

# BRIEF OVERVIEW OF ACTIONS TO FIGHT MARINE LITTER

BRAZIL AND SANTOS (SP)



COMBATE ÀS FONTES DE  
POLUIÇÃO MARINHA POR  
RESÍDUOS SÓLIDOS

## PREFACE

This document incorporates the scope of the project “Fighting the sources of solid waste marine pollution”, an initiative of the Brazilian Association of Public Cleansing and Waste Management Companies (ABRELPE) and resources provided by the Swedish Environmental Protection Agency (SEPA).

With an estimated duration of 12 months (July, 2018 – June, 2019), the project gathers a set of studies, actions and proposals which aims to identify and fight the sources of land-waste that result in estuary and beachfront water pollution in the city of Santos, in the state of São Paulo, Brazil. The project team and a group of experts will focus on the current municipal solid waste management practices in order to identify the possible gaps that cause the littering of all kind of post-consumption materials – especially plastic items.

The municipality of Santos, located on the coastal area of São Paulo State, Brazil, was chosen by the project due to its geographical, socio-economic and political aspects, which offer ideal conditions for the development of data for future projects in different parts of the world. It is a densely urbanized island, with intense economical and touristic activities, in addition to an ecosystem sensitive to the pressure caused by a floating population and informal occupation of critical areas, such as the mangroves.

The municipality, represented by its Secretary of Environment (SEMAM), has shown a sensibility towards solid waste management and pro-activeness on the different interfaces of the subject with social, economic and environmental matters.

This Overview represents the project’s kick-off, in which a review of the actions and of the legal framework applied to a national level is being performed, as well as highlighting Santos location and all the active actors in the region. The main goal is to set the scene where the project will be developed.

## ACKNOWLEDGMENTS

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## CONCEPT AND COORDINATION

Brazilian Association of Public Cleansing and Waste Management Companies (ABRELPE)/ (secretaria@abrelpe.org.br).

ABRELPE is a non-profit organization that gathers and represents companies that operate in the urban cleansing services and management of municipal solid waste. Its mission is based on the principles of environmental preservation and sustainable development and its main objective is to promote technical and operational development of the solid waste sector in Brazil.

In an international context, ABRELPE is the representative in Brazil of the ISWA – International Solid Waste Association, the main global entity dedicated to the solid waste matters; it’s also the head office of the Regional IPLA Office for South America (International Partnership for the development of waste management services together with local authorities), a well-known program supported by the UN through the UNCRD – United Nations Centre for Regional Development. Moreover, ABRELPE is part of the Municipal Solid Waste Initiative of the CCAC (Climate and Clean Air Coalition), an international partnership for the environment agenda that operates on several fronts to reduce short-lived climate pollutants and fight climate change.

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**1.1. SOLID WASTE GENERATION**

Following the industrial revolution of the XVIII century, human society has gone through an abrupt transformation, adopting new habits that began to demand a constant increase in the supply of a broad range of consumer goods to a variety of different needs. Hence, such heritage has consolidated into what is nowadays called “the consumerism society”.

In the current scenario of populational growth, urbanization and the higher demand for products and services, for short and long term use, it is easy to observe a growth tendency for production and supply of such goods. Even though most of the consumers are focused on the products they are going to buy, consumption is not limited to the utilization of these goods, but will in many cases perpetuate with the so called “post-consumption”, represented by the packages. Plastic is the most common material present in packages available in the market, primarily due to its low added value, long durability and flexibility. Besides, it enables the storage of food and a whole range of other products, in addition to safeguard safety

during transportation of electronic equipment, among others.

Due to all the benefits offered by plastic and other materials, plus the latent lack of perception<sup>1</sup> of the citizens concerning the impact of their choices, the waste generation continues to grow – and it would not be the main issue here if the reverse logistics system were properly implemented, the recycling processes were economically viable and the inadequate final destination units, such as open dumps, were closed as recommended by the Brazilian legal framework.

The National Solid Waste Policy (PNRS – Federal Law 12305/2010) has already established the co-responsibility for the post-consumption product life cycle. Public authorities, distributors, importers, manufactures, traders, waste management companies and consumers assume specific commitments. Waste must be adequately disposed, depending on its physical characteristics and economic feasibility for recycling, composting or energy recovery; only residues, without any possibility of utilization, must be disposed in a landfill.

1 - IBOPE (Brazilian Institute of Public Opinion and Statistics): information obtained in <https://www1.folha.uol.com.br/mercado/2018/06/pesquisa-mostra-que-brasileiro-sabe-pouco-sobre-coleta-e-reciclagem.shtml>. Accessed in de 2018.

In Brazil, despite the PNRS enforcement, the scenario is far from being ideal: in 2017, around 40% - approximately 80,000 tons - of the collected urban solid waste were sent to open dumps or controlled landfills without any kind of re-utilization, causing numerous environmental and social impacts (ABRELPE, 2018). Of the 215,000 tons generated daily, approximately 19,000 tons/day were not collected, nor disposed properly. In other words, they are left adrift

in public roads, environmental protected areas, river basins, or either burned or possibly dumped in empty lots, causing all kinds of contamination. Solid waste has become a huge environmental problem to the oceans as one of the main threats to their ecosystems (SANTOS, 2008), which highlights the unquestionable relationship between the mismanagement of solid waste and its accumulation derived from anthropic activities.

## 1.2. MARINE LITTER

Marine litter, which is linked to the quality of the local solid waste management and influenced by cultural and socioeconomics char-

acteristics, is a complex matter represented by the human society and its interaction with the environment (Figure 1).

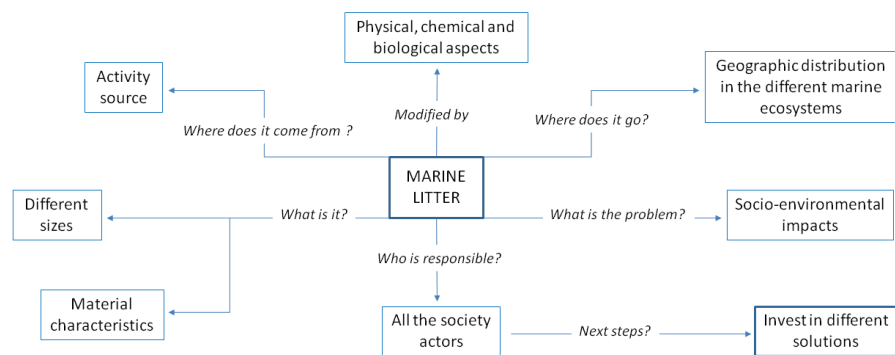


Figure 1. The complex environmental problematic caused by marine pollution of solid waste.

