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POLLUTION IN COASTAL ENVIRONMENTS: AN ANALYSIS OF PUBLIC POLICIES AND SDGS 6 AND 14

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ABSTRACT

Coastal environments are facing increasing pressure due to contamination from various sources, which threatens marine biodiversity and also the quality of life of communities. The coastal zone is extremely important in Brazil, where, on about 8 thousand kilometers of coast, a fifth of the country's population lives. The management of these contaminants, through public policies, is in line with the Sustainable Development Goals (SDGs) 6 – Drinking water and sanitation and SDG 14 – Life below water. The present work proposes a bibliographic review on public policies for coastal regions in Brazil, seeking to address the management of maritime-estuarine pollution, the work in Environmental Education and Sanitation and SDGs 6 and 14. As of 2019, Brazil has demonstrated a growing commitment to the protection and sustainable management of coastal zones, through updated policies and new projects. Coastal environmental education in Brazil has advanced significantly with the implementation of educational programs in schools, community awareness initiatives and the growing use of digital technologies. The implementation of SDGs 6 and 14 in Brazil has advanced, with improvements in sanitation infrastructure, depollution projects and monitoring initiatives. However, challenges such as insufficient infrastructure, plastic and chemical pollution, and policy coordination still need to be addressed.

Keywords: Coastal Zone, Contaminant Sources, SDG 6, SDG 14, Coastal Environmental Education, Sustainable Management.

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INTRODUCTION

Coastal environments, which represent the interface between land and sea, play a crucial role in both the ecological balance and the sustainability of human communities. These biodiversity-rich ecosystems are critical to the health of the planet, providing habitat for a vast array of marine species and essential ecological services such as erosion protection and climate regulation. However, these environments face increasing pressure due to contamination from various sources, such as industrial pollution, domestic sewage, and solid waste.

The coastal zone is extremely relevant in Brazil, which has about 8 thousand kilometers of coastline, where approximately a fifth of the country's population lives. These contaminants and the associated public policies are directly related to Sustainable Development Goals (SDGs) 6 – Drinking Water and Sanitation, and 14 – Life below Water, highlighting the importance of water management, human health and ocean conservation from the perspective of sustainability.

Coastal contamination not only compromises the integrity of marine habitats, but also threatens the biodiversity of these ecosystems. Toxic substances, such as heavy metals and industrial chemicals, can accumulate in the food chain, affecting the health of marine species and, consequently, the quality of fisheries resources. In addition, the degradation of these environments directly impacts the quality of life of communities that depend on these resources for their livelihoods and well-being. Research indicates that water pollution can increase the incidence of disease, harm human health, and reduce the availability of essential resources for the local economy.

Given this scenario, it is essential to implement effective policies and sustainable management practices to mitigate pollution and recover coastal environments. Integrating efforts between governments, communities, and the private sector is essential to address the challenges posed by contamination and ensure the preservation of these vital ecosystems for future generations. The promotion of innovative solutions and awareness of the importance of coastal conservation are fundamental steps to ensure the resilience and health of these environments, which are essential both for marine biodiversity and for the quality of life of the populations that depend on them.

The present work proposes a bibliographic review on public policies aimed at coastal regions in Brazil, addressing the management of maritime-estuarine pollution, efforts in environmental education, sanitation and the involvement of society in the fulfillment of SDGs 6 and 14. It is emphasized that the challenges faced by society require integrated

and multisectoral approaches, with the collaboration of governments, the third sector, civil society and other relevant actors in the process.

The coastal zone is of great global importance, considering that about 60% of the world's population lives less than 100 km from the coast (Vitousek et al., 1997). Recent studies estimate that between 2.15 and 2.90 billion people live in regions close to coastal zones, with 0.9 to 1.2 billion in low-elevation areas, subject to problems such as sea level rise (Reimann et al., 2023).

Brazil has an extensive coastal strip of approximately 7,367 kilometers, covering 17 states and 5,570 municipalities, many located in coastal areas. According to the 2022 Brazilian Census, 111.28 million people live near the coast, within a range of up to 150 kilometers from the coast, representing 54.8% of the total population (IBGE, 2022).

