THE FISH FAUNA OF TWO TRIBUTARIES OF THE PASSO FUNDO RIVER, URUGUAY RIVER BASIN, RIO GRANDE DO SUL, BRAZIL

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RESUMO

A fauna de peixes de dois tributários do rio Passo Fundo, bacia do rio Uruguai, Rio Grande do Sul, Brasil

A estrutura e composição da fauna de peixes foi estudada nos rios Caraguatá e Butiá, tributários do rio Passo Fundo, afluente da margem esquerda do rio Uruguai superior, localizado no sul do Brasil. Entre julho de 1995 e fevereiro de 1997 foram realizadas coletas sazonais com redes de espera em sete pontos estabelecidos nos rios. Um total de 553 exemplares, pertencentes à 20 espécies, foram coletados. As quatro espécies com maior participação em número contribuíram com 65,1% do total capturado. As ordens mais representativas em número de exemplares foram Characiformes e Siluriformes, com 45% e 40% de participação, respectivamente. Os rios apresentaram um índice de similaridade ictiofaunística de 0,58 e praticamente a mesma equitatividade. A diversidade foi maior no rio Caraguatá.

Palavras-chave: bacia do rio Uruguai, rio Passo Fundo, diversidade, composição, ictiofauna, similaridade.

ABSTRACT

The fish fauna of the Caraguatá and Butiá Rivers was studied. Both rivers are tributaries to the Passo Fundo River, itself a tributary to the left (southern) margin of upper Uruguay River in southern Brazil. Sampling was done at seven collecting stations with gill nets on a seasonal basis between July 1995 and February 1997. A total of 553 specimens were collected, with representatives of 20 species. These species were primarily of the orders Characiformes and Siluriformes (45% and 40% of the number of species, respectively). Four species, *Bryconamericus* sp, *Astyanax* sp. "A", *Oligosarcus brevioris* and *Astyanax* sp. "B", were the most abundant, together making up 65.1% of the total number captured. Both rivers studied showed a similarity

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index of 0,58 and virtually the same evenness value, but the diversity coefficient was slightly larger for the Caraguatá River.

Key words: rio Uruguai drainage, rio Passo Fundo, diversity, composition, fish fauna, similarity.

INTRODUCTION

The Uruguay River is the third largest of the rivers of the La Plata basin (Di Persia & Neiff, 1986), extending 1,838 km and with a drainage area of about 365,000km². Approximately two hundred fish species have been recorded in the Uruguay River drainage to date, well below the number reported for other rivers of the La Plata basin. The lack of adequate studies on neotropical fish fauna has been discussed for some time (Lachner *et al.*, 1976; Margalef, 1983; Lowe-McConnell, 1987), and may also be the reason for the apparent low diversity in the Uruguay River. Knowledge of this diversity is particularly important in assessing and mitigating effects of anthropogenic impacts on the river.

To help address this issue, we investigated the fish fauna of two previously unstudied headwater tributaries of the Uruguay drainage that are situated in the highly agricultural plateau of northern Rio Grande de Sul state of Brazil.

METHODS AND MATERIAL

The Caraguatá River (28°08'S 52°18'W) is a tributary to the Butiá River (28°04'S 052°27'W) about 20km upstream of its junction with the Passo Fundo River, itself one of the four main tributaries of the upper Uruguay River. Both rivers run at an elevation of about 600m through agricultural land of the the middle plateau of Rio Grande do Sul State, with similar physiographic characteristics (Tab. 1). The Caraguatá river is about 40km long, and has many disturbed environments due to intensive agriculture on its banks, with a bottom that consists primarily of sludge and organic matters. In the better preserved areas, the bottom consists of small rocks and gravel and has slow to fast water currents. The Butiá river is about 45km long and similar to the Caraguatá, but with an even greater degree of agricultural impact.

Between July 1995 and February 1997 we made eleven collecting expeditions – one or more to each of seven sampling sites chosen to represent the different environments, depths, and bottom types (Fig.1) in the two rivers. These sites were denominated "Bio A", "Bio B", "Bio C" and "Bio D". Collection was carried out with gill nets of 10-70 mm mesh size, which were set for approximately 24 hours but also inspected at dawn and sunset. Fish

were identified and weighed immediately upon capture and then deposited on the MCP (Museu de Ciências e Tecnologia da PUCRS).

