Neotropical Ichthyology

Original article

https://doi.org/10.1590/1982-0224-2022-0097

urn:lsid:zoobank.org:pub:E61E0188-6E5B-481E-99D5-59BA5B4E6F79

New species of *Farlowella* (Siluriformes: Loricariidae) from the rio Tapajós basin, Pará, Brazil

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A new species of stick-catfish *Farlowella* is described from streams of the lower rio Tapajós drainage, in Pará State, northern Brazil. The new species is distinguished from all congeners by a naked gular region (*vs*. gular region with plates) and from most congeners by the presence of five lateral series of plate rows on anterior region of body (*vs*. four). The new species shows variation in the series of abdominal plates and a discussion on the variation of abdominal plates within *Farlowella* is made and comments on synapomorphic characters in Farlowellini.

Keywords: Amazon, Armored catfish, Biodiversity, Loricariinae, Taxonomy.

Uma nova espécie de cascudo-graveto *Farlowella* é descrita de pequenos igarapés do baixo rio Tapajós, no Estado do Pará, norte do Brasil. A nova espécie é distinta de todas as suas congêneres por uma região gular nua (*vs*. região gular com placas) e de muitas congêneres pela presença de cinco fileiras de placas laterais na região anterior do corpo (*vs*. quatro). A nova espécie apresenta variação na série de placas abdominais e é feita uma discussão sobre a variação das placas abdominais dentro de *Farlowella* e comentários sobre caracteres sinapomórficos em Farlowellini.

Palavras-chave: Amazônia, Biodiversidade, Cascudo, Loricariinae, Taxonomia.

Submitted October 18, 2022
Accepted March 7, 2023
by Paulo Lucinda
Epub April 28, 2023

Online version ISSN 1982-0224
Print version ISSN 1679-6225

Neotrop. Ichthyol.
vol. 21, no. 1, Maringá 2023

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INTRODUCTION

The genus *Farlowella* Eigenmann & Eigenmann, 1889 is a component of the freshwater fish fauna of the Neotropics. With 32 valid species, *Farlowella* is the second-most species-rich genus of Loricariinae, a sub-family comprised of 262 valid species in 31 genera (Delgadillo *et al*., 2021; Londoño-Burbano, Reis, 2021; Fricke *et al*., 2023). *Farlowella* representatives are widely distributed in the main cis-Andean South America river drainages and trans-Andean Maracaibo and Magdalena river basins (Terán *et al*., 2019). They are easily distinguished by having a pronounced rostrum, a thin, elongated, brown body with two longitudinal bands that extend from the tip of the rostrum to the caudal peduncle (Covain, Fisch-Muller, 2007), resembling dry twigs or sticks, which justifies the popular name stick catfishes.

The first taxonomic study was the description of the genus *Acestra* by Kner (1853), with the first species described: *Acestra acus* and *A. oxyrryncha*, but without designating the type species of the genus, until *A. acus* was determined by Bleeker (1862). However, *Acestra* was already occupied in Hemiptera (Dallas, 1852) and the name *Farlowella* was then replaced by Eigenmann, Eigenmann (1889). From the end of the 19th century, several species were described, totaling 37 names that remained for almost a century, when Retzer, Page (1996) revised the genus based on characters of external morphology. This was the last revision of its species, as well as the first exclusive hypothesis of the phylogenetic relationships of the genus. In that study, the authors performed a phylogenetic analysis with morphological data including only one external group, *Aposturisoma myriodon* Isbrücker, Britski, Nijssen & Ortega, 1983 (= *Farlowella myriodon*), that was used to root the tree; the monophyly of the genus, and species relationships were not actually tested. The authors also proposed six species groups and six species were considered as *incertae sedis*.

Recently, Londoño-Burbano, Reis (2021), based on combined molecular and morphological phylogenetic analysis, formally recognized *Aposturisoma myriodon* as a member of *Farlowella* to assign the monophyly of the genus. Although *A. myriodon* is phenotypically different from *Farlowella*, this configuration had already been recovered by Covain *et al.* (2016). Based on the review of *Farlowella* material deposited in different collections and on the examination of material collected in the river near the confluence with rio Tapajós, in its lower portion, we identified a new species of *Farlowella*, which is described herein.

MATERIAL AND METHODS

Measurements were taken point to point with digital calipers. Measurements are expressed as percents of the standard length (SL), except subunits of head, which are expressed as percents of the head length (HL). Measurements follow Boeseman (1971), except measurement of distance from pectoral-fin origin to pelvic-fin origin that follow Retzer, Page (1996), plus minimum width of snout (minimum width at the tip of snout) (Fig. 1A), distance between cleithral processes (between the humeral processes of the cleithrum) (Fig. 1B) and maximum width of snout (maximum width in transverse line from the posterior edge of the ventral plate before mouth) (Fig. 1C). Counts and nomenclature of lateral plate series follow Ballen *et al*. (2016a).

Osteological nomenclature follows Paixão, Toledo-Piza (2009), except for parieto-supraoccipital instead of supraoccipital (Arratia, Gayet, 1995), pterotic-extraescapular instead of pterotic-supracleithrum (Slobodian, Pastana, 2018). Vertebral counts include only free centra, with the compound caudal centrum (preural 1+ ural 1) counted as a single element. Cleared and stained (cs) specimens were prepared according to the methods of Taylor, Van Dyke (1985). Numbers in parentheses following meristic counts correspond to number of specimens having that count, and those indicated by an asterisk (*) belong to the holotype. Map was generated in the QGIS 3.14.16 program. Institutional abbreviations follow Sabaj (2022). The estimated Extent of Occurrence (EOO) and Area of Occupation (AOO) of the species was calculated using the web portal of the Geospatial Conservation Assessment Tool (GeoCAT: http://geocat.kew.org/) and the categories and criteria of conservation status of species followed IUCN (IUCN Standards and Petitions Committee, 2022).

