



## What are coastal cities doing about the problem of marine litter? A case study in southern Brazil

### *O que as cidades costeiras estão fazendo sobre o problema do lixo no mar? Um estudo de caso no Sul do Brasil*

Bruna de RAMOS<sup>1\*</sup>, Dione Silveira KITZMANN<sup>1</sup>

<sup>1</sup>Instituto de Oceanografia, Universidade Federal do Rio Grande (FURG), Rio Grande, RS, Brasil.

\* E-mail de contato: ramos.de.bruna@gmail.com

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**ABSTRACT:** Beach management is a key issue in combating marine litter, especially in tourist areas. It is necessary to promote government initiatives that refine local autonomy to improve the quality of beaches. Partnerships between interested institutions at the local level are stimulated to fight against environmental, economic, and social problems. Marine litter, as a more holistic problem, is growing in the international and national sphere, support programs are being developed, with possible advantages at the local level. Cassino Beach in Rio Grande, Brazil, was used as a case study to evaluate the current approaches to managing marine litter, with a focus on tourism-generated litter, analyzing the weaknesses and strengths of municipal management. The case presented as weaknesses a lack of awareness and policy, administrative deficiencies, few resources, and few spaces that promote public participation. Knowledge and information, institutional competencies, partnership, and strategies appeared as strong points. It was possible to observe that the municipality of Rio Grande is assimilating problems, planning actions and few projects are being implemented.

*Keywords:* beach management; cassino beach; SWOT analysis; tourism; beach litter.

**RESUMO:** A gestão das praias é um ponto fundamental no combate ao lixo no mar, principalmente nas zonas turísticas. É necessário promover iniciativas governamentais que melhorem a autonomia local para aperfeiçoar a qualidade das praias. As parcerias entre instituições interessadas em nível local são incentivadas para combater os problemas ambientais, econômicos e sociais. O lixo no mar, como uma problemática mais holística, está crescendo internacional e nacionalmente, programas de apoio estão sendo desenvolvidos, com possíveis vantagens em nível local. A Praia do Cassino, no Rio Grande - RS, Brasil, foi usada como estudo de caso para avaliar as abordagens atuais de gestão do lixo no mar, com foco no lixo gerado pelo turismo, analisando as fragilidades e os pontos fortes da gestão municipal. O caso apresentou como pontos fracos a

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falta de consciência e política, deficiências administrativas, poucos recursos e poucos espaços que promovam a participação pública. Conhecimento e informação, competências institucionais, associação e estratégias apareceram como pontos fortes. Entendeu-se que o município de Rio Grande está assimilando problemas, planejando ações e poucos projetos estão sendo implementados.

*Palavras-chave:* gestão da praia; praia do cassino; análise SWOT; turismo; lixo em praia.

## 1. Introduction

Marine litter is considered by the scientific community as one of the most serious and difficult issues to be addressed. Marine litter can cause ecological and socio-economic problems (Law, 2017). Among ecological impacts, faunas' litter ingestion is one of the most evident, already reported for 100% of turtle species, 50% of mammal species, and 40% of seabird species (Gall & Thompson, 2015). In addition, biota can be entangled and suffocated by marine litter, especially Abandoned, Lost or Discarded Fishing Gear (ALDFG) (WSPA, 2018; Link *et al.*, 2019). Also, marine litter can contribute to dispersal of potentially invasive species and even biodiversity loss (Gregory, 2009). However, in coastal cities with touristic potential, the presence of marine litter in the beach environment, by visually altering the landscape, acts as a threat to tourism and, consequently, the local economy (Krelling *et al.*, 2017). In addition, ALDFG can cause economic losses in the case of ghost fishing of species of commercial interest and damage to navigation due, for example, to entanglement of nets and cables in propellers (WSPA, 2018).

Being a global theme marine litter is receiving attention and importance on the international agenda. As, for example, Goal 14 - Living Below

Water - of the United Nations Sustainable Development Goal (SDG), which aims to prevent and significantly reduce marine pollution from all types of land-based activities, including marine litter. In addition, the United Nations (UN) has declared Decade of Ocean Sciences for Sustainable Development for 2021-2030, which can help develop scientific knowledge, management approaches, and technological innovation to combat marine litter pollution. In this scenario, countries with a maritime border, seeking to combat marine litter<sup>1</sup>, are devoting efforts to studying and quantifying litter, as well as developing strategies to combat marine pollution (UNEP, 2017). Brazil launched in 2019 the National Plan to Combat Marine Litter, one of the objectives is to reduce the amount and impacts of marine litter, from land-based sources (MMA, 2019). Although the state of São Paulo is one of the few states working on monitoring and mapping strategies about marine litter at the local level, the National Plan to fight against marine litter incentive initiatives at the local level as a local plan or integrative strategies (MMA, 2019)

Globally, almost 80% of marine litter comes from land-based sources, among the main land-based sources are the dumpsites; industrial emissaries; wastewater, urban and rural runoff, tourism, and activities of the shipping and fishing industries.

