

Compliance with the ban on plastic straws in coastal municipalities of Rio Grande do Sul, Brazil

Cumprimento da proibição de canudos plásticos em municípios costeiros do Rio Grande do Sul, Brasil

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Abstract: Disposable plastics are widely used due to their convenience; however, improper disposal and high durability lead to environmental persistence and ecological impacts. In response to this issue, various regions of the world have adopted regulations to restrict or ban these materials, including items such as plastic straws. To evaluate compliance with the legislation banning plastic straws, the use of disposables was observed at kiosks on the beaches of Torres, Imbé, and Tramandaí, on the northern coast of Rio Grande do Sul, in southern Brazil, in the summer of 2022/2023. The five most used disposable items by consumers at the sampled kiosks were straws (23.33%), plastic cups (16.8%), paper napkins (13.06%), aluminum cans (10.42%), and glass bottles (10.26%). Of these, 60.21% of the materials were made of plastic, demonstrating a worldwide pattern of high plastic waste generation. Plastic straws without degradability labeling were offered by 52.77% of kiosks. Conversely, 41.67% provided straws classified as biodegradable plastics, while only 5.56% supplied paper straws. This is the first empirical survey conducted after the enactment of municipal laws banning the use of plastic straws along the northern coast of Rio Grande do Sul, providing concrete evidence on the level of compliance with the regulation and its implementation gaps. Thus, despite regulations fully banning non-biodegradable plastic straws in the three coastal cities, their use and distribution remain widespread. A legal ban on the use of disposable materials is a key step in managing coastal waste. However, for these regulations to be fully effective, they must be accompanied by enforcement measures, a municipal waste management program, engagement and accountability across the production chain, and public awareness campaigns on consumption habits.

Keywords: law; marine pollution; single-use materials; disposables.

Resumo: Os plásticos descartáveis são amplamente utilizados devido à sua praticidade, porém seu descarte inadequado e alta durabilidade resultam em persistência no ambiente e impactos ecológicos. Diante dessa problemática, diversas regiões do mundo adotaram regulamentações para restringir ou proibir o uso desses materiais, incluindo itens como canudos plásticos. Com o intuito de avaliar o cumprimento da legislação de proibição de uso de canudos plásticos em municípios costeiros do litoral norte do Rio Grande do Sul, no sul do Brasil, observou-se o uso de descartáveis nos quiosques da orla de três municípios (Torres, Imbé e Tramandaí), no verão de 2022/2023. Os cinco itens descartáveis mais utilizados pelos consumidores nos quiosques amostrados foram os canudos (23,33%), copos plásticos (16,8%), guardanapos de papel (13,06%), latinhas de alumínio (10,42%) e garrafas de vidro (10,26%). Destes, 60,21% dos materiais eram de plástico, evidenciando um padrão mundial da elevada geração de resíduos plásticos. Canudos plásticos sem indicação de degradabilidade foram oferecidos por 52,77% dos quiosques. Por outro lado, 41,67% disponibilizavam canudos classificados como plásticos biodegradáveis, enquanto apenas 5,56% forneciam canudos de papel. Este é o primeiro levantamento empírico realizado após a promulgação das leis municipais que proíbem o uso de canudos plásticos no litoral norte do Rio Grande do Sul, fornecendo evidências concretas sobre o grau de cumprimento da normativa e suas lacunas de aplicação. Assim, embora haja regula-

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mentação proibindo completamente o uso de canudos plásticos não biodegradáveis nas três cidades litorâneas, o uso e a distribuição desse material continuam ocorrendo regularmente. A existência de leis que proíbam o uso de materiais descartáveis é uma etapa importante na gestão de resíduos sólidos das zonas costeiras. Contudo, para que estas normativas sejam, de fato, eficazes é necessário haver, conjuntamente, ações de fiscalização, um programa de gestão de resíduos municipal, o envolvimento e responsabilização da cadeia produtiva e uma campanha de conscientização da população sobre seus hábitos de consumo.

Palavras-chave: legislação; poluição marinha; materiais de uso único; descartáveis.

1. Introduction

There has been a significant increase in the global production and consumption of plastic, driven by growing consumption patterns. It is estimated that approximately 359 million tons of plastic are produced annually worldwide. Plastics are very versatile, lightweight, durable, flexible, and have a low production cost, being widely used in various everyday activities of society (Pilapitiya & Ratnayake, 2024).

Disposable, or single-use, materials contribute to the increase in plastic production and consumption, accounting for one-third of the amount produced worldwide. These materials, such as plastic bags, straws, cups, and disposable packaging, are usually discarded immediately after use (Singh & Biswas, 2023). Despite their convenience, because they are not biodegradable, these plastics can cause serious environmental problems when disposed of incorrectly, as they accumulate in the environment for hundreds of years, contaminating terrestrial and aquatic environments, both continental and marine (Li et al., 2020).

