EDITORIAL

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A new species of *Farlowella* Eigenmann and Eigenmann (Siluriformes: Loricariidae) from the Parapetí and Grande rivers in the Bolivian Andes

Una nueva especie de *Farlowella* Eigenmann & Eigenmann (Siluriformes: Loricariidae) de los Rios Grande y Parapeti en los Andes bolivianos

SCIENTIFIC ARTICLE
ARTÍCULO ORIGINAL

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ABSTRACT

A new species of *Farlowella* (Siluriformes: Loricariidae: Loricariinae: Farlowellini) from the Parapetí River (Iténez basin) and Grande River (Mamoré basin), in the Bolivian Amazon Basin, is described. *Farlowella guarani* sp. n. belongs to the *nattereri* species-group defined by Retzer & Page (1996), and has been identified and differs from its congeners by having short snout-mouth length (< 50% of head length), snout-mouth length 30.5 – 73.5 % of pectoral fin length in adults, fourth row of anterior lateral plates keeled, pectoral fin length > 100 % of pectoral fin origin to pelvic fin origin length, possession of 22 – 27 abdominal plates, 22 – 31 upper and 20 – 28 lower jaws teeth, presence of dark dots on head and dorsal portion forming longitudinal fragmented stripes. This is the first record of *Farlowella* in the Parapetí River and represents the record at highest elevation (> 900 m) of the genus in South America. *F. guarani* is the second species recently described for the Bolivian Amazon, after *F. altocorpus*, and both are tentatively restricted to Andean portions of the Madera River watershed.

Palabras clave: Stick catfish, Bolivian Amazon, Iténez River basin, Mamoré River basin, Systematics.

RESUMEN

Se describe una nueva especie de *Farlowella* (Siluriformes: Loricariidae: Loricariinae: Farlowellini) del Río Parapetí (cuenca Iténez) y Río Grande (sistema Mamoré), en la Cuenca del Amazonas en Bolivia. *Farlowella guarani* sp. n. pertenece al grupo de especies *nattereri* definido por Retzer & Page (1996), y ha sido identificada y difiere de sus congéneres por tener hocico corto (< 50% de la longitud de la cabeza), longitud hocico-boca 30.5 – 73.5 % de la longitud de la aleta pectoral en adultos, cuarta fila de escudos laterales anteriores quillados, longitud de la aleta pectoral > 100% de la longitud del origen de la aleta pectoral al origen de la aleta pélvica, presencia de 22 – 27 escudos abdominales, 22 – 31 dientes en la mandíbula superior y 20 – 28 en la mandíbula inferior, presencia de puntos oscuros sobre la cabeza y el dorso formando franjas longitudinales fragmentadas. Este es el primer registro de *Farlowella* en el río Parapetí y representa el registro a mayor elevación (> 900 m) del género en América del Sur. *F. guarani* es la segunda especie descrita para la Cuenca del Amazonas en Bolivia, después de *F. altocorpus*, y ambas están tentativamente restrictas a las porciones andinas de la cuenca del río Madera.

Palabras clave: Pez gato palo, Amazonía Boliviana, cuenca Iténez, cuenca Mamoré, Sistemática.

INTRODUCTION

The stick catfish genus *Farlowella* Eigenmann and Eigenmann 1889 (Siluriformes: Loricariidae) is composed of slender and elongated species with prominent caudal filaments and a pronounced bony snout. A recent approach combining molecular and morphological phylogenetic methods showed the genus comprises the Farlowellini Tribe (sub-family Loricariinae), with the genus *Aposturisoma* deeply nested in *Farlowella*, suggesting the former should be recognized as synonym of the latter (Londoño-Burbano & Reis 2021). This species lives in shallow, gently flowing waters associated with submerged dead leaves, sticks and trunks. Currently, 31 species are known in the genus (including the monotypic *Aposturisoma* as synonym), and they are distributed along the Magdalena, Amazon, La Plata, Orinoco, Essequibo, and small Atlantic drainages in northern South America, including the Maracaibo basin (Ballen & Mojica 2014; Carvajal-Vallejos *et al.* 2014; Ballen *et al.* 2016a, b; Terán *et al.* 2019; Fricke *et al.* 2019; Londoño-Burbano & Reis 2021).