Unfortunately, several estuaries, such as the Capibaribe River in Pernambuco, are highly polluted (Zanardi-Lamardo et al., 2016). Studies, such as those by Santana et al. (2015), point to the seriousness of the problem. Castro and Almeida (2012) discuss dredging operations in coastal areas, carried out both for port maintenance and for the remediation of contaminated areas. These operations highlight the need for sustainable interventions in degraded regions to mitigate environmental impacts.

The World Health Organization (WHO) defines maritime-estuarine pollution as: "The introduction, by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or has the possibility of resulting in deleterious effects against marine life, danger to human health, obstacle to maritime activities, including fishing and other legitimate uses of the sea, loss of quality for the use of seawater and reduction of amenities" (Vikas and Dwarakish, 2015).

Plastic pollution is one of the biggest threats to the oceans, considering that these materials do not degrade, but fragment into smaller pieces, harming living beings for long periods (Law, 2017). Contamination by domestic sewage is also a concern, contributing to the eutrophication of coastal environments (Vikas and Dwarakish, 2015). In addition, chemical and radioactive products (Tornero and Hanke, 2016) and the bioaccumulation of contaminants in the food chain further aggravate the situation (Law, 2017).

In 2000, UN member countries established the Millennium Development Goals (MDGs), whose partially achieved targets inspired the creation of the 17 Sustainable Development Goals (SDGs) in 2012, during the Rio+20 conference. Among these, SDG 6 – "Ensure the availability and sustainable management of water and sanitation for all", and SDG 14 – "Conservation and sustainable use of the oceans, seas and marine resources for sustainable development" stand out.

The present study is based on an exploratory literature review of relevant texts published in the last five years, addressing maritime-estuarine pollution, coastal environmental education, sanitation and SDGs 6 and 14.

MATERIAL AND METHODS

The present research is a bibliographic review, based on a qualitative approach, of an exploratory nature, which according to Marconi and Lakatos (2017), implies the collection of data indirectly through bibliographic sources such as books, monographs, dissertations/theses, journals and scientific articles. The scientific repositories consulted were: (i) Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Ensino Superior do Governo Federal – CAPES (www.periodicos.capes.gov.br), (ii) Google scholar (www.scholar.google.com) and (iii) ResearchGate (www.researchgate.net). Platforms such as the United Nations (http://www.estrategiaods.org.br) and the Ocean Conference (http://nacoesunidas.org.br) also subsidized the study.

The theoretical objects were the keywords chosen, namely, respectively: (1) Coastal environmental policies, (2) Coastal pollution management, (3) Coastal environmental education and (4) Sanitation and SDGs 6 and 14. They were thus chosen and combined, so that they constitute the topics of Results and Discussion, of the present review.

Texts in Portuguese, English and Spanish were selected in the bibliographic searches, in the interval of the last five years (2019-2024). It is important to note that the work was based on bibliographic and documentary research, gathering information about the theme, seeking not only to repeat previously described subjects, but to improve and examine them according to the original focus or approach (Marconi and Lakatos, 2017), in a longitudinal, prospective and retrospective way, with methodological rigor of the present review. Therefore, the intention is to reconstruct theory, concepts, ideas, ideologies, controversies, with the support of strengthening theoretical foundations (Demo, 2012).

When applying the keywords in the three chosen databases, only the references with greater relation to the title and objective of the research were chosen, within the first twenty citations retrieved, and the repeated references were excluded. Despite the selective use of keywords, some searches returned texts not directly related to the coastal environment and thus were not used.

Below, Table 1 shows, in a summarized way, all the methodological execution in order to apply in the topic Results and Discussion, of this literature review research. In some cases, searches resulted in fewer than 20 works and then all resulting productions were selected.

Table 1. Results of searches carried out in three databases. The first twenty (20) citations were checked, in order of importance, when available.

Database/ Keywords*	Articles	Books/ Chapters	Theses/ Dissertations/ Monographs
Portal CAPES			
1	19	1	0
2	16	0	0
3	20	0	0
4	7	0	0
Google Scholar			
1	13	0	7
2	14	1	5
3	12	0	9
4	13	0	7
ResearchGate			
1	13	4	3
2	16	2	2
3	12	6	0
4	16	3	1

*Number refers to the terms: (1) Coastal Environmental Policies; (2) Coastal Pollution Management; (3) Coastal Environmental Education; and (4) Sanitation and ODs 6 and 14.

