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Ichthyofauna of streams of the Rio Sapucaí basin, upper Rio Paraná system, Minas Gerais, Brazil

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Abstract: The Rio Sapucaí basin, in Minas Gerais State, Brazil, is one of the many watersheds of the upper Rio Paraná system. Ichthyofauna surveys in this basin, in general, are scarce. In addition, small rivers and streams of the region have been targets of anthropogenic actions (e.g., pollution) – which suggest that more ichthyological studies must be performed within the watershed. In this study we provide a survey of species that occur within three streams of the lower Rio Sapucaí basin. Samples were collected in April, July, and November 2017 and in May 2018. Collections resulted in 349 individuals belonging to 28 species, five orders, and 12 families. Among our findings are three putatively undescribed species and the first record of *Oligosarcus argenteus* and *Pareiorhina hyptiorhachis* within the Rio Paraná system.
Keywords: *fishes; inventory; Oligosarcus argenteus; Pareiorhina hyptiorhachis; undescribed species.*

Ictiofauna de riachos da bacia do Rio Sapucaí, sistema do alto Rio Paraná, Minas Gerais, Brasil

Resumo: A bacia do Rio Sapucaí, no Estado de Minas Gerais, Brasil, é uma das muitas bacias hidrográficas do sistema do alto Rio Paraná. Levantamentos de ictiofauna nessa bacia, em geral, são escassos. Além disso, rios de pequeno porte e córregos da região têm sido alvos de ações antrópicas (e.g., poluição) – o que sugere que mais estudos ictiológicos devem ser realizados na bacia. Neste trabalho nós fornecemos um levantamento de espécies que ocorrem em três riachos da porção baixa da bacia do Rio Sapucaí. As amostras foram coletadas em Abril, Julho, e Novembro de 2017 e em Maio de 2018. As coletas resultaram em 349 indivíduos pertencentes a 28 espécies, cinco ordens e 12 famílias. Dentre os nossos achados estão três espécies possivelmente não descritas e o primeiro registro de *Oligosarcus argenteus* e *Pareiorhina hyptiorhachis* no sistema do Rio Paraná.
Palavras-chave: *espécies não descritas; inventário; Oligosarcus argenteus; Pareiorhina hyptiorhachis; peixes.*

Introduction

Ichthyofauna surveys are important for the conservation of freshwater fishes at both short and long-term scales. These studies provide additional information about species' distribution (e.g., Valdiviezo-Rivera et al. 2017, Bertora et al. 2018, Delariva et al. 2018, Honorio & Martins 2018, Oliveira-Silva et al. 2018) – which, in turn, may assist in new assessments about their "conservation status" (e.g., Melo et al. 2017). Additionally, surveys provide useful data for the establishment of freshwater protected areas (sensu Azevedo-Santos et al. 2018a). Therefore, ichthyological surveys should be carried out more frequently, especially in Brazilian freshwaters.

The Rio Sapucaí basin (~ 560,000 hectare; Magalhães Jr & Diniz 1997), Minas Gerais, Brazil, is part of the upper Rio Paraná system (Magalhães Jr & Diniz 1997). To our knowledge, only two ichthyological surveys have been published for this watershed. Ingenito & Buckup (2007) provided a list with the fishes of three localities in the upper portion of the basin near the Serra da Mantiqueira. Subsequently, Belei & Sampaio (2012) publishes a work with the fishes from the Rio Lourenço Velho, a direct tributary of the Rio Sapucaí. However, streams of the lower region of the watershed remain understudied.

Countless rivers and streams of the Rio Sapucaí basin have been targets of anthropogenic actions (e.g. small dams; see Belei & Sampaio 2012), which can significantly impact the overall biodiversity (Pelicice et al. 2017). These actions coupled with the lack of biodiversity knowledge suggest that more surveys must be conducted within the watershed. In this study we provide the results of a fish survey conducted in three different streams of the lower portion of the Rio Sapucaí basin, in Minas Gerais, Brazil.

Material and Methods

Fishes were collected in April, July, and November 2017, and in May 2018 (totaling four collections, one per month), across three different streams of the Rio Sapucaí basin (Table 1; Figure 1-2). Sampling occurred during daytime roughly 100 to 200 meters upstream of each stream. Collections were carried out with a small cast net (1.4 cm of mesh in opposite nodes), a hand net (~1.5 mm mesh), gill nets (1 and 2 cm in opposite nodes), and fishhooks of different sizes. Collections were performed with permission issued by Brazilian Institute of Environment and Renewable Natural Resources (IBAMA, in Portuguese) – license numbers 46904-1 and 63177-1.

Vouchers specimens were euthanized with successive dosages of anesthetic, and transferred to a 10% formalin solution. Following fixation, individuals were transferred to a 70% alcohol solution and deposited at LBP (Laboratório de Biologia de Peixes, Departamento de Morfologia, Universidade Estadual Paulista "Júlio de Mesquita Filho", Botucatu, São Paulo, Brazil), DZSJRP (Departamento de Zoologia e Botânica, Universidade Estadual Paulista "Júlio de Mesquita Filho", São José do Rio Preto, São Paulo, Brazil), and LIRP (Laboratório de Ictiologia de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, São Paulo, Brazil).

Species reported in Table 2 were classified according to Fricke et al. (2018).

