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18

BIODIVERSITY ACTION PLAN

5 YEARS

20
22

A young sea turtle is crawling on a sandy beach. The turtle is dark and wet, with its shell and flippers visible. In the background, there are waves crashing onto the shore under a clear blue sky. A large green graphic overlay is positioned on the right side of the image, containing the title and subtitle text.

AVOID, MINIMIZE, MITIGATE AND OFFSET IMPACTS:

five years of the GNA
Biodiversity Action Plan

2018 - 2022

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01. INTRODUCTION

Presentation

This material represents the consolidation of the first five years of implementing the GNA's Biodiversity Action Plan (BAP). It describes the mitigation, conservation and compensation measures for terrestrial (*restinga*), freshwater (lagoons) and coastal (marine) ecosystems carried out between 2018 and 2022 by GNA, associated with the projects involved in the implementation of a natural gas thermoelectric park in the Port of Açu in the state of Rio de Janeiro, Brazil.

01. INTRODUCTION

GNA

GNA is a private power generation company resulting from a joint venture formed by leading companies in their areas of business: bp, Siemens Energy, Siemens AG, Spic Brasil and Prumo Logística. With a view towards developing structured, sustainable and efficient energy and gas facilities, **GNA owns the largest Natural Gas Thermolectric Park in Latin America.**

Photo: GNA Collection.



01. INTRODUCTION

Natural Gas Thermoelectric Park

Located in the Port of Açu in the Northern region of the state of Rio de Janeiro, GNA's Natural Gas Thermoelectric Park plays a strategic role in the security of energy supply and the diversification of the Brazilian energy matrix. The development involves investments of roughly R\$12 billion and involves two thermoelectric plants (TPP GNA I and GNA II); a Liquefied Natural Gas Regasification Terminal (LNG Terminal – LNGT) and two transmission lines (TL 345 kV Açu-Campos and TL 500 kV Açu-Campos 2).

Jointly, the TPP GNA I and TPP GNA II will reach approximately 3 GW of installed capacity, which is enough energy to serve around 14 million homes, equivalent to the demands of the states of Rio de Janeiro, Minas Gerais and Espírito Santo combined.



**TPP
GNA I**

1,338 MW



**Transmission
Line**

345 kV
connected to
the National
Interconnected
System (SIN)



**LNG
Terminal
(LNGT)**

21 MM m³
of natural gas
per day



**TPP
GNA II**

1,672 MW



**Transmission
Line**

500 kV
connected to
SIN

Photo: GNA Collection.



TPP GNA I

A Gas-fired Thermoelectric Power Plant with an installed capacity of 1,338.3 MW, TPP GNA I had its Installation License (IL) issued by the State Environmental Institute of Rio de Janeiro (INEA/RJ) in March 2018, the same month as the start of construction, carried out by the Açú Thermal Consortium, made up of Andrade Gutierrez and Siemens. In September 2020, authorization was received from INEA/RJ to carry out pre-operational activities and its Operating License (OL) was issued in December.

The first TPP GNA I distribution of electrical power took place in September 2021 with activation requested by the National Electric System Operator (ONS) to cover the demand by the National Interconnected System (SIN, in Portuguese) due to the critical downturn in the reservoirs of Brazilian hydroelectric plants, a direct result of the lowest rainfall seen in the last 91 years during the rainy season (October 2020 to April 2021). Since February 2022, after hydroelectric reservoir levels returned to normal, the ONS determined the shutdown of TPP GNA I, remaining hibernated throughout 2022.

LNG Terminal (LNGT)

Dock Terminal that has a Floating Storage and Regasification Unit (FSRU), FSRU BW Magna, with a capacity to run 21 million cubic meters/day of LNG (Liquefied Natural Gas).

The Installation License (IL) of the LNGT was issued by INEA/RJ in December 2018 and the company Acciona was responsible for the construction and commissioning activities. The Operating License (OL) was issued in May 2020 and its activities are conducted by the company called KN.

345 kV Transmission Line

At 52 km long, the 345 kV transmission line consists of a 55m wide easement and 124 towers that connect the TPP GNA I to an existing substation in the city of Campos dos Goytacazes, owned by Furnas, connecting the plant to the national grid and enabling the supply of electricity to the National Interconnected System (SIN).

The renewed Installation License (IL), after transfer of ownership from Porto do Açú Operações to GNA, was issued by INEA/RJ in November 2019. Construction and commissioning were completed by Alubar, and Engelmig took charge of its maintenance. The Operating License (OL) was issued in May 2020.

TPP GNA II

A gas-fired Thermoelectric Power Plant boasting an installed capacity of 1,672 MW. Its Installation License (IL) was issued by the State Environmental Institute of Rio de Janeiro (INEA/RJ) in January 2020. Construction began in October 2021 and is expected to wrap up in 2025. It is being carried out by the Açú Thermal Consortium, made up of Andrade Gutierrez and Siemens.

500 kV Açú-Campos 2 TL

At 37 km long, this 500 kV Transmission Line has an easement of 64m. It is under construction and will connect the TPP GNA II to the Campos 2 Substation, enabling the supply of power to the National Interconnected System (SIN). Its Installation License was issued by the State Environmental Institute of Rio de Janeiro (INEA/RJ) in November 2021. Construction began in December 2021 and is being carried out by Andrade Gutierrez, Railec and Cobra.



Aerial image of the Natural Gas Thermoelectric Park.
Photo: GNA Collection.

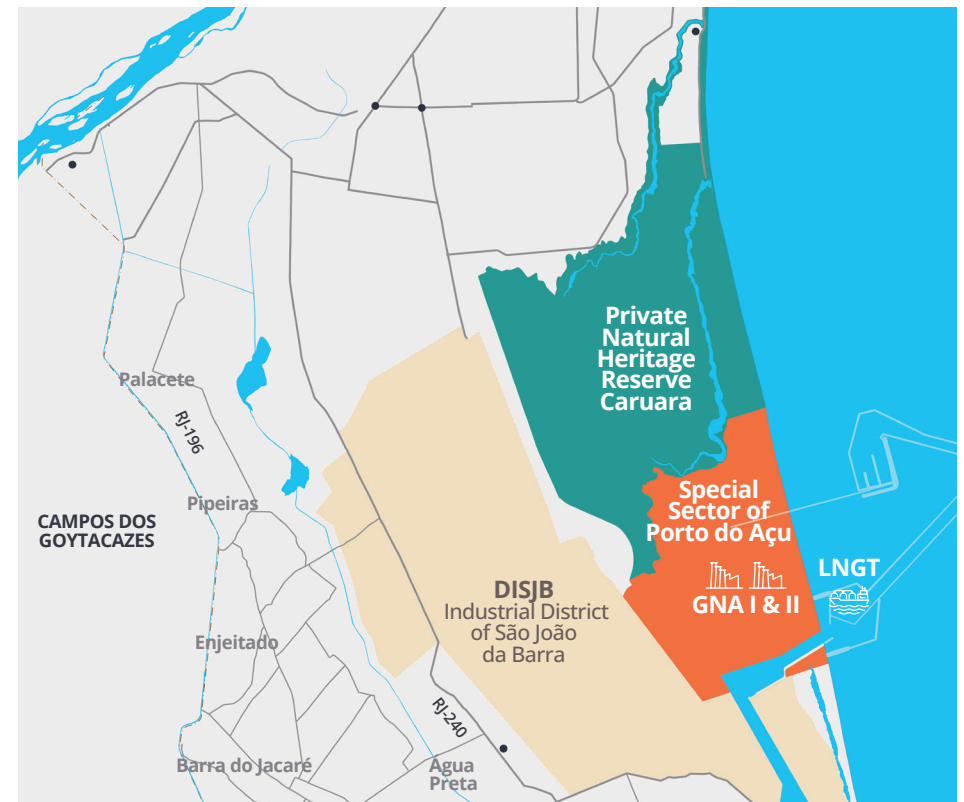
Where we are

The GNA Natural Gas Thermoelectric Park is located in the city of São João da Barra, in the Port of Açu, in the north of the state of Rio de Janeiro. Our area of influence also includes the city of Campos dos Goytacazes, located 50 km from our facilities.



In operation since 2014, the Port of Açu is the only fully private port in Brazil and the largest deepwater port-industry complex in Latin America. Managed by Porto do Açu Operações, a partnership between our shareholder Prumo Logística and the Port of Antwerp International, it is becoming the largest gas and energy hub in Brazil.

Totalling 130 km², the Port of Açu maintains an area of 40 km², the Caruara Private Natural Heritage Reserve (RPPN Caruara), which is the largest private conservation unit devoted to preserving the restinga ecosystem in Brazil.



02. THE BAP

GNA Biodiversity Action Plan

Our Biodiversity Action Plan (BAP) came out in 2018 as a response from GNA to the International Finance Corporation (IFC), who at the time were one of the lenders of our ventures. IFC requires the developments to which it allocates direct investments to comply with Performance Standards to manage risks and associated environmental and social impacts. These Performance Standards are divided into eight topics that need to be complied with over the duration of the investment, and Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources (PS6) is applied to developments located in modified natural and critical habitats, which potentially affect or depend on ecosystem services over which the funded development has direct management control (or significant influence) or include the production of living natural resources.



The Natural Gas Thermolectric Park fits the profile defined for the PS6 because it is located in a region initially occupied by sandbank vegetation. According to criterion IV of paragraph 16 of PS6 (IFC, 2012), the restinga (sandbank) is considered a critical habitat – a highly threatened ecosystem due to the high rates of deforestation and intense anthropization of the natural environments of the Atlantic Rain Forest.

The BAP was created to define and implement impact management measures on biodiversity to ensure that our facilities are installed and operated without causing a net loss in biodiversity (No Net Loss), in addition to seeking a positive net balance of biodiversity (Net Gain), as referred to in paragraph 10 of PS6. These measures are designed to achieve high sustainability performance and were the basis for drafting this Plan.

Produced in 2018, the BAP presents the mitigation of the impacts of GNA developments according to the mitigation hierarchy, to avoid, minimize, restore and offset impacts of the implementation of the TPP GNA I, LNG Terminal and 345 kV Transmission Line. The operationalization of these actions was structured in the Biodiversity Management Plan (BMP) and in the Biodiversity Monitoring and Evaluation Plan (BMEP), where 21 Mitigation Measures were defined*.

The BMEP details the mitigation measures proposed in the BAP to comply with the project's impact mitigation hierarchy. The following are specified for each measure: the base line values, evaluation indicators, related impacts, possibly affected biodiversity values, trends, expected results of these measurements, triggers for adaptive management and their respective documents and programs associated with each step. Altogether, the BMEP involves 26 indicators that are needed to verify the range of No Net Loss/Net Gain or to be used as supporting information.

In most cases, the monitoring done by GNA is the same as required by the environmental licensing process, and in some situations the monitoring takes place for a longer period than required by environmental regulations in order to comply with the requirements of the lenders. It is important to note that the monitoring of sea turtle spawning, which will be seen later, is not required by environmental regulators, and is an initiative voluntarily supported by GNA.

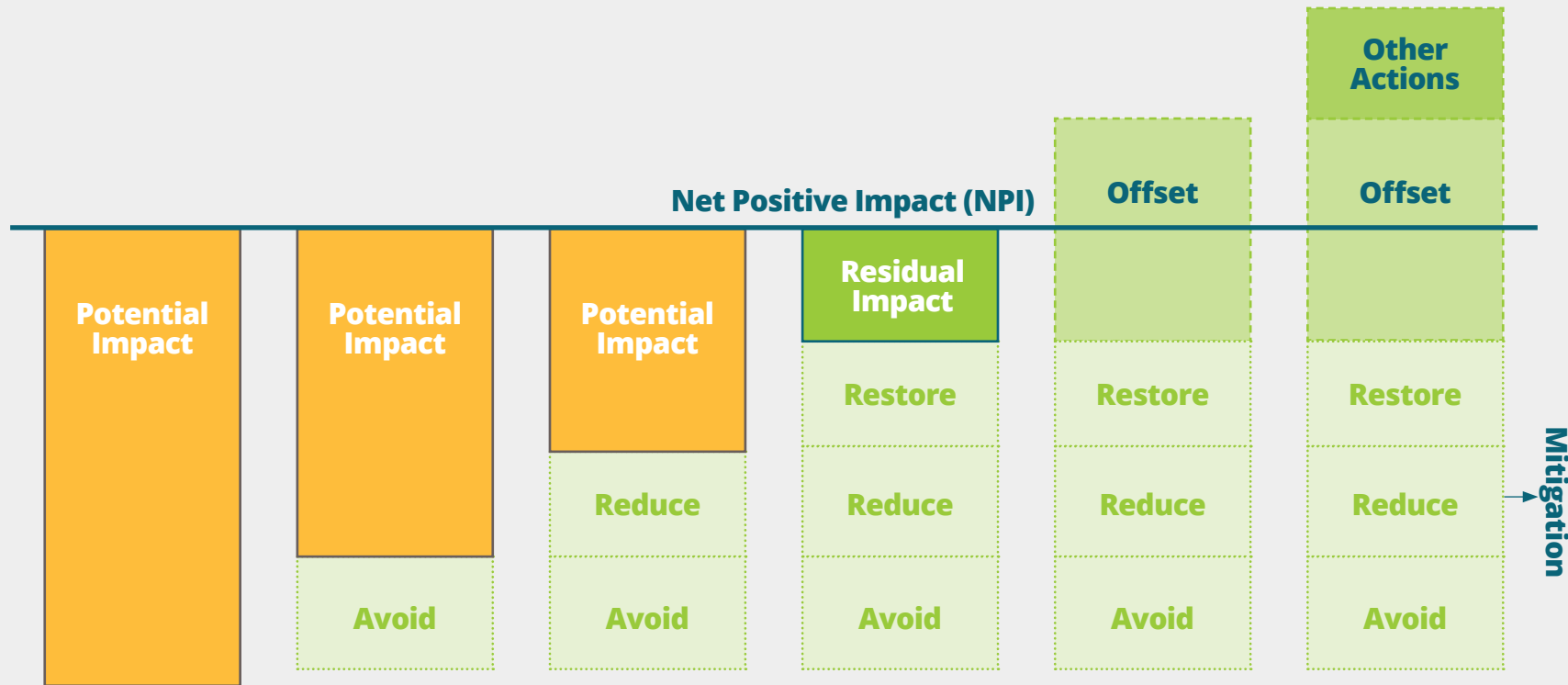
Annual reports tracking BAP's activities are produced to compile the results of various monitoring steps, show the status of each mitigation, and to measure, define and provide transparency on the 26 indicators tracked by BMEP.

* Revised in December 2022 and approved in January 2023, GNA's BAP was updated to include the GNA I (all in the operation phase) and GNA II (currently in the implementation phase) developments. It is important to emphasize that this material includes the actions carried out up to 2022, within the scope of GNA I.

Mitigation hierarchy scheme implemented by GNA



Biodiversity Value



Mitigation

03. BAP: COMMITMENTS

Environmental conservation: the 21 Mitigation Measures

The implementation status of the 21 Mitigation Measures established under the BAP reflect our commitment to environmental responsibility, which GNA sees as a cross-cutting and driving element in the company's strategic decision-making.

For each measure, this consolidated summary indicates: the impact to be mitigated, the indicator(s) of its implementation and desired result(s), and the current status, including respective evidence. It also states whether the measure has helped avoid a net loss of biodiversity or represents a net gain. Associated management and monitoring plans or documents are also listed.

The evidence presented is based on the data generated by the various monitoring programs, each following the best practices and adopting their own methodologies. Accordingly, the methodological criteria are not specified in this publication, but are detailed in the documentation for each program*.

Photo: GNA Collection.

* The documents are public and interested parties may have access upon a request to INEA.



ATLANTIC RAIN FOREST - RESTINGA (SANDBANK)

The *Restinga* Ecosystem is part of the Atlantic Rain Forest biome, recognized as the most threatened biodiversity hotspot in the world. Although they are mainly located in areas that have been anthropized for the production of sugar cane and livestock, the implementation of GNA developments required the suppression of vegetation with the potential for direct and indirect impacts on the sandbank habitat.

Some aspects were considered in order to evaluate these impacts and establish mitigation measures, including the Sandbank (*Restinga*) habitat, Critical Habitat (CH) trigger species and bird species associated with the Sandbank. Three possible impacts were identified, resulting in seven mitigation measures.

VEGETATION CLEARING	
• Installation of firebreaks;	16
• <i>Restinga</i> restoration at RPPN Caruara with minimal 1:1 proportion;	18
• Payment of monetary environmental compensation;	30
• Participation in the “Green Belt” program;	32
HABITAT LOSS	
• Relocation of fauna species to a suitable habitat;	34
• Sandbank habitat restoration.	37
BIRD MORTALITY ALONG TRANSMISSION LINES	
• Installation of bird anti-collision beacons.	39



Photo: Jéssica Neves.

IMPACT

VEGETATION CLEARING

Vegetation clearing, to implement GNA projects, could lead to a net loss of critical habitat. This is why compensation measures were mandated.

The total vegetation suppression allowed by the Vegetation Clearing Authorization (VCA) obtained for the first stage of our projects in the Port of Açú was 11.0085 ha. However, the suppression actually carried out was 10.78 ha. This total includes 9.50 ha to house the TPP GNA I, the LNG Terminal, the 345 kV T Line and the macro-drainage system (in this case, serving both the TPP GNA I and the TPP GNA II), plus 1.28 ha for the creation of a corridor that would run the length of the LNGT gas pipeline system to prevent the spread of possible forest fires*.

The reduction between what was authorized and what was done was due to a change in the layout of part of the transmission line related to the TPP GNA I, eliminating the need to suppress 0.07 ha of Restinga, and the fact that 0.16 ha of the area designated to be used for the firebreaks to control fires for the LNGT pipeline system was made up of soil/sand already exposed. It should also be noted that the effective suppression of native vegetation is even lower, considering that part of these suppressed areas had already been intensely anthropized and de-characterized as natural environments. As an example, 2.02 ha of the area earmarked for the LNGT were anthropized areas.

* The creation of this corridor was a recommendation resulting from an analysis carried out using the HAZOP methodology (Hazards and Operability Study).



Photo: Luana Mauad.



Mitigation Measure 1

INSTALLATION OF FIREBREAKS



Impact to be mitigated

Burning of vegetation due to the spread of fire in the event of fires along the roads surrounding the project. The lack of firebreaks can make it difficult to control any accidental fires, affecting the sandbank habitat around the GNA and the Caruara Private Natural Heritage Reserve (RPPN Caruara, its acronym in Portuguese from Reserva Particular do Patrimônio Particular Caruara).



Implementation indicator(s)

Firebreaks constructed. There are no limits or reference values applicable to this measure.



Desired outcome(s)

Firebreaks preventing flames from spreading in the event of fires. No adaptive management was required.



Current status and evidence

Measure fully complied with, in accordance with the guidelines of GNA's Environmental Works Management Program and Environmental Inspection Program.

The Firebreak Implementation and Maintenance Procedure, produced by GNA, establishes the criteria and assumptions used in order to implement and ensure the maintenance of firebreaks during all of the company's projects (implementation, operation, closure and post-closure). Inspections are routinely performed to assess the conditions of the firebreaks and the maintenance activities that are needed, such as the cleaning and removal of vegetation. As an additional precaution, we have stepped up efforts to educate staff members by running internal educational campaigns through announcements and lectures given by the GNA Fire Brigade on the causes of forest fires, as well as methods for prevention and combat.



Fire control firebreaks implemented in GNA I enterprises.
Source: GNA Collection.



No Net Loss/Net Gain

Not applicable. However, by establishing and maintaining firebreaks, it contributes to the “No Net Loss” of Biodiversity goal.



Associated management and monitoring plans or documents

- Forest Fire Prevention and Control Plan (Port of Açú);
- Implementation and Maintenance Plan for Fire Control Firebreaks (GNA);
- RPPN Caruara Management Plan.

Mitigation Measure 2

RECOMPOSITION AND CONSERVATION, IN THE RPPN CARUARA, OF NATIVE RESTINGA VEGETATION, AT A MINIMUM PROPORTION OF 1:1



Impact to be mitigated

Net loss of sandbank area, a critical habitat, due to the suppression of vegetation necessary for the installation of GNA developments. This measure was required by INEA/RJ and adopted in order to achieve a net gain in biodiversity. Restoration activities were focused on degraded areas of the RPPN Caruara, created by Port of Açú Operations and recognized as a sustainable use conservation unit by INEA/RJ in 2012.



Implementation indicator(s)

In addition to the “planted area” indicator (hectares planted at the RPPN Caruara), important indicators were included to check on the efficiency of the restoration, such as the richness of plant species, diversity and equitability indices, measurement of phytosociological parameters, fauna species using the area, written analysis (performed by a specialist) of the effectiveness and legal protection of the restoration area.



Desired outcome(s)

For each indicator, a result to be achieved has been determined:

1. Hectares planted at the RPPN Caruara, certified by regulatory agencies. There are no limits for this indicator and the desired result is to achieve an area greater than 11 hectares restored.
2. Planted species (by quantity, percentage of native species, average plant height and percentage of canopy cover). There are no limits for this indicator and the baseline is missing sandbank habitats, because the original sandbank was replaced by pasture area in the past. The desired outcome is to obtain a variety of more than 25 species, with more than 95% being native to the restinga habitat, and for the average height of the plants and the percentage of canopy to improve by the 10th year of restoration, confirmed by statistical analysis and aerial or satellite images.
3. Fauna species (number of mammals, birds and herpetofauna from the sandbank). The limit for the indicator is the previous results of fauna monitoring campaigns. The desired result is the normal occurrence, throughout the RPPN Caruara, of native species associated with the restinga, evaluated with statistical comparisons over time between the monitoring campaigns conducted.
4. Specialized written analysis on the effectiveness of restoration activities. The expected result is a written expert analysis confirming that the planted hectares are on the proper path towards restoration, supported by evidence of the composition and structure of the fauna and flora species. If the target areas are not able to satisfy the requirements for compensation, restoration techniques will have to be adapted.
5. Legal protection of the restoration area. The expected result is to ensure that the restoration takes place in a legally protected area, allowing conservation efforts for the restinga ecosystem to continue.



Current status and evidence

Results: Restoration of the Sandbank (*Restinga*)

A specific plan was produced to provide guidance on the restoration of the sandbank (The Restinga Recovery and Conservation Plan) including goals, a baseline, methodology, indicators, monitoring of progress and adaptive management. It is worth noting that the definition of restoration compensation requirements is different for each type of vegetation and is based on varied definitions of laws, while also depending on assessments by the relevant environmental agency. All compensation related to GNA's projects comply with the legal requirements.

Our sandbank restoration activities at the RPPN Caruara began in October 2019. Despite the minimum proportion recommended in the BMEP to offset vegetation suppression to be 1:1, we developed a restoration project focused on overcoming the total suppression. Additionally, in July 2022, when the planting had been completed, we had reached 57.72 ha in restoration process, which represents more than five times the area of 10.78 ha of suppressed vegetation. 37,32 seedlings were planted. Considering only the suppression of native vegetation, excluding areas that have already been anthropized, the recovery is almost 6.5 times the suppressed area. These areas will undergo a minimum period of four years of maintenance and annual monitoring until satisfactory results are obtained that prove the establishment of the planted seedlings and the certificate of release for the restoration obligations to be issued by the environmental agency.

The fact that the restored total is higher than the suppressed area contributes to a Net Gain of biodiversity and will probably also favor the connectivity of fragments of native vegetation. Some relevant evidence points to the positive effect that restinga restoration activities have now generated in the area. Some of the planted specimens are now flowering and bearing fruit. In addition, the attraction of fauna to the restoration area was further verified in 2022, proving that the planted specimens are establishing ecological interactions providing food and shelter for fauna species.

With 100% of the restinga restoration plantations implemented for GNA I projects, the result of this indicator was fully achieved. However, in order to be considered complete under environmental licensing, restoration projects require a certificate of release to be issued by the regulatory body following a minimum of four years of maintenance and monitoring, which is expected to take place as of 2024.