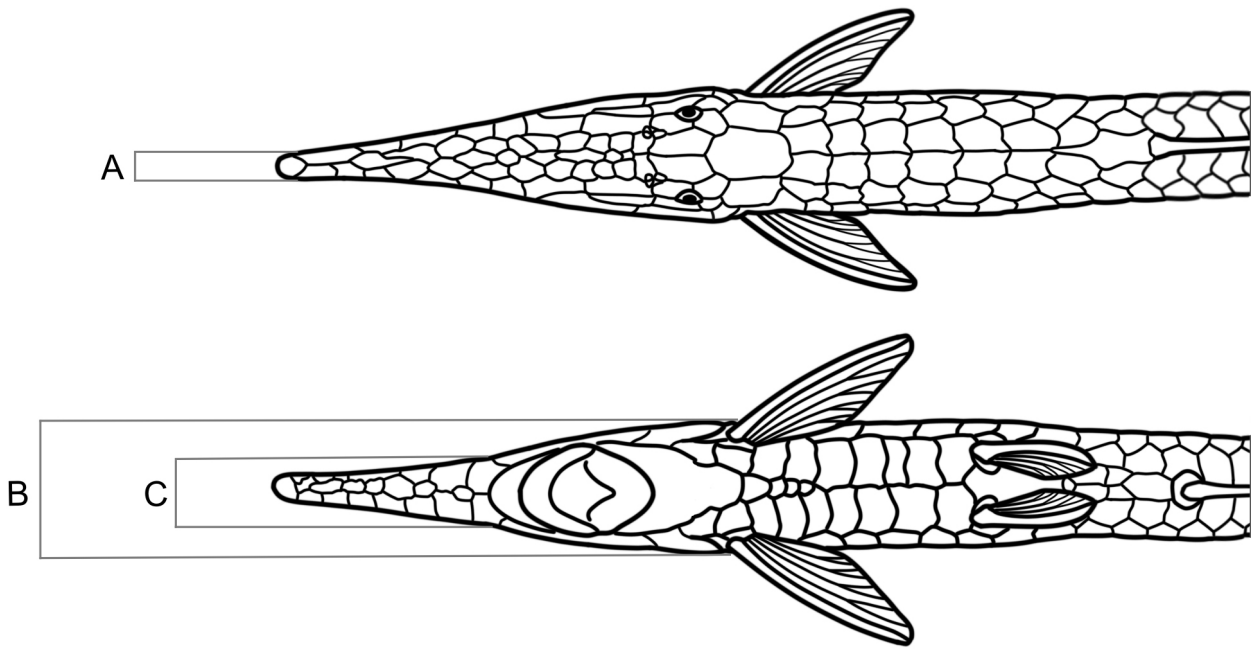

FIGURE 1 | Additional measures used in this study. **A.** Minimum width of snout; **B.** Distance between cleithral processes; and **C.** Maximum width of snout.

RESULTS

Farlowella wuyjugu, new species

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(Figs. 2–3; Tab. 1)

Holotype. MPEG 26178, 143.4 mm SL, Brazil, Pará State, Juruti municipality, lower rio Tapajós, rio Amazon basin, igarapé Rio Branco, 02°20'58.6"S 56°01'26.4"W, 27 Nov 2012, M. B. Mendonça.

Paratypes. All from Brazil, Pará State, Juruti municipality, rio Arapiuns basin, lower rio Tapajós, rio Amazon basin. INPA 59894, 2, 124.8–128.9 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'44.5"S 56°11'37.3"W, 8 Sep 2002, W. B. Wosiacki. MNRJ 53691, 2, 127.3–130.9 mm SL, same locality as INPA 59894. MPEG 10062, 5, 112.0–121.6 mm SL, same locality as INPA 59894, 3 Mar 2006, L. F. A. Montag. MPEG 12865, 5, 90.9–123.2 mm SL, same locality as INPA 59894, 11 Dec 2006, L. F. A. Montag & A. Hercos. MPEG 15900, 12, 2 cs, 97.6–136.5 mm SL, same locality as INPA 59894, 8 Sep 2002, W. B. Wosiacki. MPEG 10857, 5, 111.7–128.2 mm SL, igarapé São Francisco, 02°34'52"S 55°54'10.8"W, 19 Aug 2006, A. Hercos. MPEG 32191, 4, 94.3–133.9 mm SL, same locality as MPEG 10857, 14 Sep 2014, M. B. Mendonça. MPEG 12684, 5, 1 cs, 122.8–144.7 mm SL, igarapé São Francisco, 02°34'50.7"S 55°50'13.8"W, 14 Dec 2006, L. F. A. Montag.

Non-types. All from Brazil, Pará State, Juruti municipality, rio Arapiuns basin, lower rio Tapajós, rio Amazon basin. MPEG 10055, 4, 102.9–124.3 mm SL, MPEG 10062, 13, 70.0–109.7 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'44.5"S 56°11'37.3"W, 3 Mar 2006, L. F. A. Montag. MPEG 10851, 1, 119.2 mm SL, MPEG 10852, 3, 79.5–116.1 mm SL, MPEG 10853, 1, 121.9 mm SL, igarapé São Francisco, 02°34'50.7"S 55°54'13.8"W, 19 Aug 2006, A. Hercos. MPEG 10855, 4, 46.7–88.7 mm SL, MPEG 10856, 7, 54.2–108.4 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'44.5"S 56°11'35.5"W, 17 Aug 2006, A. Hercos. MPEG 10857, 11, 65.1–145.8 mm SL, MPEG 10858, 2, 106.2–112.8 mm SL, MPEG 10859, 4, 64.4–128.3 mm SL, MPEG 10861, 1, 113.7 mm SL, igarapé São Francisco, 02°34'50.7"S 55°54'13.8"W, 19 Aug 2006, A. Hercos. MPEG 10860, 1, 128.6 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'44.5"S 56°11'35.5"W, 17 Aug 2006, A. Hercos. MPEG 10862, 3, 49.6–54.6 mm SL, igarapé São Francisco, 02°34'50.7"S 55°54'13.8"W, 19 Aug 2006, A. Hercos. MPEG 10956, 1, 26.2 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of rio Branco, 02°36'44.5"S 56°11'35.5"W, 17 Aug 2006, A. Hercos. MPEG 12491, 4, 18.6–45.8 mm SL, igarapé Mutum, 02°36'44.8"S 56°11'37.3"W, 9 Sep 2002, W. B. Wosiacki. MPEG 12865, 4, 69.8–93.4 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'44.5"S 56°11'37.3"W, 11 Dec 2006, L. F. A. Montag & A. Hercos. MPEG 13040, 2, 35.7–38.4 mm SL, MPEG 13043, 2, 20.6–30 mm SL, MPEG 13050, 2, 11.0–118.4 mm SL, igarapé São Francisco, 02°34'50.7"S 55°54'13.8"W, 19 Aug 2006, L. F. A.