Results

A total of 349 individuals representing five orders, 12 families, and 28 fish species (Table 2) were collected from all reaches (i.e., R1, R2, R3). The order and family with highest species richness, considering all reaches, was Siluriformes and Characidae, respectively (Figure 3-4). We found the highest species richness at R3, with a total of 23 species, followed by R1 with nine and R2 with seven (Table 3).

Three putatively undescribed species were also collected: *Astyanax* sp. and '*Heptapterus'* sp., both from R1, and *Imparfinis* sp., from R3. Additionally, we found individuals of *Oligosarcus argenteus* and *Pareiorhina hyptiorhachis*, which represent the first record of these two species within the Rio Paraná system (Table 3). Individuals of *Trichomycterus septemradiatus* were collected at R1, which also

Table 1. Localities sampled from the lower Rio Sapucaí basin, Rio Paraná system, Minas Gerais, Brazil

Reaches	Acronym	Coordinates	Altitude (meters)	Municipality	Remarks
Reach 1	R1	20°54'57.59"S, 45°56'21.15"W	~828	Carmo do Rio Claro	Stream of unknown name. Affluent of Ribeirão Itací, Rio Sapucaí basin. Reach in the stream well-preserved. Riparian vegetation present. Reach with substrate, in general, composed by rocks juxtaposed.
Reach 2	R2	20°55'25.12"S, 45°58'21.63"W	~783	Carmo do Rio Claro	Stream of unknown name. Affluent of Ribeirão Itací, Rio Sapucaí basin. Reach in the stream with total (in some local partial) absence of riparian vegetation. Substrate composed by sandy, rarely with some rocks.
Reach 3	R3	21° 3'25.73"S, 46° 8'47.10"W	~787	Conceição da Aparecida	Stream known as Ribeirão Fortaleza, Rio Sapucaí basin. Reach in the stream with riparian vegetation completely removed. Substrate composed by sandy, with a local composed by rocks. Some locals impacted due the cattle breeding.

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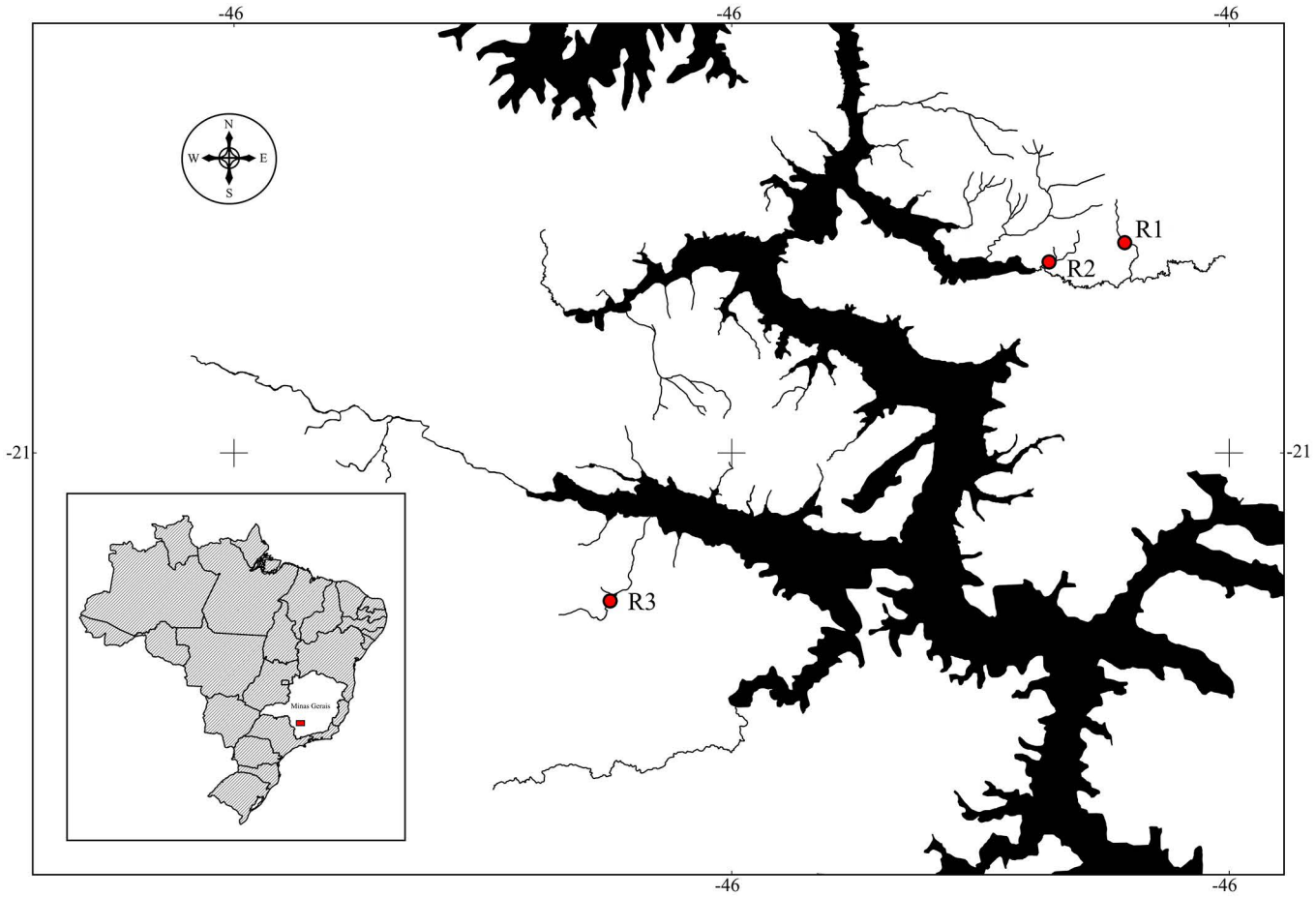

Figure 1. Partial view of Rio Sapucaí (under influence of the Furnas reservoir), in Minas Gerais, Brazil, with the location of each reach (R1, R2, and R3) sampled.

expands the distribution of this species into the Rio Paraná system. Lastly, we recorded *Knodus moenkhausii* and *Poecilia vivipara*, two non-native fish species within the Rio Sapucaí basin.