In the Bolivian Amazon Basin, four species of *Farlowella* have been recorded: *F. oxyrrhyncha* (Kner 1853), *F. nattereri* (Steindachner 1910), *F. smithi* Fowler 1913, and *F. altocorpus* Retzer 2006 (Carvajal-Vallejos *et al.* 2014; Carvajal-Vallejos & Zeballos 2011). *F. oxyrrhyncha* is the most common and widespread species in this basin, present in Acre, Orthon, Madre de Dios, Beni, Mamoré and Iténez (or Guaporé) systems, while *F. altocorpus* is present only in the upper portion of the Beni system and is potentially a species restricted to this watershed. *F. smithi* and *F. nattereri* have been recorded in the Beni and Mamoré systems, but also in the Madera (or Madeira) and Iténez systems, respectively (Carvajal-Vallejos *et al.* 2014). There is no study reviewing the systematics of *Farlowella* representatives currently known to occur in Bolivia.

Recent collections in intermittent branches and rivers of the Parapetí and Grande rivers at the south-western portion of the Bolivian Amazon Basin (Andean Region), close to the border with La Plata Basin (Chaco Region), revealed the presence of a new species of *Farlowella*. The Parapetí River runs to the Iténez system, and the Grande River to the Mamoré system (SNHN 2007), and there are no records of *Farlowella* in the Parapetí known so far. The new species of *Farlowella* has characteristics that correspond to the *Farlowella nattereri* artificial species-group morphologically defined by Retzer & Page (1996), and is described and compared herein with other species of the group, mainly with *F. jauruensis* Eigenmann & Vance 1917 from the Upper Paraguay River (La Plata Basin) in Brazil. Although Retzer & Page's (1996) species-groups were not recovered as monophyletic by the phylogeny of Londoño-Burbano & Reis (2021), these species complexes help to differentiate and compare species in a practical way.

A key for the species identified in Bolivia is presented for further systematic comparisons with material obtained from poorly explored areas in the country, and as an identification tool for fish ecology work in Andean portions.

METHODS

Measurements [mm] were made using digital calipers following Retzer & Page (1996) and the criteria and terminology of Boeseman (1971). We used the genus revision of Retzer & Page (1996) to compare descriptions of *Farlowella nattereri* artificial species group (*F. hasemani*, *F. isbruckeri*, *F. jauruensis*, *F. nattereri*, *F. odontotumulus*), and posterior descriptions of Retzer (2006) to compare with *F. altocorpus*, Ballen *et al.* (2016a) to compare with *F. gianetii* and complementary material identified as *F. jauruensis*, and Terán *et al.* (2019) to compare with *F. azpelicuetae*. The comparison of posterior lateral plates (coalescent series in Ballen *et al.* 2016) with the holotype of *F. jauruensis* FMNH 55088, was based on a picture photographed by M. Littmann (Morris *et al.* 2006).

Institutional abbreviations of the comparative material (see at the end) follow Fricke & Eschmeyer (2019).

FIGURE 1. *Farlowella guarani* sp. n., holotype, UMSS 14311, 163.8 mm of SL, dorsal, lateral, and ventral views.

RESULTS

Farlowella guarani, new species (Figure 1-3, Table 1 and 2).

Holotype. UMSS 14311, 163.8 mm of SL, sex unknown. Bolivia: Santa Cruz Department: Amazon basin, Iténez River system: Parapetí River, San Antonio Community,-20.0210-63.1900, 22 August 2013, E. De La Barra, J. Zubieta, S. Villafán.

Paratypes. All from Bolivia, Amazon basin. UMSS 13820, 5 ex., 59.9 – 164.4 mm of SL, same data as holotype. UMSS 13798, 1 ex., 88.9 mm of SL, same data as holotype; UMSS 13836, 1 ex., 118.7 mm of SL, same data as holotype; CBF 13789, 1 ex., 152.1 mm of SL, same data as holotype; UMSS 13966, 3 ex., 101.0 – 127.2 mm of SL, sex unknown. Chuquisaca Department: Iténez River system: Parapetí River, San Pedro Community, -20.1616 -63.8879, 09 October 2013, E. De La Barra, J. Zubieta, H. Delgadillo, M. Arraya, C. Jezequel; MNKP 11713, 1 ex., 117.9 mm of SL, sex unknown. Chuquisaca Department: Iténez River system: Parapetí River, San Pedro Community,-20.1616-63.8879, 09 October 2013, E. De La Barra, J. Zubieta, H. Delgadillo, M. Arraya, C. Jezequel; UMSS 14792, 1 ex., 168.7 mm of SL, sex unknown. Santa Cruz Department: Mamoré River system: Grande River, Tatarenda Nuevo, -19.0711-63.5511, 05 July 2015, H. Muñoz, L. Córdova, D. Barroso; UMSS 14851, 2 ex., 126.0 – 158.3 mm of SL, sex unknown. Santa Cruz Department: Mamoré River system: Grande River, El Camping, -18.9175 -63.4600, 09 July 2015, D. Barroso; UMSS 14858, 2 ex., 151.9 – 162.2 mm of SL, Santa Cruz Department: Mamoré River system: Grande River, Yumao, -19.0850 -63.5939, 11 July 2015, H. Muñoz, L. Córdova, D. Barroso.

