

Environmental Impacts and the Awareness of a Riverine Community in the Maranhão Amazon: Solutions for Sustainability and Food Security

Maria Priscila Sá Matos Ribeiro¹, Élica Virna Rodrigues Barbosa¹, Lucas Gomes Garcia¹, Mairim Russo Serafini², Mikele Cândida Sousa De Sant'Anna¹, Danilo Francisco Corrêa Lopes¹

¹Bioeconomy, Environment, Innovation, Intelligence, Technology, Education and Health Research Center (BAITES) - Federal University of Maranhão - UFMA, Maranhão, Brazil;

Avenida dos Portugueses- Bacanga, São Luís, Brazil

²Federal University of Serjipe,

maria.priscila@discente.ufma.br;

Abstract - Disorderly growth along the banks of the Pericumã River, which is part of the Maranhão Amazon, further exacerbates the environmental impacts associated with the improper disposal of waste and effluents. These pollutants harm the health of the environment and the species inhabiting the river, many of which are caught for human consumption. This study aims to analyze and diagnose the impacts on the Pericumã River, raising awareness among riverside communities regarding land use, occupation, and the exploitation of natural resources. Additionally, it proposes solutions to mitigate the generated impacts and establish suitable conditions for the capture, consumption, and processing of fish in accordance with food safety standards. Information was disseminated to the population by creating a booklet distributed during workshops held in the communities.

Keywords: consumption, conservation, environmental impacts, food safety

1. Introduction

The municipality of Pinheiro is situated predominantly in the Pericumã River basin, with its headquarters located near the mouth of this body of water, which can increase the exposure of natural resources (water, soil, riparian forests, etc.) in this area to potential environmental impacts [1]. It is also important to note that the region's natural landscape, characterized by its lakes and rivers, supports a rich biodiversity conducive to fishing activities [2].

Fishing in the Baixada Maranhense is predominantly artisanal and constitutes a subsistence activity for many families, essential for the livelihood of a significant portion of the population [3]. In addition to providing supplementary income, the activity also generates considerable employment in various communities in all the region's municipalities. Fishing, therefore, plays a fundamental role in the local social and economic context. The methods employed are varied and traditional, involving nets, containers, and cages, representing an essential part of the region's fishing culture [4].

However, in the municipality of Pinheiro, changes have been made to the natural ecosystem due to the breeding of animals (buffaloes, pigs, dogs, and cats), which deposit their feces on the banks of the river, as well as the remains of domestic waste and effluents, which has led to changes in the physical, chemical and biological properties of the water [5]. In recent years, water resources have been altered by anthropogenic pressures, including industrial discharges and agricultural runoff, which are the leading causes of water quality degradation in transitional environments [6].

Environmental changes, such as climate variability and habitat degradation, can alter these ecosystems, affecting fish availability, fishing practices, and yields [7]. Thus, environmental changes must be monitored to minimize adverse environmental impacts.

Community commitment is key to promoting sustainable practices in small-scale fisheries. Involving fishermen in discussions and activities raises awareness and encourages collective action in favor of sustainability [8]. It is essential to raise awareness among the fishing community in this region about management measures for the sustainable use of the resources present in the Pericumã River basin.

The primary objective of this research is to raise awareness among the population about the importance of food safety when consuming fish and the preservation of the natural environment. To this end, it aims to produce an information booklet and promote actions that involve holding workshops and lectures for communities dependent on fishing and fish consumption.

2. Methodology

The research site is located in the municipality of Pinheiro with the following geographical coordinates: Latitude: 2° 31' 15" South, Longitude: 45° 4' 58" West. The methodology used in this work was action research, as adopted by Thiollent (1996) [9]. This approach aims to equip individuals with the means to respond more effectively to the challenges they encounter, primarily through transformative action strategies, thereby finding solutions to problems where conventional methods have yielded limited results [10]. As [11] notes, the primary purpose of this method is the collective and participatory construction of knowledge, aiming to identify solutions to problems that require investigation to generate positive impacts for people, the community, and society as a whole.