Several studies have reported, for example, the negative impacts resulting from the ingestion of plastic materials by marine fauna, which include both physical effects, such as obstruction of the gastrointestinal tract, and chemical effects, related to the transfer of contaminants associated with debris, which may have lethal or sublethal consequences for organisms (Zhang et al., 2023; Pilapitiya & Ratnayake, 2024).

Discarded plastics can also fragment, generating microplastics (smaller than 5 mm), which spread easily through the environment and have already been identified in various organisms in the food chain, potentially causing toxic effects (Danopoulos et al., 2020; Li et al., 2020; Salazar-Pérez et al., 2021; Zhang et al., 2023). Among the negative impacts on fauna are ulcers, reduced reproduction, and oxidative stress. In humans, microplastics have been linked to cardiovascular diseases, chronic kidney disease, birth defects, cancer, and other health problems (Pilapitiya & Ratnayake, 2024).

Plastic straws are one of the most well-known single-use materials contributing to plastic pollution in oceans and coastal areas, ranking among the ten most frequently found solid waste items in beach clean-up actions worldwide (Ocean Conservancy, 2024). Straws are typically made from the polymer polypropylene and are widely used due to their practicality in

consuming beverages. However, when discarded, due to their small size and low density, most are not recycled and end up as waste (Zanghelini et al., 2020).

Faced with this problem, several countries have adopted strategies to mitigate the negative impact of plastic products, including bans, taxation, and shared responsibility among public authorities, consumers, and manufacturers. One of these measures, the ban on single-use materials has already been implemented in more than 60 countries (Desalegn et al., 2022; Singh & Biswas, 2023), reflecting a global trend in addressing plastic pollution. In the Brazilian context, this issue gained momentum from 2018 onwards, with the enactment of municipal legislation banning the use of plastic straws in different states, including Rio Grande do Sul (Maffessoni et al., 2023; Aguilar et al., 2024). Among the pioneering regions in adopting these regulations is the northern coast of Rio Grande do Sul, where the ban came into effect in 2018, in the municipalities of Torres (Law No. 5,000, of September 5, 2018) and Imbé (Municipal Law No. 1,971, of September 18, 2018); and in 2019, in Tramandaí (Law No. 4,302, of May 24, 2019).

This region is among the top tourist destinations in the state, especially during the summer, when there is a significant population increase due to summer vacation activities (Lopes et al., 2018). The seasonality intensifies consumption and, consequently, the generation of solid waste, which demands proper management.

Therefore, it is assumed that the legislation banning the use of plastic straws is not effectively enforced, due to weaknesses in monitoring and adherence by commercial establishments and consumers. This issue takes on particular relevance in tourist regions, where proper solid waste management and the reduction of disposable plastic use are essential for the conservation of coastal ecosystems and for maintaining the environmental attractiveness of these destinations.

Considering the importance of verifying compliance with these laws and their effectiveness in reducing solid waste generation, this study constitutes the first empirical survey conducted after the enactment of municipal laws banning the use of plastic straws on the northern coast of Rio Grande do Sul. More specifically, it evaluates the use of plastic straws and other disposable materials by vacationers at beach kiosks in the municipalities of Torres, Imbé, and Tramandaí.

2. Materials and Methods

2.1. Study area and data collection

The study was conducted in the coastal municipalities of Torres, Imbé, and Tramandaí, on the northern coast of Rio Grande do Sul (Figure 1). According to the Instituto Brasileiro de Geografia e Estatística (IBGE),