FIGURE 2. Snout length variation in a series of juveniles to adult specimens of *Farlowella guarani* sp. n., UMSS 13820.5, 164.4 mm of SL; UMSS 13820.2, 139.4 mm of SL; UMSS 13820.3, 120.3 mm of SL; UMSS 13820.6, 71.9 mm of SL, and UMSS 13820.4, 59.9 mm of SL (From top to bottom).

Diagnosis: *Farlowella guarani* is close to the putative *Farlowella nattereri* artificial species-group. It is distinguished from other members of this group by possessing a snout-mouth length measuring 30.5 – 73.5 % of pectoral fin length in adults, except in *F. jauruensis* (65 – 104 %), and *F. azpelicuetae* (48.9 – 77.8 %). It is distinguished from *F. jauruensis* by having a head width/head length 42.3 – 56.9 % (vs. 28.1 – 39.7 %), snout-mouth length/interorbital width 56.4 – 166.7 % (vs. 181 – 215.9 %), interorbital width/head length 28.6 – 44.0% (vs. 19.7 – 23.2 %), pectoral fin length > 110 % (vs. 91 – 100%) from pectoral fin origin to pelvic fin origin length, posterior lateral plates 21 – 22 (vs. 13 – 14, and vs. 19 considering FMNH 55088 picture), abdominal plates 22 – 24 (vs. 20). Shortest individuals (59.9 – 71.9 mm of SL), probably immature, possess a snout-mouth length/head length < 25% (Figure 2), which is > 40% in specimens of 56.9 – 83.5 mm of SL. It is distinguished from *F. azpelicuetae* by having interorbital width/head length 28.6 – 44.0 % (vs. 19.6 – 23.8 %), more posterior lateral plates 21 – 22 (vs. 18 – 20). Shortest individuals (59.9 – 71.9 mm of SL), probably immature, possess a snout-mouth length/head length < 25% (Figure 2), which is at least 26.9 % in the shortest specimen with 64.2 mm of SL showed by Teran *et al.* (2019). It can be differentiated from *F. gianetii* by the color pattern of the snout consisting of complete dark marbled pigmentation (vs. dark pigmentation on sides), snout-mouth length/head length 23.6 – 48.2 % (vs. 46 – 54.4 %), snout-mouth length/pectoral fin length 30.5 – 73.5 % (vs. 84.8 – 124.8 %), and more caudal fin rays i, 12, i (vs. i, 10, i). It is distinguished from *F. odontotumulus* and *F. isbruckeri* by possessing a snout-mouth length/head length < 50% (vs. > 60% and > 50%, respectively), the fourth row of anterior lateral plates keeled (vs. not keeled), and the snout-mouth length/pectoral fin length < 75 % (vs. > 125 % and 91 – 100%, respectively). It differs from other non-members of *Farlowella nattereri* species-group, except *F. gracilis*, by having five rows of lateral plates (vs. four rows). The new species is distinguished from *F. gracilis* by having a shorter snout-mouth length < 50% of head length (vs. ≥ 50%), lesser anterolateral plates 10-11 (vs. 14 plates), more postlateral plates 21-22 (vs. 18-20 plates), plates in the second row of anterior lateral plates diamond-shape (vs. hexagonal-shape), eyes elevated on head (vs. not elevated).

Description: Morphometric and meristic data in Table 1 and Table 2, respectively.

