


THE PREFERENCE OF THE CHARACIFORMES *BRYCON ORBIGNYANUS* (VALENCIENNES, 1850) FOR THE ENVIRONMENT IN RELATION TO LUMINOSITY

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ABSTRACT

The construction of dams has interfered markedly in the local landscape of some Brazilian states, causing changes in the environment. In this way, the spawning of migratory fish can be harmed. Some species are threatened with extinction, as is the case of *Brycon orbignyanus*, popularly known as piracanjuba. Studies related to the biology and behavior of fish are essential for their preservation. Among the most important factors that affect the feeding strategy of fish, light seems to be a stimulus that makes them more or less active. The objective of this study was to evaluate the preference of the fish *Brycon orbignyanus* for the environment in relation to luminosity. The experiment was carried out with piracanjuba larvae at the Nico Nieser Laboratory of the Ecology and Evolution discipline, in Uberaba, Minas Gerais, Brazil, on January 26 and 27, 2011. For the experiment, a rectangular glass aquarium measuring 30 x 10 x 10 cm was used, which was divided into two environments with each length, one light and the other dark. For five minutes, the movement of each specimen in the aquarium was observed. Due to the possibility of individual identification of the larvae, the method adopted was that of the "focal animal". During the experiment, all the specimens of piracanjuba remained in the bright environment. A significant number of fish species are visually guided and the decrease in light can compromise food selection.

Keywords: Biodiversity. Water resources. Rheophilic species. Bryconidae.

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INTRODUCTION

The exploitation of multiple uses of water significantly influences the availability and quality of water resources¹. The increase in population and, consequently, industrial growth, has stimulated the development and execution of projects for the construction of hydroelectric dams and irrigation, causing environmental impacts on the ichthyofauna, interrupting the migration routes of spawning fish².

The construction of dams has markedly interfered with the local landscape of some Brazilian states, causing changes in the economic, social and environmental order in the areas where they are installed. One of the main damages caused to the environment by the construction of dams is the loss of biodiversity³.

This loss is related to the disappearance of terrestrial habitats due to damming, and to the modifications produced in the aquatic habitat, such as changes in depth⁴.

In this way, migratory fish are affected by the changes imposed by damming. Some species are threatened with extinction, such as *Brycon orbignyianus*, (Valenciennes, 1849) Eigenmann & Norris, 1900, popularly known as piracanjuba. This species has had its population drastically restricted in its natural environment, probably due to environmental degradation⁵⁻⁷.

Fish represent the most numerous and diverse group among vertebrates, with about 25,000 known species, of which approximately 600 occur in the Paraná basin. They are found in different aquatic environments, being adapted to a peculiar habitat, which varies for each species⁸. In this way, some species inhabit rapids, others in lakes. Many have great commercial value, constituting an expressive source of animal protein for the human population. They exhibit great variation in body size, color, and shape, and some species have elaborate life cycles and reproductive strategies⁹.

South America has the greatest wealth of freshwater fish on the planet. In Brazil, there are more than three thousand classified species. One of the common difficulties of fish farming stations, with a view to the production of animals, for various purposes, such as the repopulation of watercourses modified by the construction of dams and hydroelectric plants, production of protein for human consumption or fish-pay, is the limitation existing in the initial phases of cultivation of native species. Usually high mortality rates are observed until the fingerling stage. From this stage of development, some authors report an increase in the survival and productivity of fish in culture¹⁰.

Environmental factors are decisive for the development of larvae and fish, and greatly influence feeding in the early stages of development¹¹. Although fish have high



reproductive capacity, many species are in the process of extinction. This has been occurring due to the destruction of its habitat, as a result of anthropogenic activities¹².

Among the Brazilian fish species, the piracanjuba stands out for its economic value due to its excellent meat. The piracanjuba is a fish that spawns and has good commercial acceptance because it has excellent quality meat, arousing great interest from researchers and producers. Despite this scientific and commercial interest that this species has been receiving, little is known about the preference of this fish for the environment in relation to luminosity¹³.

Studies related to the biology and behavior of fish are essential for their preservation. Among the most important factors that affect the feeding strategy of fish, light seems to be a stimulus that makes them more or less active. Thus, in order to take measures aimed at preserving the piracanjuba, it is necessary to know the biology and behavior of this species, involving the preference for the environment in relation to luminosity⁷.