The work was carried out in stages and organized according to a timetable. The first step was to gather literary data to collect information about the contamination of the Pericumã River's waters and to identify appropriate solutions to improve their current state. The work also included safer methods for handling fish for consumption, encompassing the purchase and preparation of food. Thus, in August and September 2019, material was collected on water conservation and work related to food handling and safety.

The next stage involved creating an educational booklet with clear and accessible information to guide the management and conservation of the Pericumã river basin. This material was structured based on the results obtained in the main project and included relevant literature references to raise awareness among the community about sustainable practices and the importance of preserving water resources in the region.

The actors involved in this study were made aware by holding feedback workshops, during which they discussed, together with fishermen and class representatives, actions for the sustainable use of aquatic ecosystems in the Baixada Maranhense region. The aim was to combat pollution and reduce disrespect for the environment, which often occurs due to a lack of information on this crucial issue.

3. Results

3.1. Creation of a digital booklet

The educational booklet was developed by gathering information in simple, easy-to-understand language on the management and conservation of the Pericumã river basin based on the main project's results and studies found in the literature. The material includes detailed guidance on measures to preserve the local ecosystem and safe fish handling practices. Additionally, it provides instructions for the safe preparation of fish for human consumption, including the ideal cooking temperature and tips for maintaining food quality and preservation. In this way, the booklet aims to promote environmental awareness and food safety in the community.

3.2. Feedback workshops

The workshops took place between December 2019 and early 2020. Some villages were selected, but this stage was not completed fully. We had the Christmas break and vacations, and then, at the beginning of the semester, face-to-face activities stopped due to the Coronavirus pandemic.

In the communities served, leaflets were presented and handed out to 30 members of the municipality's fishermen's colony. There were debates and discussions on the project's theme to achieve the proposed objective, which was to develop integrated natural resource management actions with the riverside communities. Full participation in the project was also feasible through the development of strategies to support the population in actions related to food safety, including good practices for handling and preparing fish.

3.3. Analysis

Artisanal fishing is fundamental in local, regional, and national economic, social, and environmental dynamics. It is directly responsible for promoting food and nutritional security for the population. It also plays a significant economic role in the lives of fishing populations. During conversations with the community's residents, it was noted that most of

them derive their primary source of income from fishing, supplemented by fishing insurance and other government aid. As the income from fishing alone is insufficient to support the family, the population also engages in various activities, including raising poultry, pigs, and buffalo.

The population of the Pinheiro—MA region consumes a lot of fish from the Pericumã River. This is a custom of the city's residents, who fish as a form of subsistence and a source of income, boosting the local economy. For the residents of Pinheiro, this activity is considered a cultural “art” that is passed down from generation to generation.

However, the fishing scenario has been changing, above all, due to the increasing pressure on fish stocks resulting from overfishing during the closed season, anthropogenic activities, and the fact that the region lacks a sewage treatment plant, which means that domestic sewage reaches the river. This situation may worsen the ecosystem and even contaminate the species that the population consumes. In this way, species' growth has been vividly visualized, resulting in reduced aquatic biodiversity due to the disorder of the physical and chemical environment and changes in the dynamics of biological communities.

Increased nutrient loading can cause eutrophication of inland and coastal waters. This is characterized by excessive plant and algae growth that limits light penetration, depletes dissolved inorganic carbon, increases pH, and ultimately contributes to the degradation of biodiversity and water quality in aquatic ecosystems [12]. Eutrophication also interrupts food chains and reduces biodiversity by favoring particular phytoplankton species, such as toxic cyanobacteria [13].

As a result of the educational experience, the residents became more engaged in scientific discussions and were involved in the search for solutions to the problem. This type of activity provided a more in-depth understanding and a greater appreciation of the species, integrating theoretical knowledge with practical experience and promoting the development of a critical environmental awareness, with a focus on preserving and maintaining the species.

4. Conclusion

Studies have shown that dialogue within the community needs to be increased. Therefore, technical guidance and educational campaigns are required for those involved in the fish production chain to reduce risks to consumer health. Public policies are also necessary to sustain the water resources in the Pericumã river basin, promoting environmental preservation and the development of complementary activities to artisanal fishing.

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