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Article

Freshwater fishes of the Bahia State, Northeastern Brazil

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Abstract: This work was carried out from the assessment of the conservation status of the freshwater ichthyofauna from Bahia State. The inventory data and species distribution were obtained from the specialized scientific literature and representative ichthyological collections. A total of 281 native species was recorded in Bahia State, distributed in the Northeastern Mata Atlantica (NMA) and São Francisco (SFR) freshwater ecoregions. There was a larger number of species in the NMA (187 spp.), composed by several coastal basins, than in the SFR (134 spp.), composed by São Francisco river basin. Among the 30 families recorded, Characidae and Rivulidae were the most representative, with 53 and 48 species, respectively. The conservation status of 214 species was assessed and 33 of them (15%) were included in the IUCN threat categories. Of these, 11 species were classified as vulnerable (VU), 12 as endangered (EN), and 10 as critically endangered (CR). Most threatened species (n = 14) belongs to the family Rivulidae. The larger number of threatened species in the NMA: (n = 23) is mainly related to the high endemism of restricted-range species associated with the human occupation impacts along the coastal regions. In the SFR, most of threatened species are annual killifishes, which are locally disappearing due to increasing degradation of their temporary habitats.
Keywords: *biodiversity, threatened species, endemism, Northeastern Mata Atlantica ecoregion, São Francisco river basin.*

Peixes de água doce do Estado da Bahia, Nordeste do Brasil

Resumo: Este trabalho foi realizado a partir da avaliação do estado de conservação da ictiofauna de água doce do Estado da Bahia. Os dados de inventário e distribuição das espécies foram obtidos a partir da literatura científica especializada e de coleções ictiológicas representativas. Um total de 281 espécies nativas foi registrado no Estado da Bahia, distribuídas nas ecorregiões de água doce Mata Atlântica Nordeste (NMA) e São Francisco (SFR). A riqueza de espécies foi maior na NMA (187 spp.), composta por diversas bacias costeiras, do que na SFR (134 spp.), composta pela bacia do rio São Francisco. Das 30 famílias registradas, as mais representativas foram Characidae e Rivulidae, com 53 e 48 espécies, respectivamente. O estado de conservação de 214 espécies foi avaliado e 33 (15%) destas foram classificadas em alguma categoria de ameaça da IUCN. Destas, 11 foram classificadas como vulneráveis (VU), 12 em perigo (EN) e 10 criticamente em perigo (CR). A maioria das espécies ameaçadas (n = 14) pertence à família Rivulidae. O elevado número de espécies ameaçadas na NMA: (n = 23) está associado ao alto endemismo das espécies com distribuição restrita e aos impactos da ocupação humana ao longo da região costeira. Na SFR, a maioria das espécies ameaçadas é de peixes anuais, que estão localmente desaparecendo devido à degradação crescente de seus habitats temporários.

Palavras-chave: *biodiversidade, espécies ameaçadas, endemismo, Ecorregião Mata Atlântica Nordeste, bacia do rio São Francisco.*

Introduction

The Neotropical region harbors the most diverse freshwater fish fauna in the world, with more than 5,700 described species, although the final number may exceed 8,000 species (Albert et al. 2011, Reis 2013, Bertaco et al. 2016, Reis et al. 2016). Putting this number into perspective, Neotropical freshwater fishes account for about one in five of the world's fish species, or approximately 10% of all vertebrate species (Albert & Reis 2011). According to Ribeiro (2006), the reasons for such a marked diversity are likely to be both historical and ecological, a result of millions of years of evolution from the breakup of Gondwana to the present day.

It is often claimed that freshwater ecosystems are the most endangered in the world (Sala et al. 2000, Dudgeon et al. 2006, Nogueira et al. 2010). As in other freshwater regions, South American fishes are threatened by overexploitation, flow modification, habitat destruction, species invasion, pollution, eutrophication, and siltation (Lévêque et al. 2008). Several fish conservation initiatives are underway in South America, including an ambitious program that assesses the conservation status of all Brazilian fish species (Reis 2013). This program resulted in the Brazilian list of threatened fishes and aquatic invertebrates, known as the Brazilian Red List (MMA 2014). Along with this national task, some parallel regional projects of conservation assessment of continental fishes have also been conducted (e.g., Rosa et al. 2003, Alves & Leal 2010, Reis et al. 2016).

In 2013, one of these regional initiatives was carried out in Bahia State, northeastern Brazil, and the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) in collaboration with the Secretaria do Meio Ambiente do Estado da Bahia (SEMA), and several ichthyologists completed a comprehensive conservation assessment of the freshwater ichthyofauna in the state. It is important to highlight that the results of this regional workshop became the basis for the publishing of the list of threatened freshwater fish species reported from Bahia state (SEMA 2017). Bahia, one of the 27 federative units of Brazil, is the fifth largest state by area, with more than 564.000 km^2 and 417 municipalities (IBGE 2019). This state partially encompasses two freshwater ecoregions as proposed by Abell et al. (2008), the São Francisco (SFR, ecoregion 327) and Northeastern Mata Atlantica (NMA, ecoregion 328) ecoregions (Figure 1). According to these authors, a freshwater ecoregion is defined as a large area encompassing one or more freshwater systems with a distinct assemblage of natural freshwater communities and species.

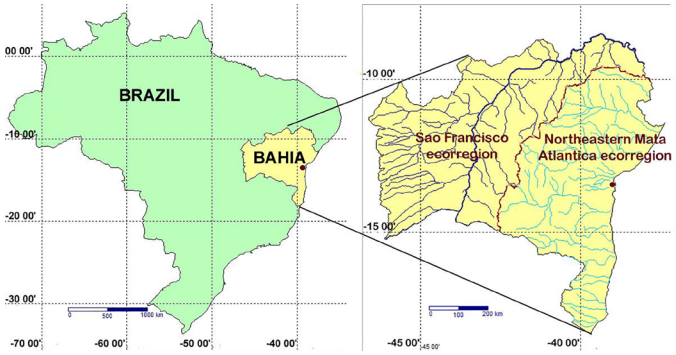

Figure 1. Localization and river drainages across Bahia state. Parts of the São Francisco (in dark blue) and Northeastern Mata Atlantica (in light blue) freshwater ecoregions in Bahia State, Northeastern Brazil, are shown. Red dotted line indicates the boundaries between Northeastern Mata Atlantica ecoregion and São Francisco ecoregion.

Although political geographic boundaries are useless for biological organisms, national or regional species lists are important for monitoring and conservation planning efforts (Silveira et al. 2010, Hortal et al. 2015). In this sense, any conservation initiative starts from the identification of the species that will be protect by such initiative. However, that apparently simple and basic information is absent or incomplete for diverse regions of Brazil. For example, the procedure of compilation of fish species that occur in rivers that drain Bahia state to evaluation of conservation status took several weeks of hard work previously to 2013 workshop, and involved the participation of several experts.

Before that effort, the knowledge about the species that occur in Bahia rivers was dispersed in some studies which focused on description of new species (e.g., Garavello 1977, Malabarba et al. 2004, Costa 2007, Zanata & Serra 2010), or representing the fish species inventory of some basins or part of them (e.g., Sato & Godinho 1999, Godinho & Godinho 2003, Rosa et al. 2003, Santos 2005, Sarmento-Soares et al. 2007, Barbosa & Soares 2009, Burger et al., 2011).

To make available the results of the list of threatened freshwater fishes of Bahia State elaborated during the aforementioned 2013 workshop, we report here the first checklist of freshwater fish species of the Bahia state. This list includes species from the SFR and NMA ecoregions described at present, as well the conservation status for those evaluate in 2013 Workshop. Without the pretense of being a definitive list, it is a starting point that should be broadened and updated in order to compile the scattered information available.

Material and methods

1. Study area

Freshwater fish species from stretches and tributaries in the SFR and NMA ecoregions of Bahia State (Figure 1) were analyzed. The SFR ecoregion is equivalent to the São Francisco basin, the third largest Neotropical hydrographic basin which is enclosed in an area of more than 630,000 km^2 (Sato & Godinho 1999, Kohler 2003, Langeani et al. 2009). The São Francisco is the longest river running entirely in Brazil, corresponding to more than 7.5% of the Brazilian territory (Godinho & Godinho 2003, Pompeu & Godinho 2006). With more than 2,500 km of extension (Godinho & Godinho 2003, Langeani et al. 2009), the São Francisco river and its tributaries drain three biomes (Caatinga, Cerrado and, peripherally, Atlantic Forest) crossing six states (from its source to mouth: Minas Gerais, Goiás, Bahia, Pernambuco, Alagoas, and Sergipe) plus the Federal District (Paiva 1982, Godinho & Godinho 2003, Langeani et al. 2009). From its headwaters in the Serra da Canastra, located in the central-western part of Minas Gerais State (at about 1,200-1,500 m above sea level), to its mouth, between Alagoas and Sergipe, the river drains more than 500 municipalities (Kohler 2003, Sato & Godinho, 2003). Although not entirely located in Bahia State, the São Francisco is the largest and one of the most important rivers of the state.