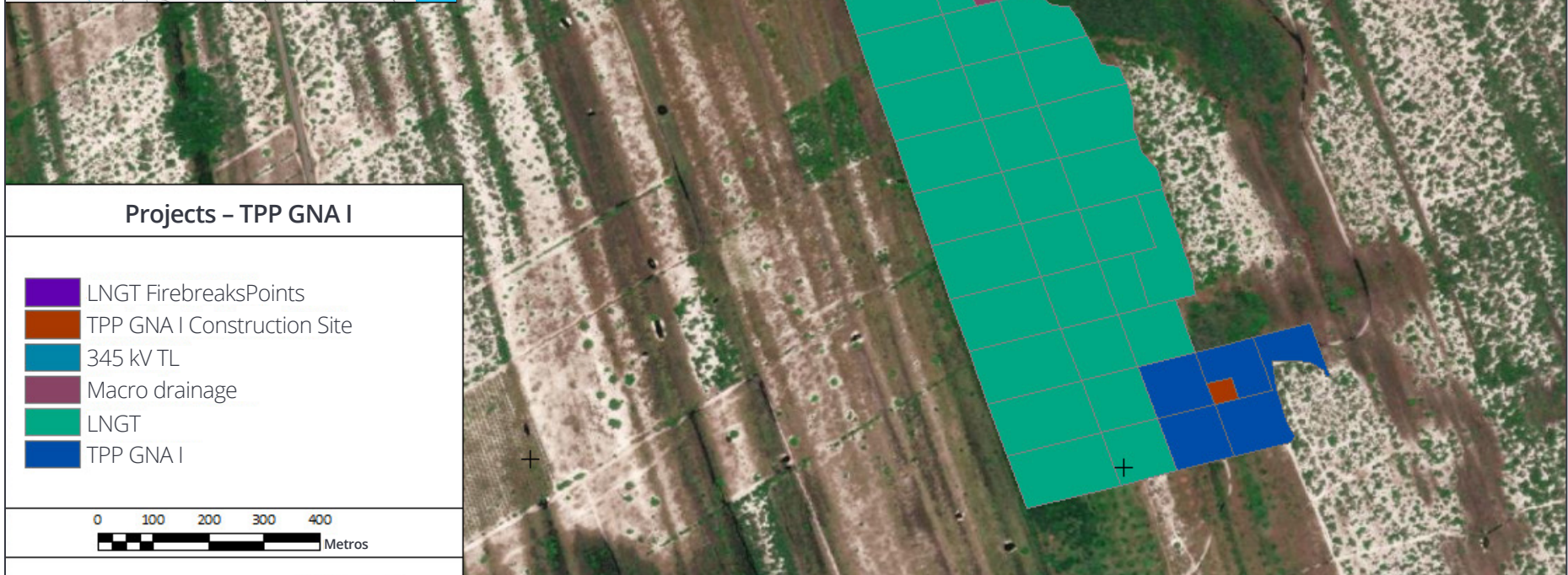
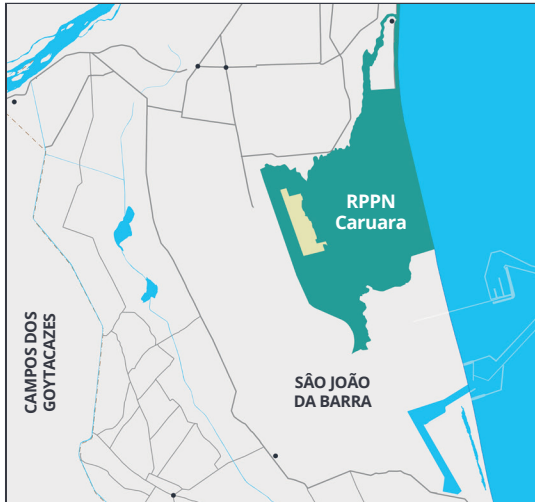


Ecosystem:
Atlantic Rain Forest - RestingaEcosystem:
FreshwaterEcosystem:
Coastal

Summary of GNA vegetation clearing and forest restoration activities by each component of the project

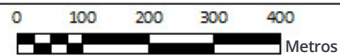
Project	Applicable Environmental Licenses	Vegetation Clearing Area (ha)	Compensation rates based on areas of native and unsuppressed vegetation	Area required for Restoration (ha)	Planting status
GNA TPP I	LI no. IN044379	1.14*	0.91 x 3 = 2.71 ha 0.03 x 2 = 0.07 ha	2.57	100% (4.47ha/4.47ha)
	LI no. IN046056	0.35	0.27 x 3 = 0.81 ha 0.08 x 2 = 0.16 ha	0.97	
	ASV no. 203339201904559	0.31	0.31 x 3 = 0.93 ha	0.93	
	Subtotal	1.80 (1.73*)		4.47	
Construction Site	LI no. IN047115	277 specimens	277 x 6 m ² = 0.17 ha	0.17	100% (0.17ha/0.17ha)
	Subtotal			0.17	
LNGT	LI no. IN047687	3.29	3.29 x 10 ha	32.90	100% (35.6ha/35.60ha)
	ASV no. 20339201906674	0.96	0.78 x 3 = 2.34 ha 0.18 x 2 = 0.36 ha	2.70	
	Subtotal	4.25		35.60	
	ASV no. 20339202015567	1.44*	0.94 x 3 = 2.8 ha 0.35 x 10 = 3.5 ha	6.30	
Subtotal	1.44 (1.28*)		6.30		
L-T 345 kV	LI no. IN019365	1.42		1.00	100% (9.92ha/9.92ha)
	ASV no. 20339201905965	2.10	1.31 x 5 = 6.55 ha 0.79 x 3 = 2.37 ha	8.92	
	Subtotal	3.52		9.92	
Macrodrainage	ASV no. 20339202005699	0.42	0.42 x 3 = 1.26 ha	1.26	100% (1.26ha/1.26ha)
	Subtotal	0.42		1.26	
Total		11.01 (10.78*)		57.72	100% (57.72ha/57.72ha)

* Area actually suppressed.



Projects - TPP GNA I

- LNGT FirebreaksPoints
- TPP GNA I Construction Site
- 345 kV TL
- Macro drainage
- LNGT
- TPP GNA I

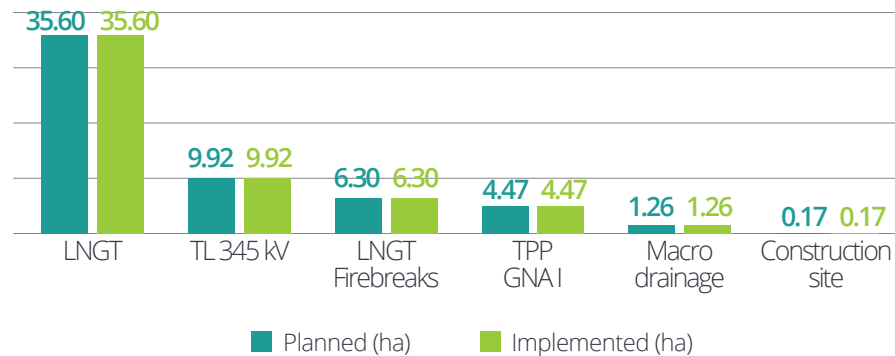


- Municipal Limits - IBGE, 2019
 - Image Basemap ESRI
 - Projection GCS WGS 1984



Schematic map of the projects area associated with each GNA's Vegetation Clearing License.
 Source: GNA Collection.

» Chart of GNA I's compensation areas (planned vs. implemented) for each project



Results: Diversity of plant species

Foram plantadas 79 espécies, sendo 100% nativas. Como forma de 79 species were planted, all being (100%) native. As a way to keep track, annual monitoring reports describe the activities conducted over the year, the performance levels and indicators of the restoration project (density, species diversity, average height, and others), as well as the difficulties encountered during the period and the actions planned for the coming year. The actions planned under annual monitoring involve traditional maintenance activities for forest restoration in degraded areas, including irrigation, weeding around seedlings, use of mulch, replanting (when and if needed), control of invasive exotic species, fencing and maintenance firebreaks to control fires. After two years of planting, the average height of the seedlings ranged from 0.58 to 0.67 m and the canopy cover ranged from 28.24% to 31.54%.



Results: Mapped fauna specimens

It is important to point out that the fauna results refer to the RPPN Caruara planting areas in general and not specifically to the GNA recovery compensation areas, since it was necessary to use areas with older plantations versus newly planted areas for more robust comparisons. Monitoring includes sampling points in reference areas and points in restoration areas. Fauna monitoring allows comparison between results to obtain complementary evidence of the progress of restinga restoration.

Statistical analyses are performed in order to offer useful and comparable results, such as species rarefaction curve and cluster analyses. In addition, ecological indices (diversity, equitability, dominance and diversity) are also the focus of the monitoring program.

Fauna species recorded by monitoring campaigns

Important: the indicators for this measure comprise only the sampling units in areas in the process of restoration (different planting ages). However, GNA performs other monitoring activities for terrestrial fauna in the vicinity of its developments and in conserved areas of the RPPN Caruara as a whole. The results are displayed in this table as a way of enriching the information in this document.

Fauna Group	Monitoring Campaign	Areas around GNA	RPPN Caruara	RPPN Caruara Restoration Area
Mammal species	August-September/2021	14 08 Terrestrial 06 Chiropterans*	24 12 Terrestrial 12 Chiropterans*	16 04 Terrestrial 12 Chiropterans*
	February 2022	15 07 Terrestrial 08 Chiropterans*	24 11 Terrestrial 13 Chiropterans*	15 06 Terrestrial 09 Chiropterans*
	August 2022	15 08 Terrestrial 07 Chiropterans*	26 13 Terrestrial 131 Chiropterans*	15 05 Terrestrial 10 Chiropterans*
Bird species	August-September/2021	64	101	63
	February 2022	69	83	60
	August 2022	76	93	65
Herpetofauna Species	August-September/2021	23	41	18
	February 2022	27	43	27
	August 2022	18	33	12

* As of the 2021 campaigns, as recommended, the methodology for chiropterans was adjusted with the inclusion of an ultrasound detector method.

» Herpetofauna

Areas of the RPPN Caruara: Over the last four monitoring campaigns, 1,269 specimens belonging to 59 distinct species of reptiles and amphibians were recorded. Among the species found, only one species is considered endangered (*Glaucomastix littoralis*), while the rest are common and widely distributed species.



Herpetofauna recorded during GNA's monitoring campaigns at RPPN Caruara.
Photo: Carlos Henrique Nogueira.

» Avianfauna

Areas of the RPPN Caruara: Over the last four monitoring campaigns, 131 species of birds distributed across 21 orders and 45 families were recorded, of which Passeriformes, with 46 species, and Charadriiformes, with 12 species, were the most representative. The Thraupidae (13 species) and Tyrannidae (12 species) families were the most representative.

Six species that are in at least one endangered category on the global, national and state red list were recorded: *Penelope superciliaris*, *Dendrocygna autumnalis*, *Himantopus melanurus*, *Himantopus mexicanus*, *Chroicocephalus cirrocephalus* and *Stilpnia peruviana*. Of the total, two species had exclusive records and were new to all the secondary sources analyzed: *Himantopus mexicanus* during the third campaign, and *Ramphastos toco* in the fourth campaign. In addition, two species are also endemic to the Atlantic Rain Forest: *Ramphocelus bresilia* and *Stilpnia peruviana*.



Avifauna recorded during GNA's monitoring campaigns at RPPN Caruara.
Photo: GNA Collection.

» Mammals

Areas of the RPPN Caruara: The compilation of two years (from the start of the operation) of monitoring in the RPPN Caruara resulted in the registration of 409 specimens, belonging to 17 different species of wild mammals. Two of them are threatened and endemic to the Atlantic Rain Forest (*Cerradomys goytaca* and *Bradypus crinitus*), while the rest are common and widely distributed species. The otter (*Lontra longicaudis*) should also be mentioned, because it is a species belonging to the “Near threatened” category on the red lists of threatened species.

Specifically on bats, using the bioacoustics method, 16 species were recorded, six species from the Vespertilionidae family (*Myotis nigricans*, *Myotis riparius*, *Eptesicus furinalis*, *Lasiurus blossevillii*, *Lasiurus ega* and *Lasiurus villosissimus*), seven species from the Molossidae family (*Molossus molossus*, *M. fluminensis* and another species referred to as *Molossus* sp., *Nyctinomops macrotis*, *Promops nasutus*, *Eumops perotis*, and another species referred to in our report as *Eumops* sp.), a species of the family Noctilionidae (*Nictilo leporinus*), and two representatives of the family Phyllostomidae (*Desmodus rotundus* and another that could not be identified beyond the family level, referred to in our report as *Phyllostomidae* sp.).



Mammals recorded during GNA's monitoring campaigns at RPPN Caruara and in the surroundings of GNA's enterprises.
Photos: GNA Collection and Daniel Almada.

Results:**Written expert analysis of the effectiveness of restoration efforts**

To be done 10 years following on from the completion of the plantings.

Results:**Legal protection of the restoration area**

RPPN Caruara continues to be legally protected as a Conservation Unit.

» Germplasm Rescue

During the vegetation clearing process, threatened flora species and species of conservation interest were rescued and transplanted to RPPN Caruara. A total of 1,224 specimens of 13 species were transplanted. The threatened species of restinga flora that were rescued include *Melanopsidium nigrum* – VU (Vulnerable), *Scutia arenicola* – EN (Endangered), *Erythroxylum ovalifolium* – VU and *Inga maritima* – EN.

The rescued specimens are planted in the restoration areas within the RPPN Caruara and monitored for a minimum period of two years or until proof of their proper establishment in the area. Monitoring campaigns carried out indicate considerable success in the transplantation of herbaceous species, mainly representatives of Bromeliaceae, Orchidaceae and Cactaceae, which achieved a range of 85 to 100% survival. For some shrub-tree species, survival rates have been around 30% and, as such, strategies are being designed to increase this survival rate. One of the examples is the development of the research project “Vegetative Propagation of *Melanopsidium nigrum* via induction of adventitious roots”, conducted in partnership with the Universidade Estadual do Norte Fluminense Darcy Ribeiro (UENF) to evaluate methods that increase the success of propagation. The initial results were published in a scientific journal in 2022 (M. DE MENEZES DE ASSIS GOMES et al., 2022).



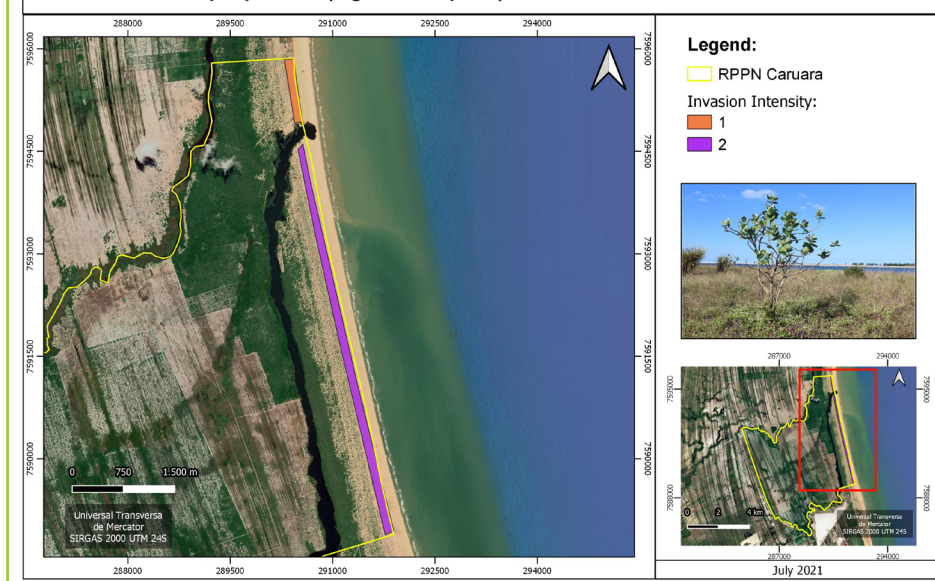
Vegetative propagation experiment carried out in partnership with UENF.

Photo: GNA Collection.

» Management of Exotic Species

To ensure the success of restoration measures, we developed maintenance activities in the planting areas. One of the key initiatives is the removal of invasive alien species that pose a threat to the development of the restinga. The identification and planning for removal of alien species is established in the Control Procedure for Invasive Exotic Species of Flora. To better understand and document the occurrence of exotic species, we analyzed, in conjunction with the RPPN Caruara team, the occurrence of 10 exotic species, drawing up maps according to their location and intensity of invasion in the RPPN Caruara.

***Calotropis procera* (algodão-da-praia) Recorded Area at RPPN Caruara**



***Acacia auriculiformis* (acácia) Recorded Area at RPPN Caruara**



Examples of identified invasive exotic species at RPPN Caruara.

Source: GNA Collection.



No Net Loss/Net Gain

The actions planned to prove the indicators defined to identify the “No Net Loss” and “Net Gain” criteria for biodiversity are still in underway. It is important to reinforce that any habitat restoration (especially restinga) requires medium/long term maintenance efforts until satisfactory levels of recovery and biomass are achieved. However, it can be pointed out that the measures to obtain Net Gain have been done properly. The evidence includes:

- The 57.72 ha of planted area, which far exceeds the amount of vegetation suppressed (10.78 ha)
- The development of plants, evidenced by flowering, fruiting and the occurrence of interactions between fauna species in areas under restoration
- Research to increase the survival rate of *M. nigrum*



Associated management and monitoring plans or documents

- Forest Restoration Projects for the GNA TPP I, Construction Sites, LNGT and 345 kV L-T
- The RPPN Caruara Management Plan
- Restinga Recovery and Conservation Plan
- Germplasm Rescue Program
- Procedure for Controlling Exotic and/or Invasive Species of Flora
- INEA Law (Resolution) No. 143 of June 14, 2017
- Fauna Monitoring Plan
- Executive Summary of the Restinga Restoration Workshop at the RPPN Caruara
- RPPN Caruara Fauna Monitoring Plan
- Biomass Enhancement Study



Mitigation Measure 3

PAYMENT OF MONETARY ENVIRONMENTAL COMPENSATION



Impact to be mitigated

Vegetation clearing. Federal Law No. 9.985/2000, which established the National System of Conservation Units (SNUC), establishes, in its article 36, the payment of monetary environmental compensation for the implementation of projects with significant environmental impact. SNUC is regulated by Decree No. 4.340/2002, State Law No. 6.572/2013 (amended by State Law No. 7.061/2015) and Joint Resolution SEA/INEA No. 638/2016. The legislation establishes that the Environmental Compensation Chamber (CCA) defines the allocation and supervises the correct application of the funds resulting from monetary environmental compensation.

To comply with this measure, three Environmental Compensation Commitment Terms (TCCA) were signed with INEA/RJ and SEAS/RJ, one for each licensing process: TCCA No. 03/2012, referring to the implementation of 345 kV TL; TCCA No. 01/2018, required by the installation license of the GNA TPP I; and TCCA No. 07/2018, required by the installation license of LNGT.



Implementation indicator(s)

Payments made totaling R\$ 31.8 million, whose Operational Manager is the Institute for Development and Management (IDG).*



Desired outcome(s)

Correct allocation and application of funds in protected regional areas. It should be noted that we formally expressed our desire for the financial support to be applied in areas that are directly and indirectly influenced by the projects, including suggesting the protection of freshwater bodies with similar ecological characteristics that exist in the region. It is important to emphasize, however, that this decision is up to the Environmental Compensation Chamber (CCA) and the State executes the projects approved by the CCA.



Current status and evidence

Measure fully complied with. Payments were made as agreed in the TCCAs.

* After 2022, the Fundação Assistencial e de Apoio à Biodiversidade São Francisco de Assis - FSFA became the Operational Manager.



No Net Loss/Net Gain

As the use of resources is not part of GNA's management, a summary of the expenses paid with funds derived from monetary environmental compensation payments has been requested. If presented, there will be enough information to conduct this verification.



Associated management and monitoring plans or documents

- Environmental Compensation Agreements
- Cooperation agreement between GNA and the Government of the State of Rio de Janeiro
- TCCA No. 03/2012 was signed to compensate for the impacts related to the implementation of the 345kV TL. Item 1.1 of the aforementioned TCCA set an amount of R\$ 568,308.57, specifically with regard to investing in environmental conservation units, corresponding to 0.56% of the value of the investment declared for implementing the project
- TCCA No. 01/2018 was created to establish environmental compensation relating to the implementation of the GNA TPP I. Item 2.1 of the TCCA determined a deposit of R\$ 28,736,387.54 (1.06% of the value total investment) into a bank account
- TCCA No. 07/2018 was signed with the objective of establishing environmental compensation due to the implementation of the LNGT. Item 2.1 of the TCCA ordered the deposit of R\$ 2,495,492.37 (0.88% of the total investment amount) into a bank account

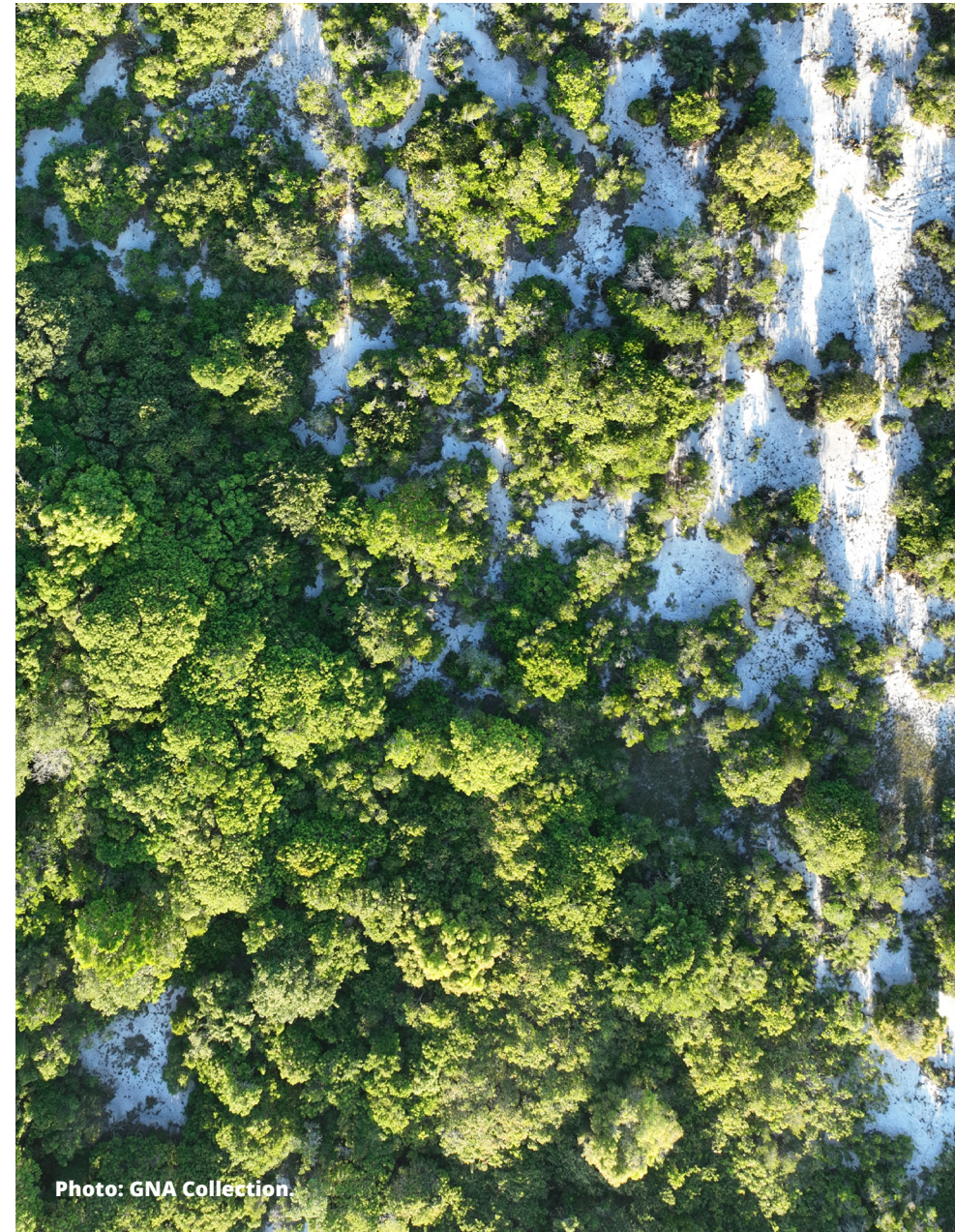


Photo: GNA Collection



Mitigation Measure 4

VOLUNTARY PARTICIPATION IN THE “GREEN BELT” PROGRAM



Impact to be mitigated

Suppression of vegetation for implementing the Port of Açu Complex, where we are located.



Implementation indicator(s)

This is a voluntary measure that is not related to any GNA environmental compensation, but is associated with our premise of, whenever possible, seeking opportunities for Net Gain in biodiversity. Created by the Port of Açu Operations (Porto do Açu Operações) company, which is the owner and runs the Complex. The Program's primary objective is to create a transition zone of native habitat between the Complex and the surrounding region.



Desired outcome(s)

Participation in the project to create a vegetation transition zone between the industrial development area and the natural landscape, thereby providing the possibility of connecting fragments of restinga in the region.



Current status and evidence

Awaiting resumption of the project by *Porto do Açu Operações*. The program was suspended after seedlings were planted in some test modules. We are waiting to evaluate how to participate if the program is resumed.



No Net Loss/Net Gain

Not applicable.