Montag. MPEG 13041, 1, 56.3 mm SL, MPEG 13044, 5, 56.8–93.2 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'44.5"S 56°11'35.5"W, 12 Dec 2006, L. F. A. Montag. MPEG 13042, 3, 48.1–45.5 mm SL, igarapé São Francisco, 02°34'50.7"S 55°54'13.8"W, 14 Dec 2006, L. F. A. Montag. MPEG 13045, 1, 92.7 mm SL, igarapé São Francisco, 02°34'50.7"S 55°54'13.8"W, 14 Dec 2006, L. F. A. Montag. MPEG 13046, 1, 101.7 mm SL, igarapé São Francisco, 02°34'50.7"S 55°54'13.8"W, 15 Dec 2006, L. F. A. Montag. MPEG 13048, 5, 50.2–80.8 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'44.5"S 56°11'35.5"W, 11 Dec 2006, L. F. A. Montag. MPEG 13731, 2, 63.9–69.4 mm SL, MPEG 14143, 7, 61.9–136.5 mm SL, igarapé São Francisco, 02°34'50.7"S 55°54'13.8"W, 15 May 2007, A. Hercos. MPEG 14271, 1, 42.8 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'44.5"S 56°11'35.5"W, 27 Nov 2007, A. Hercos. MPEG 14711, 13, 46.2–126.3 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'44.5"S 56°11'35.5"W, 11 May 2007, A. Hercos. MPEG 15900, 8, 56.6–95.8 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'44.5"S 56°11'37.3"W, 8 Sep 2002, W. B. Wosiacki. MPEG 16955, 1, 120.7 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'33.2"S 56°11'33.4"W, 19 Feb 2008, W. B. Wosiacki. MPEG 26172, 13, 71.8–129.8 mm SL, MPEG 26173, 4, 61.5–94.5 mm SL, MPEG 26333, 1, 86.4 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'45.8"S 56°11'36.8"W, 28 Nov 2012, M. B. Mendonça. MPEG 26179,19, 43.5–156.4 mm SL, igarapé Rio Branco, 02°20'58.6"S 56°01'26.4"W, 27 Nov 2012, M. B. Mendonça. MPEG 29996, 2, 112.7–117.4 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'45.8"S 56°11'36.8"W, 6 Dec 2013, M. B. Mendonça. MPEG 26997, 9, 100.5–129.9 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'45.8"S 56°11'36.8"W, 7 Dec 2013, M. B. Mendonça. MPEG 26998, 1, 88.9 mm SL, igarapé São Francisco, 02°34'52"S 55°54'10.8"W, 11 Dec 2013, M. B. Mendonça. MPEG 26999, 5, 51.9–138.1 mm SL, igarapé Rio Branco, 02°20'58.6"S 56°01'26.4"W, 12 Dec 2012, M. B. Mendonça. MPEG 32191, 4, 93.7–136.6 mm SL, MPEG 32192, 2, 55.6–115.1 mm SL, igarapé São Francisco, 02°34'52"S 55°54'10.8"W, 19 Sep 2014, M. B. Mendonça. MPEG 32193, 15, 32.9–124.2 mm SL, MPEG 32194, 14, 61.4–127.3 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'45.8"S 56°11'36.8"W, 22 Sep 2014, M. B. Mendonça. MPEG 32195, 1, 135.1 mm SL, igarapé Rio Branco, 02°20'58.6"S 56°01'26.4"W, 18 Sep 2014, M. B. Mendonça. MPEG 32507, 72.4–113.1 mm S, MPEG 32508, 11, 49.0–116.5 mm SL, igarapé Mutum, affluent of rio Aruã, tributary of Rio Branco, 02°36'45.8"S 56°11'36.8"W, 20 Mar 2015, M. B. Mendonça.

Diagnosis. *Farlowella wuyjugu* can be diagnosed from its congeners by lack of plates in gular region (*vs.* gular plates present) (Fig. 3). The new species can be distinguished from its congeners, except *Farlowella altocorpus* Retzer, 2006, *F. azpelicuetae* Terán, Ballen, Alonso, Aguilera & Mirande, 2019, *F. gianetii* Ballen, Pastana & Peixoto, 2016, *F. gracilis* Regan, 1904, *F. guarani* Delgadillo, Maldonado & Carvajal-Vallejos, 2021, *F. hasemani* Eigenmann & Vance, 1917, *F. isbrueckeri* Retzer & Page, 1997, *F. jauruensis* Eigenmann & Vance, 1917, *F. myriodon*, *F. nattereri* Steindachner, 1910, and *F. odontotumulus* Retzer & Page, 1997, by having five lateral series of plate rows on anterior region of body (*vs.* four). Additionally, *F. wuyjugu* differs from *F. altocorpus* and *F. azpelicuatae* by having a

smaller body width at dorsal origin (4.3–5.5 *vs.* 6.4–8.1% SL); from *F. gianetti* by number of caudal-fin rays (i,11,i or i,12,i *vs.* i,10,i); from *F. gracilis* by having head triangular in dorsal view (*vs.* head square); from *F. guarani* by interorbital width (12.0–16.0 *vs.* 28.6–44% HL) and eye diameter (3.6–5.8 *vs.* 6.6–13.3% HL); from *F. hasemani* by all fin rays uniformly pigmented (*vs.* fin rays not pigmented); from *F. isbruckeri* and *F. odontotumulus* by having the ventromedian row of anterior plates keeled (*vs.* ventromedian row of anterior plates unkeeled); from *F. jauruensis* by having five branched pelvic-fin rays (*vs.* four branched pelvic-fin rays); from *F. myriodon* by having dark brown lateral stripe on each side of snout (*vs.* absence of such stripe, snout completely dark); and from *F. nattereri* by having a short pectoral fin, not reaching the pelvic-fin base (*vs.* long pectoral fin, reaching the pelvic-fin base).

Description. Dorsal, lateral, and ventral views of holotype in Fig. 2. Morphometric and meristic data for holotype and paratypes summarized in Tab. 1. Body slender and very elongated, completely covered by dermal plates, except in gular portion. Head triangular and elongate in dorsal and ventral views. Rostrum slender and flat in ventral view. Orbit circular, dorsolaterally placed, visible in dorsal view and not visible in ventral view. Preorbital ridge present. Mouth ventral. Dorsal profile of head concave from snout tip to anterior margin of nares, relatively straight to convex from point to posterior margin of nares to posterior margin of parieto-supraoccipital and slightly concave to dorsal-fin origin. Posterior profile of margin of dorsal-fin origin slightly concave and straight profile to end of caudal peduncle. Ventral profile slightly straight from tip of snout to anal-fin origin, slightly concave in anal-fin base and straight profile to end of caudal peduncle.

FIGURE 2 | Dorsal, lateral and ventral view of *Farlowella wuyjugu*, holotype, 143.4 mm SL, MPEG 26178, Brazil, Pará State, Juruti municipality, igarapé Rio Branco, lower rio Tapajós, rio Amazon basin.

TABLE 1 | Morphometrics of *Farlowella wuyjugu*, new species. Values as percents of standard length (SL) and head length (HL) for holotype and 38 paratypes. n = number of specimens, SD = Standard deviation.