Material found in marine ecosystems are generated either by marine activities such as fishing and marineculture, maritime transportation, offshore oil and gas activities, touristic cruises or by

in-land activities. Waste generated by management failures that occur in countryside areas will, by influence of wind, pluvial and fluvial waters, be carried out into the hydrographic basins and eventu-

ally reach coastal areas (SHEAVLY & REGISTER, 2007). Should waste be discharged on coastal areas, it may be left at the beach or at urban areas of the coastal municipality, exposed to weather, waves and tidal conditions.

It is commonly mentioned that 80% of the material found in marine ecosystems are originated by terrestrial, land activities. Recently, a study showed how 95% of the waste pollution derives mainly from 10 rivers in the world (SCHMIDT, KRAUTH & WAGNER, 2017) pointing to the importance of a systemic and comprehensive look at the process of waste generation and destination throughout its whole lifecycle.

Monitoring and cleanup activities on coastal ecosystems have shown that, most of the times, macroplastics (> 2.5 cm) (CHESHIRE et al., 2009) are predominantly found, consisting of approximately 90% of the removed material. Smaller plastic particles, known as microplastics (< 0.5 cm) are not easily removed from the environment (GESAMP, 2015) and thus represent a bigger challenge. Microplastics come from different sources: they can be fragments of bigger objects, synthetic textile fibers or decomposed parts of cosmetics and personal hygiene products, such as scrubbing soaps or tooth paste, which find their way to the ocean through wastewater.

Due to its durability and flotation properties, plastic is the most common waste observed in coastal regions, though it shall be highlighted that the smaller the fragment, the harder its removal of the environment. Immersed in the seabed - made of sand, rocks or reef ecosystem - denser material represent a high percentage of the total ocean waste collected. Examples of these materials are: metal, textile, glass, rubber, fishing gear and some specific denser plastics, such as nylon, used in fishing nets.

Facing no barriers, solid waste can be found in different water columns and depths. Researchers have observed dischargeable plastic items located at Mariana Trench, the deepest spot of all oceans, at 10,898 meters (CHIBA et al., 2018). Furthermore, they are distributed in coastal zones, reaching the different ecosystems that exist in the region, and also found in ocean gyres, central regions where there is a huge accumulation of materials due to the hydrodynamic of the main oceanic currents (COZAR et al., 2014). Over time this material will suffer physical alterations, being redistributed, fragmented and, as mostly plastics, potentially adsorbing chemical substances to their surface, such as PCBs (polychlorinated biphenyl) and PBTs (persistent, bio accumulative and toxic substances) (GESAMP, 2015).

The negative impacts to the marine biodiversity are several (DERRAIK, 2002, GREGORY, 2009, GESAMP, 2015), for the organisms interact in different ways with these materials. Entanglement is one of the main impacts to marine life, causing drowning, choking, body deformations, injuries and/or feeding disabilities. Ingestion is also one of the most serious concerns caused by marine litter. These materials, commonly found in the stomach contents of whales, marine birds, turtles, and small fishes, can cause starvation sensation and blocking of respiratory airways. A wide variety of organisms ingest the microplastic particles (COLE et al., 2011), like mussels, juvenile fishes and invertebrate larvae. Its impacts to the planktonic organisms are still under research (KAPOSI et al., 2014; SANTANA et al., 2018).

Another impact not commonly mentioned is the fixation of marine organisms to the material surface. Once adrift, waste acts as a vector of species from one place to another (GREGORY, 2009), leading to ecological imbalance in case exotic species are introduced to a different habitat. The material can also disperse chemical pollutants (which are adhered to its surface) to the sea, possibly contaminating the marine life that ingests them. Eventually, human beings are also exposed to the waste or

contaminated fragments, being at risk of consuming contaminated organisms (CAUWENBERGHE & JANSSEN, 2014).

Therefore, the impacts to the health and quality of life of human beings (THOMPSON et al., 2009, GREGORY, 2009), as well as to the environment health, are innumerable and difficult to measure. Besides the mentioned physical and chemical damage to the organisms and the environment, the esthetic matter of waste present in beachfronts is also a problem. Studies show the potential negative impact caused to the tourism (KRELLING, 2017) and, consequently, to the economy of coastal municipalities, increasing the concerns related to the subject in different sectors of the society.

According to the United Nations Environment (UN Environment), the costs of the environmental damages caused by plastic waste account for US\$ 13 billion per year. Hence, considering all topics mentioned above, a broader, mature, cohesive and systemic vision of the solid waste problematic to the oceans is necessary in order to determine effective and integrated solutions to fight against this huge and complex environmental threat.

### 1.3. GLOBAL REACTION

Ocean protection became a hot topic since the Rio 92 Conference, in which the marine litter problematic was brought into light by the international community in different instances due to its increase in accumulation and the observed impact to the environment.

In 2011, during the IV International Conference on Marine Litter, the Honolulu Strategy was established (NOAA & UNEP, 2011), providing recommendations raised by specialists in the field and setting measures to support the fight against marine litter to different stakeholder groups, such as governments, universities, civil society and the private sector. Actions related to the removal of waste from marine zones (coastal areas and open seas) have been suggested and, more importantly perhaps, strategies to intercept the waste flow to the ocean, regardless of its activity source, whether marine or land-based, identified. Other examples of integrated suggested actions were the environmental education to different publics, local waste management improvement, and the elaboration of public policies (LOHR et al., 2017).

During the Rio+20, held in 2012, UNEP (United Nations Environment Programme) created the Global Marine Litter Partnership

(GPML), in attempt to gather specialists to discuss the subject. In that same year, the UN organized its first United Nations Environment Assembly (UNEA), which has become an important international forum to discuss, among other environmental-related themes, the matter of solid waste in coastal zones and oceans.

The following editions of the UNEA - 2014, 2016 and 2017 - contributed to accelerate discussions on the subject, with the elaboration of three specific resolutions. These resolutions identify and address the need of an integrated engagement of the different stakeholder groups in order to guide the UN State-Members to act and fight against the problem. It is important to highlight, as detailed hereafter, that Brazil takes part of the mentioned discussion forums and is engaged to fight marine litter, as a contributor to the resolutions and consigner to the declarations.

In 2015, the Sustainable Development Goals (SDGs) initiative was launched, consisting of targets to be achieved by 2030. Among the 17 goals of the UN 2030 Agenda, the SDG 14, called "Life below water", aims to "conserve and sustainably use the oceans, seas and marine resources for sustainable development". Target 14.1 stands

out, calling for “by 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution”

The growing attention to the oceans peaked during The Ocean Conference 2017, also hosted by UN Environment. In this event, participant countries debated the different possible ways to ensure

that the SDG 14 would become part of government strategies, and thus, different propositions and volunteer commitments were assumed. Considering this global context, with the increase pressure on the environment caused by waste, as well as the greater visibility of the current threats to the oceans, the theme of marine litter has also gained more attention in Brazil.