IMPACT

LOSS OF HABITAT

In addition to the impact on plant species, we believe that the vegetation suppression needed to implement our projects also represents a potential impact on fauna. This was a precautionary approach taken in the GNA's Biodiversity Action Plan (BAP), since the fragments of restinga that occur in the areas of the developments could no longer provide viable and sustainable habitat for most species of fauna due to the forest fragmentation that already existed, even before the implementation of the GNA Thermolectric Park. As such, we understand that the loss of any restinga habitat would be harmful to these species and we have included mitigation measures for this impact.



Photo: Luana Mauad.

Mitigation Measure 5

RELOCATION OF FAUNA SPECIES OF INTEREST TO SUITABLE HABITAT



Impact to be mitigated

Impact caused to fauna species that are considered triggers for critical habitat (sandbank) due to vegetation suppression. The following were considered species of interest: *Dendropsophus meridianus*, *Rhinella pygmaea*, *Xenohyla truncata*, *Cerradomys goytaca* and *Glaucomastix littoralis*.



Implementation indicator(s)

Individuals of each species of interest found. If specimens from these species are found during vegetation suppression activities, they should be relocated to a suitable habitat in the RPPN Caruara, where ecological niches are not fully occupied.



Desired outcome(s)

Specimens relocated to suitable (unoccupied) habitat in the RPPN Caruara and relocated specimens enriching populations in the RPPN Caruara.



Current status and evidence

Measure fully complied with. The rescue and relocation efforts were carried out in parallel with the vegetation suppression activities planned for each project, tracking its progress. Eleven specimens of *Rhinella pygmaea*, one *Glaucomastix littoralis* and one specimen of *Cerradomys goytaca*. All were relocated to a suitable habitat in the RPPN Caruara and no adaptive management measure was required as the relocation of individuals was successful.

There were also records of species of interest in the campaigns of fauna monitoring programs carried out after the GNA TPP I went operational, which demonstrates that the operation of our structures is not a limiting factor for the presence of these specimens.

Records of species of interest in fauna monitoring programs

Species	Local	Number of Records	Total records
<i>Rhinella pygmaea</i>	GNA Surroundings	30	44
	RPPN Caruara	14	
<i>Glaucomastix littoralis</i>	GNA Surroundings	10	87
	RPPN Caruara	77	
<i>Caiman latirostris*</i>	GNA Surroundings	07	13
	RPPN Caruara	06	
<i>Cerradomys goytaca</i>	GNA Surroundings	05	25
	RPPN Caruara	20	

It should be pointed out that we continue to displace (or rescue) wildlife specimens whenever necessary. This is a daily activity performed by the GNA Fire Brigade and scheduled to take place throughout the operational phase whenever any specimen is at risk or putting operational activities at risk. We also have an agreement involving veterinary care for wild animals in the event of accidents with the fauna at our facilities.

* While not a critical environment trigger species, it is a species of conservation interest in the region and has been highlighted in our monitoring.



No Net Loss/Net Gain

The indicator for this measure is supporting information and is not applicable to verify Net Gain. But the action contributes to achieving the No Net Loss target for the projects.



Associated management and monitoring plans or documents

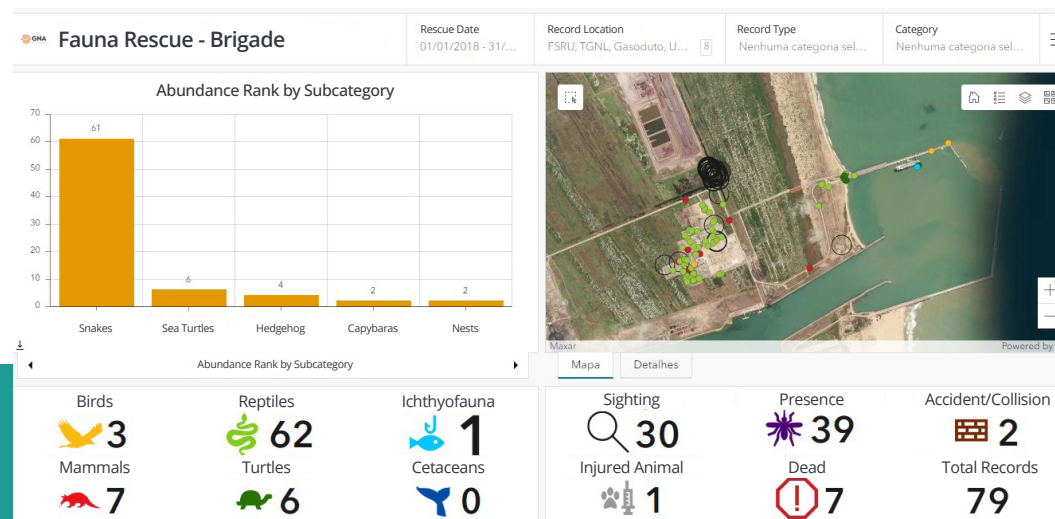
- RPPN Caruara Support Capacity Study
- Fauna and Flora Management during the implementation of the GNA TPP I
- Fauna and Flora Management during the implementation of the Internal TL; (part of the 345 kV TL located within the boundaries of the Special Sector of the Port of Açú) of the GNA TPP I
- Fauna and Flora Management during the implementation of the LNGT
- Fauna Management in the LT 345 kV cabling phase
- Fauna Management - Fauna Accident Prevention Program for the 345 kV TL
- Procedure for Synanthropic, Domestic and Wild Fauna Scaring and Rescue

» Fauna Rescue during vegetation clearing activities

During the vegetation clearing activities involving the implementation of GNA projects, 3,308 specimens of fauna were displaced and/or rescued and relocated, with reptiles being the largest group. Whenever possible, these specimens were displaced or relocated to a safe environment as close as possible to the recording site in adjacent areas to the development or released into the RPPN Caruara. Among the threatened species are two specimens of the *Glaucomastix littoralis* (green-tailed-lizard, *lagarto-da-cauda-verde*) and four *Cerradomys goytaca* (*ratinho-goytacá*), both endemic to *restinga* areas in the state of Rio de Janeiro.



Green-tailed-lizard (*Glaucomastix littoralis*).
Photo: Carlos Henrique Nogueira



» Care for fauna during the operational phase

We maintain care for the existing fauna in the surroundings throughout the operational phase of our projects. We developed a Procedure for the Synanthropic, Domestic and Wild Fauna Scaring and Rescue, which provides for fauna sighting record sheets and establishes protocols for various situations, with the GNA's Emergency Brigade and Environment staff conducting the actions provided for in day-to-day activities.

As of December 2022, a total of 79 animals have been registered/rescued. The majority (62 specimens) represented by herpetofauna, followed by 7 mammals (4 hedgehogs, 2 capybaras and 1 armadillo), 3 birds and 6 sea turtles. We have a regularly updated dashboard that compiles detailed information about our interaction with wildlife.

Mitigation Measure 6

SANDBANK HABITAT RESTORATION

Impact to be mitigated

Impact caused to of the flora *restinga* species due to vegetation clearing.

This measure is applied for more than one impact and is fully described in Mitigation Measure 2.



IMPACT

BIRD MORTALITY ALONG TRANSMISSION LINES

The installation of transmission lines and associated structures poses a risk of injury and death of birds, either through a collision during flight or electrical discharges when landing on the cable. This led to the creation of the Birdlife Management Plan, and a specific mitigation measure was defined to reduce this impact.



Photo: GNA Collection.

Mitigation Measure 7

**INSTALLATION OF
BIRD-FLIGHT DIVERTERS****Impact to be mitigated**

Mortality and injuries of birds caused by collision during flight or electrocutions when landing on the 345 kV TL.

**Implementation indicator(s)**

Flight diverters installed in areas with a high risk for bird collisions.

**Desired outcome(s)**

Flight diverters installed in areas with high risk of bird collisions and monitoring of bird interactions with the 345 kV TL.

Photo: GNA Collection.





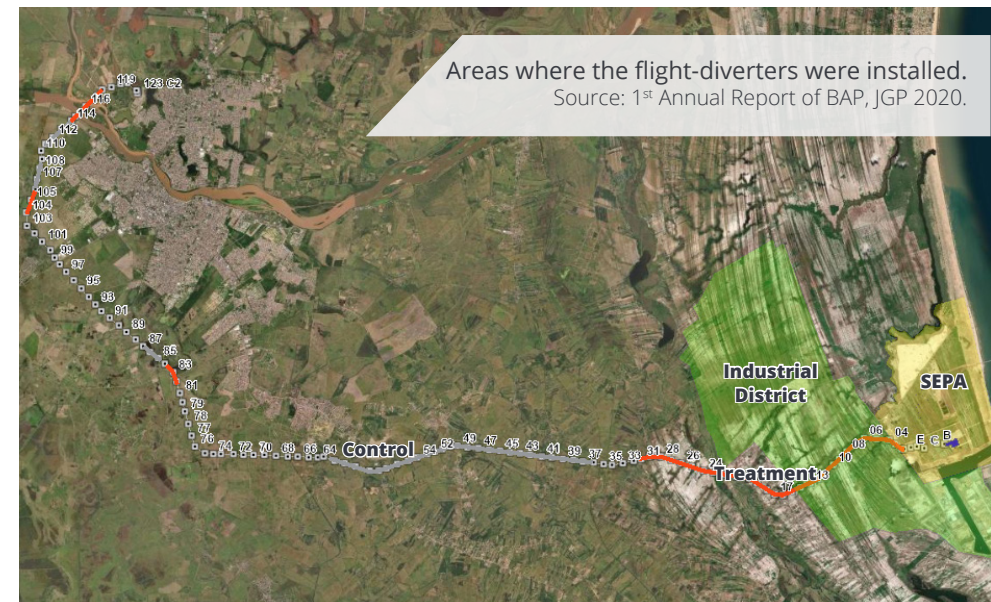
Current status and evidence

Measure fully implemented. During the 345 kV TL cabling phase, a total of 776 anti-collision and anti-electrocution devices were installed in the areas identified by the Birdlife Management Plan according to their relevance in protecting birdlife species.

Monitoring campaigns were structured in order to verify the effectiveness of the devices. The methodology for this monitoring involved eight sections along the transmission line: four of them without the flight diverters (control sections) and four with the flight diverters installed (treatment sections).

The campaigns recorded information, such as:

- Bird species and number of individuals observed in the area of influence of the transmission line
- Highest flight estimate of each specimen recorded
- Flight behavior
- Recorded collision events
- Carcasses and other evidence of collisions with transmission lines
- Species that use the 345 kV TL structure for nesting
- Weather conditions
- Vegetation and terrain characteristics
- Date and time of recorded events



After the first six monitoring campaigns, we conducted an adaptive management measure, expanded the sampling effort and established a new frequency for this monitoring program, which resulted in more monitoring hours per campaign and more robust outcomes to meet the program's objectives. All sections were monitored for 400 minutes daily, totaling 3,200 minutes per campaign. In addition, in order to optimize the time spent in the field and take advantage of the birds' activity, the experts spent uninterrupted 50 minutes observing the birds' interactions with the 345 kV transmission line. By the end of 2022, 16 monitoring campaigns were carried out. Also, a cumulative impact assessment between the 345 kV TL and 500 kV TL was conducted and the results will be considered in future monitoring programs after the implementation of the 500 kV TL (part of the GNA II projects).

Over the 16 monitoring campaigns, 4,179 interactions were recorded with the 345 kV TL structures — 2,132 sections undergoing treatment and 2,047 in the control. According to the statistical analysis applied, there have been no significant difference between the treatment and control sections so far. The monitoring will remain quarterly and the analyzes will continue to be conducted in an effort to understand the results of the program and to yield further information about this rather new topic; a topic that has been scarcely mentioned in scientific literature.



Monitoring campaign of bird interactions with the 345 kV Transmission Line.
Photo: Jéssica Neves.



Avifauna recorded in GNA's monitoring campaigns.
Photo: GNA Collection.

The basic-crossing flight was the most recorded for both groups (treatment and control), with 78% of the birds presenting basic-crossing flight behavior. It was therefore not possible to conclude whether there had been a change in flight behavior with diverters present. However, this data may point out that birds that naturally exercise the most circular type of flight avoid this type of flight behavior when viewing the structures of the transmission line.

The carcass location rate was zero after 12 hours in both sections (treatment and control). This result does not guarantee the absence of deaths, possibly being more related to the fact that the carcasses are removed very quickly by the necrophagous species.

However, over the 16 monitoring campaigns, 19 collision events were recorded. Of these, 15 did not result in deaths, with individuals following their initial route of travel after the collision. The carcasses were found in the other four collisions, two of which are species with a high susceptibility to collision (*Coragyps atratus* and *Patagioenas picazuro*) and two with a low degree of danger (*Ramphovelus bresilia* and *Crotophaga ani*).

With the data collected by the 16 campaigns carried out thus far, it is not possible to define the efficiency of the installation of the flight diverters, as the difference between the interactions among the treatment and control was not statistically significant. With the newly planned campaigns we hope to prove or disprove this hypothesis.



No Net Loss/Net Gain

The indicator of this measure is supporting information and does not apply to verify No Net Loss/Net Gain. Despite this, the measure indirectly contributes to the achievement of No Net Loss by reducing the impacts of the projects on birdlife.



Associated management and monitoring plans or documents

- Birdlife Management Plan

» Recorded species

Throughout the 16 monitoring campaigns conducted, 3,941 specimens of 64 species were recorded. The most abundant species was *Coragyps atratus*, with 484 records. The only record of a threatened species occurred during the 1st monitoring campaign and involved the species *Busarellus nigricollis* (*gavião-belo*), classified as Vulnerable in the state of Rio de Janeiro, according to the state's regional list. The only migratory species recorded was *Pandion haliaetus* (*águia-pescadora*), sighted during the first and third monitoring campaigns. Species endemic to the Brazilian territory were not recorded.



Sicalis flaveola.
Photo: Fabio Patiu.



Pipraeidea melanonata.
Photo: Fabio Patiu.



Pandion haliaetus (*águia-pescadora*).
Photo: Fabio Patiu.



FRESHWATER

Changes or degradations in lagoons, swamps and ephemeral ponds existing in the area where our projects are being implemented can have an impact on the restinga habitat because these bodies of freshwater are hydrologically and ecologically correlated with it, in addition to being a habitat for various faunal groups that are important to the ecosystem, such as benthic macrofauna, phytoplankton, zooplankton and ichthyofauna. As a result, BAP identified a potential impact that led to a mitigation measure.

REDUCTION OF WATER QUALITY AND QUANTITY

- Installation of oil water separators 46
- Maintaining a permeable surface 48
- Restoration of restinga habitat 50
- Payment of monetary environmental compensation 50



IMPACT

REDUCTION OF WATER QUALITY AND QUANTITY

The possibility of oil runoff, the intervention of structures in lagoons and ponds, water abstraction, thermal water runoff and waterproofing surface areas can negatively impact the availability of fresh water in the area of our projects. As such, a mitigation measure was established to prevent any loss of biodiversity due to reduced water quality or quantity.



Mitigation Measure 8

INSTALLATION OF OIL WATER SEPARATORS**Impact to be mitigated**

Reduction in water quality due to contamination from possible oil leaks.

**Implementation indicator(s)**

Oil Water Separators installed.

**Desired outcome(s)**

Zero oil discharge to freshwater bodies.





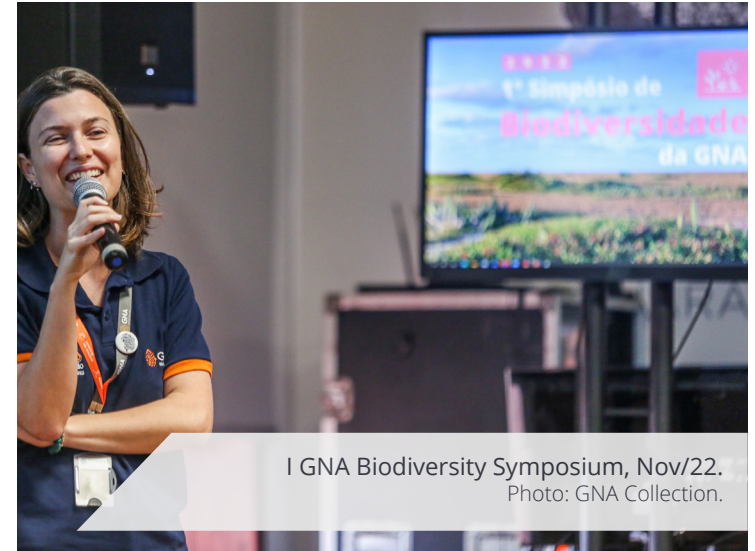
Current status and evidence

Measure fully implemented. The installation of oil and water separators and containment trays in all facilities of the project reported in the Installation License Request Report, and in the monitoring reports from the Construction Site Environmental Management Program demonstrate that they have been effectively installed. It is worth noting that the drainage project was developed including operational and rainwater drainage systems, with a catchment system via an extensive drainage network that covers a large part of the GNA TPP I area. All effluent is diverted to the separation tanks. The waste is removed by the appropriate trucks and sent for treatment to a specific facility by specialized companies licensed for this activity.

As for the monitoring of the region's lagoons, it was clear that the lagoons had not undergone any impacts as a result of GNA's activities after four campaigns. So, we developed a new scope for the theme that focuses on studies directed to the RPPN Caruara lagoons (IQUIPARI and GRUSSAÍ), an initiative that was discussed during the 1st GNA Biodiversity Symposium, held in November 2022. Since then, our efforts have been focused on understanding the processes related to these lagoons and their ecosystem services.

» 1st GNA Biodiversity Symposium

The 1st Biodiversity Symposium was held on November 8th and 9th, 2022. The event included, among other participants, representatives from INEA/RJ, the Municipality of São João da Barra, universities from the North Fluminense and Rio de Janeiro state, and environmental consulting companies. This initiative will take place annually to present and discuss the results and future perspectives of the GNA BAP and its monitoring programs, as well as to discuss the mitigation of impacts and conservation of terrestrial and marine fauna and flora in the region.



I GNA Biodiversity Symposium, Nov/22.
Photo: GNA Collection.



I GNA Biodiversity Symposium, Nov/22.
Photo: GNA Collection.



No Net Loss/Net Gain

The indicator of this measure is supporting information and it does not apply to verify No Net Loss/Net Gain. Despite this, the measure helps reduce impacts on bodies of freshwater and to achieving No Net Loss by avoiding pollution in an important ecosystem related to the *restinga*.



Associated management and monitoring plans or documents

- Lagoon Monitoring Plan
- Liquid Effluent Management Procedure

Mitigation Measure 9

MAINTAINING A PERMEABLE SURFACE



Impact to be mitigated

Reduction of rainwater absorption into the soil, impacting the region's aquifers.



Implementation indicator(s)

Percentage of the area occupied by the Port of Açú with a permeable surface.



Desired outcome(s)

Maintaining a permeable surface corresponding to 15% of the total area occupied by GNA developments, helping to preserve the region's aquifers and ensuring their levels of underground water storage remain normal.



Current status and evidence

This measure is fully complied with.

In compliance with a regulation by the Industrial Development Company of the State of Rio de Janeiro (CODIN, in Portuguese), a hydrological engineering study identified the percentage of the total area of Port of Açu as 15% to be maintained as a permeable surface to ensure that normal levels of the region's aquifers are preserved. Thus, GNA TPP I maintains an area of 2.77 hectares (which represents 15.23% of the total area licensed for the construction of GNA TPP I) with its original vegetation to ensure the minimum permeable area required by Port of Açu. In addition, the built-up areas have high permeability coefficients, with points reaching 70% of the original permeability.



Area of TPP GNA I, highlighting the area maintained with its original permeability (blue polygon).
Source: Relatório ABAP Annual Report, JGP 2020.



No Net Loss/Net Gain

The indicator of this measure is supporting information and does not apply to verify No Net Loss/Net Gain. However, the action helps maintain groundwater at an acceptable level, providing a secure environment for local biodiversity and playing a role in achieving the goal of No Net Loss in freshwater bodies in the restinga habitat of our developments.



Associated management and monitoring plans or documents

- Master Plan of the Industrial and Logistics Complex of the Port of Açu (Clipa)
- Effluent Management Procedure; Limnological Monitoring Procedure
- Remote Sensing Monitoring of Coastal Lagoons

Mitigation Measure 10

RESTORING THE *RESTINGA* HABITAT

Impact to be mitigated

Impact caused to the quality and quantity of water in freshwater bodies due to vegetation suppression.

This measure is applied for more than one impact, and is fully described in Mitigation Measure 2. It should be pointed out that the restoration and maintenance of the native vegetation cover of the RPPN Caruara play an important role in preserving the quantity and quality of water in the freshwater bodies of the region, mainly in the Iquipari Lagoon.

Mitigation Measure 11

PAYMENT OF MONETARY ENVIRONMENTAL COMPENSATION

Impact to be mitigated

Reduction of water quality and quantity in the region's freshwater bodies.

This measure is applied for more than one impact, and is fully described in Mitigation Measure 3. In this case, the payment of monetary environmental compensation (carried out by the three Environmental Compensation Commitment Agreements signed with INEA/RJ and SEAS/RJ) may also involve the protection of freshwater bodies with similar ecological characteristics in the region (e.g.: Parque Estadual da Lagoa do Açú and Parque Nacional Restinga de Jurubatiba).





ECOSYSTEM

COASTAL

The GNA Thermoelectric Park is located in a coastal area. The beaches and near-shore marine areas provide nesting and feeding grounds for threatened sea turtle species. These are places that attract individuals of the *Caretta caretta* species (IUCN: Vulnerable; SEMA: Endangered), which account for 85% of all nests found in the region. Another relevant point is that the beaches in this area are also crucial for the birth of males hatchlings in the South Atlantic, as higher incubation temperatures in the nesting sites of northern Brazil result in predominantly female offspring.

The region has also witnessed, in smaller numbers, nesting of other sea turtles species such as *Eretmochelys imbricata* (IUCN: Critically Endangered; SEMA: Critically Endangered), *Lepidochelys olivacea* (IUCN: Vulnerable; SEMA: Endangered) and *Dermochelys coriacea* (IUCN: Vulnerable; SEMA: Critically Endangered).

These beaches are recognized by the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA, in Portuguese) and the Chico Mendes Institute for Biodiversity Conservation (ICMbio) for their national relevance in terms of sea turtle nesting. Even though they are not recognized as a critical environment trigger species in the BAP, sea turtles are a priority biodiversity value for which GNA maintains a monitoring program.

Although the physical infrastructure of our developments is minimal in the coastal area, basically limited to pipelines, the implementation and operation of our thermoelectric park can have an impact on this ecosystem.

In order to assess these impacts and set up mitigation measures, certain aspects were considered such as mortality and the decline in reproduction of sea turtles and decline in habitat suitability. Two possible impacts were identified, resulting in ten mitigation measures.