Largest individual paratype UMSS 14792 (168.7 mm of SL). Body slender, slightly depressed and cylindrical. Width of body posterior to dorsal fin noticeably more slender than anterior portion. Head and tail slightly and deeply depressed, respectively. Dorsal profile concave from tip of snout to level of eyes; tip of snout points upwards and nearly to same level of upper edge of orbits. Almost straight from dorsal portion of head to anteriormost dorsal caudal-fin procurrent ray. Ventral profile obliquely straight from tip of snout to anterior edge of mouth. Straight to slightly convex from pectoral girdle to anal-fin insertion and straight from back portion of anal-fin insertion to anteriormost ventral caudal-fin procurrent ray. Body completely covered by plates, except in tip of snout (some young individuals) and gular region.

Viewed dorsally, head roughly triangular and with concave lateral margins from tip of snout to nares level, and slightly convex from this last same point to pectoral fin insertion. Widest point of head at opercle level. Snout short with tip

slightly expanded distally (length 23.6 – 48.2 % of HL) (Figure 3, Figure 4), without hypertrophied odontodes in lateral margins. Nares with two openings, anterior bigger than posterior, and both separated by thin membranes. Preorbital ridge present. Eyes elevated on head, visible only in lateral and dorsal view. Iris operculum present. Dorsal surface of head slightly flat at level of parieto-supraoccipital bone, compound pterotic ornamented with tiny ridges and pits. Mouth ovoid, lower lip bigger than upper lip. Surface of lower lip covered by round papillae and upper lip by oval papillae, which decrease in size as they approach to margin. Twenty-two to 31 bicuspid teeth on left upper jaw; 20 – 28 bicuspid teeth on left lower jaw (Table 2). Buccal papillae present with papillose surface. Ventral surface of head covered by small plates without particular pattern. Maxillary barbel very short and forming part of buccal papillose margin.

FIGURE 3. Pigmentation pattern variation in the dorsal, anal and caudal fins of *Farlowella guarani* sp. n. Top: paratype, CBF 13789, 152.1 mm of SL. Middle and below: holotype, UMSS 14311, 163.8 mm of SL.

Five lateral plate rows on body, all forming longitudinal keels but most prominent in fourth row. Plates of second row diamond-shape. Ten to 11 anterolateral plates, 21 – 22 postlateral plates, 20 – 23 postabdominal plates, 7 – 8 dorsal (predorsal) plates, and 22 – 23 postdorsal plates (Table 2). Abdomen flat and angled laterally, covered by three complete rows of plates (22 – 27); lateral rows most regular in shape than midabdominal row. Lateral abdominal plates angled and delimiting abdomen laterally. Anal plate V-shaped with posterior margin concave.

Pectoral fins long and surpassing origin of ventral fins, and with distal border almost straight. Pectoral spine two times wider than branched rays, with small flattened and hypertrophied odontodes present in dorsal and ventral portions. Cleithrum narrow and blunt, more often divided into two portions. Pelvic fins extend beyond anus but do not reach origin of anal fin. Anal and dorsal fins similar in form; origin of anal fin inserted at level of fourth branched ray of dorsal fin. Caudal fin emarginated, upper lobe wider but shorter than lower. Long filaments present in both lobes, lower lobe having longest filament most of the time.

Dorsal-fin rays i6 (17), pectoral-fin rays i6 (14) (holotype) or i5 (3), pelvic-fin rays i5 (17), anal-fin rays i5 (17), and caudal-fin rays i12i (17).

TABLE 1. Measurements of holotype and paratype of *Farlowella guarani* sp. n.

Measurements	**Holotype**	**Paratypes (n = 17)**	
		Range	Mean
Standard length [mm]	163.8	59.9 – 168.7	126.8
Head length [mm]	32.5	10.5 – 37.0	22.5
Percent of Standard Length			
Pre-dorsal length	40.9	37.2 – 42.0	40.3
Dorsal fin length	14.5	14.2 – 20.5	17.4
Pectoral fin length	15.9	12.8 – 15.3	14.3
Pelvic fin length	9.2	8.5 – 10.0	9.1
Anal fin length	17.5	9.2 – 17.3	15.5
Post-dorsal fin length	52.8	50.0 – 55.8	54.1
Pectoral fin origin to pelvic fin origin length	13.1	11.1 – 12.9	12.0
Body width	9.7	9.1 – 11.0	9.8
Body depth	6.3	5.7 – 6.9	6.5
Eye to dorsal fin origin length	23.2	21.3 – 23.9	22.5
Percent of Head Length			
Eye diameter	9.2	6.6 – 13.3	9.3
Snout-to-mouth length	40.8	23.6 – 48.2	39.3
Snout-to-eye length	81.7	74.6 – 87.6	81.4
Interorbital width	39.9	28.6 – 44.0	36.6

TABLE 2. Meristic of holotype and paratypes of *Farlowella guarani* sp. n.

