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Pilot Study Of Anthropic Impacts Of The Pará River On Carananduba Beach And The Cajueiro River On Mosqueiro Island In Belém - PA (Brazil)

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Abstract
Justification: *Continental aquatic ecosystems and marine ecosystems are being extensively altered in their structure by anthropogenic impacts, producing substantial changes in land use, air pollution, with impacts on surface and underground water resources. These impacts are global, regional, and local and range from climate changes and climate variations to the deforestation of ciliary forests, changes in river flow and the introduction of exotic species.*
Objective*: assessment of anthropogenic impacts of Carananduba Beach on the Pará River and Cajueiro River in the Metropolitan Region of the Mosqueiro district.*
Methodology: *field research, with in locus analyses using qualitative and quantitative methods, in water collection on Carananduba beach on Mosqueiro Island in Belém - PA and observational, in Carananduba and Cajueiro river, in aspects of environmental morphology, urban occupation and anthropogenic impacts, occupation of riverbanks, characteristics of urban sewage on the beach limits, local commerce and resulting environmental impacts. urbanisation and environmental impacts, sewage and urban waste in the area of the Pará and Cajueiro rivers. Water samples were collected, and qualitative chemical analysis was carried out in situ on Carananduba beach to identify the possible presence of heavy metals.*
Conclusions: *The impacts on Carananduba beach and in the area of the bridge over the Cajueiro River, which cause environmental disequilibrium, are anthropogenic, especially due to the occupation and use of areas without basic sanitation infrastructure and correct waste removal, causing impacts that are still reversible at the moment. Traces of hexavalent copper, a potential cause of dermatitis, were found on Carananduba beach. However, more samples need to be collected to identify whether the source is seasonal or perennial, to intervene with measures that can eliminate or mitigate its occurrence. There is an urgent need to implement environmental education policies for the community, sewage treatment and urban waste collection.*
Key words: *Environmental chemistry, Water analysis, Limnology, Hydrographic basin*.

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I. Introduction

Water constitutes one of the most distributed and important compounds in the Earth's crust. Its importance for life does lay in the fact that no metabolic process occurs without its direct or indirect action. It was its anomalous properties, compared to other compounds, that enabled the emergence and maintenance of life on Earth. It is worth highlighting that water in the liquid state has greater density than in the solid state (ice), a fact of great significance for the distribution of aquatic organisms. This is because if the ice did not float in the water, lakes and rivers in cold regions would freeze completely during the winter, which would cause the death of all organisms. It is worth mentioning that almost all other compounds are denser when in the solid state than in the liquid state[1].

Limnological study is basically, as in other sciences, a search for principles. These principles that act on certain processes and operating mechanisms can be used in predictions and comparisons. Particularly, the comparative aspect of Limnology must be highlighted. For example, when comparing the **hydrodynamics** of rivers, lakes and dams, certain basic aspects of functioning are immediately understood that significantly interfere in the **life cycle**, distribution, and biomass of aquatic organisms. The fact that it enables predictions and prognoses also qualifies Limnology as a science, important from an applied point of view. In recent years, the degradation

of inland water ecosystems has been increasing, based on the dumping of various types of waste, the effects of deforestation in the river basin and air pollution and subsequent acid rain. Therefore, the containment of these deterioration processes and the correction and prevention of changes in inland waters can only be done if a solid scientific knowledge base exists. On the other hand, human interference in aquatic life (overexploitation of aquatic plants and animals, **introduction of exotic species**) has produced immense changes in the structure of aquatic ecosystems. In addition to the problems of pollution, eutrophication, and deterioration that inland waters have been suffering, it must also be considered that the appropriate management of these ecosystems is also important for better use of existing resources in lakes, rivers, and dams[2].

Several variables must be considered when collecting material for research in limnology, including: temperature; odour; pH; colour; transparency; turbidity; Dissolved oxygen; Electric conductivity; chlorophyll; deep current; surface current; total suspended solids; total dissolved solids; current speed; wind speed, among others. For example, in a water column at a certain depth there are certain species of plankton at another depth, which can change due to luminosity, current speed, among other specific aspects[3].

Continental aquatic ecosystems and marine ecosystems are being extensively altered in their structure and function, due to the growth and demands of the human population, as well as economic development in many regions, which produces substantial changes in land use, air pollution, with impacts on surface and underground water resources.

Organisms as Indicators of Uncontaminated Natural Waters and Pollution and Contamination – Bioindicators: Continental aquatic ecosystems and marine ecosystems are being extensively altered in their structure and function, due to the growth and demands of the human population, as well as the economic development in many regions, which produces substantial changes in land use, air pollution, with impacts on surface and underground water resources. These impacts are global, regional, and local and range from climate change to the deforestation of ciliary forests, changes in river flow and the introduction of exotic species. Spatial and temporal changes in these processes affect the structure and function of aquatic ecosystems and make it difficult to assess and predict consequences under the effects of multiple stress factors[2].

In this paper, pilot field research was carried out, as part of the research "Environmental impacts of urbanisation on water resources in Metropolitan Region of Belém and its effects on the health of local populations and the environment: A brief look by geomedicine[4]" by the team at Professor Aureliano da Silva Guedes, where qualitative and quantitative analyses were carried out on the water at Carananduba beach and the bridge over the Cajueiro River on the island of Mosqueiro, district of the city of Belém in the state of Pará, to identify the quality of the water. Aiming to evaluate the geosocial-environmental aspects of Carananduba Beach in the Metropolitan Region of Belém in the Mosqueiro district.