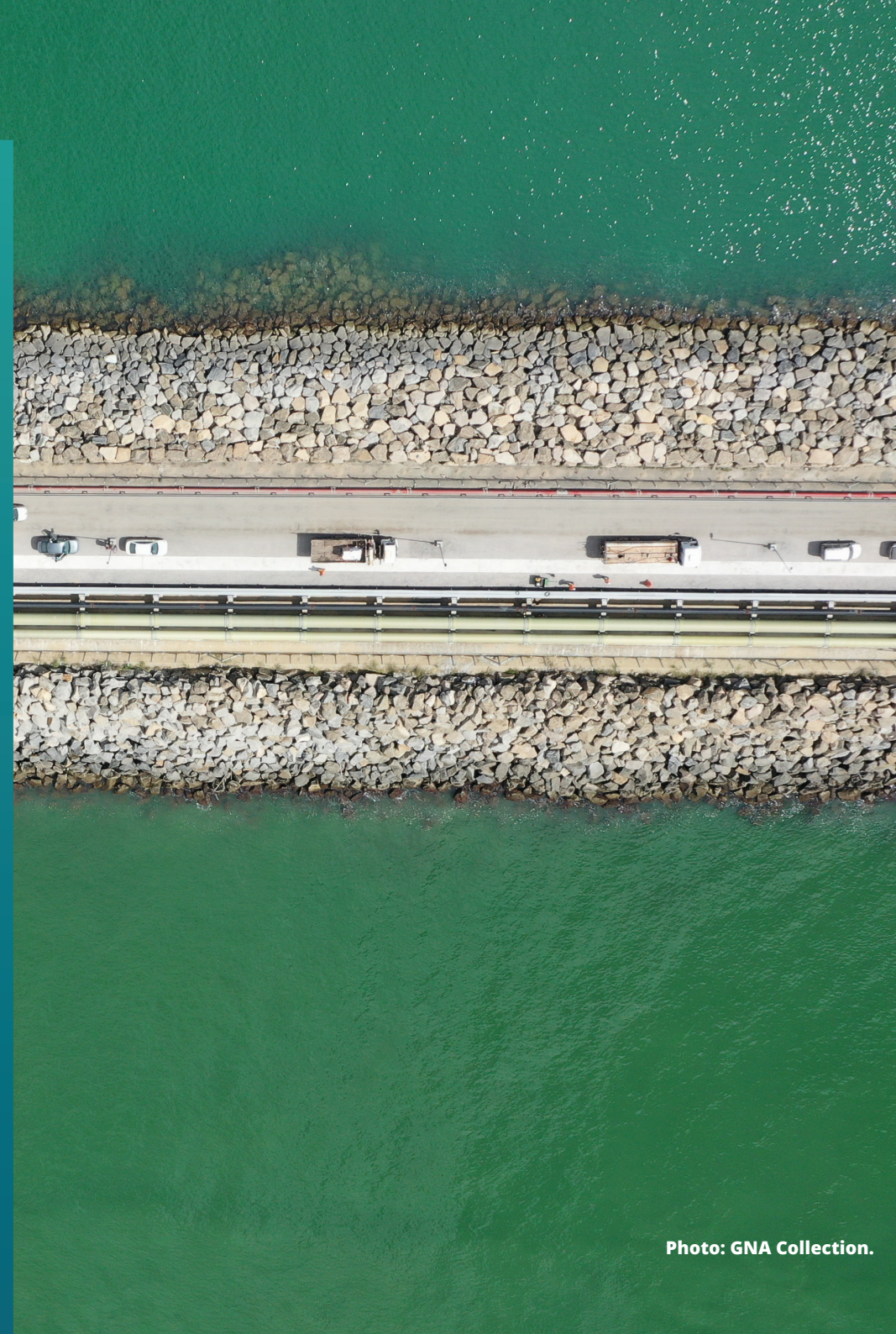
COASTAL

MORTALITY AND DECREASED REPRODUCTION OF SEA TURTLES

- Dredging carried out considering the sea turtles' reproductive season 54
- Lighting of GNA structures designed to reduce impacts from illumination to the reproduction of sea turtles 55
- The paint color of the FSRU was conceived to minimize artificial light reflection to accommodate sea turtles reproduction 59
- Ongoing and structured actions for the conservation of sea turtles 61

DECLINE IN HABITAT SUITABILITY FOR ALL NEAR-SHORE MARINE SPECIES

- Mixing ship cooling water with hot water output from the power plant to manage water temperatures prior to discharge into the ocean 69
- Implementation of anti-entrainment structure for marine life (sea chest) in the cooling water intake system for the FSRU and the power plant operation 71
- Water quality management 73
- Ship ballast off-shore exchange to minimize the risk of introducing invasive alien species 87
- Removal of invasive marine species from the LNGT area and FSRU BW MAGNA 90
- Rock pier construction increases habitat availability for hard-bottom marine species 91



IMPACT

MORTALITY AND DECREASED REPRODUCTION OF SEA TURTLES

Threats from human activities impact all stages of the sea turtles life cycle, from the loss of spawning areas and feeding habitats to mortality on the coast and in the high seas due to the intense practice of both artisanal and industrial fishing. According to the National Action Plan for the Conservation of Sea Turtles (2011), the key threats are: coastal development, such as photopollution, extraction of sand and landfill, transit of vehicles on the sand strip, presence of humans on the beach, construction of ports, berths and jetties; pollution and diseases; fishing activities; climate change; consumption and use of meat and eggs and, finally, predation by animals. While the LNGT is operational, there are activities expected that could have a potential impact on sea turtles, such as: nocturnal activities or even security lights remaining on at night; boat traffic and the involvement of animals in the water intake system for cooling the FSRU.

It should be noted that most of these procedures have been implemented since the installation phase of the LNGT. In terms of impacts due to boat traffic, it should be noted that the number of vessels involved in the activity is minor, as there is one LNGC vessel and four support tugs, with entry and exit scheduled for every 15 days, in case of 100% demand for the thermoelectric plant (TPP GNA I). As such, the indirect impact of this increase in traffic, which could result in collisions with sea turtles and cetaceans or interference with fishing, is unlikely. In the case of collisions or interactions with specific groups of marine animals, such as dolphins, GNA must follow the protocol and guidelines established by the administrator of the navigation channel of Port of Açú.



Mitigation Measure 12

DREDGING CARRIED OUT CONSIDERING THE SEA TURTLES' REPRODUCTIVE SEASON**Impact to be mitigated**

Mortality of sea turtles due to collision with boats (or other elements) used in dredging, in addition to reduced reproduction of sea turtles due to dredging activities.

**Implementation indicator(s)**

Time of dredging.

**Desired outcome(s)**

Dredging schedule adapted to the reproductive period for sea turtles, helping to reduce potential impacts caused to their reproduction.

**Current status and evidence**

This measure is fully complied with.

The dredging activities near the GNA area have already been completed. The dredging schedule has been adapted to accommodate the reproductive period of sea turtles in the region. Qualified professionals were also on-site to monitor chelonians and marine cetaceans on board the dredgers, with direct access to the vessel's commander to determine the immediate stoppage of dredging activities until the sea turtles observed in the vicinity of the dredger moved away. Sea turtle baffles attached to the dredge heads were also used as a preventive measure. Dredging was needed for the installation of the LNGT, beginning on February 5, 2019 and continuing up to August 2019. In September 2019, there was the lowering of high points of the sea bottom with the use of a "Plough" type vessel. New dredging in the port as a whole is expected to follow the aforementioned schedule.

* In the period from April 12 to July 24, 2019, a second dredger was added to the dredging activities.



No Net Loss/Net Gain

The indicator for this measure is supporting information and it is not applicable in verifying No Net Loss/Net Gain. However, the measure helps to achieve the No Net Loss target, considering the objectives of mitigating the mortality rate of sea turtles.



Associated management and monitoring plans or documents

- Technical Environmental Control Instructions for Dredging Activities
- Dredging Management Plan

Mitigation Measure 13

LIGHTING OF GNA STRUCTURES DESIGNED TO REDUCE IMPACTS FROM ILLUMINATION CAUSED TO THE REPRODUCTION OF SEA TURTLES



Impact to be mitigated

Damage to the reproduction of sea turtles due to artificial lighting systems.



Implementation indicator(s)

Lighting installed in accordance with Brazilian legislation (Resolution No. 10 of the National Environment Council [CONAMA] in October 24, 1996) and as detailed in the specific procedure for photomitigation (PO.MA.039 Photopollution Mitigation). The desired outcome is that lighting for GNA structures is within the specifications for protecting sea turtles, so the reproduction process can happen as close to normal as possible.



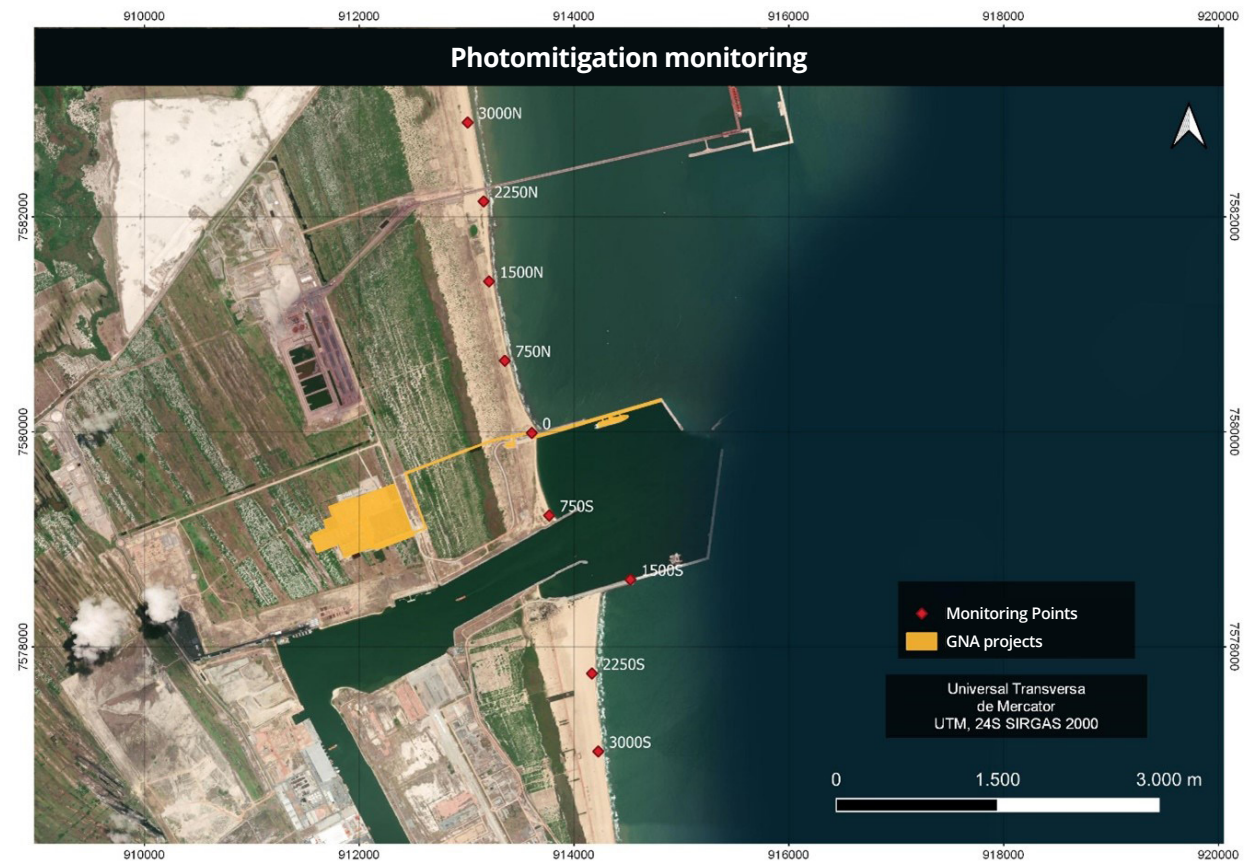
Current status and evidence

This measure has been carried out since the design of the lighting systems for the GNA structures, and continues during the implementation and operational phases. As a result, the installation and maintenance of artificial lighting systems used in the offshore areas that are close to the coast, as well as those in the onshore terminal, complied with current regulations, thereby preventing impacts from spotlights (direct and indirect) on the beach, and also attenuating the generation of a luminous horizon.

After the lighting was installed, seven campaigns* involving the photomitigation monitoring program were carried out involving a network made up of eight data collection stations (four in the north and four in the south), with the origin point located in the LNGT. The methodology adopted complies with Brazilian regulations (Ordinance No. 11/95 of IBAMA/MMA) as well as the Biodiversity Action Plan.

* Campaigns conducted in: September 2020; February, May, September 2021; January, May and September/November 2022.

Study area for the photomitigation monitoring campaign.
Source: Environmental photomitigation procedure of GNA.



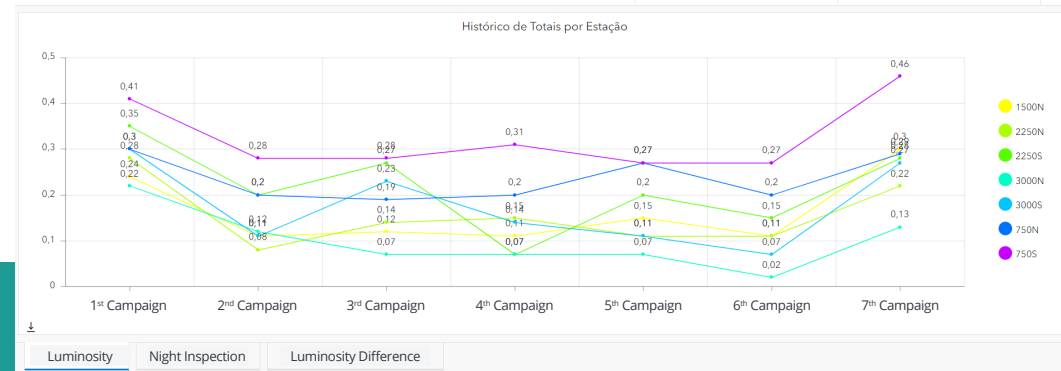
Ecosystem:
Atlantic Rain Forest - RestingaEcosystem:
FreshwaterEcosystem:
Coastal

As a result of the analysis of the monitoring campaigns, some elements of photopollution were observed from both internal (GNA) and external contributions (other projects in Port of Açú), throughout the study area. These elements are characterized by the presence of luminous horizon, direct light and reflectance. Nocturnal inspections showed that lighting increased due to temporary nighttime construction activities for the GNA II implementation, new projects in the retro-area from Terminal 2 and ship-to-ship operations at Terminal 2, as well as weather conditions.

Considering the technical instructions and photomitigation recommendations for implementing the GNA TPP II, measures are being taken during nighttime activities at work sites, with a focus on photomitigation and operational safety of the activities. For GNA I, shifting the position of some reflectors was assessed in terms of operational safety. In the case of the FSRU, compliance with the photomitigation plan and the importance of maintaining lighting conditions, according to photomitigation criteria throughout the FSRU's operation, were reinforced.

Photomitigation Biodiversity

Luminosity

Photomitigation Station
1500N, 2250N, 2250...Campaign
1ª Campanha, 2ª Ca...

» Specific dashboard for photomitigation.

A specific dashboard for photomitigation actions was added to GNA's biodiversity data monitoring. The dashboard is updated in real time, according to the activities performed.

In addition, an Action Plan was established to be implemented by our Sustainability and Engineering (Maintenance) teams. Through the action plan, GNA seeks the possibility of changing the position of some reflectors, considering both the sea turtles conservation as well as operational safety.

» Photomitigation Action Plan

This plan includes the following:

- Verification of lighting non-conformities
- Construction site checklist
- Night inspections
- Daytime inspections
- Assessment of the inspection' results
- Verification of temporary and mobile lighting
- Internal meetings to discuss the results of the inspections
- Meetings with the maintenance department to follow up on corrections to non-conformities
- Inclusion of the environmental photopollution issue in the annual report of the Biodiversity Action Plan (BAP)
- Specific training on environmental photopollution for employees involved in the process

With the creation of the Action Plan, we expect to see a reduction in the intensity of lighting, but it should be noted that operations at the GNA TPP I, and particularly at the FSRU and LNGT, must comply with safety rules. In addition, GNA's structures are in an industrial area within Port of Açú, with several developments that contribute significantly to the light intensity that reaches the monitoring sites, and it is not the responsibility of GNA management to apply adaptive management measures for these outside contributions.



Activities of the Photomitigation
Action Plan.
Photos: GNA Collection.



No Net Loss/Net Gain

This measure plays a role in preventing No Net Loss, due to the mitigation of impacts on the spawning and reproduction of sea turtles. The Sea Turtles Monitoring Program tracks the effectiveness of the implemented measure.



Associated management and monitoring plans or documents

- Photomitigation Mitigation Procedure
- Environmental Photomitigation Criteria for the LNGT
- Sea Turtles Monitoring Procedure
- Port of Açú Sea Turtles Monitoring Program
- Monitoring Reports on Photomitigation Activities

Mitigation Measure 14

THE PAINT COLOR OF THE FSRU WAS CONCEPTED TO MINIMIZE ARTIFICIAL LIGHT REFLECTION TO ACCOMMODATE SEA TURTLES REPRODUCTION



Impact to be mitigated

Damage to sea turtle nesting due to light reflectance on FSRU hull and deck.



Implementation indicator(s)

Paint colors used on the hull and deck of the FSRU comply with specifications for low light reflection.



Desired outcome(s)

The color of the paint satisfies the specifications for reducing the reflectance effect of the FSRU in the water, helping to enable turtle nesting as close to normal as possible.



Current status and evidence

This measure is fully complied with.

In 2019, the FSRU, originally painted light green with blue accents, received new colors. The hull was painted navy blue and the deck gray.



No Net Loss/Net Gain

This measure plays a role in preventing No Net Loss, due to the mitigation of impacts on the spawning and reproduction of sea turtles. The ongoing assessment of photopollution and the Sea Turtles Monitoring Program monitor the effectiveness of the implemented measure.



Associated management and monitoring plans or documents

- GNA Sea Turtles Monitoring Procedure
- Port of Açú Sea Turtles Monitoring Program

BEFORE

FSRU with hull in the original paint.
Photo: GNA Collection.



AFTER

FSRU with navy blue-painted hull and gray deck:
reduction of light reflectance on the water.
Photo: GNA Collection.



Mitigation Measure 15

ONGOING AND STRUCTURED ACTIONS FOR THE CONSERVATION OF SEA TURTLES



Impact to be mitigated

Decline in reproduction and increase in mortality rates of sea turtles due to the installation and operation of GNA facilities (it is considered a cumulative impact with other projects already underway in the Port of Açú Complex).



Desired outcome(s)

Stability or improvement of nesting and productivity on the spawning beach, according to the baseline. If there is a decline, Port of Açú is responsible for determining response measures. GNA may, however, support sea turtles conservation projects in other regions if it believes that the measures are not effective.



Implementation indicator(s)

Number of existing nests; number of nests with eggs and percentage of nests producing hatchlings.

» LBaseline – sea turtle nesting

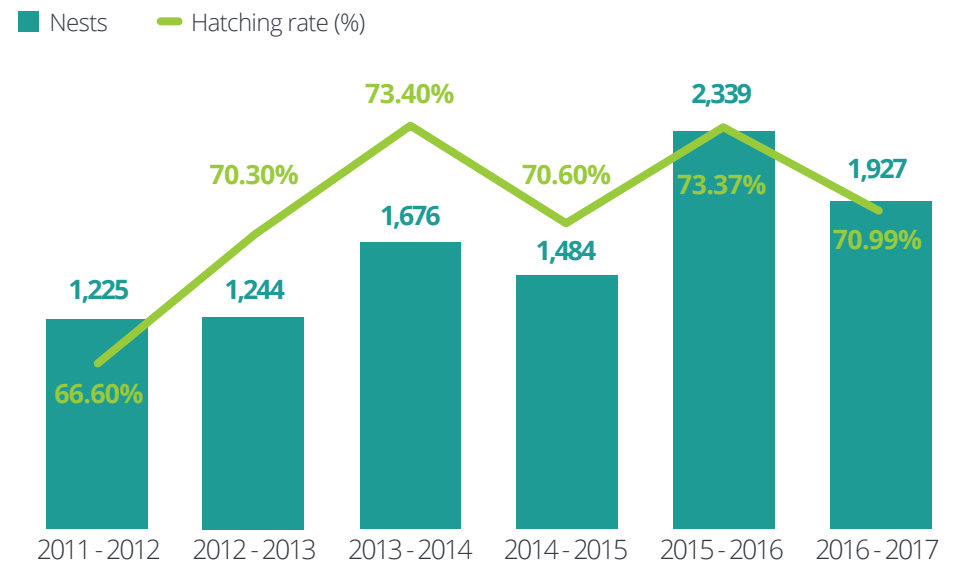


Photo: GNA Collection.



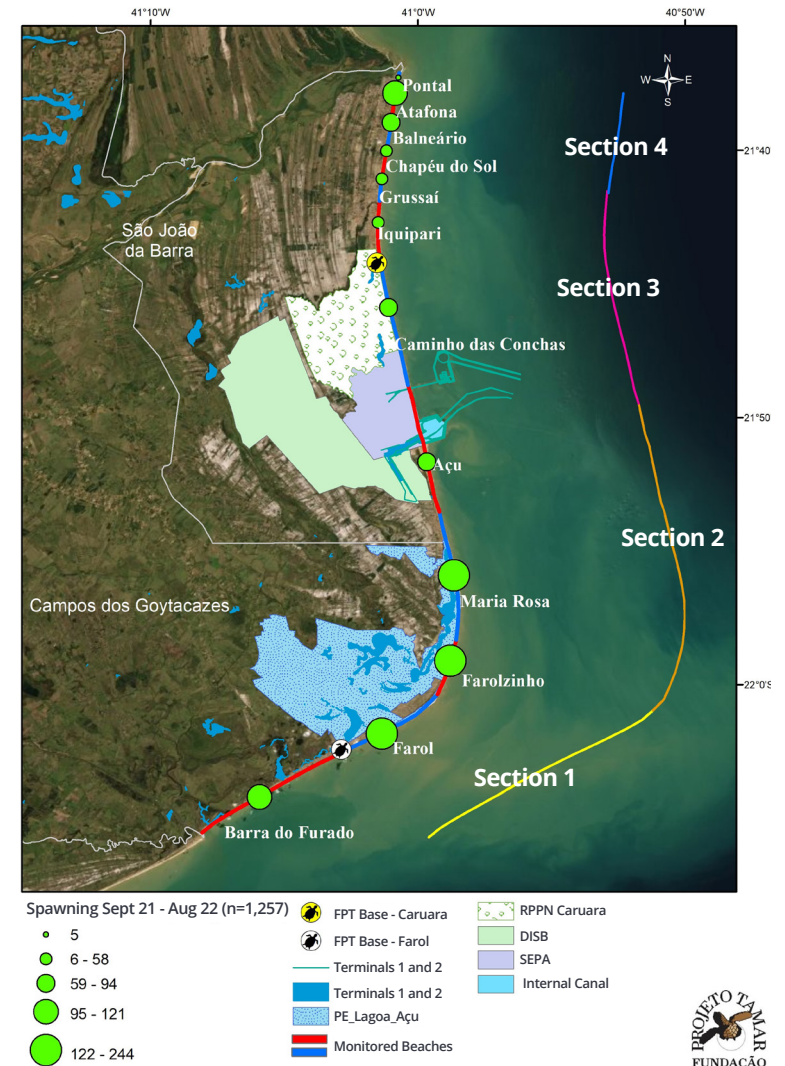
Current status and evidence

The measure is implemented through GNA's support for the various actions carried out by Port of Açú to conserve the sea turtles species found in the region, including monitoring, protection of nests and hatchlings, engagement with local communities and provision of veterinary services whenever necessary.

The initiatives are part of the Sea Turtles Monitoring Program (PMTM, its acronym in Portuguese, *Programa de Monitoramento de Tartarugas Marinhas*), maintained by four companies doing business in Port of Açú, including GNA, a partner in the program since September 2021*. The idea is to increase the success of the turtles' nesting and, consequently, their reproduction rates.

The PMTM methodology is used to monitor the reproductive and non-reproductive events of sea turtles, evaluating the causes of mortality and any possible changes observed in the patterns of reproductive occurrences. As of 2021, monitoring was done by the TAMAR Project Foundation (Fundação Projeto TAMAR).

Each day, roughly 62 km of the coast are monitored, divided into sections, toured by monitors of the program early in the morning. Reproductive records are made by locating and identifying females, nests and tracks from hatchlings. Once logged, the nest is monitored until hatching. Non-reproductive logs refer to occurrences of live (but non-nesting) or dead animals arriving on beaches. Activities performed through the program also include the provision of veterinary care for debilitated sea turtles and necropsy, when necessary and possible, to ascertain the cause of death. Logs detailing stranding and necropsies have helped us understand the seasonal distribution of species and the causes of death in sea turtle individuals.



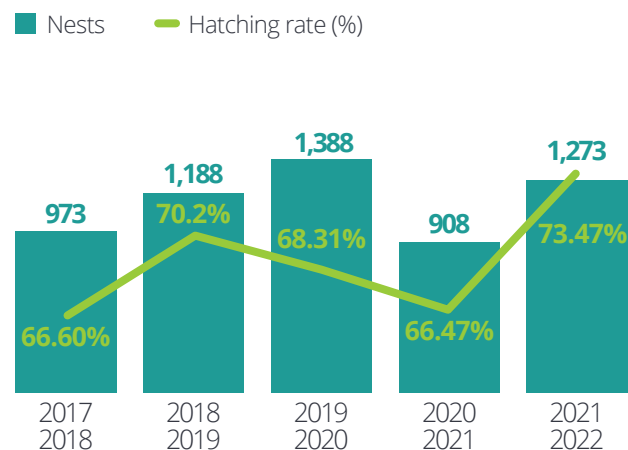
Monitoring area of the Marine Turtles
Monitoring Program.

Source: TAMAR. Semiannual Technical Report - September 2021 to August 2022.

* GNA voluntarily provides financial support for monitoring.

The *Fundação Projeto TAMAR* releases a full report every six months with the data collected, providing detailed information about the PMTM activities over the period. Data from the reports reveal that, during the period from 2017 to 2019, the number of nests was slightly higher than the lowest value reached over the last eight years of monitoring, while the hatching rate came to around 66% for the 2017-2018 season and then increased slightly to 70% between 2018-2019, reaching 73% over the 2021-2022 season, demonstrating that the number of nests and hatching rate remained stable when compared to the baseline.

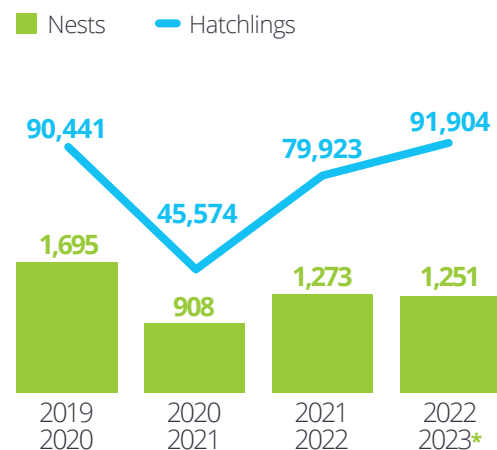
» Sea turtles nesting between 2017 and 2022



Generally, the report containing the PMTM results provides enough information to conclude that there were no significant changes in the reproductive patterns of sea turtles and, thus far, there is no evidence that GNA's projects have had any impact on the nesting behavior of these animals.

