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# Stream fish fauna from the tributaries of the upper Itapetininga River, upper Paranapanema River basin, state of São Paulo, Brazil

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**Abstract**: The study area, which is located in urban and rural areas within the upper Paranapanema River basin, is undergoing several types of anthropogenic and non-anthropogenic impacts, such as chemical alterations, habitat disruption, and biological invasions. The aim of this study is to describe the fish faunal composition from tributaries of the Itapetininga River, upper Paranapanema River basin, state of São Paulo, Brazil. Herein, we include a list of 49 fish species, belonging to seven orders, 19 families and 35 genera, captured from September 2009 to November 2013. Thus, the present study fills part of the knowledge gap about the fish fauna from tributaries of the Paranapanema basin by adding data from small tributaries not studied so far. Moreover, our findings can help inform future conservational and/or management strategies within the upper Paranapanema basin.

**Key words:** Neotropical ichthyology; species inventory; ichthyofaunal diversity

## INTRODUCTION

The state of São Paulo harbors about 390 species of fish (Oyakawa and Menezes 2011), corresponding to approximately 8.5% of the estimated total for the whole country. Of that total, 260 species occur in the upper Paraná Basin (Oyakawa and Menezes 2011). The Paraná River and its main tributaries (Tietê, Paranapanema and Grande) house several medium-sized and large fish species, such as curimbatás (*Prochilodus* sp.), piaparas (*Leporinus* sp.), pintados (*Pseudoplatystoma* sp.) and jaús (*Zungaro jahu*), which are widely distributed and important for commercial and subsistence fishing. However, in the headwaters of all four river basins within the state of São Paulo (Paraná, Paranapanema, Ribeira de Iguape and Paraíba do Sul), small to medium-sized fish species belonging to the orders Characiformes and Siluriformes are the most commonly found. In general, these species have a restricted distribution, little or no commercial value (except for a few species exploited in the trade of ornamental fish), and high dependence on riparian vegetation as a source of food of allochthonous origin, and for reproduction and protection (Castro and Menezes 1998; Langeani et al. 2007; Oyakawa and Menezes 2011).

Inventories conducted in the headwaters of the upper Paraná River, especially in the state of São Paulo (Castro and Casatti 1997; Casatti et al. 2001; Castro et al. 2003, 2004, 2005; Langeani et al. 2005) cited the presence of a diverse ichthyofauna: 310 species for the upper Paraná River (Langeani et al. 2007) and 391 species for the state of São Paulo (Oyakawa and Menezes, 2011). Many of species have not yet been described and several are exotic (Castro et al. 2003, 2004, 2005). Similar results were also obtained through reviews of ichthyological collections and other independent studies, reinforcing the fact that the ichthyofaunal survey in the Alto Paraná basin is incomplete (Agostinho and Gomes 2005). Nonetheless, the importance of increasing collection efforts in the area and of reviewing the deposited material in collections must be emphasized. The main goal of this study is to gather data from surveys on fish species diversity from the tributaries of the upper Itapetininga River, upper Paranapanema River basin, state of São Paulo, Brazil, based on available data for the rivers Turvo (Cerqueira and Smith 2015), Pinhal,

Pinhalzinho, Claro and Clarinho (Carvalho and Smith 2013; Almeida 2013), as well as the small hydroelectric plants (HEPs) Paineiras and Jorda Flor (Ferreira 2011), resulting in a fish species list.

## MATERIALS AND METHODS

The hydrographic basin of the Itapetininga River has a drainage area of 2,600 km$^2$. Its headwaters, formed by the Pinhal Grande and Turvo Rivers, near Pilar do Sul, begin on the western slope of the Serra de Paranapiacaba mountain, in the same river basin as the Sorocaba (Tietê River basin) and Juquiá (Ribeira de Iguape River basin) sub-basins (Figure 1).

The vegetation is preserved and partially preserved at the headwaters (Turvo and Pinhal Grande River) and close to the mouth of the Itapetininga River. In its middle portion, vegetation is less dense, due to its proximity to the municipality of Pilar do Sul (Cerqueira and Smith 2013). The margins of the Paineiras reservoir consist of shrubs and trees interspersed with areas of eucalyptus plantations in the middle and lower portions, and pasture in the upper portion. The banks of the Jorda Flor reservoir contrast with the Paineiras reservoir by being occupied predominantly by pastures, with some stretches of eucalyptus planting and signs of erosion (Ferreira 2011) (Figure 2).

