

Fishes from the Itapecuru River basin, State of Maranhão, northeast Brazil

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(With 1 figure)

Abstract

The Itapecuru is a relatively large river in the northeastern Brazilian state of Maranhão. During several expeditions to this basin, we collected 69 fish species belonging to 65 genera, 29 families and 10 orders. Characiformes and Siluriformes were the orders with the largest number of species and Characidae, Loricariidae, Cichlidae, Auchenipteridae and Pimelodidae were the richest families. About 30% of the fish fauna of the Itapecuru basin is endemic or restricted to northeastern Brazil. Just over a fifth (22%) of the species is also known to occur in the Amazon basin and only a few are more widely distributed in South American.

Keywords: taxonomy, biodiversity, freshwater fishes.

Peixes da bacia do Rio Itapecuru, Estado do Maranhão, nordeste do Brasil

Resumo

A bacia do rio Itapecuru é relativamente grande no Estado do Maranhão, nordeste do Brasil. Durante várias expedições nesta bacia, nós coletamos 69 espécies de peixes, pertencentes a 65 gêneros, 29 famílias e 10 ordens. Characiformes e Siluriformes foram as ordens com maior número de espécies e Characidae, Loricariidae, Cichlidae, Auchenipteridae e Pimelodidae as famílias com maior riqueza. Cerca de 30% da fauna de peixes da bacia do rio Itapecuru é endêmica ou restrita à região Nordeste. Um total de 22% das espécies são conhecidas por ocorrer na bacia Amazônica e somente poucas espécies são largamente distribuídas na América do Sul.

Palavras-chave: taxonomia, biodiversidade, peixe de água doce.

1. Introduction

The Itapecuru River basin is a relatively large coastal drainage system in northeastern Brazil. It is situated in the mid-east of the state of Maranhão, between latitudes 2° 51 S and 6° 56 S, and longitudes 43° 02 W and 43° 58 W. It encompasses a total area of 52,972.1 km², corresponding to approximately 16% of the state. The Itapecuru River is limited to the southeast mainly by the Parnaíba basin, the Itapecuru mountains and the Azeitão plateau, to the southwest by the Mearim basin and to the northeast by the Munim basin. The Itapecuru River has three physically distinct areas. The upper Itapecuru, from its source to the east of the town of Colinas, is dominated by plains, plateaus and cuestas and has a strongly undulating relief rising to 350 m a.s.l. in the Itapecuru, Alpercatas, Croeira, and Boa Vista ranges. The middle Itapecuru from Colinas to Caxias is in an area of low plateaus with gently to strongly undulating relief and many plateaus, with a difference of

60 m altitude. The lower Itapecuru, from Caxias to its mouth in the Bay of São José, is characterized by gently undulating relief with low plateaus (Alcântara, 2004).

Little is known about the ichthyofauna of the Itapecuru, although the adjoining basins of the Parnaíba and Pindaré-Mearim Rivers have been relatively well sampled. The first naturalists to set eyes on the Itapecuru were actually Spix and Martius, but they merely used the waterway to navigate from Caxias to the state capital, São Luiz in June, 1819 (Papavero, 1971). The first freshwater fish species described from northeast Brazil were based primarily on specimens collected in the Parnaíba River basin during the Thayer Expedition, headed by Louis Agassiz from the Museum of Comparative Zoology of Harvard University. The specimens were all collected by Orestes St. John, between October and December, 1865 at locations labeled as “Lagoa de Parnagua, Piauí”, “Parnahyba River basin”,

“Puty River, Teresina” and “Gurgéia River, Piauí” (Higuchi, 1996). The species described from specimens collected during this field trip were described by Garman (1890a, b, 1913), Steindachner (1877, 1881), Eigenmann and Eigenmann (1889), Eigenmann and Henn (1916) and Borodin (1931). Another large collection from the Parnaíba River basin was compiled by Steindachner in 1903 and resulted in a considerable amount of publications and species descriptions (Steindachner, 1906, 1907, 1908a, b, 1909, 1910). In 1903, Haseman, in a field trip to the area, was the first to collect specimens of fish in the Itapecuru near Caxias. His material was used by Steindachner (1915), who described *Otocinclus hasemani*, and by Nijssen (1971) who described *Corydoras blichi vittatus*.