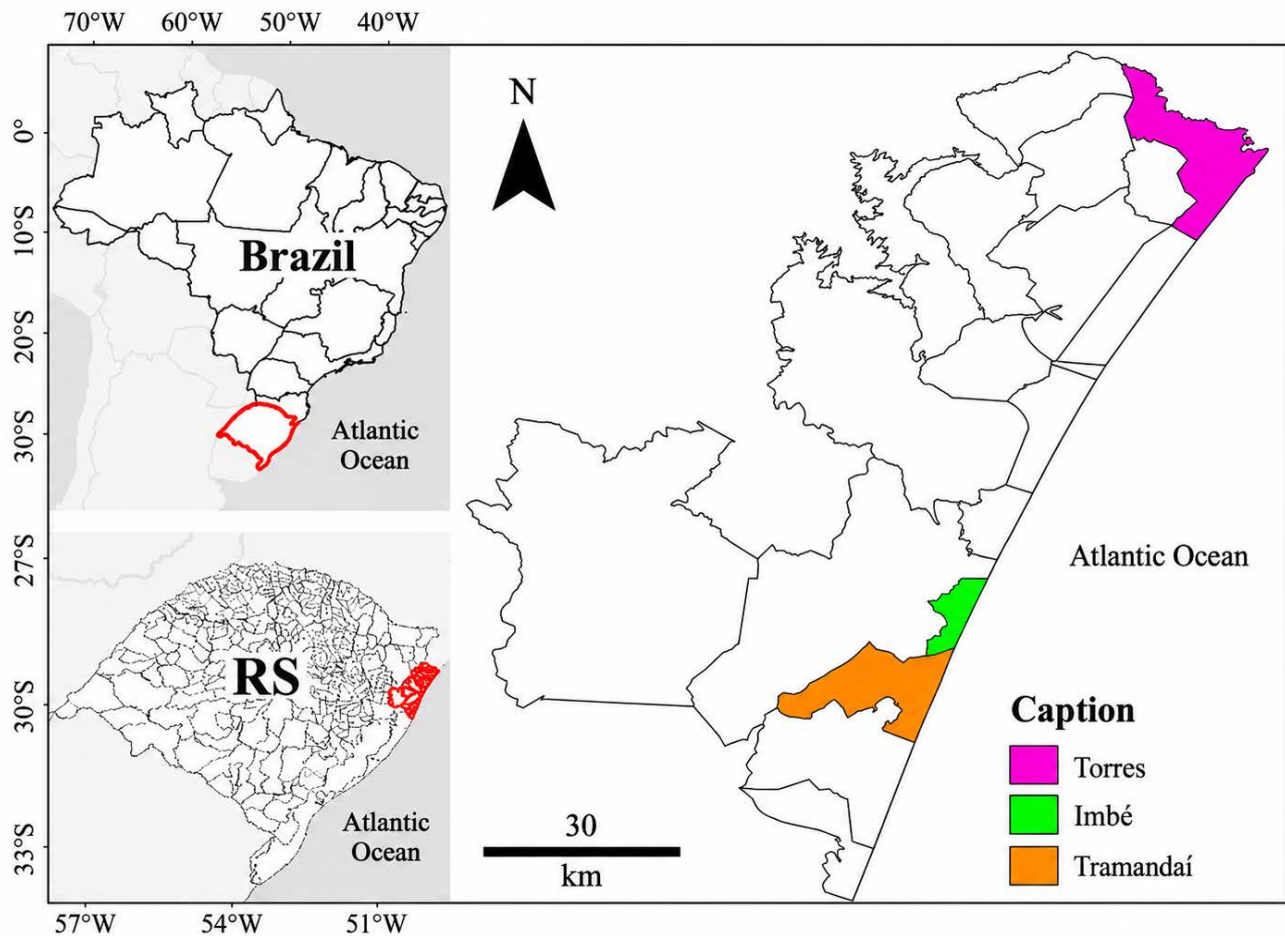


Figure 1

Location of the municipalities of Torres, Imbé and Tramandaí on the coast of Rio Grande do Sul – Brazil.

SOURCE: modified from IBGE, 2022.

Torres is the northernmost municipality on the coast of Rio Grande do Sul, bordering the state of Santa Catarina, and has 41,751 inhabitants (IBGE, 2022). The municipalities of Imbé and Tramandaí are located further south of Torres and have estimated populations of 26,824 and 54,387 inhabitants, respectively (IBGE, 2022).

The data was collected from 10 kiosks in each of the municipalities during the 2022/2023 summer season, totaling 30 establishments. This number was chosen as a reference to standardize the sampling effort among the locations, since Torres had exactly ten kiosks operating on its main summer beach (Praia Grande). Thus, comparability between the municipalities and representative coverage of the establishments distributed along the beach areas were ensured.

The kiosks operate primarily during the summer season (December to March), with many being closed or removed from the shoreline outside of this period. Therefore, the sampling was restricted to the summer and cannot be extrapolated to other seasons. In Torres, samples were taken from all existing kiosks along Praia Grande (-29.333700° , -49.718520°) (~ 2 km). In Imbé (-29.973739° , -50.117600°), the ten monitored kiosks were located within a stretch of approximately 1 km. In Tramandaí (-29.987040° , -50.124000°), ten kiosks established along a stretch of approximately 2 km

were included. The sampling was carried out over three separate days, on weekends, when there is a higher flow of tourists in each location.

The municipalities of Torres, Imbé, and Tramandaí were selected because they have similar laws to ban the use of plastic straws, enacted around the same time, and because of their importance to tourism on the northern coast of Rio Grande do Sul.

2.2. Evaluation of the use of disposable items

The evaluation of disposable item use in commercial establishments was conducted through direct observation of consumer behavior at each beach-front kiosk for a period of 30 minutes, or until 10 consumers had been served, whichever occurred first. Each disposable item used was recorded, and the material composition was visually identified.

