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Environmental Management

The arrival of offshore wind farms on the coast of Rio Grande do Norte and potential socio-environmental conflicts

A chegada de parques eólicos *offshore* no litoral do Rio Grande do Norte e os potenciais conflitos socioambientais

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ABSTRACT

Offshore wind generation has aroused the interest of various sectors and entities in Brazil, mainly because of its high capacity to generate energy within the energy transition scenario. After IBAMA issued the Terms of Reference for the Environmental Impact Study, the number of registered projects increased significantly. Although there are no offshore wind farms installed in Brazil, onshore generation stands out, especially in the state of Rio Grande do Norte, whose region is characterized by high wind speeds. Despite the increase in energy generation associated with offshore wind farms, the arrival of new developments could trigger socio-environmental conflicts in the marine space already occupied by various activities. The main conflicts identified are dealt with in this paper, namely: limitation of areas for artisanal fishing, alteration of the natural landscape, damage to tourist and sporting activities, limitations on maritime travel and risks to biodiversity. The analysis of these potential conflicts indicates the need to implement Marine Spatial Planning (MSP) and increase investment in biodiversity studies in order to analyze the main environmental impacts of offshore wind farms within the Brazilian context.

Keywords: Offshore wind energy; Rio Grande do Norte; Socio-environmental conflicts

RESUMO

A geração eólica *offshore* despertou o interesse de diversos setores e entidades do Brasil, principalmente, pela sua alta capacidade de geração de energia dentro do cenário de transição energética. Após a emissão do Termo de Referência para elaboração do Estudo de Impacto Ambiental (EIA) pelo IBAMA, o número de empreendimentos cadastrados aumentou significativamente. Embora não existam parques eólicos *offshore* instalados no Brasil, a geração onshore se destaca, especialmente, o estado do Rio Grande do Norte cuja região é caracterizada pela alta magnitude dos ventos. Apesar do aumento

da geração de energia associado às eólicas *offshore*, a chegada de novos empreendimentos poderá desencadear conflitos socioambientais no espaço marinho já ocupado por diversas atividades. Os principais conflitos identificados são tratados no presente trabalho, a saber: limitação das áreas destinadas à pesca artesanal, alteração da paisagem natural, prejuízos às atividades turísticas e esportivas, limitações ao deslocamento marítimo e riscos à biodiversidade. A análise desses potenciais conflitos indica a necessidade de implementação do Planejamento Espacial Marinho (PEM) e o aumento dos investimentos em estudos sobre a biodiversidade a fim de analisar os principais impactos ambientais dos parques eólicos *offshore* dentro do contexto brasileiro.

Palavras-chave: Energia eólica *offshore*; Rio Grande do Norte; Conflitos socioambientais

1 INTRODUCTION

In 2023, 10.8 GW of new *offshore* wind generation capacity was added to the grid, bringing offshore wind capacity to 75.2 GW. This was a notable increase of 24% from the previous year, which made 2023 the second-largest year for new global *offshore* wind capacity. China leads the sector for the sixth year in a row, increasing its installed capacity to 38 GW (Global Wind Energy Council, 2024).

Europe also stands out in the *offshore* wind generation sector and, in 2023, reached a record 3.8 GW of new installed capacity, reaching a total of 34 GW, 43% of which comes from the United Kingdom and 23% from Germany (Global Wind Energy Council, 2024).

Although Brazil does not yet have *offshore* wind farms, the country stands out for its onshore generation. According to the Brazilian Wind Energy Association (2023), at the end of 2022, onshore wind energy in Brazil had 904 plants and 25.63 GW of installed wind power, which is an increase of 18.85% from the previous year.

The Northeast region of Brazil is particularly noteworthy as in 2022 it represented 90.3% of the country's total generation. Rio Grande do Norte was also prominent with one of the largest generations of the year, with 23.20 TWh (Brazilian Wind Energy Association, 2023).

As of 2020, entities such as the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA), the Energy Research Company (EPE) and the Ministry of Mines and Energy (MME) began an offshore wind generation movement.

IBAMA issued its Terms of Reference (TR) for the Environmental Impact Study (EIA) and, in the following years, there was a significant increase in the number of environmental licensing processes, with 14 in Rio Grande do Norte.

A large number of socioeconomic activities are being carried out in coastal and marine areas, and the installment of these new ventures could represent yet another negative effect on the marine environment and lead to socio-environmental conflicts.