The NMA, in turn, comprises all coastal drainages in eastern Brazil, from the Sergipe river in the north to the Itabapoana river in the south (Camelier & Zanata 2014a). To the west, the NMA ecoregion is limited by the watershed border with the São Francisco river basin, along the Serra do Espinhaço up to the north, and by the Paraíba do Sul river basin in the south (Hales & Petry 2013). This ecoregion includes more than 25 isolated basins (Camelier & Zanata 2014a), draining the eastern slopes of the Brazilian crystalline shield directly into the Atlantic Ocean. From north to south, the main drainages of the NMA in Bahia State are: Vaza-Barris, Real, Itapicuru, Inhambupe, Pojuca, Paraguaçu, Jequiriçá, Contas, Cachoeira, Almada, Una, Pardo, Jequitinhonha, Buranhém, Frades, Jucuruçu, Itanhém, Peruípe, and Mucuri (Langeani et al. 2009, Camelier & Zanata 2014a). These drainages, along with several other smaller isolated basins of the NMA, are separated by the scarped, mountainous landscapes of the eastern margin of the Brazilian shield (Ribeiro 2006). The NMA is mainly inserted in the Atlantic Forest biome, although the northern drainages from the upper Contas to the Vaza-Barris river basins are partially under the influence of the semiarid Caatinga (Rosa et al. 2003, Camelier & Zanata 2014a, Lima et al., 2017).

2. Species inventory and list compilation

The species inventory and information about their distributions were obtained by consulting different sources in the reliable specialized scientific literature (i.e. original descriptions, taxonomic reviews, phylogenetic studies, and species catalogues) and representative ichthyological collections such as Instituto Nacional da Mata Atlântica (formerly Museu de Biologia Professor Mello Leitão-MBML), Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP), Museu Nacional do Rio de Janeiro (MNRJ), Museu de Zoologia da Universidade de São Paulo (MZUSP), Museu de História Natural da Bahia (UFBA), and Universidade Federal do Rio Grande do Norte (UFRN). Data were obtained from these fish collections or by searches in the national system of information on ichthyological collections (e.g., SIBIP/NEODAT III 2019, CRIA 2019) and, eventually, checked by consulting specialists. Taxonomic classification and species naming were determined mainly according to Fricke et al. (2020); for the species of Characidae, according to Mirande (2010).

To elaborate the list supporting this study, only freshwater fish species formally described until December 2019 were considered. Despite the fact that freshwater species were defined as those known to spend a significant part of their life cycle in low salinity (<0.5 ppt) continental waters (Myers 1949; Berra 2001), in the present study only primary freshwater fishes were considered.

The International Union for Conservation of Nature (IUCN) criteria were used to asses the conservation status of the species (IUCN 2012). The conservation status of species already evaluated according to these criteria was updated to the state of Bahia, which represented the regional assessment. Since the regional workshop for the evaluation of endangered freshwater fish species in Bahia occurred in November 2013, species described after this period did not have their conservation status assessed. The only exception is *Rhamdiopsis* sp., an undescribed troglobitic species whose description process is well advanced (M. E. Bichuette pers. comm.). Subterranean ecosystems and their biota pose special problems for conservation due to their intrinsic fragility and the distinctive features of subterranean communities, such as a high degree of endemism and morphological, ecological and behavioral specialization (Trajano & Bichuette 2010). Therefore, the assessment of the conservation status of *Rhamdiopsis* sp. has become necessary.

Species whose known distribution is restricted to the stretches of the basins draining Bahia State were classified as endemic. It should be noted that endemic species from the ecoregions analyzed (SFR or NMA), which are known to occur in other states (e.g., Sergipe, Minas Gerais, Espírito Santo), were not classified as endemic. Non-native species recorded in basins of the Bahia State were included in the list, but their conservation status was not evaluated.

Results

1. *Ichthyofauna composition*

A total of 281 native freshwater fish species was recorded along the drainages of Bahia State (Table 1), accounting for about 9% of all species (3,116) known to occur in Brazil (ICMBio 2014). Of the taxa listed in this study, one subfamily (Copionodontinae), nine genera (*Copionodon*, *Glaphyropoma*, *Hirtella*, *Kalyptodoras*, *Mucurilebias*, *Myxiops*, *Ophthalmolebias*, *Prorivulus*, and *Pseudotatia*), and 126 species are only known from river basins draining Bahia State. Most of the native species are from the NMA, with 187 species occurring in Bahia. In stretches of the SFR draining the state, 134 native species were listed (Table 1).

Table 1. List of freshwater fish species of Bahia State and their conservation status according to state (SEMA 2017) and national assessments (MMA 2014), IUCN criteria and ecoregion (NMA, Northeastern Mata Atlantica; SFR, São Francisco), as well as their respective indication of origin (X, native species but not endemic to the Bahia part of the ecoregion; END, endemic to the Bahia part of the ecoregion; NNA, non-native species).

ORDER/Family/*Species*	SEMA 2017		MMA 2014		SFR	NMA	Voucher / Source
	Status	IUCN Criteria	Status	IUCN Criteria			
CLUPEIFORMES							
Engraulidae							
Anchoviella vaillanti (Steindachner 1908)	LC		LC		X		MZUSP 54604, MCP 16611
CHARACIFORMES							
Acestrorhynchidae							
Acestrorhynchus britskii Menezes 1969	LC		LC		X		MZUSP 83828, MZUSP 54683
Acestrorhynchus falcatus (Bloch 1794)	LC		LC			X	MNRJ 21754, MZUSP 102488, MZUSP 102557, UFBA 4507
Acestrorhynchus lacustris (Lütken 1875)	LC		LC		X	X	MZUSP 57172, MZUSP 28770, UFBA 2647, UFBA 4946
Anostomidae							
Hypomasticus mormyrops (Steindachner 1875)	VU	B1 ab(iii)	LC			X	UFBA 4827, UFBA 5665
Leporellus pictus (Kner 1850)	NE		NE		X		UNT 13927; UNT 9561
Leporellus vittatus (Valenciennes 1850)	LC		LC		X		MZUSP 54659, UFBA 833
Leporinus bahiensis Steindachner 1875	LC		LC			END	UFBA 2645, UFBA 2954, UFBA 1946, UFBA 4456, UFBA 4258, UFBA 4483
Leporinus copelandii Steindachner 1875	LC		LC			X	MZUSP 88513, UFBA 2828, UFBA 5123, UFBA 5666
Leporinus melanopleura Günther 1864	LC		LC			END	BMNH 1863, MZUSP 111246, UFBA 4282, UFBA 5103, UFBA 8052
Leporinus melanopleurodes Birindelli, Britski & Garavello 2013	NT		NT			END	MZUSP 100987, MZUSP 109769, MZUSP 111227
Leporinus piau Fowler 1941	LC		LC		X	X	MZUSP 54667, MZUSP 14470, UFBA 4231
Leporinus steindachneri Eigenmann 1907	LC		LC			X	MZUSP 63464, MZUSP 87868, UFBA 4415, UFBA 4715, UFBA 5056
Leporinus taeniatus Lütken 1875	LC		LC		X	X	MZUSP 83818, MZUSP 54662, UFBA 1948, UFBA 3564
Megaleporinus brinco (Birindelli, Britski & Garavello 2013)	LC		LC			END	MZUSP 105166, MZUSP 109762, UFBA 4843
Megaleporinus conirostris (Steindachner 1875)	LC		LC			X	MZUSP 63463, UFBA 5038
Megaleporinus elongatus (Valenciennes 1850)	NE		NE		X		MZUSP 2823, MZUSP 28773
Megaleporinus garmani (Borodin 1929)	DD		LC			X	MZUSP 87848, UFBA 5238
Megaleporinus obtusidens (Valenciennes 1837)	LC		LC		X		UFBA 200, UFBA 280, UFBA 835, UFBA 836, UFBA 966, UFBA 1005

