

Ichthyofauna of the Carrapato, Mutum and Caba Saco streams (Araguaia River Basin), Serra dos Carajás region, southeastern Pará, Brazil

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ABSTRACT: The ichthyofaunistic studies from the Tocantins-Araguaia River Basin are mainly concentrated in the main channel of the Araguaia and Tocantins rivers, due to faunal studies required for hydroelectric projects. Brooks and streams are usually neglected, though they represent the habitats most threatened by human activities. These small water courses present a great diversity of fishes, and they also have high rates of endemic species. The study was conducted from December 2009 to January 2010. For the inventory, the methodology used was the Rapid Assessment Program (RAP). In each sampled area three types of data collection were utilized: open interviews with local fishermen, naked eye fish surveying, and fishing with cast nets and gill nets. This study aimed to identify the main fish species that occur in the Mutum and Caba Saco streams, that form the Pau D'Arco River, and in the Carrapato Stream that flows to the Preto River, both belonging to the Araguaia River Basin.

INTRODUCTION

The Neotropical ichthyofauna is dominated by fishes that have a relatively old association with freshwater habitats (Lovejoy *et al.* 2006). The Araguaia River is part of the Tocantins-Araguaia River basin which is one of the major river systems in South America (Lundberg 1998). Its complex geomorphological and climatic formation has an intrinsic relation to the fact that the drainage area includes major phytogeographic regions such as Cerrado, Amazon Forest and palm three forest (Mata de Cocais), thereby concentrating an important biodiversity, with a high level of endemism and outstanding natural value (Zuanon 2001; Dias *et al.* 2000; Latrubesse and Stevaux 2006).

Fish fauna studies from the Tocantins-Araguaia River basin are mostly concentrated in the in the main river channels of this basin, some of them in the upper Araguaia region (Lowe McConnel 1991; Venere *et al.* 1999; Benedito-Cecilio *et al.* 2004; Melo *et al.* 2004; Silva *et al.* 2009). Other studies focused the lower Tocantins region, mainly due to ichthyofaunistic studies related to the construction of Tucuruí Dam and other hydroelectric projects in the region (Santos *et al.* 1984; Carvalho and Merona 1986; Camargo and Petrere-Jr. 2004; Santos *et al.* 2004; Merona *et al.* 2010). In this vast region, studies on the freshwater fish communities of brooks and streams have been rather neglected, although they deserve special attention, also because they are the most affected and threatened by human activities (Agostinho *et al.* 2005; Barletta *et al.* 2010; Nogueira *et al.* 2010). Backup (1999) and Sá *et al.* (2003) highlighted the diversity of fish that these small water courses present, indicating high levels of endemic and/or rare species. These biotic characteristics of the streams justify the urgency of studying the ichthyofauna that occurs in these streams (Backup 1999).

There is an urgent need of ichthyofaunal studies in the region of the Araguaia River and its tributaries, as they form one of the most important river systems of South America and also because of several other aspects already presented, which makes this area an interesting spot for water resources and aquatic biota diversity studies (Dias *et al.* 2000). Sá *et al.* (2003) emphasize the importance of the streams from the Cerrado biome, which represents a considerable part of the Araguaia River basin.

This study aims to inventory, through Rapid Assessment Program (RAP), the fish fauna from the Carrapato, Caba Saco and Mutum streams, which form the Pau D'Arco River (Arraia River micro-basin, Araguaia River basin) and the Preto River (Preto River micro-basin, Araguaia River basin) in the Serra dos Carajás region, in the state of Pará.

MATERIALS AND METHODS

Study Site

The collections were held at the Araguaia River basin, in the Caba Saco, Mutum (tributaries of Pau D'Arco River) and Carrapato (tributary of Preto River) streams (Figure 1), in the municipalities of Redenção and Santa Maria das Barreiras, in the Serra dos Carajás region, southeastern Pará. The collections were held under the IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis) permit number: 154/2007.

Data collection

The methodology used was a fast inventory (RAP - Rapid Assessment Program) following Latini and Petrere (2004) with modifications. Four visits to each sample area were made between December 2009 and January 2010. In each visit, four types of data collection were used: open interviews with local fishermen; naked eye fish surveying

on the riverside; fishing with gill nets; and fishing with 15 mm – mesh cast nets. The gill nets were set in groups of six at a time, all of them having the same length (10 meters) and height (1.6 meters), and mesh sizes 15, 20, 30, 40, 50 and 60 mm, measured between adjacent knots (which allows the capture of most small size fish species). The nets were set randomly so they would reach several distinct habitat physiognomies. All nets were placed for 30 minutes. The use of such nets for this time interval ensured identical collection efforts for all sampled areas, totaling 48 m²/hour (6 nets x 10 meters long x 1.6 meters high x 0.5 hours) in each station. The cast nets were operated using five random releases in each sample site.