1.1 Objective

The objective is to assess and discuss potential socio-environmental conflicts arising from the installment of *offshore* wind farms on the coast of Rio Grande do Norte.

2 METHODOLOGY

An exploratory survey was conducted on the main socioeconomic activities on the coast of Rio Grande do Norte, where plans to install *offshore* wind farms are underway. This survey is intended to assess and anticipate possible socio-environmental conflicts arising from the installment of this new activity in the marine environment.

3 RESULTS AND DISCUSSIONS

The regions with the strongest winds in Brazil are along the coasts of Sergipe, Alagoas, Rio Grande do Norte, Ceará, Rio Grande do Sul and Santa Catarina. It is estimated that, in the long term, the Exclusive Economic Zone (EEZ) has a potential of 1.78 TW, which means that the offshore wind potential of the Brazilian coast is greater than the onshore potential (Ortiz; Kampel, 2011).

Silva (2019) assessed Brazil's offshore wind potential and classified it into Theoretical *Offshore* Potential (1,687.6 GW), Technical Offshore Wind Potential (1,064.2 GW), and Environmental and Social *Offshore* Wind Potential (330.5 GW). These are considered the best areas for installing projects according to technical criteria and conflict reduction (Silva, 2019).

3.1 IBAMA Projects

Since IBAMA issued its TR and EIA for offshore wind farms, there has been a significant increase in the number of registered projects, which currently sits at 97.

According to data from IBAMA (2024), the Northeast region has 48 registered projects, which represents 109 GW of installed power. 14 of these projects are located on the coast of Rio Grande do Norte, which account for a total of 25,468 MW of installed power over an area of 6,813 km^2, which results in an average power per projected area of 3.74 MW/km2. It should be noted that 47% of the project area in Rio Grande do Norte overlaps an area of 3,116 km^2.

3.2 Main socioeconomic activities on the coast of Rio Grande do Norte

3.2.1 Fishing

Rio Grande do Norte develops industrial and small-scale fishing. Carvalho (2016) explains that industrial fishing is concentrated mainly in the city of Natal and uses large storage vessels that can travel longer distances.

According to Carvalho (2016), small-scale fishing is the most traditional type of fishing in the state and is primarily a family-run activity. It provides food security for the local population and is the source of income for many families. According to Carvalho (2016), there are 22 municipalities in Rio Grande do Norte with small-scale fishing and landing points that presented statistical data between 2000 and 2014. The municipalities of Natal, Macau, Caiçara do Norte, Rio do Fogo, Touros and Porto do Mangue account for an average of 89% of small-scale fishing in the state.

3.2.2 Port Activities

Rio Grande do Norte has three seaports: the Port of Natal, the Port of Areia Branca and the Port of Guamaré. The Port of Natal is used for transporting goods and cabotaged freight containers (Federation of Industries, Rio Grande do Norte, 2024).

The Port of Areia Branca is an *offshore* port that handles sea salt, which corresponds to 95% of national production and has the capacity to handle 3.4 million tons of salt per year (Federação das Indústrias do Rio Grande do Norte, 2024).

Lastly, the Port of Guamaré handles oils from maritime and land fields in the state (Transpetro, 2022). It is used for loading and unloading cargo from the Clara Camarão refinery (Federation of Industries of Rio Grande do Norte, 2024).

3.2.3 Salt Production

According to Costa et al. (2013), small-scale salt production is currently limited to a few locations in the state with smaller salt mines, where shovels and wheelbarrows are still used for the mining activities in the municipalities of Grossos, Mossoró, Areia Branca and Guamaré. It is worth noting that, in addition to its relevance to the local economy, small-scale salt production is a historical, natural and architectural heritage.

In addition to small-scale salt production, there is the Areia Branca *Offshore* Salt Terminal (island port) which is located 26 km from the city of Areia Branca. It is an artificial structure in the open sea situated 14 km from the coast (Secretary Of Ports of The Presidency of The Republic, 2015). Although there is no traffic route for fishing vessels near the Salt Terminal, there are a number of vessels in the area used for transporting salt (Rio Grande do Norte Dock Company, 2009).

3.2.4 Petroleum and Gas

According to data from the National Petroleum Agency (ANP, 2024), the state of Rio Grande do Norte has 14 oil and natural gas fields closely located to *offshore* wind farms, as shown in Table 1.