RESULTS AND DISCUSSION

According to the Federal Constitution of 1988 (Brasil, 1988) the Brazilian coastal zone, considered a national heritage, corresponds to the geographical space of interaction of air, sea and land, including its renewable or non-renewable resources, covering a maritime strip and a land strip, according to its own limits cited by our Magna Carta. The aforementioned Federal Constitution, in its Article 225, recognizes the Brazilian coast as a national heritage and, according to the Ministry of the Environment (Brasil, 2015), its management, by the different administrative spheres, presents itself as a challenge, given the multiplicity of actors involved in this management.

Federal Decree No. 5,300, of December 7, 2004 (Brasil, 2004), deals with the Regulation of the National Coastal Management Plan (PNGC). This decree regulates the PNGC, providing for rules for the use and occupation of the coastal zone and management of the seafront, establishing the competencies of each managing body, in the three spheres of power (federal, state and municipal).

Several authors, dealing with local issues, have sought to evaluate projects for the implementation of public policies in coastal management. Thus, for example, Melo and Cestaro (2019) evaluated the implementation of the Via Costeira project in Rio Grande do Norte, a particular case, but of relevance to the national context. According to the authors, the project, despite being controversial, was approved and implemented by several state governments, having contributed to the dynamization of the state's economy, generating employment and income, improvements in urban infrastructure, among other positive impacts, however, it also generated negative impacts, especially in environmental aspects.

The study by Souza *et al.* (2019) was designed with the objective of mapping and identifying the main vectors responsible for the suppression of mangrove cover in the Southern Bahia Lowlands region, Brazil, based on satellite images. Two main vectors responsible for the suppression of mangrove forests were identified: the disorderly expansion of urban areas (especially in the municipality of Valença) and the advance of clandestine shrimp farming, due to the installation of shrimp cultivation tanks, without the proper environmental licensing process (especially in the municipality of Nilo Peçanha).

Aguiar and Ervatti (2020) sought to identify, based on the concept of coastal vulnerability, which were the most vulnerable places in the coastal zone of the municipality of Rio de Janeiro and to research existing public policies and adaptation plans, aimed at coastal areas at risk, and assess whether they would be adequate and sufficient. According to the authors, the main positive conclusions found were the existence at the national level of updated measures aimed at coastal zones, but, in relation to the negative aspects, they found the need for greater involvement of the government, population and private initiative in municipal policies. The authors highlight the need for researchers and public agencies to be closer to vulnerable populations, for a greater knowledge of the real needs of each location.

Domingos and Braga Júnior (2024) concluded that there was a significant contribution from the National Policy for the Sustainable Development of Traditional Peoples and Communities to the elaboration of the State Policy for the Sustainable Development of Fisheries and Aquaculture in Rio Grande do Norte and, in the same way, these instruments could contribute to the development of other policies at the state level, having as interested subjects, other traditional peoples or communities, such as quilombolas and indigenous communities.

Thus, as briefly reported above, local projects show that it is possible to develop programs aimed at monitoring and assisting regional administrations in order to better conserve coastal zones.

COASTAL ENVIRONMENTAL POLICIES

The searches carried out on the theme "Coastal Environmental Policies", in the three databases, resulted in 45 articles, 5 books/book chapters and 10 theses, dissertations or monographs. These results show that this theme is quite recurrent and discussed. However, the analyzed texts basically show the application of specific policies, so that, for the purpose of this text, the topics considered representative of the available bibliography

are presented. Below are discussed seven texts that cover, in a broad and elucidative way, the topic analyzed.

According to several authors, Brazilian coastal areas face multiple challenges, including disorderly urbanization, pollution, and climate change (review in Pinho and Carriço, 2021). Brazil has one of the largest stretches of coastline in the world and a diversity of ecosystems, such as mangroves, coral reefs and sandbanks, which are extensively occupied historically and need to be preserved. To deal with these challenges, the country needs effective policies that integrate environmental conservation with socioeconomic development (Pinho and Carriço, 2021).