Data analysis

The collected fishes were taken to the Laboratório de Sistemática Molecular de Vertebrados, at the Universidade Federal de Viçosa (UFV) to be identified using specific taxonomic keys and identification guides (Géry 1969; Santos *et al.* 1984, 2004; Melo *et al.* 2005; Britski *et al.* 2007) and consulting specialists. The captured fishes were identified and deposited at the Laboratório de Sistemática Molecular de Vertebrados Beagle, at the Universidade Federal de Viçosa. Fishes with measurements inferior to 0.4 m and 1 kg were fixed, larger specimens were returned alive to the streams, with the exception of unique or rare ones. All fishes were weighed, measured and photographed.

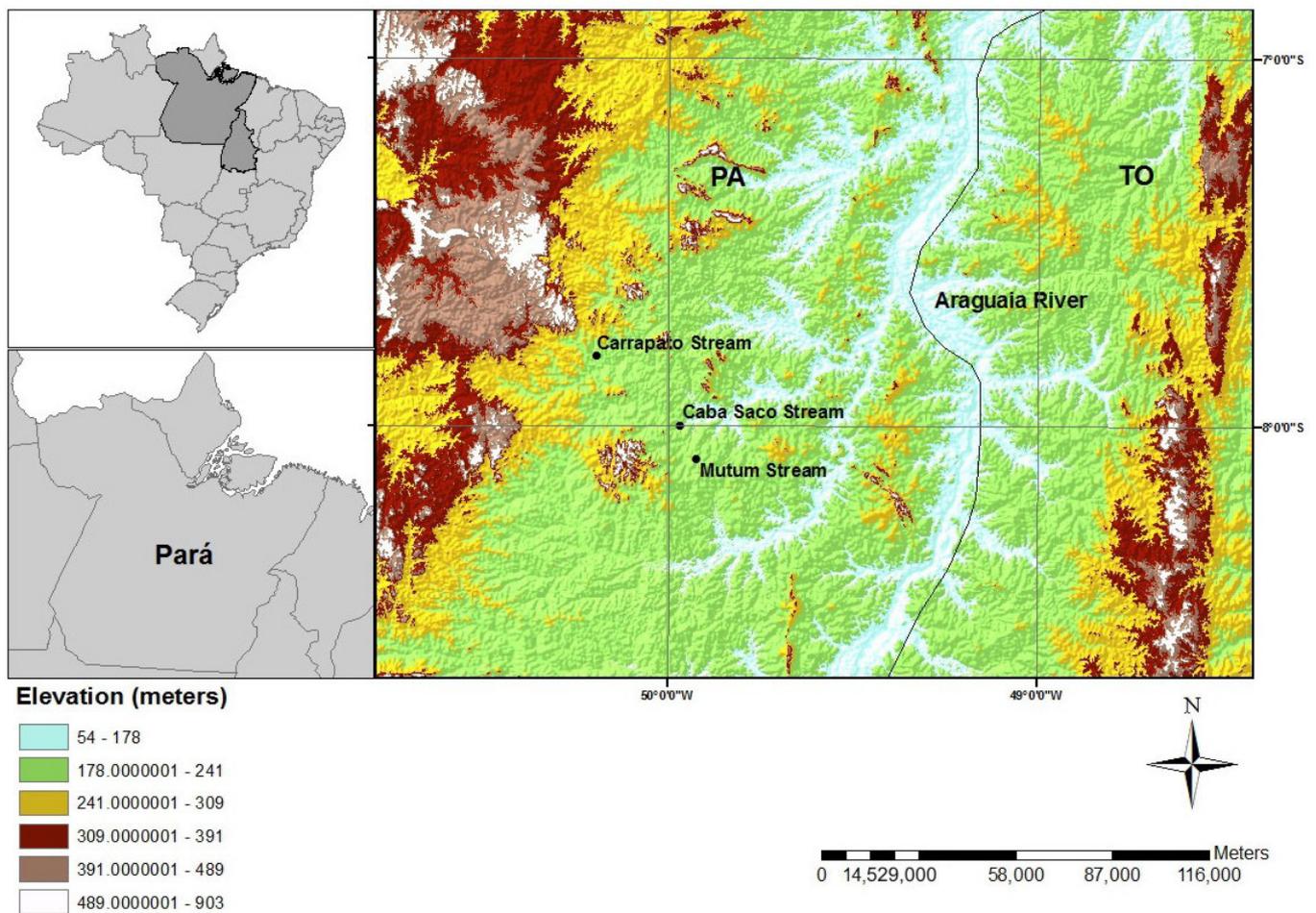


FIGURE 1. Map of the study region - localization of the rivers and the position of the sampling sites.