Discussion

Overall, members of the orders Siluriformes and Characiformes comprise the majority of species found in the three sampled streams of the Rio Sapucaí basin (see Figure 3). Dozens of investigators who have conducted fish surveys of rivers, reservoirs, or streams of the upper Paraná basin (e.g., Casatti et al. 2003, Smith et al. 2007, Smith & Petrere Jr 2007, Fagundes et al. 2015, Frota et al. 2016, Santos et al. 2017, Cavalli et al. 2018) have also found species richness to be highest in these orders. Therefore, the relatively high species counts in these two orders, as we found in this study, is an expected result for many regions of the upper Rio Paraná system.

The families with highest species richness in the lower Rio Sapucaí region are Characidae and Heptapteridae. However, in context of the Rio Paraná basin as a whole, Loricariidae has been reported to contribute higher species richness than Heptapteridae (Langeani et al. 2007). This suggests that loricariid species may have been undersampled in this survey. Specimens were collected only during the day (see Material and Methods section), which may have contributed to an undersampling of loricariids and possibly other groups (see below). Therefore, for future studies we recommend sampling at each stream during the night as well.

Odontostilbe weitzmani Chuctaya, Bührnheim, & Malabarba, 2018, a species recently described from the upper Paraná system (Chuctaya et al. 2018), has previously been collected at R1 (DZSJRP 20445, 2014 year). However, this species was not collected during this survey.

Three putatively undescribed species (i.e., *Astyanax* sp., '*Heptapterus*' sp., and *Imparfinis* sp.) were collected during this survey (Figure 5a, b, c). In addition to this study, Ingenito & Buckup (2007) discovered six undescribed species within the upper Rio Sapucaí basin. With these results we believe more ichthyological surveys in rivers and streams of the Rio Sapucaí basin are necessary, as additional undescribed species likely remain to be discovered.

Langeani et al. (2007) did not report *Oligosarcus argenteus* (Figure 5e) within the upper Rio Paraná system. Additionally, in a recent revision of the genus *Oligosarcus*, Ribeiro & Menezes (2015) reported this species as endemic to the Rio São Francisco and Rio Doce basins. In turn, *Pareiorhina hyptiorhachis* (Figure 5f) was recently described from the Rio Paraíba do Sul basin (Silva et al. 2013). Our study reports individuals of *O. argenteus* at R1 and individuals of *P. hyptiorhachis* at R1 and R2. Therefore, these findings represent the first records of these two species in the Rio Sapucaí basin, as well as in the Rio Paraná system in general.