The National Solid Waste Plan (Planares), instituted through Decree No. 11,043, of April 13, 2022 (Brasil, 2022), includes specific strategies for waste management in coastal areas. The plan aims to reduce marine pollution and promote the circular economy by encouraging recycling and waste reduction in coastal areas. According to a study by Dias *et al*. (2019), the implementation of these strategies has shown progress in reducing the amount of solid waste disposed of inappropriately in Brazilian coastal regions.

The National Policy on Climate Change (PNMC), in force since 2021 (Brasil, 2021), includes guidelines for adapting to and mitigating the effects of climate change in coastal zones. This policy provides for the implementation of projects for the recovery of degraded ecosystems, the protection of mangrove and coral reef areas, and the promotion of infrastructure resilient to climate change. A practice that has been adopted at different governmental levels, from municipal, state to federal, is payments for environmental services, which remunerate producers who have an area recovered or financially support them to recover an area on their property. Two well-known successful examples of Payments for Environmental Services (PES) are Catskill, in New York, USA; and in the municipality of Extrema, Minas Gerais, which protect its watersheds and water resources for water production from payments for environmental services (Rodrigues *et al*., 2023).

In 2023, the government launched a national project focused on the recovery and preservation of mangroves, vital ecosystems for biodiversity and coastal protection. This project aims to restore degraded areas and promote scientific research on the importance of mangroves in mitigating the impacts of climate change. A study conducted with elementary school students found that the landscape affects the individual and vice versa, through a diversity of positive and negative interpretations, with some distorted and derogatory views of the mangrove ecosystem (Santos, 2020). The study by Vikou *et al*. (2023), in the urban mangroves of the municipality of Paranaguá (PR), pointed out a total of 475 anthropogenic pressure points on the 22 mangrove patches analyzed. The most

prominent class was household garbage, followed respectively by the release of untreated domestic effluents, debris (construction material) and, finally, shackles. According to the review work by Silva and Fontgalland (2021), it is possible to see that the Brazilian legislation for mangroves does not have specificities that deal with their sustainable use, but that the projects created in these areas present very important and satisfactory results.

Despite the advances, coastal environmental policies face significant challenges. Policy implementation is often hampered by financing issues (Vikou *et al*., 2023), lack of coordination between different levels of government, and resilience from economic sectors, which rely on intensive exploitation of coastal zones (Silva and Fontgalland, 2021).

To address these challenges, it is essential to strengthen governance and community participation in environmental policies (Rodrigues *et al*., 2023). Integrating scientific knowledge with the traditional practices of coastal communities can improve policy effectiveness and ensure that benefits are distributed equitably.

COASTAL POLLUTION MANAGEMENT

The searches carried out on the theme "Coastal Pollution Management", in the three databases, resulted in 46 articles, 13 books/book chapters and 7 theses, dissertations or monographs. The significant number of articles and books found shows that the topic is important and has drawn the attention of Brazilian researchers. For the purpose of this text, the topics considered representative of the available bibliography are presented. Below are discussed five texts that cover, in a broad and elucidative way, the topic analyzed.

There is no current and comprehensive reference on the quantity or the main components of coastal pollutants that are released on the Brazilian coast. The National Plan to Combat Waste at Sea (PNCLM), launched by the Ministry of the Environment in March 2019 (Brasil, 2019), provided for 30 actions, but at least 25 were abandoned and the versions of the plan launched in the following years (2020, 2021 and 2022), with only five initiatives planned. The PNCLM also had, in its original version, six axes: Immediate Response, Solid Waste Management, Research and Technological Innovation, Incentive Instruments and Sectoral Pacts, Standardization and Guidelines, and Education and Communication. No publication on the application of the PNCLM was found, suggesting that this policy, although very important, was not implemented. According to Turra *et al.* (2020), in a review book on garbage at sea, "more than a problem, garbage in the seas can be understood as an opportunity to materialize society's efforts, with a view to promoting a balanced and socially just environment".

Regarding solid waste, in the state of São Paulo alone, the Secretariat of Infrastructure and Environment of the State of São Paulo estimated that the amount of Urban Solid Waste, in 2018, exceeded 41,300 tons/day (SIMA, 2020). Although São Paulo may be the state with the largest amount of solid waste produced on the Brazilian coast, the number presented above shows the size of the problem to be solved by the country.