## 2. NATIONAL ACTIONS - BRAZIL

The Brazilian coast stretches over 7,000 km, shared by 17 states and 395 coastal municipalities, which house 26% of the country’s population (IBGE, 2011). According to a survey, inhabitants living up to 50

km off the coast of Brazil are the 16<sup>th</sup> largest contributor to ocean pollution by solid waste, with a discharge of 70,000 to 190,000 tons of waste to the ocean every year (JAMBECK et al., 2015).

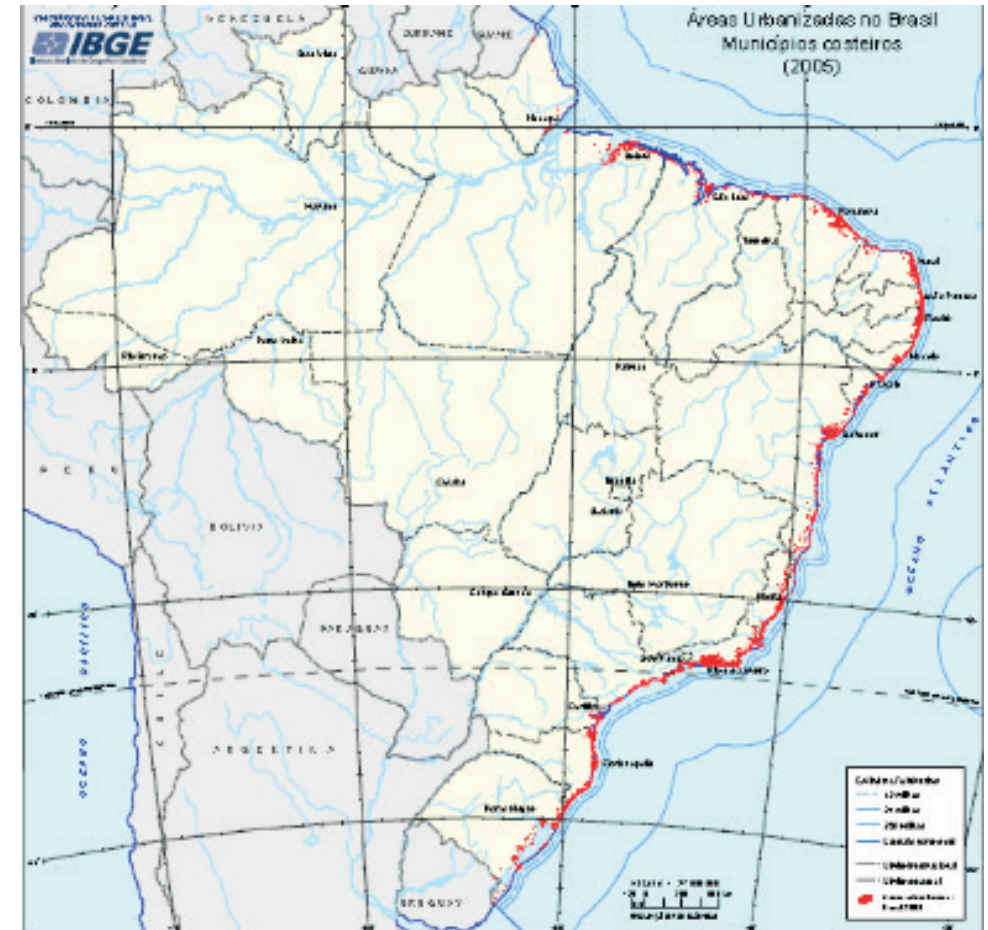


Figure 2. Map of Brazil highlighting urban concentration on the coast. Adapted from IBGE, 2015.

Therefore, national, regional and local movements are being developed by different institutions,

aligned with Brazil’s mobilization in the international context, with a goal to take the lead in the fight

against this problem. They will be presented below and are subdivided in public policies, nationwide

## 2.1. PUBLIC POLICIES

The marine litter topic has no specific public policies yet, but is present in a couple of Brazil's Legal frameworks, such as the National Environmental Policy (Federal Law 6938/1981), the National Solid Waste Policy (Federal Law 12305/2010) (OLIVEIRA, 2013) and the 4<sup>th</sup> National Conference on Environment (2013). As a result of one of the commitments assumed by Brazil during the Oceans Conference in 2017, the theme is strongly internalized in the National Coastal Management Plan (Federal law 7661/1988).

The mentioned commitment is referred to as "Development of a national strategy to fight marine litter", and it was designated as part of the Federal Action Plan to Coastal Zones 2017-2019 (PAF-Activity 1 – National Plan to fight Marine Litter) in the Coastal Management Integration Group (GI-GERCO) of the

campaigns, research and integrated actions.

Inter-Ministerial Commission for Sea Resources (CIRM). Thus, the specific political tool for the combat to solid waste in oceans will be the National Plan to Fight Marine Litter (PNCLM), which is currently in drafting stage, with completion expected for 2019.

The first action taken at the PNCLM agenda was the I National Seminar to Fight Marine Litter (Figures 3 and 4), held in Rio de Janeiro, from 6<sup>th</sup> to 8<sup>th</sup> of November 2017. Organized by the Ministry of Environment, UN Environment and IOUSP, it was attended by more than 150 people from different sectors. The objective was to align the knowledge of the experts in the country, considering their different work sectors, and discuss a common approach to the document to be elaborated.



Figures 3 and 4. First National Seminar to Fight Marine Litter, which gathered representatives of the public authorities, private sector, civil society and academics. The event marked the beginning of discussions about the National Plan to Fight Marine Litter. Photos: Laboratory team of Management, Ecology and Marine Conservation, IOUSP.

On the 4<sup>th</sup> of June 2018, the Decree n° 188 was signed by the Minister of Environment, Edson Duarte, creating a multi-sectoral commission responsible for coordinating the elaboration of the document. The plan is to base it on the principles of integrated management, circular economy and an ecosystemic approach. In addition, the participation of different sectors of society will be stimulated through campaigns to collect information and suggestions consistent with the proposal for the development of the policy. For its elaboration, plans already under development

by other countries and regions of the world will also be considered.

Due to the Brazilian government's engagement with the subject and the strengthening of its local scientific capabilities, the country was invited to attend the GPML 2018. That enables the exchange of information with other participants regarding innovations on the solid waste management field, methodologies and results of research, strategies to control the entrance of waste in the marine environment and a systematic update from its experts about the public policies around the world.