The studied streams originate in the Serra de Paranapiacaba range, at approximately 1,100 m of altitude. The vegetation on this part of the basin is characterized by Atlantic Forest, with an average rainfall of 1,700 to 2,400 mm and an average annual temperature of 18°C to 20°C (Almeida 2013). Samplings were carried out in small streams where the Pinhal River joins the Turvo River to become the Itapetininga River (Figure 1). The 52 selected sampling sites are located in the southeastern portion of the state of São Paulo, within upper Paranapanema basin. All localities belong to the upper Paranapanema system, 15 are located in the rivers Clarinho, Claro, Pinhalzinho and Pinhal, 19 are located in the HEPs Paineiras and Jorda Flor, six are located in the Pinhal River and 12 are located in the Turvo River (Figure 1). Figure 2 shows some of the sampling localities and Table 1 shows the coordinates and the localities that correspond to the images. Stretches of streams within the Claro and Pinhal microbasins were analyzed, contemplating second to fourth order streams (Almeida 2013). We also sampled 15 sections, nine in the Claro River microbasin (C1 to C7 and CL1 and CL2) and six in the Pinhal River microbasin (P1 to P6). The junction point between the two streams was called the mouth (Almeida 2013). Another study was conducted by Carvalho and Smith (2013) in the Pinhal River, divided into six sampling localities, from its headwaters to its