RESULTS AND DISCUSSION

The fishes captured and identified using a combination of methodologies called RAP (Latini and Petrere 2004) in the Caba Saco, Mutum and Carrapato streams, were distributed in 37 species, in 33 genera from 14 families and five orders: Characiformes (Characidae, Erythrinidae, Anostomidae, Hemiodontidae, Prochilodontidae, Curimatidae, Acestrorhynchidae, Cynodontidae, Ctenoluciidae), Siluriformes (Loricariidae, Pimelodidae), Perciformes (Cichlidae), Synbranchiformes (Synbranchidae), and Rajiformes (Potamotrygonidae) (Table 1). Among these families, Characidae (Characiformes) and Cichlidae (Perciformes) represented the greater species richness, with 13 and six species, respectively. Siluriformes were

only represented by four species belonging to two families (Loricariidae and Pimelodidae), while the Synbranchidae and Potamotrygonidae by a single species, each. Other studies in the Tocantins-Araguaia River basin also report the order Characiformes as the most diverse, followed by Siluriformes (Aloísio *et al.* 2005; Melo *et al.* 2005; Lucinda *et al.* 2007) and not by Perciformes as occurred in this study.

Carrapato Stream concentrated a higher level of richness and abundance that may be related to its greater water volume and the strong influence of major rivers, such as the Preto and Araguaia (Table 1). This fact justifies the presence of large species like *Pseudoplatystoma fasciatum*, *Hemisorubim platyrhynchos* and *Potamotrygon motoro*,

TABLE 1. Species surveyed with RAP protocols in some streams of the Araguaia Basin. Popular names; taxonomic classification; sample station: 1- Carrapato Stream, 2- Caba Saco Stream, 3- Mutum Stream; Species category: N-native, RI- Reportedly introduced, CR- critically endangered (Rosa and Lima 2008); method of collection: G – Gill net, C – Casting net, IN – Interview, NS – Naked eye surveying.

TAXON	LOCAL NAME	SAMPLE STATION	SPECIES CATEGORY	METHOD
CHARACIFORMES				
Characidae				
<i>Astyanax bimaculatus</i> (Linnaeus, 1758)	Lambari, tambuí	1, 2, 3	N	G/C
<i>Tetragonopterus argenteus</i> Cuvier, 1816	Pataca	1	N	G/C
<i>Moenkhausia</i> sp.	Piaba	1, 2, 3	N	G
<i>Brycon</i> sp.	Piabanha	1	N	G
<i>Chalceus epakros</i> Zanata and Toledo-Piza, 2004	Piaba do rabo vermelho	1	N	G
<i>Triportheus trifurcatus</i> (Castelnau, 1855).	Sardinha	1	N	G
<i>Roeboides affinis</i> (Günther, 1868)	Corcunda	1, 2, 3	N	G/C
<i>Mylossoma duriventre</i> (Cuvier, 1818)	Pacu	1	N	G
<i>Piaractus brachypomus</i> (Cuvier, 1818)	Caranha	1	N/RI	IN
<i>Serrasalmus geryi</i> Jégu and Santos, 1988	Piranha Branca	1	N	G
<i>Serrasalmus manuei</i> (Fernández-Yépez and Ramírez, 1967)	Xupita	1	N	G
<i>Serrasalmus rhombeus</i> (Linnaeus, 1766)	Piranha preta	1, 3	N	G
<i>Pygocentrus nattereri</i> Kner, 1858	Piranha vermelha	1	N	G
Erythrinidae				
<i>Hopleryrhinus unitaeniatus</i> (Spix and Agassiz, 1829)	Jeju	1, 2, 3	N	G
<i>Hoplias malabaricus</i> (Bloch, 1794)	Traíra	1, 2, 3	N	G
Anostomidae				
<i>Leporinus friderici</i> (Bloch, 1794)	Piau cabeça gorda	1, 2, 3	N	G/C
<i>Schizodon vittatus</i> (Valenciennes, 1850)	Piau vara	1	N	G
Prochilodontidae				
<i>Prochilodus nigrans</i> Agassiz, 1829	Papa terra	1	N/RI	IN
Curimatidae				
<i>Curimata cyprinoides</i> (Linnaeus, 1766)	Branquinha	1, 2, 3	N	G
<i>Steindachnerina amazonica</i> (Steindachner, 1911)	Branquinha	1, 2, 3	N	G
<i>Steindachnerina gracilis</i> Vari and Vari, 1989	Branquinha	1, 2, 3	N	G
Acestrorhynchidae				
<i>Acestrorhynchus falcatus</i> (Bloch, 1794)	Cachorrinho	3	N	G
Cynodontidae				
<i>Rhaphiodon vulpinus</i> Spix and Agassiz, 1829	Chacorra-facão	1	N	G
Ctenoluciidae				
<i>Boulengerella cuvieri</i> (Agassiz, 1829)	Bicuda	1	N	G
Hemiodontidae				
<i>Hemiodus unimaculatus</i> (Bloch, 1794)	Voador	1	N	G
PERCIFORMES				
Cichlidae				
<i>Astronotus ocellatus</i> (Agassiz, 1831)	Cara-açú	1	N/RI	G/C
<i>Cichla monoculus</i> Spix and Agassiz, 1831	Tucunará de crista	1	N/RI	IN
<i>Cichla ocellaris</i> Bloch and Schneider, 1801	Tucunará	1	N/RI	G
<i>Crenicichla cyclostoma</i> Ploeg 1986	Joaninha	1, 2, 3	N/CR	G
<i>Geophagus surinamensis</i> (Bloch, 1791)	Rola – Pedra	1, 2, 3	N	G
<i>Aequidens duopunctatus</i> Haseman, 1911	Cará	1, 2, 3	N	C
SILURIFORMES				
Loricariidae				
<i>Hypostomus</i> sp.	Cascudo	1, 2, 3	N	G
Pimelodidae				
<i>Pimelodus blochii</i> Valenciennes, 1840	Mandi	1, 2, 3	N/RI	G
<i>Hemisorubim platyrhynchos</i> Valenciennes, 1840	Jiripoca	1	N/RI	IN
<i>Pseudoplatystoma fasciatum</i> (Linnaeus, 1766)	Pintado	1	N/RI	IN
SYNBRANCHIFORMES				
Synbranchidae				
<i>Synbranchus marmoratus</i> Bloch, 1785	Mussum	1, 2, 3	N	NS
MYLIOBATIFORMES				
Potamotrygonidae				
<i>Potamotrygon motoro</i> (Muller and Henle, 1841)	Arraia de fogo	1	N	NS