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Megaleporinus reinhardti (Lütken 1875)	LC		LC		X	X	MZUSP 54670, MZUSP 58224, UFBA 2868, UFBA 3386
Schizodon knerii (Steindachner 1875)	NE		NE		X		MZUSP 54676; MCP 16747, UFBA 6582
Bryconidae							
Brycon devillei (Castelnau 1855)	EN	B1 ab(i,iii)	EN	B1 ab(i,iii)		X	MNHN 4517
Brycon ferox Steindachner 1877	DD		LC			X	MZUSP 53305, MZUSP 93920, UFBA 5039, UFBA 5060, UFBA 5095
Brycon orthotaenia Günther 1864	LC		LC		X		MZUSP 70220, MCP 16676
Brycon vonoi Lima 2017	NE		NE			X	MCZ 2416
Henochilus wheatlandii Garman 1890	NE		NE		X		HU-Zoo 21109
Salminus franciscanus Lima & Britski 2007	LC		LC		X		MZUSP 28797, UFBA 6577
Salminus hilarii Valenciennes 1850	LC		LC		X		UNT 12431, UNT 12457
Characidae							
Astyanax aff. *bimaculatus* (Linnaeus 1758)	LC		LC			X	MZUSP 54839, MZUSP 54840, MCP 17920, MCP 36779, MBML 6407, MBML 4055, MHNCI-Peixes 11468
Astyanax brucutu Zanata, Lima, di Dario & Gerhard 2017	NE		NE			END	ZUEC 12765, MZUSP 120743, UFBA 8167
Astyanax burgerai Zanata & Camelier 2009	DD		DD			END	MZUSP 101245, UFBA 4346
Astyanax epiagos Zanata & Camelier 2008	DD		DD			END	MZUSP 89568, UFBA 2792
Astyanax fasciatus (Cuvier 1819)	LC		LC		X	X	MZUSP 28768, MZUSP 58823, MZUSP 28789, MZUSP 47378, MZUSP 80106, MBML 5357, MBML 6530, MBML 4103
Astyanax hamatilis Camelier & Zanata 2014	NE		NE			END	MZUSP 49232, MCP 47663, UFBA 3675, UFBA 6987,
Astyanax jacobinae Zanata & Camelier 2008	DD		DD			END	MZUSP 89570, UFBA 2793
Astyanax lacustris (Lütken 1875)	LC		LC		X		MZUSP 58840, MZUSP 80125, MZUSP 80128
Astyanax lorien Zanata, Burger & Camelier 2018	NE		NE			END	MZUSP 123398, UFBA 5393, UFBA 8109, UFBA 8359
Astyanax pelecus Bertaco & Lucena 2006	LC		LC			END	UFBA 5634, UFBA 5638
Astyanax rivularis (Lütken 1875)	LC		LC		X	X	UFBA 246
Astyanax rupestris Zanata, Burger & Camelier 2018	NE		NE			END	MZUSP 89567, MZUSP 38537, MCP 53156, UFBA 2789
Astyanax sincora Burger, Carvalho & Zanata 2019	NE		NE			END	MZUSP 120747, MNRJ 48346, UFBA 8201
Astyanax varii Zanata, Burger, Vita & Camelier 2019	NE		NE			END	MZUSP 121062, MCP 54205, UFBA 7046
Astyanax vermilion Zanata & Camelier 2009	LC		LC			END	MZUSP 101243, UFBA 4343
Compsura heterura Eigenmann 1915	LC		LC		X	X	MZUSP 54626, MZUSP 58801, UFBA 3005, UFBA 3301
Hasemania piatan Zanata & Serra 2010	EN	B1 ab(iii,v)	EN	B1 ab(iii,v)		END	MZUSP 104538, MZUSP 104539, UFBA 4298

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Hasemania nana (Lütken 1875)	NE		NE		X		MZUSP 84072
Hemigrammus brevis Ellis 1911	LC		LC		X	X	MZUSP 58922, UFBA 3081
Hemigrammus gracilis (Lütken 1875)	LC		LC		X		MZUSP 84102, MZUSP 84035, UFBA 2866
Hemigrammus marginatus Ellis 1911	LC		LC		X	X	MZUSP 28802, UFBA 1942, UFBA 2721, UFBA 4127
Hyphessobrycon bifasciatus Ellis 1911	LC		LC			X	MZUSP 54792, UFBA 4971, UFBA 5079
Hyphessobrycon brumado Zanata & Camelier 2010	LC		LC			END	MZUSP 101246, UFBA 4340, UFBA 4341
Hyphessobrycon diastatos Dagosta, Marinho & Camelier 2014	NE		NE		X		MZUSP 114030
Hyphessobrycon itaparicensis Lima & Costa 2001	LC		LC			X	UFBA 4618, UFBA 5454, UFBA 7558, UFRN 207
Hyphessobrycon micropterus (Eigenmann 1915)	LC		LC		X	X	MZUSP 58425, UFBA 2843
Hyphessobrycon negodagua Lima & Gerhard 2001	DD		DD			END	MZUSP 53898, UFBA 4360, UFBA 5392
Hyphessobrycon parvellus Ellis 1911	LC		LC			X	UFBA 2897, UFBA 3128, UFBA 3334, UFBA 3418, UFBA 4320
Hyphessobrycon santae (Eigenmann 1907)	LC		LC		X		MZUSP 40178
Hyphessobrycon vinaceus Bertaco, Malabarba & Dergam 2007	LC		LC			END	UFBA 4607, UFBA 4608
Kolpotocheirodon figueiredoi Malabarba, Lima & Weitzman 2004	CR	B2 ab(iii)	CR	B2 ab(iii)		END	MZUSP 700731, UFBA 7068
Lepidocharax diamantina Ferreira, Menezes & Quagio-Grassioto 2011	EN	B2 ab(iii,iv)	EN	B2 ab(iii,iv)		END	MNRJ 37509, MZUSP 160499, UFBA 7816
Mimagoniates microlepis (Steindachner 1877)	LC		LC			X	MZUSP 93866, MZUSP 55012, USNM 249895,
Mimagoniates sylvicola Menezes & Weitzman 1990	EN	B1 ab(iii,iv)	EN	B1 ab(iii,iv)		END	MZUSP 93867, UFBA 3040, UFBA 4819, UFBA 5780, UFBA 7004
Moenkhausia costae (Steindachner 1907)	LC		LC		X	X	MNHN 1907, UFBA 2837, UFBA 3571
Moenkhausia diamantina Benine, Castro & Santos 2007	LC		LC			END	MZUSP 49233, MZUSP 49233, UFBA 3664
Moenkhausia sanctaefilomenae (Steindachner 1907)	LC		LC		X		MZUSP 58294, MZUSP 58272
Moenkhausia vittata (Castelnau 1855)	LC		LC			X	MZUSP 54776, MZUSP 54778, MZUSP 51804, UFBA 4945, UFBA 5063,
Myxiops aphos Zanata & Akama 2004	LC		LC			END	MZUSP 81026, UFBA 7798
Nematocharax varii Barreto, Silva, Batalha-Filho, Affonso & Zanata 2018	NE		NE			END	MZUSP 123176, MCP 53336, UFBA 8439,
Nematocharax venustus Weitzman, Menezes & Britski 1986	LC		LC			X	UFBA 3762, UFBA 4259, UFBA 4494, UFBA 4280, UFBA 3823, UFBA 4378, UFBA 4913
Oligosarcus acutirostris Menezes 1987	LC		LC			X	UFBA 5117, UFBA 4911

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Oligosarcus macrolepis (Steindachner 1877)	LC		LC			X	MZUSP 93871, UFBA 5113, UFBA 4894, UFBA 4501, UFBA 5098
Orthospinus franciscensis (Eigenmann 1914)	LC		LC		X		MZUSP 54679, MZUSP 54678, UFBA 4741
Phenacogaster franciscoensis Eigenmann 1911	LC		LC		X	X	MZUSP 28795, MZUSP 47376, UFBA 3141
Phenacogaster julliae Lucena & Lucena 2019	NE		NE		X		MZUSP 123642, MCP 53629
Piabina argentea Reinhardt 1867	LC		LC		X	X	MZUSP 58878, UFBA 28, UFBA 138, UFBA 5318, UFBA 5338, UFBA 5356, UFBA 6121, UFBA 1941,
Psellogrammus kennedyi (Eigenmann 1903)	LC		LC		X	X	MBML 6539, MZUSP 58822, UFBA 2835
Rachoviscus graciliceps Weitzman & Cruz 1981	EN	B2 ab(iii,iv)	EN	B2 ab(iii,iv)		END	MZUSP 93252
Roeboides xenodon (Reinhardt 1851)	LC		LC		X		MZUSP 54684, MCP 16920
Serrapinnus heterodon (Eigenmann, 1915)	LC		LC		X	X	MZUSP 58794, MZUSP 47359, MZUSP 49251, MZUSP 54770, UFBA 1943, UFBA 3051, UFBA 3332,
Serrapinnus piaba (Lütken 1875)	LC		LC		X	X	MZUSP 58797, MZUSP 58796, MZUSP 54751, MZUSP 49252, MZUSP 54782, UFBA 2838, UFBA 2857
Tetragonopterus franciscoensis Silva, Melo, Oliveira & Benine 2016	NE		NE		X	X	MZUSP 90886, LBP 11552, MZUSP 90905
Crenuchidae							
Characidium aff. *zebra* Eigenmann 1909	LC		LC			X	UFBA 5742
Characidium bahiense Almeida 1971	DD		DD		X	X	MCP 17013, UFBA 2975, UFBA 2847, UFBA 3333, UFBA 4348
Characidium clistenesi Melo & Espíndola 2016	NE		NE			END	MZUSP 120530
Characidium cricarense Malanski, Sarmento-Soares, Silva-Malanski, Lopes, Ingenito & Buckup 2019	NE		NE			X	MBML 12879, MBML 3846
Characidium deludens Zanata & Camelier 2015	NE		NE			END	MZUSP 115000, UFBA 7563
Characidium helmeri Zanata, Sarmento-Soares & Martins-Pinheiro 2015	NE		NE			END	UFBA 8709, UFBA 8711, UFBA 8715
Characidium kamakan Zanata & Camelier 2015	NE		NE			END	MZUSP 115009, UFBA 7720
Characidium samurai Zanata & Camelier 2014	NE		NE			END	MZUSP 108188, UFBA 7259
Curimatidae							
Curimatella lepidura (Eigenmann & Eigenmann 1889)	LC		LC		X	X	MZUSP 54646, MZUSP 47363, UFBA 3519
Cyphocharax gilbert (Quoy & Gaimard 1824)	LC		LC		X	X	MZUSP 1358, MZUSP 58881, MZUSP 51808, UFBA 4505, UFBA 4624,
Cyphocharax pinnilepis Vari, Zanata & Camelier 2010	LC		LC			END	MZUSP 93453, UFBA 4885

