

# Evaluation of Water Quality for Bathing Conditions in Formigueiro Beach- Porto Nacional - To

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**Abstract**— *The environmental problems are currently in the spotlight in the news media around the world, although in a negative way. This theme arouses great curiosity among people. The water, which is an exhaustible natural resource, has been suffering severely through misuse and lack of awareness regarding humanity's natural assets. With the population growth, cities are now receiving industrial facilities, and this leads to an increase of the waste dumped on the surface, affecting the bed of rivers and lakes, and consequently affecting water quality. Besides this means of pollution, there are several other forms such as garbage thrown into the water, uncontrolled mining, among others. All samples from the three analyzed points had Escherichia coli values lower than 200 NMP/100 ml of sample. Thus, according to Resolution n° 274, the E. coli values found in this range allowed to classify the analyzed locations as safe and excellent for carrying out primary contact activities, or, bathing for most of the analyzed period. The following project had the objective of analyzing the conditions of the water in the Formigueiro Beach, used by bathers that come into primary contact, as well as the normative that competes to it, also focused on the environmental issues as: degradation, polluting sources, means of use, sustainability and bathing.*

**Keywords**— *Environmental problems, bathing conditions, Quality.*

## I. INTRODUCTION

Brazil is home of a huge quantity of water, and this is really a privilege. Regarding water resources, it has a large volume of water in its territory, which has been used for several purposes. With this great quantity of water supply, it serves for multiple uses, such as: sourcing, fishing, recreation, irrigation bath, among others.

According to Tucci and Bertoni (2003), the population growth in general has greatly affected nature. Without having any other means to proper use the

resources, or perhaps by carelessness and lack of a control check, people continue to pollute the springs so that the three main areas of use - residential, industrial and agricultural environments- all discharge their dirty and/or contaminated water into clean water, thereby reducing the scarcity of natural resources and also the loss of water quality.

All water we use in our daily activities and random uses, the final destination of them will be the rivers. By means of this article, it was analyzed some causes of the contamination of these waters and what the relation with the bathing. According to (VALLE & SILVEIRA, 2000) the transmission of infections related to pathogenic organisms, with some examples such as bacteria, viruses and protozoa, are commonly transmitted by water. While most waterborne diseases affect the gastrointestinal tract, others can affect parts of the body such as muscles, the nervous system, and organs such as the heart.

In order to carry out this research, the classification was done using objective criteria, based on the monitoring of the indicators of the fecal coliform group. Then, it was analyzed whether they were in agreement with the parameters decreed by CONAMA Resolution 274/00, determining if the waters are proper or unfit for recreation purposes.

This study on the parameters served to verify the water quality, as well as to correlate the values obtained during the period, which demonstrated the current state of the conditions of the chosen place in relation to the bathing, being able to indicate measures where can be developed environmental preservation methods.

## II. MATERIAL AND METHODS STUDY AREA

The municipality of Porto Nacional is located in the central region of the state of Tocantins, approximately 64 km from the capital of Palmas, which

has an area of 4,446 km<sup>2</sup>. Currently the city has 52,700 people. (IBGE, 2019).

The São João river basin is extensive and it is located between the parallels 10°46'43 "and 20°41'20" south latitude and between the meridians 48° 14'16 "and 48°24'51" longitude west, southeast of the municipality of Porto Nacional, with an area of 82 km<sup>2</sup>. It counts with a tropical climate with rainy summer and dry winter (the warmest months coincide with the period without rains,

August and September), precipitations around 1,600mm and average annual temperatures around 26°C; and the predominant vegetation is the savanna, as shown in figure 01.

The chosen location for this research was the Formigueiro Beach, located in the Jardim Querido sector, located in the Tocantins River basin, as shown in figure 02.