In the 2021-2022 season, 199 accidental strandings of sea turtles were recorded in the municipalities of Campos de Goytacazes and São João da Barra. Most of the animals identified (95.8%) were found stranded during daily monitoring and collected by the institution that handles these incidents in the study area. A total of 106 necropsies were performed. In addition to the cause of death, these procedures also make it possible to assess the presence of anthropogenic interactions that may or may not be decisive in the deaths. The results point to evidence of anthropogenic interactions in 48 animals (45.58%). It was not possible to identify whether there was an interaction or not in 49 animals (46.23%), and 9 animals did not demonstrate evidence of interactions (8.5%).

» Total sea turtles nests and hatchlings in the seasons between 2019 and 2023

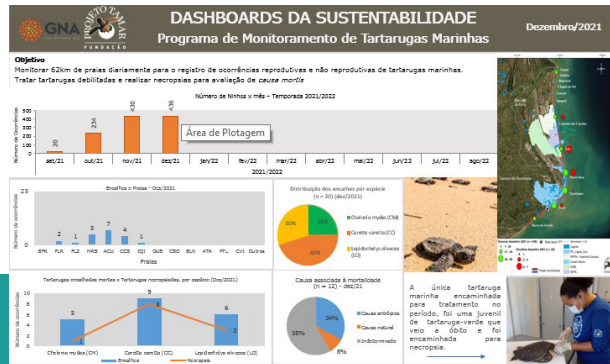


* Data since Dec/2022.



Photo: GNA Collection.

The 2022-2023 season protected about **91.904*** sea turtles hatchlings. Since the program began in 2011, **1.196.764** hatchlings have been protected.



» Sea Turtles Monitoring Monitoring Program (PMTM)

Sustainability dashboard specifically for the PMTM, showing key data from September to December 2022.

» Raising awareness among fishermen

GNA also retained the Fundação Projeto Tamar to run a project intended to educate local fishermen on contributing to the conservation of sea turtles. From September 2021 to September 2022, the initiative involved engaging with fishermen, theoretical and practical workshops and lectures on techniques for conservation, resuscitation of turtles weakened by accidental fishing, use of the Turtles Excluder Device (TED) – which allows turtles caught in shrimp trawling nets to escape – and other techniques to prevent the accidental deaths of these animals. Some of the more notable actions include:

- Outreach to fishermen using gillnets

Meetings took place informally, with monitors from the Fundação Projeto Tamar speaking to fishermen about the fishing gear they use and their interactions with sea turtles. One of the primary objectives was to characterize the nets used (analyzing length, net height, mesh size, target species, etc.). In all, 93 fishermen were spoken to and the information collected supported the development of specific actions in terms of the local reality, in an effort to increase the chances of the project's success with the fishing community.



Workshop on the conservation of sea turtles and the use of the Turtles Excluder Devices (TED).
Photos: GNA Collection.

- Lecture titled “Productive fishing and the conservation of sea turtles”

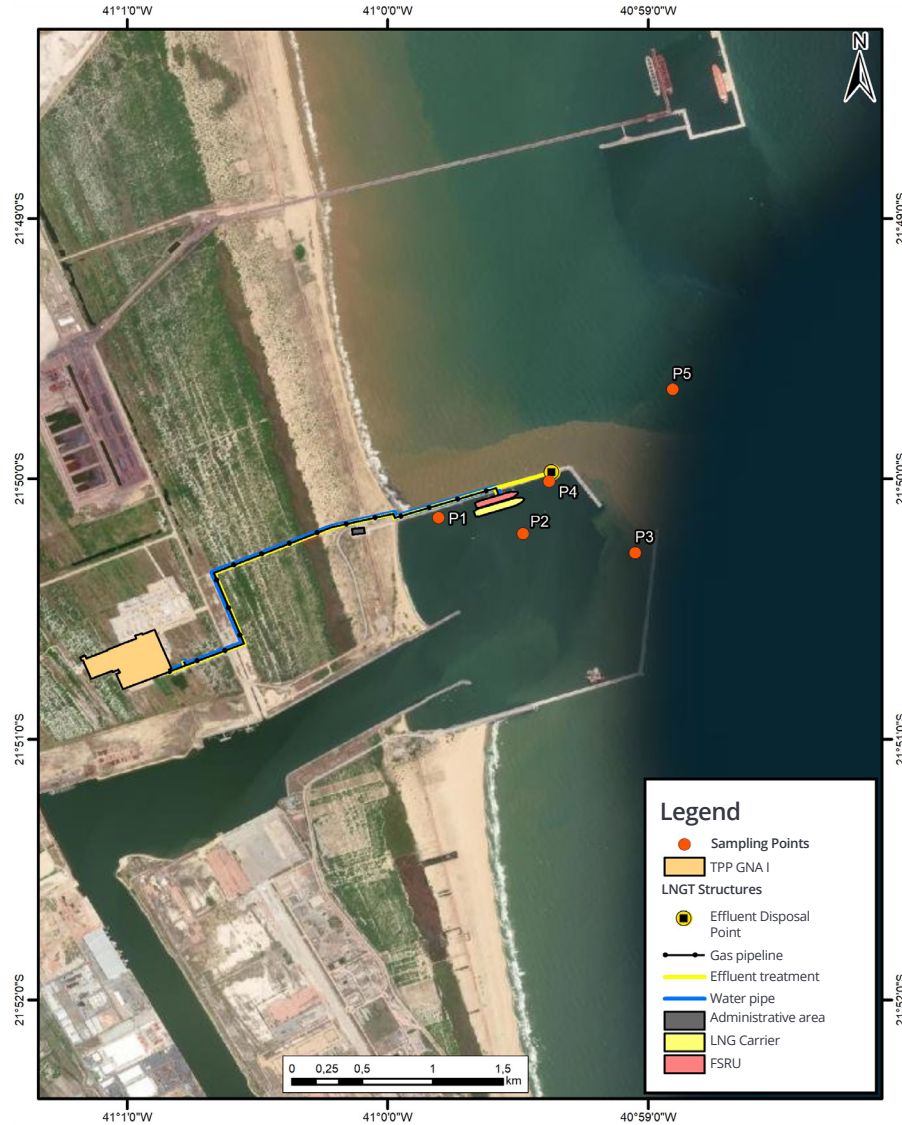
Held on July 21, 2022, at the Z2 fishing colony center in Atafona, São João da Barra, 29 fishermen attended the presentation from the municipalities of Campos do Goytacazes and São João da Barra as part of a training course for professional fishermen.



- Workshops on the construction and use of the Turtles Excluder Device (TED)

Between March 1 and May 31, 2022, during the shrimp trawling off-season, when shrimp fishermen are ashore, GNA held three workshops, one in each fishing colony in the region. The goal was to introduce different possibilities to reconcile productive fishing with biodiversity conservation. Important matters were discussed at the event, including the origin of TED, setting up the device to make sure it works properly, the legal framework of TED in Brazil and, finally, the desired format for the participatory and transparent work. Although TED is required in Brazil for all shrimp boats over 11 meters (Federal Ordinance No. 31 of Inmetro Normative Instruction [INI], of December 2004), the shrimp fishermen of Campos dos Goytacazes and São João da Barra were never trained on how to install them on nets. The devices were assembled alongside fishermen in the three workshops and donated as a template for later reproduction.

Another key outcome from this program was the call by fishermen to monitors from Fundação TAMAR to save 11 turtles accidentally trapped in fishing nets. **This reflects the establishment of a relationship of trust between the community and the project that will contribute to the conservation of sea turtles.**



Sampling points (green circles) for the Hydroacoustic Monitoring Program. Source: Econservation, 2021.

» **Hydroacoustic monitoring**

GNA has implemented a hydroacoustic monitoring program aimed at verifying the influence of noise on marine life, with a focus on cetaceans. However, the program can also assess impacts on other animals in the marine group, including sea turtles. This monitoring program can therefore be applied as a complementary measure to sea turtles conservation initiatives.

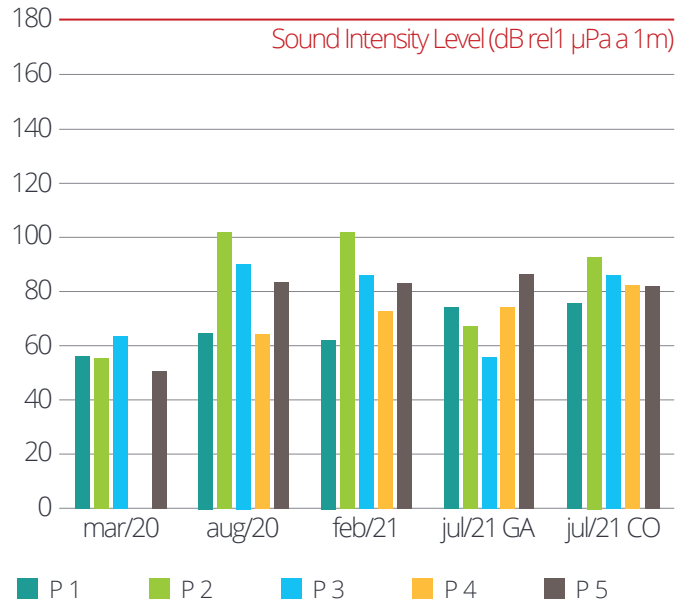
Four different scenarios were established in the Hydroacoustic Monitoring Program to evaluate various operational conditions, such as:

- (1) No operation
- (2) Only regasification operation
- (3) Only ship-to-ship operation
- (4) Regasification and ship-to-ship operations simultaneously.

Results from the campaigns point to operational noise levels below the limits accepted by international entities (NOAA Limit, 2016: 180 dB rel1 μ Pa at 1 m) and quite close to the baseline campaigns, showing acoustic intensity close to the natural environment.

There was no change in the behavior of the dolphins observed during the monitoring. Birds and sea turtles were also observed in the area during monitoring activities, and did not change their behavior during the ship-to-ship and regasification activities. The distribution of the recording points and the method used were sufficient for the intended objectives. The results indicate that there was no hydroacoustic impact on marine fauna, and no adaptive management measure was necessary.

» Sound Intensity Level (dB rel1 µPa a 1m) maximum in the Environment



Maximum acoustic intensity level (dB rel1 µPa at 1m) at each point, without a vessel in March and August 2020, with FSRU vessel in February 2021, with FSRU in regasification in July 2021, and with ship-to-ship operation and regasification in July 2021. Point 4 was not included in March 2020.

GA=Regasification.

CO=Ship-to-ship operation and regasification.



Hydroacoustic monitoring campaign.
Photos: Econservation.



No Net Loss/Net Gain

Actions associated with mitigation measure 15 show GNA's consistent effort to reach the No Net Loss goal associated with the impacts of projects on marine life. In addition, hydroacoustic monitoring campaigns revealed that no measurable impacts are expected due to noise from the operation, which helps prevent net loss of biodiversity. For monitoring the reproductive period of sea turtles, the indicators demonstrate both No Net Loss and Net Gain, taking conservation measures into account.



Associated management and monitoring plans or documents

- Sea Turtles Monitoring Program
- Marine Monitoring Plan

IMPACT

DECLINE IN HABITAT SUITABILITY FOR ALL NEAR-SHORE MARINE SPECIES

The GNA ITPP I also influences the marine environment, as it requires seawater for the cooling tower and desalination plant for internal use, in addition to generating effluents, which are disposed of through a single return line. However, this influence could be considered to be indirect and these impact-generating aspects associated directly with the operation of the LNGT. Both the water catchment for the LNGT and GNA TPP I activities, as well as the disposal of effluents, take place through structures associated with LNGT (respectively through a water main and spillway). During the operation phase, potential changes in the quality of water and marine sediments surrounding the project could occur mainly due to the release of effluents from the Liquid Natural Gas (LNG) regasification process at the FSRU, from the cooling system for the GNA TPP I and other associated processes, such as sewage. The disposal of effluents occurs jointly – LNGT + GNA TPP I – at the disposal point on the north jetty, potentially influencing the water and marine sediments at the site. Changes in the physical compartment can also occur during maintenance dredging involving sediment remobilization, altering water and sediment quality. Possible changes in water and sediment, in turn, have an impact on marine organisms. In addition, direct impacts on the biotic environment may occur, such as the availability of new substrates (with the presence of the FSRU), possible interactions of organisms with the seawater collection system or with vessels (whose traffic is associated with the LNGT operations) and even acoustic impacts that stem from the sounds emitted by the equipment used during the operation. For sea turtles, the emission of light is also an element that could cause impacts.



Photo: GNA Collection.

Mitigation Measure 16

MIXING SHIP COOLING WATER WITH HOT WATER OUTPUT FROM THE POWER PLANT TO MANAGE WATER TEMPERATURES PRIOR TO DISCHARGE INTO THE OCEAN



Impact to be mitigated

Negative effect on the adaptation of some species and/or marked increase in animal attraction caused by the disposal of thermal wastewater.



Implementation indicator(s)

Temperature of the water in the mixing zone at °C.



Desired outcome(s)

The variation in water temperature in the mixing zone must not exceed 3 °C of the ambient temperature (historically measured in the section, varying between 25.33 °C in summer, 22.53 °C in winter and 22.45 °C during cold fronts). In addition, in an effort to monitor the local conditions more reliably, given changes in the climate, a control point was established, outside the dispersion plume, according to modeling made for the subject, and monitoring is done by comparing the temperature in the mixing zone with the control point in real time. If the water temperature varies >3°C from the ambient ocean temperature at the control point, an alert will be issued and the output mechanism will need to be recalibrated.



Current status and evidence

Measure fully implemented. The FSRU operates by capturing seawater at room temperature to exchange heat with liquefied gas received from LNGC vessels at a temperature close to -162°C and turn it back into natural gas. The effluents from the TPP used to cool the plant are released at a warmer temperature. The implementation project was developed to direct both effluents to the same spillway, promoting the mixing needed to moderate water temperatures before being discharged into the ocean, as recommended in the World Bank Group's Environmental Health and Safety Guidelines for LNG facilities.

The outfall structure was completed in November 2020. In 2021, at the start-up of the TPP GNA I, the outfall began to discharge thermal wastewater. In early 2021, we hired a company to install an automatic water temperature monitoring system. The grid is composed of four sampling points in the mixing zone and an additional point that works as a control point (P5) outside the mixing zone to establish a comparison.

The baseline was established by averaging the measurements taken in previous monitoring campaigns that occurred between the historical summer and winter averages for the region, according to the GNA Environmental Impact Study (CPEA, 2017; JGP, 2020). It also follows the criteria established by CONAMA Resolution 430/11 and INEA Technical Note NT - 202.R-10/86.

As such, automatic monitoring has been ongoing since mid-March 2021, generating monthly reports and submitting data every 5 minutes to a system that can be seen online, at any time, by the GNA Environment team. The overall results suggest that, within the expected variation range, most of the variation observed at the sampling points is in line with the temperatures measured at the control point, indicating a major influence from the environmental conditions of the area. The temperature measured remained within the expected range.



No Net Loss/Net Gain

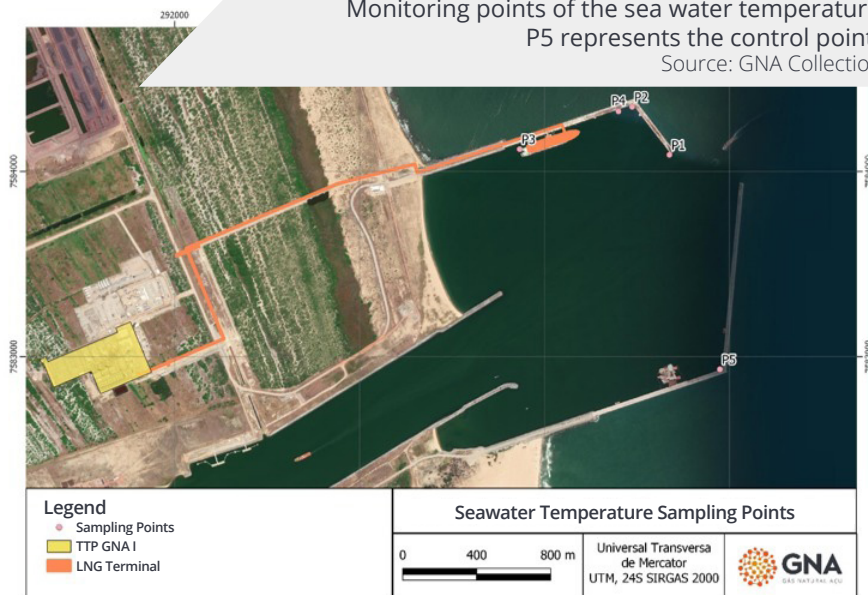
The indicators of this measure are needed to verify the absence of net loss. Based on the results from the monitoring reports, it can be inferred that the measures established to balance thermal discharges are being done properly and are helping to prevent the Net Loss of biodiversity. So far, no disturbance due to thermal wastewater discharge has been recorded.



Associated management and monitoring plans or documents

- Wastewater management technical instruction
- Ship effluent and waste management procedure
- Effluent Monitoring and Control Program – GNA TPP I and LNGT
- Marine Sediments and Water Quality Monitoring Procedure
- Seawater temperature monitoring procedure

Monitoring points of the sea water temperature.
P5 represents the control point..
Source: GNA Collection.



Mitigation Measure 17

IMPLEMENTATION OF ANTI-ENTRAINMENT STRUCTURE FOR MARINE LIFE (SEA CHEST) IN THE COOLING WATER INTAKE SYSTEM FOR THE FSRU AND THE POWER PLANT OPERATION



Impact to be mitigated

Death or injury of large marine animals resulting from the water intake process for FSRU and the TPP operations.



Implementation indicator(s)

Sea turtles or other large marine organisms pulled in and trapped by the water intake system.



Desired outcome(s)

There is no record of sea turtles or other large marine organisms sucked in or trapped by the FSRU water intake system. If sea turtles or other large marine organisms are pulled into the water intake system, the sea chest needs to be redesigned.



Current status and evidence

Measure fully implemented. The opening of the FSRU seawater intake system is 5 m2 wide, which is enough to allow large marine animals to enter, causing injuries or deaths. To prevent this from happening, grids have been installed and the intake pump is located away from the grid. In addition, the water intake flow was set to decrease the likelihood of medium and large animals being attracted to the movement of water.

Measures were put in place to verify potential negative impacts from fauna interactions with FSRU and LNGT structures, such as registering sea turtles with atypical behavior around the FSRU or vessels that provide services to GNA. The key initiatives are:

- Instruction on collecting carcasses of marine fauna specimens (sea turtles and cetaceans) that happen to appear in the LNGT area and proper disposal to the Port of Açú Sea Turtles Monitoring Program

- Use of complementary information resulting from maintenance activities, inspections and other environmental monitoring involving image recording (such as remotely operated underwater vehicles, scuba diving etc.) on the FSRU hull and LNGT structures
- Inspections carried out twice a day by the Emergency Brigade in the LNGT area to record, among other activities, the presence of birds and sea turtles
- Stepped-up training for employees and promotion of GNA's biotic monitoring plans, procedures, programs and protocols

Records indicate that, as of December 2022, no evidence of impacts on marine fauna from the FSRU water intake system has been documented. Sea turtles continue to be commonly sighted around the FSRU and LNGT displaying typical behavior. Data from other marine monitoring programs conducted by GNA consultants further report sea turtles carrying out normal activities in the region. Any sea turtle death needs to be investigated, with a necropsy performance as established by the Sea Turtles Monitoring Program, and analyzed any possible relation with the FSRU's water intake process, being the data used, if necessary, to reevaluate the anti-entrainment system installed.



No Net Loss/Net Gain

This measure contributes to the goal of No Net Loss of GNA projects. However, the real efficiency cannot be assessed directly due to the infeasibility of monitoring in the water intake area owing to the associated risk. Accordingly, the No Net Loss assessment should be tracked by the associated monitoring plans.



Associated management and monitoring plans or documents

- Sea Turtles Monitoring Procedure
- Marine Monitoring Plan



Photo: GNA Collection.

Mitigation Measure 18

WATER QUALITY MANAGEMENT



Impact to be mitigated

Water quality affected by the operation of the FSRU, GNA TPP I and the associated wastewater and thermal discharges.



Implementation indicator(s)

Diversity and relative abundance of marine fish, plankton and benthic communities and local fisheries catch per unit effort. The baselines for assessing the indicators are established in the Marine Monitoring Plan and the Fisheries Monitoring Plan/ GNA – Port of Açu, respectively, and consider as initial scenario the absence of the FSRU operation.



Desired outcome(s)

No statistically significant differences are expected to be found between the situation existing before and after the start of the operation of the GNA projects. If there are statistically significant differences or downward trends in biodiversity values discovered, the monitoring needs to be checked, in addition to water quality controls and action plans established to implement corrective measures.



Current status and evidence

In order to establish a baseline of the situation prior to GNA and FSRU operations, campaigns were conducted in January and October 2020. The data generated is important to allow a comparison with previous, current and future values.

» Water and marine sediment quality

Since October 2020, quarterly water and marine sediment quality monitoring campaigns have been carried out (January, April, July and October). This monitoring also acts as a monitor of the efficiency of wastewater quality control and thermal discharges from our operations. In addition, in order to understand the influence of the Paraíba do Sul river in the port area, two sampling points were added to the monitoring grid from October 2021 and have been under surveillance since then.

* Statistically significant detection of small to moderate changes is not feasible

As established by the Marine Monitoring Plan, the water and marine sediment quality variables established by CONAMA Resolutions 357/05 and 454/12, the results obtained in the monitoring of the LNGT, and the environmental impact assessment (EIA of the LNGT) are used as indicators. Historical data from the region (since 2015, therefore prior to GNA becoming operational), are being used to assess possible impacts on the area, including the range of variations found in the results in the region – historic maximum and minimum values.

The following aspects are checked to analyze water quality:

- **In situ** - pH, dissolved oxygen, salinity, electrical conductivity, turbidity, temperature, transparency and depth.
- **Chemical analysis:** Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), oils and greases, suspended solids, Total Organic Carbon (TOC), thermotolerant coliforms, metals and semi-metals, inorganic nutrients and hydrocarbons, and others.

In the sediments, metals and semi-metals, tributyltin, hydrocarbons, pesticides and granulometry are analyzed.



Sampling points of the Marine Water and Sediments Quality Monitoring Program.
Source: GNA Collection.



Campaign of the Marine Water and Sediments Quality Monitoring Program
Photos: Ethica Ambiental.

Results - Water

The results of the monitoring campaigns demonstrate that most of the variables are within the limits of CONAMA Resolution 357/05 – Class 1 Saline Water and are similar to those found in the survey carried out for the environmental licensing of the LNGT and other previous surveys in the field. It can be generally concluded that the physicochemical parameters analyzed are within the range reported by other studies in the region and considered normal for the type of water analyzed, with no differences between the points under the influence of the thermal plume, effluent discharge and boat maneuvers and the control points. Higher values historically found in the samplings, such as Zinc, Boron and Aluminum, may be due to the influence of the plume of the Paraíba do Sul river, and depending on the season, intense rains and strong winds that sweep the bottom sediments. The results obtained demonstrate that there is no need for adaptive management.

Results - Sediments

The sedimentary variables analyzed are within the limits of CONAMA Resolution 454/12 – Level 1 and are similar to the baseline of the EIA for the LNGT and those indicated in EHS (Environment, Health and Safety) guidelines for ports, anchorages and terminals. The particle size variations corroborate the existence of a sedimentary mosaic in the region, typically found on the inner continental shelf. The results obtained demonstrate that there is no need for adaptive management.