Petrobras has been operating in the Potiguar Basin for over 40 years, performing oil and natural gas exploration and production activities when there was no environmental licensing process. These activities were later regularized in accordance with current environmental legislation (Petrobras, 2018).

Table 1 – Oil and natural gas fields located near offshore wind farm projects

N°	Field Name	Discovery Date	Starting Date	Main Liquid
01	Dentão	31/07/1987	09/08/2022	Oil
02	Pescada	24/10/1980	01/05/1999	Gas
03	Arabaiana	29/11/1986	06/08/2002	Oil
04	Salema Branca	18/03/2003	-	Oil
05	Guajá	13/10/2000	-	Gas
06	Biquara	12/05/1992	23/07/2008	Gas
07	Oeste de Ubarana	23/03/1985	16/03/2007	Gas
08	Ubarana	14/11/1973	30/06/2007	Oil
09	Cioba	03/01/1982	16/03/2007	Oil
10	Agulha	09/06/1975	30/09/1979	Oil
11	Siri	21/09/1997	-	Oil
12	Salina Cristal	24/08/1982	31/07/1987	Oil
13	Pitiguari	01/10/2004	07/07/2009	Gas
14	Macau	16/08/1982	31/08/1982	Oil

Source: ANP, 2024

In 2017, the average daily production for the 28 oil platforms in the Potiguar Basin and Ceará was approximately 1,166 m^3/day of natural gas, which corresponds to 0.27% of the country's production (Petrobras, 2018).

3.2.5 Tourism

There are two areas that attract tourism in the state: the Coastal Dunes and the White Coast. The Coastal Dunes were established by Decree No. 18,186, of

April 14, 2005 and spread across the municipalities of Pedra Grande, São Miguel do Gostoso, Touros, Rio do Fogo, Maxaranguape, Ceará-Mirim, Extremoz, Natal, Senador Georgino Avelino, Tibau do Sul, Baía Formosa, Canguaretama, Arês, Nísia Floresta, Parnamirim and São Gonçalo do Amarante.

According to the Integrated Sustainable Tourism Development Plan – PDTIS (Rio Grande do Norte, 2011), the Hub is made up of 451 tourist attractions, with emphasis on the natural attractions in the municipality of São Miguel do Gostoso. According to Almada (2023), the center of São Miguel do Gostoso has a medium dependence relationship with the center of the network as it is home to two tourist profiles: people who have already visited Rio Grande do Norte and want to further explore the area and people who go to practice extreme sports such as *kitesurfing*.

Pereira and Dantas (2019) *apud* Almada (2023) highlight that São Miguel do Gostoso is one of the 21 municipalities in the Northeast that registers the highest number of *kitesurfers*. Sales (2016) explains that adventure tourism has helped the municipality develop by attracting tourists with high purchasing power.

The White Coast was created by Decree No. 18,187, of April 14, 2005, and spreads across the following municipalities: Apodi, Areia Branca, Assú, Caiçara do Norte, Galinhos, Grossos, Guamaré, Itajá, Macau, Mossoró, Porto do Mangue, São Bento do Norte, São Rafael, Tibau, Carnaubás, Pendências, and Serra do Mel. According to the Integrated Sustainable Tourism Development Plan - PDTIS (Rio Grande do Norte, 2011), this Hub has 340 tourist elements.

According to a study carried out by AECOM (2010), the municipalities of Caiçara do Norte and Galinhos are also hotbeds for *kitesurfing*.

3.2.6 Conservation Units (CUs)

Regarding the location of offshore wind farm projects, the following Conservation Units stand out: Rosado Dunes Environmental Protection Area, the Ponta do Tubarão

State Sustainable Development Reserve (SDR), and Coral Reefs Environmental Protection Area.

The Rosado Dunes Environmental Protection Area (RDEPA) was created by Decree No. 27,695, of February 21, 2018, and covers an area of approximately 16 thousand hectares, located in the municipalities of Porto Mangue and Areia Branca. It does not yet have a Management Plan or a Management Council (Rio Grande do Norte, 2024).