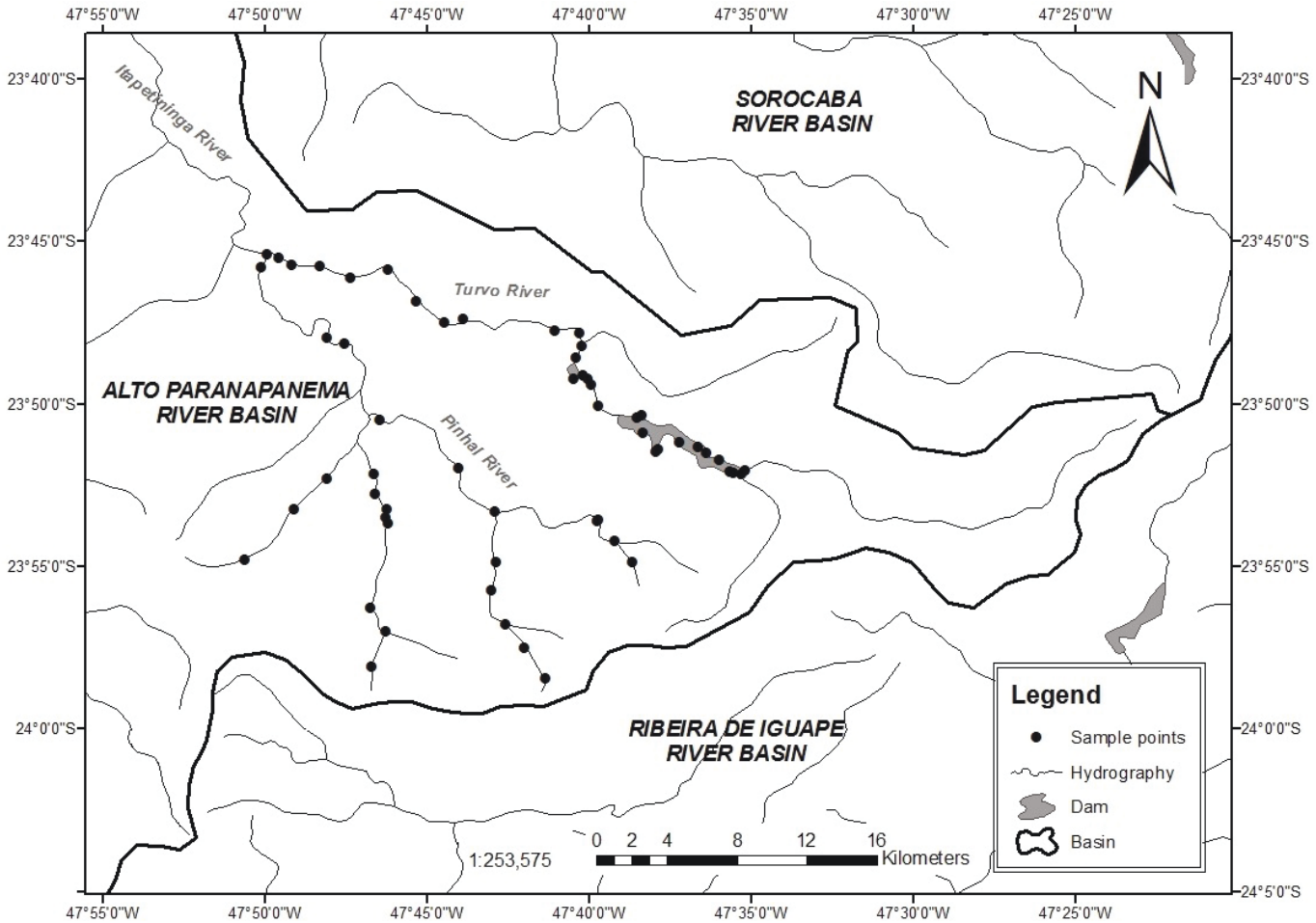


**Figure 1.** Location of the sampling sites.


**Figure 2.** Sites sampled in tributaries of the upper Paranapanema River, SP, Brazil. See Table 1 for detailed location information. Photos by Mauricio de Proença Carvalho (A, Clarinho River; and B, Pinhal River) and Vitor Loreno de Almeida Cerqueira (C and D, Turvo River; 2E and 2F, Pinhal River).

mouth where it joins with the Turvo River.

The fishes were captured from September 2009 to November 2013, using electrofishing, gillnets and traps. All collected specimens were fixed in 10% formalin and, after 72 hours, transferred to 70% ethanol. Specimens were identified according to Reis et al. (2003) and Oliveira et al. (2011), and deposited in the Ichthyology Laboratory of the Department of Zoology and Botany, UNESP, São José do Rio Preto (DZSJRP) and in the Zoology Laboratory of the Paulista University, Sorocaba (LZUNIP). The collection licenses were issued by IBAMA with the numbers 24151-1, 10275-2 and 13352-1.

## RESULTS

Our findings report the occurrence of 49 species, seven orders and 19 families (Table 2). Characiforms and Siluriforms were dominant in number of captured species, with 50% and 36% of the recorded species, respectively. Perciformes and Gymnotiformes, both with 4% of the recorded species, and Synbranchiformes, Cyprinidae and Cyprindotiformes each with 2% of the recorded species, were less representative. The families were represented in the following descending relative percentage order: Characidae (22%), Loricariidae (16%), Heptapteridae (14%), Anostomidae (10%), Crenuchidae

**Table 1.** Sampling localities in tributaries of the upper Paranapanema river: environments, locations, collection method and geographical coordinates.