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Steindachnerina elegans (Steindachner 1875)	LC	LC	X	X	MZUSP 58290, MZUSP 54697, MZUSP 54700, UFBA 3417, UFBA 3230, UFBA 3328, UFBA 3209, UFBA 4848, UFBA 4447, UFBA 4247, UFBA 4377
Erythrinidae					
Erythrinus kessleri Steindachner 1877	DD	DD		END	MZUSP 93891, MZUSP 44018
Hoplerythrinus unitaeniatus (Spix & Agassiz 1829)	LC	LC	X	X	MZUSP 57392, MZUSP 38539, MZUSP 2801, UFBA 2899, UFBA 2966, UFBA 3044
Hoplias brasiliensis (Spix & Agassiz 1829)	LC	LC		X	MZUSP 45483, MZUSP 40174, MZUSP 40170, MZUSP 40270, UFBA 5429
Hoplias intermedius (Günther 1864)	LC	LC	X		MZUSP 94050, MZUSP 94434
Hoplias malabaricus (Bloch 1794)	LC	LC	X	X	MZUSP 62574, MZUSP 84071, UFBA 3020, UFBA 384, UFBA 3104, UFBA 2947, UFBA 1985, UFBA 3839, UFBA 3717, UFBA 4916, UFBA 4808
Iguanodectidae					
Bryconops affinis (Günther 1864)	LC	LC	X		MZUSP 57922, MZUSP 54641, MZUSP 57924
Lebiasinidae					
Nannostomus beckfordi Günther 1872	DD	DD		X	UFBA 1855, UFBA 1887, UFBA 1890, UFBA 1897, UFBA 3742, UFBA 4675, UFBA 4680, UFBA 7412
Parodontidae					
Apareiodon hasemani Eigenmann 1916	LC	LC	X		MCP 17045
Apareiodon itapicuruensis Eigenmann & Henn 1916	LC	LC		END	UFBA 0234, UFBA 4156
Parodon hilarii Reinhardt 1867	LC	LC	X		MZUSP 58286, MZUSP 28780
Prochilodontidae					
Prochilodus argenteus Spix & Agassiz 1829	LC	LC	X		MZUSP 28778, MZUSP 2040
Prochilodus brevis Steindachner 1875	LC	LC		X	UFBA 3436, UFBA 1947, UFBA 5669, UFBA 4628, UFBA 4629
Prochilodus costatus Valenciennes 1850	LC	LC	X	X	MZUSP 54756, MZUSP 21549, UFBA 2825
Prochilodus hartii Steindachner 1875	LC	LC		X	MZUSP 42677, UFBA 5272
Prochilodus vimboides Kner 1859	LC	LC		X	UFBA 5094, UFBA 5061, UFBA 5181
Serrasalmidae					
Colossoma macropomum (Cuvier 1816)	-	-	NNA		Bezerra et al. 2008
Metynnis maculatus (Kner 1858)	-	-	NNA	NNA	Rodrigues et al. 2018; MCP 36973
Myleus micans (Lütken 1875)	LC	LC	X	X	MZUSP 58277, MZUSP 20460
Pygocentrus piraya (Cuvier 1819)	LC	LC	X	NNA	MZUSP 57552,
Serrasalmus brandtii Lütken, 1875	LC	LC	X	X	MZUSP 58296, MZUSP 57550, MZUSP 49254, MZUSP 57508, UFBA 3018, UFBA 2823

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Triportheidae					
Lignobrycon myersi (Miranda Ribeiro 1956)	NT	NT		END	UFBA 4260, UFBA 5179
Triportheus guentheri (Garman 1890)	LC	LC	X		MCP 16706, MCP 16680
Triportheus signatus (Garman 1890)	DD	LC		X	UFBA 3173, UFBA 4836
GYMNOTIFORMES					
Gymnotidae					
Gymnotus bahianus Campos-da-Paz & Costa 1996	LC	LC		END	MZUSP 102453, MZUSP 48949, UFBA 4452,
Gymnotus capitimaculatus Rangel-Pereira 2014	NE	NE		END	UFRJ 9785, UFRJ 9964
Gymnotus carapo Linnaeus 1758	LC	LC	X	X	MBML 6548, MZUSP 86104, UFBA 3041, UFBA 2651, UFBA 4455
Gymnotus cf. *pantherinus* (Steindachner 1908)	NE	NE		X	MZUSP 104746
Gymnotus interruptus Rangel-Pereira 2012	DD	DD		END	UFRJ 8218
Hypopomidae					
Brachyhypopomus menezesi Crampton, Santana, Waddell & Lovejoy 2016	NE	NE	X		MZUSP 87147, MZUSP 40190
Sternopygidae					
Eigenmannia besouro Peixoto & Wosiacki 2016	NE	NE	END		MZUSP 57890
Eigenmannia virescens (Valenciennes 1836)	LC	LC	X		MZUSP 84036, MZUSP 57891
Sternopygus macrurus (Bloch & Schneider 1801)	LC	LC	X		MZUSP 2644, MZUSP 84045
SILURIFORMES					
Auchenipteridae					
Glanidium botocudo Sarmento-Soares & Martins-Pinheiro 2013	DD	DD		X	MNRJ 32538
Pseudauchenipterus affinis (Steindachner 1877)	LC	LC		X	MZUSP 51762, MZUSP 51750
Pseudauchenipterus jequitinhonhae (Steindachner 1877)	LC	LC		X	MZUSP 51735, UFBA 05398
Pseudotatia parva Mess 1974	NE	NE	END		FMNH 70580
Tatia bockmanni (Sarmento-Soares & Buckup 2005)	DD	LC	X		MZUSP 82351
Trachelyopterus galeatus (Linnaeus 1766)	LC	LC	X	X	MZUSP 90280, UFBA 93, UFBA 130, UFBA 163, UFBA 848, UFBA 872, UFBA 2819, UFBA 3046, UFBA 05119, UFBA 6648
Trachelyopterus striatulus (Steindachner 1877)	LC	LC		X	MZUSP 52627, MZUSP 93912, UFBA 4712, UFBA 4992,
Callichthyidae					
Aspidoras kiriri Oliveira, Zanata, Tencatt & Britto 2017	NE	NE		END	MNRJ 47400, UFBA 7352

