



The genus *Brycon* Müller & Troschel (Ostariophysi: Characiformes: Bryconidae) of Espírito Santo State, Brazil: new records and comments on conservation

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Abstract

The occurrence of the species of the genus *Brycon* (Characiformes: Bryconidae) in Espírito Santo State is herein reviewed. *Brycon opalinus*, a species formerly known only from the upper rio Paraíba do Sul and upper rio Doce basins, is recorded for the first time in the rio Itapemirim, an independent coastal basin in southern Espírito Santo State, Brazil. With the records of *B. opalinus*, four *Brycon* species are now known from Espírito Santo State: *B. insignis* in the rio Itabapoana basin, on the boundary between Rio de Janeiro and Espírito Santo, *B. opalinus* in the rio Itapemirim basin, *B. dulcis* in the rio Doce basin, and *B. ferox* in the rio Barra Seca, rio Itaúnas and the rio São Mateus basins. Additionally worth highlighting is that several fisherman and local inhabitants report the occurrence *Brycon vermelha* in the rio Cotaxé, a tributary of the rio São Mateus in Espírito Santo and Minas Gerais states, although there are no preserved specimens of *B. vermelha* from river basins other than the rio Mucuri, in Minas Gerais state.

Key words: *Brycon dulcis*, *Brycon ferox*, *Brycon insignis*, *Brycon opalinus*, *Brycon vermelha*

Resumo

A ocorrência das espécies do gênero *Brycon* (Characiformes: Bryconidae) no estado do Espírito Santo foi revisada no presente estudo. *Brycon opalinus*, espécie anteriormente conhecida apenas do alto rio Paraíba do Sul e bacia superior do rio Doce, é aqui pela primeira vez documentada para o rio Itapemirim, uma bacia costeira independente no sul do estado do Espírito Santo, Brasil. Com os registros de *B. opalinus*, quatro espécies de *Brycon* são conhecidas atualmente para o estado do Espírito Santo: *B. insignis* na bacia do rio Itabapoana, na divisa entre o Rio de Janeiro e o Espírito Santo, *B. opalinus* na bacia do rio Itapemirim, *B. dulcis* na bacia do rio Doce e *B. ferox* nas bacias do rio Barra Seca, rio Itaúnas e rio São Mateus. Além disso, vale ressaltar, que vários pescadores e moradores locais relatam a ocorrência de *Brycon vermelha* no rio Cotaxé, um afluente do rio São Mateus nos estados de Espírito Santo e Minas Gerais, embora não haja exemplares preservados de *B. vermelha* de outras bacias hidrográficas além da bacia do rio Mucuri, no estado de Minas Gerais.

Palavras chave: *Brycon dulcis*, *Brycon ferox*, *Brycon insignis*, *Brycon opalinus*, *Brycon vermelha*

Introduction

The Neotropical genus *Brycon* Müller & Troschel is composed of 44 valid species (Fricke *et al.* 2021; Lima 2017). The genus *Brycon* comprises medium- to large-sized fishes (reaching about 700 mm SL), distributed from southern Mexico to the rio de La Plata in Argentina, including a large radiation of species in the transandean river basins from the Maracaibo system to northern Peru, and the rivers in eastern Brazil (Lima 2003, 2017).

The recent revision of cis-Andean *Brycon* species by Lima (2017) solved most of the taxonomic problems involving species distributed along the area (with the exception of the *Brycon pesu* species complex), as well as summarized information on the ecology and conservation of each species. Based on external morphological features, species of *Brycon* are easily identified among Characiformes by a combination of unusual tooth features: three tooth rows on premaxilla, rarely four, with the inner teeth larger than remaining ones, two tooth rows on dentary, with the second tooth row consisting of diminutive, unicuspid teeth on the posterior portion of dentary, and the presence of a pair of symphyseal teeth behind the main tooth row at the jaw symphysis (Howes 1982; Lima 2003, 2017).