To assess whether the consumption patterns of vacationers were similar across the three beaches, the Chi-square statistical test was applied, along with an analysis of standardized residues, in order to identify which materials significantly contributed to the observed differences. The analysis was conducted using RStudio software, adopting a significance level of 5%.

Regarding the specific use of straws, samples of the straws available at each kiosk were collected (one sample per establishment) and the following information was analyzed:

1. Packaged (yes or no);
2. Packaging material (if available);
3. Straw brand;
4. Descriptions available on the packaging;
5. Straw composition (described on the packaging or by visual assessment classifying it as paper or plastic).

In addition to this information, the availability of straws at the service counter was analyzed, verifying whether the item was present or absent.

Among the study's limitations, the short sampling period stands out, restricted to three days during the peak summer season, which may not fully reflect variations throughout the summer period. Furthermore, the observation of consumption patterns may have been influenced by momentary climatic factors, such as solar incidence, winds, and extreme heat. However, despite these limitations, it was possible to identify a behavioral pattern among vacationers, which lends validity to the observations made.

3. Results and Discussion

3.1. Use of disposable items on beaches

In the 30 kiosks sampled, the habits of 277 consumers during the purchase of food and beverages were analyzed, resulting in the use of 643 disposable items (Table 1), with an average of 2.3 items/customer. The five disposable items most frequently used on the beachfront of the three locations were straws (23.33%), plastic cups (16.8%), paper napkins (13.06%), aluminum cans (10.42%), and glass bottles (10.26%) (Table 1).

Consumption patterns varied among the beaches ($p\text{-value} = 2.2e^{-16}$), with the greatest differences observed in the use of cardboard packaging in Tramandaí and glass bottles in Imbé (Table 1). However, the consumption of plastic materials predominated in all three locations, representing 59% in Torres, 62% in Imbé, and 60% in Tramandaí. The highest consumption of paper/cardboard occurred in Tramandaí (26%), followed by Torres (22%) and Imbé (7%). Glass was most used in Imbé (20%), while its use in Torres was 9% and in Tramandaí 3%. Finally, aluminum showed similar percentages among the municipalities, ranging from 10% to 12% (Figure 2).

The results highlight the high quantity of solid plastic waste generated on the beaches examined, reflecting a globally observed pattern (Abelouah et al., 2021; Hinata et al., 2025). These single-use materials inevitably become solid waste, and inadequate disposal practices and the absence of efficient

Table 1 Quantity and percentage of disposable items available at kiosks on the beachfront of Torres, Imbé and Tramandaí, in Rio Grande do Sul, during the summer of 2022/2023.

Item	Quantity of solid waste per municipality – unit (%)			
	Towers	Imbé	Tramandaí	Total
Straws	47 (22.82)	57 (29.93)*	46 (19.17)	150 (23.33)
Disposable cups	34 (16.5)	35 (17.77)	39 (16.25)	108 (16.8)
Paper napkin	38 (18.45)*	13 (6.6)*	33 (13.75)	84 (13.06)
Can	20 (9.71)	23 (11.68)	24 (10)	67 (10.42)
Glass bottle	19 (9.22)	39 (19.79)*	8 (3.33)	66 (10.26)
PET bottle	15 (7.28)	9 (4.57)	11 (4.58)	35 (5.44)
Styrofoam packaging	14 (6.79)	8 (4.06)	11 (4.58)	33 (5.13)
Plastic packaging	5 (2.43)	6 (3.05)	20 (8.33)*	31 (4.82)
Cardboard packaging	0 (0)	0 (0)	30 (12.5)*	30 (4.67)
Disposable plastic cutlery	5 (2.43)	4 (2.03)	15 (6.25)*	24 (3.73)
Plastic bag	7 (3.4)*	0 (0)	0 (0)	7 (1.09)
Disposable plate	0 (0)	3 (1.52)	1 (0.42)	4 (0.62)
Plastic container	2 (0.97)	0 (0)	2 (0.83)	4 (0.62)
Total	206 (100)	197 (100)	240 (100)	643(100)

*CAPTION: statistically significant difference.