## 2.2. CAMPAIGNS WITH NATIONAL COVERAGE

Several entities from the organized civil society, public and private institutions have been promoting actions that contribute to the eradication of marine litter; there are also movements that integrate two or more of these social groups, such was the case of the 1<sup>st</sup>

Seminar to Fight Marine Litter. As most of the initiatives are restricted to local activities, this topic will only address the actions applied to three or more Brazilian states, considered here to as a representation of national coverage.

The UN Environment Clean Seas international campaign is well known in Brazil, under the name of Mares Limpos (Figure 5). With an estimated duration of 5 years, the campaign (in cooperation with 52 countries), was launched in the country in June 2017 with support from Brazilian government and, a

year later, changed the slogan to “Rios Limpos para Mares Limpos” (Clean Rivers to Clean Seas) as a way to expand its scope of actions to the countryside areas, contributing to the perception of the existing connection between freshwater and oceans.



Figure 5. UN Environment campaign logo, Mares Limpos.

The focus of the campaign is to mobilize the government, civil society and private sector, with the purpose to stimulate their contribution to the control of the plastic waste that reaches the river basins and oceans and to encourage ban policies for disposable plastics and microplastics used in cosmetics.

Another initiative of the Mares Limpos campaign, in partnership with the online university training

center Open Universiteit and the GPML, is an online course (Massive Open Online Course) about marine litter, not offered in Portuguese language at the moment. With subscriptions that are open sporadically, the course highlights the available information about the matter, aiming to teach the participants about the complexity of ocean pollution by solid waste.

### 2.3. NON-GOVERNMENTAL ORGANIZATIONS (NGOS)

With greater visibility to the subject, a high number of NGOs are active on the cause, however only a few take action in different States of the country, allowing a national context approach to their actions. One of them is the Ecosurf Institute<sup>2</sup>, which has been active in the cause since 1998. The institution, initially formed to raise awareness to surfers about marine litter in Itanhaém, South Coast of São Paulo, is currently represented in the Central and South coast of São Paulo, in Rio de Janeiro, Pará, Ceará, Santa Catarina and Rio Grande do Sul States, and its public targeted expanded to the general population.

The efforts of each branch are regional and have different approach, which are: environmental education, public policies, research, activism and mobilization. Their cleanup activities are made in a monitoring format, whereby data regarding the collected material are usually published on their social media (Figures 6 and 7). Representatives of the Institution are invariably invited to represent the “third sector” in national events on the subject; the NGO is also a partner of the Mares Limpos movement, and its technical consultant is the ambassador for the UN Environment Clean Seas.



Figures 6 and 7. Information collected in the cleanup movement organized by the Ecosurf Institute at Costão beach, in Peruíbe, SP (July 2018). Source: Ecosurf Institute.

2 - Ecosurf Institute: for more information, access <http://www.ecosurf.org.br>

Another important NGO to mention is the Oceano à Vista<sup>3</sup> (OàV), created by oceanography students. The main goal of OàV is to stimulate the discussion about the oceanographer profession, as well as to sensitize the population and professionals of the sea about the marine and coastal environment importance, and the threats to their different ecosystems. In this proposal, it aims to unite the students of the 12 Brazilian universities that offer a Bachelor in Oceanography program.

One of its existing projects is called “Limpa, Oceano!” which actions have been realized since 2015. Figure 8 below presents the activities organized by students of the following universities in 2017:

Federal University of Maranhão (UFMA), Federal University of Ceará (UFC), Federal University of Pernambuco (UFPE), Federal University of Bahia (UFBA), Federal University of Espírito Santo (UFES), State University of Rio de Janeiro (UERJ), University of São Paulo (USP), University Monte Serrat (UNIMONTE), Federal University of São Paulo (UNIFESP), Federal University of Paraná (UFPR), Federal University of Santa Catarina (UFSC) and Federal University of Rio Grande (FURG). According to the information obtained from the institution, the actions accounted for 6 km of beaches cleaned in 10 Brazilian states, and contributed with over 5 tons of solid waste collected from the sea.



Figure 8. Disclosed information by Oceano à Vista, with a list of dates and places where the “Limpa, Oceano!” activities occurred, organized in June 2017.

3 - Oceano à Vista: For more information, access <http://oceanoavista.wixsite.com/oceanografia>

In Brazil, there are different NGOs whose goal is conserve marine life, and their projects are usually focused on some species or specific groups. With a wide recognition in the country, Tamar<sup>4</sup> and Albatroz<sup>5</sup> projects are represented in different States; these two

## 2.4. CLEANUP ACTIONS

Another important action group to mention is the one that carries out cleanup activities of beach and other environments. Along the Brazilian coast there are institutions that organize cleanup activities in monthly and quarterly basis, and their objectives vary from specific de-pollution of the environment to the awareness raising of those involved.

projects of greater national visibility and many others of smaller size, intend to encourage the care of their flagged species, but also shed a light on the anthropic impacts that threatens them, such as marine litter.

In 2017 the Rede Praia Limpa<sup>6</sup> program was created, comprised of 170 institutions that provide cleaning services to beaches, mangroves and rivers among other environments. Organized by the Ecosurf Institute in partnership with UN Environment during the Clean Seas Week, the program is currently being updated, but an example of its content is exemplified in Figure 9



Figure 9. Map of Rede Praia Limpa program, indicating the different beach cleaning activities that happen around Brazil and the information presented once an institution registers.

4 - TAMAR Project: for more information, access <http://www.tamar.org.br>

5 - Albatroz Project: for more information, access <https://projetoalbatroz.org.br>

6 - For more information, access <http://bit.ly/MapaPraiaLimpa>

Most of the beaches cleaning actions in Brazil are also concentrated on the “International River and Beaches Cleanup Day”. The second Saturday of September marks the day of massive mobilizations around the globe to cleanup, marine environments and river basins, mainly. This date was defined due to the high levels of waste concentrated at the United States beaches right after summer break (July-August in the Northern Hemisphere). For over 30 years several task-forces have been organized to cleanup these environments.

The same date applies to Brazil, even though summer in the

## 2.5. BRAZILIAN SCIENCE IN MARINE LITTER

In Brazil, researchers take different approaches on the problematic and try to better understand the complexity of the question. The data collection shown in ANNEX 1 was compiled by the Laboratory of Ecology and Conservation, Coastal Management of IOUSP in 2016, based on scientific articles around the subject. To this publication, the list has been updated.