II. Methodology

The method used was field research, with *in locus* analyses using qualitative and quantitative methods, collecting water on Caranamduba beach on Ilha de Mosqueiro in Belém - PA and observational, including the Cajueiro River.

Aspects of environmental morphology, urban occupation and its anthropogenic impacts, occupation of riverbanks, characteristics of urban sewage on the beach limits, local commerce and resulting environmental impacts, urbanisation and environmental impacts, sewage, and urban waste in the Pará and Cajueiro rivers were observed[5].

Water samples were collected, and qualitative chemical analysis was carried out *in locus* of water from Carananduba beach to identify possible presence of heavy metals, using the resources listed in table 1.

Table 1

Multiparameter Test	Used to identify whether there is the presence of heavy metals in the collected sample and the Ph.
Environmental Thermometer	Used to measure the ambient temperature of the location at the time of sample collection.
Secchi Disc	Mechanism used to measure the transparency or turbidity of water.
Conductivity meter	This equipment was used to measure the electrical conductivity of water.

Used materials.

III. Results and discussion

On July 18, 2023, on Caranaduba beach, the transparency and turbidity of the water was measured, using the Secchi Disc, where it was possible to observe the turbidity of the water to a depth of 38cm at 10m from the shore of the beach.

A 500mL sample of water from Carananduba beach was collected, and with the help of an environmental thermometer the temperature was measured, which at the time was 31.2ºC, where the Ph was 6.2, this is due to the water on this beach appears brackish due to the influence of the Atlantic Ocean. Electrical conductivity was

1.806 milliSiemens/cm, considered normal. The amount of dissolved solids in a sample of brackish water from the beach was considered normal.
In the multiparameter test, it was possible to obtain the results shown in table 2.

Table 2

Ph (Hydrogenion Potential)	6,2
TDS (Total Dissolved Solids)	0,903 mg/l
Carbonate	0mg/l
Water Hardness	100mg/l
Bromine	0mg/l
Nitrate	0mg/l
Nitrite	0mg/l
Iron	0mg/l
Chromium (VI)	2mg/l
Lead	0mg/l
Copper	0mg/l
Mercury	0mg/l
Fluoride	25mg/l

Collected water data

The presence of bromine or bromides, nitrate, nitrite, iron, lead, copper and mercury were not found at the time of collection and analysis of the water samples. It should be noted that changes to these data may occur due to current, tide, among others.

The presence of chromium VI, which can cause dermatitis, at the time of sample collection at high tide, was found to be 2 mg/l, which is above the recommended level, which would be up to 0.1 mg/l of hexavalent chromium in dissolved form, which it needs to be analysed through more collections in different situations, to issue an appropriate opinion, as it could be a seasonal or perennial factor, therefore, more data and the source of induction are needed.

In the observational method, the presence of sewage was found in the Carananduba beach area, which requires urgent public sanitation policies to promote better water quality, guaranteeing the health of bathers.

In the research stretch on the Cajueiro River bridge: The analysis of this point was observational, where a high level of pollution was found, through the observation of a strong odour, caused by waste dumped in an exacerbated manner on the river bed, it was also observed that sewage from houses located on the banks of the river are dumped directly into it, as well as fishing boats moored there also do so, in addition to the presence of a large amount of garbage on the banks of the river, coming from the market and residences of local areas, requiring public environmental education policies.

On Carananduba beach, the main element causing environmental disequilibrium is anthropical, by either expanding occupation and use in areas such as the edge of streams and beach coves, forming a village of families, who use the beach area to discharge organic waste. arising from the lack of public policies for basic sanitation and waste collection, to contain this damage.

It is noteworthy that Brazil has technologies, industrial facilities and developed labour at all levels that could be used to avoid problems arising from the lack of sewage treatment, which reduces the quality of life and takes the lives of thousands of Brazilians annually. An analysis of data generated by different government sources indicates that Brazilian municipalities where sewage collection and treatment rates are recorded have lower rates of hospitalisations due to diseases caused by lack of basic sanitation and are also those with the highest rates of literate citizens and the best education rates. Thus, it can be concluded that education is one of the most important instruments for the Brazilian population to achieve a quality of life with more dignity[6].

IV. Conclusions

The biocenosis can suffer natural disturbances where nature can recover on its own, returning to homeostasis; However, in anthropogenic impacts, recovery, in most cases, requires interventions from man himself, as their impacts are more complex and often irrecoverable by natural and/or artificial means. The impacts on Carananduba beach and in the bridge over the Cajueiro River, the elements that cause environmental disequilibrium are anthropic, especially due to the occupation and use of areas without basic sanitation infrastructure and correct waste removal, causing impacts that are still reversible at the moment.

As for heavy metals, only hexavalent copper, a potential cause of dermatitis, was found on Carananduba beach. However, more samples need to be collected to identify whether the source is seasonal or perennial, in

order, if necessary, to intervene with measures that can eliminate or mitigate its occurrence.

There is a need to urgently implement environmental education policies to have the community disseminate information about how to preserve the river basin. Sewage treatment is also necessary to improve and preserve water quality, avoiding future health problems for the local population and tourists who use the beach during vacation periods, weekends, and holidays.

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