Currently, the genus *Brycon* is represented by eight species (Lima 2017) in the Northeastern Mata Atlântica Freshwater ecoregion (*sensu* Abell *et al.* 2008a): *Brycon insignis* Steindachner, from the rio Paraíba do Sul and small adjacent coastal river basins to the rio Itabapoana; *Brycon vermelha* Lima & Castro, endemic to the rio Mucuri and with a possible occurrence in the rio São Mateus basin; *Brycon howesi* Lima, endemic to the rio Jequitinhonha basin; *Brycon dulcis* Lima, endemic to the rio Doce basin; *Brycon ferox* Steindachner, from coastal river drainages from rio do Frades (Bahia state) to Barra Seca (Espírito Santo State); *Brycon vonoi* Lima, from the rio Pardo basin and apparently also from an adjacent river system (the rio Una); *Brycon opalinus* (Cuvier), from the headwaters tributaries from the rio Paraíba do Sul and rio Doce basins; and finally *Brycon devillei* Castelnau, considered as a *species inquirenda* and known only from its holotype, said to have been collected in Bahia state (Lima 2017). *Brycon opalinus* and *B. nattereri* Günther (from the upper rio Paraná, upper rio Tocantins and upper rio São Francisco basins) are morphologically similar, sharing a short snout, and are commonly known as pirapitinga, while the remaining species from eastern Brazil, all of which have an acute snout, are typically known as piabanha (except for *B. vermelha*, popularly known as vermelha).

Brycon species were in the past widely distributed across many river basins, but in recent decades several species have become endangered or experienced severe reductions in their distributions (Lima 2017). Seven species are reported to be threatened in Brazil (MMA 2014). Within Espírito Santo State, three of the previously four reported species for the state were considered threatened, *Brycon dulcis* is considered Critically Endangered and *B. insignis* and *B. opalinus* are considered Endangered (Fraga *et al.* 2019). The three main factors contributing to the decline of *Brycon* species are river impoundments, water pollution, and removal of the riparian vegetation (summarized by Lima 2017).

The present study aims to update the information provided by Lima (2017) on the *Brycon* species occurring in the state of Espírito Santo, providing records of species for river basins from where they were previously unknown, as well as recently collected information on their conservation in the state.

Material and methods

A survey on the material of the genus *Brycon* from the state of Espírito Santo was conducted in two ichthyological collections not examined by Lima (2017): INMA (Instituto Nacional da Mata Atlântica, formerly MBML, Santa Teresa), and CZNC (Coleção Zoológica do Norte Capixaba, Universidade Federal do Espírito Santo, São Mateus). An additional recent record of *Brycon* from the state was found at UMMZ (University of Michigan Museum of Zoology, Ann Arbor). The identification of specimens was performed based on Lima (2017). In the material examined, names of geographic entities and localities are given in the language and grammar of the Brazil. In the text, references to rivers were made in Portuguese (e.g., rio Doce). Museum lots examined for each species were arranged geographically, according to river basin (figure 1). Secondary literature (fish catalogs, checklists) which added no original information for a given species were in most cases omitted.