| Environment | Locality | Method | Coordinates | Environmental characterization |
|---|---|---|---|---|
| Lotic | Rio Claro Grande | electrofishing | 23°58′22″ S, 047°41′21″W | Stretch composed of preserved rainforest vegetation, with high level of shading on its bed. Its banks are heterogeneous, with rocks, vegetation, roots, trunks and slopes. Average width of 6m, shallow depth. |
| Lotic | Rio Claro Grande | electrofishing | 23°56′20″ S, 047°42′31″W | Stretch composed of preserved rainforest vegetation, with high level of shading on its bed. Its banks have a high amount of vegetation, followed by rocks, trunks and roots. Average width of 8 m, shallow depth. |
| Lotic | Rio Claro Grande | electrofishing | 23°54′52″ S, 047°42′48″W | Stretch composed of preserved vegetation, however there is a road along its banks as well as forestry plantations. The shading is 50–75% on the creek bed. Average width and depth of 7.5 m and 0.5 m, respectively. Margins are stable, since they have a high amount of vegetation and roots. |
| Lotic | Rio Claro Grande | electrofishing | 23°54′52″ S, 047°42′48″W | Stretch composed of degraded forest and forestry. Shading of 50–75% on its bed. The banks are mostly not stable, that is, there is the presence of slopes and exposed soil, however there is some vegetation. Its average width and depth are 6m and 0.3m, respectively. |
| Lotic | Rio Claro | electrofishing | 23°53′19″ S, 047°42′51″W | Stretch composed of degraded forest and agriculture. Shading on 26–50% of the bed. Its banks are composed predominantly of slopes. The average width and depth are 6 m and 0.35 m, respectively. |
| Lotic | Rio Claro | electrofishing | 23°51′54″ S, 047°43′46″W | Stretch composed mostly of degraded forest and a small amount of pasture. Shading from 50–75% of the bed. The margins present slopes. The average width and depth are 6.6 m and 0.4 m, respectively. |
| Lotic | Rio Claro | electrofishing | 23°51′51″ S, 047°46′27″W | Stretch composed mostly of degraded forest and a small amount of pasture. Shading from 50–75% of the bed. The margins present slopes. The average width and depth are 7 m and 0.5 m, respectively. |
| Lotic | Clarinho | electrofishing | 23°54′21″ S, 047°39′12″W | Stretch composed of degraded forest. Shading 0–25% of the bed. Its banks are mostly composed of rocks, slopes and vegetation. The average width and depth are 4.4 m and 0.4 m, respectively. |
| Lotic | Clarinho | electrofishing | 23°53′32″ S, 047°39′38″W | Stretch composed of degraded forest and forestry. Shading on 25% of its bed. On the banks there is the predominance of vegetation and rocks. The average width and depth are 5.5 m and 0.25 m, respectively. |
| Lotic | Pinhalzinho | electrofishing | 23°58′54″ S, 047°46′40″W | Stretch composed of preserved rainforest. Shading on more than 76% of its bed. Margins composed of vegetation, rocks and slopes. The average width and depth are 6.7 m and 0.38 m, respectively. |
| Lotic | Pinhalzinho | electrofishing | 23°57′85″ S, 047°46′23″W | Stretch composed of preserved rainforest, although there is a road along one of its margins. Shading on more than 76% of its bed. Margins composed of slopes. The average width and depth are 6.5 m and 0.4 m, respectively. |
| Lotic | Pinhal | electrofishing | 23°56′16″ S, 047°46′42″W | Stretch composed of preserved forest, degraded forest and urban occupation. Shading on 50% of the bed. Margins composed of slopes and vegetation. The average width and depth are 8.7 and 0.5 m, respectively. |
| Lotic | Pinhal | electrofishing | 23°53′28″ S, 047°46′63″W | Stretch composed of preserved forest, degraded forest and urban occupation. More than 25% shading. Banks predominant with vegetation. The average width and depth are 12.7 m and 0.5 m, respectively. |
| Lotic | Pinhal | electrofishing | 23°52′47″ S, 047°46′34″W | Stretch composed of agriculture and degraded forest. Shading on 50% of the bed. Banks predominantly with slopes and exposed soil. The average width and depth are 7.4 m and 0.6 m, respectively. |
| Lotic | Pinhal | electrofishing | 23°52′13″ S, 047°46′34″W | Stretch composed of agriculture and degraded forest. Shading on 50% of the bed. Banks predominantly with slopes and exposed soil, respectively. The average width and depth are 7.0 m and 0.7 m, respectively. |
| Lotic | Rio Pinhal | sieves, covo traps and gillnets | 23°53′42″ S, 047°46′10″W | Stretch composed of riparian vegetation, but with the absence of marginal aquatic vegetation. The average width and depth are 8.0 m and 0.85 m, respectively. |
| Lotic | Rio Pinhal | sieves, covo traps and gillnets | 23°53′17″ S, 047°46′10″W | Stretch composed of riparian vegetation, but with some level of alteration. Aquatic marginal vegetation absent. Average width and depth is 8.0 m and 0.85 m, respectively. |
| Lotic | Rio Pinhal | sieves, covo traps and gillnets | 23°48′06″ S, 047°47′31″W | Stretch composed of riparian vegetation, but with some level of alteration. Aquatic marginal vegetation absent. Average width and depth is 8.5 m and 1.35 m, respectively. |
| Lotic | Rio Pinhal | sieves, covo traps and gillnets | 23°47′58″ S, 047°48′03″W | Stretch composed of riparian vegetation, but with some level of alteration. Aquatic marginal vegetation absent. Average width and depth is 8.5 m and 1.35 m, respectively. |
| Lotic | Rio Pinhal | sieves, covo traps and gillnets | 23°47′58″ S, 047°48′03″W | Stretch composed of riparian vegetation, but with some level of alteration. Aquatic marginal vegetation absent. Average width and depth is 12.13 m and 1.65 m, respectively. |
| Lotic | Rio Pinhal | sieves, covo traps and gillnets | 23°45′27″ S, 047°49′46″W | Stretch composed of riparian vegetation, but with some level of alteration. Aquatic marginal vegetation absent. Average width and depth is 8.45 m and 1.65 m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°81′05″ S, 047°66′75″W | Stretch composed of riparian vegetation with low level of human disturbance. Aquatic marginal vegetation absent. Average width and depth are 15.45 m and 1.67 m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°80′41″ S, 047°66′66″W | Stretch with absence of riparian vegetation and a certain level of human disturbance. Aquatic marginal vegetation present. Average width and depth are 12.8 m and 2.35 m, respectively. |