<sup>1</sup> National Plan to Combat Marine Litter – Plano Nacional de Combate ao Lixo no Mar MMA (2019).

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(Macfadyen *et al.*, 2009; UNEP, 2016). Seasonal summer touristic activities, including an increase in population and beach use, can contribute to increase marine litter on beaches (Tourinho & Fillmann, 2011). In coastal zones, irregular and indiscriminate deposition of solid wastes inland, rivers, and even at the sea is widespread (Bergmann *et al.*, 2015), this irregular deposition of waste is often associated with poor management and failure to offer infrastructure for recycling, which leads to deposition and accumulation of waste in rivers, lakes, and oceans. The situation is aggravated in places where the population has a low level of education (Oliveira & Turra, 2015).

The situation is more complex on a local scale, compared to a regional and/or national scale. Beaches in Brazil are under Federal jurisdiction, represented by the Secretaria do Patrimônio da União (SPU), the National agency is responsible for beach management in Brazil, but in some cases, there are omissions and/or mismanagement, often with lack of understanding of local contexts. In 2015 the scenario changed with Beach Management Adhesion Agreement (TAGP, in Portuguese), a federal initiative that gave coastal cities the possibility to manage their beaches (Scherer *et al.*, 2020). At the local level, there is a lack of specific public policies regarding marine litter. Especially, if regions that have touristic potential with seasonal use of their beaches, with direct litter deposition peaks (Krelling *et al.*, 2017). With different levels and types of use, management is also different in year, coastal cities that are known for multiple uses, such as port, fishing, and industrial activities, need to deal with different sources and management actions to fight marine litter. UNEP Marine Plastics and Microplastics - Global lessons and research to inspire action

and guide policy change (UNEP, 2016), suggest as weaknesses in the marine litter problem the lack of knowledge about the effectiveness of current governance arrangements and the lack of implemented and/or monitored management actions.

In the context of multiple uses of the coastal zone and seasonal tourist activity, Cassino beach in Rio Grande do Sul (Rio Grande do Sul, RS, Brazil) can be a case study of how local management actions focused on marine litter work. Cassino beach has the peculiarity of the traffic of cars and food trailers on the sand strip, characteristics that increase during the summer. Projeto Lixo Marinho of the Federal University of Rio Grande – FURG maintains a monitoring program on quantities of marine litter quantities Cassino beach, including baseline data (Ramos *et al.*, 2020). Cassino beach showed more marine litter in urban and touristic regions than in non-urban areas. In addition, the tourist source of marine litter represented 21,7% of the total litter collected (de Ramos *et al.*, 2021), which reinforces the importance of coastal management actions and monitoring focused on marine litter issues in coastal cities.

Among the first steps to combat marine litter is diagnosing the current situation in the coastal municipality, and local management practices to deal with the issue. Several stakeholders lead local management actions, it is important to establish a dialogue and connections to deal with the problem. In this context, it is important to highlight the relevant local stakeholders and their involvement, this can be a key point to design more sustainable management models, create and implement effective waste reduction and removal measures (UNEP, 2016). Based on this, this paper aimed to point out the actions of marine litter management in Cassino

beach, focusing on the litter generated by tourism activities. This paper also analyzed the strengths and weaknesses of municipal management to address the problem of marine litter in the summer/tourist season at Cassino beach.

## 2. Methodology

### 2.1. Study area

Cassino Beach is in Rio Grande municipality

(Rio Grande do Sul, RS, Brazil) southern Brazil. This beach is at the mouth of the Lagoa dos Patos, a lagoon considered one of the largest coastal lagoons in the world. The coastal plain of this region is 220 km in continuous extension, and the territorial part belonging to the municipality of Rio Grande is approximately 70 km long. The center of the Cassino neighborhood (Figure 1) represents the tourist portion of the city, whose economy is also composed of industrial, fishing and port activities. The beach is also characterized by car traffic on sandy strips and presents an increase in beach users during the