	Holotype	n	Range	Mean	SD
Standard length (mm)	143.4	38	90.9–144.7	119.7	–
Percents of standard length					
Head length	24.8	38	23.2–28.5	26.4	1.3
Body depth at dorsal-fin origin	3.5	38	3.1–4.4	4.0	0.3
Body width at dorsal-fin origin	4.5	38	4.3–5.5	4.9	0.3
Body width at anal-fin origin	4.4	38	4.4–5.7	4.9	0.3
Predorsal length	43.5	38	42.0–46.7	44.4	1.0
Postdorsal length	51.1	38	50.4–54.3	52.3	1.0
Postanal length	49.4	38	49.4–53.8	51.7	1.1
Prepelvic length	35.0	38	34.2–38.0	36.4	1.0
Distance from parieto-supraoccipital to dorsal fin	18.2	38	16.6–19.3	17.9	0.6
Caudal peduncle depth	1.5	38	0.8–1.6	1.3	0.2
Dorsal fin length	12.2	38	12.1–14.1	13.0	0.5
Pectoral fin length	9.4	38	8.6–10.7	9.4	0.5
Pelvic fin length	5.5	38	5.0–6.3	5.8	0.3
Anal fin length	11.5	38	11.1–13.6	12.1	0.5
Distance from pectoral fin origin to pelvic fin origin	10.9	38	10.9–13.3	12.3	0.5
Distance between cleithral processes	4.5	38	4.5–6.5	5.6	0.4
Percents of head length					
Head width	24.4	38	19.6–27.7	23.6	1.7
Head depth	16.8	38	14.6–27.3	16.8	2.0
Snout-mouth length	44.2	38	31.1–47.1	39.4	3.9
Minimum width of snout	4.7	38	3.2–5.9	4.2	0.6
Maximum width of snout	13.6	38	9.9–38.3	13.0	4.3
Snout length	85.5	38	77.4–95.5	82.1	2.9
Eye diameter	5.8	38	3.6–5.8	4.5	0.5
Interorbital width	14.1	38	12.0–16.0	13.6	0.9
Postorbital head length	19.2	38	14.4–22.6	19.6	1.8
Internarial distance	5.3	38	4.1–5.7	4.9	0.4

Mouth ovoid, lower lip longer than upper lip; wide oval papillae on upper lip and round papillae on lower lip, decreasing in size from oral aperture to lip margin; lip margin papillose. Bicuspid slender teeth, each premaxilla with 22(2), 23*(1), 29(1), 31(1), 33(1), 36(1), 37(3), 39(1), 40(2), 41(1), 42(3), 43(2), 44(1), 46(3), 47(4), 48(4), 49(4), 51(2), 53(1) or 55(1) teeth and each dentary with 18*(3), 22(1), 23(1), 26(2), 28(1), 29(2), 30(2), 32(3), 33(3), 34(1), 35(4), 36(3), 37(1), 38(4), 39(2), 40(2), 41(1), 42(1) or 43(2) teeth; premaxilla larger than dentary. Two maxillary barbels small and projecting slightly from mouth margin.

Five lateral plate rows on body, with 31(6), 32*(30) or 33(3) dorsal plates; 6(1), 7*(5), 8(23) or 9(10) dorsomedian plates; 7(1), 8*(5), 9(20) or 10(13) median plates; 14*(7), 15(27) or 16(5) ventromedian plates; 35(3), 36(7), 37*(15), 38(9), 39(3) or 40(2) ventral plates; 5(14), 6*(18), 7(6) or 8(1) dorsomedian+median plates; 18(12), 19(20) or 20*(7) coalescent plates; 8*(39) predorsal plates; 23(6), 24*(30) or 25(3) postdorsal plates; 20(2), 21(14), 22*(21), 23(1) or 24(1) postanal plates; 2 plates at the base of caudal fin and one preanal plate. Abdomen covered with two lateral rows with 6(6), 7*(19), 8(11), 9(2), 11(1) lateral abdominal plates (left) and 6(10), 7*(14), 8(8) or 9(7) lateral abdominal plates (right), and one midabdominal incomplete (23)* row or when complete (16) row with 2(1), 3(2), 4*(2), 5(1), 6(5), 7(7), 8(7), 9(3), 10(3), 11(2), 12(3), 13(2) or 16(1) midabdominal plates.

Lateral line complete; reaching up to last caudal peduncle coalesced plate. Preopercular canal passing through infraorbital six with two pores. Terminal exit of parietal branch in frontal bone curved. Canal-bearing cheek plate in ventral position. Nasal slightly curved in anterior portion with pore opening laterally.

Pectoral-fin rays i,6*(39); posterior margin slightly concave; unbranched ray longest. Dorsal-fin rays i,6*(39); posterior margin straight to slightly concave; three* or four plates along its base; unbranched ray longest. Pelvic-fin rays i,5*(39); posterior margin straight; unbranched ray longest. Anal-fin rays i,5*(39); posterior margin straight to slightly concave; unbranched ray longest; three* or four plates along its base. Caudal-fin rays i,11,i(2) or i,12,i*(37); posterior margin deeply concave; dorsal and ventral lobes similar in size; filaments on upper and lower unbranched rays. All fin rays with odontodes; more developed odontodes on unbranched first ray.

Mesethmoid long; lateral expansion of anterior portion absent; mesethmoid ventral posterior process present. Nasal rectangular irregular bone curved laterally. Frontal wide, occluded from dorsal border of orbit. Orbit anteriorly delimited by dermal plate, dorsally by frontal bone, dorsolaterally by sphenotic, and ventrally by infraorbital series. Sphenotic quadrate in shape, contacting frontal bone anterolaterally, parieto-supraoccipital dorsally, infraorbital six ventrally, and pterotic-extrascapular posteriorly. Pterotic-extrascapular with large perforations. Parieto-supraoccipital wide and oval, contacting first predorsal plate posteriorly. Anterior contact of hyomandibula with metapterygoid and quadrate, and ventral with preopercle. Symphyseal cartilage between quadrate and hyomandibula. Anterior margin of quadrate articulation with anguloarticular. Dentary almost twice the size of anguloarticular. Autopalatine irregular, rod-like shape. Anterior margin of autopalatine articulation with maxilla and posterior contact posteriorly with vomer and metapterygoid. Preopercle long and partially exposed; anterior process reaching at least half of quadrate length. Suspensorium rectangular in overall shape. Three branchiostegal rays. Hypohyal anterior border

straight, without anterior projection. Urohyal triangular and posterior margin rounded, with medial foramen. Anterohyal and posterohyal partially separated by cartilage. Anterior margin of anterohyal greatly expanded. Basibranchial 2, 3 and 4 present; basibranchial 2 and 3 elongated; basibranchial 2 equal to basibranchial 3; basibranchial 2 and 3 ossified and basibranchial 4 cartilaginous. Two hypobranchials; hypobranchial 1 ossified and hypobranchial 2 cartilaginous. Four epibranchials with similar size. Five ceratobranchials; ceratobranchial 1 with accessory flange; ceratobranchial 5 triangular; ceratobranchial teeth restricted to mesial area of plate. Upper pharyngeal plate club-shaped, completely covered with fine teeth. Vertebral count 39(1) and 40(1); five thin pleural ribs directly attached to centra 8, 9, 10, 11 and 12(1) and four thin pleural ribs directly attached to centra 9, 10, 11 and 12(1); parapophysis of complex vertebra well developed (two specimens).

FIGURE 3 | Gular region and variation of abdominal plates in specimens, ventral view of *Farlowella wuyjugu*. **A.** MPEG 26178, 143.4 mm SL; **B.** INPA 59894, 128.9 mm SL; **C.** MPEG 12684, 125 mm SL.