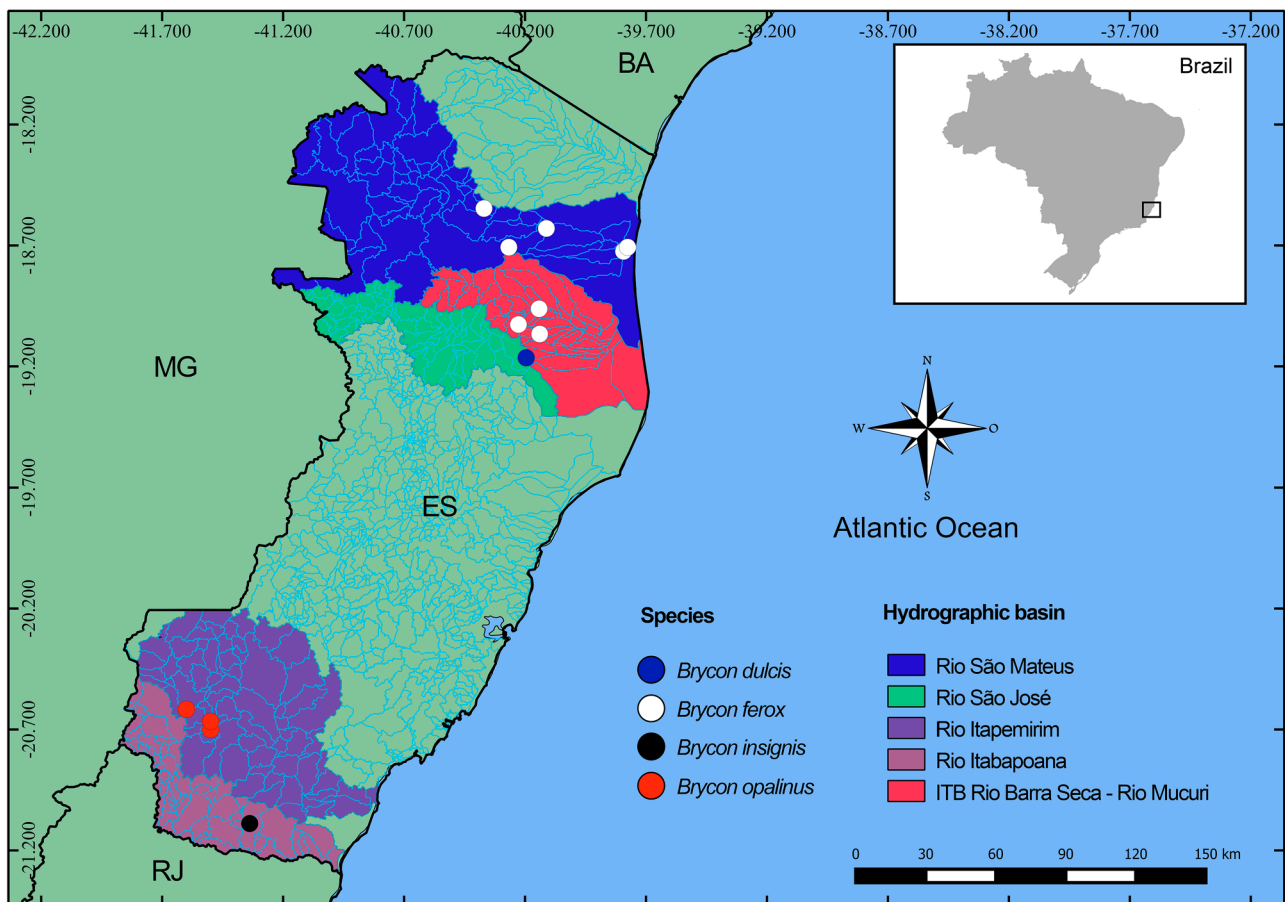


FIGURE 1. Map of Espírito Santo State with records of *Brycon* species: *Brycon dulcis* (blue dots), *Brycon ferox* (white dots), *Brycon opalinus* (red dots) and *Brycon insignis* (black dots) with the hydrographic basins where they occur highlighted.

Results

In the present study, the four *Brycon* species that have material deposited in scientific collections (*Brycon dulcis*, *Brycon ferox*, *Brycon insignis* and *Brycon opalinus*) were considered. However, it is important to present some information obtained about *Brycon vermelha*, as although there are no preserved specimens of from river basins other than the rio Mucuri itself, several fisherman and local inhabitants report its occurrence in the rio Cotaxé (a tributary of the rio São Mateus basin) in Ataléia (Minas Gerais) and from the district of Cotaxé in Ecoporanga (Espírito Santo). Two adult specimens of the species from the rio Cotaxé at the border of the states of Minas Gerais (municipality of Ataléia) and Espírito Santo (municipality of Ecoporanga) were caught in 2011, but unfortunately were not preserved (O. Cantelmo, pers. comm.). During expeditions made by LFSI and collaborators to the same region in January 2014 and August 2016 no specimens of *B. vermelha* were obtained. However, at least 10 distinct professional or amateur fishermen from the region (in different locations and dates and in both states) confirmed the presence of the piabanha-vermelha in the main channel of the rio Cotaxé, even though they are rarely encountered. Between 2012 and 2016 the authors also found videos and pictures of amateur fishermen capturing and releasing specimens of *B. vermelha* from the rio Cotaxé at Ataléia on the internet (personal blogs and YouTube channels), but such digital data was removed and are no longer available. According to fishermen reports, *B. vermelha* is found in forested margins of the main channel of the rio Cotaxé only in deep rocky pools under the shadows of large trees. At the beginning of the rainy season, the species can also be captured near the mouth of smaller tributaries of the rio Cotaxé (at the homonymous district in Ecoporanga). The interviewed fishermen were unanimous in stating that the species is a great fighter, extremely difficult and rare to be captured, and that it was fished with rod and reel using earthworms, chicken giblets or artificial baits (spinner-bait model). During the expeditions to the rio Cotaxé we used multiple types of collecting gear, including beach seines, hand nets, cast nets, and rod and reel with several

types of artificial baits, but we were unsuccessful in obtaining any specimens of *B. vermelha* (possibly because the expeditions were carried out outside the proper season for their capture). The information herein obtained about the environmental preferences for *B. vermelha* in the rio Cotaxé is very similar to those presented by Lima & Castro (2000) and Lima (2017) for specimens from the rio Mucuri basin, and it can be concluded that the occurrence of the species is linked to the presence of riparian forests.