The Shannon-Weaver index (Krebs, 1989) was used to evaluate the specific diversity, calculated with the DIVERS software and the Bray-Curtis index (Krebs, 1989) was used to compare the fish fauna between sampling sites and between the Caraguatá and Butiá rivers. To facilitate the interpretation of the results, we used: "1- Bray-Curtis" as a similarity measurement, with a range of 0 to 1 (indicating "low" to "high" similarity). The Bray-Curtis index alone deals with the abundance of species, in contrast to similarity indexes, and ignores cases in which species are absent in both community samples. It is also influenced greatly by the presence of very abundant species, in such a way that rare species add very little to the value of the coefficient (Krebs, 1989).

For each sampling station and each river, abundance and diversity were analyzed separately. Species representing less than 5% of the total collected individuals were considered rare.

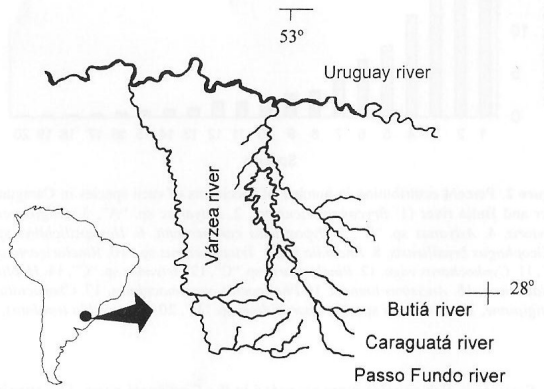

Figure 1. Sampling sites in the Caraguatá river and Butiá river, Rio Grande do Sul, Brazil.

(11,5%), *Hypostomus commersonii* (10.4%), and *Hemipsilichthys* sp. (9,3%). These species contributed with 81.6% of the total captured. *Hypostomus commersonii*, *Oligosarcus brevioris*, and *Rhamdia* sp. contributed the most in terms of biomass, comprising 92,5% of the total biomass of 28.6 kg.

The sampling station with the greatest diversity, evenness, and richness of species was "Bio D" (Tab. 3). This station has several different environments, with both slow and fast waters, rocks, gravel and ooze on the bottom, and depths ranging from 0.8m to 3.4m. Station "Bio B", in contrast, possessed the smallest diversity index, evenness, and species richness.

The lowest faunal similarity index occurred between sampling sites "Bio A" and "Bio B" (Tab. 4). This is probably due to the high degree of anthropogenic impact at station "Bio B", that has resulted in considerable deposition of sediments and a dramatic decrease in depth of the river. On the other hand, "Bio A" station was the most natural of the sites and contained the greatest environmental diversity.

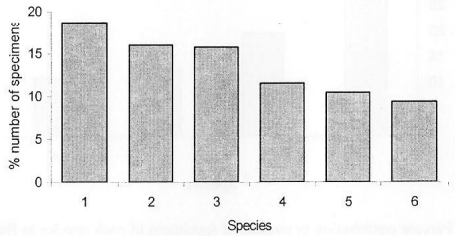

Figure 3. Percent contribution in number of specimens of each species in Caraguatá river (1. *Astyanax* sp. "A"; 2. *Oligosarcus brevioris;* 3. *Bryconamericus* sp.; 4. *Astyanax* sp. "B"; 5. *Hypostomus commersonii;* 6. *Hemipsilichthys* sp.)

In the Butiá river, 178 individual fish were collected, representing 14 species. The most abundant species captured (Fig. 4) were *Bryconamericus* sp. (28.1%) *Astyanax* sp. "A" (19.7%), *Astyanax* sp. "B" (12.9%), and *Oligosarcus brevioris* (11.2%). These species contributed 71.9% of the

total number of individuals captured. *Oligosarcus brevioris*, *Hypostomus commersonii*, *Hoplias malabaricus*, and *Cyphocharax voga* were the species of greatest biomass, together contributed 85.7% of the total biomass captured in the Butiá river (6.68 kg). The "Bio D" sampling site contained the greatest diversity and the "Bio B" site the lowest (Tab. 5). Species similarity between sampling sites in Butiá river were low (Tab. 6), with the highest between "Bio B" and "Bio C" and the lowest between "Bio C" and "Bio D".

The species *Characidium* sp. B, *Rineloricaria* sp. B, and *Phalloceros caudimaculatus* were collected only in the Butiá river and the species *Characidium vestigipinne*, *Rhamdia* sp., *Rineloricaria* sp. C, *Hisonotus* sp., *Crenicichla lepidota,* and *Tricomycterus* sp. were only found in the Caraguatá river. Of the 20 species captured during this survey, only 11 species were found to be shared by the two rivers.