The most comprehensive contribution to the scientific knowledge of the fish species of the Brazilian Northeast is the study of Fowler (1941), who analyzed material collected at several sites by Rodolpho von Ihering, one of the pioneers of pisciculture in Brazil. Von Ihering’s collection contained 823 specimens representing approximately 104 species, 36 of which were described by Fowler (1941). Many specimens were from Ceará, Lago Papary in Rio

Grande do Norte, the Jaguaribe and São Francisco rivers in Pernambuco, and Teresina in Piauí. Fowler’s (1941) paper included his drawings and the vernacular names recorded by R. von Ihering. As noted by Rosa et al. (2003), Fowler’s species names are often synonyms – e.g., *Hassar woodi* and *Hassar iheringi*, which are both synonymies of *Hassar affinis* Steindachner – while some descriptions are based exclusively on small juveniles (e.g., *Ancistrus salgadae*, with approximately 2 cm SL). A recent survey of the Mearim River in Maranhão recorded 60 species (Soares, 2005).

The aim of the present paper is to present and comment on an inventory of fish species from the Itapecuru basin in the Brazilian state of Maranhão.

2. Material and Methods

Specimens of fish were collected during eight field expeditions (each of approximately five days duration) to the lower, middle and upper section of the Itapecuru River (Figure 1). Three locations were sampled on the lower Itapecuru, one near the town of Rosário (02° 55' 60" S and

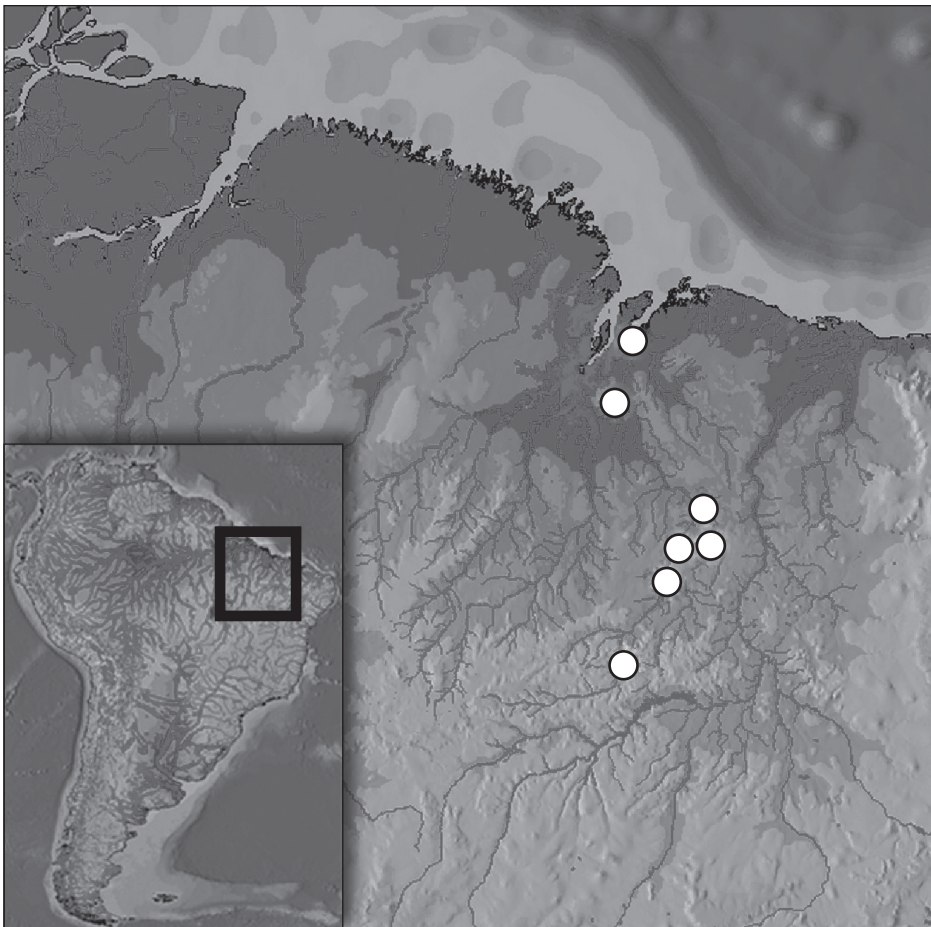


Figure 1. Map the Itapecuru River basin, northeastern Brazil.