This species is considered large, measuring between 62.5 and 80 cm, weighing up to 8.2 kg. Females reach a total length of 80 cm and body weight of 8.2 kg and males, 68 cm and 3.6 kg⁶.

This species is ecologically demanding, being one of the first to disappear in response to human-generated changes, especially deforestation, agricultural activities and dams, and can therefore be considered as a biological indicator of the environmental quality of rivers¹⁴.

The Brazilian legislation itself defines that the quality of aquatic environments can be evaluated by biological indicators, using aquatic organisms and/or communities for this purpose¹⁵.

According to MMA Ordinance No. 445, of December 17, 2014, the piracanjuba is on the National List of Species of Aquatic Invertebrates and Endangered Fish. This species is an endangered species, being fully protected, including, among other measures, the prohibition of capture, transport, storage, guarding, handling, processing and commercialization¹⁶.

This species is also included in the list of endangered species of the fauna of Minas Gerais, in the Red Book, since 1998 and is currently critically endangered in this state¹⁷.

The species *Brycon orbignyanus* (Valenciennes, 1849) became an endangered species in the Grande, Mogi Guaçu and Pardo rivers. In these rivers, many specimens were captured in the forties. This species became extinct in this region due to deforestation of riparian vegetation, pollution, the construction of dams, and the indiscriminate use of pesticides¹⁸.

The objective of this study was to evaluate the preference of the fish *Brycon orbignyanus* (piracanjuba) for the environment in relation to luminosity.

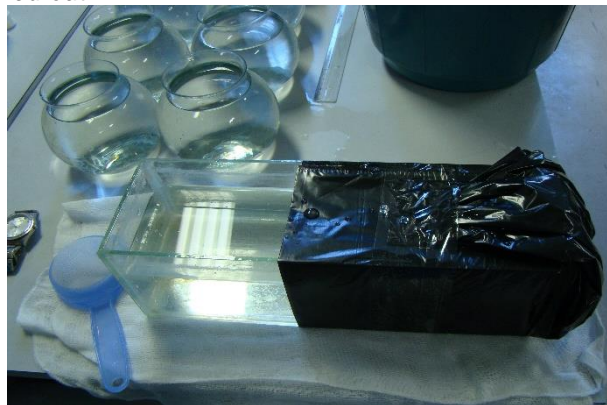
MATERIALS AND METHODS

This work was carried out with the larvae of the fish *Brycon orbignyanus* (piracanjuba). The larvae used were collected at the Companhia Energética de Minas Gerais – CEMIG, at the Volta Grande Environmental Station – EAVG, located in the municipality of Conceição das Alagoas – MG with approximately 04 days of life and undetermined sex, in January 2011.

The experiment was carried out at the Laboratory of Ecology and Evolution, Department of Biological Sciences of the Federal University of Triângulo Mineiro – UFTM, in Uberaba – MG, on January 26 and 27, 2011, from 5:30 p.m. to 7 p.m., with larvae of the fish *Brycon orbignyanus* (piracanjuba). In the laboratory, the larvae were stored in a glass aquarium measuring 95 x 35 x 55 cm, with a capacity of 160 L, with constant aeration at a temperature of 26°C and exposed to the natural light cycle, for two days before the experiment. During the study period, the larvae were fed with natural plankton.

For the experiment, a rectangular glass aquarium measuring 30 x 10 x 10 cm was used, which was divided into two environments with each length, one light and the other dark. For the dark environment, a black plastic bag was used (Figure 1).15 cm

FIGURE 1. Aquarium divided into two environments: light and dark; where the experiment with larvae of *Brycon orbignyanus* was carried out.



The piracanjuba larvae were removed from the larger aquarium, with a one-mm mesh sieve, one by one and transported to the aquarium with two environments.

Due to the possibility of individual identification of the larvae, the method adopted was that of the "focal animal"^{19,20}, where the fish larvae were placed individually in the bright compartment of the aquarium, and the movement of the specimen was analyzed, with registration every five minutes (Figures 2 and 3).