Coloration in alcohol. Ground color of dorsum and head pale or dark brown. Light brown color with diffuse and scattered dark brown spots on predorsal portion, from tip of parieto-supraoccipital and extending to all plates. Five to six rounded spots between the second and third infraorbital, extending to opercle. One dark brown lateral stripe on each side, that runs from snout to caudal peduncle. Ventral portion of head brown; yellow between lower lip and anterior portion of anal fin. Dorsal profile in posterior portion of anal fin light brown with diffuse and scattered dark brown spots along the plates, same to dorsal portion, more delimited in some individuals. Upper lip with scattered chromatophores. Pectoral, dorsal, pelvic, and anal fin rays with hyaline membranes and pigmented brown rays, sometimes forming dark bands. First rays markedly dark. Caudal fin almost completely dark brown, membranes and rays pigmented, in some individuals with area of hyaline membrane (Fig. 4).

Geographical distribution. *Farlowella wuyjugu* is known only from small, forest creeks near Juruti, Pará State, tributaries of rio Arapiuns, rio Tapajós in its lower portion, rio Amazon basin, Brazil (Fig. 5).

Etymology. The specific epithet refers to the combination of the words *Wuy jugu*, which is the self-denomination of indigenous people known in Brazil as Munduruku. This ethnic group is part of the Tupi trunk and they are located in different regions and territories in the states of Pará, Amazonas, and Mato Grosso. In the region of the lower Tapajós River, in recent years some communities in the process of their ethnic identity have recognized themselves as Munduruku (Ramos, 2022). A noun in appositon.

FIGURE 4 | Caudal fin coloration of *Farlowella wuyjugu*. MPEG 31191, 119.9 mm SL.

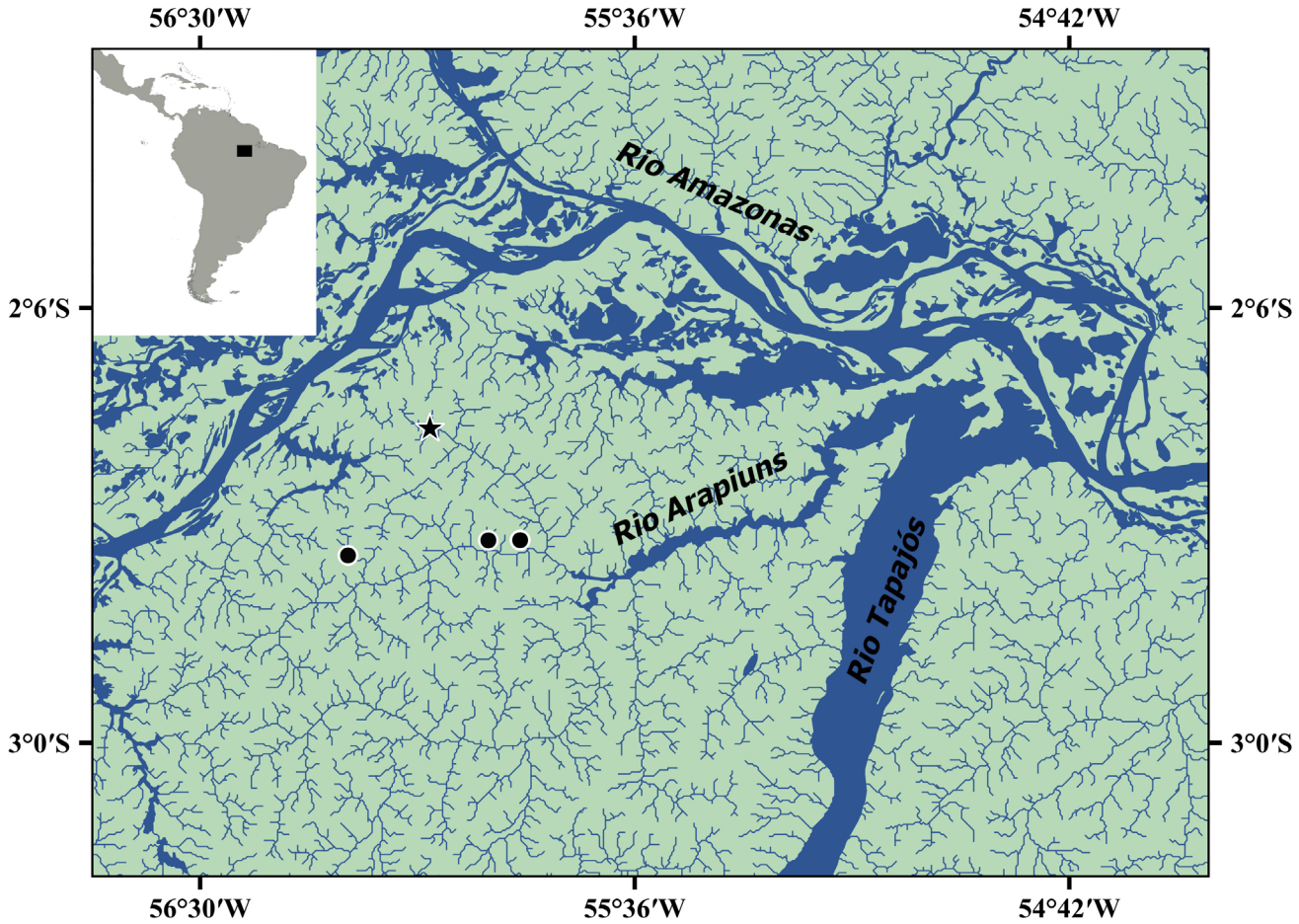

FIGURE 5 | Geographic distribution of *Farlowella wuyjugu* in lower rio Tapajós. Star = holotype; circles = paratypes localities.

Conservation status. *Farlowella wuyjugu* is known from four collection stations [igarapé Rio Branco (Fig. 6), igarapé Mutum, and igarapé São Francisco] in Juruti municipality, Pará State, Brazil. Using the GeoCAT we calculate the extent of occurrence (EOO) of the species in 4,921 km^2, suggesting a threatened category of Endangered (EN). *Farlowella wuyjugu* is sampled in few localities in the Juruti municipality, impacted by a large bauxite extraction project, deteriorating their habitats. Following the recommendations by the IUCN (IUCN Standards and Petitions Committee, 2022), *F. wuyjugu* should be categorized as Nearly Threatened (NT), following criterions B2:EN (EOO < 5,000 km^2), b(iii) (decline of quality of habitat by bauxite extraction).