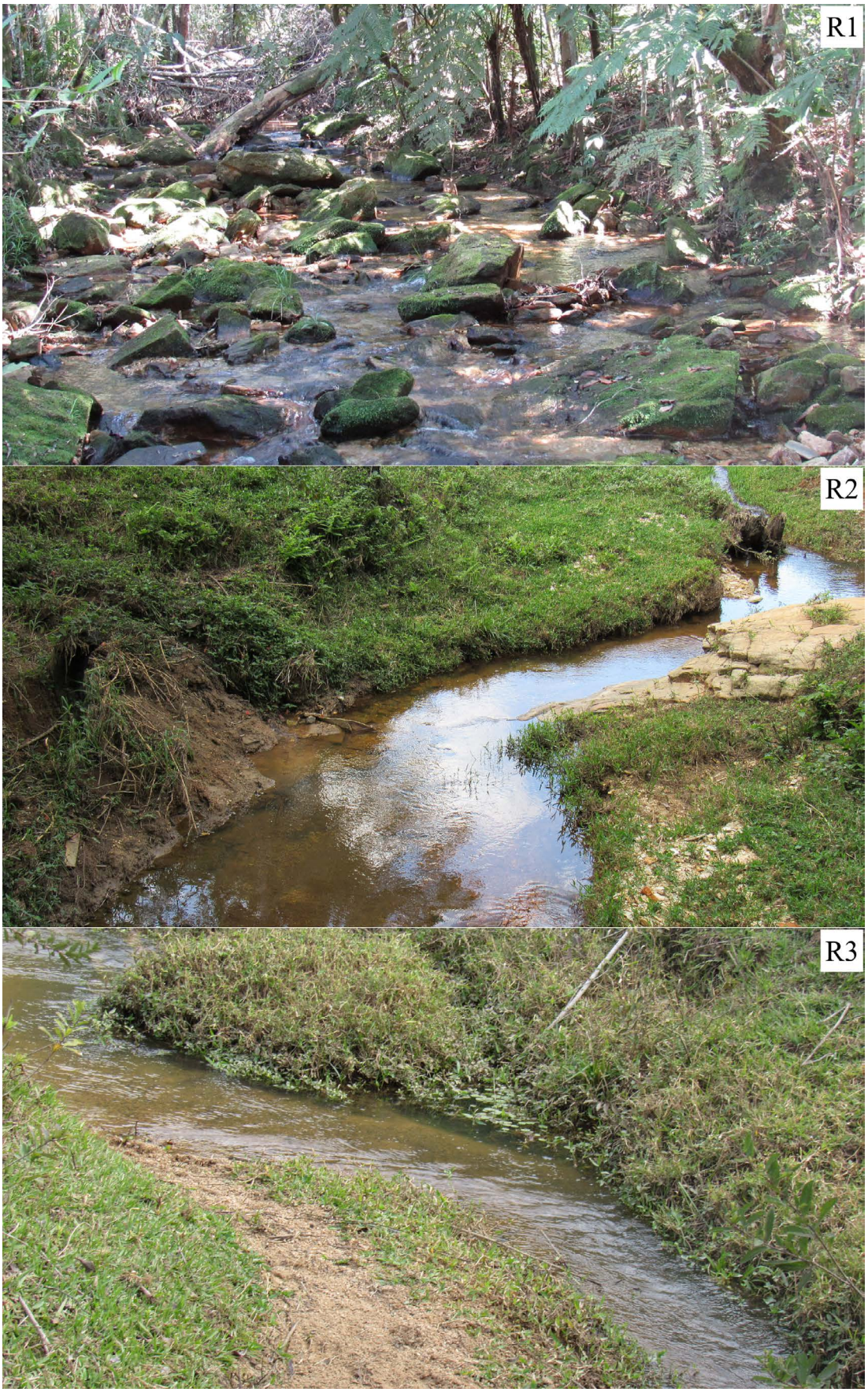

Figure 2. Partial view of each reach (R1, R2, and R3) sampled in streams of the Sapucaí basin, Minas Gerais, Brazil.

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Table 2. Fish species captured in three reaches of streams of the Rio Sapucaí basin, upper Rio Paraná system, Minas Gerais, Brazil.

SPECIES	VOUCHER
CHARACIFORMES	
Crenuchidae	
Characidium zebra Eigenmann, 1909	DZSJRP 21138; LBP 26604
Characidium gomesi Travassos, 1956	DZSJRP 21136
Erythrinidae	
Hoplias malabaricus (Bloch, 1794)	LBP 23576; LBP 23580; LBP 23592; LBP 26591
Characidae	
Astyanax fasciatus (Cuvier, 1819)	LBP 23600; LBP 26585; LBP 26587; LBP 26608
Astyanax lacustris (Lütken, 1875)	LBP 26586; LBP 26589
Astyanax sp. **	LBP 23573; LBP 26571
Knodus moenkhausii (Eigenmann & Kennedy, 1903)***	DZSJRP 21131; LBP 26578; DZSJRP 21132; LBP 26583; LBP 26584; LBP 26605
Oligosarcus argenteus Günther, 1864*	LBP 23572
Oligosarcus paranensis Menezes & Géry, 1983	LBP 23591; LBP 26596
Piabarchus stramineus (Eigenmann, 1908)	LBP 26607
Piabina argentea Reinhardt, 1867	LBP 23601; LBP 26592; LBP 26611
GYMNOTIFORMES	
Gymnotidae	
Gymnotus carapo Linnaeus, 1758	LBP 23597; LBP 26602
Sternopygidae	
Eigenmannia cf. *trilineata* Lopez & Castello, 1966	LBP 23595; LBP 26599
SILURIFORMES	
Heptapteridae	
Cetopsorhamdia iheringi Schubart & Gomes, 1959	LBP 23574; LBP 26568; LBP 26574; LBP 26576; LBP 26582; LBP23599; LBP 26606
Rhamdia cf. *quelen* (Quoy & Gaimard, 1824)	LBP 26609
'*Heptapterus*' sp.**	LBP 23577; LBP 26570; LBP 26575
Imparfinis schubarti (Gomes, 1956)	LIRP 14326; LBP 26601
Pimelodella gracilis (Valenciennes, 1835)	LIRP 14327
Imparfinis sp.**	LIRP 14325; LBP 26600
Pimelodidae	
Pimelodus maculatus Lacepède, 1803	LBP 26594
Trichomycteridae	
Trichomycterus candidus (Miranda-Ribeiro, 1949)	LBP 23575; LBP 26567; LBP 26579; LBP 26581; LBP23596
Trichomycterus septemradiatus Katz, Barbosa & Costa 2013	LBP 23578; LBP 26569; LBP 26573; LBP 26577
Callichthyidae	
Callichthys callichthys (Linnaeus, 1758)	LBP 23598; LBP 26603
Loricariidae	
Hisonotus cf. *alberti* Roxo, Silva, Waltz, Melo 2016	LBP 23590; LBP 26593; LBP 26595
Hypostomus ancistroides (Ihering, 1911)	LBP 23594; LBP 26598
Pareiorhina hyptiorhachis Silva, Roxo, & Oliveira 2013 *	LBP 23571; LBP 26566; LBP 26572; LBP23579; LBP 26580
CICHLIFORMES	
Cichlidae	
Geophagus brasiliensis (Quoy & Gaimard, 1824)	LBP 23593; LBP 26588; LBP 26590; LBP 26597
CYPRINODONTIFORMES	
Poeciliidae	
Poecilia vivipara Bloch & Schneider, 1801***	LBP 26610

* First record for the upper Rio Paraná system.

** Putatively undescribed species.

*** Non-native species.

Table 3. Species captured (X) in each reach of the three different streams, Rio Sapucaí basin, Minas Gerais, Brazil.