Meristic	Holotype	Paratype (n = 17)	
		Range	Mean ± SD
Predorsal plates	8	7–8	7.4 ± 0.5
Postdorsal plates	22	22–23	22.4 ± 0.5
Anterolateral plates	10	10–11	10.8 ± 0.4
Postlateral plates	21	21–22	21.5 ± 0.5
Postabdominal plates	23	20–23	21.8 ± 1.3
Left upper jaw teeth	24	22–31	27.3 ± 2.6
Left lower jaw teeth	20	20–28	24.0 ± 2.8

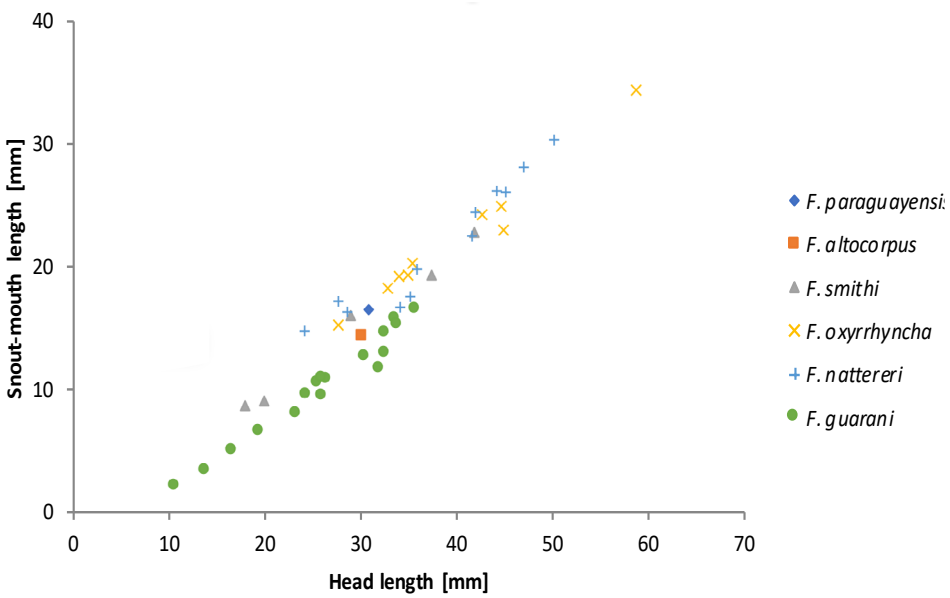

FIGURE 4. Plot of snout-mouth length against head length of two species of *Farlowella nattereri* artificial group (*F. nattereri*, *F. altocorpus*) and other species of different putative groups present in Bolivia, including *Farlowella guarani* sp. n.

Color in alcohol: Adults and juveniles have variable body colorations ranging from dark to light brown. Head and dorsal portion in adults with small dark dots, which give appearance of longitudinal fragmented stripes in dorsum. Snout notably darker but not uniformly dark and variable according size. Snout coloration dark marbled in adults (bigger individuals) and almost uniformly dark in juveniles (smaller individuals). Juveniles possess two longitudinal dark bands running from behind snout to dorsal fin origin, crossing eyes with dark reticulations near eyes. In adults, those bands run from behind the eyes up to dorsal fin origin, showing irregular pattern of lines and dots (at times disappearing) on head. Fin rays covered with small dots uniformly distributed among hyaline zones forming line patterns; inter-radial membrane hyalines. Pectoral fin spine with 5 – 6 dots, unbranched pelvic and

anal fin ray with 4 – 5 dots. Only two specimens, holotype and paratype (CBF 13789) (SL > 139 mm), have dark coloration on distal portions of first branched rays in anal and dorsal fins, and in unbranched anal ray, which form stripes running from middle of fins when slightly compressed (Figure 3).

Caudal fin pigmentation consists of continuous dark narrow stripe covering both lobes and basal portion. However, in some individuals, narrow stripe appears in both lobes but discontinues to base of caudal fin, leaving hyaline spaces onto basal portion of lobes (Figure 3). Lobes have 2 – 3 clear ocelli onto borders.