***Brycon dulcis* Lima & Vieira 2017**

Local names. Piabanha, biririca.

Distribution and additional records. *Brycon dulcis* is recorded from the middle and lower rio Doce basin, in the Minas Gerais and Espírito Santo (Lima 2017). The species was reported specifically from Espírito Santo State only from the Lagoa Juparanã system, with the last record from the state in 1965, from which it was inferred that the species might have been extirpated from the lower portion of the rio Doce basin (Lima 2017). Somewhat surprisingly, a juvenile specimen was collected in January 2014 in the Lagoa de Juparanã (UMMZ 250042), which demonstrates that, despite the odds, *B. dulcis* still survives in the lower portion of the rio Doce basin. Recently a single *B. dulcis* specimen (MBML 13000, figure 2) was captured downstream from Cachoeira do Oito hydropower dam, in the Colatina, Espírito Santo, confirming that this species still occurs in the lower section of rio Doce in Espírito Santo. Lima (2017) also commented on a possible previous occurrence of the species in the rio Santa Maria da Vitória, based on some old lots putatively collected from this river basin. João L. Gasparini (pers. comm.) reported that old fishermen from that area mentioned the previous existence of a fish that was very likely a *Brycon* species at the rio Santa Maria da Vitória, known by them as biririca (a name still employed for *B. insignis* at the rio Itabapoana (Lima 2017). So, apparently, *Brycon dulcis* once had a distribution extending southward into the rio Santa Maria da Vitória.



FIGURE 2. *Brycon dulcis*, MBML 13000, 250,0 mm SL: Brazil, Espírito Santo, rio Doce basin.

Habitat and ecological notes. The Lagoa de Juparanã on the lower rio Doce is the largest coastal lake in Brazil (Sarmiento-Soares *et al.* 2017). Today, the Juparanã is inhabited by numerous allochthonous species, typical of lentic environments of other biomes such as the piranha *Pygocentrus nattereri* Kner and the tucunaré *Cichla kelberi* Kullander & Ferreira. The collapse of Lagoa do Juparanã, mainly caused by eutrophication and habitat destruction, changed its fauna composition (E.H. de Barros, pers. comm.), and most of the native species that previously occurred in the lake are now rare. This is the case of *Brycon dulcis*, an inhabitant of shallow waters and feeding on allochthonous resources, and its populations are possibly vulnerable to predation by the piranhas, and the juveniles, by *Cichla kelberi*.

***Brycon ferox* Steindachner, 1877**

Local name. Piabanha.

Distribution and additional records. *Brycon ferox* was reported by Lima (2017) as occurring from the rio Itaúnas in northern Espírito Santo State northward to the rio dos Frades basin in southern Bahia state, Brazil. However, the species was also recorded from the rio São Mateus in Espírito Santo (immediately southward to rio Itaúnas basin) by Sarmiento-Soares & Martins-Pinheiro (2012), Plesley *et al.* (2014) and Mazzini *et al.* (2014), a fact unfortunately omitted by Lima (2017). In addition, recent expeditions made by LFSI and collaborators to the river drainages from northern Espírito Santo (rio Itaúnas, rio São Mateus, and rio Barra Seca basins), and by LNR to the upper rio Barra Seca revealed that *B. ferox* is widely distributed in the region (figure 3). With the new information herein provided, the distribution of the species extends southward to the rio Barra Seca (Espírito Santo), which is situated immediately north of the rio Doce basin.



FIGURE 3. *Brycon ferox*, CZNC 1648, 134,12 mm SL: Brazil, Espírito Santo, rio São Mateus basin.