Some 35 researchers and PhDs from 11 of the 17 Brazilian coast-

Southern Hemisphere and a greater concentration of people going to the beaches occur in the months of January and February. Specific actions that contribute to the International River and Beaches Cleanup Day are organized around the country, mostly linked to some of the mentioned international movements. In 2018, several coastal or countryside cleaning actions were encouraged, organized and scheduled on the 15<sup>th</sup> of September, 2018. The groups Instituto “Limpa Brasil” and “Let’s do it” mobilized over 200 cities in Brazil aiming to strategically standardize and collect data from different places and activities.

al states are listed in the data collection, as well as scientists coordinating projects that are related to the subject and/or those having at least one project related publication as the first or last author. To verify their main area of research, Curricula’s Lattes<sup>7</sup> have been reviewed by searching the following keywords: marine litter, solid waste, marine debris and litter. With that the following articles about marine litter have been selected:

- *Monitoring of solid waste in marine environments;*
- *Distribution and abundance of solid waste in coastal and marine environments;*
- *Waste in marine environments and its interaction with the biota;*
- *Microplastics in biological and environmental samples;*
- *Environmental impacts caused by marine litter;*
- *Solid waste management;*
- *Solid waste contamination in marine environments;*

- *Environmental education about solid waste;*
- *Solid waste perception on marine environments.*

It is important to emphasize that, despite the difficulties, science is constantly in motion, and thus, this survey must be updated periodically. It is also possible that a prominent researcher was not included in the list during this document elaboration due to his or her ongoing PhD studies.

## 2.6. ENVIRONMENTAL COMPENSATION PROJECTS AND PARTNERSHIPS

Intersectoral partnerships have also been created to contribute to the cause. It is important to highlight that, despite the different visions and specific objectives of each institution and sector involved, one of the common goals is to eliminate solid waste at sea. This report, for example, is the result of the partnership between ABRELPE and SEPA, in collaboration with the IOUSP; the project scope foresees partnerships with national and local organization seeking for preventive actions to the marine environment pollution by solid waste.

Another relevant example of partnerships on the national scenario is the agreement between Plastivida (Instituto Sócio Ambiental dos Plásticos) and the Laboratory of Ecology and Conservation,

Coastal Management of IOUSP. Plastivida, composed by plastic manufacturing companies, is signatory of the “World Declaration of Plastic Association to Marine Litter Solutions” (2011), throughout which the Institute commits to work together with governments, NGOs, researchers and other decision makers to prevent marine litter. Hence, the partnership with USP is given through a technical-scientific project to mitigate marine litter, promoting scientific studies, environmental educational activities and incentive to good practices on solid waste disposals. The agreement was initiated in 2012, same year international and national scientific articles related to the topic were collected. From 2012 to 2014 quarterly field data collections were held in or-

7 - Curriculum Lattes: tool created by CNPq (National Center of Scientific and Technological Development), which main objective is to organize and standardize the curriculum vitae of national territory, widely used by researchers. Access: <http://lattes.cnpq.br>

der to diagnosis and monitor the accumulated waste in 12 beaches along the Brazilian coast, in Alagoas, Bahia and São Paulo States. The work results are yet to be published.

The Plastic Sectoral Forum – “Por um Mar Limpo” initiative - was created in 2016 and gathers 16 companies, such as Braskem, Dow,

Abiplast, Plastivida, among others, as well as associations and plastic manufacturing industry-related unions. The forum’s objective is for the industry to collectively contribute to the solution of the marine litter problem, seeking to switch a reactive behavior into a proactive behavior towards the matter.

### 3. LOCAL SCOPE – THE REALITY OF SANTOS

Several local scenarios are observed within the overall national scene. With that in mind and for the reasons already presented, the city of Santos (SP) was chosen to briefly present its strategy against marine litter in this report. The industrial and urban developing scenario in Santos resulted in several mobilizations of stakeholders such as environmental activists, entrepreneurs, researchers and media representatives.

Located in the south coast of São Paulo State (24°00' S, 46°30' W), the municipality of Santos has a

total territorial area of 271 Km<sup>2</sup>, with 39,4 Km<sup>2</sup> of insular area on the island of São Vicente, and the remaining 231,6 Km<sup>2</sup> located in the continental area. The island is surrounded by the known Estuarine System of Santos and São Vicente, which is composed by the Santos, São Vicente and Bertioga Canals (name of neighboring cities), and the Bay of Santos. The estuary also holds the biggest port complex of Latin America and the neighboring municipality, Cubatão, is home to a large industrial pole. Seven other municipalities integrate the Metropolitan Region of Baixada Santista.

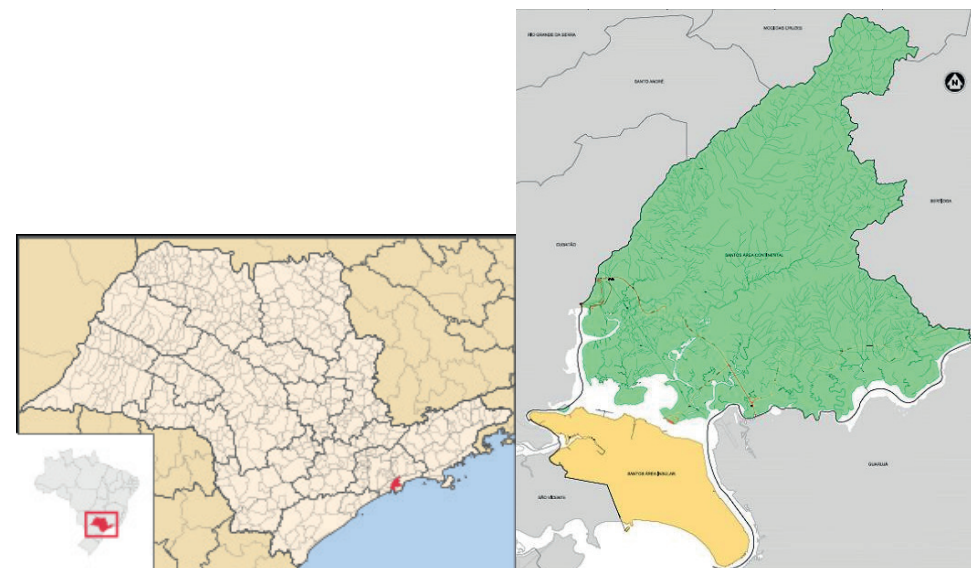


Figure 10. Map of Brazil (left), the State of São Paulo highlighted (center) and the localization of the municipality of Santos, insular and continental areas (on the right). Sources: Wikipedia and Novo Milênio.

