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Taxonomy of *Pimelodus brevis* Marini, Nichols & La Monte, 1933 (Siluriformes: Pimelodidae), an uncertain species from the rio Paraná basin

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Pimelodus brevis Marini, Nichols & La Monte, 1933 was described from the río de la Plata, Departamento San Fernando, Argentina, based only on the holotype, which is missing since 1960s. This species has been cited in the literature and is considered valid despite of no voucher specimen has been found in museum. A taxonomic analysis comprising material from the rio Paraná basin provided additional specimens that made it possible to demonstrate the identity of *P. brevis*. Based on the original description and illustration of the holotype, we performed an allometric analysis and then we were able to compare the data with the similar sympatric congeners. Those comparisons allowed us to conclude that *P. brevis* is a junior synonym of *P. argenteus* Perugia, 1891, described from the río Paraná, Colonia Resistencia, Argentina. Comments on the status of congeners and taxonomic recommendations are provided.

Pimelodus brevis Marini, Nichols & La Monte, 1933 foi descrita do rio de la Plata, San Fernando, Argentina, com base apenas no holótipo, que está desaparecido desde a década de 1960. Esta espécie é considerada válida, a despeito da ausência de espécimes-testemunhos em coleções. Uma análise compreendendo material da bacia do rio Paraná forneceu espécimes adicionais, possibilitando reconhecer a identidade taxonômica de *P. brevis*. Com base na descrição original e na ilustração do holótipo, foi realizada uma análise alométrica e comparação dos dados com as congêneres simpátricas similares. Essas comparações permitiram concluir que *P. brevis* é sinônimo júnior de *P. argenteus* Perugia, 1891, descrita do rio Paraná, Colonia Resistencia (atual Departamento San Fernando), Argentina. Comentários sobre o status de congêneres e recomendações taxonômicas são fornecidas.

Key words: Neotropical, Catfish, Systematics, *Pimelodus argenteus*, Junior synonym.

Introduction

The pimelodid genus *Pimelodus* Lacepède is the most diverse within the family, comprising 33 valid species with a wide geographic distribution through the Neotropical region (Eschmeyer, 2014). The genus is still lacks support by unambiguous synapomorphies, thus many authors have diagnosed it based on characters primarily presented by Eigenmann & Eigenmann (1890). The taxonomic status of some species have presented problems which include its type species *Pimelodus maculatus* Lacepède, 1803, poorly described and without type specimen, besides unclear taxonomic status of some species, *e.g.*, *P. brevis* Marini, Nichols & La Monte, 1933, poorly described and lacking types.

Pimelodus brevis was described from the río de la Plata, Departamento San Fernando, Argentina and the holotype (AMNH 12240) is missing since 1960s (Lundberg & Littmann, 2003; Azpelicueta, pers. comm.). Nevertheless some authors have considered it as valid (*e.g.*, Ringuelet, 1940; Pozzi, 1945; Ringuelet *et al*., 1967; Lundberg & Littmann, 2003; Ferraris Jr., 2007; Ribeiro & Lucena, 2007; Ribeiro *et al*., 2011), in some cases, solely based on the original description and its single illustration of the holotype. A taxonomic analysis comprising material from the rio Paraná basin provided additional specimens that made it possible to demonstrate the identity of *Pimelodus brevis*.

Material and Methods

In order to compare *Pimelodus brevis* to species of *Pimelodus* from the río de la Plata basin, measurements corresponding to those in the original description were used. These are straight-line distances taken point-to-point with digital calipers on the left side of the fish whenever possible, recorded to the nearest 0.1 mm, and followed Lundberg & McDade (1986), with the modifications of Lundberg & Parisi (2002) and Rocha & Ribeiro (2010). For comparing ratios

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of original descriptions and percentages, the values were converted using the formula p=100/x, where p=ratio and x=percentage (Graça & Pavanelli, 2007) and are presented as percentages of standard (SL) or head lengths (HL).