Variation of abdominal plates within *Farlowella wuyjugu*. Abdominal plates are usually termed as lateral abdominal plates, which are transversely elongated plates between the pectoral-fin axilla and the pelvic-fin insertion, and midabdominal plates, which cover the abdomen between the lateral ones (Londoño-Burbano, Reis, 2021). The midabdominal plates, in *Farlowella*, can be absent or present and when present can be incomplete or complete. Ballen *et al*. (2016b) described *Falowella mitoupibo* Ballen, Urbano-Bonilla & Zamudio, 2016 and proposed as diagnostic for the species an incomplete median disjunct row of abdominal plates, divided at the center by plates

belonging to the lateral rows of abdominal plates (*vs.* two or three complete rows of abdominal plates or an incomplete median row of one or two plates anteriorly that never reach to the level of the prepelvic plate). Although the authors proposed this character as a diagnosis for the species, in recent examinations of the type material of *F. mitoupibo*, it was possible to observe two completes rows of abdominal plates in one specimen (M. Dopazo, pers. obs.). *Farlowella wuyjugu* have midabdominal plates and can be an incomplete or complete midabdominal series (Fig. 3). An incomplete midabdominal series can be a disjunct row as described for *F. mitoupibo* or an incomplete median row of plates anteriorly that do not reach to the level of the prepelvic plate (Figs. 3A, B). Retzer, Page (1996) proposed the number of rows of abdominal plates as a diagnostic character to differentiate species group of *Farlowella*: two rows (*F. acus* (Kner, 1853) group and *F. amazonum* Günther, 1864 group) and three rows (*F. curtirostra* Myers, 1942 group, *F. mariaelene* Martín Salazar, 1964 group, *F. nattereri* group, *F. knerii* (Steindachner, 1882) group and unassigned species group). Although Retzer, Page (1996) proposed the number of rows of abdominal plates as a diagnostic character to differentiate species groups of *Farlowella*, both states were found in *F. wuyjugu* and *F. mitoupibo*, rendering that character not be useful to differentiate groups because they are variable within *Farlowella* species. A phylogenetic analysis of the genus (including the species described here) is being carried out and aims to test if these characters (proposed by Retzer, Page, 1996) are in fact phylogenetically informative.

FIGURE 6 | Igarapé Rio Branco, type-locality of *Farlowella wuyjugu*.

DISCUSSION

Londoño-Burbano, Reis (2021) recovered the tribe Farlowellini Fowler, 1958 including five genera, *Lamontichthys* Miranda Ribeiro, 1939, *Pterosturisoma* Isbrücker & Nijssen, 1978, *Sturisoma* Swainson, 1838, *Sturisomatichthys* Isbrücker & Nijssen, 1979 and *Farlowella* Eigenmann & Eigenmann, 1889. The authors defined two exclusive synapomorphies for the tribe: (1) nuchal plate articulated to lateral plates (char 175) and (2) the presence of gular plates (char 179). According to Londoño-Burbano, Reis (2021), gular plates are large, polygonal dermal plates covering the ventral surface of the head behind the lower lip. Character 175 was observed in *F. wuyjugu*, however, character 179 is not applicable to the new species because of the lack of gular plates. Almost twenty years after the publication of the study by Retzer, Page (1996). *Farlowella* was proposed as a monophyletic group by Londoño-Burbano, Reis (2021) with 11 morphological and 38 molecular synapomorphies. Of the eleven morphological synapomorphies, four were considered exclusive for the genus: (1) number of branchiostegal rays fewer than four (char 109); (2) straight and upright lamina on neural spine on the sixth vertebra for articulation with ventral surface of parieto-supraoccipital (char 114); (3) absence of pleural rib associated to the seventh vertebra (char 117); (4) short anteriormost paraneural spines (char 129). These character states were all observed in *F. wuyjugu* supporting the species as a member of the genus. Despite the high number of morphological characters and the number of terminals used in the analysis by the authors, there are many high homoplastic characters and not useful for a diagnosis at the species level.

Other *Farlowella* species are also identified for the rio Tapajós basin (*F.* gr. *amazonum*, *F.* cf. *oxyrryncha*, *F. schreitmuelleri* Arnold, 1936, and *F.* sp.; M. Dopazo, pers. obs.). Species with type locality in or near the region are *F. amazonum* (Santarém, Pará State), *F. gladiolus* Günther, 1864 (rio Cupari, rio Tapajós basin, Amazon River drainage, Pará State), and *F. schreitmuelleri* (lower Amazon River basin, Santarém, Pará State), but they differ from *F. wuyjugu* mainly by the number of lateral series of plate rows on anterior region of body (four *vs.* five). *Farlowella amazonum* and *F. gladiolus* were described in the same work by Günther (1864). In the review of the genus by Retzer, Page (1996), *F. gladiolus* was placed in the synonymy with *F. amazonum*, however, Covain *et al.* (2016) recognized the former as a valid species. There are several taxonomic issues regarding the validity of *Farlowella* species and their delimitation. These questions are being addressed in an ongoing taxonomic review (by MD and MRB) of the genus. Our description of *F. wuyjugu* contributes to the knowledge of the rio Arapiuns and to the understanding of the ichthyofauna of the rio Tapajós basin.

Comparative material examined. *Farlowella acus*: **Colombia**: MPUJ 2834, 1, 183.6 mm SL; MPUJ 2842, 1, 133.3 mm SL; MPUJ 2955, 1, 50.1 mm SL: MPUJ 7320,1 124.1 mm SL; MPUJ 9287, 1, 122.5 mm SL; MPUJ 10915, 1, 116.9 mm SL; MPUJ 11158, 1, 130.4 mm SL; MPUJ 13270, 1, 38.6 mm SL: MPUJ 16876, 1, 76 mm SL; **Venezuela**: ANSP 130038, 20, 90.6–149.7 mm SL; MZUSP 147, 2, 108.4–123.8 mm SL; *Farlowella* cf. *altocorpus*: **Brazil**: INPA 3034, 49, 64.2–155.6 mm SL; INPA 3035, 16, 58–148.6 mm SL; *Farlowella amazonum*: **Brazil**: LIA 7233, 1, 84.7 mm SL; LIA 7235, 64.8–198.5 mm SL; LIA 7236, 4, 69.2–92,5 mm SL; LBP 4344, 1, 82.9 mm SL; LBP 10860, 3, 111.0–144.7 mm SL; LBP 11118, 1, 132.2 mm SL; LBP 12117, 5, 47.4–147.2 mm SL; LBP 15179, 1, 82.9 mm SL; LBP 17994, 3, 70.7–121.81 mm SL; LBP 20432, 1, 110.1 mm SL; LBP 20964, 2, 67.5–113.1 mm SL; LBP 21208, 4, 69.5–121.7 mm SL; LBP 21230, 1, 142.1 mm