According to estimates from IBGE (2018), the population is close to 440,000 inhabitants, of which 99% live in the urban areas of the insular portion and the remaining 1% in the continental area. During high season and holiday

periods there is a considerable increase for the demand of urban infrastructure and services. It is estimated that the floating population in the municipality of Santos can increase around 15% by 2020 (PRGIRS-BS, 2018).

### 3.1. PUBLIC POLICIES AND URBAN CLEANING SERVICES.

The municipality legal framework that addresses subjects like public cleansing services is quite extensive and will be listed in a subsequent report to this document; only matters that directly influence the project object will be highlighted hereto: the municipal solid waste management.

The city has an Integrated Management Plan for Solid Waste dated from 2011, but also partakes in the recently launched Regional Plan for the Integrated Management of Solid Waste of Baixada Santista (PRGIRS-BS; AGEM, 2018). This document discusses the problematic of solid waste at sea in a synthetic way, and co-relates data of each municipality of Baixada Santista to aspects that affect the generation of solid waste that finds its way to the marine environment.

Of the cities covered by the PRGIRS-BS<sup>8</sup> document, only Guarujá, in its city plan, treated marine litter as a separate topic, proposing a specific guideline against the prob-

lem; Praia Grande, São Vicente and Bertioga suggest broader action strategies, in an attempt to also cover the waste that (if not intercepted) would reach the oceans. The city of Santos focus its attention to the improved performance of the solid waste management system, presented hereunder, without mentioning strategies or setting goals and deadlines for its improvement.

Published in 2016, the Complementary Law 952, known as Recicla Santos, which aims to increase the separate collection and recycling rates by declaring mandatory the segregation at source of dry recyclables in households and small businesses, as well as obliging large businesses to hire private service providers. The premise guiding the law is to keep potentially recyclable waste material away from the only private sanitary landfill of the region, which already serves seven of its nine municipalities.

Despite the focus on the city's insular territory, where most of the

population is concentrated, the Recicla Santos project maximized the municipal collection of dry recyclables (Santos Municipality City Hall, 2018). According to the city, popular participation has proved effective, as over 4,000 tons of waste were properly destined for recycling in 2017 instead of being taken to the landfill. With regards to other legal instruments that directly interfere with the matter, the city recently sanctioned a law banning the use of plastic straws and its plastic package - in effect from 1<sup>st</sup> of January 2019 - and encouraged similar initiative in others neighboring municipalities.

The public cleaning services in the city are carried out by a private company called Terracom Construções Ltda. The regular household collection is performed on a daily basis - door-to-door approach - in the insular territory, and covers 100% of the city population according to PGIRS. The collected material, around 450

to 500 tons/day (Santos City Hall, 2017), goes first to a transfer station or directly to its final destination area, the sanitary landfill Sítio das Neves, both located in the municipality. The dry fraction collected is carried out on a weekly basis from door-to-door in the insular territory, but not carried out in the continental area.

The city's sweeping services cover approximately 5,000 kilometers of public roads; as a coastal municipality, cleaning services extends to the city's eight kilometers of beachfront and gardens, where concrete bins and waste containers are available - according to the municipality, 92 units used for mixed waste and 46 for recyclables. Beach cleaning is carried out by using a tractor with a rake - or "iron comb" - attached to its frame; around 50 to 60 tons of solid waste are collected on a daily basis from the city beach (Santos City Hall, 2017).



Figure 11. Beach cleaning routine, carried out by Terracom.

8 - As indicated on Table 60, page 97, of the Regional Plan for the Integrated Management of Solid Waste of Baixada Santista.

Considering the high flow of solid waste carried by the estuary canals, a service of floating waste collection at sea was implemented by the city from 2008 to 2017. Currently out of service, the goal was to complement the already mentioned collection services, supported by catamarans, which are multi-hull boats. According to the City Hall, the floating waste collected by the municipal service corresponded to 4 to 6 tons/month; they also indicate that most of the material that reaches the beaches or were intercepted by the catamarans come from the irregular waste disposal from dwellings of the mangrove ecosystem, located in the northern part of the insular territory.

The “Estação Ambiental” project, created by the municipality in 2016, relays on young volunteers/scholarship holders for actions to raise environmental awareness on locals and tourists around topics such as proper management of urban solid waste, especially the separate collection. The activity covers places like street markets and door to door communication, as well as the city beaches; under the coordination of the Municipal Secretary of Environment and in partnership with the state project “Verão no Clima”, during high season (December to March) the project builds up tents with entertaining programs for all ages and information about the appropriate disposal of waste.

### 3.2. SCIENTIFIC RESEARCH ABOUT THE REGION

Several research projects related to pollution are carried out in Santos’ estuary and adjacent coastal areas. This is given especially due to the intense port activity, as many activities related to its functionality impact the marine environment.

With regards to marine litter pollution, few studies were found to quantify and qualify the material

found on the beach (ORLANDI, ARANTES & BARRELLA, 2015; CARMINATTO et al., 2017) and at Santos Estuary (MARCHESANI et al., 2010). Other researches highlight the problem and the accumulation of pellets on the beach (TURRA et al., 2014; BALTHAZAR-SILVA, 2016), as the Port of Santos is responsible for the import and export of these plastics resins (PEREIRA, 2014).

### 3.3. CLEANUP ACTIONS, ENVIRONMENTAL EDUCATION AND ACTIVISM

In Santos and adjacent municipalities there are a range of institutions working with the marine litter issue. The activities vary and, to the purpose of this document, were classified according to their different strategies and objectives:

- *Interception (before the waste reaches the marine environment);*
- *Solid waste management;*
- *Removal/de-pollution (of the existing accumulation)*
- *Environmental awareness about solid waste (at sea or not)*
- *Reduction of the potential entry of solid waste into coastal environment.*

The institutions involved on the subject, mainly those of organized civil society entities, as well as their main activities related to marine litter were selected based on the “Rede Praia Limpa” program, internet search, social media and individual contacts. ANNEX 2 lists the entities and their main activities.

It is important, however, to highlight the activities of two organizations with distinct geographic actuation, as per following map (Figure 12).