Examined specimens are deposited at the American Museum of Natural History, New York (AMNH); Academy of Natural Sciences of Drexel University, Philadelphia (ANSP); Field Museum of Natural History, Chicago (FMNH); Instituto Nacional de Pesquisas da Amazônia, Manaus (INPA); Museu de Ciências e Tecnologia, Pontificia Universidade Católica do Rio Grande do Sul, Porto Alegre (MCP); Museo de La Plata, La Plata (MLP); Museu Paraense Emílio Goeldi, Belém (MPEG); Museo Civico di Storia Naturale "Giacomo Doria", Genova, Italy (MSNG); Museu de Zoologia da Universidade Estadual de Londrina, Londrina (MZUEL); Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP); Naturhistorisches Museum Wien, Wien (NMW); Coleção Ictiológica do Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura, Universidade Estadual de Maringá, Maringá (NUP); Rijksmuseum van Natuurlijke Historie, Leiden (RMNH); and Departamento de Zoologia, Universidade Federal do Rio Grande do Sul, Porto Alegre (UFRGS).

Results

Pimelodus brevis was described based on a single specimen from the río de la Plata, San Fernando, Argentina, collected by Dr. Tomás Marini in 1932 (Fig. 1). The specimen apparently was cataloged at the Museo Nacional in Buenos Aires, Argentina, under the number 1054a and then was hand carried to The American Museum of Natural History (USA) by Dr. Tomás Marini (Marini, 1934), who, together with J. Nichols and F. La Monte, described the new species of *Pimelodus* and cataloged the holotype - AMNH 12240 -, which is missing since 1960s (Lundberg & Littmann, 2003; M. Azpelicueta, pers. comm.).

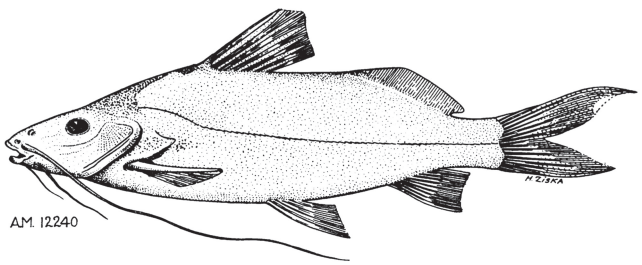

Fig. 1. *Pimelodus brevis* Marini, Nichols & La Monte, 1933, holotype, AMNH 12240, 285.0 mm SL. Modified from Marini *et al*. (1933).

After the description of *P. brevis* in 1933, Ringuelet (1940) provided the second citation for the species from the Rosario (Argentina), middle río Paraná. It is supposed that Ringuelet (1940) has examined a specimen named *P. brevis*, however Ringuelet (1940) provided neither voucher number nor the length of the fish. In the subsequent works some authors have included this location, Rosario, in the geographical range of the species, such as Pozzi (1945), who included *P. brevis* in a list of freshwater fishes from the Argentina, referring to río Paraná (Rosario) and río de la Plata (San Fernando) as its geographic distribution. Ringuelet & Arámburu (1957) and Ringuelet *et al*. (1967) reproduced such information.

Despite the absence of types, some data provided by the authors in the original description help with the identification of *P. brevis*: its color pattern without dark dots; its great standard length (285 mm); orbital diameter (6.4 times in head, 2 in snout); and body depth (28.6% SL). Marini *et al.* (1933) reported the color pattern of *P. brevis*: "Specimen in its present condition is without markings, somewhat paler below than above and with fins dark gray. A slightly pale area is indicated along the upper sides differentiating a broad dark lateral shade most obvious posteriorly." Only three species of *Pimelodus* from the rio Paraná basin have no dark dots on body: *P. albicans* (Valenciennes, 1840), type locality Buenos Aires, Argentina; *P. argenteus* Perugia, 1891, type locality río de la Plata, río Paraná, Colonia Resistencia (now Departamento San Fernando), Argentina; and *P. atrobrunneus* Vidal & Lucena, 1999, type locality, rio Ligeiro, a tributary to the rio Uruguai, Brazil, endemic from the upper rio Uruguai basin. *Pimelodus albicans* has some faint dark stripes along the side of the body.