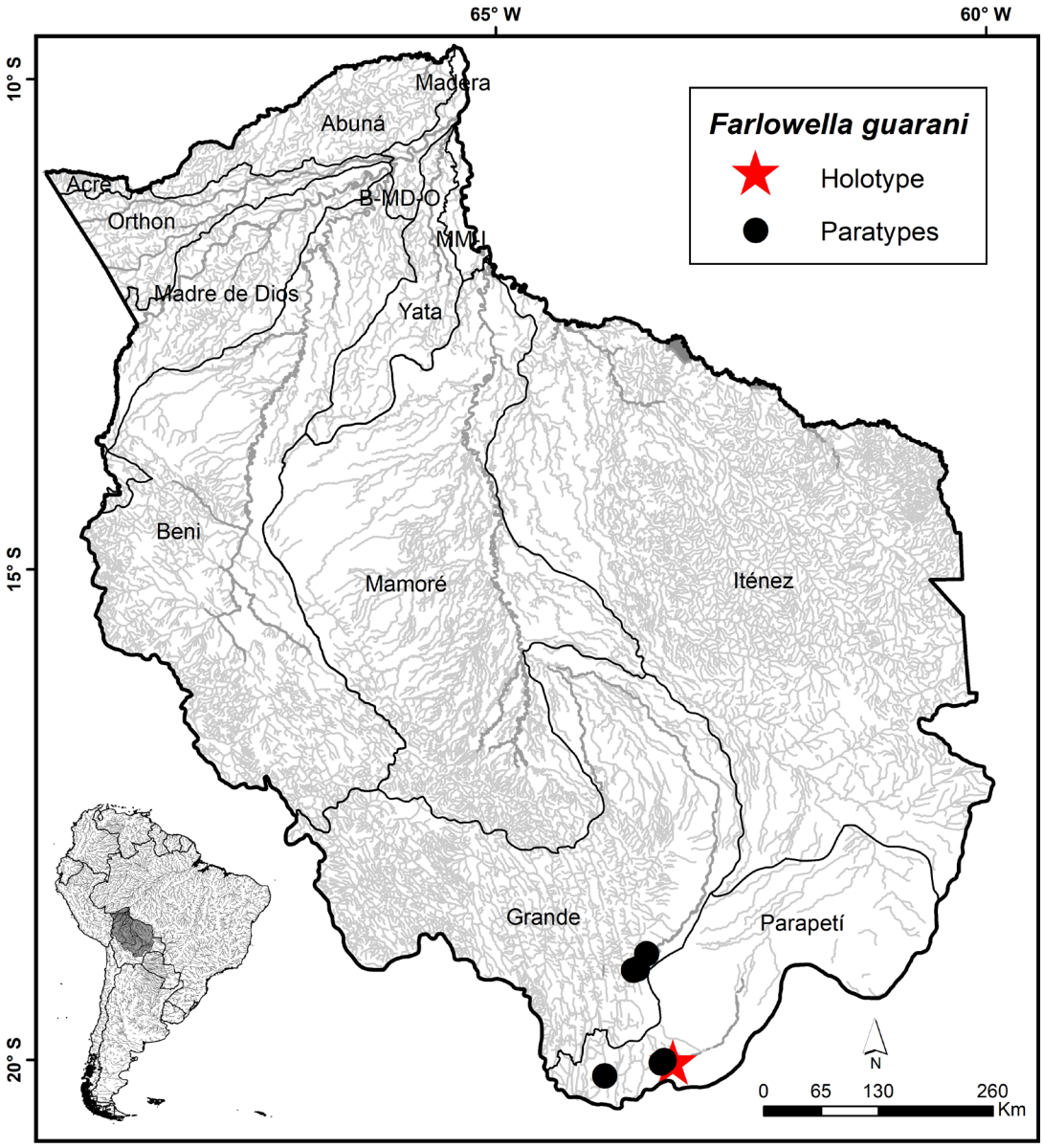

FIGURE 5. Distribution of *Farlowella guarani* sp. n. in the South-Western Bolivian Amazon, Grande (Mamoré system) and Parapetí (Iténez system) rivers watersheds.

Etymology: The species name, guarani, refers to the indigenous group living in the area where the species was collected. Guaraní first nation people are one of the most numerous indigenous groups in Bolivia.