SPECIES	REACH		
	R1	R2	R3
Astyanax fasciatus		X	X
Astyanax lacustris		X	X
Astyanax sp.	X		
Callichthys callichthys			X
Cetopsorhamdia iheringi	X	X	X
Characidium gomesi			X
Characidium zebra			X
Eigenmannia cf. *trilineata*			X
Geophagus brasiliensis			X
Gymnotus carapo			X
'*Heptapterus*' sp.	X		
Hisonotus cf. *alberti*			X
Hoplias malabaricus	X	X	X
Hypostomus ancistroides			X
Imparfinis schubarti			X
Imparfinis sp.			X
Knodus moenkhausii	X	X	X
Oligosarcus argenteus	X		
Oligosarcus paranensis			X
Pareiorhina hyptiorhachis	X	X	
Piabarchus stramineus			X
Piabina argentea			X
Pimelodella gracilis			X
Pimelodus maculatus			X
Poecilia vivipara			X
Rhamdia cf. *quelen*			X
Trichomycterus candidus	X	X	X
Trichomycterus septemradiatus	X		

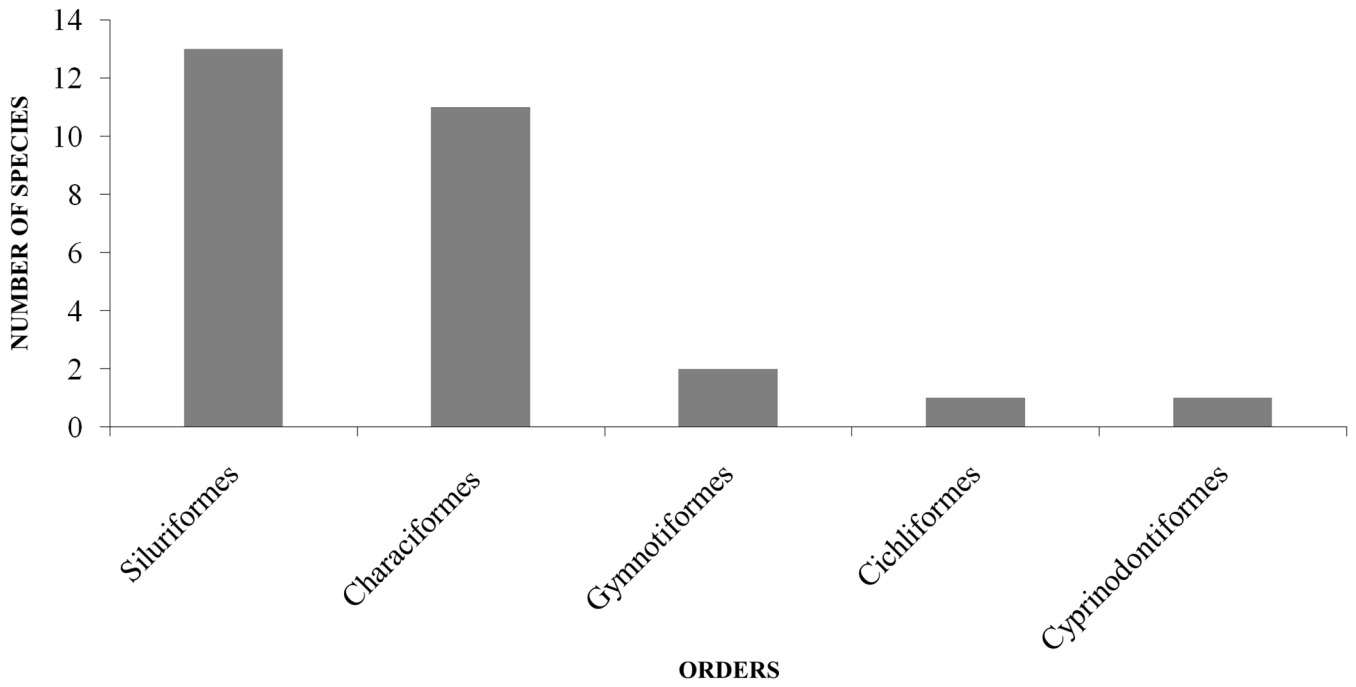

Figure 3. Species richness by orders collected in reaches of three different streams of the Rio Sapucaí basin, Minas Gerais, Brazil.