Habitat and ecological notes. As mentioned above, *Brycon ferox* is distributed in Espírito Santo State along the entire course of the rio Itaúnas, rio São Mateus, and rio Barra Seca basins, except in their estuarine portions. Research carried out during a whole year for ecological purposes by the LFSI team at the Reserva Biológica de Sooretama resulted in the capture of 11 *B. ferox* specimens. Of these specimens, one was captured in the rio Barra Seca (which borders the protected area and is partially preserved) and one at the Córrego do Cupido, outside of the protected area in a degraded area converted to pasture. The remaining specimens were recorded in the Córrego Rodrigues, a tributary of the rio Barra Seca, in its portion that runs within the protected area, but not along its stretch outside the Reserva Biológica de Sooretama, where there was no riparian forest left. Machado (2017) studied the diet of ten specimens of *B. ferox* collected from the rio Barra Seca basin in the Reserva Biológica de Sooretama, and found the species concentrated on ten food items, from which about 92% was represented by insects, followed by plants (4%, fragments and seeds, including seeds of Plantaginaceae and Solanaceae) and fish (3%). Additional ecological data about the species, including data on its reproduction, are necessary for a better understanding of its ecological requirements.

***Brycon insignis* Steindachner, 1877**

Local name. Piabanha

Distribution and additional records. *Brycon insignis* is recorded from the rio Paraíba do Sul basin in São Paulo, Rio de Janeiro, and Minas Gerais states, plus several smaller coastal river drainages in Rio de Janeiro State, i.e., rio Guandu, rio Macaé, rio São João, rio Imbé and lagoa Feia system, and rio Itabapoana, at the border of Rio de Janeiro and Espírito Santos states (Lima 2017). The species is herein being recorded for the first time from headwater areas of the rio Itabapoana, in southern Espírito Santo State, based on juveniles collected from the córrego Pratinha, Mimoso do Sul (MBML 8296, figure 4).



FIGURE 4. *Brycon insignis*, MBML 8296, 107,4 mm SL: Brazil, Espírito Santo, rio Itabapoana basin.

Habitat and ecological notes. *Brycon insignis* occurs mainly in large rivers with slow flow, unlike the sympatric *B. opalinus* (in the rio Paraíba do Sul basin), which favors headwater areas (Lima 2017). *Brycon insignis* is an omnivore with adult specimens ingesting animal and vegetal foods in approximately equal proportions while juveniles tend to ingest a higher proportion of animal food (Hilsdorf et al. 2008). The breeding period of *Brycon insignis* occurs during the summer (Andrade-Talmelli et al. 2001, 2002; Matsumoto et al. 2009; Tolussi et al. 2010), males becoming mature at the second (~20 cm) and females at the third year of life (~25 cm) (Hilsdorf et al. 2008). The specimens herein reported from *Brycon insignis* were captured in a tributary of the rio Muqui do Sul, a tributary of the rio Itabapoana basin. These specimens were found in a small, degraded stream with clear waters, lentic stretches alternated with rapids, about 60 to 120 centimeters of depth, two to five meters wide and a predominantly sand/clay substrate with very fine gravel. The degree of shading was low due to the surrounding area being modified into a pastureland.

***Brycon opalinus* (Cuvier, 1819)**

Local name. Pirapitinga.

Distribution and additional records. *Brycon opalinus* was previously known from the upper rio Paraíba do Sul and upper rio Doce basins in the states of São Paulo, Rio de Janeiro, and Minas Gerais, Brazil (Lima 2017). Its current geographical range is highly fragmented and restricted to some headwater tributaries of the rio Paraíba do Sul and rio Doce basins, with relatively healthy populations in some river stretches (Lima 2017). There is an old record for the species downstream from the rio Doce in Espírito Santo State, considered doubtful by Lima (2017) in view of the known preference of the species for headwater areas. *Brycon opalinus* is recorded herein for the first time from the rio Itapemirim (figure 5), a river system located in the southern portion of the Espírito Santo State. The specimens were all sampled in the upper rio Itapemirim basin, in the rio Braço Norte Direito, on a stretch limited upstream by Parque Estadual da Cachoeira da Fumaça (PECF) and downstream by Central Geradora Hidrelétrica (CGH) Francisco Gross, near the mouth of tributaries.

Habitat and ecological notes. *Brycon opalinus* is found in headwater areas, inhabiting small rivers, characterized by possessing slightly dark-stained to clear waters, and lentic stretches alternated with rapids (Lima 2017). All *B. opalinus* specimens collected in the rio Itapemirim basin were found in stretches close to rapids. The rio Braço Norte Direito near Parque Estadual da Cachoeira da Fumaça, where the species was first recorded in this basin in the years 2012 and 2013, had a maximum width of 28.6 m, a maximum depth of about 2.2 m, and the river in this stretch has a fast current with rapids. The substrate is composed mainly of sand and pebbles, with scattered rocks. Water transparency in this river varies markedly throughout the year, with relatively low turbidity and clear waters during the dry season, and turbid waters, with low transparency, during the rainy season. The catchment area of the rio Braço Norte Direito is mostly deforested, being mainly composed of pastureland, with a few more vegetated areas in an initial phase of succession.