Distribution: *Farlowella guarani* is currently present in Parapetí River (Iténez River system) from two localities: San Pedro - Chuquisaca Department, and San Antonio - Santa Cruz Department. It is also present in Grande River (Mamoré River system) from three localities: Camping, Yumao and Tatarenda Nuevo near to Abapó town (Santa Cruz Department) (Figure 5).

Habitat: *Farlowella guarani* was collected in five localities of the Parapetí River (2) and Grande River (3). Specimens in the type locality (San Antonio, Parapetí River) were caught in habitats containing fallen trunks and floating vegetation. The substratum was composed of small stones, pebble, gravel and silt. Waters had 0.4 m deep, 8.0 mg/l oxygen concentration, 0.24 m/s velocity, 29 °C of mean temperature. The site was situated at 632 m above sea level (masl) and the aquatic habitat was shared with other fish species identified as *Acrobrycon tarijae* Fowler 1940, *Astyanax abramis* (Jenyns 1842), *Astyanax lineatus* (Perugia 1891), *Characidium bolivianum* Pearson 1924, *Hypostomus* gr. *plecostomus*, *Eigenmannia* sp., *Leporellus pictus* (Kner 1858), *Othonocheirodus* sp., *Parodon* sp., *Pimelodella gracilis* (Valenciennes 1835), *Pimelodus albicans* (Valenciennes 1840), *Prochilodus lineatus* (Valenciennes 1837), *Pseudopimelodus mangurus* (Valenciennes 1835), *Rhamdia quelen* (Quoy & Gaimard 1824) and *Trichomycterus barbouri* (Eigenmann 1911).

The locality San Pedro, also in the Parapetí River, had the substratum composed by small stones, gravel and sand. Specimens were collected in the main channel of the river associated to fallen trunks. The water had 0.31 m deep, 7.3 mg/l oxygen concentration, low velocity (< 0.24 m/s) and 21 °C of mean temperature. Elevation of the site was 928 masl and the same other fish species observed in San Antonio were present except *Eigenmannia* sp., *L. pictus*, *Othonocheirodus* sp., *Parodon* sp., *R. quelen*, but one additional *Bryconamericus iheringi* (Boulenger 1887).

In the Grande River, the new species was collected in three localities. The habitat where the species was found had a combination of riffles and plains, associated rooted and floating vegetation at the borders. Some characteristics were similar to San Antonio in the Parapetí River. The substratum was dominated by pebble, gravel and sand. Waters had higher concentrations of oxygen (21.9 – 24.9 mg/l) than Parapetí River and variable pH values (5.42 – 8.72). Other species present in the same habitat were *Acrobrycon starnesi* Arcila, Vari & Menezes 2014, *Odontostilbe dierythrura* Fowler 1940, *Knodus mizquae* (Fowler 1943), *Pimelodella gracilis* (Valenciennes 1835), *Megalonema platanum* (Günther 1880), *Rhamdella* sp., *Cetopsorhamdia* sp., *Parodon buckleyi* Boulenger 1887, and *Prochilodus nigricans* Spix & Agassiz 1829.

Comparisons with Bolivian material: This species differs from its congeners in Bolivia as *F. altocorpus* by having more posterior lateral body plates 21 – 22 (vs. 16 – 18), and the caudal fin with a narrow stripe running continuous or sometimes intermittent on the external edge of lobes to the base (vs. bands only on upper and lower rays). It is distinguished from *F. nattereri*, *F. oxyrrhyncha*, *F. smithi* and *F. paraguayensis* by having five rows of lateral plates (vs. four rows).

Differential key to the species of *Farlowella* from Bolivia: Based on species and specimens reviewed from Bolivia and following terminology of Retzer & Page (1996). *Farlowella azpelicuetae* was included due to its presumable distribution range including Bolivia.

1. Four rows of anterior lateral body plates … 2
- Five rows of anterior lateral body plates … 4

2. Ratio of snout-mouth/head length < 0.5; outer rays of lower caudal fin lobe pigmented only at distal end … *F. paraguayensis*
- Ratio of snout-mouth length/head length > 0.5 … 3

3. Head and snout of breeding male densely covered with breeding odontodes; lower body of cleithrum narrow; snout narrow … *F. smithi*
- Head and snout of breeding male sparsely covered with breeding odontodes; lower body of cleithrum broad; snout broad; anterior lateral body plates hexagonal in shape … *F. oxyrrhyncha*