Pimelodus brevis was described based on a single specimen of 285 mm SL. It is a large specimen since most *Pimelodus* specimens are less than 300 mm SL (MSR, pers. obs.). *Pimelodus albicans* is the largest species reaching up to 485 mm SL (holotype) (Fig. 2). No specimen of *P. argenteus* larger than 250 mm (total length) has been found in any museum, and *P. atrobrunneus* is a small species reaching about 200 mm SL, which also has a shallower body depth (15.9-23.4% of SL *vs*. 28.6% in *P. brevis*). Marini *et al.* (1933) gave the following note on *P. brevis*: "This is an unusually short-bodied species for the genus. In some respects it suggests *Pimelodus labrosus* [= *Iheringichthys labrosus*], with which it has been compared." However, it is odd that they have compared a large specimen of *P. brevis* (280 mm SL) with *I. labrosus*, that rarely exceeds 200 mm SL, has a short body depth, a distinct fully ventral mouth and a spotted body, instead of comparing it with other species so common in the rio Paraná basin, such as *P. maculatus*, *P. argenteus*, or *P. albicans*.

Fig. 2. *Arius albicans* Valenciennes, 1840 (= *Pimelodus albicans*), holotype, MNHN 9400, 485 mm SL, Buénos-Ayres [= Buenos Aires, Argentina]. Photo by Hautecoeur M.

Some measurements provided by Marini *et al.* (1933) are listed below and are useful for comparisons. Using the SL and the data given in the paper we calculated some important measurements of *P. brevis*. However, we did not find any specimen with that size to compare, so the morphometric analyzes may be influenced by allometry. We thus performed a morphometric analysis including the holotype of *P. brevis* (Fig. 1) (based on the description) and specimens of *P. albicans* (73.8-181.3 mm SL) (Fig. 2) and *P. argenteus* (137.0-204.7 mm SL) (Fig. 3). The presence of small specimens in the analysis showed a strong negative allometry of the orbital diameter related to size (SL) (Fig. 4). The orbital diameter of the holotype of *P. brevis* is contained 6.4 times in HL, whereas *P. argenteus* has larger eye (3.7-4.4 times) and *P. albicans* a very smaller eye (5.3-7.7 times in HL).

Fig. 3. *Pimelodus argenteus*, MCP 19248, 204.7 mm SL, Bella Vista, río Paraná, Corrientes, Argentina. Photo by André Canto.

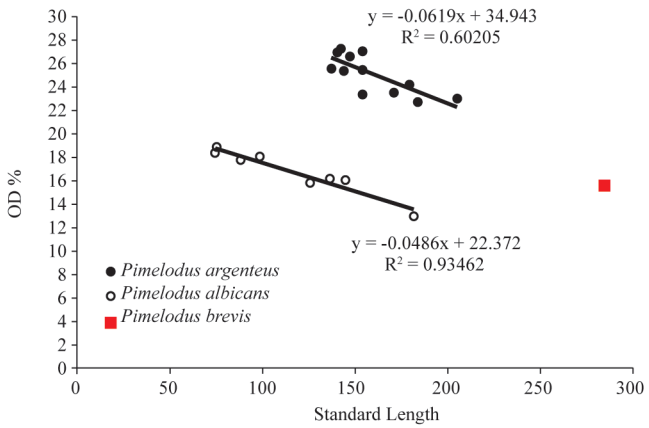

Fig. 4. Linear regression of percent of orbital diameter (OD) on standard length of *Pimelodus argenteus*, *P. albicans*, and *P. brevis*. R^2 = coefficient of determination.

Based on those data and on our sample, *P. brevis* would fit the description of *P. albicans* due to the small size of the orbit (15.6% of HL *vs.* 13.0-18.9%). However, the difference of the standard length of both species is very high, since the largest *P. albicans* analyzed here is 181.3 mm SL. Based on the Fig. 4, which show the allometry, we may conclude that specimens of *P. albicans* larger than 181.3 mm SL would have an even smaller orbit diameter. The holotype of *P. albicans* in the MNHN has about 485 mm SL and its orbit diameter is 12.2 times in head length (8.2%) (Fig. 2).