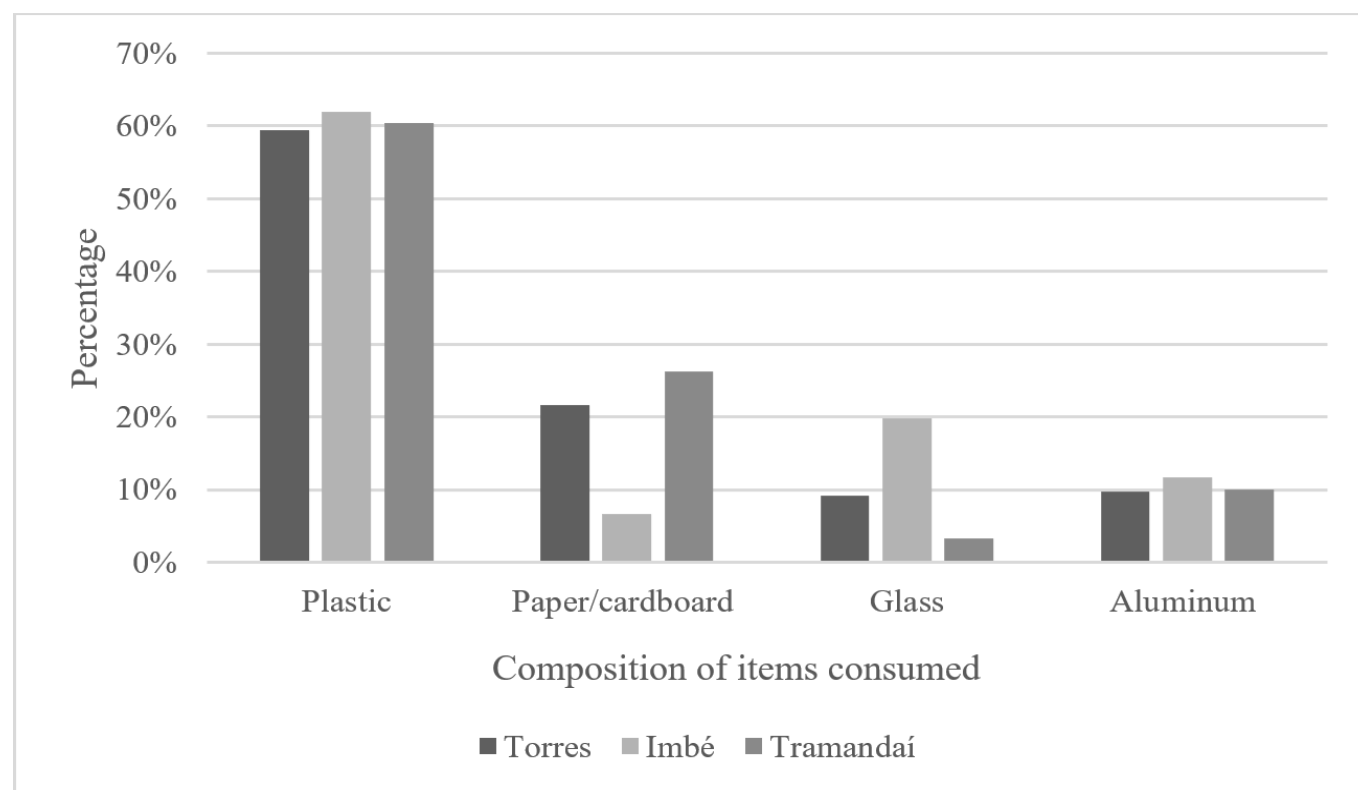


Figure 2

Composition of disposable materials consumed by vacationers at the beach kiosks in Torres, Imbé and Tramandaí, Rio Grande do Sul, during the summer of 2022/2023.

infrastructure for their management contribute significantly to marine pollution, exacerbating environmental impacts on the coastal ecosystem (Grechinski, 2020).

Single drums (plastic trash cans) for waste disposal were observed distributed along the shoreline, especially near the kiosks, on the analyzed beaches. These containers receive all types of materials (compostable, recyclable, or non-recyclable waste) which, after disposal, are collected by the municipalities and sent to transfer stations for subsequent disposal in landfills. However, during the summer period, the existing trash cans are filled more quickly than the removal process by the municipality, resulting in the accumulation of garbage and frequent dispersal, by the action of the wind, of low-density items, such as straws themselves. At the same time, solid waste of greater economic value, such as aluminum cans and PET bottles, are frequently recovered by independent recyclable material collectors in the region, contributing in a limited way to the recycling process.

Given this scenario, it would be advisable to implement clearly marked containers for selective waste collection near the kiosks, along with the adoption of municipal strategies for the separate collection and disposal of segregated waste. Clear signage on the containers, combined with educational campaigns aimed at raising public awareness, are factors that favor waste segregation at the source and can promote advances in the sustainable management of solid waste (Pereira & Fiore, 2022).

However, the exclusive ban of the use of plastic straws, as defined by existing legislation in these municipalities, among several other single-use

plastic items used in local commerce, may result in insignificant or even undesirable effects, such as an increase in the use of other disposable products, especially plastic cups (Chitaka et al., 2020), which represented the second most consumed material on the beaches examined.