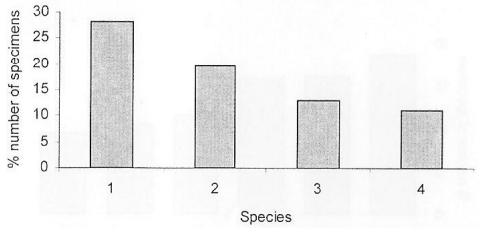

Figure 4. Percent contribution in number of specimens of each species in Butiá river (1. *Bryconamericus* sp.; 2. *Astyanax* sp. "A"; 3. *Astyanax* sp. "B"; 4. *Oligosarcus brevioris*)

Table 1. Characteristics of the sampling sites in Caraguatá and Butiá rivers.

Sampling Station	Water	Average Depth	Bottom Type	Riparian Area	Human Activities in Riparian Area
Caraguatá river					
A	Fast water; clear to brown in color	1.20m	Rocks and mud	Scarce vegetation, dominated by grasses (Poaceae)	Intensive agriculture (soy bean and wheat); cattle presence
B	Slow water; white to brown in color	1m	Ooze and organic matter	Moderatly abundant vegetation;	Rice farm
C	Slow and fast water; white to brown in color	2m	Ooze and gravel	Grassland and native fields dominated by grasses	Agricultural and cattle-breeding
D	Fast water; white to brown in color	1.50m	Rocks, gravel and ooze	Humid and moderate vegetation	Intensive agriculture (soy bean and wheat)
Butiá river					
B	Fast and slow waters; brown in color	0.80m	Rocks and ooze	Moderatly abundant vegetation	Intensive agriculture (soya and wheat)
C	Slow and brown in color	1.2m	Rocks and ooze	Slender vegetation	Intensive agriculture (soya and wheat)
D	Slow and brown in color	1m	Ooze and silt	Slender vegetation	Intensive agriculture (soy bean and wheat)

Table 2. Fish species captured in Caraguatá and Butiá rivers (♣ species captured only in the Caraguatá river, ♦ species captured only in the Butiá river, ♠ species captured by the two rivers)

CHARACIFORMES	Loricariinae
Erythrinidae	*Rineloricaria* sp. "B" ♦
Hoplias malabaricus (Bloch, 1794) ♠	*Rineloricaria* sp. "C" ♣
Curimatidae	Ancistrinae
Cyphocharax voga (Hensel, 1869) ♠	*Ancistrus taunayi* Miranda- Ribeiro, 1918 ♠
Acestrorhynchidae	Hypostominae
Oligosarcus brevioris Menezes, 1987 ♠	*Hypostomus commersonii* Valenciennes, 1840 ♠
Characidae	*Hemipsilichthys* sp. ♠
Tetragonopterinae	Hypoptopomatinae
Astyanax sp. "A" ♠	*Hisonotus* sp. ♣
Astyanax sp. "B" ♠	Trichomycteridae
Astyanax sp. "C" ♠	*Trichomycterus* sp. ♣
Bryconamericus sp. ♠	PERCIFORMES
Crenuchidae	Cichlidae
Characidium sp. "B" ♦	*Crenicichla lepidota* Heckel, 1840 ♣
Characidium vestigipinne ♣	*Geophagus brasiliensis* Kner, 1865 ♠
SILURIFORMES	CYPRINODONTIFORMES
Pimelodidae	Poecillidae
Rhamdia sp. ♣	*Phalloceros caudimaculatus* (Hensel, 1968) ♦
Loricariidae	

Table 3. Species number (S), individuals number (N) and Shannon-Weaver diversity index of the fish fauna collected in Caraguatá river sampling sites (J = eveness; H' = diversity of species; Hmáx = maximum possible diversity index).

Index	Sampling sites				
	Bio A	Bio B	Bio C	Bio D	Total
S	10	05	12	11	17
N	59	63	153	100	375
Hmáx.	2.04293	1.48220	2.33438	2.20617	2.73156
H	1.79381	1.27242	1.91130	2.08990	2.26568
J	0.80986	0.80801	0.78293	0.89108	0.80708

Table 4. Similarity coefficient (1 - Bray-Curtis) between Caraguatá river sampling sites.