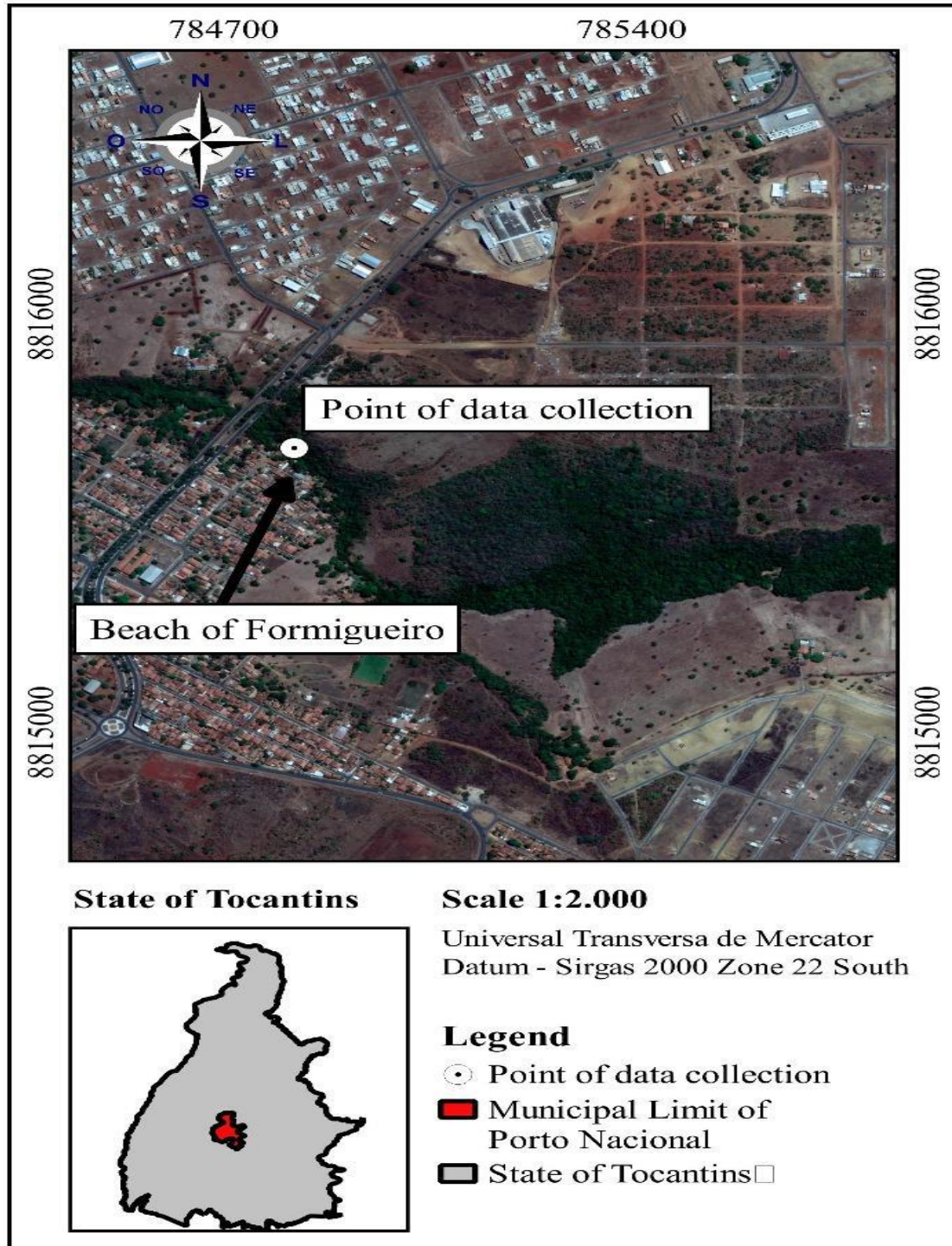


Fig.2: Location and collection map of the Ribeirão São João Basin

**Water analyses**

The samples were collected initially from the month of August and continued until December of 2018. Serving as basis for the beginning of the analyses, the parameters were: total of coliforms and *Escherichia coli* (verification of the bathing conditions index). Next, it was performed the methodology in locu, allowing the beginning of the laboratory methodology.

**Field Methodology**

The samples were collected on a weekly basis after the selection of the collecting points. We used 100 ml sterilized glass containers, approximately 25 cm deep. The points chosen for collection were selected according to the number and concentration of people bathing in the locations, following Art. 5, single paragraph of CONAMA Resolution No. 274/2000.

**Laboratory Methodology**

The samples collected in a 1L flask were transported to the Laboratory of Chemistry of the Instituto Federal do Tocantins - Porto Nacional Campus, where the microbiological analyses were carried out on the *E. coli* group, based on the filter membrane technique according to the methodology described by Standard Methods (APHA, 2005).

**BATHING CONDITIONS**

According to Aureliano (2000), bathing conditions is a parameter based on the analysis of the quality of the water that will come into contact with people. This verification is performed based on the samples collected in locu, and they later go through laboratory tests to check if the water fits the parameters necessary to be used for recreation. Follow the classification of the water according to table 01.

*Table.1: Classification of water regarding its bathing conditions according to Resolution 274.*

Category	Fecal Coliform(NMP/100ml)	Escherichia Coli (NMP/100ml)
Excelent	< 250	< 200
VeryGood	< 500	< 400
Satisfactory	< 1000	< 800
Unsafe	Above 2500	Above 2000

\*NMP: Most probable number by 100 ml. In 80% plus of one set of samples obtained in each of the previous five weeks.

SOURCE: Resolution N° 274/2000 Do CONAMA;

This study was based on the most probable number (MPN) of microorganisms of the fecal coliform bacteria type found in 100 ml of water sample. Being carried out during the two seasons of the year, at the end of the dry period and beginning of the rainy season, from August to December 2018.