On the other hand, examined specimens of *P. argenteus* (the largest with 204.7 mm SL) (Fig. 3) showed larger eye (22.7-27.3% of HL) than *P. brevis* (15.6% of HL). The Fig. 4 shows that *P. argenteus* and *P. albicans* have negative allometry for that character, and also that the orbital diameters of these two species do not develop at the same rate relative to size or body length. Using the linear equation to estimate the orbit diameter for *P. argenteus* and *P. albicans* we have y= 17.3 and y= 8.5, respectively. This result means that a specimen of *P. argenteus* and *P. albicans* with 285 mm SL would have an orbital diameter of 17.3% and 8.5% of HL, respectively. The estimated orbital diameter for *P. argenteus* (17.3% of HL) is almost the same of the holotype of *P. brevis* (15.6% of HL) for the same SL (285 mm), whereas for *P. albicans* the eye becomes much smaller (8.5% of HL). This result for *P. albicans* is corroborated by the holotype, which has about 485 mm SL, with an orbital diameter of 8.2% of HL.

As stated by Marini *et al.* (1933), *P. brevis* is an unusually short-bodied species. We could calculate its body depth as 28.6% of SL (*vs*. 20.5-21.3% of SL in *P. albicans* and 23.4-29.6 in *P. argenteus*). As noted in the Fig. 5, the body depth of these species clearly has its proportions altered with the growth, and then the body depth becomes higher in *P. argenteus* whereas in larger specimens of *P. albicans* that percent is shorter. The body depth of the holotype of *P. albicans* is 20.8% of SL, however based on its current preservation we may have caution in using some measurements related to body. On the other hand, as the head is very ossified and bones bound the orbital diameter, we assume that those measurements related to head are safer.

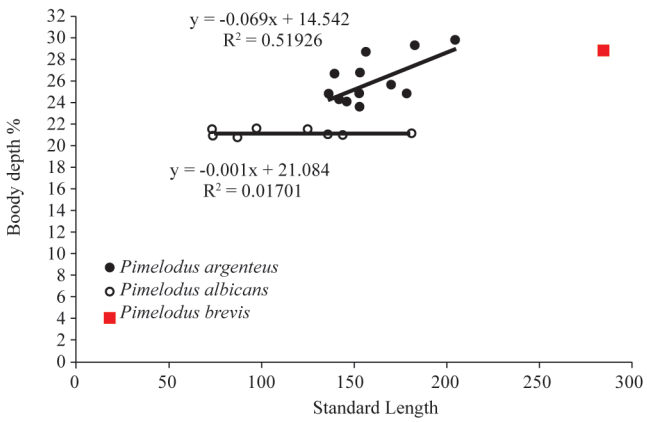

Fig. 5. Linear regression of percent of body depth on standard length of *Pimelodus argenteus*, *P. albicans*, and *P. brevis*. R^2 = coefficient of determination.

The interorbital and supraoccipital processes of *P. brevis* are strongly convex, as stated by Marini *et al.* (1933). We can see a tightly convex interorbital and supraoccipital processes in *P. argenteus* (Fig. 3), whereas *P. albicans* has a flat head, notably in larger specimens (Fig. 2). Another feature provided by those authors is related to the adipose

fin. As *P. brevis* is a short-bodied species, the adipose fin is close to the dorsal fin and this can be observed in specimens of *P. argenteus* (Fig. 3) whereas in *P. albicans* the adipose fin is more distant from the dorsal fin.

Based on the original description with illustration provided by the authors, and the data given here we conclude that *Pimelodus brevis* Marini, Nichols & La Monte, 1933 is a junior synonym of *P. argenteus* Perugia, 1891 (Fig. 6).

Fig. 6. *Pimelodus argenteus*, syntype, MSNG 14570, 165 mm SL, río de la Plata, río Paraná, Colonia Resistencia [Departamento San Fernando], Argentina. Photo by Mark Allen.

The geographic distribution of *Pimelodus argenteus* includes the lower río Paraná and rio Paraguay basins, although it seems to be not common in the río de la Plata (M.S.R. pers. obs. and D. Nadalin pers. comm.) (Fig. 7).