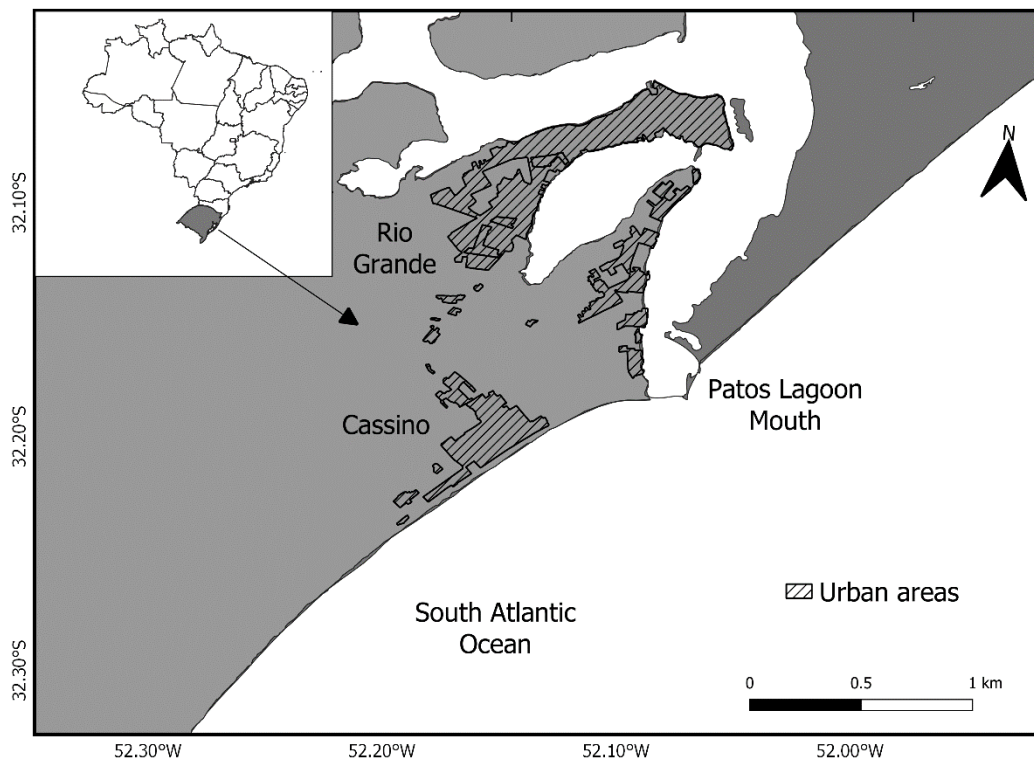


FIGURE 1 – The map indicates the study area, Cassino beach, Rio Grande municipality – RS, Brazil. Hatched areas represent urban areas  
SOURCE: the authors.

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summer (December-March) (Porto, 2018). Over the past 20 years, Cassino Beach has experienced a steady increase in population and a disorderly urban occupation; the resident population is currently estimated at 35,000, increasing to about 200,000 during the summer (Prefeitura Municipal de Rio Grande, 2020).

## *2.2. Mapping management actions against marine litter and associated stakeholders*

A series of meetings were held with the Rio Grande<sup>2</sup> Municipal Public Agency and an active search for previous studies on Cassino beach in the summer was conducted to find management actions that are related to marine litter management in the summer. In addition, qualitative research was conducted on news stories related to the summer season in Cassino (December 15<sup>th</sup> to March 15<sup>th</sup>, 2015-2019), to identify what or which stakeholders participate directly or indirectly in management actions against marine litter in the summer at Cassino beach.

## *2.3. Stakeholders' prioritization and SWOT analysis*

Stakeholders were ranked according to influence and importance on a numerical scale from 1 to 5. The stakeholder importance scale was considered as the importance that the marine litter problem can reach stakeholders, while the influence scale refers to the ability to act and put plans

or projects into practice. (PNUD, 2009). To better visualize, the matrix of importance and influence of stakeholders was used (PNUD, 2009). Made up of four blocks: Block I (Keep close): high importance and high influence; Block II (Keep satisfied): high importance and low influence; Block III (Keep informed): low importance and high influence, and Block IV (Minimum effort): low importance and low influence. In this methodology, stakeholders are the people and/or institutions that will benefit or whose interests may be affected by some activity or resolution of a problem. (PNUD, 2009). In the case of marine litter management, any institution direct or indirectly related to management actions related to touristic-marine litter at Cassino beach in the summer (mapped in the previous methodological step) was considered as a stakeholder.

## *2.4. Mapping management actions against marine litter and associated stakeholders*

To map the strengths and weaknesses of marine litter management actions at Cassino beach, semi-structured interviews with 9 open-ended questions each (Supplementary Material) were performed with the most important and relevant stakeholders. Which are represented by the stakeholders allocated in a matrix of importance and influence Block I.

To analyze management actions to combat the marine litter problem, information from interviews was compiled into a SWOT (Strengths, Opportunities, Weakness, and Threats) matrix. In this

<sup>2</sup> Prefeitura Municipal do Rio Grande-RS.

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analysis, strengths and weaknesses were considered as internal forces, i.e., everything related to municipal management competencies, and opportunities and threats were considered as external forces, i.e., everything outside of municipal management competencies and control (Dantas & Melo, 2008).