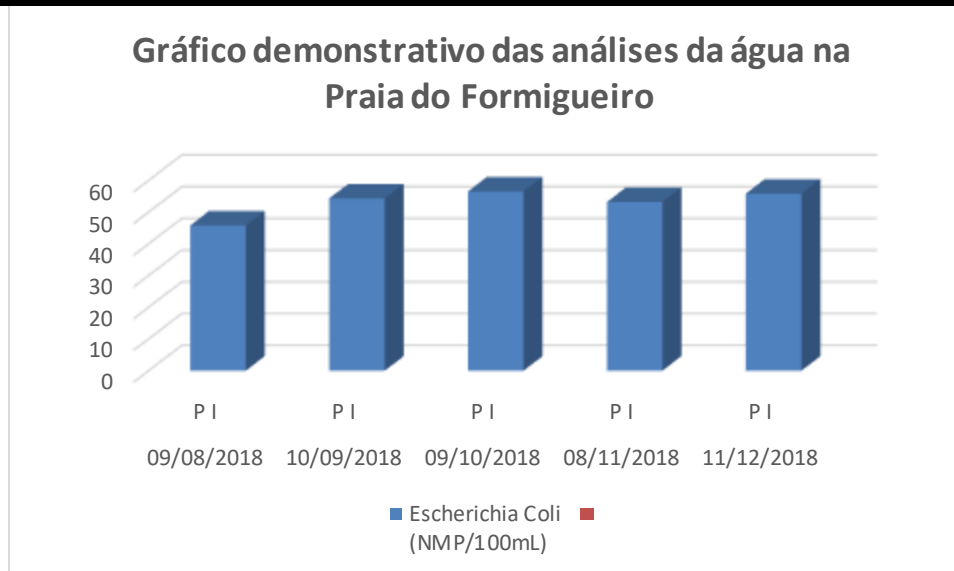
**III. RESULTS AND DISCUSSION**

It were performed in this study analyses of fecal coliforms and *Escherichia coli* (*E. Coli*) in the Formigueiro beach. The results for the whole period of the analyses showed that the water at the research site was always above 2,419.6 NMP / 100 ml. Carvalho Souza (2016), conducted a survey on a beach located in the same city of Porto Nacional, with the monitoring of 3 different points, (PI), where it was verified that the density of *E. coli* presented variation from 36.3 to 103.4 NMP / 100ml at the point (PII) were much better, ranging from 14.4 to 56.9 NMP / 100ml already at the point (PIII) range from 19.3 to 71 NMP / 100ml.

The water analyses on Formigueiro beach during the months of August to December 2018 showed results that fit the bathing conditions standards at its analyzed point, where there was a variation between 45.8 MPN / 100 ml and 55.8 MPN / 100 ml respectively. In the collection period analyzed, the Formigueiro beach obtained very little or no concentration of visitors or bathers due to the fact that the analyses were carried out on working days and outside the busy season of the beach.

Thus, if we compare this result with the one obtained in 2016 at Porto Real Beach, we noticed that the difference of results can be described by many factors, such as the number of bathers and the wastes received, which are two crucial factors. In terms of flow of tourists and bathers, the beach of Formigueiro is less propitious than the beach of Porto Real; on the other hand, the contribution of animal feces (chickens, cattle, etc.) and human feces from private cesspits and creation of animals along the banks of the basin weighs against Formigueiro beach, which may increase the risk of contamination in the water of that region.

The notion of water quality is linked to the objectives of use attributed to water bodies, so that these uses require different levels of water quality, which vary according to the intended purpose of a given water source (MAGALHÃES JR, 2003A; SPERLING, 2005). After the laboratory tests were carried out in a period of five consecutive months, *E. coli* values were determined. Bacteria were present in all samples, but the values were acceptable when compared to CONAMA Resolution 274/2000, according to the graph 01.



*Graph.1: Parameter evaluated in Formigueiro Beach*

#### **TRADUÇÃO DOS TERMOS DO GRÁFICO:**

**Gráfico demonstrativo das análises da água na Praia do Formigueiro** = Demonstrative graph of the analyses of the water on Formigueiro Beach

#### **IV. CONCLUSION**

Therefore, Formigueiro Beach is of a great importance to the community of Jardim Querido. Its waters serve to supply several tank trucks daily, providing water for a car wash located near the shores of the beach, generating income for the residents. It is also used for bathing, leisure, among other multiple uses. Therefore, it is necessary to implement preventive actions, seek partnerships with the city hall and responsible institutions, so that there is a preservation of water, mainly through the awareness of bathers, and also through measures and policies of maintenance by the public administration.

Finally, according to the values obtained during the research, it was verified that that water can be used for recreational activities, since it meets the parameters determined by CONAMA Resolution 274/2000, presenting values below the recommended level and being classified as EXCELLENT.

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