Brycon opalinus is not known to undertake large migrations (Lima 2017). It is likely that this species uses the

rio Braço Norte Direito as a migratory corridor and spawning area (this river stretch is approximately 18 km long). This assumption is based on the fact that only juveniles were recorded within the Parque Estadual da Cachoeira da Fumaça (PECF) (Rodrigues 2013), which is situated downstream from a waterfall 144 meters high, which corresponds to a natural barrier for most of the aquatic fauna in this river. The PECF protects a preserved section of rio Braço Norte Direito, one of the main tributaries forming the rio Itapemirim. While the few recorded adult specimens were found downstream from the PECF, in the area comprised by CGH Francisco Gross.



FIGURE 5. *Brycon opalinus*, MBML 9587, 145.9 mm SL: Brazil, Espírito Santo, rio Itapemirim basin.

Discussion

Conservation and environmental threats to the species of *Brycon* from the Espírito Santo

It is known that the species of *Brycon* are very sensible to anthropogenic disturbance, such as the loss of riparian forest, water pollution and damming (Lima 2017). Some species of the genus are closely linked to the existence of riparian vegetation, even if it is not necessarily in the same well-preserved standards (Presly *et al.* 2014; Rodrigues 2013). The northern portion of Espírito Santo was heavily modified by direct and diffuse environmental impacts, such as the removal of natural forest cover, introduction of allochthonous species, mining activities, silting, obstruction and change of water bodies for the construction of dams (without government regulation or inspection) and water pollution (Presly *et al.* 2014). In the rio Doce, besides all the impacts already mentioned, the breakup of Fundão tailings dam in Mariana-MG resulted in high levels of ore throughout the course of the river, thus affecting all aquatic biota (Wanderley *et al.* 2016). The southern portion of Espírito Santo also suffers from impacts from deforestation, siltation, use of pesticides, introduction of allochthonous species, and sewage and industrial effluents disposal in rivers and streams (INCAPER 2011). In addition to these impacts, there is a great potential for construction of dams in the area due to its hilly terrain and high gradient, which changes the flows of the basins over time.

The species *Brycon ferox* occur in northern Espírito Santo, in the rio Barra Seca and rio São Mateus basins. As mentioned by Lima (2017), this species seems to be less demanding than other species of the genus in its requirements regarding size of the waterbody, river flow and presence of well-preserved riparian forests. However, most specimens of the species recorded by LFSI and his field team were collected under trees, large shrubs or other riparian vegetation, including preserved areas inside and surrounding protected areas such as the Reserva Biológica de Sooretama (rio Barra Seca basin). These observations hint at a scenario slightly distinct from the one postulated by Lima (2017), where the species is suggested to be even less strict as to its ecological requirements. However, there is little ecological data available of the species. Although *Brycon ferox* is not currently considered a threatened species, neither in the national list of endangered species in Brazil nor in the list of endangered species from Espírito Santo, apparently changes in the conservation of riparian vegetation may cause deleterious impacts to the populations of the species.

There is little information available about the populations of *Brycon opalinus* and *B. insignis* occurring in the southern portion of Espírito Santo. *Brycon opalinus* seems to be rare in the rio Itapemirim basin as few specimens have been collected. There is no effective strategy for the conservation of the ichthyofauna of the rio Itapemirim. The Parque Estadual da Cachoeira da Fumaça may be important for maintaining stocks of juveniles of species in the rio Itapemirim basin (Rodrigues 2013). The species is found in an area of less than 200 square kilometers in the rio Itapemirim basin, in the municipality of Alegre. *Brycon opalinus* is formally considered to be threatened with extinction in Brazil, and is considered Vulnerable (MMA 2014).

Brycon insignis is formally considered as threatened with extinction in Brazil and in the state of Espírito Santo, and is considered Endangered (MMA 2014; Fraga et al. 2019). *Brycon insignis* was captured in a tributary of the rio Muqui do Sul, which is part of the rio Itabapoana basin. In addition to being scarcely forested, the river courses were channelized to facilitate the flow of water. Additionally, the presence of waterfalls and rapids has made the area a target for the construction of dams. The flows of the basin have been decreasing over time as a consequence of the installation of dams and the area has experienced deforestation. The rivers of the system are silted, with increasingly shallow beds. At the same time, no sewage treatment systems are present compromising water quality (Salim 2017).