### **3. Results**

#### *3.1. Mapping management actions against marine litter and associated stakeholders*

Through qualitative research and informal meetings with the Municipal Public Agency of Rio Grande, it was possible to pinpoint the stakeholders related to tourism activity on the beach and management actions related to summer marine litter on Cassino Beach. Not all stakeholders were directly associated with a management action, so this was considered in the prioritization of stakeholders (Figure 2). The stakeholders most present in the news and informal meetings were merchants, Tourism Office<sup>3</sup>, NGOs, hotel sector, tourists and locals, Urban Services Office<sup>4</sup>, Environmental Office<sup>5</sup>, Cassino Office<sup>6</sup>, Communication Office<sup>7</sup>, Culture Office<sup>8</sup> and Fisheries Office<sup>9</sup>. Most actions are led by the public sector (Table 1).

The Pé na Areia project aims to develop environmental awareness in the local and current context for children, broadening their knowledge about environmental issues through lectures, videos, plays, activities, walks along the coast, etc. The focus is on children between 7 and 10 years old and the project has limited spaces. The Ritmo do Mar Project aims to promote a social intervention in the summer at Cassino beach, based on cultural, ethical and sustainability values, through a thematic presentation of the Brazilian carnival, using predominantly reusable materials, the project is composed of children and teenagers from different locations in the city of Rio Grande. These projects are focused on children and are not focused on marine litter.

“Papa Pet” is a fish that eats plastic, in other words, it is a structure, which refers to a fish, that acts as a disposal point for pet bottles on the main street of Casino. This action was an initiative of the Cassino office and was inspired by the Australian government’s action. The "Papa Pet" was removed in 2022 by the local administration and the reasons remain unknown.

Every day in the summer (December 15 to March 15), the Urban Services Office carries out beach cleaning from the dunes to the tidal zone with the use of machines. In addition, this Office has placed about 300 to 350 dumpsters that are

<sup>3</sup> Secretaria de Município de Turismo, Esporte e Lazer

<sup>4</sup> Secretaria de Município de Controle e Serviços Urbanos

<sup>5</sup> Secretaria de Município do Meio Ambiente

<sup>6</sup> Secretaria de Município do Cassino

<sup>7</sup> Secretaria de Município de Comunicação e Relações Institucionais

<sup>8</sup> Secretaria de Município da Cultura

<sup>9</sup> Secretaria de Município da Pesca

TABLE 1 – Mainly management actions related to marine litter in summer in Cassino beach and associated stakeholders, the public sector is represented in bold.

Management action	Stakeholders
Foot on the Sand Project	<b>Environmental Office</b> and NGO
Sea Rhythm Project	NGO, <b>Environmental and Cassino's Office</b>
Fish that eat plastic - Papa pet	<b>Cassino's Office</b>
Daily beach clean-ups	<b>Urban Services Office</b>
Independent Clean-ups	NGOs and/or University
Guide of activities on the beach strip	<b>Environmental Office and University</b>
Law no. 8269, of September 21, 2018	<b>Municipal Agency of Rio Grande</b>
Child Environmental Patrol	<b>Environmental Office</b>

collected on the beach in the late afternoon every day. In addition, every year, in partnership with the Cassino Office occurs a public event called Mutirão Praia Limpa, a big clean-up action. Other clean-up days occur throughout the year, especially around September 19<sup>th</sup>, the “World Clean-up Day”, one of the world's largest annual events of preservation and protection and volunteer efforts for the ocean, rivers, and beaches. World Cleanup Day is celebrated with litter cleanup and waste mapping activities. Federal University of Rio Grande (FURG) is usually present in this activity since the data produced feeds a worldwide database on marine litter.

The guide for activities on the beach strip was developed in partnership between the Environmental Office and the Federal University of Rio Grande (FURG), seeking to improve the use of the sand strip in the summer with a focus on contributing with basic guidelines for the separation of solid waste generated directly by beach users, merchants and tourists in the summer (FURG & SMMA, 2020).

This guide is part of an environmental licensing process to authorize the commercialization of trailers on the sand strip, the process also includes an environmental workshop to inform traders.

The municipality of Rio Grande, following a national trend, created Law No. 8269, dated September 21, 2018, which "prohibits the use and supply to customers of plastic straw by restaurants, bars and similar, beach food trucks and ambulant sellers in the municipality". This law applies to the entire municipal territory.

The Projeto Patrulha Mirim (Junior Patrol Project) is usually held in the summer by the Environmental Office. It aims to integrate and raise awareness among children about various environmental issues. Although this project is not focused on coastal zone problems or marine litter issues, these themes can be part of the activities.

In prioritizing stakeholders on marine litter issues, the Office of Culture and Fisheries focused on the organization of events in the summer season

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such as the Fish Festival, the Brazilian carnival, the New Year's Celebration, and the religious celebration of Yemanjá and Nossa Senhora dos Navegantes. A good summer season, in the economic sector, at Cassino beach is related to the success of the realization of these events. In addition, these events do not occur totally on the sand strip and the partnership with the Urban Services office determines when clean-up action needs to be done during and/or after the events. The importance and current influence of the Culture and Fisheries Office on marine litter management are low (Figure 2 - Block IV). This means that the stakeholders in Block IV need *minimal effort* to solve the problem of marine litter in Cassino beach, also they are not strongly affected by the marine litter problem. The actions of the stakeholders in Block IV cannot affect the implementation of the reform policy and they assign it a low priority to it.