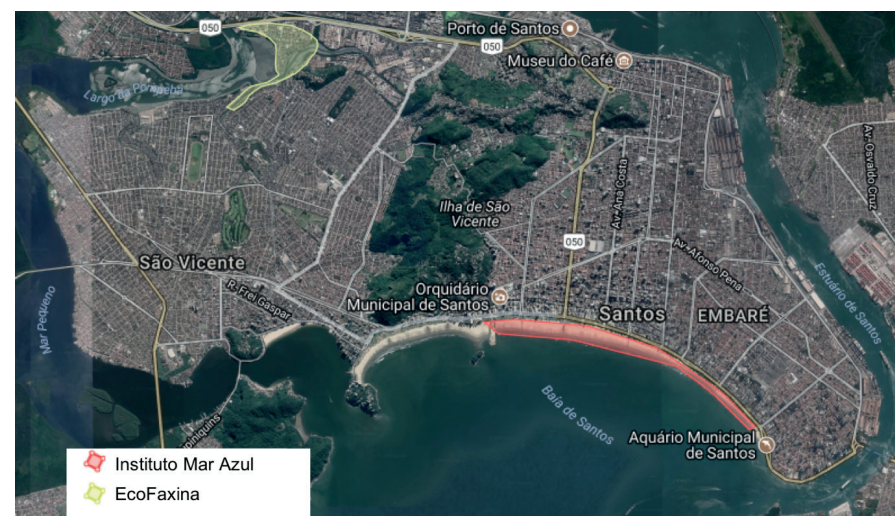


Figure 12. Map of Santos territory highlighting the geographic performance of IMA and EcoFaxina. Source: Google Maps, 2018.

Created in 2013, Instituto Mar Azul (IMA) is a nongovernmental organization which promotes micro-litters collection interventions along Santos coastal area. Participants range from organized scout groups to public and private elementary school children, as well as volunteers. Since April 2017 IMA organizes an intervention on the last Saturday of each month,

in a pre-determined quadrant of the coast, to collect, count and weigh items considered micro-litter. According to its president, Hailton Santos, by August 2018 were registered more than 85,000 items in 16 volunteer interventions, where soft plastic fragments and cigarette butts were the most common types found.



Figure 13. Intervention organized by IMA and the volunteers involved. Source: Hailton Santos, 2018.

The work carried out by the Instituto Ecofaxina<sup>9</sup>, founded in 2008, has focus on cleaning activities, monitoring and environmental education, concentrated in areas where sub-normal dwellings, called stilt houses, are located in the mangrove ecosystem. It is estimated that around 10% of the population from Santos municipality lives in these areas of precarious infrastructure.

In addition to practical activities at the communities, Ecofaxina also participates in debates with the public sector in order to facilitate projects that contribute with its goal of recovering degraded mangrove areas and reduce the plastic amount due to irregular dwellings dumping.



Figures 14 and 15. Volunteer actions on mangrove waste removal and stilt house communities in Santos Estuary area. Source: Instituto EcoFaxina (Tadeu Sampaio and William R. Schepis)

According to the Institute website, more than 95 cleaning actions were already carried out, most of them on mangroves, but EcoFaxina has also organized de-pollution activities on beaches, rocky shore and rivers. Over 2,000 volunteers participated in the Institute's activi-

ties over ten years, with more than 50.5 tons of waste collected. Such environmental liability harms not only the mangroves health, but also the marine and coastal ecosystems, resulting in poor quality of life for those living in the area.

9 - Instituto Ecofaxina: for more information, access <https://www.institutoecofaxina.org.br>

## 4. CONSIDERATIONS

Far from exhausting the actions currently carried out on the subject, the first project's report on the fight against sources of marine pollution by solid waste allows the following reflections on the information collected:

- There is a massive mobilization about the topic in Brazil, a country of continental proportions and great distances that cause a dispersion of actions to fight marine litter. However, indications of a unified approach are observed due to faster communications tools, especially social medias, which has been an important means of disseminating knowledge and engaging people in voluntary actions.

- The process leading to the National Plan to Fight Marine Litter brings together a significant diversity of government actors, private sector and the civil society, and is evolving at a sufficient pace to aggregate new scientific knowledge (which still needs investment to allow for its support and expansion) and new public policies at a municipal level;

- The awareness and action points established by coastal cities were and continues to be stimulated by social mobilization, concerned about the conditions of the oceans and their marine fauna. It is observed, however that local legislation focuses on the banning of plastic items, especially straws, and not on the identification of the sources that cause the pollution of the sea by these items and consequently the improvement

of a local solid waste management. Plastic straws, currently targeted with banning decrees by important touristic coastal city such as Rio de Janeiro (RJ), Florianópolis (SC) and Santos (SP) - the study object of the project -, are among the most commonly founded items during voluntary cleaning actions along with cigarette butts and soft plastic fragment from other products;

- In this sense, the importance of the project developed in Santos lies in benefit of a broader, consistent and permanent identification and management of the sources of waste generation in land, mitigating its littering to the maximum level.

- As final considerations, the national scenario demands for pilot projects that points out to a broader horizon beyond beach cleanings, which, although considered an important tool for social engaging and awareness, does not solve the problem of marine pollution by solid waste from urban centers. The country is moving forward towards a comprehensive policy, but legislation and local management are fundamental keys to the process as municipalities are responsible for waste management activities and the decision makers in charge of mitigation and prevention actions.

With that, the project will now move forward with lenses focused on the municipality of Santos, its local characteristics and the routine of solid waste management in the city.



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ANNEX 1. List of Brazilian researchers and their projects on marine litter

State	Institution	Topics	Researchers	
AL	Universidade Federal de Alagoas - UFAL	Distribution and abundance of solid waste in coastal and marine environments	Cláudio Luis Santos SAMPAIO	
		Waste in marine environments and its interaction with the biota		
BA	Instituto Federal de Educação, Ciência e Tecnologia Baiano- IFBA	Monitoring of solid waste in marine environments	Jose Rodrigues de SOUZA FILHO	
		Distribution and abundance of solid waste in coastal and marine environments		
		Solid waste management	Plínio Martins FALCÃO	
		Distribution and abundance of solid waste in coastal and marine environments		
		Solid waste management		
		Solid waste management		
	Universidade Católica do Salvador - UCSAL	Solid waste management	Moacir Santos TINÔCO	
		Distribution and abundance of solid waste in coastal and marine environments		
		Solid Waste perception		
		Solid waste management		
	Universidade Federal da Bahia - UFBA	Universidade Federal da Bahia - UFBA	Distribution and abundance of solid waste in coastal and marine environments	Gerson Fernandino de ANDRADE NETO
			Solid Waste perception	
Monitoring of solid waste in marine environments				
Universidade Federal da Bahia - UFBA		Distribution and abundance of solid waste in coastal and marine environments	Iracema Reimão SILVA	
		Distribution and abundance of solid waste in coastal and marine environments	Vanessa HATJE	
		Waste in marine environments and its interaction with the biota	Carlos Roberto FRANKE	
ES	Universidade Federal do Espírito Santo - UFES	Distribution and abundance of solid waste in coastal and marine environments	Valeria da Silva QUARESMA	