Among those responsible for the degradation of the stretches studied, hydroelectric generation reservoirs are of particular importance. These human activities generate impacts, direct or indirect, on river fish assemblages (Agostinho et al. 2007; Barretto & Uieda 1999; Daga et al. 2014; Suárez & Lima-Junior 2009). Among the diverse environmental impacts known to occur as consequence of establishment and operation of hydroelectric dams (Agostinho et al. 2007; CEMIG 2016; Fearnside 2006, 2013; Marteleto 2015), the most evident one is the change in abundance and species richness, with increase of some species and reduction or disappearance of others. Additionally, the establishment of dams in tributaries of a single hydrographic basin may alter the hydrologic dynamics, the nutrient transport and the pattern of fish species migration throughout the basin (Guerra & Carvalho 1995; Lima & Lima 1986; Pompeu & Martinez 2006). Rheophilic species, such as species of *Brycon*, are the most affected as their natural routes are interrupted and they can lose access to breeding and spawning sites. In some cases, whole spawning beds have been destroyed or disappeared (Agostinho 1992; Agostinho et al. 2007, 2008; Antonio et al. 2007; Godinho & Godinho 1994).

The first records of some species of *Brycon* are important findings in Espírito Santo State revealing that our knowledge of the fish fauna along the intensely explored and occupied Mata Atlântica rivers is still far from complete. However, the genus *Brycon* is problematic regarding conservation status of its species, with some species at risk of disappearance within the Northeastern Mata Atlântica rivers (Lima 2017). We urge additional studies of fish populations in Espírito Santo State. We hope it will be possible to adopt measures for conservation and mitigation of anthropic impacts, together with fiscal efforts and state incentive funding, such as payment for environmental services (Pagamento por Serviços Ambientais or PSA in Portuguese) towards preservation and recovery of riparian vegetation, an area considered for permanent preservation (Áreas de Preservação Permanente or APP) according to the Brazilian forest code (Brasil 2012), in order to increase the quality of the remaining stretch of the rivers. On the other hand, it is necessary that the hydroelectric projects try to minimize the impact to the fish fauna, searching for solutions and management technologies to integrate electric energy generation in association with aquatic species conservation and maintenance.

Key to the species of *Brycon* occurring in Espírito Santo State (adapted from Lima (2017)):

1. Fifth infraorbital bone wider than high; head profile distinctly pointed 2
- Fifth infraorbital bone about as wide as high; head profile either obtuse or pointed 3
2. Caudal, dorsal, and anal fins carmine-red in life, light-colored in preserved specimens *Brycon vermelha*
- Caudal, dorsal, and anal fins darkened in both living and preserved specimens *Brycon insignis*
3. Head profile distinctly pointed, including snout 4
- Head profile approximately obtuse, including snout *Brycon opalinus*
4. Mouth distinctly anisognathous, premaxillary pointed, extending beyond dentary, leaving outer, and often second, premaxillary tooth row exposed in ventral view *Brycon ferox*
- Mouth approximately isognathous, premaxillary and dentary mostly overlapping, leaving only part of outer premaxillary series exposed in ventral view in some specimens *Brycon dulcis*