44° 14' 60'' W), one at Itapecuru-Mirim (03° 31' 39'' S and 44° 24' 19'' W) and the third near Aldeias Altas (04° 44' 09'' S and 43° 27' 54'' W). On the middle section of the river, two sites were sampled near Caxias (05° 02' 44'' S and 43° 24' 45'' W and 05° 07' 33'' S and 43° 33' 60'' W), and one at 05° 26' 37'' S and 43° 52' 03'' W near the town of Governador Eugênio Barros. The upper stretch was sampled at 06° 22' 26'' S and 44° 22' 60'' W in the proximity of Mirador and near the town of Colinas town (06° 01' 60'' S and 44° 18' 60'' W). Additional sampling was conducted in tributaries, targeting mainly small-sized fishes.

Fish were captured using gillnets (15-35 mm meshes), cast nets (12-35 mm meshes), and hand nets (5 mm mesh). Specimens were transported on ice to the laboratory, where they were preserved in 10% formalin solution and finally conserved in 70% ethanol. The specimens were deposited under the numbers 104552-104603 in the fish collection of the Museu de Zoologia da Universidade de São Paulo, in São Paulo, and at the Universidade Estadual do Maranhão, CESC in Caxias.

The diversity of species was estimated using the Shannon-Wiener diversity index (H'), and the uniformity of the distribution of the species was assessed using the equitability index (Krebs, 1998a, b).

3. Results

A total of 1563 specimens were collected, representing 69 species, 65 genera, 29 families and 10 orders. Characiformes, with 24 species and Siluriformes with 25, were the richest species orders. Characidae, with 13 species, Loricariidae with seven, Cichlidae, Pimelodidae, and Auchenipteridae, all with five, were the richest species families (Table 1).

The maximum possible diversity for the 69 species collected from the Itapecuru River would be 6.108 bit per individual, although our results returned a diversity of 5.025 bits per individual with an equitability of 0.822, which indicates a high diversity, but with a certain degree of homogeneity among the species collected in the basin. Both diversity (H') and equitability (E) were highest on the mid Itapecuru in November, 2007 ($H' = 4.334$, $E = 0.885$), which is the dry season. The lowest values were recorded in the upper part of the river in the wet season, in March 2008 ($H' = 3.226$, $E = 0.678$). The largest number of specimens (644) and species (55) was collected in the lower Itapecuru, followed by the mid section, with 540 specimens and 36 species, and the upper river, with 411 specimens belonging to 29 species.

Table 1. List of species of fishes collected in the Itapecuru River basin.

CHARACIFORMES	
Acestrorhynchidae	<i>Acestrorhynchus cf. lacutris</i>
Anostomidae	<i>Leporinus piau</i> *
	<i>Schizodon dissimilis</i> *
Characidae	<i>Aphyocharax</i> sp.
	<i>Astyanax bimaculatus</i>
	<i>Charax</i> sp.
	<i>Hemigrammus</i> sp.
	<i>Metynnis</i> sp.
	<i>Myloplus</i> sp.
	<i>Poptella compressa</i>
	<i>Pygocentrus nattereri</i>
	<i>Roeboides margaretae</i> *
	<i>Roeboides sazimai</i> *
	<i>Serrapinnus</i> sp.
	<i>Serrasalmus rhombeus</i>
	<i>Triportheus signatus</i> *
	<i>Characidium bimaculatum</i> *
	<i>Curimata macrops</i> *
	<i>Psetrogaster rhomboides</i> *
	<i>Steindachnerina notonota</i> *
Cynodontidae	<i>Cynodon gibbus</i>
Erythrinidae	<i>Hoplias malabaricus</i>
Hemiodontidae	<i>Hemiodus argenteus</i>
Prochilodontidae	<i>Prochilodus lacustris</i> *

* Indicates species endemic to northeastern Brazil; ** i indicates introduced species.