*Continued*

**Table 1.** *Continued.*

| Environment | Locality | Method | Coordinates | Environmental characterization |
|---|---|---|---|---|
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°79′63″ S, 047°67′13″ W | Stretch with certain level of riparian vegetation and a low level of human disturbance. Aquatic marginal vegetation absent. Average width and depth are 6.7 m and 3.25 m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°79′33″ S, 047°68′27″ W | Stretch with certain level of riparian vegetation and human disturbance. Aquatic marginal vegetation present at some points. Average width and depth are 10.45 m and 2.9 m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°78′97″ S, 047°73′11″ W | Stretch with low level of riparian vegetation and a highly disturbed. Aquatic marginal vegetation absent. Average width and depth are 6.56 m and 3.5 m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°78′94″ S, 047°74′00″ W | Stretch with certain level of riparian vegetation and presence of disturbed areas. Aquatic marginal vegetation present. Average width and depth are 8.97 m and 1.8 m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°78′08″ S, 047°75′55″ W | Stretch with certain level of riparian vegetation and a few areas showing human disturbance. Aquatic marginal vegetation absent. Average width and depth are 13.13m and 2.2m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°76′88″ S, 047°76′27″ W | Stretch with certain level of riparian vegetation and a low level of human disturbance. Aquatic marginal vegetation present. Average width and depth are 7.65 m and 2.4 m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°78′77″ S, 047°76′88″ W | Stretch with certain level of riparian vegetation and a low level of human disturbance. Aquatic marginal vegetation present. Average width and depth are 9.87 m and 2.2 m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°80′38″ S, 047°75′97″ W | Stretch with certain level of riparian vegetation and human disturbance. High amount of aquatic marginal vegetation. Average width and depth are 10.11 m and 2.4 m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°81′97″ S, 047°76′44″ W | Stretch with a high level of riparian vegetation and low level of human disturbance. Aquatic marginal vegetation present at some points. Average width and depth are 11.13 m and 2.0 m, respectively. |
| Lotic | Rio Turvo | sieves, covo traps and gillnets | 23°75′73″ S, 047°82′73″ W | Stretch with a high level of riparian vegetation and low level of human disturbance. Aquatic marginal vegetation present at some points. Average width and depth are 10.91m and 2.5m, respectively. |
| Lentic | Jorda flor | covo traps and gillnets | 23°50′00″ s, 047°39′41″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations and almost no native vegetation. Approximate distance to the dam was 3,280 m. |
| Lentic | Jorda flor | covo traps and gillnets | 23°49′10″ S, 047°39′43″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations and almost no native vegetation. Approximate distance to the dam was 1,586 m. |
| Lentic | Jorda flor | covo traps and gillnets | 23°49′11″ S, 047°39′54″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations and almost no native vegetation. Approximate distance to the dam was 1,204 m. |
| Lentic | Jorda flor | covo traps and gillnets | 23°49′12″ s, 047°40′20″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations and almost no native vegetation. Approximate distance to the dam was 725 m. |
| Lentic | Jorda flor | covo traps and gillnets | 23°48′57″ s, 047°40′27″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations and almost no native vegetation. Approximate distance to the dam was 222 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°52′03″ S, 047°35′12″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 1,268 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°52′06″ s, 047°35′25″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 1,524 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°51′51″ s, 047°35′43″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 2,964 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°51′44″ s, 047°36′02″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 4,588 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°51′57″ s, 047°36′12″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 5186m. |
| Lentic | Paineiras | covo traps and gillnets | 23°51′25″ s, 047°36′16″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 5,822 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°51′32″ s, 047°36′22″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 7,265 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°51′29″ s, 047°36′47″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 1,310 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°51′10″ s, 047°37′08″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 3,530 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°51′21″ s, 047°37′40″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 4,320 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°51′34″ s, 047°37′48″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 5,780 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°50′54″ s, 047°38′22″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 7,200 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°50′20″ s, 047°38′27″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 7,500 m. |
| Lentic | Paineiras | covo traps and gillnets | 23°50′25″ s, 047°38′35″ W | Stretch with riparian vegetation made up of pasture and *Eucalyptus* plantations. Approximate distance from the dam was 8,650 m. |