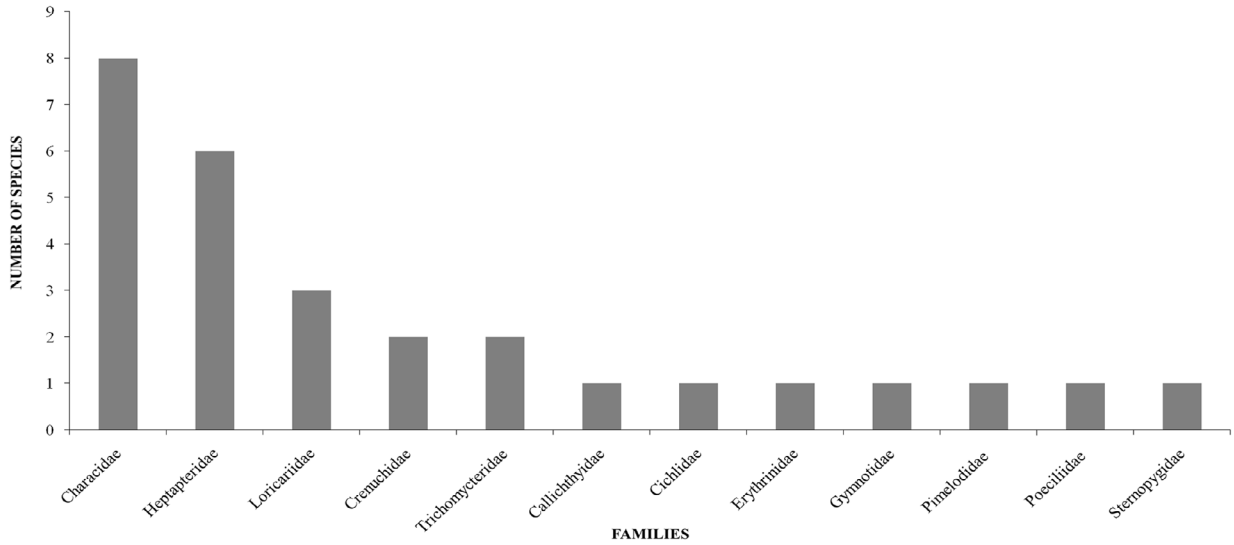

Figure 4. Species richness by families collected in reaches of three different streams of the Rio Sapucaí basin, Minas Gerais, Brazil.

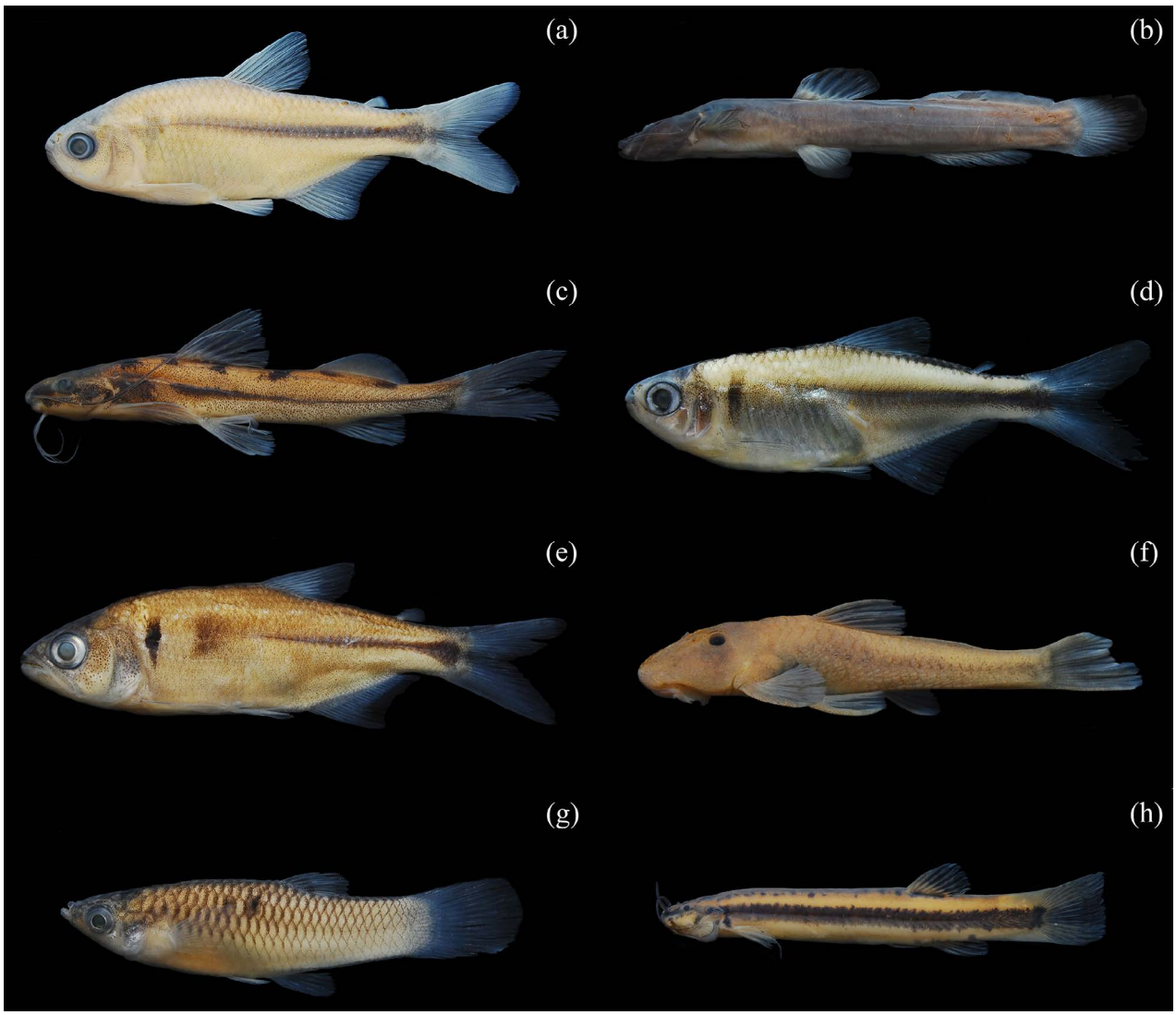

Figure 5. Representative individuals of eight species collected in this study: (a) *Astyanax* sp., 43.9 mm SL, LBP 26571; (b) '*Heptapterus*' sp., 104.8 mm SL, LBP 23577; (c) *Imparfinis* sp., 58.7 mm SL, LBP 26600; (d) *Knodus moenkhausii*, 34.5 mm SL, LBP 26584; (e) *Oligosarcus argenteus*, 61.8 mm SL, LBP 23572; (f) *Pareiorhina hyptiorhachis*, 28.5 mm SL, LBP 26572; (g) *Poecilia vivipara*, 29.6 mm SL, LBP 26610; (h) *Trichomycterus septemradiatus*, 39.6 mm SL, LBP 26573.