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Aspidoras maculosus Nijssen & Isbrücker 1976	DD		DD			END	MZUSP 88170, UFBA 3291
Aspidoras psammatides Britto, Lima & Santos 2005	DD		DD			END	MZUSP 67194
Aspidoras virgulatus Nijssen & Isbrücker 1980	LC		LC			X	MZUSP 39124, MBML 2030
Callichthys callichthys (Linnaeus 1758)	LC		LC		X	X	UFBA 159, UFBA 2650, UFBA 3422, UFBA 5262,
Corydoras costai Ottoni, Barbosa & Katz 2016	NE		NE		X		UFRJ 7790, MCP 48169
Corydoras garbei Ihering 1911	LC		LC		X		MZUSP 5319, MZUSP 5324
Corydoras lacerdai Hieronimus 1995	EN	B1 ab(iii)	EN	B1 ab(iii)		END	MZUSP 47682, MZUSP 47683
Corydoras lymnades Tencatt, Vera-Alcaraz, Britto & Pavanelli 2013	DD		LC		X		MNRJ 22370
Corydoras multimaculatus Steindachner 1907	LC		LC		END		MZUSP 57405, MZUSP 57404
Corydoras nattereri Steindachner 1876	LC		LC			X	MZUSP 51796, UFBA 4728, UFBA 2839
Hoplosternum littorale (Hancock 1828)	LC		LC		X	X	MZUSP 57551, UFBA 1611
Scleromystax prionotos (Nijssen & Isbrücker 1980)	LC		LC			X	MCP 23650, MBML 1470, MBML 1546, UFBA 5073
Clariidae							
Clarias gariepinus (Burchell 1822)	-		-			NNA	Rocha et al 2008, MNRJ 28363
Doradidae							
Franciscodoras marmoratus (Lütken 1874)	LC		LC		X		MZUSP 2201, UFBA 208
Kalyptodoras bahiensis Higuchi, Britski & Garavello 1990	EN	B2 ab(iii)	EN	B2 ab(iii)		END	MZUSP 38565, UFBA 3171, UFBA 7108, UFBA 7455
Wertheimeria maculata Steindachner 1877	LC		LC			X	UFBA 5667
Heptapteridae							
Acentronichthys leptos Eigenmann & Eigenmann 1889	EN	B1 ab(iii)	LC			X	MZUSP 93856, UFBA 6019
Cetopsorhamdia iheringi Schubart & Gomes 1959	LC		LC		X	X	UFBA 4370, UFBA 5121, UFBA 6097
Imparfinis borodini *Mees* & Cala 1989	NE		NE		X	X	MBML 10327, MBML 10729
Imparfinis minutus (Lütken 1874)	LC		LC		X	X	UFBA 935, UFBA 4958, UFBA 5071, UFBA 4987, UFBA 5053
Phenacorhamdia tenebrosa (Schubart 1964)	DD		LC			X	MCP 36935, MCP 36723, UFBA 7114
Pimelodella harttii (Steindachner 1877)	DD		DD			X	MZSUP 5141, UFBA 5647
Pimelodella itapicuruensis Eigenmann 1917	DD		LC			X	MZUSP 88169
Pimelodella lateristriga (Lichtenstein 1823)	LC		LC			X	MZUSP 93864, MZUSP 54763, MZUSP 51798, UFBA 4973, UFBA 4984,
Rhamdia enfurnada Bichuette & Trajano 2005	LC		LC		END		LIRP 5643

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Rhamdia jequitinhonha Silfvergrip 1996	DD		VU			X	MZUSP 102718
Rhamdia quelen (Quoy & Gaimard 1824)	LC		LC		X	X	MCP 16658, MZUSP 83796, MZUSP 93851 MZUSP 54006, MZUSP 101358, UFBA 3006, UFBA 2894, UFBA 03353,UFBA 4263, UFBA 4858, , UFBA 4909, UFBA 4956
Rhamdiopsis krugi Bockmann & Castro 2011	VU	B1ab(iii)	VU	B1ab(iii)		END	LIRP 5929, LIRP 5931, LIRP 5930
Rhamdiopsis sp.	VU	D2	VU	D2	END		M. E. Bichuette (comm. pers.)
Loricariidae							
Harttia longipinna Langeani, Oyakawa & Montoya-Burgos 2001	DD		DD		END		DZSJRP003666, MZUSP 57168
Hirtella carinata Pereira, Zanata, Cetra & Reis 2014	NE		NE			END	ANSP 198032, MCP 48127, UFBA 5655
Hypostomus brevicauda (Günther 1864)	DD		DD			X	BMNH1864
Hypostomus francisci (Lütken 1874)	LC		LC		X		UFBA 4191, UFBA 6641
Hypostomus jaguar Zanata, Sardeiro & Zawadzki 2013	LC		LC			END	MZUSP 110603, UFBA 6501
Hypostomus johnii (Steindachner 1877)	NE		NE		X		MCZ 7863, NMW 44192
Hypostomus leucophaeus Zanata & Pitanga 2016	NE		NE			END	MZUSP 119822, UFBA 2993
Hypostomus lima (Lütken 1874)	NE		NE		X		UFBA 2046
Hypostomus macrops (Eigenmann & Eigenmann 1888)	NE		NE		X		MBML 11304, MBML- 10813, NUP 20383
Hypostomus unae (Steindachner 1878)	DD		LC			X	BMNH 1861, NMW 44259
Hypostomus vaillanti (Steindachner 1877)	NE		DD		X		NMW 44273
Hypostomus velhochico Zawadzki, Oyakawa, Britski 2017	NE		NE		X		MCP 16689, MZUSP 94586, MZUSP 120452
Hypostomus wuchereri (Günther 1864)	DD		DD			X	BMNH1863
Megalancistrus barrae (Steindachner 1910)	LC		LC		END		NMW 48019
Otocinclus xakriaba Schaefer 1997	LC		LC		X		MZUSP 51103, MCP 16877
Otothyris travassosi Garavello, Britski & Schaefer 1998	LC		LC			X	MZUSP 94020, MZUSP 51435, MZUSP 94021, MZUSP 39095, MZUSP 51439, MZUSP 51438, MZUSP 51803, UFBA 4931,
Pareiorhaphis bahianus (Gosline 1947)	LC		LC			END	UFBA 4486, UFBA 4555, UFBA 5100
Pareiorhaphis lophia Pereira & Zanata 2014	NE		NE			END	MCP 47711, MCP 47712, MCP 48004, MZUSP 86089, MZUSP 86154, MZUSP 88163, UFBA 6188, UFBA 7026, UFBA 7063, UFBA 7350
Parotocinclus adamanteus Pereira, Santos, de Pinna & Reis, 2019	NE		NE			END	MZUSP 124560, MCP 54151, MZUSP 93274
Parotocinclus arandai Sarmento-Soares, Lehmann & Martins-Pinheiro 2009	LC		LC			END	MBML 2135, MBML 1486

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Parotocinclus bahiensis (Miranda Ribeiro 1918)	LC		LC			END	MZUSP 99753, UFBA 2978, UFBA 3103, UFBA 3349, UFBA 3118
Parotocinclus cristatus Garavello 1977	LC		LC			END	MZUSP 102611, MZUSP 102634, UFBA 4451
Parotocinclus jimi Garavello 1977	LC		LC			END	MZUSP 24531, UFBA 3875
Parotocinclus minutus Garavello 1977	DD		DD			END	MCP 40034
Pogonopoma wertheimeri (Steindachner 1867)	LC		LC			X	MZUSP 51779
Pterygoplichthys chrysostiktos (Birindelli, Zanata & Lima 2007)	LC		LC			END	MZUSP 88157
Pterygoplichthys etentaculatus (Spix & Agassiz 1829)	LC		LC		X		MCP 16709
Rhinelepis aspera Spix & Agassiz 1829	DD		LC		X		MZUSP 83660, MZUSP 2219
Pimelodidae							
Bergiaria westermanni (Lütken 1874)	NE		LC		X		UNT 12428, UNT 12470
Conorhynchos conirostris (Valenciennes 1840)	EN	A2ac	EN	A2ac	X	X	MNHN A-9413
Duopalatinus emarginatus (Valenciennes 1840)	LC		LC		X		MZUSP 24871, MZUSP 2287
Pimelodus fur (Lütken 1874)	LC		LC		X		MZUSP 1078
Pimelodus maculatus Lacepède 1803	LC		LC		X		MZUSP 54637, MZUSP 57549
Pimelodus pohli Ribeiro & Lucena 2006	LC		LC		X		MCP 16661, MCP 16671
Pseudoplatystoma corruscans (Spix & Agassiz 1829)	NT		NT		X		UFBA 268
Pseudopimelodidae							
Cephalosilurus fowleri Haseman 1911	DD		LC		X		FMNH 54254
Lophiosilurus alexandri Steindachner 1876	VU	A2 cd	VU	A2 cd	X		MZUSP 1160, MZUSP 53261
Microglanis pataxo Sarmento-Soares, Martins-Pinheiro, Aranda & Chamon 2006	LC		LC			X	MZUSP 51790, UFBA 4985
Trichomycteridae							
Ammoglanis multidentatus Costa, Mattos & Santos 2019	NE		NE			END	MNRJ 51340, UFRJ 12088
Copionodon elysium Pinna, Burger & Zanata 2018	NE		NE			END	MZUSP 120631, UFBA 8100
Copionodon exotatos Pinna, Abrahão, Reis & Zanata 2018	NE		NE			END	MZUSP 123522, MZUSP 121656
Copionodon lianae Campanario & de Pinna 2000	NT		NT			END	MZUSP 81034
Copionodon orthiocarinatus de Pinna 1992	NT		NT			END	MZUSP 42463, UFBA 3688
Copionodon pecten de Pinna 1992	NT		NT			END	MZUSP 42461, UFBA 5289
Glaphyropoma rodriguesi de Pinna 1992	DD		DD			END	MZUSP 42465
Glaphyropoma spinosum Bichuette, de Pinna & Trajano 2008	VU	B1 ab(iii)	VU	B1 ab(iii)		END	MZUSP 99742