The data collected in these three municipalities highlight the need for integrated approaches in coastal management with the aim of mitigating the generation of plastic waste. In addition to more efficient solid waste management in the coastal region, through the implementation of selective collection on beaches, it is essential to encourage the circular economy in order to increase the lifespan of materials (Arijeniwa et al., 2024). Thus, the following actions are necessary:

- a) Regulation: governments should adopt strict standards for reducing single-use plastics, establishing clear targets and encouraging alternative solutions (Fanini & Guittard, 2021);
- b) Accountability: the industry must be held accountable for producing easily recyclable materials and for managing the end-of-life of its products (Singh & Biswas, 2023; Arijeniwa et al., 2024);
- c) Research, development and innovation: prioritize investments aimed at creating sustainable alternatives to plastics and improving recycling technologies (Pilapitiya & Ratnayake, 2024);
- d) Awareness raising: promoting awareness campaigns within the community about the negative impacts of plastic pollution and the benefits of the circular economy, encouraging more sustainable consumption habits (Aguilar et al., 2024).

Initiatives like these are already being adopted in countries such as Germany, Japan, and France, representing significant advances in addressing the current challenges of plastic waste management. In contrast, in Brazil, this process is still quite incipient and focuses the implementation of strategies to incorporate consumer actions and perspectives (Pilapitiya & Ratnayake, 2024). According to data from the National Sanitation Information System (base year 2022), only 7.73% of recyclable waste collected in Brazil is effectively recovered. In Rio Grande do Sul and on the northern coast of the state, these rates are even lower, corresponding to 6.89% and 3.90%, respectively. Thus, in addition to prioritizing the fight against disposable plastic waste, it is necessary to overcome the challenges related to selective collection and recycling, which still present large gaps.

Specifically regarding the northern coast of Rio Grande do Sul, it is recommended to expand the infrastructure for collecting and processing recyclable materials, implement seasonal planning for solid waste management, and develop environmental education programs aimed at tourists and entrepreneurs in the sector. These initiatives should stimulate sustainable waste management practices, especially during the summer season when

the floating population increases significantly. Furthermore, it is essential to promote recycling through public policies and partnerships with the private sector, fostering a more efficient and inclusive system.

3.2. Evaluation of the straws used

In the sampling conducted along the coastline of three coastal municipalities in Rio Grande do Sul, kiosks provided a total of 150 straws to consumers. In 80% of the kiosks, the straws were displayed on the counter and freely accessible for consumer use. Regardless of the manufacturing material, the free availability of straws, even those made of alternative materials, can stimulate consumption (Maffessoni et al., 2023). According to the study conducted by Wagner & Toews (2018), the practice of providing straws to customers only upon request reduced the use of this item by 32%. This data reinforces the importance of rethinking the provision of straws in establishments, prioritizing approaches that encourage conscious consumption and contribute to the reduction of solid waste.

In the municipalities evaluated, 60% of the straws distributed in Imbé complied with the current regulations, followed by Tramandaí (50%) and Torres (42.85%). The kiosks in Torres had the lowest compliance rate, with most straws being distributed in violation of the legislation. On the other hand, only in Torres was the use of paper straws identified, corresponding to 14.28% of the straws distributed in the beach kiosks, demonstrating specific initiatives to replace them with more sustainable alternatives, although insufficient to compensate for the low overall compliance rate of the municipality.

Given that the municipalities examined have specific legislations regarding the use of plastic straws and the results demonstrate non-compliance with these regulations, public policies are needed that address the strong seasonality of the northern coast, including increased enforcement. During the summer season, some municipalities have conducted inspection campaigns in commercial establishments. In March 2023, for example, the Department of Environment of Tramandaí inspected establishments, seizing straws that did not comply with municipal legislation (Tramandaí, 2023). This highlights the need for more rigorous monitoring in coastal municipalities, complementing other strategies against the use of disposable plastics.

Analysis of the straws used in the kiosks (Table 2) showed that most still use plastic straws (94.44%), with 52.77% not complying with the legislation, which reinforces the importance of inspection to ensure that only permitted materials are sold.

The results highlight a discrepancy between the existence of municipal legislation and its effective application in the establishments evaluated. Although the three municipalities have regulations banning the use of

Table 2 Frequency and description of straws distributed by kiosks on the beaches of Torres, Imbé and Tramandaí, in Rio Grande do Sul, during the summer of 2022/2023.