(6%), Curimatidae and Cichlid (4% each), and Bryconidae, Prochilodontidae, Erythrinidae, Paradontidae, Pimelodidae, Callichthydae, Trichomycteridae, Sternopygidae, Gymnotidae, Cyprinidae, Poeciliidae and Synbranchidae (all adding up to 2%). Two migratory species were recorded, *Prochilodus lineatus* (curimbatá) and *Salminus hilarii* (tabarana), both represented by few individuals.

## DISCUSSION

Of the 49 recorded species, 47 are native to the upper Paranapanema basin. The most abundant native ones are the lambari (*Astyanax altiparanae*), the acará (*Geophagus brasiliensis*) and the traíra (*Hoplias malabaricus*), species typically found in reservoirs in southeastern Brazil (Agostinho et al. 2007). Some species of lower occurrence or low density in the surveyed tributaries are little known to local residents, for example *Serrasalmus maculatus* and *Trichomycterus* sp. Many locals do not even recognize these species as typical of rivers, streams and municipal reservoirs (Cerqueira and Smith, 2015). None of the recorded species are endemic or threatened of extinction. These results are similar to ichthyofaunal surveys conducted in rivers of the upper Paraná (Langeani et al. 2007; Ortega and Hidalgo, 2008; Vari et al. 2009; Oyakawa and Menezes, 2011; Le Bail et al. 2012).

Migratory species in the adult stage are mostly residents of larger streams or rivers, being occasionally found in these low-order streams when in their young stage (Pompeu and Godinho 2003). These two species were collected in lotic stretches of the inventoried rivers. It is important to emphasize that *S. hilarii* can be used as an environmental indicator (Honji et al. 2011). According to Lima-Junior (2004) and Honji et al. (2011), this is due to their degree of habitat selectivity and to them being at the top of the food chain. This species is currently classified as 'endangered' in the state of São Paulo. Due to the fact that these species are migratory, Froese and Pauly (2012) in particular, believe that the barriers created by the dams (Paineiras and Jorda Flor) disrupt upstream spawning migration of these species (Dugan 2008).

The analyzed tributaries, considering both lentic and lotic ones, have a great diversification in species composition patterns. Only three species (*Astyanax altiparanae*, *A. fasciatus* and *Hypostomus ancistroides*) appear in all the study sites. On the other hand, there are species considered rare that were not captured in any of the tributaries. With the exception of *Cyprinus carpio*, an invasive species present in the Paineiras reservoir, seven species were caught occurring in only one type of tributary. These species are: *Eigenmannia virescens*, *Leporinus friderici*, *Leporinus paranensis*, *Leporinus striatus*, *Cyphocharax modestus*, *Steindachnerina insculpta* and *Serrasalmus maculatus*. The other species are common in the basins of the Upper Paranapanema according to Oyakawa and Menezes (2011).