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Ituglanis agreste Lima, Neves & Campos-Paiva 2013	LC		LC			END	MNRJ 40196, UFRN 29
Ituglanis cahyensis Sarmento-Soares, Martins-Pinheiro, Aranda & Chamon 2006	EN	B1 ab(iii)	EN	B1 ab(iii)		X	MNRJ 28404, MNRJ 28406
Ituglanis paraguassuensis Campos-Paiva & Costa 2007	DD		DD			END	MZUSP 63138
Microcambeva draco Mattos & Lima 2010	EN	B1ab(iii)	EN	B1ab(iii)		END	MCP 17796, MCP 47695
Stegophilus insidiosus Reinhardt 1859	LC		LC		X		MBML 9078
Trichomycterus bahianus Costa 1992	LC		LC			END	MZUSP 38636, MBML 1580
Trichomycterus payaya Samento-Soares, Zanata & Martins-Pinheiro 2011	DD		DD			END	MBML 2560, UFBA 5284
Trichomycterus pradensis Sarmento-Soares, Martins-Pinheiro, Aranda & Chamon 2005	LC		LC			X	MBML 1480, MBML 1520
Trichomycterus rubbioli Bichuette & Rizzato 2012	VU	D2	VU	D2	END		MZUSP 110977, MZUSP 110978, MZUSP 110984
Trichomycterus tete Barbosa & Costa 2011	LC		LC			END	UFRJ 7774, UFRJ 7775, UFRJ 7776, UFRJ 8082
CYPRINODONTIFORMES							
Poeciliidae							
Pamphorichthys hollandi (Henn 1916)	LC		LC		X	X	MZUSP 58869, MZUSP 57507, UFBA 2892, UFBA 3037,
Phalloceros mikrommatos Lucinda 2008	DD		DD			END	UFPB 5370, UFPB 2688
Phalloceros ocellatus Lucinda 2008	LC		LC			X	MZUSP 93985, MZUSP 51794
Phalloptychus eigenmanni Henn 1916	CR	B2 ab(iii,iv)	CR	B2 ab(iii,iv)		END	UFBA 3416, UFBA 7726
Poecilia reticulata Peters 1859	-		-		NNA	NNA	MZUSP 86110, MZUSP 58884, MCP 18128, MBML 5380, UFBA 5402
Poecilia vivipara Bloch & Schneider 1801	LC		LC		X	X	MZUSP 93991, MZUSP 51810, UFBA 3021, UFBA 2860, UFBA 3331, UFBA 3121, UFBA 4165, UFBA 4257, UFBA 4239, UFBA 4382,
Rivulidae							
Anablepsoides bahianus (Huber 1990)	DD		DD			END	UFBA 3423, UFBA 2951
Atlantirivulus depressus (Costa 1991)	NT		NT			END	UFPB 2213, UFRJ 2118
Atlantirivulus unaensis (Costa & de Luca 2009)	DD		DD			END	UFRJ 6597
Cynolebias altus Costa 2001	LC		LC		END		MZUSP 62564, MZUSP 62565
Cynolebias attenuatus Costa 2001	DD		DD		END		MZUSP 62566, MZUSP 62567
Cynolebias elegans Costa 2017	NE		NE		END		UFRJ 9431, UFRJ 6890
Cynolebias gibbus Costa 2001	DD		DD		END		MZUSP 62568, UFRJ 4796
Cynolebias gilbertoi Costa 1998	DD		DD		END		MZUSP 52304, MZUSP 52305
Cynolebias itapicuruensis Costa 2001	DD		DD			END	UFBA 2626

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Cynolebias leptocephalus Costa & Brasil 1993	DD		DD		END		MZUSP 43676, UFRJ 687
Cynolebias obscurus Costa 2014	NE		NE		END		UFRJ 6774
Cynolebias ochraceus Costa 2014	NE		NE		END		Costa 2014
Cynolebias oticus Costa 2014	NE		NE		END		UFRJ 9437
Cynolebias paraguassuensis Costa, Suzart & Nielsen 2007	DD		DD			END	UFRJ 6454, UFRJ 6455
Cynolebias porosus Steindachner 1876	DD		DD		END		MZUSP 41378, MZUSP 41379
Cynolebias rectiventer Costa 2014	NE		NE		END		UFRJ 8896
Cynolebias roseus Costa 2014	NE		NE		END		UFRJ 9330, UFRJ 9331
Cynolebias vazabarrisensis Costa 2001	DD		DD			END	MZUSP 62561, MZUSP 62560
Hypsolebias adornatus (Costa 2000)	VU	D2	VU	D2	END		MZUSP 54563, UFRJ 4805
Hypsolebias carlettoi (Costa & Nielsen 2004)	CR	B2ab(i,ii,iii,iv)	CR	B2ab(i,ii,iii,iv)	END		MCP 34089, UFRJ 5945
Hypsolebias caeruleus Costa 2013	NE		LC		END		UFRJ 6855
Hypsolebias faouri Britzke, Nielsen & Oliveira 2016	NE		NE		END		ZUEC 10796
Hypsolebias flagellatus (Costa 2003)	NE		NA		X		MCP 28578, UFRJ 4788
Hypsolebias fulminantis (Costa & Brasil 1993)	CR	B2ab(i,ii,iii,iv)	CR	B2ab(i,ii,iii,iv)	END		MZUSP 43674, UFRJ 685
Hypsolebias gardneri Costa, Amorim & Mattos 2018	NE		NE		X		UFRJ 11859
Hypsolebias ghisolfii (Costa, Cyrino & Nielsen 1996)	CR	B2ab(i,ii,iii,iv)	CR	B2ab(i,ii,iii,iv)	END		MZUSP 49403, UFRJ 3526
Hypsolebias gilbertobrasili Costa 2012	NE		NT		END		UFRJ 8325
Hypsolebias guanambi Costa & Amorim 2011	NE	D2	VU	D2	END		UFRJ 6861
Hypsolebias harmonicus (Costa 2010)	NE	D2	VU	D2	END		UFRJ 6696
Hypsolebias igneus (Costa 2000)	CR	B2ab(i,ii,iii,iv)	CR	B2ab(i,ii,iii,iv)	END		MZUSP 56254, UFRJ 4857
Hypsolebias lopesi (Nielsen, Shibatta, Suzart & Martín 2010)	NE	D2	VU	D2	END		MZUSP 103102
Hypsolebias mediopapillatus (Costa 2006)	VU	D2	VU	D2	END		UFRJ 5406, MCP 40139
Hypsolebias nitens Costa 2012	NE		LC		END		UFRJ 8289
Hypsolebias nudiorbitatus Costa 2011	NE		DD			END	UFRJ 6837
Hypsolebias picturatus (Costa 2000)	VU	D2	VU	D2	END		MZUSP 59228, UFRJ 5053
Hypsolebias pterophyllus Costa 2012	NE		LC		END		UFRJ 8376
Hypsolebias shibattai Nielsen, Martins, Araujo & Suzart 2014	NE		NA		END		ZUEC 7648
Hypsolebias trifasciatus Nielsen, Martins, Araújo, Lira & Four 2014	NE		NA		END		ZUEC 8302
Kryptolebias hermaphroditus Costa 2011	NE		NE			X	UFRN 4344
Melanorivulus decoratus (Costa 1989)	NT		NT		END		MZUSP 39982, MZUSP 39983

continue...