In this context, the Communications Office is involved in outreach and event marketing, this office is responsible for all communication processes, including the social media of the city agency, so the influence of the Communications Office is high (Figure 2 - Block III). The Communication Office needs to *keep informed* about the marine litter problem and spread information about the issue and how to solve it. The communication Office's actions can affect the implementation of the reform policy, but they give it low priority, especially because summer tourism is a small part of this Office's tasks.

Tourists and local residents present a huge role in beach use during the summer season, consequently, their importance in generation of marine litter is high (Krelling *et al.*, 2017). Although, the influence on the creation and implementation of management actions is low, mainly due to the sea-

sonality of tourist activities at Cassino beach (Figure 2 - Block II). A similar situation happens with the hotel industry and traders, they are major producers of garbage, especially food trailers located on the beach. They must follow a series of measures to avoid marine litter pollution (provided by the Beachfront Activity Guide), but their influence in the creation and implementation of management actions is low (Figure 2 - Block II). The Tourism Office manages all the activities and events that happen in the summer season, but the current administration is focused on events that happen in the urban part, such as the Brazilian Carnival, this Office has not led actions to prevent or minimize the problem of marine litter on Cassino beach (Figure 2 - Block II). The Federal University of Rio Grande (FURG) is also in Block II, there are some management actions in partnership with the public sector, but the University has not implemented management actions alone on the issue of marine litter. Stakeholders in Block II need to *keep satisfied*, tourists and locals are responsible for the economic success in the summer season, so it is important to maintain the beach clean and with a structure to satisfy these stakeholders. Stakeholders in Block II can give high priority to the reform policy, but their actions may not impact the implementation of the reform policy, especially if the public sector did not offer support, such as infrastructure.

The municipality of Rio Grande has several initiatives, many of them in partnership with NGOs such as NEMA (Núcleo de Educação e Monitoramento Ambiental) and Caminho Marinho, environmental NGOs are naturally important in how to deal with the marine litter problem, in the case of Cassino the influence is great due to the reliability and tradition of these institutions at the local level



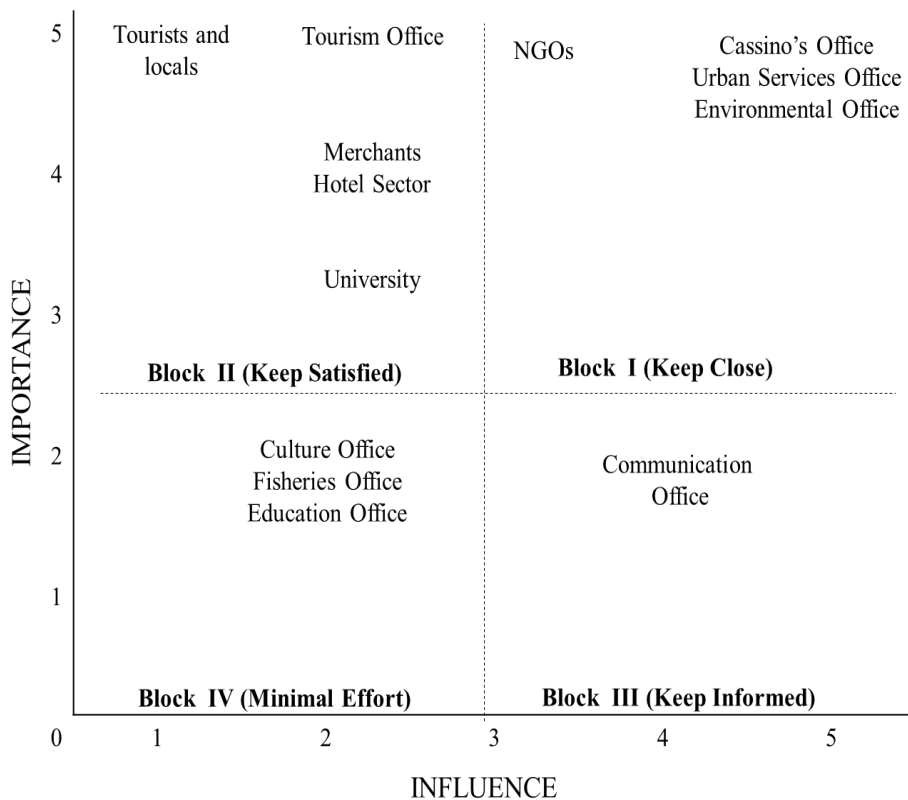


FIGURE 2 – Matrix of importance and influence, stakeholders are plotted according to importance and influence on a 1-5 scale.