The Ponta do Tubarão State Sustainable Development Reserve (PTSSDR) was created by Law No. 8,349, of July 18, 2003, in the region of Diogo Lopes and Barreiras, in the municipalities of Macau and Guamaré (Rio Grande do Norte, 2024). According to the Management Plan of the Ponta do Tubarão State RDS (IDEMA, Funcitern, 2018), this CU was created as a result of the demands from the traditional populations who depend on small-scale fishing and felt threatened by the arrival of entrepreneurs interested in building tourist developments.

The Coral Reef Environmental Protection Area (CREPA), created by Decree No. 15,746, June 6, 2001, aims to protect the marine environment in the municipalities of Maxaranguape, Rio do Fogo, and Touros. The natural beauty and biological diversity of the CREPA attracts a large number of tourists who visit the coral reefs (parranchos) (Rio Grande do Norte, 2024).

3.2.7 Key Biodiversity Areas

Ordinance No. 463, of December 18, 2018, establishes key areas for the Conservation, Sustainable Use, and Benefit Sharing for Biodiversity or Key Biodiversity Areas in Brazil. According to Article 2 of said Ordinance, the areas are classified according to levels of biological importance (extremely high, very high, high, not yet known) and levels of priority (extremely high, very high and high).

According to the Key Areas for the Conservation, Sustainable Use and Benefit Sharing of Brazilian Biodiversity 2nd Edition (MMA, 2023), the Key Areas for Biodiversity

in the Coastal and Marine Environment occupy 25% of the total area of coastal zone, territorial waters, exclusive economic zone, and the extended continental shelf, as shown in Table 2 below.

Table 2 – Total area (ha) and percentage of total area occupied by Key Areas (KA) in each region of the country

Territorial Zone	Total Area (ha)	Key Areas (ha)	% of Protected Area
Coastal Zone	41,853,807	3,805,080	9%
Territorial Waters	25,128,034	15,855,238	63%
Exclusive Economic Zone	338,367,285	102,893,379	30%
Extended Continental Shelf	96,296,586	4,140,496	4%
Total	501,645,712	126,694,193	25%

Source: MMA, 2023

The coastal and marine zone of Rio Grande do Norte has areas of high, very high, and extremely high biological importance. In view of this, the main characteristics of turtles, sea cows, cetaceans, birdlife, bats, and coral reefs in Rio Grande do Norte are presented below.

3.2.7.1 Turtles

According to the Marine Turtle Licensing Guide – Guidelines for Assessing and Mitigating the Impacts of Coastal and Marine Projects (Instituto Chico Mendes de Conservação da Biodiversidade, 2017), the key areas of marine turtle reproduction include part of the coast of Rio Grande do Norte and the ocean islands of Atol das Rocas. The *E. imbricata* (hawksbill sea turtle) and *C. caretta* (loggerhead sea turtle) species are mainly found on the beaches of Rio Grande do Norte, while *C. mydas* (green sea turtle) nests can be found on the Atol das Rocas islands.

CONAMA Resolution No. 10/1996 establishes that environmental licensing on nesting beaches can only be issued after IBAMA has assessed and permitted such activity, in conjunction with the Sea Turtle Center (TAMAR). This same resolution also defines the areas that must be assessed (which include the state of Rio Grande do Norte) along the expanse of Pipa beach.

IBAMA/ICMBio Normative Instruction No. 1/2011 establishes that area 4 extends from Anaú in the municipality of Pitimbú/PB to Ponta Negra in the municipality of Natal/RN. The restriction period for oil and gas exploration and production activities extends from December 1st to May 31st.

It is worth noting that the Terms of Reference for Environmental Impact Study (EIS) and Environmental Impact Report (EIR) for *Offshore* Wind Complexes (IBAMA, 2020) require that this restriction must be taken into account when assessing alternative locations.

3.2.7.2 Sea Cows

Souza (2018) *apud* Attademo et al. (2021) explains that the increased number of human activities (port activities, oil and gas, shrimp farming, real estate development, and habitat loss) have had a large impact on the manatee population in the state, and this impact has been growing steadily.

According to Attademo et al. (2021), the Beach Monitoring Project (BMP) in the Potiguar Basin, created in 2009, is a federal environmental licensing condition required by IBAMA for oil and gas activities. This project is carried out by the Federal University of Rio Grande do Norte (UERN) and supported by the White Beach Cetaceans Project (PCCB).