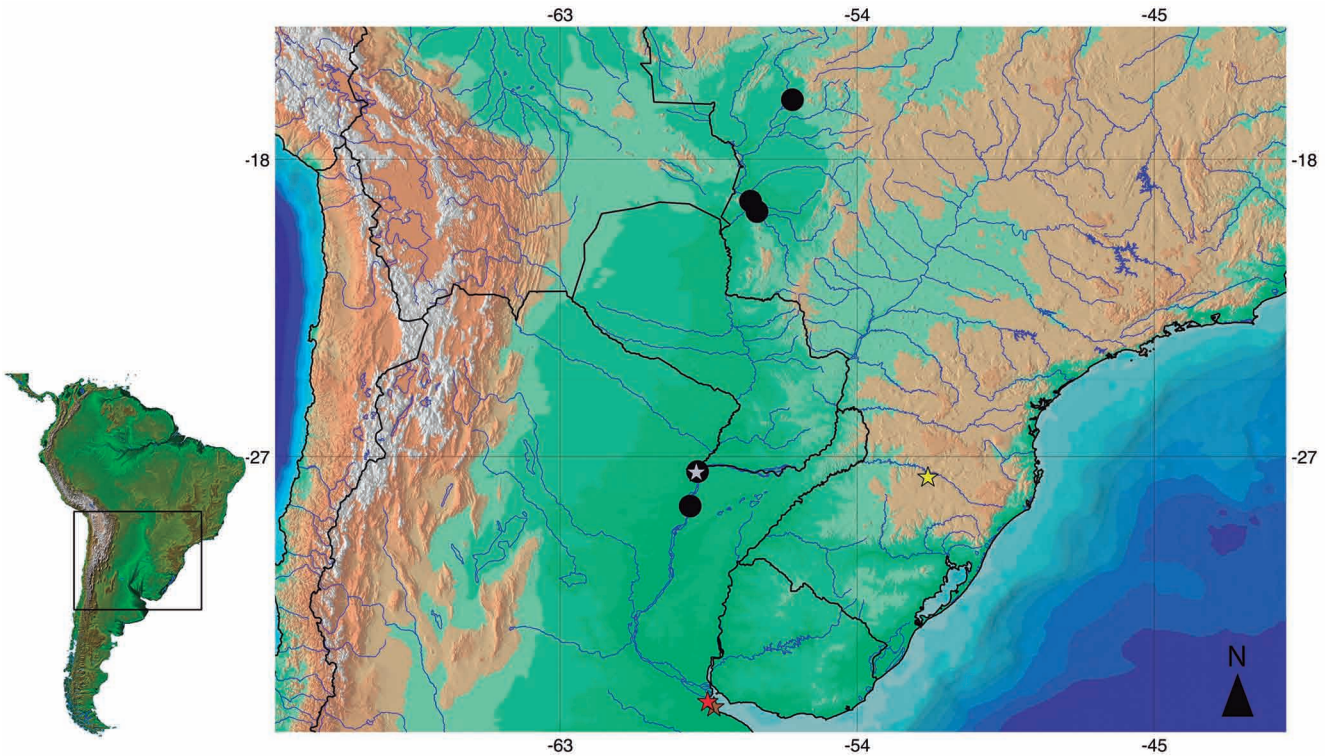

Fig. 7. Partial map of South America with the geographic distribution of *Pimelodus argenteus* (black dots) and the type localities of *P. albicans* (brown star); *P. atrobrunneus* (yellow star); *P. argenteus* (gray star), and *P. brevis* (red star).

Discussion

Some works have reported *P. brevis* as valid and even with a wide distribution (*e.g.*, Ringuelet, 1940; Ringuelet *et al*., 1967; López *et al*., 2003). The first two provided both description and short diagnosis, translated from the original description, and no list of specimens analyzed. The last listed *P. brevis* as valid species and included the río Durazno, widening its geographical distribution range, but also without giving numbers of voucher specimens.

As evidenced by the holotypes of *P. albicans* and *P. brevis* [herein a junior synonym of *P. argenteus*], large-size pimelodids perhaps had been captured frequently in the last century, but nowadays large catfishes in the rio Paraná basin are uncommon, specially those species that knowingly reached large sizes in the past, such as *Pseudoplatystoma* Bleeker and *Zungaro* Bleeker species.