Table 1. Continued...

GYMNOTIFORMES	
Apterontidae	<i>Apteronotus</i> cf. <i>albifrons</i>
Rhamphichthyidae	<i>Rhamphichthys atlanticus</i> *
Sternopygidae	<i>Sternopygus macrurus</i>
SILURIFORMES	
Ariidae	<i>Arius rugispinis</i> <i>Hexanematachthys couma</i>
Aspredinidae	<i>Aspredo aspredo</i>
Auchenipteridae	<i>Ageneiosus inermis</i> <i>Ageneiosus ucayalensis</i> <i>Auchenipterus menezesi</i> *
	<i>Parauchenipterus galeatus</i> <i>Pseudauchenipterus nodosus</i>
Callichthyidae	<i>Callichthys callichthys</i> <i>Corydoras</i> sp.*
Doradidae	<i>Hassar affinis</i> *
	<i>Platydoras brachylechis</i> *
Heptapteridae	<i>Pimelodella parnahybae</i> *
Loricariidae	<i>Ancistrus</i> sp. <i>Hemiodontichthys</i> cf. <i>acipenserinus</i> <i>Hypoptopoma</i> sp. <i>Hypostomus</i> sp. <i>Loricaria</i> sp. <i>Loricariichthys acutus</i> <i>Pterygoplichthys</i> cf. <i>punctatus</i>
Pimelodidae	<i>Hemisorubim platyrhynchus</i> <i>Pimelodus blochii</i> <i>Pimelodus ornatus</i> <i>Pseudoplatystoma</i> cf. <i>punctifer</i> <i>Sorubim lima</i>
BELONIFORMES	
Belonidae	<i>Strongylura marina</i>
CLUPEIFORMES	
Engraulidae	<i>Anchoviella iheringi</i> <i>Anchovia surinamensis</i> <i>Pterengraulis atherinoides</i>
CYPRINODONTIFORMES	
Anablepidae	<i>Anableps anableps</i>
PERCIFORMES	
Centropomidae	<i>Centropomus parallelus</i>
Cichlidae	<i>Cichlasoma orientale</i> *
	<i>Crenicichla</i> sp.* <i>Crenicichla menezesi</i> *
	<i>Geophagus parnaiba</i> *
	<i>Satanoperca</i> sp. <i>Oreochromis niloticus</i> **
Scianidae	<i>Pachypops fourcroi</i> <i>Plagioscion squamosissimus</i>
PLEURONECTIFORMES	
Anchiridae	<i>Apionichthys dumerili</i>
SYNBRANCHIFORMES	
Synbranchidae	<i>Synbranchus marmoratus</i>
MUGILIFORMES	
Mugilidae	<i>Mugil incilis</i>

* Indicates species endemic to northeastern Brazil; ** indicates introduced species.