(Figure 2 - Block I). The Urban Services Office, the Environmental Office, and the Casino Office are responsible for maintaining and managing the quality of the beach strip in the summer. These offices have the greatest influence on beach management issues and Casino's marine litter reduction and management are important for improving the environmental and tourism quality of the beach (Figure 2 - Block I). Stakeholders in Block I need to *keep close*; they are responsible for cleaning activities, awareness, and supervision. Block I stakeholders give high priority to reform policy and take actions

that have an impact on the implementation of plans and initiatives.

### 3.2. SWOT analysis

Influential and important stakeholders (Urban Services, Environmental Office and Casino, and two municipal NGOs) were interviewed. Belonging to the Influence and Importance matrix of Block I, these stakeholders are defined as an institution that is important to keep close in the management

TABLE 2 – Synthesis of SWOT analysis of the local management focused on marine litter generated by touristic activities in the Rio Grande (RS, Brazil).

INTERNAL FORCES	STRENGTHS	WEAKNESSES
	<ul style="list-style-type: none"> <li>• Knowledge and information</li> <li>• Institutional competences</li> </ul>	<ul style="list-style-type: none"> <li>• Administrative deficiency (management tools, qualified managers)</li> <li>• Low Resources</li> <li>• Few spaces of Participation</li> </ul>
EXTERNAL FORCES	OPPORTUNITIES	THREATS
	<ul style="list-style-type: none"> <li>• Partnership</li> <li>• Instruments and governmental strategies</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of Education</li> <li>• Lack of Implemented policy</li> </ul>

process.

The information obtained from interviews was analyzed to identify Strengths, Weakness, Opportunities, and Threats (SWOT) in coastal management with a focus on marine litter generated by touristic activities. The main results of the SWOT analysis (Table 2) demonstrated that the strengths are related to knowledge and information production and institutional competencies, weaknesses are related to administrative deficiency, resources and lack of participation, opportunities were related to partnership and strategies. Finally, threats are connected to education and policy issues.

In **Strengths**, it was possible to identify solid knowledge and information production based on institutions such as the Federal University of Rio Grande (FURG) that presents some research groups, especially in the Oceanographic Institute focused on the production of marine litter data such as the Projeto Lixo Marinho – FURG. In this context, some extension and consultation projects are developed between the university and municipal administra-

tion. For example, in 2018-2019 and 2019-2020 summer season, a Beachfront Activity Guide was developed in partnership between the Environmental Office and FURG. Institutional competencies are also a strength in coastal management that can influence the issue of marine litter. The existence of the Cassino office, a municipal office responsible for any issue in the coastal neighborhood, is important to minimize bureaucracy and divide institutional competencies. Through the Beach Management Adhesion Agreement (TAGP), a federal initiative to give local levels autonomy to manage beaches, although several municipalities, without the TAGP grant, plan and execute management actions on Brazilian beaches. It is possible to point out the municipal coastal manager, evidencing the interests of local management to improve quality of the beach, the TAGP became a mandatory project for the development and implementation of the Projeto Orla, a participatory project that seeks the order of the coastal zone. In addition, the municipality of Rio Grande, following a national trend, created a law

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that prohibits the use and supply of plastic straw in the municipality.

In **Weaknesses**, local management focused on marine litter was identified that resources directed to coastal issues are usually destined to emergency measures, such as beach mud events or infrastructure improvements such as access for cars. There is no specific budget for marine litter management, however, during the summer, the local authority cleans the sand strip daily and distributes trash cans along the beach. These problems also affect the hiring of skilled labor, making the quantity and qualification of professionals in the local context a weakness, administrative deficiency is an internal factor that needs to be improved. In Cassino neighborhood, the initiatives for real access to participation appear to be inefficient actions in the context of management, especially on the issue of marine litter. Public participation initiatives in Rio Grande appear in programs such as the participatory budget, in the open office program in which the community can take its problems to the local authority, and in public hearings. However, the dialogue and participation of organized civil society in public services of this nature is very small.

The **Opportunities** are related to a partnership with institutions outside the local government as NGOs, Universities, and the port/industrial sector. The launch of the National Plan to Combat Marine Litter (PNCLM), in 2019, allows the creation of public notices that deal with the theme of marine litter, the availability of resources for this theme is increasingly on the international scenario. The issue of marine litter opens opportunities for diversification of the economy, the transformation of waste into a resource can heat up the local economy. In addition, the United Nations Decade of Science for

Sustainable Development (2021 - 2030) can bring opportunities to support efforts to reverse the cycle of declining ocean health and bring together stakeholders behind a common framework that will help ensure that ocean science can support the national and local level by creating better conditions for sustainable ocean development, including SDG 14 which relates to marine pollution. Strategies and legal instruments such as the TAGP have already been signed by the municipality, make it mandatory to carry out planning projects and increase the quality of the coast.