Trichomycterus septemradiatus (Figure 5h) was previously known only from its type locality, a single stream in the Rio Sapucaí basin (Katz et al. 2013). Our study reports individuals of *T. septemradiatus* at R1; therefore, we extend the distribution of this species within the basin.

Individuals of two non-native species, *Knodus moenkhausii* and *Poecilia vivipara*, were collected in this survey (see Table 3). *Knodus moenkhausii* (Figure 5d) has previously been assigned by different authors as non-native to the upper Rio Paraná system (e.g., Langeani et al. 2007, Souza et al. 2015, Azevedo-Santos et al. 2018b). *Poecilia vivipara* (Figure 5g) has also been reported by Langeani et al. (2007) as a non-native species introduced to the upper Rio Paraná system. Therefore, we consider *K. moenkhausii* and *P. vivipara* as non-native species within the Rio Sapucaí basin (sensu Langeani et al. 2007). However, sources of these introductions remain unknown.

Here we contribute to the knowledge of the fish fauna of the Rio Sapucaí basin, upper Paraná system. However, we recognize this study likely represents a small fraction of what remains to be sampled within this basin. The presence of putative undescribed species coupled with increasing anthropogenic effects highlights the need to conduct more surveys of the ichthyofauna of waterbodies of this region.

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Author Contributions

Valter M. Azevedo-Santos: idealized the survey and collected all individuals; identified fish species; wrote this manuscript.

Heraldo A. Britski: identified fish species; wrote this manuscript.

Claudio Oliveira: wrote this manuscript.

Ricardo C. Benine: wrote this manuscript.

Conflicts of interest

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

References

AZEVEDO-SANTOS, V.M., FREDERICO, R.G., FAGUNDES, C.K., POMPEU, P.S., PELICICE, F.M., PADIAL, A.A., NOGUEIRA, M.G., FEARNSIDE, P.M., LIMA, L.B., DAGA, V.S., OLIVEIRA, F.J.M., VITULE, J.R.S., CALLISTO, M., AGOSTINHO, A.A., ESTEVES, F.A., LIMA-JUNIOR, D.P., MAGALHÃES, A.L.B., SABINO, J., MORMUL, R.P., GRASEL, D., ZUANON, J., VILELLA, F.S. & HENRY, R. 2018a. Protected areas: A focus on Brazilian freshwater biodiversity. Divers. Distrib., https://doi.org/10.1111/ddi.12871

AZEVEDO-SANTOS, V.M., COELHO, P.N. & DEPRÁ, G.C. 2018b. Ichthyofauna of the Ribeirão Frutal and tributaries, upper Rio Paraná basin, Minas Gerais, Southeastern Brazil. Biota Neotrop. 18(3): e20180517. http://dx.doi.org/10.1590/1676-0611-BN-2018-0517

BELEI, F., SAMPAIO, W.M.S. 2012. Ictiofauna do rio Lourenço Velho, afluente do Rio Grande: pequena diversidade, grande importância para a conservação de uma espécie ameaçada. Evol. Conserv. Biodivers., 3: 14-27.

BERTORA, A., GROSMAN, F., SANZANO, P., ROSSO, J.J. 2018. Fish fauna from the Langueyú basin, Argentina: a prairie stream in a heavily modified landscape. Check List 14 (2): 461-470. https://doi.org/10.15560/14.2.461

CASATTI, L., LANGEANI, F. & CASTRO, R. M. C. 2003. Peixes de riacho do Parque Estadual Morro do Diabo, bacia do alto rio Paraná, SP. Biota Neotrop. 1: - http://www.biotaneotropica.org.br/v1n12/pt/abstract?inventory+BN00201122001

CAVALLI, D., FROTA, A., LIRA, A. D., GUBIANI, E. A., MARGARIDO, V. P. & GRAÇA, W. J. 2018. Update on the ichthyofauna of the Piquiri River basin, Paraná, Brazil: a conservation priority area. Biota Neotrop. 18(2): e20170350. http://dx.doi.org/10.1590/1676-0611-BN-2017-0350

CHUCTAYA, J., BÜHRNHEIM, C.M. & MALABARBA, L.R. 2018. Two new species of *Odontostilbe* historically hidden under *O. microcephala* (Characiformes: Cheirodontinae). Neotrop. Ichthyol. 16: e170047. http://dx.doi.org/10.1590/1982-0224-20170047

DELARIVA, R. L., NEVES, M. P., LARENTIS, C., KLIEMANN, B. C. K., BALDASSO, M. C. & WOLFF, L. L. 2018. Fish fauna in forested and rural streams from an ecoregion of high endemism, lower Iguaçu River basin, Brazil. Biota Neotrop.18(3): e20170459. http://dx.doi.org/10.1590/1676-0611-BN-2017-0459

FAGUNDES, D.C., LEAL, C.G., CARVALHO, D.R., JUNQUEIRA, N.T., LANGEANI, F. & POMPEU, P.S. 2015. The stream fish fauna from three regions of the Upper Paraná River basin. Biota Neotrop. 15(2): e20140187. http://dx.doi.org/10.1590/1676-06032015018714

FRICKE, R., ESCHMEYER, W. N. & FONG, J. D. 2018. SPECIES BY FAMILY/SUBFAMILY. (http://researcharchive.calacademy.org/research/ichthyology/catalog/SpeciesByFamily.asp). (last access 30 October 2018).