In tributaries downstream both cited dams, the presence of many specimens of the anostomids *L. friderici*, *L. paranensis* and *L. striatus* were recorded in the Turvo River. Other species also present in the Turvo River were *S. maculatus*, *C. modestus* and *S. insculpta*. In the streams of the Pinhal River the following species were collected: *A. paranae*, *P. argentea*, *C. gomesi*, *C. schubarti*, *P. nasus*, *P. tenebrosa*, *H. nigromaculatus*, *P. reisii* and *S. marmoratus*. According to our results and Alegretti et al. (2012), the fish population in southeastern Brazil is

**Table 2.** List of fish species collected in tributaries of the upper Paranapanema River. The samples were collected from 2009 to 2013 counting a total of 40 species. "Genus sp." tags were not included in this count, so as to avoid counting the same species twice. * migratory species,** exotic species.

| Order/family/species | Voucher |
|---|---|
| **CHARACIFORMES** | |
| **Characidae** | |
| *Astyanax altiparanae* (Garutti & Britski, 2000) | DZSJRP 13655/15395 / LZUNIP 0073 / LZUNIP 0101 |
| *Astyanax fasciatus* (Cuvier, 1819) | DZSJRP 13673/13682/12365 / LZUNIP 0074 / LZUNIP 0102 |
| *Astyanax paranae* (Eigenmann, 1914) | DZSJRP 15325 |
| *Bryconamericus stramineus* (Eigenmann, 1908) | DZSJRP 13663 / LZUNIP 0075 |
| *Hyphessobrycon anisitsi* (Eigenmann, 1907) | DZSJRP 15327/12364 |
| *Piabina argentea* (Reinhardt, 1867) | DZSJRP 15330/12366 / LZUNIP 0103 |
| *Oligosarcus paranensis* (Menezes & Géry, 1983) | DZSJRP 15394 / LZUNIP 0076 |
| *Astyanax* aff. *paranae* (Eigenmann, 1914) | LZUNIP 0104 |
| *Astyanax* sp. | LZUNIP 0105 |
| *Oligosarcus* sp. | LZUNIP 0106 |
| **Serrassalmidae** | |
| *Serrasalmus maculatus* (Kner,1858) | LZUNIP 0087 |
| **Crenuchidae** | |
| *Characidium gomesi* (Travassos, 1956) | DZSJRP 13643/13665 |
| *Characidium schubarti* (Travassos, 1955) | DZSJRP 13650 |
| *Characidium zebra* (Eigenmann, 1909) | DZSJRP 13654 / LZUNIP 0107 |