4. Discussion

The fish fauna in the Itapecuru River comprises 69 species, of which 20 or approximately 30%, are endemic to northeastern Brazil, known to occur from the Pindaré-Mearim Rivers in Maranhão to the Jaguaribe River in Ceará (see Table 1). One species, *Oreochromis niloticus*, is an introduced African cichlid. A few species are known to be widespread, occurring in several South American river basins: *Astyanax bimaculatus*, *Hoplias malabaricus*, *Ateronotus albifrons*, *Sternopygus macrurus*, *Arius rugispinis*, *Hexanemataichthys couma*, *Ageneiosus inermis*, *Parauchenipterus galeatus*, *Pseudoauchenipterus nodosus*, *Callichthys callichthys*, *Hemisorubim platyrhynchus*, *Pimelodus blochii*, *Pimelodus ornatus*, *Sorubim lima*, *Centropomus parallelus*, *Plagioscion squamosissimus*, and *Synbranchus marmoratus*. Some of these species (e.g., *Astyanax bimaculatus* or *Synbranchus marmoratus*) may represent species complexes, rather than distinct taxa, and are in need of taxonomic revision. A number of other species are known to occur in the Amazon basin (in some cases ranging as far as the Orinoco and coastal rivers in Surinam and the Guyanas), a distribution pattern predicted by Agassiz and Agassiz (1975). This is the case of *Poptella compressa*, *Pygocentrus nattereri*, *Serrasalmus rhombeus*, *Cynodon gibbus*, *Hemiodus argenteus*, *Aspredo aspredo*, *Ageneiosus ucayalensis*, *Hemiodontichthys acipenserinus*, *Loricariichthys acutus*, *Pterygoplichthys punctatus*, *Pseudoplatystoma punctifer*, *Strongylura marina*, *Anchovia surinamensis*, *Pterengraulis atherinoides*, *Anableps anableps*, and *Pachypops fourcroyi*. The present register of the latter three species are new records for northeastern Brazil (Casatti, 2002; Ghedotti, 2003; Kullander and Ferraris, 2003). Fifteen taxa could not be identified to the species level due to the poor taxonomic resolution. A few of these are new records for northeastern Brazil and may even represent undescribed species. *Pseudopimelodus* sp. is the first *Pseudopimelodidae* known to occur in the region (Shibatta, 2003), while the specimens of *Serrapinnus* sp., *Aphyocharax* sp., and *Hypoptopoma* sp. represent new records for these genera.

Several species (*Apionichthys dumerili*, *Anableps anableps*, *Centropomus parallelus*, *Strongylura marina*, *Anchovia surinamensis*, *Pterengraulis atherinoides*, and *Pseudoauchenipterus nodosus*) were only collected on the lower Itapecuru, indicating a preference for estuarine environments.

This is a first systematic inventory of the ichthyofauna of the Itapecuru River. Most of the coastal rivers of the Brazilian Northeast are still poorly known. Due to the predominance of Amazonian species in the Itapecuru basin, it might be predicted that the region's fish fauna becomes more species-rich towards the Amazon delta, i.e., present an east to west gradient of species richness.

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References

- AGASSIZ, L. and AGASSIZ, EC., 1975. Viagem ao Brasil: 1865-1866. Tradução de João Etienne Filho. São Paulo: Editora da Universidade de São Paulo.
- ALCÂNTARA, EH., 2004. Caracterização da bacia hidrográfica do Rio Itapecuru, Maranhão. *Caminhos de Geografia*, vol. 7, no. 11, p. 97-113.
- BORODIN, 1931. On the genus *Anostomus* (Family Characinae). *Bulletin of the Museum of Comparative Zoology*, vol. 72, no. 2, p. 37-52.
- CASATTI, L., 2002. Taxonomy of the South American genus *Pachypops* Gill, 1861 (Teleostei: Perciformes: Scianidae), with the description of a new species. *Zootaxa*, vol. 26, p. 1-20.
- EIGENMANN, CH. and EIGENMANN, RS., 1889. A revision of the edentulous genera of Curimatinae. *Annals of the New York Academy of Sciences*, vol. 4, no. 12, p. 409-440.
- EIGENMANN, CH. and HENN, AW., 1916. Description of three new species of characid fishes. *Ann. Carnegie Mus.*, 10 (1-2): 87-90.
- FOWLER, HW., 1941. A collection of fresh-water fishes obtained in eastern Brazil by Dr. Rodolpho von Ihering. *Academy of Natural Sciences Philadelphia*, vol. 93, p. 123-199.
- GARMAN, S., 1890a. On the species of the genus *Chalcinus* in the Museum of Comparative Zoology at Cambridge, Mass., U.S.A. *Bulletin of the Essex Institute*, vol. 22, no. 1/3, p. 1-7.
- , 1890b. On the species of the genus *Anostomus*. *Bulletin of the Essex Institute*, vol. 22, no. 1/3, p. 15-23.
- , 1913. The Plagiostomia (sharks, skates, and rays). *Memoirs of the Museum of Comparative Zoology*, vol. 36, p. 1-515.
- GHEDOTTI, MJ., 2003. Family Anablepidae. In: R. Reis; S. O. Kullander & C. Ferraris (Eds.) Checklist of the Freshwater Fishes of South and Central America, Edipucrs, Porto Alegre, RS, pp. 582-585.
- HIGUCHI, H., 1996. *An updated list of ichthyological collecting stations of the Thayer Expedition to Brazil (1865-1866)*. Available from: <<http://www.mcz.harvard.edu/Departments/Fish/thayer.htm>>. Access in: 19 Jan. 2009.
- KREBS, CJ., 1998a. *Programs for Ecological Methodology*. 2nd ed. Vancouver, Canada: University of British Columbia.
- , 1998b. *Ecological Methodology*. 2nd ed. Menlo Park: Benjamin Cummings.
- KULLANDER, SO. and FERRARIS, CJ., 2003. Family Engraulidae. In REIS, R., KULLANDER, SO. and FERRARIS, C. (Eds.). Checklist of the Freshwater Fishes of South and Central America. Porto Alegre: Edipucrs. p. 39-42.