Material examined. All from Brazil, Espírito Santo State. *Brycon dulcis*. UMMZ 250042 (1, 67.8 mm SL): Linhares, Lagoa de Juparanã, Patrimônio da Lagoa, 19° 9'52"S, 40°11'43"W; A. Thomaz et al., 13 Jan 2014. MBML 13000 (1,0, 250.0 mm SL): Colatina, rio Pancas, 19°28'07"S; 40°36'32"W; E. H. de Barros and L. N. Rodrigues, 21 Dec 2017. *Brycon opalinus*. MBML 9883 (161.9 mm SL): Alegre, rio Braço Norte Direito, 20°40'S, 41°30'W; E. H. de Barros, 12 Jan 2015. MBML 7538 (1 rx, 68.4 mm SL), rio Braço Norte Direito, Parque Estadual Cachoeira da Fumaça, 20°37'S; 41°36'W; G. R. Carmassi and L. N. Rodrigues, 01 Jul 2013. MBML 9587 (1 rx, 145.9 mm SL), rio Itapemirim, 20°42'S, 41°30'W; E. H. de Barros, 6 Nov 2014. MBML 12156 (1 rx, 71.4 mm SL): Alegre, rio Braço Norte Direito, 20°40'S; 41°30'W; E. H. de Barros and L. N. Rodrigues, 14 Oct 2016. *Brycon insignis*: MBML 8296 (2 rx, 91.8–107.4 mm SL): Córrego Pratinha under ES-391, Mimoso do Sul, rio Itabapoana basin, 21°05'21,4"S 41°20'17,8"W, 04 May 2014, Thais A. Volpi, Juliana P. da Silva, Lorena Tonini and Eduardo L. Muhl; *Brycon ferox*: CZNC 169 (1, 142.0 mm SL): Cachoeira do Inferno, rio Cricaré, downstream of the old dam, locality of Nestor Gomes, São Mateus, rio São Mateus basin, 18°42'27"S 40°16'01"W, 28 June 2012, L. F. S. Ingenito, L. F. Duboc, I. M. Mazzini, M. C. Sily, N. Sartor and P. Plesley; CZNC 364 (1, 67.5 mm SL): rio Cotaxé, Fazenda Biririca, locality of Santana (or Odilo Barbosa), São Mateus, rio São Mateus basin, 18°37'47"S 40°06'42"W, 17 December 2012, L. F. S. Ingenito, M. C. Sily, I. M. Mazzini, P. Plesley and A. M. Rodrigues; CZNC 393 (1, 88.2 mm SL): same locality as CZNC 364, 22 February 2013, L. F. S. Ingenito, L. F. Duboc, I. M. Mazzini, P. Plesley and M. C. Sily; CZNC 427 (1, 81.5 mm SL): same locality as CZNC 364, 20 March 2013, P. Plesley, E. Damasceno, C. B. Corrêa, I. M. Mazzini, M. C. Sily and A. M. Rodrigues; CZNC 906 (4, 83.7–97.3 mm SL): rio Preto do Sul, São Mateus, rio São Mateus basin, 18°43'28"S 39°47'34"W, 24 January 2014, L. F. S. Ingenito, P. Plesley and A. A. Oliveira; CZNC 1648 (4, 123.2–151.0 mm SL): Córrego Rodrigues, Reserva Biológica de Sooretama (REBIO), Picadão road, Sooretama, rio Barra Seca basin, 19°01'37"S 40°13'38"W, 2 May 2015, P. Plesley, M. C. Sily, D. F. Machado and C. A. Silva; CZNC 1670 (1, 11.0 mm SL): Córrego Cupido (near Reserva Biológica de Sooretama, REBIO), road to headquarters REBIO, Sooretama, rio Barra Seca basin, 19°03'59"S 40°08'22"W, 25 June 2015, M. C. Sily, P. Plesley, D. F. Machado and C. A. Silva; CZNC 1723 (1, 152.4mm SL): same locality as CZNC 1644, 14 August 2015, M. C. Sily, P. Plesley, D. F. Machado and C. A. Silva; CZNC 1785 (3, 132.9–157.1 mm SL): same locality as CZNC 1648, 17 November 2015, M. C. Sily, P. Plesley, D. F. Machado and C. A. Silva; CZNC 1873 (1, 145.5 mm SL): same locality as CZNC 1644, 19 January 2016, M. C. Sily, P. Plesley and D. F. Machado; CZNC 1898 (1, 45.4 mm SL): rio Barra Seca, Fazenda Calvin (near REBIO de Sooretama), at mouth of córrego Paraisópolis, Jaguaré, rio Barra Seca basin, 18°57'43"S 40°08'31"W, 22 February 2016, M. C. Sily, P. Plesley and D. F. Machado; CZNC 2335 (1, 186.8mm SL): rio São Mateus at the junction of the rio Cricaré and rio Cotaxé, São Mateus, rio São Mateus basin, 18°42'27"S 39°46'33"W, 16 February 2016, L. F. S. Ingenito, N. Sartor, J. Monteiro and L. Ziviani; MBML 3390 (1, 198.7 mm SL): rio do Norte, Patrimônio de Santo Antônio, Braço Norte de São Mateus, Boa Esperança, rio São Mateus basin, 18°32'50"S 40°22'11"W, 22 May 2010, S. D. Vieira.

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