The Joint Normative Instruction IBAMA/ICMBio No. 2/2011 establishes that the entire coast of Rio Grande do Norte is a restricted area, up to the 12-meter isobath. Attademo et al. (2021) mention that the state is an important conservation area for the marine sea cow population due to the presence of mothers and calves. It is also

important for connecting this population in the extreme south with the population in the north of Brazil, in addition to the large number of stranded calves.

3.2.7.3 Cetaceans

According to an analysis conducted by Lima et al. (2021), during a ten-year period in the northern coast (January/2010 to December/2019) and a five-year period in the eastern coast (January/2015 to December/2019), a single species of the parvorder Mysticeti was recorded and 16 species of the parvorder Odontoceti were recorded.

According to Lima et al. (2021), the municipalities with the highest number of these records were Areia Branca and Porto Mangue. Stranded cetaceans were found to occur most between the months of September and January, mostly due to entanglement in fishing gear.

It is worth noting that the cause of these cetacean strandings, identified in a study by Lima et. al (2021), coincides with a study conducted by Attadcmo (2007), which shows records of marine life entangled in fishing gear and nets, thus destroying the local fauna.

Lima et. al (2021) explains that strandings can also occur when marine life collides with vessel propellers and seismic activities. He also comments on the impacts that heavy fuel and oil vessel traffic cause.

3.2.7.4 Birdlife

Silveira (2019) conducted a study on the diversity, spatial distribution and temporal variation of seabirds in the Potiguar Basin based on records collected by the White Coast Cetaceans Project, between 2010 and 2018, which indicated a diverse range of seabird occurrences throughout the year, with 21 families and at least 55 species, with at least 29 species confirmed. It is noteworthy that 400 records were obtained over the nine-year analysis period.

According to Silveira (2019), the species with the highest number of records were the Roseate Tern (*Sterna dougallii*), the Northern Tern (*Sterna hirundo*), the Grey-headed Gull (*Chroicocephalus cirrocephalus*) and the Great Egret (*Ardea alba*), which have a conservation status of least concern. Nevertheless, there is a high number of species and also a growing number of onshore wind farms that make birdlife conservation measures necessary.

The Report on Concentration Areas of Migratory Birds in Brazil (CEMAVE, ICMBio, 2022) and its article Concentration Areas of Migratory Birds in Brazil by Santos et al. (2022) explain that there are two aggregation areas of migratory birds in Rio Grande do Norte, the mouth of the Apodi-Mossoró river and the Areia Branca salt flats, and the Coastal Complex of the Potiguar Basin.