*Continued*

**Table 1.** *Continued.*

| Order/family/species | Voucher |
|---|---|
| **Parodontidae** | |
| *Parodon nasus* (Kner, 1859) | DZSJRP 13642 |
| **Erythrinidae** | |
| *Hoplias malabaricus* (Bloch, 1794) | DZSJRP 15396 / LZUNIP 0077 / LZUNIP 0108 |
| **Anostomidae** | |
| *Leporinus octofasciatus* (Steindachner, 1915) | LZUNIP 0078 / LZUNIP 0109 |
| *Leporinus paranensis* (Garavello & Britski, 1987) | LZUNIP 0084 |
| *Leporinus friderici* (Bloch, 1794) | LZUNIP 0085 |
| *Leporinus striatus* (Kner, 1858) | LZUNIP P 0086 |
| *Schizodon nasutus* (Kner, 1858) | DZSJRP 15393 / TURUNIP 0079 / LZUNIP 0110 |
| **Prochilodontidae** | |
| *Prochilodus lineatus* (Valenciennes, 1837) | LZUNIP 0080 / LZUNIP 0111 |
| **Bryconidae** | |
| *Salminus hilarii* (Valenciennes, 1850) | LZUNIP 0081 / LZUNIP 0112 |
| **Curimatidae** | |
| *Cyphocharax modestus* (Fernández-Yépez, 1948) | LZUNIP 0082 |
| *Steindachnerina insculpta* (Fernández-Yépez, 1948) | LZUNIP 0083 |
| **PERCIFORMES** | |
| **Cichlidae** | |
| *Geophagus brasiliensis* (Quoy & Gaimard, 1824) | DZSJRP 13674/15392 / LZUNIP 0090 |
| *Oreochromis niloticus* (Linnaeus, 1758)** | NO VOUCHER |
| **SYNBRANCHIFORMES** | |
| **Synbranchidae** | |
| *Synbranchus marmoratus* (Bloch, 1795) | DZSJRP 13667 |
| **CYPRINODONTIFORMES** | |
| **Poeciliidae** | |
| *Phalloceros reisi* (Lucinda, 2008) | DZSJRP 13699 |
| **CYPRINIFORMES** | |
| **Cyprinidae** | |
| *Cyprinus carpio* (Linnaeus, 1758)** | DZSJRP 15401 |
| **GYMNOTIFORMES** | |
| **Gymnotidae** | |
| *Gymnotus carapo* (Linnaeus, 1758) | DZSJRP 15400 |
| **Sternopygidae** | |
| *Eigenmannia virescens* (Valenciennes, 1836) | LZUNIP 0091 |
| Siluriformes | |
| **Heptapteridae** | |
| *Cetopsorhamdia iheringi* (Schubart & Gomes, 1959) | DZSJRP 13648 |
| *Imparfinis borodini* (Mees & Cala, 1989) | DZSJRP 13694 / LZUNIP 0092 |
| *Imparfinis mirini* (Haseman, 1911) | DZSJRP 13666 / LZUNIP 0093 |
| *Phenacorhamdia tenebrosa* (Schubart, 1964) | DZSJRP 13656 |
| *Pimelodella avanhandavae* (Eigenmann, 1917) | DZSJRP 13695 / LZUNIP 0094 |
| *Rhamdia quelen* (Quoy & Gaimard, 1824) | DZSJRP 13685/15397 |
| **Loricariidae** | |
| *Hisonotus* sp. | DZSJRP 15323 / LZUNIP 0095 |
| *Hypostomus ancistroides* (Ihering, 1911) | DZSJRP 13692/13701/15399 / LZUNIP 0070 LZUNIP 0096 |
| *Hypostomus nigromaculatus* (Schubart, 1964) | DZSJRP 15319/15320 |
| *Neoplecostomus* sp. | DZSJRP 13676 |
| *Rineloricaria pentamaculata* (Langeani & de Araujo, 1994) | DZSJRP 13686 / LZUNIP 0097 |
| *Hypostomus margaritifer* (Regan, 1908) | DZSJRP 15402 / LZUNIP 0071 |
| *Hypostomus* sp. 1 | LZUNIP 0098 |
| *Hypostomus* sp. 2 | LZUNIP 0099 |
| **Trichomycteridae** | |
| *Trichomycterus* sp. | DZSJRP 13687/15324 |
| **Callichthyidae** | |
| *Hoplosternum littorale* (Hancock, 1828) | DZSJRP 15398 |
| **Pimelodidae** | |
| *Pimelodus maculatus* (Lacepède, 1803) | LZUNIP 0072 / LZUNIP 0100 |

mostly composed of small and non-migratory species.

*Oreochromis niloticus* (Nile Tilapia) and *Cyprinus carpio* (Carp), two invasive species, were recorded herein. These species were collected in the Paineiras and Jorda Flor reservoirs, both located in the Turvo River, municipality of Pilar do Sul. *O. niloticus* and *C. carpio* can easily adapt to lentic environments, being commonly used to restock dammed environments. Usually, these species occupy lentic environments seeking for shelter in macrophytes, submerged rocks and logs that provide suitable habitats for the survival of their populations (Smith et al. 2005a, 2005b; Biagioni et al. 2013). *O. niloticus*, originally from the African continent, was brought to Brazil mainly for fish farms. Similarly, *C. carpio,* originally from Asia, was also brought to Brazil for fish farms, which makes both species the most cultivated in the country (MPA 2012). The number of introduced species may be even higher than reported in this study due to the large number of fish breeding sites in the sub-basin, providing unintentional escape routes. Moreover, invasive species could have also been added to the sub-basin deliberately in order to improve sport fishing (Smith et al. 2007).

Fish fauna inventories from low-ordered water bodies are important in highlighting the regional biodiversity. Thus, the present study fills part of the knowledge gap about the fish fauna from tributaries of the Paranapanema basin by adding data from small tributaries not studied so far. Moreover, our findings can help inform future conservational and/or management strategies within the upper Paranapanema basin.

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