Regarding liquid waste, it is known that an important part of the pollutant load from coastal watersheds, which is drained to estuarine and mangrove regions, is released into the ocean with all the waste from domestic or industrial sewage, without any treatment (Souza *et al*., 2019). This action is directly related to the mortality of organisms, decreased biodiversity, and changes in the functioning of ecosystems, due to the alteration of natural landscapes and loss of species (Leão *et al.,* 2022).

Some studies, such as the study by Santos *et al.* (2023) show that some environments are contaminated and not prone to use by the population. This study by Santos *et al.* (2023) in the Guaibim Coastal Plain environmental protection area (Guaibim Environmental Protection Area), Bahia, considered a Priority Area for Conservation, using parameters of pH, Conductivity, Salinity, Dissolved Oxygen, Oxygen Saturation, Total Phosphorus, Ammonia, Nitrite, Nitrate, Chlorophyll and Thermotolerant Coliforms, showed that, among other parameters, the density of thermotolerant coliforms exceeds the limits of CONAMA Resolutions 357/05 and 274/00 (Brazil, 2000, 2005) and the authors recommend not using the Guaibinzinho for fishing and bathing activities and the Mamucabo for bathing, due to the imminent risk to public health.

In other cases, such as in the study by Navi and Abessa (2023), the results show that some environments are preserved and thus suitable for various uses by the population. The study by Navi and Abessa (2023), on the management of pollution in marine and coastal conservation units in the state of São Paulo, which can be extended to other federation units, showed that these conservation units, in their management and planning programs, give little importance to pollution, giving more emphasis to fishing and public use, despite the possibility of being affected by pollutants from different sources. Thus, according to the authors, it is necessary to reinforce studies and monitoring on pollution in the PAs, create communication and education mechanisms, as well as intensify inspection programs in the management of the units. On the other hand, the study by João and Silva (2022), in the water and sediments of the lagoons of the Laguna Estuarine System (Santa Catarina, Brazil), showed that, at all collection points, the water quality was good/optimal, for the parameters analyzed, with no results outside those expected by the regulatory agencies.

COASTAL ENVIRONMENTAL EDUCATION

The searches carried out on the theme "Coastal Environmental Education", in the three databases, resulted in 44 articles, 6 books/book chapters and 9 theses, dissertations or monographs. The important number of recent articles and books found shows that the theme is relevant and has been well explored. For the purpose of this text, the topics considered representative of the available bibliography are presented. Below are discussed eight texts that cover, in a broad and elucidative way, the topic analyzed.

Marine and Coastal Environmental Education (EAMC) aims in an interdisciplinary way, to develop teaching practices to address the challenges of our society, such as climate change and marine pollution. Schools are spaces in which environmental issues can be experienced to promote the SDGs – Sustainable Development Goals (Oliveira and Neiman, 2020). Currently, in Brazil, according to Oliveira and Neiman (2020), four documents deal with the environmental issue in formal education curricula: the National Curriculum Parameters (PCN); the National Curriculum Guidelines (DCN); the National Curriculum Guidelines for Environmental Education (DCNEA) and the National Common Curriculum Base (BNCC); among other decrees, guidelines, and resolutions (Oliveira and Neiman, 2020).

In this sense, Marine and Coastal Environmental Education (EAMC) has the potential to be a field of experiences and experiences about the marine-oceanic system and, consequently, an important promoter of ocean literacy (Ghilardi-Lopes et. Al., 2019). However, according to Pazoto *et al*. (2022) EAMC is still poorly understood in the spheres of interdisciplinarity, transdisciplinarity, and transversality, resulting in an apparent low effectiveness of actions in school environments and curricula.

In relation to environmental education and climate change, it is noted that it is possible to add educational responses to the actions provided for in public policies, which must still be effectively implemented in Brazilian public management (Quintana and Kitzmann, 2020). In the study by Quintana and Kitzmann (2020) on public policies and educational processes related to climate change and coastal zones, the possibilities of mainstreaming environmental education were evaluated. Based on research in documentary references, made by the authors, the interactions between six public policies related to these themes were analyzed, covering a time scale of twenty years. It was identified that there are possibilities to add educational responses regarding Climate Change in the actions foreseen in public policies, which must still be effectively implemented in Brazilian public management.