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Mucurilebias leitaoi (Cruz & Peixoto 1992)	CR	B2 ab(ii,iii,iv,v)	CR	B2 ab(ii,iii,iv,v)		END	MNRJ 11646, MNRJ 11647
Ophthalmolebias bokermanni (Carvalho & Da Cruz 1987)	CR	B2 ab(iii)	CR	B2 ab(iii)		END	MZUSP 91519
Ophthalmolebias ilheusensis (Costa & Lima 2010)	CR	B1 ab(iii)	CR	B1 ab(iii)		END	UFRJ 6690, UFBA 5297
Ophthalmolebias perpendicularis (Costa, Nielsen & de Luca 2001)	CR	B2 ab(i,ii,iii,iv,v)	CR	B2 ab(i,ii,iii,iv,v)		END	MZUSP 62570
Ophthalmolebias rosaceus (Costa, Nielsen & de Luca 2001	VU	D2	VU	seD2		END	MZUSP 62572
Ophthalmolebias suzarti (Costa 2004)	VU	D2	VU	D2		END	MZUSP 91518
Prorivulus auriferus Costa, Lima & Suzart 2004	DD		DD			END	UFRJ 5932, UFRJ 5933
Xenurolebias myersi (Carvalho 1971)	EN	B2ab(iii)	EN	B2ab(iii)		X	UFRJ 249, UFRJ 377, UFRJ 1921
SYNBRANCHIFORMES							
Synbranchidae							
Synbranchus marmoratus Bloch 1795	LC		LC		X	X	MZUSP 83815, MZUSP 2667, UFBA 3010, UFBA 2832, UFBA 4009, UFBA 5646
PERCIFORMES							
Cichlidae							
Astronotus ocellatus (Agassiz 1831)	-		-		NNA	NNA	MBML 7173, UFBA 5458
Cichla spp.	-		-		NNA	NNA	MBML-Peixes 10405, UNT 10429, MZFS 13845, MZFS 11497
Cichlasoma sanctifranciscense Kullander 1983	LC		LC		X	X	MZUSP 58926, MZUSP 84085,UFBA 2977, UFBA 386, UFBA 3444, UFBA 3131, UFBA 4457
Crenicichla lacustris (Castelnau 1855)	LC		LC			X	UFBA 4709, UFBA 4824
Crenicichla lepidota Heckel 1840	LC		LC		X	X	MZUSP 84229, MZUSP 57903, UFBA 388
Geophagus brasiliensis (Quoy & Gaymard 1824)	LC		LC			X	MZUSP 87890, MZUSP 39110, MZUSP 54850, MZUSP 49240
Geophagus diamantinensis Mattos, Costa & Santos 2015	NE		NE			END	UFRJ 8833
Geophagus itapicuruensis Haseman 1911	DD		DD			END	FMNH 54365, FMNH 54204
Geophagus multiocellus Mattos & Costa 2018	NE		NE			X	UFRJ 11764, MNRJ32263
Geophagus obscurus (Castelnau 1855)	DD		DD			END	MNHN A-9511
Geophagus rufomarginatus Mattos & Costa 2018	NE		NE			X	UFRJ 9994, UFRJ 9519
Geophagus santosi Mattos & Costa 2018	NE		NE			X	UFRJ 11765, UEFS 10336
Oreochromis niloticus (Linnaeus 1758)	-		-			NNA	MNRJ 28647, LIRP 5724, MCP 36707
Coptodon rendalii (Boulenger 1897)	-		-		NNA	NNA	MZUSP 86156, Rodrigues et al 2018
Sciaenidae							
Pachyurus adspersus Steindachner 1879	DD		DD			X	LIRP 1150, LIRP 1149
Pachyurus francisci (Cuvier 1830)	LC		LC		X		MZUSP 2498, MCP 16632
Pachyurus squamipennis Agassiz 1831	LC		LC		X		UNT 12455
Plagioscion squamosissimus (Heckel 1840)	-		-			NNA	MZUSP 75093

Only 40 (14%) native species are shared between the two ecoregions. Eleven non-native species were listed in Bahia, which accounted for less than 5% of all species analyzed. Among the 30 families recorded (excluding those related only to non-native species), the most representative were Characidae and Rivulidae, with 53 and 48 species, respectively, followed by Loricariidae with 28 species (Figure 2). Many species were described in the last 20 years, 75 from the NMA and 41 from the SFR, corresponding to 27% and 15% of all species listed in this study, respectively (Table 1).

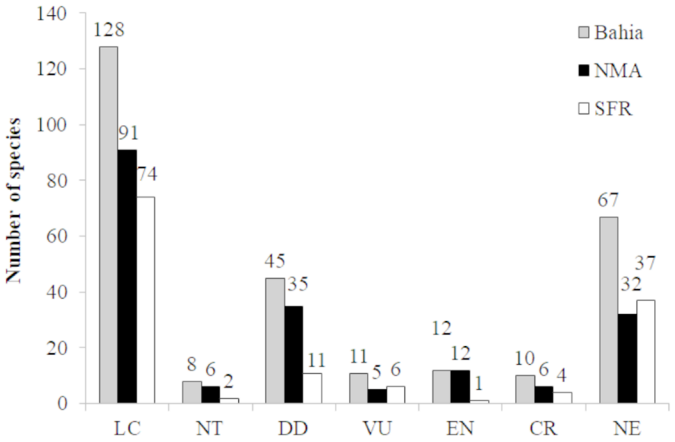

Figure 2. Number of freshwater fish species recorded per family in Bahia State and separately for each ecoregion studied (NMA, Northeastern Mata Atlantica; SFR, São Francisco).

2. *Assessment of conservation status*

In this study, 214 freshwater fish species were evaluated. Most of them were classified as 'Least Concern' (LC), 45 as 'Data Deficient' (DD), and eight as 'Near Threatened' (NT), which are not considered threatened categories according to the IUCN criteria (IUCN 2012) (Table 1, Figure 3). Thirty-three freshwater fish species (26 of them endemic to Bahia) were included in the threatened categories: 11 as 'Vulnerable' (VU), 12 as 'Endangered' (EN), and 10 as 'Critically Endangered' (CR) (Table 1, Figure 3). The Bahia State Red list has been already published by the Secretaria do Meio Ambiente do Estado da Bahia (SEMA 2017), although it contains only the threatened species and their conservation status.

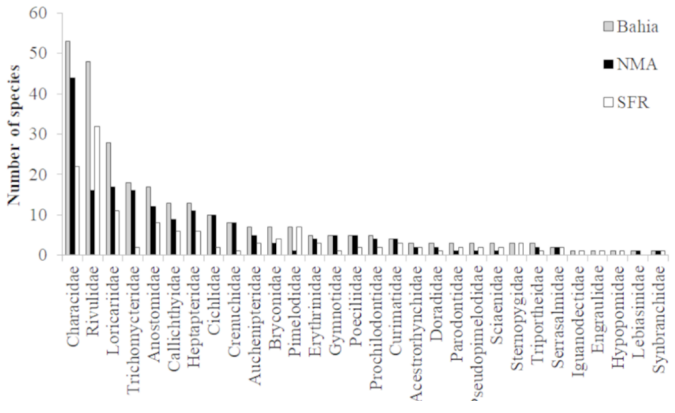

Figure 3. Number of freshwater fish species in Bahia State classified according to the categories proposed by IUCN (2012): LC, least concern; NT, near threatened; DD, data deficient; VU, vulnerable; EN, endangered; CR, critically endangered. NMA, Northeastern Mata Atlantica freshwater ecoregion; SFR, São Francisco freshwater ecoregion.

Most of the threatened species are in the NMA (23 species, 69.7%), while 10 (30.3%) endangered species are found in the SFR (Figure 3). Most of these belong to the family Rivulidae, with 14 species (42.4 % of threatened species), seven in each ecoregion. In addition, several small fish species of the Characidae, Heptapteridae, and Trichomycteridae families were also representative in the list of endangered species. These fishes are typical of first- and second-order streams, which may suffer more intensely from the effects of human activities (Oliveira & Bennemann 2005). Among tricomicterids and heptaperids, three troglobitic species (*Glaphyropoma spinosum*, *Rhamdiopsis krugi*, and *Rhamdiopsis* sp.) stand out among all others because of their low population density and restricted distribution in some caverns (Bockmann & Castro 2010, Bichuette et al. 2008, M. E. Bichuette pers. comm.), which are not protected in any conservation unit. Taken together, these factors can chronically devastate these populations and compromise species survival.

Discussion

1. *Species composition*

In this study, 281 native freshwater fish species were recorded in Bahia State, distributed in coastal drainages of the NMA ecoregion and the São Francisco river basin draining the state. The composition of the Bahia State species partially agrees with the overall pattern of the Brazilian fish fauna, in which most species belong to Characidae, followed by Loricariidae (Bizerril 1994, Gonçalves & Braga 2012, Camelier & Zanata 2014a, Ferreira et al. 2014). Curiously, Bahia is one of the Brazilian states with the largest records of Rivulidae in its basins (see Frick & Eschmeyer 2020). Among the remaining families occurring in the state, more than half are represented by five or fewer species.

The number of Rivulidae species is higher in the SFR ecoregion, mainly due to the presence of several annual fish species of the genera *Hypsolebias* and *Cynolebias* that inhabit temporary pools in the tributaries at the right margin of the middle São Francisco river basin (Costa 2014, Costa et al. 2014). In the drainages of the NMA ecoregion, Rivulidae is mainly represented by the annual fish species of the genus *Ophthalmolebias*, most of them endemic to Bahia, presenting a narrow distribution, usually restricted to a single basin (Costa & Lima 2010). In this ecoregion, Rivulidae and Loricariidae have almost the same number of species, differing from the general pattern found in the other Brazilian coastal drainages cited above.