FROTA, A., DEPRÁ, G.C., PETENUCCI, L.M. & GRAÇA, W.J. 2016. Inventory of the fish fauna from Ivaí River basin, Paraná State, Brazil. Biota Neotrop.16(3): e20150151. http://dx.doi.org/10.1590/1676-0611-BN-2015-0151

HONORIO, J. R. & MARTINS, I. A. 2018. Ichthyofauna of the Una river in the Paraíba do Sul Paulista River Valley, Southeastern of Brazil. Biota Neotrop. 18(4): e20180528. http://dx.doi.org/10.1590/10.1590/1676-0611-BN-2018-0528

INGENITO, L.F.S. & BUCKUP P.A. 2007. The Serra da Mantiqueira, southeastern Brazil, as a biogeographical barrier for fishes. J. Biogeogr. 34: 1173-1182. https://doi.org/10.1111/j.1365-2699.2007.01686.x

KATZ, A.M., BARBOSA, M.A., COSTA, W.J.E.M. 2013. Two new species of the catfish genus *Trichomycterus* from the Paraná river basin, southeastern Brazil (Teleostei: Trichomycteridae). Ichthyol. Explor. Freshw. 23 (4): 359-366.

LANGEANI, F., CASTRO, R.M.C., OYAKAWA, O.T., SHIBATTA, O.A., PAVANELLI, C.S. & CASATTI, L. 2007. Diversidade da ictiofauna do Alto Rio Paraná: composição atual e perspectivas futuras. Biota Neotrop. 7: 181-197. http://www.biotaneotropica.org.br/v7n3/pt/abstract?article+bn03407032007

MAGALHÃES JR., A.P. & DINIZ, A.A. 1997. Padrões e direções de drenagem na Bacia do Sapucaí - Sul de Minas Gerais. Geonomos 5: 29-32

MELO, B.F., BENINE, R.C., BRITZKE, R., GAMA, C.S. & OLIVEIRA, C. 2016. An inventory of coastal freshwater fishes from Amapá highlighting the occurrence of eight new records for Brazil. ZooKeys 606: 127-140.

OLIVEIRA-SILVA, L., RAMOS, T. P. A., CARVALHO-ROCHA, Y. G. P., VIANA, K. M. P., AVELLAR, R. C. & RAMOS, R. T. C. 2018. Ichthyofauna of the Mamanguape river basin, Northeastern, Brazil. Biota Neotrop. 18(3): e20170452. http://dx.doi.org/10.1590/1676-0611-BN-2017-0452

PELICICE, F.M., AZEVEDO-SANTOS, V.M., VITULE, J.R.S., ORSI, M.L., LIMA-JUNIOR, D.P., MAGALHÃES, A.L.B., POMPEU, P.S., PETRERE JR, M. & AGOSTINHO, A.A. 2017. Neotropical freshwater fishes imperilled by unsustainable policies. Fish Fish. 18 (6):1119–1133. https://doi.org/10.1111/faf.12228

RIBEIRO, A.C. & MENEZES, N.A. 2015. Phylogenetic relationships of the species and biogeography of the characid genus *Oligosarcus* Günther, 1864 (Ostariophysi, Characiformes, Characidae). Zootaxa 3949 (1): 041-081. http://dx.doi.org/10.11646/zootaxa.3949.1.2

SANTOS, A.C., GONÇALVES, C.C. & CARVALHO, F.R. 2017. Ichthyofauna of the "Cachoeira de São Roberto" and fishes of lower Preto River, upper Paraná River basin, Brazil. Biota Neotrop. 17(1): e20160196. http://dx.doi.org/10.1590/1676-0611-BN-2016-0196

SILVA, G.S.C., ROXO, F.F. & OLIVEIRA, C. 2013. *Pareiorhina hyptiorhachis*, a new catfish species from Rio Paraíba do Sul basin, southeastern Brazil (Siluriformes, Loricariidae). ZooKeys 315: 65-76. https://doi.org/10.3897/zookeys.315.5307

SMITH, W.S., & PETRERE JR, M. 2007. Fish, Itupararanga Reservoir, Sorocaba River Drainage, São Paulo, Brazil. Check List 2007: 3(2). http://dx.doi.org/10.15560/3.2.131

SMITH, W.S., PETRERE JR, M. & BARRELLA, V. 2007. Fishes, Sorocaba river sub-basin, State of São Paulo, Brazil. Check List 3(3): 282-286. https://biotaxa.org/cl/article/view/3.3.282/13429

SOUZA, C. S., OLIVEIRA, C. & PEREIRA, L. H. G. 2015. *Knodus moenkhausii* (Characiformes: Characidae): one fish species, three hydrographic basins a natural or anthropogenic phenomenon? DNA Barcodes, 3: 129-138. DOI: 10.1515/dna-2015-0016

VALDIVIEZO-RIVERA, J., CARRILLO-MORENO, C. & GEA-IZQUIERDO, E. 2017. Annotated list of freshwater fishes of the Limoncocha Lagoon, Napo river basin, northern Amazon region of Ecuador. Check List 14 (1): 55-75. https://doi.org/10.15560/14.1.55

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