Sampling sites	A	B	C
A	–		
B	0,25	–	
C	0,27	0,28	–
D	0,29	0,69	0,53

Table 5. Species number (S), individuals number (N) and Shannon-Weaver diversity index of the fish fauna collected in Butiá river sampling sites (J = eveness; H' = diversity of species; Hmáx = maximum possible diversity index).

Index	Sampling sites			
	Bio B	Bio C	Bio D	Total
S	04	06	12	14
N	13	17	148	178
Hmáx.	1.07683	1.40313	2.33040	2.48538
H	1.02155	1.50868	1.96132	2.05295
J	0.82450	0.93743	0.80302	0.79081

Table 6. Similarity coefficient (1 - Bray-Curtis) between Butiá river sampling sites.

Sampling sites	B	C	D
B	–		
C	0,33	–	
D	0,26	0,17	–

Table 7. Species number (S), individuals number (N) and Shannon-Weaver diversity index of the fish fauna collected in Caraguatá river and Butiá river (J= eveness; H' = diversity of species; Hmáx. = maximum possible diversity index).

Index	Caraguatá river	Butiá river
S	17	14
N	375	178
Hmáx.	2.73156	2.48538
H'	2.26568	2.05295
J	0.80708	0.79081

DISCUSSION

The most recent estimates of Neotropical freshwater fish diversity suggest that up to 8,000 may exist, representing about 25% of all fish diversity worldwide, including both freshwater and marine (Vari & Malabarba, 1998). This is probably still an underestimate, due to various factors that have often been cited since initially expressed by Böhlke *et al.* (1978): the richness and complexity of the fauna, the vast expanse of the aquatic systems on the continent, and the limited human and infrastructure resources dedicated to research on this ichthyofauna. The twenty two years which have passed since Böhlke *et al.* (1978) paper have seen a resurgence in research on that ichthyofauna (Vari & Malabarba, 1998).

As described by Lowe-McConnel (1987), most of these fish species belong to the Characiformes and Siluriformes orders.

The fish fauna of the rivers we studied was also dominated by Characiformes and Siluriformes (45% and 40% of the captured fish, respectively). However, only a relatively low number of fish were collected during this study, possibly partly because of the high degree of anthropogenic disturbance of the rivers, but also due to the limited collecting devices used. As the number of new species encountered continued to rise with every collection (Fig. 1), and the apparent fauna of the two rivers remained fairly dissimilar during our study, it is likely that more species exist in the rivers but were not found.

The limited number of studies in the area sampled, as well as in the whole basin, make it difficult to draw definitive conclusions about the fish fauna composition. Bertoletti *et al.*(1989a) found 74 fish species in the upper

Uruguay River, with only eight of these species found in our study, but *Bryconamericus* sp. also the most abundant. Bertoletti *et al.* (1989b) also sampled the Canoas River, a right margin tributary of the upper Uruguay River, and found 53 species, nine of which also occurred in the Caraguatá river and Butiá river. More distantly, Pavanelli & Caramaschi (1997), working with both gill nets and seine nets, found 44 species in a study of the São Pedro and Caracu tributaries of the Paraná River, with *Cheirodon notomelas* the most abundant, and Castro & Casatti (1997) found 19 species in a tributary of the rio Pardo, in southeastern Brazil (using block and dip nets), with *Astyanax fasciatus*, *A. bimaculatus*, and *Phalloceros caudimaculatus* the most abundant.

The diversity in the Caraguatá and Butiá rivers was relatively low (2.26 and 2.05, respectively) (Tab. 7), when compared to the tributaries of the rio Paraná studied by Pavanelli & Caramaschi (1997), but were more dissimilar. The gill net samples from the streams in the Pavanelli & Caramaschi (1997) study showed a diversity index of 3.97 and a similarity index between the streams of 0,77. The differences in apparent similarity could be partially explained by the different indexes used: the Sorensen index in Pavanelli & Caramaschi (1997) and the Bray-Curtis index in the present study, but also may be an indicator that more species are to be found yet in the streams we studied and/or that the impacts of deforestation and agriculture are resulting in faunistic changes. The Caraguatá river, for example, had the greater calculated diversity, evenness and species richness with the indexes used, a greater environment diversity, and a lower level of anthropogenic impact than the Butiá river.

The low number of individual fish found in the present study, and the discrepancies of fish diversity between the two rivers, suggests that further studies need to be done with urgency before human impacts destroy the fauna further.

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