which were found only in this stream, in addition to the occurrence of species from large rivers that rarely appear in small tributaries, except during the spawning season (e.g. *Hemiodus unimaculatus*, *Triporthesus trifurcatus* and *Schizodon vittatus*) (Buckup 1999; Melo et al. 2005). The Mutum and Caba Saco streams had a small portion of the fish species present in the Carrapato stream fish, probably due to the small size of these streams, with high seasonal fluctuations of water volume and therefore do not sustain the large species (Esteves and Aranha 1999).

Through interviews, it was evident that the region is subjected to an intense process of native fish aquaculture activities that may explain the presence of large fish species in these small streams. This introduction occurs mainly by accidental events, such as disruption of dams and artificial ponds. Local fishermen indicated the following species as being recently introduced: Caranha (*Piaractus brachypomus*), Tucunaré (*Cichla ocellaris*, *C. monoculus*), Papa-terra (*Prochilodus nigrans*), Cara-açú (*Astronotus ocellatus*), Pintado (*Pseudoplatystoma fasciatum*), and Jiripoca (*Hemisorubim platyrhynchos*). The situation described may be worrisome: although all the surveyed species were native to the Tocantins-Araguaia River Basin, the effects of species introduction in habitats or river stretches where they do not occur naturally (therefore disrupting original community composition, as explained by the River Continuum Concept (Vannote et al. 1980). This faunal mixing goes against the currently accepted concept that native species are less harmful than exotics. When a lowland species is introduced in higher reaches of the same drainage it may find some conditions that usually favor invasive species success: lack of predators or diseases, low diversity and vacant niches (Pimm 1989).

This study reported the presence of an endangered species, commonly known as the Joaninha (*Crenicichla cyclostoma*), in the three streams mentioned (Rosa and Lima 2008; Albernaz and Avila-Pires 2009). Rosa and Lima (2008) indicated the last recordings of this species in the 1980s, before and shortly after the construction of the Hydroelectric Dam in Tucuruí. The specimens captured in this study were collected in possible home range indicated by Rosa and Lima (2008) in the Araguaia basin, at the end of the middle portion and the start of the lower portion of this basin. In the Serras dos Carajás region, the main threats to this species are habitat destruction for mineral exploration, deforestation and hydroelectric dams (Casatti 2010). Nogueira et al. (2010) reported that the Araguaia-Tocantins River Basin has 22 critical areas containing approximately 101 species, all of which are currently living in restricted ranges and that could potentially be included in the endangered species lists. Ichthyofaunal studies from the Amazon River Basin and the river systems connected to it, as the Tocantins-Araguaia River Basin, are still very scarce, especially the ones focusing habitats such as small streams and brooks. Faunal inventories are essential for understanding the still largely unknown diversity of Neotropical fishes (Langeani et al. 2009; Casatti et al. 2010). The RAP methodology seemed to be an efficient tool for carrying out ichthyofaunal surveys, because it allows complementation of standard collecting devices (gill nets and cast nets) with naked eye surveying and interviews.

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