3.2.7.5 Bats

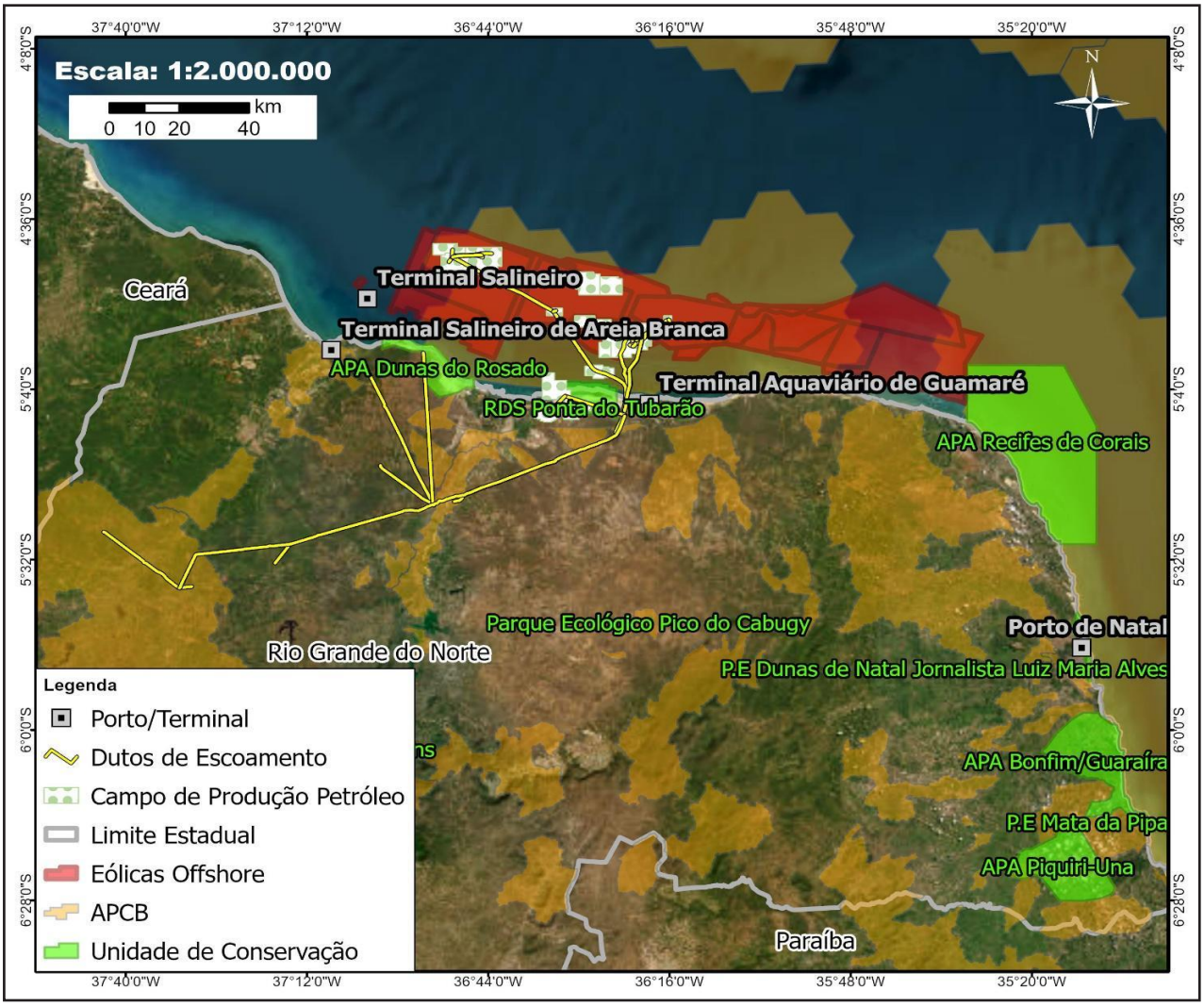
According to the Report on Concentration Areas of Migratory Birds in Brazil (CEMAVE, ICMBio, 2022) and its article Bats and wind turbines: modeling of species richness and current collision risk in Brazil, the authors explain that Rio Grande do Norte is the second state with the highest total number of wind turbines (4,693) and, in relation to the total rotor area, this corresponds to 61,088,354 m2 (Bernard; Santos, 2022). The rotor area in Rio Grande do Norte corresponds to a wall that measures 610 km long and 100 meters high, which shows how obstructed the airspace is and how challenging circulation is for bats since the wind turbines used in the marine environment are tall and have large blades, which results in a much larger rotor area (Bernard; Santos, 2022).

3.2.7.6 Coral Reefs

According to the Atlas of Coral Reefs in Brazilian Conservation Units (Prates, 2006), the State APA of Coral Reefs is characterized by its warm, shallow waters, which are clean for most of the year and are subjected to growing use. They are formed by

the lowlands of Maracajaú, Rio do Fogo, Cioba and Cação, by submerged channels, and by other structures that need to be studied (Prates, 2006).

Figure 1 – Environmental interference in offshore wind farm project areas along the coast of Rio Grande do Norte



Source: Author.

According to Santos et al. (2006), the features that prevail on the inner platform of Touros are the reefs of Sioba, Cação, Rio do Fogo and Maracajau, which consist of a reef complex. Coral reefs are located at depths of less than 10 meters, at a distance of

5 to 7 km from the coast, parallel to the coastline. They are slightly exposed during low tide, have an extension of 8 to 12 km, and come in two forms: knolls and patch reefs.

According to Santos et al. (2006), there is also a strip of sandstone banks at a depth of approximately 25m on the edge of the inner platform formed mainly by quartz with carbonate cement. The Conceição, Minhoto and Tubarão banks, which are formed by inorganic carbonate structures and few coral reefs, were mapped on the northern coast, between São Bento do Norte and Macau. These structures are parallel to the coastline, located between 20 and 30 meters deep, about 20 km from the coast, and are slightly submerged during low tide.

Figure 1 shows the location of offshore wind farm projects along the coast of Rio Grande do Norte and lists the main environmental interferences.

3.3 Possible impacts and conflicts

Given the current scenario and existing conflicts in the region, new conflicts and concerns raised in the local population are foreseeable.