Type	Description	Frequency (%)
A	Biodegradable plastic straws, wrapped in paper, Plastsul brand.	30.56
B	Conventional plastic straws, wrapped in paper and without a label description.	36.11
C	Conventional plastic straws, packaged in plastic material, Strawplast brand.	8.33
D	Conventional plastic straws, without packaging.	8.33
E	Biodegradable plastic straws, wrapped in paper, Theoto brand.	2.78
F	Biodegradable plastic straws, wrapped in paper, Plazapel brand .	8.33
G	Paper straws, packaged in custom paper by the Lake Condominium and the Praia Limpa Torres Project.	2.78
H	Paper straws, wrapped in paper, Billa brand.	2.78

plastic straws, such regulatory instruments have low practical effectiveness, since most of the straws distributed are not in accordance with the law.

To understand more precisely how this nonconformity manifests itself in practice, the characteristics of the eight types of straws distributed were analyzed (Figure 3). Among the straws collected, the most used were: plastic straws, packaged in paper and without a description on the label (type B – 36.11% of the kiosks); followed by type A straws – biodegradable plastic, packaged in paper, from the Plastsul brand (30.56%). The other straw types (C – H) were distributed less frequently (5.56%) (Table 2).

The survey conducted in this study revealed that 41.67% of the straws were identified as “biodegradable plastic” (types A, E, and F), and only 5.56% (types G and H) as paper straws. Thus, types A, E, F, G, and H, corresponding to 47.23% of the total, comply with the legislation that bans the use of conventional plastic straws. Therefore, 52.77% of the straws provided by the kiosks are still made of common plastic material.

The variety of straw types offered, coupled with the lack of clear information about their composition and degradability, highlights the need for greater transparency in labeling. The current situation compromises the ability of retailers and consumers to make choices aligned with legal requirements and poses challenges for regulatory authorities to monitor products and ensure they comply with established standards.

Regarding the packaging of the straws, it was observed that 91.67% of the items provided were packaged. Of these, 83.34% were packaged in paper, while 8.33% used plastic packaging. On the other hand, 8.33% of the straws offered did not have any type of packaging, which is inconsistent with the legislation in force in the municipalities of Torres and Imbé, which requires that straws be individually packaged in hermetically sealed envelopes.

Although the predominance of paper packaging represents progress in terms of its biodegradability, studies such as that of Fanini & Guittardi (2021), conducted in Greece, show that packaging is an additional, often

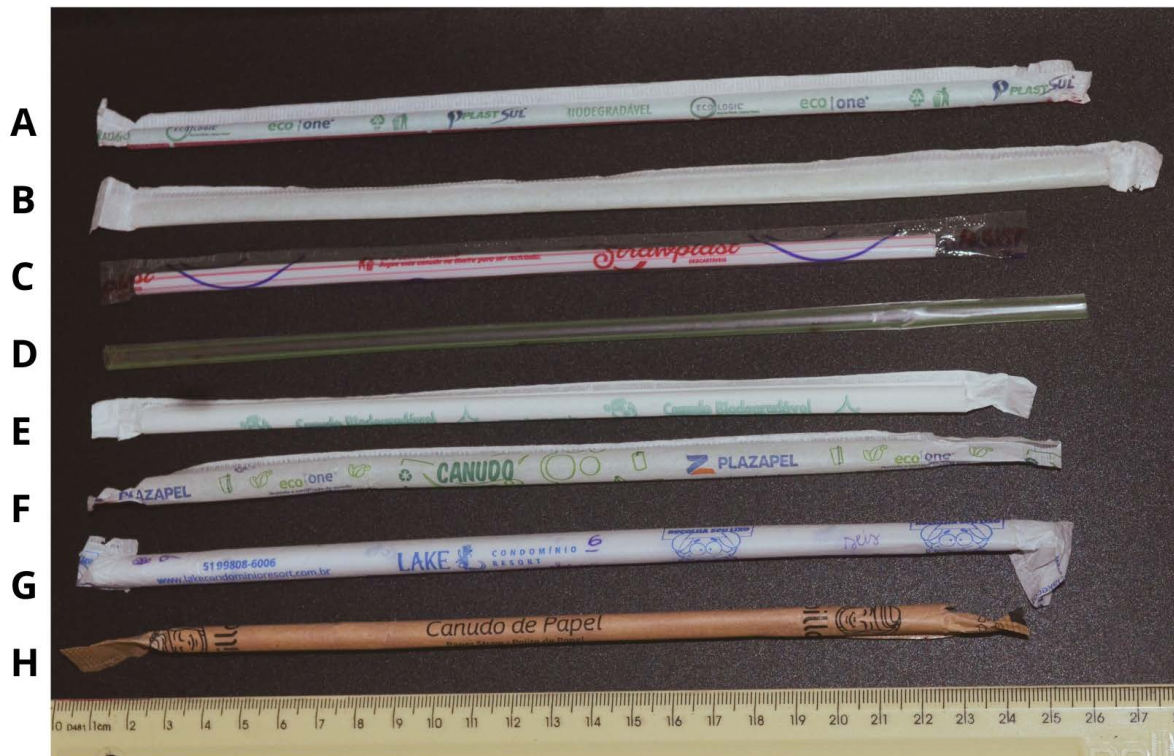


Figure 3

Typology of straws distributed by kiosks on the beach in Torres, Imbé and Tramandaí in Rio Grande do Sul, in the summer of 2022/2023.