Regarding formal education, the work of DeToni *et al.* (2023) aimed to understand how EAMC practices are developed in the final years of municipal schools in Florianópolis, Santa Catarina State, Brazil. According to the authors, the results of the research showed that the development of EAMC in the context of the schools of the Municipal Education Network of Florianópolis, through the view of the School Supervisors, is still timid, lacking a more effective support, not only from the structural and pedagogical point of view, but mainly in the strengthening of interdisciplinary and transdisciplinary pedagogical practices, which demands commitment and motivation from professionals who care about socio-environmental issues.

As a way to increase the effectiveness of environmental education, several projects, such as the one by Silva *et al.* (2024), proposes alternative teaching models. Thus, for example, the Ocean project (Silva *et al*., 2024), was proposed as a contribution to the construction of an environmentally conscious profile of students from the Florestan Fernandes Municipal Education Unit, in the port municipality of Santos (SP/Brazil). According to the authors, the product of the project revealed evolution and breadth of absorption of concepts and vocabularies, greater awareness and awareness of local and regional environmental issues, which drive the change in behavior and dissemination of acquired experiences.

Another work that aimed to reach a general audience was presented by Reis et al. (2020). In this work, the authors aimed to characterize the conditions of use and maintenance of the coastal zone of the Municipality of São Luís, and to evaluate the possible applications of Environmental Education as a tool for solving characterized problems. According to the authors, advertisements in the media, information boards, special Environmental Education programs on days with a greater flow of tourists, pamphlets, programs that generate sustainable alternatives for solid waste disposal for merchants, in addition to infrastructure maintenance projects and adequate conditions of use, are possibilities that can respond effectively in the maintenance of better conditions for the maintenance of the coastal zone and consequently, it will imply increasingly diversified uses in these areas.

The work of Martins de Sousa *et al.* (2023), also carried out with a general audience and aiming at general environmental education, aimed to propose environmental management measures based on the analysis of socio-environmental impacts in the district of Icaraí de Amontada, municipality of Amontada (CE), Brazil. The main actions proposed were: construction of the sewage collection network; provision of piped water; collection, treatment and proper disposal of solid waste; develop environmental education projects in

the district's schools; environmental inspection and monitoring, with concomitant implementation of the Orla Project, as a coastal management tool; and an environmental management program for monitoring and containment of coastal erosion.

Despite the advances, coastal environmental education faces several challenges according to Freire and Rodrigues (2020). The lack of resources and specialized training for educators, the need for greater integration between public policies and educational practices, and cultural and economic resistance are significant barriers to the effective implementation of environmental education programs. Among the current and remaining conceptual and methodological limits of Environmental Education Research in Brazil, with a focus on the training of teachers and environmental educators, discussed by Freire and Rodrigues (2020), the authors highlight: the persistence of the historical gap between theory and practice; the disarticulation of new theories in relation to the geo-epistemological contexts of the environmental field; the absence of North-South dialogues and the absence of epistemologies from the South.

SANITATION AND SDGS 6 AND 14

The searches carried out on the theme "Sanitation and SDGs 6 and 14", in the three databases, resulted in 36 articles, 3 books/book chapters and 8 theses, dissertations or monographs. This was the topic with the lowest number of recent articles and books found, suggesting that the topic is still in development. For the purpose of this text, the topics considered representative of the available bibliography are presented. Below are discussed four texts that cover, in a broad and elucidative way, the topic analyzed.

A review study, published by Leão and Souza (2020), deals with the New Legal Framework for Basic Sanitation Law 14.026/2020 (Brasil, 2020), encompassing aspects of the theme, focusing on SDG 6. Through the analysis of data from the years 2015 to 2020, from the global and national panorama of access to drinking water and sanitation, the authors conclude that the goals planned to be achieved by 2030 will hardly be met. In addition, according to the authors, the new national framework mentioned above emphasized the care of the population with drinking water and sewage treatment and less emphasis on sanitation. The new regulatory framework also expanded the attributions of ANA (National Water and Basic Sanitation Agency), which, until the new framework, was called the Federal Water Resources Regulatory Agency, which also makes the commitment to comply with this SDG 6 more challenging.