According to Sátiro (2023), the population expressed its concern over the installation of offshore wind farms and the impacts it has on fishing. Sátiro (2023) created the Social Cartography of the Sea, an instrument for the community of small-scale fishing in the Galinhos territory which identifies threatening economic activities, offshore wind generation being one.

In a lecture on the Impacts of Offshore Wind Energy on Small-Scale Fishing, Xavier (2024) stated that there have been no fishing statistics in Brazil for almost 12 years, and added that there are already movements opposing the implementation of offshore wind farms in Ceará due to the losses it brings to small-scale fishing.

Xavier (2024) went on to explain that many fishermen use a “zig-zag” technique while fishing, a movement they perform in their sailing ships. The installation of wind turbines represent an obstacle to this as there are no planned exclusion zones around the wind turbines.

A Complementary Study (RAS) on the Areia Branca Salt Terminal (Companhia Docas do Rio Grande do Norte, 2009) reports that, although there are no traffic routes for fishing vessels in the vicinity of the Salt Terminal, there are many barges and ships transporting salt that come in and out. Fishing activity is prohibited in the vicinity of the Salt Terminal, so it is carried out in the surrounding area, 2 km from the Terminal and the Mar de Touros, at a minimum distance of 8 km from the coast and reaching up to 38 km out to sea (Companhia Docas do Rio Grande do Norte, 2009).

In addition to the existing oil and gas fields, there are also exploratory blocks that consist of areas selected and demarcated by the energy sector authorities to be prospected for accumulations and subsequently explored for the production of oil and gas (Couto, 2024).

The natural beauty of the area and extreme sports are what drive tourism in Rio Grande do Norte and thus make assessing the environmental impact of offshore wind farms on the natural landscape important and rational.

A study conducted in Ireland showed that 49% of respondents were interested in visiting the farms, however 35% said they did not notice them. Regarding the impact caused to the beach, 17% of respondents considered the farms to be environmentally unfriendly, but 50% thought there was no harm (Cronin; Cummins; Wolsztynski, 2021).

With regards to biodiversity preservation, Rio Grande do Norte has areas of extremely high, very high and high biological importance. Furthermore, it has a great wealth of species such as turtles, cetaceans, sea cows, birds and bats, which are already focal points of projects developed by the State University of Rio Grande do Norte (UERN).

The Report on Concentration Areas of Migratory Birds in Brazil (CEMAVE, ICMBio, 2022) and its article *Offshore* wind farms in Brazil lists the impacts on coastal birds and seabirds. Potential impacts, recommendations for licensing and implications for the conservation of seabirds and coastal birds, Bugoni et al. (2022) explains that the rapid development of global *offshore* wind energy and discussions on this topic

in Brazil have generated a high number of demands, which poses a great challenge due to the urgency and environmental heterogeneity, not to mention the seabirds in Brazil. Furthermore, it adds that large-scale mapping of seabird sensitivity to offshore projects is difficult, and goes beyond environmental licensing, suggesting that this kind of mapping be conducted within the scope of Marine Spatial Planning (MSP).

4 FINAL CONSIDERATIONS

After assessing the main socioeconomic activities developed along the coast of Rio Grande do Norte and the characteristics of the local biodiversity, it is clear that there is still much to be debated, detailed and established in order that *offshore* wind farm installations do not pose yet another threat to the territory and marine environment, and thus guarantee the sustainable development of the region.

Although there are extensive discussions about offshore wind generation in Brazil, there are still obstacles that need to be overcome such as the implementation of Marine Spatial Planning (MSP) to guarantee effective mapping of existing economic activities, and also to guarantee that studies be conducted on Brazilian biodiversity.

What we already know about the environmental impacts of the implementation and operation of offshore wind farms comes mainly from the experiences of leading European countries in this sector. However, it is important and necessary to point out that these countries have different environmental and biodiversity characteristics than those in Brazil. This means knowledge about Brazilian biodiversity must be enhanced and improved, with the aim of "tropicalizing" known environmental impacts and evaluating them within the Brazilian scenario.

Furthermore, investment in renewable energy sources for a more sustainable economy, such as the implementation of offshore wind farms, must also be socially referenced and fair in order to minimize the impacts they have on traditional communities whose lives and identities have depended on the sea for many generations.

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