Finally, the main **Threats** in local management of marine litter are scientific dissemination and contact between public administration and society at the national level. The local level is no different. There are still few environmental education actions focused on the coastal zone and/or marine litter. Regarding the provision of information to society, the local authority has a well-developed social media, however, it is not observed that marine litter issues information in these channels. Also mapped as a weakness is the lack of continuity of public policies, poor knowledge management, and lack of financial and technical support from the state government.

#### ***4. Discussion***

Marine litter is a problem that needs to be faced by multiple stakeholders and governmental scales, at the local level marine litter management is more difficult due to lack of resources and public policies (Andrade & Scherer, 2014). In the scientific literature, management studies at a local level are sparse, even more so on marine litter issues, which can be a sign that marine litter public policies are

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not reaching or being developed at local levels (Law, 2017). SWOT analysis presents itself as a tool to support the identification and management planning at Cassino beach. It was possible to visualize and analyze strengths and weaknesses in coastal management related to marine litter at Cassino beach and suggest priority points for dealing with marine litter, especially from tourist sources.

**Weaknesses** and **Threats** when analyzed together can express the vulnerabilities in local management focused on marine litter. The main considerations about this were the lack of an explicit policy for marine litter in Rio Grande and the poor integration between the municipal management agencies and those at the national and/or regional level. Other cities with touristic potential in southern Brazil also do not present specific policies to address the marine litter problem (Diederichsen *et al.*, 2013; Krelling *et al.*, 2017). The low number of management actions directly focused on marine litter and the limited financial resources can also be considered as vulnerabilities in coastal management related to marine litter. Management actions need more local community participation, which is a weakness in the city of Rio Grande. Furthermore, the disconnection between scientific knowledge, managers, and communities, as well as the limited education of citizens appears as a result of limited participation. Lack of participation is a vulnerability found in other coastal cities around the world, such as Cadiz (Llope, 2017), and participation is taken as a key point in achieving the implementation of a plan (Trimble & Berkes, 2013; Jucan & Jucan, 2014).

The municipal agency needs guidance on points that merge **Weaknesses** and **Opportunities**. In other words, the Municipal Agency needs to

use opportunities to guide paths and improve weaknesses. Some examples are implementing citizen participation channels in all coastal management improvement processes and varying institutional partnerships is possible to include NGOs that are important and influential in the local context, neighborhood associations, and cooperatives. The scarcity of local resources is a common weakness in Brazil (Oliveira & Turra, 2015), for this reason, private initiative partnerships can be a good choice. The partnership with strong research and teaching institutions in the case of Rio Grande already exists but needs to be strengthened. The international sources of financial resources are also an alternative in the theme of marine litter, in the international scenario the theme has received a lot of attention. The port/industrial sector can be an important partner in the fight against marine litter, international and port-related litter are found on Cassino beach (de Ramos *et al.*, 2021), showing the importance of multiple stakeholders as pollutants and as part of the solution.

If **Strengths** and **Threats** are analyzed together, it is possible to suggest some strengths that the local agency can deal with threats. Lack of education is a threat, but knowledge and information development is a strength, i.e. greater dissemination of existing knowledge and encouragement of knowledge production; integration of various educational initiatives in favor of citizenship education using as some institutional channel can improve coastal management at the local level. The political issues can be overcome by using some well-developed institutional tools/environments such as the signing of the TAGP, the expertise of the Cassino office, and the coastal manager at the local level. In addition, the signing of the TAGP that obligates the imple-

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mentation of the Projeto Orla can be a solution to participatory problems (Scherer *et al.*, 2020), the Projeto Orla is an important participatory space that can promote participatory culture at the local level (Scherer, 2013). The participatory approach to solving environmental problems is used worldwide, an example is the Marine Spatial Planning (MSP), which has few initiatives in Brazil, with the southern coast of Brazil being a pioneer (Gandra *et al.*, 2018).

Gathering **Strengths** and **Opportunities** is possible to establish some strategic investments in the local agenda, to define some priority actions are the first steps to improve the current situation to the desired situation. In this context, scientific dissemination, and the encouragement of training of public managers in waste management and the strengthening of partnerships between universities, local tourism, urban services, environmental agencies, and NGOs, for example, are strategic investments to improve local coastal management and consequently mitigate the marine litter problem. In the same way, projects focused on marine litter and solid waste management can be designed to involve various institutions and their knowledge (Jucan & Jucan, 2014). The law prohibiting the marketing of straws on Cassino beach is an example of the use of some force to deal with the problem of marine litter, the Municipal Agency without extra resources tried to tackle the garbage pollution by creating a local law. Single-use plastic waste and tourism litter generated is a global problem (UNEP, 2018) and it is not different in Cassino beach, touristic litter is important in the litter composition, representing 21.7% of total litter collected and urban areas of Cassino beach and are associated with litter generation, especially in the summer. The straws are highly associated with touristic activities and