State	Institution	Topics	Researchers
PB	Universidade Federal da Paraíba - UFPB	Monitoring of solid waste in marine environments	Rita de Cassia Siriano MASCARENHAS
		Waste in marine environments and its interaction with the biota	
PE	Universidade Federal de Pernambuco - UFPE	Distribution and abundance of solid waste in coastal and marine environments	Monica Ferreira da COSTA
		Waste in marine environments and its interaction with the biota	
		Monitoring of solid waste in marine environments	
		Microplastics in biological and environmental samples	
	Universidade Federal Rural de Pernambuco - UFRPE	Distribution and abundance of solid waste in coastal and marine environments	Jacqueline Santos da SILVA CAVALCANTI
		Monitoring of solid waste in marine environments	
Solid Waste perception			
PR	Universidade Tecnológica Federal do Paraná - UTFPR	Solid waste management	Leticia Knechtel PROCOPIAK
		Distribution and abundance of solid waste in coastal and marine environments	
		Solid waste management	

State	Institution	Topics	Researchers
RJ	Universidade Estadual do Rio de Janeiro - UERJ	Distribution and abundance of solid waste in coastal and marine environments	Alexandre de Gusmão PEDRINI
		Solid waste management	
		Distribution and abundance of solid waste in coastal and marine environments	André Luiz Carvalho da SILVA
		Solid waste management	Fabio Vieira de ARAÚJO
		Distribution and abundance of solid waste in coastal and marine environments	
		Waste in marine environments and its interaction with the biota	
		Waste in marine environments and its interaction with the biota	Gisele Lôbo HADJU
	Waste in marine environments and its interaction with the biota	Luis Felipe SKINNER	
	Universidade Federal Fluminense - UFF	Solid waste management	Barbara FRANZ
		Distribution and abundance of solid waste in coastal and marine environments	
Solid waste management			
RN	Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande do Norte - IFRN	Solid Waste perception	Marisa Ribeiro MOURA
		Universidade Federal do Rio Grande do Norte - UFRN	Distribution and abundance of solid waste in coastal and marine environments
	Solid Waste perception		

State	Institution	Topics	Researchers
RS	Universidade Federal de Rio Grande - FURG	Monitoring of solid waste in marine environments	Gilberto FILLMANN
		Microplastics in biological and environmental samples	
		Distribution and abundance of solid waste in coastal and marine environments	
		Waste in marine environments and its interaction with the biota	
		Distribution and abundance of solid waste in coastal and marine environments	Juliana Assunção IVAR do SUL
		Waste in marine environments and its interaction with the biota	
		Monitoring of solid waste in marine environments	
		Microplastics in biological and environmental samples	
		Solid waste management	Mônica WALLNER-KERSANACH
		Solid waste management	
		Distribution and abundance of solid waste in coastal and marine environments	
		Waste in marine environments and its interaction with the biota	

State	Institution	Topics	Researchers
SC	Instituto Federal de Santa Catarina - IFSC	Solid waste management	Allan KRELLING
		Distribution and abundance of solid waste in coastal and marine environments	
		Solid waste management	
		Solid waste management	Walter Martin WIDMER
		Distribution and abundance of solid waste in coastal and marine environments	
		Waste in marine environments and its interaction with the biota	
	Universidade Federal de Santa Catarina - UFSC	Waste in marine environments and its interaction with the biota	Maíra Carneiro PROIETTI
		Distribution and abundance of solid waste in coastal and marine environments	

State	Institution	Topics	Researchers
SP	Instituto de Pesca - IP	Solid waste management	Luiz Miguel CASARINI
	Universidade de São Paulo - USP	Solid waste management	Alexander TURRA
		Solid waste management	
		Distribution of solid waste in coastal and marine environments	
		Monitoring of solid waste in marine environments	
		Waste in marine environments and its interaction with the biota	
		Microplastics in biological and environmental samples	Rosalinda Carmela MONTONE
		Distribution of solid waste in coastal and marine environments	
		Contaminação de resíduos sólidos no ambiente marinho	
		Distribution of solid waste in coastal and marine environments	Ednilson VIANA
		Solid waste management	
	Solid waste management		
	Universidade Estadual Paulista Júlio de Mesquita Filho - UNESP	Waste in marine environments and its interaction with the biota	Carolina Pacheco BERTOZZI
	Universidade Federal de São Paulo - UNIFESP	Solid waste management	Camilo Dias Seabra PEREIRA
		Distribution of solid waste in coastal and marine environments	
		Microplastics in biological and environmental samples	Luiz Felipe Mendes GUSMAO
Waste in marine environments and its interaction with the biota			
Universidade Santa Cecília - UNISANTA	Distribution of solid waste in coastal and marine environments	Walter BARRELLA	
Universidade Presbiteriana Mackenzie - UPM	Solid waste management	Paola Lupianhes DALL'OCCO	

ANNEX 2. Data collection by the institutions that organize activities related to the topic.

<b>Institutions</b>	<b>Activities</b>	<b>Actions</b>
Aborígenes Itaquitanduva	Beach cleanup	Removal; Awareness
Associação Santos de Surf	Beach cleanup	Removal; Awareness
Aquário de Santos	Beach cleanup; Exhibition material; Lecture	Removal; Awareness
Fórum da Cidadania	Beach cleanup; Exhibition material; Lecture	Solid waste management; Awareness
Instituto Biopesca	Beach cleanup; Lecture; Activism	Removal; Awareness
Instituto Ecofaxina	Daily removal; Exhibition material; Lecture	Solid waste management; Interception; Removal; Awareness
Instituto Ecosurf	Mangrove and Beach cleanup; Lecture; Activism	Solid waste management; Removal; Awareness
Instituto Gremar – Pesquisa, Educação e Gestão de Fauna	Beach cleanup; Lecture; Activism	Removal; Awareness
Instituto Mar Azul	Beach cleanup; Lecture	Removal; Awareness
Instituto Pólis	Beach cleanup	Solid waste management; Removal; Awareness
Instituto Praia Limpa	Beach cleanup; Lecture; Activism	Removal; Awareness
Mantas do Brasil	Beach cleanup	Removal; Awareness
Projeto Albatroz	Beach cleanup; Lecture	Interception; Removal; Awareness
Recicla Mais Santos	Beach cleanup; Lecture; Activism	Reduces potential waste entry; Awareness
Santos Lixo Zero	Stimulates segregation at source for recycling	Solid waste management; Reduces potential waste entry; Awareness



COMBATE ÀS FONTES DE  
POLUIÇÃO MARINHA POR  
**RESÍDUOS SÓLIDOS**



SWEDISH ENVIRONMENTAL  
PROTECTION AGENCY