- NIJSSEN, H., 1971. Two new species and one new subspecies of South American catfish genus *Corydoras* (Pisces, Siluriformes, Callichthyidae). *Beaufortia*, vol. 19, no. 250, p. 89-98.
- PAPAVERO, N., 1971. *Essays on the history of Neotropical Dipterology*. São Paulo: Museu de Zoologia, Universidade de São Paulo. vol. 1.
- ROSA, RS., MENEZES, NA., BRITSKI, HA., COSTA, WJEM. and GROTH, F., 2003. Diversidade, padrões de distribuição e conservação dos peixes da caatinga. In LEAL, IR., TABARELLI, M. and SILVA, JMC. (Eds.). *Ecologia e conservação da Caatinga*. Recife: Editora Universitária, UFPE. p. 135-181.
- SHIBATTA, OA., 2003. Family Pseudopimelodidae. In REIS, R., KULLANDER, SO. and FERRARIS, C. (Eds.). *Checklist of the Freshwater Fishes of South and Central America*. Porto Alegre: Edipucrs. p. 401-405.
- SOARES, EC., 2005. *Peixes do Mearim, Fishes of the Mearim River*. São Luís: Instituto Geia.
- STEINDACHNER, F., 1877. Die Süßwasserfische des südöstlichen Brasilien (III). *Sitzungsber Akademie der Wissenschaften in Wien*, vol. 74, no. 1, p. 559-694.
- , 1881. Beiträge zur Kenntniss der Flussfische Südamerika's. (II). *Denkschr Akademie der Wissenschaften in Wien*, vol. 43, p. 103-146.
- , 1906. Ueber zwei neue *Corydoras* – Arten aus dem Parnahyba und Parahimflusse im Staate Piauhy. *Anzeiger Akademie der Wissenschaften in Wien*, vol. 43, p. 478-480.
- , 1907. Über eine neue Psilichthys-Art, *Ps. cameroni* aus dem Flusse Cubatao im Staate S. Catharina, Brasilien. *Anzeiger Akademie der Wissenschaften in Wien*, vol. 44, no. 6, p. 82-85.
- , 1908a. Über eine neue Metynnis-Art (Fam. Characidae) aus einer Lagune am Rio Medonho. *Anzeiger Akademie der Wissenschaften in Wien*, vol. 45, no. 17, p. 326-327.
- , 1908b. Über eine während der brasilianischen Expedition entdeckte *Brachyplatystoma*-Art aus dem Rio Parnahyba und über eine dicht gefleckte und gestrichelte Varietät von *Giton fasciatus* aus den Gewässern von Santos (Staat Sao Paulo). *Anzeiger Akademie der Wissenschaften in Wien*, vol. 45, no. 9, p. 126-130.
- , 1909. Über eine *Ageneiosus* (*Pseudogeneiosus*)-Art im Rio Parnahyba und Rio Puty bei Therezina. *Anzeiger Akademie der Wissenschaften in Wien*, vol. 46, no. 20, p. 341-342.
- , 1910. Über einige *Ageneiosus*- und *Farlowella*-Arten etc. *Annalen des Naturhistorischen Museums in Wien*, vol. 24, p. 399-408.
- , 1915. Ichthyologische Beiträge (XVIII). *Anzeiger Akademie der Wissenschaften in Wien*, vol. 52, p. 346-349.