The river basins included in the NMA and SFR freshwater ecoregions which draining the state of Bahia exhibit a distinct composition, with only 40 native species shared between them. Most species from the NMA are characterized by a small size, possibly related to the large number of small streams of this ecoregion. According to several authors (e.g., Weitzman & Vari 1988, Castro 1999, Casatti et al. 2001, Abilhoa et al. 2011), the ichthyofauna of these freshwater ecosystems is mainly composed of small-sized species. In the São Francisco river basin, in addition to small fish species, larger species, most of them important for artisanal fisheries, are found, including migratory species such as *Conorhynchos conirostris*, *Prochilodus argenteus*, *Pseudoplatystoma corruscans*, and *Salminus franciscanus* (Sato & Godinho 2003, Godinho & Kynard 2006).

However, the number of species gathered in the present study is likely underestimated due to a range of factors. Some undescribed species were not counted, the only exception being *Rhamdiopsis* sp. from the Chapada Diamantina region (SFR). Some nominal widespread species may represent species complexes that need revisionary studies to solve the confusing taxonomy and the definition of the new species described (e.g., *Astyanax bimaculatus*, *A. fasciatus*, *Hoplias malabaricus*, *Geophagus brasiliensis*, *Rhamdia quelen*). In addition, some sub-basins were not sampled (e.g., most tributaries of the middle São Francisco in southwestern Bahia and headwaters of various river basins of the NMA).

More than 20 years ago, Menezes (1996a, b) cited the lack of knowledge about the fish fauna of drainages in Brazil's Northeastern region. Although a series of studies increasing that knowledge were conducted at that time, the results were far from satisfactory and Northeast Brazil is still pointed out as a region of scarce available information about freshwater fish records in a global database compilation (Tedesco et al. 2017). Current evidence of the lack of knowledge about the ichthyofauna in this region is the large number of taxa considered "sp." or accompanied by the terms "cf." or "aff." in taxonomic inventories (e.g., Sarmento-Soares et al. 2009a, Cetra et al. 2010, Burger et al. 2011, Ramos et al. 2014). Although numerous freshwater fish species from the Bahia river basins have been described in the last two decades (e.g., Bertaco & Lucena 2006, Ribeiro & Lucena 2006, Lima & Britski 2007, Benine et al. 2007, Zanata & Camelier 2008, 2009, 2010, 2014, 2015, Bichuette et al. 2008, Sarmento-Soares et al. 2009b, Sarmento-Soares et al. 2011, Ferreira et al. 2014, Vari et al. 2010, Bichuette & Rizzato 2012, Oliveira et al. 2013, Sarmento-Soares & Martins-Pinheiro 2013, Camelier & Zanata 2014b, Zanata et al. 2015, 2017, 2018, Mattos et al. 2015, Peixoto & Wosiacki 2016, Zanata & Pitanga 2016, Zawadzki et al., 2017; Barreto et al. 2018, Mattos & Costa, 2018, Burger et al. 2019, Lucena & Lucena 2019), ichthyological explorations continue to reveal unknown species, especially in small tributaries and in upper drainage areas. The increase in the number of species recently described from the São Francisco river basin has already been documented in the literature (see Alves et al. 2011 and Barbosa et al. 2017).

2. *Conservation concerns*

Overall, the results of the state and national conservation status assessments were remarkably similar, with divergences only for two species: *Acentronichthys leptos* and *Hypomasticus mormyrops*. In Bahia State, both species were included in threatened categories (VU and EN, respectively) since they occur at few impacted localities with continuing decline in the habitat quality. However, these species were classified as LC in the national assessment (MMA 2014) since their total distribution was considered wider, including river basins outside Bahia where these species are more abundant and are not threatened (e.g., Paraíba do Sul, Doce, plus small drainages in the states of São Paulo and Rio de Janeiro).

The conservation status of some species which occur in Bahia State changed in the last years. Some examples are the catfish 'pacamã' *Lophiosilurus alexandri* and the killifish *Hypsolebias adornatus*, both endemic to the SFR ecoregion, which were classified before as LC (MMA 2004) are now VU in both lists (SEMA 2017, MMA 2014). Several subpopulations of *L. alexandri* were probably locally extinct, reducing their population size by at least 30% (ICMBio 2018). On the other hand, *L. alexandri* was introduced in the Doce river, where became an important resource for artisanal fishing (Alves et al. 2007). Additionally, this species is cultivated in tanks as a commercial species for food near Colatina, Espírito Santo State (L. M. Sarmento-Soares pers. obs.). Nowadays, *H. adornatus* is also VU because one of its few known localities were destroyed, leading to local extinction. Moreover, this species is much appreciated as an aquarium fish, posing an additional and severe threat to this species. The category of three other annual killifishes, *Hypsolebias fulminantis*, *H. ghisolfii*, and *Ophthalmolebias perpendicularis* changed from VU (MMA 2004) to CR (MMA 2014). The first two, endemic to Bahia (SFR), are sympatric and were commonly found in temporary floodplain pools of Rio das Rãs, a tributary of the São Francisco basin (Costa 2007). However, their distribution is now restricted to a few localities as a consequence of the agricultural development and potteries established in the region. The case of *O. perpendicularis* is even more concerning since the species is currently classified as CR, the highest extinction risk category. In fact, this annual rivulid species may already be extinct since it was only known from the type locality in the Jequitinhonha river basin (NMA ecoregion), which was destroyed, and there has been no record of this species since 2000 (ICMBio 2018).

The large number of threatened freshwater fish species in the NMA ecoregion (23) is possibly due to the remarkable endemism of its ichthyofauna (Bizerril 1994, Ribeiro 2006, Camelier & Zanata 2014a) associated with the significant human occupation and alteration of the coastal region (Langeani et al. 2009). In the SFR ecoregion, most threatened species are annual killifishes, whose populations are disappearing due to the strong degradation and grounding of their habitats (see Costa 2002, ICMBio 2018). Eight species were classified as NT and may soon move to the list of endangered species if no conservation measures are adopted. In addition to the increasing human exploitation, the relatively small number of conservation units and protected areas in Bahia may be insufficient for the preservation of its fish fauna. Only 11.6% of the state area is protected as Conservation Units and less than 20% of these are in the higher protective level (Allen 2015). Additionally, we point out that most of these protect areas act as biodiversity islands, since they are surrounded by diverse monocultures, pastures and urban centers. One way to reduce these negative effect is the adoption of public polices that favor more environmentally appropriate agricultural practices in the buffer zones of Conservation Units, such as agroforestry systems (Sarmento-Soares & Martins-Pinheiro, 2017; Ewert et al. 2013).

The National Action Plans (Planos de Ação Nacional, PANs, in Portuguese) coordinated by the ICMBio, which have as main mission conserving Brazilian biodiversity, are public policies identifying and guiding priority actions to combat threats that endanger populations of species or environments (Polaz 2014). Therefore, the success of the PAN depends of both taxonomic information and data of the assessment of the conservation status of the species, such as provided in the present study. There are three PAN designed for freshwater fishes whose actions directly affect the conservation of the ichthyofauna in the state of Bahia: (1) Action Plan for the threatened species from the São Francisco watershed (Ordinance ICMBio nº 34, 27 May 2015), aiming mainly to improve the knowledge about threatened species and mitigate human impacting activities, to promote the conservation and recovery of aquatic fauna in the São Francisco river in five years (2015-2020);

(2) Action Plan for the threatened fish species from the Atlantic Forest rivers (Ordinance ICMBio nº 370, 1 August 2019), objecting to increase the conservation status and popularization of fishes, rivers, and streams of the Atlantic Forest in five years (2019-2024); and (3) Action Plan for the threatened species of Rivulidae family, with the general objective of establishing mechanisms to protect the rivulids and canceling the loss of habitat of the focal species, in five years (2013-2018); the second cycle of this PAN (2020-2025) was approved and it is in preparation, awaiting publication of the new ordinance.

Finally, it is expected that these joint actions (e.g., taxonomic studies, lists of species, conservation status of species, public policies) will contribute not only to the increase of the knowledge of the fish fauna but also to the conservation of these species and the environments inhabited by them.

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Ricardo Jucá Chagas: Substantial contribution in the concept and design of the study.

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Angela Maria Zanata: Contribution to critical revision, adding intellectual content.

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Priscila Camelier: Substantial contribution in the concept and design of the study; Contribution to manuscript preparation; Contribution to data collection; Contribution to data analysis and interpretation.

Conflicts of Interest

The authors declares that they have no conflict of interest related to the publication of this manuscript.

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