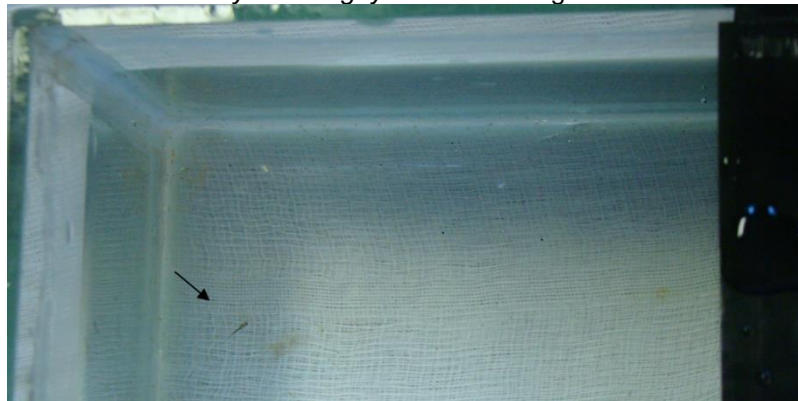
Subsequently, the specimen was removed from the aquarium and placed in another individual aquarium, with a capacity of 600 ml, to repeat the experiment the next day. In total, 08 (eight) observations were made.

All the water used in the aquariums and in the experiments came from Rio Grande, near the Volta Grande Environmental Station.

FIGURE 2. Observation of the specimen of *Brycon orbignyanus*, regarding the possible choice of the environment, in an aquarium divided into two environments.



FIGURE 3. Larva of the fish *Brycon orbignyanus* in the bright environment of the aquarium.



RESULTS AND DISCUSSION

In this work it was verified that the larvae of *Brycon orbignyanus* (piracanjuba) preferred only the bright environment. All four specimens of piracanjuba remained, for five minutes, in the bright environment. This preference did not change on the two days of the experiment (Table 1).



TABLE 1. Number of larvae of the fish *Brycon orbignyanus* (piracanjuba) with a preference for the environment (light and dark) per day.

	Days Bright environment	Dark environment
26/01/2011	04	0
27/01/2011	04	0
Total	08	0

It was observed that the animals moved in the light space in the prone position. At first, the movements of the larvae under study were fast, rectilinear and active. It was only after a few minutes that the movements occasionally reduced in intensity, but always on the light side of the aquarium.

A point to be highlighted in this work is what led the larvae of *Brycon orbignyanus* (piracanjuba) to choose the light environment avoiding the dark one. In this aspect, only a few considerations can be made, but more studies are needed.

It is known that a significant number of fish species are visually guided and the decrease in luminosity, change in light contrast and water turbidity compromise food selection^{21,22}.

Light is one of the most important factors that affect the feeding strategy of fish, being a stimulus to make fish active¹⁸. However, the effect of light can also act as a stress-generating agent, causing aggression and an increase in the rate of cannibalism²³.

The color of the environment is one of the factors that affects behavior and it is possible that it has implications for the well-being of the fish. However, little is known about the preference of fish in relation to environmental color²⁴⁻²⁶.

The magnitude of food consumption varies with the light intensity, which influences the possibility of detecting prey, and it is observed that the photoperiod is a factor that implies the growth and survival of the larvae. A characteristic of fish, such as those of the genus *Brycon*, is the well-developed and well-pigmented eyes, which facilitates the visual direction to attack their prey²³.

Fish that use vision to capture their food may be affected by environments where the main food is distributed in deep, dimly lit places²³.

The study carried out with post-larvae of *Brycon orbignyanus* found that the survival of these fish was directly related to luminosity, the lowest survival was recorded in the treatment without lighting²³.

FINAL CONSIDERATIONS

Further studies involving the biology and behavioral aspects of this species are needed to validate this work.



The protection and recovery of habitats should be priority strategies for the conservation of piracanjuba since this fish is considered an indicator of water quality and because its meat is appreciated, in addition to being a source of noble protein. Thus, research on biology, such as surveying the remaining populations and studying the behavior of this species in detail, is necessary.

In regions where this species is threatened with extinction or is already extinct, it can be carried out. However, as this fish is ecologically demanding, it is necessary to define effective actions for the recomposition of the riparian forest, where it does not exist. Another conservation strategy for this species is captive breeding, but this strategy also needs validation.

Allied to the strategies for the conservation of piracanjuba, it is essential to create environmental education programs that highlight the need for the importance of this species as well as the dissemination of information about the damage caused to the environment and, consequently, to man, by the degradation of natural resources.

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