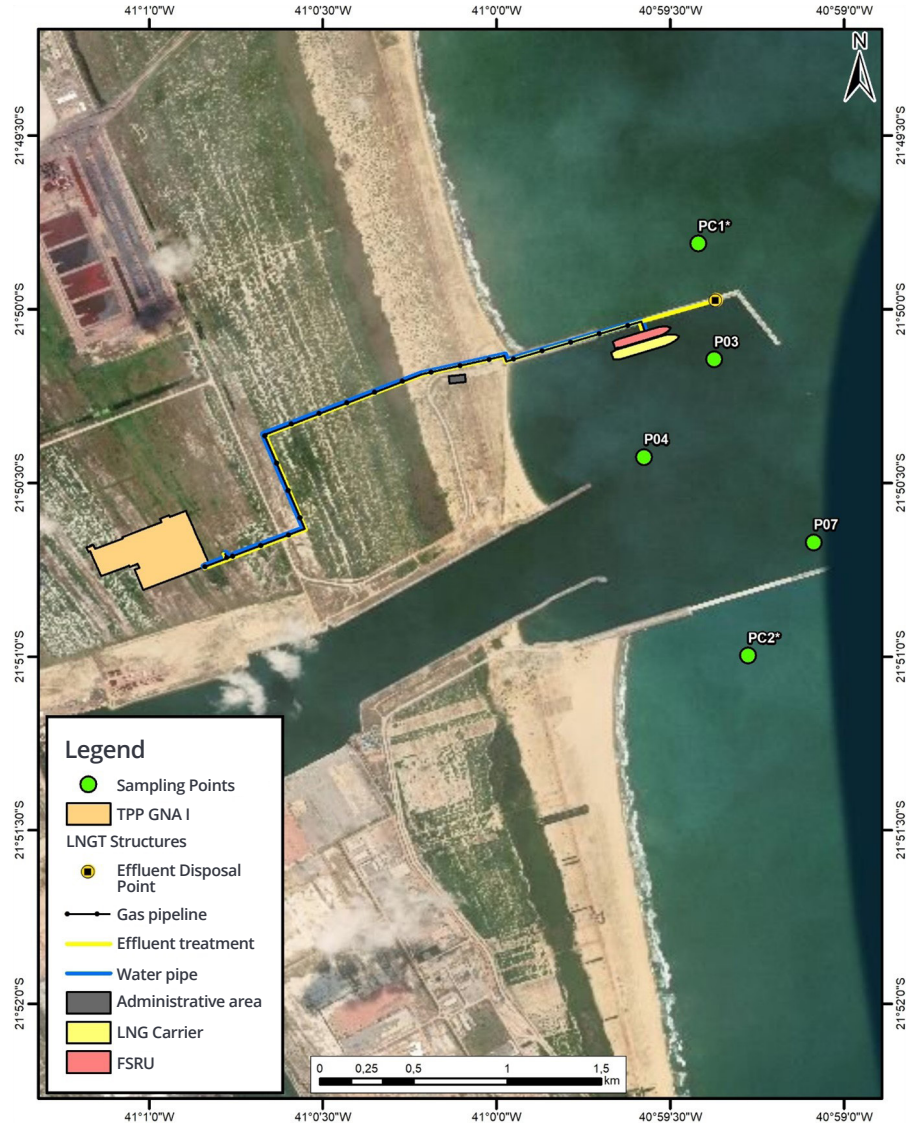
» Turbidity Monitoring

Results - Turbidity

Data collected during these monitoring campaigns indicate the existence of a temporary correlation between turbidity and the movement of LNGC (Liquefied Natural Gas Carriers) vessels involved in the supply of natural gas to the FRSU. There was a record of increased turbidity and concentration of total suspended solids at the two monitoring points established for this analysis, but both parameters returned to normal after 24 hours. As a result, it is possible to verify that the movement of the vessels does not influence the increase in turbidity and suspended solids in the water column over time and, therefore, there is no environmental impact. It is worth noting that the oceanographic and meteorological conditions of the region also have an influence on the turbidity levels for the navigation channel.

» Planktonic community

Planktonic community monitoring campaigns take place every six months in January and July. Data such as richness, density, relative abundance, diversity and equitability, which are the indicators established by the Marine Monitoring Plan, are analyzed.



Sampling points for planktonic community monitoring.
Source: GNA Collection.



Monitoring activities of the planktonic community.
Photos: Ethica Ambiental.

Results - Phytoplankton

The results found for density, relative abundance and ecological indices are similar to the campaigns carried out before the start of the operation, which shows that there is no need to establish adaptive management measures at this time. The species of phytoplankton algae identified in the area are common in the estuarine and coastal regions of Rio de Janeiro, and no species has been identified that had not previously been seen in these waters. No rare, exotic, endemic or threatened species were found either.

Indicators for phytoplankton monitoring (2019 to 2022)

Campaign	Richness (S)	Average Density (ind/mL)	More common taxa	Diversity (H')	Equitability (J')
April-19	69	196.6	Diatoms	1.26	0.53
Jul/19	116	44.0	Diatoms	1.13	0.71
Oct-19	99	51.0	Diatoms	1.62	0.71
Jan/20	87	330.4	Diatoms	1.16	0.55
Oct-20	75	36.0	Diatoms and dinoflagellates	1.50	0.76
Jan/21	58	814.0	Diatoms	1.31	0.65
April-21	48	190.3	Dinoflagellates and diatoms	0.70	0.42
Jul/21	66	79.6	Diatoms and dinoflagellates	1.61	0.85
Jan/22	72	60.8	Diatoms	1.64	0.73
Jul/22	39	3.6	Diatoms	0.89	0.90

Some of the most representative taxa include: *Pleurosigma inflatum*, *Coscinodiscopsis jonesiana*, *Prorocentrum micans*, *Paralia sulcata*, *Coscinodiscus radiatus*, *Nitzschia palea*, *Cyclotella meneghiniana* and *Prorocentrum lima*.

■ The baseline corresponds to samples in 2019 and 2020.

Results - Zooplankton

The results found for relative abundance and ecological indices are similar to the campaigns carried out before the start of the operation and in the campaigns during the same period (winter), which demonstrates that there is no need for adaptive management at this time. The species recorded are prevalent in environments along the southeast coast of Brazil. No rare, exotic or threatened species have been found.

Indicators for zooplankton monitoring (2019 to 2022)

Campaign	Richness (S)	Average Density (ind./m ³)	More common	Diversity (H')	Equitability (J')
April-19	31	724.5	Copepoda, Cirripedia and Mollusca	2.19	0.74
Jul-19	42	5,983.3	Copepoda	1.70	0.55
Oct-19	39	4,069.6	Copepoda, Mollusca and Anellida	2.18	0.72
Jan-20	27	1,185.0	Copepoda and Cirripedia	2.01	0.72
Oct-20	34	8,408.1	Copepoda, Cirripedia and Mollusca	2.17	0.72
Jan-21	21	278.8	Copepoda, Cirripedia and Mollusca	1.98	0.76
April-21	24	1,133.6	Copepoda, Cirripedia and Mollusca	1.31	0.48
Jul-21	38	7,206.5	Copepoda, Cirripedia and Mollusca	2.00	0.64
Jan/22	27	346.2	Copepoda	1.95	0.70
Jul/22	26	23,251.6	Copepoda	1.60	0.60

Some of the most representative taxa include: *Paracalanus quasimodo*, *Parvocalanus crassirostris*, *Acartia liljeborgi*, *Oithona hebes*, *Temora turbinata* and *Sagitta* sp.

Results - Ichthyoplankton

Variations were observed throughout the monitoring campaigns, but the levels occurred in ranges that had been found in the monitoring history, which suggests that they occurred due to seasonal variations, sea currents, the presence of predators and more or less favorable conditions to fish reproduction in the region. As a result, there has been no need for adaptive management up to this time. No families of rare, exotic, endangered or endemic fish larvae have been verified.

Indicators for monitoring ichthyoplankton (2019 to 2022)

Campaign	Richness (S)	Eggs average Density (eggs.100m ³)	Larvae (larvae.100m ³)	More common	Diversity (H')	Equitability (J')
April-19	6	76.5	5.2	Blenniidae, Haemulidae Sparidae	0.46	0.82
Jul-19	4	45.6	2.7	Gerreidae, Blenniidae and Engraulidae	0.57	0.89
Oct-19	9	114.0	32.3	Engraulidae, Blenniidae and Gobiidae	1.12	0.70
Jan-20	6	158.9	9.4	Engraulidae, Sciaenidae and Haemulidae	0.56	0.64
Oct-20	7	67.5	28.8	Engraulidae, Sciaenidae and Blennidae	1.18	0.81
Jan-21	7	388.2	4.6	Carangidae, Gerreidae and Gobiidae	0.19	0.60
Jul-21	4	204.7	6.1	Engraulidae, Sciaenidae and Blennidae	0.58	0.83
Jan-22	2	91.9	1.1	Sciaenidae and Blennidae	0.00	0.00
Jul-22	6	144.5	3.1	Clupeidae, Sciaenidae, Blenniidae, and Gobiidae	0.82	0.96

■ The baseline corresponds to samples in 2019 and 2020.

Some of the most representative taxa include: *Cynoscion* sp., *Blennidae*, *Brevoortia* sp., *Gobiidae*, *Scianidae* and *Engraulidae*.

» Benthic community

Similar to the planktonic community, monitoring campaigns for the benthic community occur twice a year, in January and July. Data such as richness, density, relative abundance, diversity, equitability and dominance are analyzed, which are the indicators established by the Marine Monitoring Plan.



Sampling for the Marine Biota Monitoring Program.
Photo: Ethica Ambiental.

Ecosystem:
Atlantic Rain Forest - RestingaEcosystem:
FreshwaterEcosystem:
Coastal

Sampling points for the soft-bottom benthic monitoring.
Source: ETHICA RT04/2022.

Results - Soft-bottom benthic macrofauna

The results show that the community structure remains similar to what had been observed before the start of operations activities. The soft-bottom benthic macrofauna found in the region is composed of species observed along the Brazilian coast. No families of rare, exotic, threatened or endemic species were verified.

Indicators for soft-bottom benthic monitoring (2019 to 2022)

Campaign	Richness (S)		Average Density (ind./m ³)	More common	Diversity (H')	Equitability (J')	Simpson Dominance
	Average	Total					
Oct-19	7	76	392	Annelida, Arthropoda and Mollusca	1,12	0,56	0,36
Oct-20	8	80	385	Annelida, Mollusca and Arthropoda	1,49	0,77	0,28
Jan-21	8	65	401	Annelida, Arthropoda and Mollusca	1.55	0.84	0.22
Jul-21	11	104	576	Annelida, Mollusca and Arthropoda	1.72	0.81	0.21
Jan-22	9	71	1,118	Annelida, Mollusca and Arthropoda	1.38	0.72	0.32
Jul-22	9	74	739	Annelida, Mollusca, Nemertea and Arthropoda	1.47	0.75	0.27

■ The baseline corresponds to samples in 2019 and 2020.

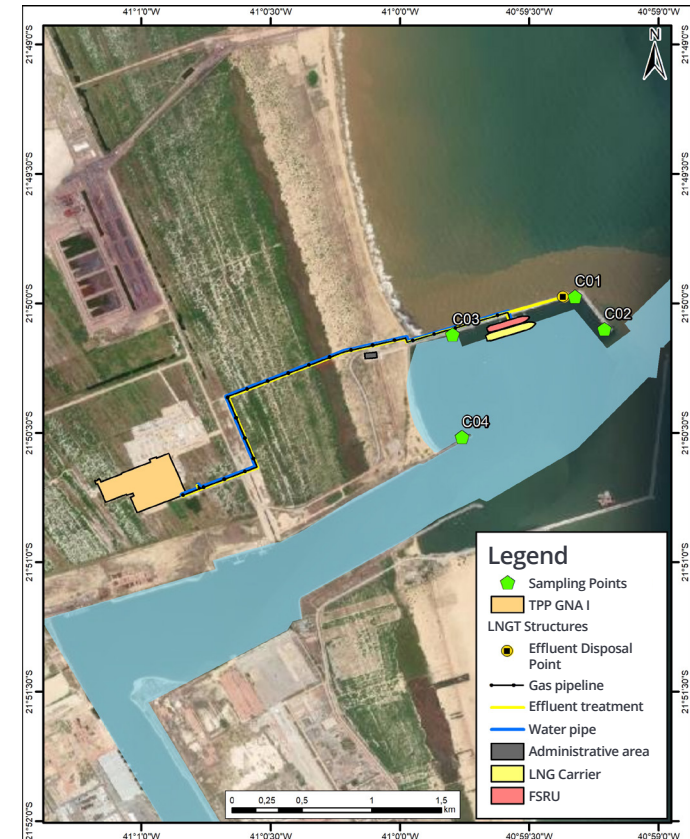
Results - Hard Bottom benthic macrofauna

Spatial comparisons of the hard bottom benthic macrofauna generally pointed out that there was no variation in density, as well as no significant variation in diversity, suggesting that the community develops in a similar way to the scenario prior to the implementation of GNA projects in the region. No rare, endemic or threatened species have been found in the coastal area. As for the exotic species, *Phallusia nigra* and *Isognomon bicolor* were identified in all sampling points, in addition to *Eualetes tulipa*, a gastropod of the Vermetidae family. It is important to mention that there are records of the presence of the coral *Tubastraea coccinea*, popularly known as sun coral in the Port of Açu region, which may hinder the development of the native hard bottom benthic community. The results of this program are also used in handling measure 19, detailed in this document.

Indicators for benthic monitoring of consolidated substrate (2019 to 2022)

Campaign	Richness (S)	Density (In./m ²)	Relative Abundance (%)	Diversity (H')	Equitability (J')
Jul/19	91	718,355.56	<i>Balanus</i> sp., <i>Chthamalus</i> sp., <i>Leptocheliidae</i> sp., <i>Trypanosyllis</i> sp., <i>Corophium</i> sp. and <i>Elasmopus levis</i>	2.57	0.86
Jan/20	68	619,466.67	<i>Balanus</i> sp., <i>Leptocheliidae</i> sp., <i>Chthamalus</i> sp., <i>Corophium</i> sp., <i>Trypanosyllis</i> sp. and <i>Cheiriphotis</i> sp.	2.41	0.70
Jan/21	68	972,666.67	<i>Elasmopus levis</i> , <i>Balanus</i> sp., <i>Ampithoe</i> sp., <i>Megabalanus</i> sp., <i>Cheiriphotis</i> sp. and <i>Leptochelia</i> sp.	1.68	0.69
Jul/21	81	1,469,866.67	<i>Photis</i> sp., <i>Quadrimaera</i> sp., <i>Brachidontes exustus</i> , <i>Syllis</i> sp., <i>Cheiriphotis</i> sp. and <i>Dulichella</i> sp.	2.62	0.75
Jan/22	85	1,496,800.00	<i>Leptochelia</i> sp., <i>Megabalanus</i> sp., <i>Chthamalus</i> sp., <i>Elasmopus</i> sp., <i>Cheiriphotis</i> sp. and <i>Photis</i> sp.	2.73	0.78
Jul/22	89	1,172,933.33	<i>Balanus</i> sp., <i>Megabalanus</i> sp., <i>Brachidontes exustus</i> , <i>Leptochelia</i> sp., <i>Elasmopus</i> sp. and <i>Chthamalus</i> sp.	2.77	0.77

■ The baseline corresponds to 2019 and 2020.



Sampling points of the Marine Biota Monitoring Program – Hard-bottom Benthic community.
Source: GNA Collection.

Results - Sandy beaches benthic community

Carried out in the implementation phase of our projects to fulfill the mandatory requirement of environmental licensing, monitoring of the sandy beaches benthic community is not part of the requirements for the operational phase. However, due to its relevance, we decided to maintain it, as a complementary element to the other analyzes. They follow the same indicators established for monitoring the other benthic communities.

The results of the monitoring campaigns reveal that the ranges found for density, relative abundance and ecological indices are similar or higher than those recorded before the start of the operation.

The multivariate analyzes allowed us to observe significant differences for abundance and variety of the community found in the external and internal area of the channel. The community showed spatial variability patterns in response to hydrodynamic, anthropic and mainly natural factors, without the need for adaptive management.

Molluscs were found in the monitoring area, including the bivalve *Donax hanleyanus*, which appears on the List of Threatened Fauna of Rio de Janeiro as “endangered”, crustaceans thalitrid and cyrolanoid, as well as opportunistic polychaetes. These records can be used as bioindicators of the quality of the environment in the assessment of the community's response to the activity developed in the monitored area. No rare, endemic, exotic or threatened species were observed at the national level.

Indicators for benthic monitoring (2019 to 2022)

Campaign	Richness (S)		Average Density (ind./m ³)	More common	Diversity (H')	Equitability (J')	Simpson Dominance
	Average	Total					
Jul-19	5	10	1,213	Annelida, Platyhelminthes and Nemertea	0.98	0.66	0.45
Oct-19	5	11	1,277	Annelida, Arthropoda and Nemertea	0.89	0.62	0.51
Jan-20	6	11	998	Annelida, Arthropoda and Nemertea	1.28	0.75	0.35
Oct-20	6	11	1,603	Annelida, Nemertea and Platyhelminthes	1.03	0.65	0.46
Jan-21	6	16	699	Annelida, Platyhelminthes and Arthropoda	1.35	0.76	0.32
Jul-21	7	15	971	Annelida, Nemertea and Arthropoda	1.35	0.76	0.71
Jan-22	7	23	2,607	Annelida, Mollusca, and Platyhelminthes	0.98	0.49	0.53
Jul-22	5	14	429	Annelida, Nemertea, and Platyhelminthes	1.18	0.72	0.39

■ The baseline corresponds to samples in 2019 and 2020.

» Ichthyofauna

Ichthyofauna monitoring campaigns take place twice a year, in January and July. Species richness, diversity, equitability and dominance are analyzed — indicators established by the Marine Monitoring Plan. It should be pointed out that all vessels used in our monitoring are inspected prior to field work using a specific checklist.



Sampling of
ichthyofauna.
Photo: GNA Collection.

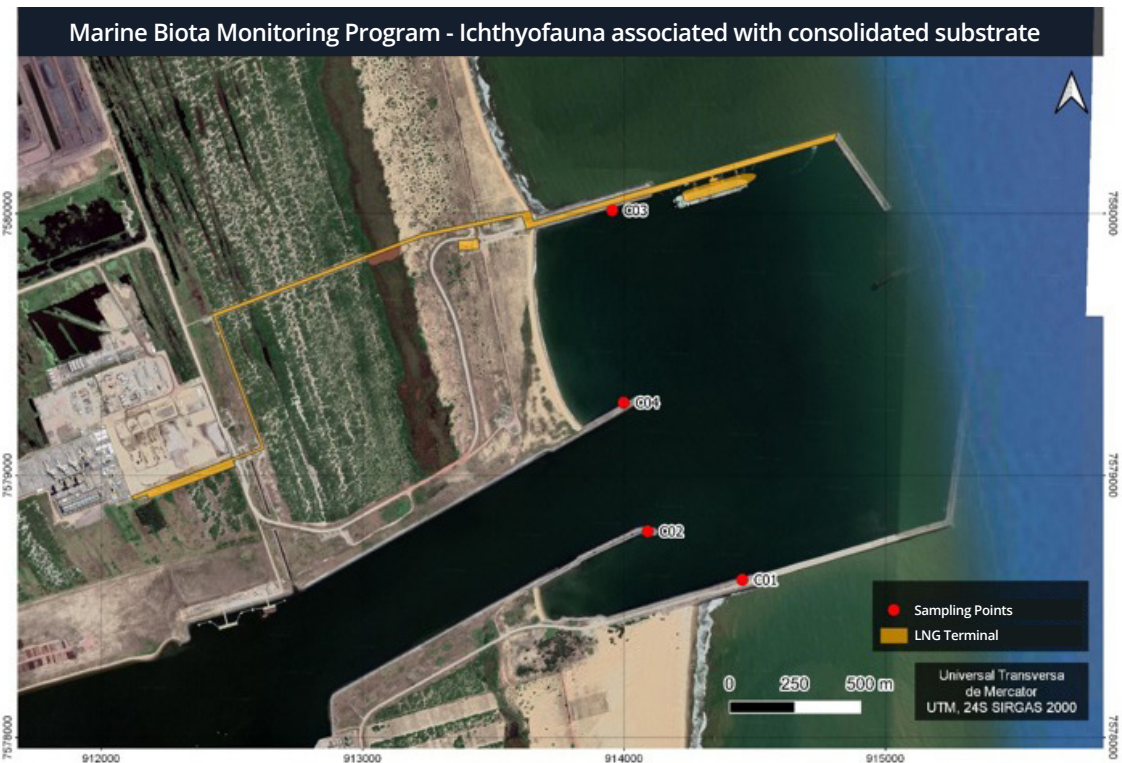


Sampling of
ichthyofauna.
Photo: Ethica Ambiental.

Results - Ichthyofauna associated with the hard-bottom

With regard to monitoring the ichthyofauna associated with the hard-bottom, sampling is done at four sites, two of which coincide with the consolidated (hard) bottom benthic fauna monitoring. It is also worth noting that adaptive management was applied involving the relocation of two sampling points to areas with a similar substrate to the others: formed by rocks, with recesses and refuges for fish and other organisms in the reef fish food chain. After relocation, the sampling performed satisfactorily in terms of monitoring, proving the effectiveness of the adaptive management adopted.

Acanthurus coeruleus was among the most frequent recorded species (28%). Most species are commercially important and represent reef fish.



Sampling points of the Marine Biota Monitoring Program - Ichthyofauna associated with consolidated substrate.
 Source: GNA Collection.

* Resultados da campanha de julho de 2022.

Results - Ichthyofauna, benthic epifauna and commercial shrimp

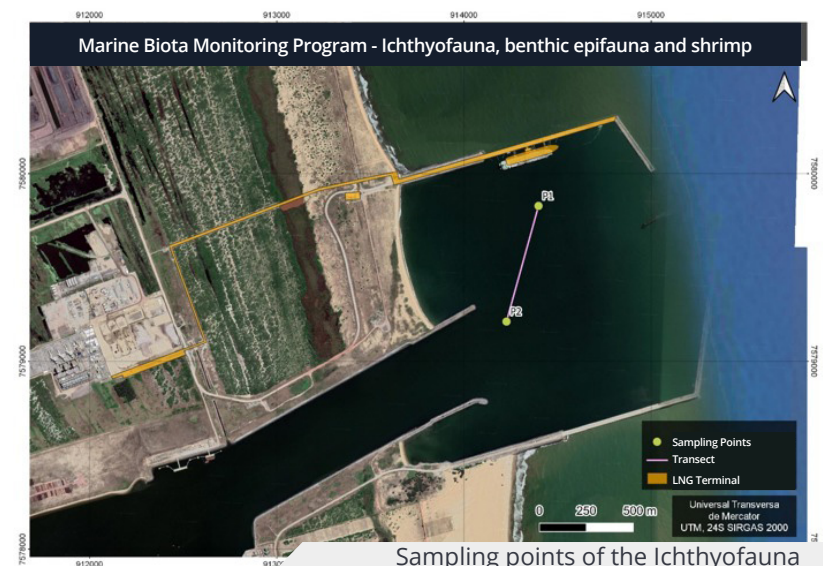
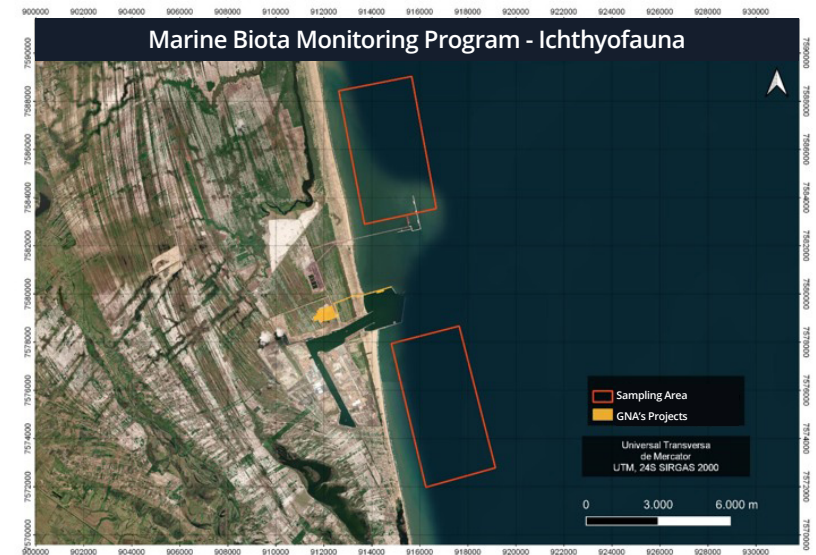
For the monitoring of ichthyofauna, benthic epifauna and shrimp for commercial use, the results point to rates similar to, or even higher, than those of campaigns done before the GNA projects became operational. Sampling is performed in two areas outside the navigation channel and within the same channel, considering areas with a higher probability of capture, according to the behavior of the local fishing activity.

In terms of ecological indices, species richness showed a significant result in temporal terms, with the 2021 campaigns being those with the highest values.

Regarding the benthic epifauna, nine species distributed in three phyla were identified: Arthropoda, Echnodermata and Mollusca.

In relation to shrimp for commercial use, only one species – *Xiphopenaeus kroyeri* (camarão sete-barbas) - was identified. Shrimp population parameters such as total length – TL (mm) and carapace – Cc (mm), weight (g) and sex are specific indicators for this group.

No rare, endemic or exotic species have been recorded.



Sampling points of the Ichthyofauna Monitoring Program.
Source: GNA Collection.

