulating medium and long-term attitudinal change.

Photo-gallery


CONSERVAR
QUE É NOSSO

Project Budget (Pilot version)

Main Axis	Phase	Action	Amount (unit)	Total ($$$)
Training/Monitor network	Phase 1	Sampling Kits Travel Expenses Transfer Consultancy	$ 500 $ 6000 $ 50 $ 750	7300
Data Acquisition	Phase 2	Scholarship	$ 900	900
Information Transformation	Phase 3	Report	Not Included	

*The organizations volunteered for the collections and implemented the monitoring protocol within the scope of the project itself.
**In all, at least 40 hours were dedicated to the report, which was not quoted in the initial value of the project and 80 hours were dedicated to dataset organization and analyzes.

Partner institutions:

Digital resources

Ocean Data for Citizen Science - Video-classes
YouTube
(https://www.youtube.com/watch?v=_8pZ9MeOK-4&list=PLq9b0Dd2HAv6WaoWgwQ5upK2lLSUsDKh8)

Dissemination of training work on Santiago Island - Video
Youtube
(https://youtu.be/wOtVXF17Ux8)

Website Our Blue Hands Project
www.ourbluehands.org

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