presented reduction along with summers in urban areas of Cassino beach (Figure 3) (data set, Projeto Lixo Marinho – FURG, Ramos *et al.*, 2020). The 2018 municipal law banning the marketing of plastic straws is an important step in combating marine litter from tourism activities and single-use plastic. While it is not possible to directly attribute the reduction in the number of straws to the municipal law, other factors such as environmental awareness, environmental education, and reduced levels of tourism due to the national economic/governmental crisis in 2019 may contribute. Furthermore, the prohibition of plastic straws can be a “marketing” strategy that does not address structural problems in the generation of marine litter, such as irregular urbanization, poverty, predatory tourism model, and deficiencies in the management of urban solid waste (UNEP, 2017; Araújo *et al.*, 2018).

In summary, beach litter management is a complex problem that requires a global or systemic view to find practical solutions. The city of Rio Grande follows a national pattern, that is, a local agency with a lack of resources trying to implement some national policies (Andrade & Scherer, 2014). Another global pattern followed by Cassino Beach is that urban and touristic areas presenting more marine litter than non-urban areas, so coastal management depends directly on the action of local managers, but often goes beyond a national issue (Oliveira & Turra, 2015). Beach litter management along the study area should be based on strategies to reduce or eliminate sources of litter involving all the sectors of society (Hanke *et al.*, 2013). There are several local initiatives, strategies, and instruments at the municipal level, although, few are implemented and none of the items go through the monitoring and evaluation process, requiring

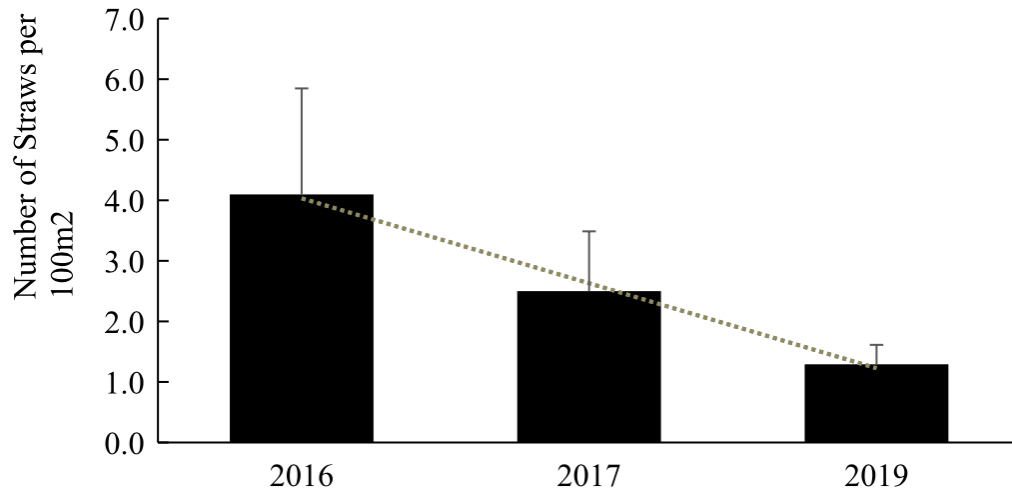


FIGURE 3 – Number of straws per 100m<sup>2</sup> collected in Cassino beach near to urban areas. Bars represent standard error and dot line a linear tendency  
SOURCE: Projeto Lixo Marinho – FURG dataset; Ramos *et al.* (2020).

an improvement of management actions. Partnerships with stakeholders to improve beach quality for the summer, as large trades and NGOs tend to pressure the government to implement actions and understand the importance of the marine litter issue (Trimble & Berkes, 2013).

## 5. Conclusion

In the SWOT analysis it was possible to infer that this is necessary to structure and improve management processes. Moreover, monitoring actions are a key point that is not done by the local administration. It was possible to understand that the municipality of Rio Grande is still assimilating problems, planning actions, and few projects and normatives are being implemented. Thus, the actions should be focused on the structuring of integrated and

participatory planning and management processes, prioritizing strategic actions, such as pragmatic public policies, clear and appropriate standards, defined competencies, institutional and capacity building, social empowerment and legitimate participatory processes, encouraging the development and dissemination of relevant information.

Along the study area, marine litter management is weak, multiple uses of the coastal zone and seasonal tourist activities can contribute to litter pollution. It is important to improve the structures that support marine litter management, such as garbage dumps, garbage collection, and information panels. Some improvements can be achieved by developing environmental studies, collaborating with research entities, and developing a waste management plan at the local and/or regional level. The information collected with waste monitoring

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could be a crucial input for future management, but first, a harmonious institutional framework must be developed to support data acquisition and further analysis.

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