CAPTION: Variety of straws identified at the kiosks in the three locations: A – Biodegradable plastic straw, wrapped in paper, Plastsul brand. B – Conventional plastic straw, wrapped in paper and without description on the label. C – Conventional plastic straw, wrapped in plastic material, Strawplast brand. D – Conventional plastic straw, without packaging. E – Biodegradable plastic straw, wrapped in paper, Theoto brand. F – Biodegradable plastic straw, wrapped in paper, Plazapel brand. G – Paper straw, wrapped in paper, customized by the Lake condominium and the Praia Limpa Torres Project. H – Paper straw, wrapped in paper, Billa brand.

underestimated source of pollution. The authors highlight the ease with which these solid wastes disperse in the environment and emphasize that banning the use of straws on beaches can reduce not only the pollution associated with the straws themselves, but also their packaging. In this context, the authors conclude that the use of straws should be limited to specific situations, such as for children or people with disabilities, promoting a more sustainable approach aligned with the reduction of negative environmental impacts.

Banning plastic straws is a viable measure, especially given the availability of alternatives such as biodegradable straws, paper straws, or reusable options, including silicone, stainless steel, glass, and bamboo (Wagner & Toews, 2018). However, the viability of these alternatives depends on changing consumption habits and the acceptance of these products by the population. It is essential that the ban on the use of plastic straws be accompanied by strategies that discourage the use of disposable materials in general (Maffessoni et al., 2023; Aguilar et al., 2024).

Furthermore, straws made from alternative materials often have higher costs or are not widely available for purchase. These limitations may lead retailers to continue opting for straws made from common polymer materials, contrary to restrictive legislation.

Alternatively, several countries, such as Italy, Spain, and the United Kingdom, have adopted the taxation of plastic products as a strategy to reduce consumption, increasing their cost through taxes. This measure induces consumers to opt for cheaper and more sustainable alternatives, such as paper straws (Desalegn & Tangl, 2022; Pilapitiya & Ratnayake, 2024).

In addition to taxation, countries like Germany and Denmark ban all single-use plastics, forcing the creation of more sustainable and multi-use alternatives (Pilapitiya & Ratnayake, 2024).

In Brazil, however, strategies aimed at reducing the use of straws or other single-use materials remain focused on banning legislation, without the use of complementary instruments such as economic incentives, taxation, continuous monitoring programs, or robust educational campaigns. To date, few municipalities are associating legal measures to implementation actions, which limits the practical effectiveness of these regulations and contributes to the continued use of conventional plastic straws.

As previously mentioned, it is crucial that governments, at their various administrative levels, adopt an integrated and comprehensive approach, involving producers, commercial establishments, and consumers, with the goal of inducing changes in consumption patterns. Thus, the selection of single-use materials should not be determined solely by low cost, but should incorporate an assessment of the potential environmental impacts on the coastal ecosystem (Maffessoni et al., 2023).

Furthermore, measures such as the implementation of taxes and restrictions on single-use disposable plastic products should be adopted in a comprehensive and integrated manner between the public and private sectors, focusing on promoting the circular economy and employing environmental education as a strategic tool (Ciezka & Rybinska, 2020; Arijeniwa et al., 2024).

4. Conclusions

The present study provides a novel contribution to the understanding of the application of legislation banning plastic straws in kiosks on the northern coast of Rio Grande do Sul, offering a diagnosis of compliance with the law. By quantifying the use of straws and other disposable materials in these establishments, the research provides evidence that can support the formulation and improvement of local public policies focused on waste management, education, and environmental enforcement.

The ban on the use of plastic straws represents a potentially viable measure for mitigating plastic pollution. However, the legislation in force in the municipalities of Torres, Tramandaí, and Imbé has not been effectively enforced by most kiosks located on the beach. This scenario highlights the limited effectiveness of the measure in reducing the generation of solid waste and, consequently, in decreasing plastic pollution.

It is recommended that municipalities implement continuous monitoring actions during the summer season, expand selective waste collection infrastructure along the coast, and develop awareness campaigns aimed at merchants and tourists, addressing consumption patterns and discouraging the use of single-use materials. According to international experiences with

banning disposable items, these measures are more effective when combined with holding manufacturers accountable, taxing and banning the use of other single-use disposable plastic materials, in addition to straws. These combined strategies could effectively contribute to reducing plastic pollution in coastal and marine environments.

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