SL; LBP 22348, 13, 54.9–203.6 mm SL; LBP 22488, 1, 169.2 mm SL; MCP 44240, 6, 163.8–190.7 mm SL; MCP 50059, 83.6–176.4 mm SL; MNRJ 762, 3, 130.1–161.2 mm SL; MNRJ 35534, 15, 79.9–166.1 mm SL, 3 cs; MNRJ 35535, 3, 176.3–161.3 mm SL; MNRJ 35536, 2, 76.3–176.8 mm SL; MNRJ 35537, 2, 99.7–179.9 mm SL; MNRJ 39040, 8, 52.1–73.7 mm SL; MNRJ 39249, 1, 66.6 mm SL; MNRJ 39270, 6, 34.4–66.8 mm SL; MPEG 3072, 2, 71,7–146.2 mm SL; MPEG 9008, 4, 147–182.3 mm SL; MPEG 13290, 5, 157.9–180.3 mm SL; MPEG 17077, 1, 50.8 mm SL; MPEG 19827, 1, 182.2 mm SL; MPEG 19945, 1, 123.8 mm SL; MPEG 23942, 2, 139–175.4 mm SL; MPEG 23726, 2, 166.4–172.5 mm SL; MPEG 24470, 1, 129.2 mm SL; MPEG 24471, 2, 166.3–74 mm SL; MPEG 30598, 5, 118.3–151.1 mm SL; MPEG 30931, 1, 104.2 mm SL; MPEG 30936, 1, 109.7 mm SL; MZUSP 23416, 5, 35.9–139.2 mm SL; MZUSP 27717, 1, 115.8 mm SL; MZUSP 121244, 1, 207.0 mm SL; UFRGS 21710, 1, 80.5 mm SL; **Peru**: ANSP 191818, 2, 172.7–179.6 mm SL; ANSP 199910, 1, 146.1 mm SL; *Farlowella azpelicuetae*: **Argentina**: MZUSP 123935, paratype, 80.8 mm SL; MZUSP 123936, 2, paratypes, 79.8–165.9 mm SL; *Farlowella gianetti*: **Brazil**: MZUSP 95564, holotype, 114.4 mm SL; MZUSP 97022, paratypes, 94.1–118.6 mm SL; *Farlowella* cf. *hahni*: **Brazil**: MZUEL 9037, 5, 56.6–131 mm SL; MZUEL 9669, 1, 47.2 mm SL; NUP 374, 6, 78.1–161.7 mm SL; NUP 818, 5, 127.6–140 mm SL; NUP 819, 10, 89.3–156.2 mm SL; NUP 1450, 1, 111.7 mm SL; NUP 1496, 5, 95.7–177.8 mm SL; NUP 2849, 1, 128.4 mm SL; NUP 4029, 2, 151.1–162.2 mm SL; NUP 4525, 1, 130.7 mm SL; NUP 4728, 5, 129.4–148 mm SL; NUP 7867, 2, 134.7–140.3 mm SL; NUP 11443, 1, 109.5 mm SL; NUP 13303, 2, 103.2–129.7 mm SL; NUP 14747, 1, 125.6 mm SL; NUP 16978, 2, 133.8–149.8 mm SL; *Farlowella hasemani*: **Brazil**: INPA 3912, 190.8 mm SL; *Farlowella henriquei*: **Brazil**: INPA 3012, 2, 68.8–111 mm SL; INPA 3030, 1, 170.3 mm SL; INPA 3911, 147.9–153.1 mm SL; INPA 3913, 1, 180.7; INPA 34545, 3, 83.6–160.5 mm SL; MZUSP 2159, holotype, 165.7 mm SL; *Farlowella isbruckeri*: **Brazil**: MZUSP 27704, paratype, 134.8 mm SL; *Farlowella jauruensis*: **Brazil:** MZUSP 59457, 2, 58.3–57.3 mm SL; MZUSP 58485, 1, 77.2 mm SL; MZUSP 115560, 1, 81.4 mm SL; *Farlowella knerii*: **Ecuador**: ANSP 130435, 2, 21.4–73.3 mm SL; ANSP 130436, 1, 123.3 mm SL; *Farlowella latisoma*: **Brazil**: MNRJ 761, holotype, 179.3 mm SL, synonymy of *Farlowella schreitmuelleri*; *Farlowella mariaelenae*: **Venezuela**: ROM 94123, 2, 67.2–81.8 mm SL; *Farlowella mitoupibo*: **Colombia**: MPUJ 8481, holotype, 203.7 mm SL; MPUJ 8479, 1, paratype, 112.6 mm SL; MPUJ 8480, paratype, 5, 65.7–170 mm SL; MPUJ 8482, paratype, 109.4 mm SL; MPUJ 8483, paratype, 1, 163.1 mm SL; MPUJ 8484, paratype, 1, 112.5 mm SL; *Farlowella myriodon*: **Peru:** MZUSP 15328, holotype, 154 mm SL; MZUSP 15332, paratype, 134.2 mm SL; MZUSP 15342, paratype, 92.6 mm SL; *Farlowella nattereri*: **Brazil**: LBP 10568, 3, 80.7–92.4 mm SL; LBP 18192, 6, 47.5–117.5 mm SL; LBP 18526, 1, 189.9 mm SL; LBP 18580, 3, 102.9–164.5 mm SL; LBP 26628, 7, 185.0–208.6 mm SL; MNRJ 3732, 2, 166.9–168.2 mm SL; MNRJ 37080, 1, 135.7 mm SL; UFRO–ICT 6731, 2, 96.4–104.6 mm SL; UFRGS 26186, 1, 147.7 mm SL; **Colombia**: ROM 107219, 3, 90.3–213 mm SL; **Peru**: LBP 22594, 1, 132.3 mm SL; ROM 64063, 6, 42.9–129.8 mm SL; *Farlowella* aff. *nattereri:* **Brazil**: INPA 1637, 1, 117.8 mm SL; INPA 1963, 2, 78.7–146.1 mm SL; INPA 2017, 1, 87.5 mm SL; INPA 2808, 1, 171.8 mm SL; INPA 3916, 1, 95 mm SL; INPA 4839, 1, 184.5 mm SL; INPA 12945, 1, 162.5 mm SL; INPA 16763, 1, 52 mm SL; INPA 43891, 1, 199.1 mm SL; Guyana: INPA 58225, 2, 135.6–52.7 mm SL; ROM 97162, 1, 112.3 mm SL; *Farlowella oliveirae* Miranda Ribeiro, 1939: MNRJ 757, holotype, 111.8 mm SL, synonymy of *Farlowella amazonum*; *Farlowella* aff. *oxyrryncha*: **Brazil**: INPA 12940, 6, 61–155.2 mm SL; INPA 12941, 1, 60.5 mm SL; INPA 29869, 5, 29.9–105.1 mm SL; INPA 31038, 1, 100.3 mm SL; MZUEL 6713, 1, 103 mm SL; *Farlowella* cf. *oxyrryncha*: **Brazil**: INPA 1645,1, 86.4 mm SL; INPA 8159, 3, 61.9–151.6 mm SL; INPA 10371, 21, 72.33–188 mm SL; INPA 12964, 1, 56.3 mm SL; INPA 14001, 1, 159.2; INPA 20796, 1, 134.4 mm SL; INPA 27505, 21, 23.9–129.3 mm SL; INPA 37694, 1, 75 mm SL; INPA 53229, 1, 199.8 mm SL; INPA 54977, 1, 110 mm SL; INPA 58662, 1, 170.5 mm SL; MCP 32735, 1, 83 mm SL; MCP 36623, 7, 51.6–112.7 mm SL; MCP 46138, 1, 103 mm SL; MPEG 13083, 3, 116.4–127 mm SL; MPEG 28662, 5, 73.7–178.5 mm SL; MPEG 30901, 1, 103.7 mm SL; UFRGS 12165, 4, 105,5–97.7 mm SL; UFRGS 12325, 5, 49.8–133.6 mm SL; UFRGS 21842, 1, 100.3 mm SL; MNRJ 23380, 1, 115.4 mm SL; MZUSP 22919, 6,