Stewart (1986), reviewing *Pimelodina* Steindachner, also concluded that *P. flavipinnis* Steindachner, 1876 (holotype 288 mm SL), is the senior synonym of *P. nasus* Eigenmann & Eigenmann, 1888 (holotype 333 mm SL). Stewart (1986) noted that differences between the two species given by Eigenmann & Eigenmann (1890) were due to allometries caused by different sizes of the holotypes. The orbital diameter had negative allometry relative to standard length and then the holotype of *P. nasus* had relatively smaller orbital diameter than the holotype of *P. flavipinnis*. Therefore all diagnostic features related to the size of the eye, such as head length and interorbital space divided by orbital diameter could be explained by the negative allometry of the eye (Stewart, 1986).

A description based on a single large specimen probably has been the cause of such problematical taxonomic status, since *P. argenteus* and *P. albicans* are clearly different but, without known large specimens currently available, those variations consequence of difference in size were being used as diagnostic characters. Furthermore, the lack of the holotype had a major role in the status of the species for more than 50 years.

We conclude that *P. brevis* is a junior synonym of *P. argenteus*, even without examination of the holotype that is missing, by estimating allometries and considering variations in ontogenetic development of congeners. In cases of missing type-material, we recommend this practice, whenever possible, in order to elucidate similar taxonomic problems, common with species described in the late ninth and early twentieth centuries. Also to avoid such problems from happening even nowadays, we reiterate the recommendation that type-series includes several specimens, with different sizes and sexes, as well as depositing type-material in different institutions.

Material examined. *Pimelodus albicans*: **Argentina:** ANSP 178802, 2 dry skeletons, unmeasured, Buenos Aires Province, río La Plata (Atlantic dr.) near La Plata, town of Ensenada fishing pier. ANSP 187383, 1, 144.4 mm SL, Corrientes, río Corrientes (tributary to the río Paraná) at Esquina. MLP 5871, 1, 98.1 mm SL, Buenos Aires, Ensenada, Punta Lara. MLP 6833, 1, 181.3 mm SL, Santa Fe, Rosario. MLP 8681, 3, 73.8-87.7 mm SL, Santiago del Estero, Desague en la rampa de la presa de río Hondo. MNHN 9400, 485 mm SL, Buenos Aires, holotype of *Pimelodus albicans* Valenciennes, 1840. MLP uncat, 2, 125.3-136.4 mm SL, río Corrientes. *Pimelodus argenteus*: **Argentina:** MCP 19248, 3 of 4, 143.4-204.7 mm SL, Corrientes, Bella Vista, río Paraná. MSNG 14570, 2, syntypes of *Pimelodus argenteus*, río de la Plata, río Paraná (Colonia Resistencia). **Brazil:** Mato Grosso State: NUP 613, 20, unmeasured, Barão de Melgaço, Lagoa da Fazenda Mimoso**.** Mato Grosso do Sul State: MZUEL 3403, 9, unmeasured, Corumbá, rio Paraguai, Porto da Manga, pesqueiro do Rubens. MZUEL 3404, 11, unmeasured, Bonito, rio Miranda. MZUEL 3498, 9, 137-178.9 mm SL, Corumbá, rio Paraguai, Porto da Manga, pesqueiro do Rubens. MZUEL 3609, 6, unmeasured, Corumbá, rio Miranda, Passo do Lontra. Paraná State: NUP 6334, 1, unmeasured, Diamante do Norte, Rosana Reservoir (rio Paranapanema). *Pimelodus atrobrunneus*: Brazil: Rio Grande do Sul State: MCP 18912, 1 c&s, 104.9 mm SL, rio Uruguai in município de Marcelino Ramos. MCP 19678, 1, 129.8 mm SL, holotype of *Pimelodus atrobrunneus* Vidal & Lucena, 1999, rio Ligeiro, rio Uruguai basin. UFRGS 10123, 1, 152.9 mm SL, rio Marmeleiro, rio Uruguai basin. UFRGS 11841, 1, 113.4 mm SL, Quevedos, rio Toropi, rio Ibicuí basin, Toropi - Guassupi Small Hydropower Plants. UFRGS 11842, 1, 129.1 mm SL, São Martinho da Serra, rio Toropi, rio Ibicuí área, Toropi - Guassupi Small Hydropower Plants. Santa Catarina State: MCP 20402, 1, 121 mm SL, rio Uruguai.

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