Indicators for the monitoring of ichthyofauna (2019 to 2022)

Campaign	Richness (S)	N	Catch Per Unit Effort (CPUE) Total (g/h)	More common	Diversity (H')	Equitability (J')
Jul-19	7	25	3,456.41	Aspistor luniscutis and Bagre bagre	0.33	0.90
Oct-19	10	35	3,407.55	Isopisthus parvipinnis and Macrodon ancylodon	1.28	0.85
Jan-20	16	131	60,733.84	Cathorops spixii, Macrodon ancylodon, Stellifer rastrifer and Paralanchurus brasiliensis	0.93	0.97
Oct-20	3	5	646.08	Symphurus tessellatus	0.47	0.43
Jan-21	14	58	4,939.31	Cathorops spixii, Stellifer brasiliensis, S. rastrifer and Paralanchurus brasiliensis	1.93	0.86
Jul-21	10	92	2,894.17	Pellona harroweri Isopisthus parvipinnis and Peprilus paru	1.49	0.70
Jan-22	8	92	1,815.33	Isopisthus parvipinnis, Stellifer brasiliensis and Symphurus tessellatus	1.61	0.95
Jul-22	10	304	10,842.47	Stellifer brasiliensis and Stellifer rastrifer	1.28	2.05

■ The baseline comprises the samplings in 2019 and 2020.

Indicators for shrimp monitoring (2019 to 2022)

Campaign	Catch Per Unit Effort (CPUE) Total (kg/h)	Average length (mm)	Average weight (g)
Jul-19	2.07	71.70	2.40
Oct-19	0.40	71.70	4.54
Jan-20	6.00	56.07	5.80
Oct-20	0.07	69.01	1.84
Jan-21	3.33	81.23	2.12
Jul-21	4.71	60.87	3.92
Jan-22	2,016.00	45.48	2.32
Jul-22	0.97	63.28	3.25

■ The baseline comprises the samplings in 2019 and 2020.



No Net Loss/Net Gain

These indicators are needed to verify the absence of net losses, especially after start-up of operations and releasing the thermal effluent. The results show that the measures established to control marine water pollution are contributing to avoid net losses. No disturbance capable of altering environmental quality and marine life has been detected.



Associated management and monitoring plans or documents

- Water quality and marine sediments monitoring procedure
- Seawater temperature monitoring procedure
- Benthic community monitoring procedure
- Planktonic community monitoring procedure
- Ichthyofauna monitoring procedure
- Marine Monitoring Plan
- Fishery Monitoring Plan/ GNA – Port of Açú



Mitigation Measure 19

SHIP BALLAST OFF-SHORE EXCHANGE TO MINIMIZE THE RISK OF INTRODUCING INVASIVE ALIEN SPECIES



Impact to be mitigated

Decline in habitat quality due to the presence of invasive alien species, which can be introduced by ship traffic due to ballast water exchange, marine biofouling or accidental transportation. In addition, the GNA Environmental Impact Study identified the existence of marine exotic species in the region where our projects have been implemented.

The monitoring was focused on the species *Tubastraea coccinea*, known popularly as sun coral, listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Sun coral competes with other benthic invertebrates for space in the fixation substrate and is considered aggressive due to its high reproductive capacity. Their presence can lead to the exclusion or extinction of native species, especially sponges and corals, compromising the entire native ecosystem.

Despite the focus on sun coral, it should be mentioned that the monitoring actions adopted, including the detection methodology, are also applicable to other invasive organisms and fouling flora.



Implementation indicator(s)

Density of invasive sun coral per square meter.



Desired outcome(s)

To maintain a density of less than 2 specimens of sun coral per square meter in the sampling areas defined by the Marine Bioinvasion Monitoring Plan. If a higher density is documented than desired, actions have to be implemented such as: removing, increasing the frequency of removal, giving greater attention to biofouling and reinforcing compliance with ballast exchange requirements for ships entering the port to fuel the GNA operation.



Current status and evidence

Measure implemented with the creation of the Ballast Water Control Procedure, required for all ships that provide service to GNA and with the preparation and implementation of the Marine Bioinvasion Monitoring Plan, which involves four procedures: Diagnosis of marine biofouling, Biofouling removal, Biofouling monitoring, and Ballast water management, in addition to being related to procedures in the Marine Monitoring Plan.

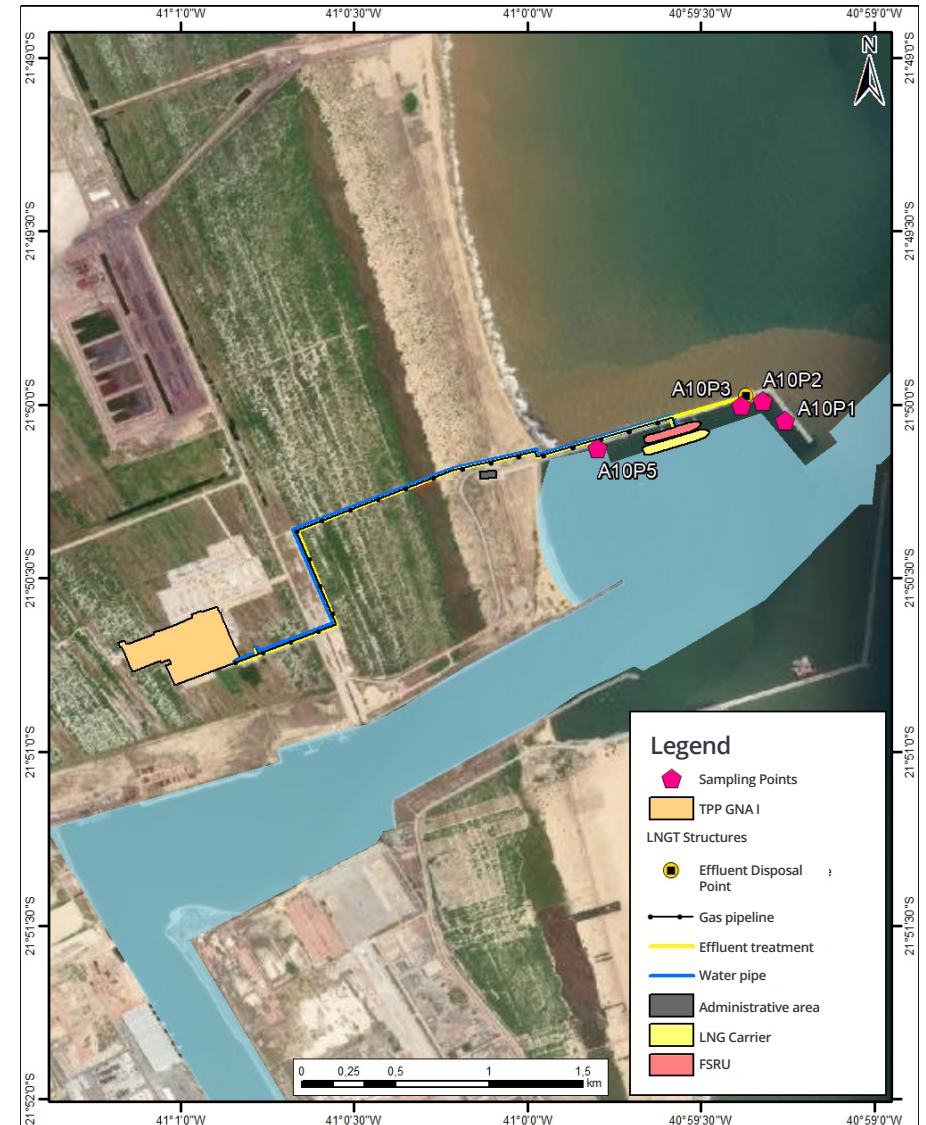
Results of these actions include:

» Sun coral monitoring

The monitoring plan for the presence of sun coral in Port of Açú was revised in November 2020 and included new areas, such as the channel and north jetty; the latter related to the LNGT. The diagnosis resulting from the visual monitoring performed in 2020 revealed a trend of colonization stability in the northern pier with density/m² values that were lower than those observed in the monitoring performed in 2018.

Sun coral density at monitoring points

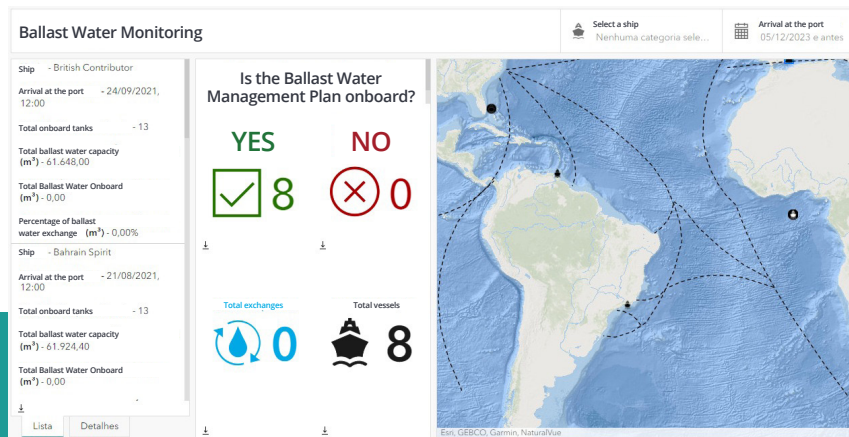
Monitoring point - North Jetty (LNGT)	Density
A10P1	1/m ²
A10P2	< 0.5/m ²
A10P3	< 0.5/m ²
A10P4	< 0.5/m ²
A10P5	0/m ²



Sampling points for detecting the presence of sun coral in the LNG terminal.
Source: GNA Collection.

» Exchanging ship ballast

From the initial liquefied natural gas cargo up to the end of 2022*, we received eight LNGC ships from countries like the United States (three), Trinidad and Tobago (two), Colombia (one) and from other ports in Rio de Janeiro (two). None of them exchanged ballast around the Port of Açu region.



» Ballast Water Monitoring

Dashboard created to support ballast water exchange management, demonstrating that there were no ballast water exchanges in 2022.

» Ballast Water Management System

Form created to input data into the ballast water management system.
Source: GNA, 2021.

It is worth noting that the ballast exchange data are registered in a computerized system whose fields are based on the Ballast Water Form of the Brazilian Navy, a federal agency and government authority responsible for this control.

* The last LNGC arrival was in February 2022.

» Biofouling inspection on the hull of the FSRU BW Magna

In April 2021, an underwater visual inspection was conducted on the submerged structures (hull) of the FSRU BW Magna. 21 locations were inspected and the presence of sun coral was confirmed in one of them. Specimens were classified as “localized distribution” and with “low population density” (1 – 24% coverage of the point where it was found).



No Net Loss/Net Gain

This indicator is supporting information and does not apply to verify No Net Loss/Net Gain. However, the measure helps achieve No Net Loss over the duration of GNA's projects. Based on a prior diagnosis, invasive species have already been identified in Port of Açu prior to the installation of the GNA project, so a joint effort is needed to effectively control marine invasive alien species and prevent the net loss of biodiversity in the area.



Associated management and monitoring plans or documents

- Technical Instructions for Ship Ballast Control
- Marine Bioinvasion Monitoring Plan

Mitigation Measure 20

REMOVAL OF INVASIVE MARINE SPECIES FROM LNGT AREA AND FSRU BW MAGNA



Impact to be mitigated

Decline in habitat quality due to the presence of invasive alien species.

This measure is complementary and interdependent with Mitigation Measure 19 and its details are described in the respective item (page 87).

It is worth noting that there are specific guidelines for the removal of invasive alien species if they are located in the LNGT or during routine cleaning activities on the hull and sensitive areas of the FSRU BW Magna. Considering that both facilities are within the Port of Açu Complex, removal actions need to adhere to the protocols established by the port management company and be previously approved by it. This definition takes the applicable legislation and the Marine Invasive Species Monitoring Plan into account, and is supported by specialized technical consultants. The removal work needs to be performed by a licensed company with proven experience in the removal of encrusting organisms.

In the case of removing *Tubastraea coccinea*, the disposal of waste will follow the Alien Species Prevention and Control Plan (PPCEX, its acronym in Portuguese, *Plano de Prevenção e Controle de Espécies Exóticas*) and applicable legislation, and will be performed by a company that is certified and licensed for this activity.

Mitigation Measure 21

ROCK PIER CONSTRUCTION INCREASES HABITAT AVAILABILITY FOR HARD-BOTTOM MARINE SPECIES



Impact to be mitigated

Decline in the quality of the marine habitat due to the presence of GNA projects.



Implementation indicator(s)

Occurrence of fish species populations associated with the hard-bottom habitat in the North Jetty area. This structure, required for our operations, represents an increase in the availability of habitat for hard-bottom marine species, which can be confirmed with the increase in the number of organisms, threatened and endemic species.



Desired outcome(s)

Presence of any population of fish species associated with the hard-bottom habitat, helping to boost diversity and the abundance of native species. If no native fish species come to inhabit the habitat created by the construction of the pier, water quality monitoring and controls need to be reviewed and action plans put in place to mitigate any possible water contamination. On the other hand, the structure of the pier can provide a habitat for alien species. This means that the effect of pier construction on marine life should be monitored.

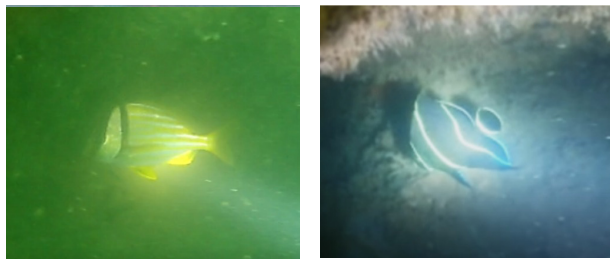


Current status and evidence

Measure fully implemented. The pier (*Molhe Norte*) was built using rocks and the Marine Monitoring Plan was created, which included the determination of sampling sites for the ichthyofauna associated with the consolidated substrate. The first monitoring campaign took place in January 2020. Fish associated with the hard-bottom were sampled through visual inspections using dives along four 100m x 2m transects. A every six-month interval was established, but no monitoring took place in July 2020 due to the Covid-19 pandemic. Adaptive management was done for this monitoring to improving the group's sampling results, as mentioned in measure 18. Consequently, it was possible to observe specimens at all the defined monitoring points in the July 2022 campaign. Although the density of fish was higher during the summer, the July 2022 season saw the second highest average density among the historical series (0,31 Ind.m²).

Result of the hard-bottom associated ichthyofauna species monitoring.

Campaign	Species Richness (S)
January/2020	10
July/2020	Monitoring not conducted due to Covid-19 pandemic
January/2021	8
July/2021	3
January/ 2022	6
July/2022	12



Species recorded during the campaigns of the Marine Biota Monitoring Program - Ichthyofauna associated with consolidated substrate. Photos: Ethica Ambiental.



Species recorded during the campaigns of the Marine Biota Monitoring Program - Ichthyofauna associated with consolidated substrate. Photos: Ethica Ambiental.

The record of species associated with the hard-bottom habitat continues to show the establishment of an ichthyofauna community inside the jetties of Port of Açu navigation channel. No endemic or threatened species were recorded, but the localized species are vital in terms of commercial/fishing.

* The sampling points for this measure are the same as those on the map shown on page 84.

Among the species already recorded are:

- *Abudefduf saxatilis* (Sargentinho)
- *Acanthurus coeruleus* (Cirurgiã-azul)
- *Anisotremus surinamensis* (Sargo de beijo)
- *Anisotremus virginicus* (Salema)
- *Caranx latus* Agassiz (Xerelete)
- *Cathorops spixii* (Bagre-gonguito or Bagre-amarelo)
- *Chaetodipterus faber* (Peixe enxada)
- *Isopisthus parvipinnis* (Pescada branca)
- *Larimus breviceps* (Oveva)
- *Lutjanus jocu* (Vermelho)
- *Mugil sp* (Tainha)
- *Nebris microps* (Pescada-banana)
- *Odontognathus mucronatus* (Sardinha)
- *Pellona harroweri* (Sardinha)
- *Pomacanthus arcuatus* (Parú-cinza)
- *Sparisoma sp.* (Escaro)
- *Stellifer brasiliensis* (Cangoá)
- *Stellifer rastrifer* (Cangoá)
- *Symphurus tessellatus* (Língua-de-mulata)
- *Trichiurus lepturus* (Peixe-espada)

» Prevention of reproductive colonies of seabirds in the LNGT

Following the sighting of *Thalasseus acuflavidus eurygnathus* (a seabird known in Brazil as trinta-réis-de-bando) in the LNGT structures, an action plan was developed in order to prevent bird breeding colonies from forming, which can pose risks for the operation and for the birds.

The action plan includes:

- Theoretical and practical training for brigades and environmental teams
- Removal of reproductive pairs
- Rescue of nests

Consequently, two training sessions on the topic have been held for the Environmental and Emergency Brigade teams. During the reproductive season, members of the brigade drive breeding pairs away using visual and acoustic methods. These actions take place each day, in the early morning and late afternoon when the birds are most active. To date, many specimens have been observed approaching the LNGT area with the sole purpose of feeding. Since 2018, only one egg has been laid (in 2021), which was predated, without the establishment of a reproductive colony. A preventive plan was drawn up in the event of any establishment of a reproductive colony in the coming seasons.

Action plan for *Thalasseus acuflavidus* established according to the lessons learned during the 2021 monitoring and relocation procedure

Months	Probability of establishing a reproductive colony	Actions in the event of encountering eggs/hatchlings in the LNGT
Jan - Mar	Very Low	Eggs and nest rescue and veterinary care.
April-June	High	Drive reproductive pairs away. Rescue and translocation to a safe location for birds.
Jul	Medium	Established reproductive colony: Rescue and translocation to a safe location for birds. Unestablished reproductive colony: rescue and veterinary care.
Aug-Sep	Low	Established reproductive colony: Rescue and translocation to a safe location for birds. Unestablished reproductive colony: rescue and veterinary care.
Oct-Dec	Very Low	Eggs and nest rescue and veterinary care.

Photo: Jéssica Neves.





Photo: GNA Collection.



No Net Loss/Net Gain

This indicator is required to evaluate the No Net Loss/Net Gain targets. The discovery of substantial larval specimens and fish species associated with the soft-bottom habitat shows evidence of Net Gain, especially for the establishment of the ichthyofauna community. Furthermore, the procedure for monitoring and driving away *Thalasseus acutiflavus* has played an important role in preventing net losses to biodiversity.



Associated management and monitoring plans or documents

- Ichthyofauna Monitoring Procedure
- Marine Monitoring Plan
- Monitoring of Nests in the LNLT (*Thalasseus acutiflavus*)

04. BAP: FINAL REMARKS

The consolidated balance of the first five years of implementing GNA's Biodiversity Action Plan (BAP), based on the indicators documented by the Biodiversity Management Plan (BMP) and Biodiversity Monitoring and Evaluation Plan (BMEP), demonstrates that GNA has been committed to achieving the relevant environmental outcomes agreed to between the parties as of the signing of the financing agreement.

The actions established are aligned with the mitigation hierarchy determined by Performance Standard 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources (PS6) of the International Finance Corporation (IFC), which initially includes preventing and minimizing impacts, followed by mitigation and compensation measures. The project is expected to generate a gain in biodiversity, as recommended in paragraph 18 of PS6 for critical habitat regions.

Among the 21 measures initially proposed, 20 have now been implemented. Only Mitigation Measure 4 is still in the feasibility analysis phase because it is not a GNA management issue. And, in terms of measures 19 and 20, established to control alien invasive species, especially *Tubastraea coccinea* (sun coral), we await the definition of removal actions to be determined by the port administrator (Porto do Açú Operations).

Even though most of the measures have been complied with, the work continues. Many of the actions implemented involve the execution of programs and plans for monitoring fauna, flora, limnic and marine biota, among others related to biodiversity and the environment. These are crucial surveys to validate the efficiency of the measures implemented and assess the occurrence of “No Net Loss” and “Net Gain” in biodiversity desired for our projects.

Given their relevance over the last five years, the monitoring plans were improved based on recommendations from independent audits and experts on the issues, including statistical analyzes that have provided a more accurate assessment of the net gain in the future and trends in biodiversity.

With the start of construction on the GNA TPP II, GNA’s BAP was updated to include impacts from this new structure. The new version was finalized in December 2022 and was approved in January 2023. This update led to changes in the BMEP and BMP, the list of Critical Habitat (CH) species and a revision of the indicators. As such, from 2024 onwards, data on GNA I & II BAP measures will be reported.

GNA maintains its commitment to comply with the requirements of the Performance Standards within the timelines stipulated in the BAP, making the needed efforts to mitigate and compensate for environmental impacts on habitats and local biodiversity values.



Photo: GNA Collection.

A photograph showing two people from behind, looking at a field of green plants. The person on the left is wearing a blue long-sleeved shirt with orange and white reflective stripes. The person on the right is wearing a grey long-sleeved shirt, a white high-visibility vest, and a green bucket hat. The background is a dense field of green plants with some yellow flowers.

05. SUMMARY: MITIGATION MEASURES

Check the summary of each mitigation measure established in the BAP.

BAP - MITIGATION MEASURES

/ SUMMARY OF IMPLEMENTING MITIGATION MEASURES

Biodiversity value affected	Mitigation Measure Number	Mitigation Measure	Indicator(s)	Indicator(s) use	Status of implementing the Mitigation Measure	Achievement of No Net Loss/Net Gain	Desired result(s)	Adaptive management	Overall assessment
Atlantic Rain Forest - Restinga	1	Installation of Firebreaks	Firebreaks installed	Support information	Fully implemented	Not Applicable	Spread of potential fire outbreaks prevented	Not required	No concern
Atlantic Rain Forest - Restinga	2	Recomposition and Conservation in the RPPN Caruara, of native restinga vegetation, at a minimum proportion of 1:1	Hectares planted at the RPPN Caruara, certified by regulatory agencies. # plant species% native speciesAverage plant height% canopy coverage	Required to verify net gain	57.7 hectares planted, which will be certified after four years of maintenance and monitoring. 100% of the planned area has been planted. # 79 species planted # 100% native species planted# Average height = 0.67 m for the Construction Site/ 0.63 m for the GNA I TPP / 0.58m for the LNGT.# canopy coverage = 28.24% for the Construction Site/28.53% for the GNA I TPP / 31.54% for LNGT	Progressing as planned to achieve net gain. Planting an area roughly 6x larger than the suppressed area. Progressing as planned to achieve Net Gain. Target species of native flora planted interacting with local fauna. Planting of 4 of the 6 threatened species of the local flora (Melanopsidium nigrum, Scutia arenicola, Inga maritima, and Erythroxylum ovalifolium).	>11 hectares* certified by regulators. >25 species** >95% Improving up to the 10th year of restoration. – assessed through a statistical analyses (correlations, regression, etc.) and by aerial or satellite imagery.	If the target areas are not able to satisfy the requirements for compensation, restoration techniques will have to be adapted	No concern

* Due to adjustments in the projects of the TPP GNA I, LNGT, and 345 kV TL, the total vegetation suppression area, originally 5.62 hectares, was adjusted to 9.50 hectares, and additional 1.28 hectares was suppressed based on HAZOP recommendations, totaling 10.78 hectares (≈11).