47.7–101.8 mm SL; MZUSP 96753, 8, 55.9–101 mm SL; MZUSP 125342, 10, 69.2–195 mm SL; *Farlowella paraguayensis* Retzer & Page, 1997: **Brazil**: INPA 567, 5, 72.3–122.1 mm SL; INPA 2829, 4, 65.1–135 mm SL; INPA 2830, 6, 70.5–153.2; INPA 3919, 12, 56.5–88.7 mm SL; INPA 12999, 4, 59.8–110.7 mm SL; MNRJ 760, 1, 162.0 mm SL; MNRJ 46680, 2, 117.8–118.3 mm SL; MZUSP 47243, 8, paratypes, 122.5–134.4 mm SL; NUP 15010, 8, 51.7–95.8 mm SL; NUP 21531, 5, 56.3–101 mm SL; ZUFMS 1292, 2, 134.6–143.3 mm SL; ZUFMS 1426, 3, 112.9–122.3 mm SL; ZUFMS 4373, 3, 113.7–128.4 mm SL; ZUFMS 5950, 4, 74.2–122.9 mm SL; *Farlowella pleurotaenia* Miranda Ribeiro, 1939: **Brazil**: MNRJ 758, holotype, 99.6 mm SL, synonymy of *Farlowella amazonum*; *Farlowella rugosa* Boeseman, 1971: **Brazil**: IEPA 3886, 1, 187.2 mm SL; IEPA 3916, 1, 113.6 mm SL; **Guyana**: ROM 64797, 1, 143.5 mm SL; ROM 85790, 3, 73.9–87.4 mm SL; ROM 85916, 1, 73.7 mm SL; ROM 85922, 2, 81.9–143.1 mm SL; ROM 86116, 2, 63.5–65 mm SL; **Suriname**: ROM 98122, 1, 90.64 mm SL; *Farlowella schreitmuelleri*: **Brazil**: IEPA 2708, 1, 59 mm SL; IEPA 4644, 1, 66.9 mm SL; IEPA 4708, 1, 63.1 mm SL, IEPA 4724, 2, 80.1–121.8 mm SL; IEPA 4727, 6, 63.3–120.6 mm SL; INPA 3917, 1, 82.8 mm SL; INPA 3918, 1, 76.2 mm SL; INPA 6777, 9, 63.1–104.7 mm SL; INPA 6978, 3, 67.6–111.3 mm SL; INPA 7069, 1, 76 mm SL; INPA 8209, 1, 75.8 mm SL; INPA 24914, 11, 78.8–125.4 mm SL; INPA 29109, 2, 55.3–66.5 mm SL; INPA 44877, 5, 66.2–111 mm SL; INPA 44493, 1, 110.1 mm SL; INPA 44662, 1, 71.4 mm SL; INPA 45127, 2, 99.4–113.3 mm SL; INPA 45891, 13, 59.5–115.4 mm SL; INPA 46005, 1, 98.6 mm SL; INPA 46027, 1, 119.7 mm SL; MZUSP 101583, 2, 91.6–132 mm SL; MZUSP 101828, 1, 93.1 mm SL; UNT 488, 3, 106.5–140.7 mm SL; UNT 488, 3, 106.5–140.7 mm SL; *Farlowella smithi* Fowler, 1913: **Brazil**: UFRGS 25175, 3, 60.9–71.8 mm SL; UFRO–ICT 507, 3, 64.8–89.9 mm SL; UFRO–ICT 24122, 3, 70.3–88.9 mm SL; MZUSP 73593, 14, 56.9–85.8 mm SL; *Farlowella vittata* Myers, 1942: **Colombia**: LBP 18722, 2, 51.9–130.6 mm SL; MPUJ 8349, 8, 37.4–124.4 mm SL; MPUJ 8353, 2, 54.3–75.1 mm SL; MPUJ 8357, 7, 78.9–128.3 mm SL; **Venezuela**: LBP 2307, 1, 87.4 mm SL; LBP 9950, 2, 51.6–123.4 mm SL; ROM 88294, 6, 90.4–77.5 mm SL; ROM 94407, 3, 62–136.3 mm SL.

ACKNOWLEDGMENTS

We are grateful to Mariangeles Arce and Mark Sabaj (ANSP); Cecile Gama (IEPA); Lucia Rapp Py-Daniel, Renildo Oliveira and Vitoria Pereira (INPA); Claudio Oliveira (LBP); Isaac Cabral and Leandro Sousa (LIA); Carlos Lucena (MCP); Alberto Akama and Angelo Dourado (MPEG); Alejandra Rodríguez, Tiago Carvalho and Saul Prada (MPUJ); Alessio Datovo, Guilherme Dutra, Mario de Pinna and Michel Gianeti (MZUSP); Carla Pavanelli and Marli Campos (NUPELIA); Marg Zur and Nathan Lujan (ROM); Fernando Jerep and José Birindelli (UEL); Juliana Wingert and Luiz Malabarba (UFRGS); Aline Andriolo and Carolina Doria (UFRO); Carine Chamon, Everton Oliveira and Paulo Lucinda (UNT); Francisco Severo Neto and Thomaz Sinani (ZUFMS) for loan material and assistance during visits of the first author to collections under their care. Alejandro Londoño-Burbano (MNRJ) for comments and discussion about the Loricariinae and generous contributions to this manuscript. Roberto Reis (MCP), Jonathan Armbruster (AUM) and an anonymous reviewer provided useful comments that helped improve the manuscript. Lucas Garcia (MNRJ) for the drawing of Fig. 1. Igor Souto-Santos (MNRJ) for helping with photos for Figs. 2, 3 and 4. Guilherme Dutra (MZUSP) for the photograph of the type locality. MD is supported from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES/PROEX 88887.335793/2019–00). MRB and WBW are supported by grants from the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, processes #311294/2021–9 and #307988/2021–0).

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AUTHORS' CONTRIBUTION

Manuela Dopazo: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Validation, Writing-original draft.

Wolmar B. Wosiacki: Data curation, Formal analysis, Validation, Writing-review and editing.

Marcelo R. Britto: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Validation, Writing-review and editing.

ETHICAL STATEMENT

Not applicable.

COMPETING INTERESTS

The author declares no competing interests.

HOW TO CITE THIS ARTICLE

- **Dopazo M, Wosiacki WB, Britto MR.** New species of *Farlowella* (Siluriformes: Loricariidae) from the rio Tapajós basin, Pará, Brazil. Neotrop Ichthyol. 2023; 21(1):e220097. https://doi.org/10.1590/1982-0224-2022-0097

Neotropical Ichthyology

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