According to Guimarães and Ferreira (2020), SDG 6 is related, to some extent, to all the others, since water is essential for people's development and well-being. Guimarães

and Ferreira (2020) studied the conditions of socioeconomic and environmental vulnerability that characterize the occupations of the estuarine mangrove regions of the Macaé River (RJ) and the results showed that the reality of the environments studied goes against the United Nations 2030 Agenda, which aims to eradicate poverty; and access to drinking water and sanitation, with an urgent need for public policies that promote the well-being of estuarine environments, focused on access to water, protection of water resources and nature-based solutions.

The study by Santos *et al.* (2020) aimed to analyze the objectives of SDG 6 aimed at the municipality of Pombal, in the state of Paraíba. According to the authors, the results showed that in relation to goal 6.1 the municipality will possibly achieve it by 2030, in relation to goals 6.2 and 6.3 it is difficult for the municipality to achieve them, and it takes effort, commitment from the public authorities to achieve these goals. The authors emphasize that in order to achieve all the goals, more investment in these areas is needed and a relationship between the government, the private sector, non-governmental organizations and civil society. This reality is also shared with many municipalities in Brazil. These two examples of work suggest that meeting SDG 6, in the intended timeframe, will be a very difficult task in Brazil.

On the other hand, the study by Razera *et al.* (2024) evaluated the contribution of the Ilha do Cardoso State Park – Cananéia/SP, in the fulfillment of all 17 Sustainable Development Goals – SDGs. The results showed a contribution of 40.6% of the SDG targets, covering the three dimensions of sustainability: environmental, social and economic. In relation to SDG 6, the conservation unit met the established goals and played an active and essential role in ensuring access to drinking water for all residents of traditional communities. In addition, it successfully implemented a biological water treatment system in the Perequê Nucleus, providing not only drinking water, but quality water for human consumption. In relation to SDG 14, it was found that: (1) there were several initiatives by communities, research institutes and environmental monitors to collect garbage in the beach regions, which suggests a positive change in the behaviors of neighboring communities, indicating tangible progress in reducing marine pollution; (2) there were actions for the conservation of mangroves; (3) there were strategies for biodiversity conservation, including the marine environmental protection area; and (4) there was support for the availability of information and increased awareness of ocean health. These results highlight the Ilha do Cardoso State Park as an important actor in advancing global sustainability goals, integrating local communities, preserving biodiversity and helping to achieve the goals of the Sustainable Development Goals. In this case, in the

case of a conservation unit, it is noted that the fulfillment of SDGs 6 and 14, as well as others, is feasible and depends on small adjustments in public policies and education actions for them to be implemented.

CONCLUSION

Brazil has demonstrated a growing commitment to the protection and sustainable management of coastal zones, through updated policies and new projects. In this sense, the integration of management strategies and the active participation of all sectors of society are fundamental to ensure the health and sustainability of Brazilian coastal zones, according to case reports presented. However, to achieve the conservation and sustainable development goals, it is necessary to overcome current challenges and promote greater integration between public policies, science, and the community.

According to several authors, Brazilian coastal areas face multiple challenges, including disorderly urbanization, pollution, and climate change. To face these challenges, several changes in environmental policies have been proposed, at the different levels of government (between municipal and federal), involving the use of solid waste, recovery of degraded areas and policies for the protection and recovery of mangroves, among others. Several of these policies have been put into practice, which allows us to conclude that in the near future we will have a significant gain in environmental protection, despite the lack of resources that often prevents the full implementation of these policies.

Coastal environmental education in Brazil has advanced significantly with the implementation of educational programs in schools, community awareness initiatives and the growing use of digital technologies. However, challenges such as educator training, policy integration, and cultural resistance need to be addressed to ensure the effectiveness of these initiatives. With an integrated and collaborative approach, it is possible to promote greater awareness and participation in the conservation of Brazilian coastal zones.

The implementation of the Sustainable Development Goals, particularly SDGs 6 and 14 in Brazil, has advanced, with improvements in sanitation infrastructure, depollution projects and monitoring initiatives. However, challenges such as insufficient infrastructure, plastic and chemical pollution, and policy coordination still need to be addressed. With an integrated and collaborative approach, it is possible to promote the sustainability and health of Brazilian coastal zones.

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