** Defined by Resolution 143/2017 of INEA/RJ.

BAP - MITIGATION MEASURES: CONTINUATION

Biodiversity value affected	Mitigation Measure Number	Mitigation Measure	Indicator(s)	Indicator(s) use	Status of implementing the Mitigation Measure	Achievement of No Net Loss/Net Gain	Desired result(s)	Adaptive management	Overall assessment
Atlantic Rain Forest - Restinga	2	Recomposition and Conservation in the RPPN Caruara, of native restinga vegetation, at a minimum proportion of 1:1	# restinga mammal species # restinga bird species # restinga herpetofauna species (Note: occurrence of critical habitat CH species)	Support information	Species associated with restinga in each taxonomic group occur in the restoration area. The species richness compared with other restinga habitats in Brazil.	Interactions of planted species with records of local herpetofauna, avifauna and mammals, suggesting a NG in areas under restoration.	Normal occurrences in the RPPN Caruara (as a whole) of native species associated with the restinga (sandbank). Statistical comparison over time between campaigns.	Not applicable	No concern
			Specialized written analysis on the effectiveness of restoration activities.		To be done 10 years after the completion of the plantings	It will be evaluated according to the progress of the restinga recovery.	Receive expert written analysis confirming that the restoration for the planted hectares is progressing as planned, supported by evidence of species composition and structure.	If restoration areas fail to meet progress targets towards Net Biodiversity Gain, GNA will adopt adaptive management measures to improve the restoration techniques.	
			Legal protection of the restoration area.		RPPN Caruara remains legally protected as a private reserve	Progressing as planned to achieve Net Gain.	RPPN Caruara is legally protected as a private reserve.	NA – Result Achieved	

BAP - MITIGATION MEASURES: CONTINUATION

Biodiversity value affected	Mitigation Measure Number	Mitigation Measure	Indicator(s)	Indicator(s) use	Status of implementing the Mitigation Measure	Achievement of No Net Loss/Net Gain	Desired result(s)	Adaptive management	Overall assessment
Atlantic Rain Forest - Restinga	3	Payment of Monetary Environmental Compensation	Payments (total of R\$ 31.8 million)	Support information	Fully complied with	Not applicable	Correct allocation and investment of funds in protected regional areas	Not required	No concern
			Funding from monetary environmental compensation invested in regional protected areas		Summary of expenses requested from the Operational Manager				
Atlantic Rain Forest - Restinga	4	Voluntary Participation in the "Green Belt" Program	TBD	Support information	Awaiting resumption of the project by Porto do Açú Operações	Not applicable	Creation of a vegetation transition zone between the industrial the Port of Açú Complex and the natural landscape, creating the possibility of connecting fragments of restinga in the region	Not applicable	Not applicable

BAP - MITIGATION MEASURES: CONTINUATION

Biodiversity value affected	Mitigation Measure Number	Mitigation Measure	Indicator(s)	Indicator(s) use	Status of implementing the Mitigation Measure	Achievement of No Net Loss/Net Gain	Desired result(s)	Adaptive management	Overall assessment
Atlantic Rain Forest - Restinga	5	Relocation of Fauna Species of Interest to Suitable Habitat	Individuals of each named species	Support information	<p>Fauna monitoring results:</p> <p>RPPN Caruara areas <i>Rhinella pygmaea</i> (01 record), <i>Caiman latirostris</i> (06 records), <i>Glaucomastix littoralis</i> (73 records), <i>Cerradomys goytaca</i> (18 records).</p> <p>Areas in the process of restoration <i>Glaucomastix littoralis</i> (04 records), <i>Rhinella pygmaea</i> (13 records), <i>Cerradomys goytaca</i> (02 records),</p> <p>Areas around GNA <i>Rhinella pygmaea</i> (30 records), <i>Caiman latirostris</i> (07 records), <i>Glaucomastix littoralis</i> (10 records), <i>Cerradomys goytaca</i> (05 records)</p>	Interactions of planted species with records of local herpetofauna, avifauna and mammals, suggesting a Net Gain in areas under restoration	<p>Individuals relocated to suitable habitat (unoccupied) in the RPPN Caruara</p> <p>Relocated individuals enrich populations in RPPN Caruara</p>	Not required	No concern
Atlantic Rain Forest - Restinga	6	Sandbank Habitat Restoration				See Mitigation Measure No2			
Atlantic Rain Forest - Restinga	7	Installation of Bird-Flight Diverters	Flight diverters installed in areas that pose a high risk for bird collisions	Support information	<p>Fully complied with</p> <p>The flight diverters were installed and monitoring campaigns were conducted.</p> <p>An action plan has been implemented</p>	Not applicable	Flight diverters installed in areas that pose a high risk for bird collisions	Not required	No concern

BAP - MITIGATION MEASURES: CONTINUATION

Biodiversity value affected	Mitigation Measure Number	Mitigation Measure	Indicator(s)	Indicator(s) use	Status of implementing the Mitigation Measure	Achievement of No Net Loss/Net Gain	Desired result(s)	Adaptive management	Overall assessment
Freshwater bodies	8	Installation of Oil Water Separators	Water and oil separator tanks installed	Support information	Fully complied with Monitoring campaigns reveal that there was no evidence of environmental impacts associated with the GNA project	Not applicable	Zero oil discharge into freshwater bodies	Not required	No concern
Freshwater bodies	9	Maintaining a permeable surface	Percentage of the occupied area by the Port of Açú with a permeable surface	Support information	Fully implemented The development of the surface follows the Master Plan Logistics and Industrial Complex of the Port of Açú. GNA maintains 2.77 ha of original vegetation, which represents 15.23% of the total area.	Not applicable	Maintenance of permeable surface corresponding to 15% of the total area occupied by GNA projects	Not required	No concern
Freshwater bodies	10	Restoring the <i>Restinga</i> Habitat				See Mitigation Measure No 2			
Freshwater bodies	11	Payment of Monetary Environmental Compensation				See Mitigation Measure No 3			
Coastal	12	Dredging Carried Out Considering the Sea Turtles' Reproductive Season	Time of dredging	Support information	Measure fully complied with. The dredging activities near the GNA area have already been completed	Not Applicable	The dredging schedule has been adapted to accommodate the reproductive period of sea turtles	Not triggered. Result achieved.	No concern

BAP - MITIGATION MEASURES: CONTINUATION

Biodiversity value affected	Mitigation Measure Number	Mitigation Measure	Indicator(s)	Indicator(s) use	Status of implementing the Mitigation Measure	Achievement of No Net Loss/Net Gain	Desired result(s)	Adaptive management	Overall assessment																		
Coastal	13	Lighting of GNA Structures Designed to Reduce Impacts From Illumination Caused to the reproduction of Sea Turtles	Lighting installed in accordance with Brazilian legislation and as detailed in a specific procedure for photo mitigation	Support information	Nighttime inspections indicated that lighting increased due to temporary nighttime activities involved in implementing GNA II, new construction work in the back area of T2 and ship-to-ship in T1, as well as weather conditions	Not applicable	The lighting adheres to specifications for the protection of sea turtles and as detailed in a specific procedure	A review of the sampling areas and methods is suggested to make field measurements more targeted towards GNA projects	Minor Concern																		
Coastal	14	The paint Color of the FSRU was conceived to Minimize Artificial Light Reflection to Accommodate Sea Turtles reproduction	Colors of the paints used on the FSRU hull and deck complying with the specifications for low light reflection	Support information	Measure fully complied with. The FSRU hull was painted dark blue and the deck painted gray	Not applicable	Paint color complies with specifications for reducing the effect of FSRU reflectance in water	Not required	No concern																		
Coastal	15	Ongoing and Structures Actions for the Conservation of Sea Turtles	Number of nests; number of nests with eggs and percentage of nests producing hatchlings	Required to verify "No Net Loss"	<p>Actions implemented.</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Nests</th> <th>Hatching rate</th> </tr> </thead> <tbody> <tr> <td>17-18</td> <td>973</td> <td>66.08%</td> </tr> <tr> <td>18-19</td> <td>1,188</td> <td>70.20%</td> </tr> <tr> <td>19-20</td> <td>1,388</td> <td>68.31%</td> </tr> <tr> <td>20-21</td> <td>908</td> <td>66.47%</td> </tr> <tr> <td>21-22</td> <td>1,273</td> <td>73.47%</td> </tr> </tbody> </table>	Year	Nests	Hatching rate	17-18	973	66.08%	18-19	1,188	70.20%	19-20	1,388	68.31%	20-21	908	66.47%	21-22	1,273	73.47%	There is no evidence of a decline in the number of nests, eggs and births in the region.	Stable or improved nesting success from baseline (GNA financial support for monitoring is voluntary)	Not required. If there is a decline, the Port of Açú is responsible for determining response measures. GNA may, however, support sea turtle conservation projects in other regions if it believes that the measures are not effective	No concern
Year	Nests	Hatching rate																									
17-18	973	66.08%																									
18-19	1,188	70.20%																									
19-20	1,388	68.31%																									
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BAP - MITIGATION MEASURES: CONTINUATION

Biodiversity value affected	Mitigation Measure Number	Mitigation Measure	Indicator(s)	Indicator(s) use	Status of implementing the Mitigation Measure	Achievement of No Net Loss/Net Gain	Desired result(s)	Adaptive management	Overall assessment
Coastal	16	Mixing Ship Cooling Water with Hot Water Output from the Power Plant to Manage Water Temperatures prior to discharge into the ocean	Water temperature in mixing zone °C	Required to verify "No Net Loss"	Automatic monitoring network installed and running. The temperature measured remained within the expected range.	Progressing as planned to achieve "No Net Loss". The temperature of the water remained within the expected range.	The variation of the water temperature in the mixing zone should not be more than 3°C from the temperature at the control point.	Not required. If the water temperature varies >3°C from the ambient ocean temperature, it will be necessary to recalibrate the output mechanism	No concern
Coastal	17	Implementation of Anti-entrainment Structure for marine life (sea chest) in the cooling water intake system for the FSRU and the Power Plant Operation	Sea turtles or other large marine organisms trapped or dragged in by the water intake system.	Required to verify "No Net Loss"	Fully implemented Sea chest installed.	Progressing as planned to achieve "No Net Loss". Visual monitoring will support verifying the effectiveness of the measurement	No record of sea turtles or other large marine organisms being sucked in, nor dragged through the FSRU water intake system	If sea turtles or other large marine organisms are dragged into the water intake system, adaptive management is required	No concern
Coastal	18	Water Quality Management	Diversity and relative abundance of marine fish, plankton and benthic communities and local fisheries catch per unit effort.	Required to verify "No Net Loss"	Monitoring in progress, no major changes detected	Progressing as planned to achieve "No Net Loss". The monitoring values remain in line with the baseline and results of previous campaigns	No statistically significant difference before/after the operation (statistically significant detection of small to moderate changes is not feasible)	If there are statistically significant differences or downward trends in biodiversity values discovered, the monitoring needs to be checked, in addition to water quality controls and action plans established to implement corrective measures	No concern

BAP - MITIGATION MEASURES: CONTINUATION

Biodiversity value affected	Mitigation Measure Number	Mitigation Measure	Indicator(s)	Indicator(s) use	Status of implementing the Mitigation Measure	Achievement of No Net Loss/Net Gain	Desired result(s)	Adaptive management	Overall assessment
Coastal	19	Ship Ballast off-shore exchange to minimize the risk of introducing invasive alien species	Invasive sun coral density per square meter	Support information	<p>Density of sun coral per m² in the north pier: A10P5: 0/m² A10P4: < 0.5/m² A10P3: < 0.5/m² A10P2: < 0.5/m² A10P1: 1/m²</p> <p>Ship ballast management protocol defined to prevent marine biofouling</p> <p>No ballast exchange was carried out in the period.</p> <p>Low sun coral density at BW Magna, with no indication for removal to date.</p>	<p>Progressing as planned to achieve "No Net Loss". Regarding the diagnosis of Biofouling of <i>Tubastraea coccinea</i> in the Port of Açu, any action related to removal must be previously approved by the port administrator. Regarding the presence of sun coral in the FSRU and GNA, during routine cleaning activities of the FSRU hull and sensitive areas of the ship, if the presence of sun coral is observed, the areas may be cleaned with the approval of the port administrator, observing the applicable legislation and GNA-PLA. SUS.013. In any case of sun coral removal, the disposal of waste will follow the Exotic Species Prevention and Control Project (PPCEX) and applicable legislation and needs to be done by a company certified and licensed for this activity</p>	<2 sun coral specimens /m ²	Not required. If the sun coral density > 2/ m ² , increase the frequency of removal, increase attention to the topic and compliance with ballast exchange requirements for ships entering the port to supply the GNA.	Not Applicable
Coastal	20	Removal of Invasive Marine Species from LNGT Area and FSRU BW MAGNA				See Mitigation Measure No 19			

BAP - MITIGATION MEASURES: CONTINUATION

Biodiversity value affected	Mitigation Measure Number	Mitigation Measure	Indicator(s)	Indicator(s) use	Status of implementing the Mitigation Measure	Achievement of No Net Loss/Net Gain	Desired result(s)	Adaptive management	Overall assessment
Costeiro	21	Rock Pier Construction increases Habitat Availability for hard-bottom marine species	Occurrence of fish species populations associated with the hard-bottom habitat in the North Jetty area	Support information	Rock pier constructed and 12 native fish species associated with hard-bottom habitats recorded	Encounter of important larval values and fish species associated with hard-bottom habitat indicating Net Gain	Any native species population of hard bottom-habitat	If no native fish species come to inhabit the habitat created by the construction of the pier, water quality monitoring and controls need to be reviewed and action plans put in place to mitigate any possible water contamination	No concern

06.

REFERENCES, GLOSSARY AND CREDITS

REFERENCES, GLOSSARY AND CREDITS

REFERENCES

In order to produce this consolidated material, the following documents were consulted:

- 1st Annual Report of the GNA Biodiversity Action Plan (BAP) – Years: 2018-2019, May/2020.
- 2nd Annual Report of the GNA Biodiversity Action Plan (BAP) – Year: 2020, February/2021.
- 3rd Annual Report of the GNA Biodiversity Action Plan (BAP) – Year: 2021, February/2022.
- 4th Annual Report of the GNA Biodiversity Action Plan (BAP) – Year: 2022, February/2023.

REFERENCES, GLOSSARY AND CREDITS

GLOSSARY

Adaptive management

Concerns the suitability of mitigation and management measures that can be implemented according to the outcomes of monitoring throughout the project. This means that actions are increasingly precise and efficient in the quest for No Net Loss/Net Gain in biodiversity. Adaptive management actions can be directed to both monitoring methods and operational activities if the need is identified.

ADI - Area of Direct Influence

Corresponds to the area that will undergo direct impacts of the implementation, operation and/or expansion of the enterprise.

All - Area of Indirect Influence

Corresponds to the area actually or potentially subject to the indirect impacts of the implementation, operation and/or expansion of the project.

Anthropized area

Natural area whose original characteristics have been altered by human activities.

Benthic invertebrates

Different groups of invertebrates that inhabit the bottom of oceans, estuaries, rivers and/or lakes, living stationary, buried or associated with different substrates (under or on them) such as sediments, rocks, logs and others, throughout their entire life cycle or for part of it.

Biodiversity hotspots

Hotspots are places on the planet with great biodiversity but have been devastated by human action. There are 35 hotspots throughout the globe, and Brazil is home to two of them: the Atlantic Rain Forest and the Cerrado.

CH - Critical Habitat

Critical Habitats (HC) are areas of high biodiversity value and include: habitats of significant importance for threatened or critically endangered species; habitats of significant importance for endemic or restricted distribution species; habitats that contain significant concentrations of migratory species and/or congregations of species; unique or very threatened ecosystems and areas associated with key evolutionary processes.

CODIN - Companhia de Desenvolvimento Industrial do Estado do Rio de Janeiro

A mixed public-private corporation, indirectly managed by the State of Rio de Janeiro and linked to the State Secretariat for Economic Development, Industry, Trade and Services (SEDEICS, Secretaria de Estado de Desenvolvimento Econômico, Indústria, Comércio e Serviços), which was formed in order to develop actions that help expand business activity in the territory of Rio de Janeiro in partnership with other government and business entities, universities and technology centers.

<https://www.codin.rj.gov.br/>

CONAMA Resolution 10/96

Establishes that environmental licensing on beaches where sea turtles spawning occurs can only take place after an assessment and recommendation by IBAMA, following dialog with the Marine Turtle Center (TAMAR).

<https://www.ibama.gov.br/sophia/cnia/legislacao/MMA/RE0010-241096.PDF>

CONAMA Resolution 357/05

Provides the classification of water bodies and environmental guidelines for their framework, and also establishes the conditions and standards for the discharge of effluents, as well as other provisions.

https://www.icmbio.gov.br/cepsul/images/stories/legislacao/Resolucao/2005/res_conama_357_2005_classificacao_corpos_agua_rtfcdaltrd_res_393_2007_397_2008_410_2009_430_2011.pdf

Resolução CONAMA 430/11

Provides for the conditions and standards of effluent discharge, complements and amends CONAMA Resolution 357/05.

<http://www.ibama.gov.br/sophia/cnia/legislacao/CONAMA/RE0430-130511.PDF>

Resolução CONAMA 454/12

Establishes the general guidelines and referential procedures for the management of material to be dredged in waters under national jurisdiction.

<https://www.ibama.gov.br/component/legislacao/?view=legislacao&legislacao=128537>

Consolidated bottom (hard-bottom)

Substrate composed of solid and rigid surfaces, such as rocks, coral reefs, sandstone reefs, limestone algae beds, and others. Also called “hard bottom” where different groups of benthic organisms inhabit. In addition, consolidated bottoms can also be considered concrete structures or other materials, built in the aquatic environment, such as jetties and piers.

Decree No. 4.340/2002

Regulates articles of law no. 9.985 of July 18, 2000, which provides for the national system of nature conservation units (SNUC, in Portuguese), and provides other provisions.

<https://legislacao.presidencia.gov.br/atos/?tipo=DEC&numero=4340&ano=2002&ato=50dkXSq5UNNpWTb07>

Domestic fauna

Includes animals that, through traditional and systematized processes of management and zootechnical improvement, have become domestic, possessing biological and behavioral characteristics that are closely dependent on man. Examples: cats, dogs etc.

Endemic species

A native plant or animal that occurs only in a particular area or geographic region.

Environmental Impact Study

An environmental study of a project, construction or activity, user of environmental resources, actually or potentially causing significant pollution or some other form of significant degradation of the environment. It is carried out in advance to analyze environmental feasibility and must be followed by a public hearing.

utilização e para promover a passagem do insumo do estado líquido para gasoso (regaseificação).

Federal Law No. 9.985/2000

Regulates art. 225, paragraph 1, items i, ii, iii and vii of the federal constitution, establishing the national system of nature conservation units and provides other measures.

<https://legislacao.presidencia.gov.br/atos/?tipo=LEI&numero=9985&ano=2000&ato=77ck3aq1kMNPWTfc9>

Firebreaks

Extended clearings designed to act as a protective barrier to prevent flames from spreading in the event of a fire.

FSRU - Floating Storage Regasification Unit

The Floating storage and regasification unit is used for the receipt of Liquefied Natural Gas (LNG) by ships, storage of the raw material until the moment of its use and to promote the passage of the raw material from the liquid to the gaseous state (regasification).

Gillnet

Type of passive fishing gear in which fish or crustaceans become trapped in its meshes due to their own movement.

IBAMA - Brazilian Institute of the Environment and Renewable Natural Resources (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis)

Self-managed federal entity whose responsibilities include: exercising the power of environmental police; conducting actions of national environmental policies, referring to federal attributions, related to environmental licensing, environmental quality control, authorization to use natural resources and inspection, monitoring and environmental control, observing the guidelines issued by the Ministry of the Environment; and carrying out the supplementary actions of competence of the Union, in accordance with current environmental legislation.

<https://www.gov.br/ibama/pt-br>

ICMBio - Chico Mendes Institute for Biodiversity Conservation (Instituto Chico Mendes de Conservação da Biodiversidade)

Brazilian environmental agency responsible for proposing, implementing, managing and protecting federal conservation units.

<https://www.gov.br/icmbio/pt-br>

IDG – Institute for Development and Management

IDG is the entity accredited by the public authorities to perform the environmental management of resources from compensatory measures and execute projects allocated for Conservation Units, approved by the Environmental Compensation Chamber of Rio de Janeiro under the auspice of the Mechanism for Biodiversity Conservation.

IFC - International Finance Corporation

World Bank Group member institution aimed at strengthening the private sector in developing countries with a view to combating poverty.

<https://www.ifc.org/>

IL - Installation License

Authorizes the installation of the project, work or activity according to the specifications contained in the approved plans, programs and projects, setting a schedule for the execution of mitigating measures and the implementation of environmental control systems.

INEA/RJ - State Institute of the Environment of Rio de Janeiro (Instituto Estadual do Ambiente do Rio de Janeiro)

An entity that is part of the indirect state Public Administration, linked to the State Secretariat for the Environment and Sustainability (SEAS, Secretaria de Estado do Ambiente e Sustentabilidade) of Rio de Janeiro. Its role is to implement state policies on the environment, water resources and forestry resources adopted by the Executive and Legislative powers of the State of Rio de Janeiro.

<https://www.inea.rj.gov.br/>

LNGC - Liquefied Natural Gas Carriers

Also known as a “methane tanker”, it is a tanker that transports liquefied natural gas from the Natural Gas Liquefaction Units to the Natural Gas Regasification points.

Nesting

The act of building nests.

Net Gain

Additional conservation action for biodiversity values in critical habitat areas. These gains can be achieved through the application of an impact mitigation hierarchy that includes the development of compensations in other similar areas.

No Net Loss

Point at which biodiversity losses related to the implementation of a project are balanced by the gains obtained by adopting the measures defined to minimize or mitigate the environmental impacts produced by the construction/operation of that enterprise.

OL - Operating License

Allows for the operation of the project, construction or activity after ensuring effective compliance with the environmental control measures and conditions determined in the previous licenses.

ONS - National Electric System Operator

The agency responsible for coordinating and controlling the operation of electricity generation and transmission facilities in the National Interconnected System (SIN, Sistema Interligado Nacional) and for planning the operation of the country's isolated systems, under the supervision and regulation of the National Electric Energy Agency (Aneel, Agência Nacional de Energia Elétrica).

<https://www.ons.org.br/>

Ordinance No. 11/95 IBAMA/MMA

Provides the maximum permitted intensity of existing sources of lighting in sea turtle nesting areas.

<https://www.ibama.gov.br/sophia/cnia/legislacao/IBAMA/PT0011-300195.PDF>

Private Natural Heritage Reserve (Reserva Particular do Patrimônio Natural)

Conservation unit of private and perpetual domain, with the objective of biodiversity conservation, without expropriation or alteration of property use rights.

RPPN Caruara

Private Reserve of Caruara Natural Heritage. It comprises an area of 40km², protected by the Porto do Açu Operações. It is the largest private conservation unit dedicated to the protection of the restinga (sandbank) ecosystem in Brazil.

SEA/INEA Joint Resolution No. 638/2016

Establishes procedures for signing environmental compensation commitment terms (TCCA, in Portuguese) to fulfill the obligation as to environmental compensation referred to in art. 36 of Federal Law No. 9.985/00 and State Law No. 6572/13.

<http://fma.ambiente.rj.gov.br/comum/code/MostrarArquivo.php?C=MTYw>

SEAS - State Department for the Environment and Sustainability of Rio de Janeiro (Secretaria de Estado do Ambiente e Sustentabilidade)

First-level hierarchical entity of the state administration of Rio de Janeiro, coordinates the state's public environmental management.

<https://www.seas.rj.gov.br/>

Ship-to-ship operation

Transferring cargo from one ship directly to another without passing through any onshore structure.

SIN - National Interconnected System

A large hydro-thermal-wind system, it is responsible for interconnecting electrical systems via the transmission grid, in order to serve the market safely and with economy.

<https://www.ons.org.br/paginas/sobre-o-sin/o-que-e-o-sin>

SNUC - National System of Conservation Units (Sistema Nacional de Unidades de Conservação da Natureza)

The set of federal, state and municipal conservation units . It is composed of 12 categories, whose specific objectives differ in terms of the type of protection and permitted uses: those that need greater care due to their fragility and particularities, and those that can be used sustainably and conserved at the same time.

Species of interest

Species that are considered triggers for a given habitat. In the case of the BAP, the species *Dendropsophus meridianus*, *Rhinella pygmaea*, *Xenohyla truncata*, *Cerradomys goytaca* and *Glaucmastix littoralis* were considered to be of interest.

State Law No. 7.061/2015

Amends Laws No. 6.572 of October 31, 2013 and No. 6.371/2012 of December 27, 2012 and provides for other measures.

<http://alerjln1.alerj.rj.gov.br/CONTLEI.NSF/%20f25edae7e64db53b032564fe%20005262ef/0d689f7cbd71a52083257ecf00616fb8?OpenDocument>

Synanthropic Fauna

Includes species of wild animals, whether native or not, that share resources (water, shelter and food) from areas inhabited by humans in order to survive. Examples: domestic pigeons, vultures, rats, cockroaches, scorpions, bats etc.

TAMAR Project Foundation (Fundação Projeto TAMAR)

A non-profit entity with over 40 years of experience in Brazil, whose mission is to promote the recovery of sea turtles, developing research, conservation and social inclusion actions. The foundation operates over roughly 1,100 km of Brazilian coast, in neritic and oceanic habitats in eight states: Rio Grande do Norte, Pernambuco, Sergipe, Bahia, Espírito Santo, Rio de Janeiro, São Paulo and Santa Catarina.

Taxons

The taxonomic unit associated with the scientific classification of living beings at any level.

Transects

A line or section, along which the occurrences of the phenomenon being studied are documented and counted.

Turtle Deflectors

Engineering measure to reduce interactions and incidental catches of sea turtles by dredgers, the main purpose of which is to cause animals resting on the bottom to be diverted from the dredge head layout during suction.

Unconsolidated bottom (Soft-bottom)

Substrate, usually muddy or sandy, where various groups of benthic organisms live. These are accumulations of debris that have lost their firmness, solidity and stability (unconsolidated), which are transported by gravity from their origin and are deposited on the slopes and bottom of oceans, estuaries, rivers and/or lakes.

Wild fauna

Includes aquatic or terrestrial animals belonging to native or migratory species in which they exist naturally within the limits of a given territory, Examples: bat, coati, jaguar, anteater, parrot, canary, tegu, alligator, tortoise etc.

REFERENCES, GLOSSARY AND CREDITS

CREDITS

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ENVIRONMENTAL RESPONSIBILITY:

transversal and guidance element
of the GNA strategic decision making



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