4. Snout-mouth length 23.6 – 54.4 % of HL … 5
- Snout-mouth length > 50% of HL … 6

5. Interorbital width/head length 28.6 – 44.0 %, and posterior lateral plates 21 – 22 … *F. guarani*, new species
- Interorbital width/head length 19.6 – 23.8 %, and posterior lateral plates 18 – 20 … *F. azpelicuetae*

6. Snout-mouth length relative to the pectoral length in adults measuring 91 – 138%; first anal and dorsal fin spines are entirely darkly pigmented … *F. nattereri*
- Snout-mouth length relative to the pectoral length in adults is 73 – 87%; first anal and dorsal fin spines are hyaline with dark stripes … *F. altocorpus*

Discussion

No records of *Farlowella* exist for the Parapetí River and upper portions of the Grande River in the south-western Bolivian Amazon so far. *Farlowella guarani* represents the first record of the genus in the southern portion of the Bolivian Amazon and the highest altitude of its genera identified in South America. This species lives below 900 masl, higher than the record of *F. altocorpus* (~ 600 masl) in a tributary of the upper Beni River system (Retzer 2006).

Farlowella species records are concentrated in central and western portions of the Bolivian Amazon (Carvajal-Vallejos *et al.* 2014). In the present study, based on examined material (see comparative material section), a specimen collected in a clear water stream from the upper portion of the Tahuamanu River, Orthon system (Pando Department) was identified as *F. paraguayensis*, adding another species of *Farlowella* for the Bolivian Amazon Basin and totalizing six species for this region. The discovery of the new species *Farlowella guarani* and the presence of *F. paraguayensis* in the Bolivian Amazon, denote that knowledge on distribution and diversity of this genus in Bolivia is still incomplete.

In the Bolivian portion of La Plata basin only one species of *Farlowella* was reported, *F. paraguayensis*. This species is not a member of the *F. nattereri* species-

group and is distributed in the upper and lower Paraguay River basin. *Farlowella jauruensis*, a rare species occurring in the upper Paraguay basin (Brazil), resembles the new species. It is a member of the *F. nattereri* species group and was described considering only one specimen (Retzer & Page 1996). Some recent information about the type locality and distribution of additional material deposited in the MZUSP of this species is showed in Ballen *et al.* (2016). These authors suggested that the type locality (aprox. 130 masl) is in the Mato Grosso State, Cáceres Municipality, not so far from the Brazil-Bolivia border and from headwaters of the Iténez River system.

Historical hydrological connections between the Amazon and La Plata basins occurred in Bolivia through communication of neighboring modern megafans originated in the Neogene (Horton & DeCelles 1997) after topographic discontinuity of Grande, Parapetí and Pilcomayo rivers leaving from the Andean front to lowlands (Horton & DeCelles 2001; Wilkinson *et al.* 2006; Latrubesse *et al.* 2012). The Parapetí River, or some arms, drained to the Pilcomayo River (Paraguay River system) during several episodes of megafan formation in the Last Quaternary (maximum activity 60-28 ka) (Latrubesse *et al.* 2012). South-to-north channel displacement of the Parapetí River, with subsequent dismemberment and disconnection from the main river of the basin due to aridity (Wilkinson *et al.* 2006), was inferred using aerial photographs by the pattern of paleocourses caused by river switching and fragmentation (Wilkinson *et al.* 2006; Latrubesse *et al.* 2012). Paleo-channels of the Grande River show that this system could be connected too to the Parapetí River during the same period or before (Latrubesse *et al.* 2012). Based on this historical past connection it is possible that *F. jauruensis* potentially inhabits both La Plata and Amazon basin portions of Bolivia. In this case, distribution of *F. jauruensis* in Bolivia would be restricted to habitats in lowlands on the Brazilian Shield, similar to those present in the Upper Paraguay in Brazil. Habitats in the type locality and other reported by Ballen *et al.* (2016) have clear waters with neutral pH, low content of mineral salts and solids in suspension, stable channel with slope relatively low, sandy bottoms and moderate seasonality, similar to those in the Bolivian portion of the Upper Paraguay (Navarro & Maldonado 2002). On the other hand, environments of *F. guarani* type locality in the Subandean Region have white waters with high content of suspended and dissolved solids, and strong seasonality. During high waters rivers turn muddy and turbulent, and lead to the Chaco-Beniana plain which is a huge alluvial region of recent formation with few small rivers that dry seasonally. Only medium to large rivers remain flowing during low water season. That implies that there is no apparent current surface hydrological connection between environments that come down from the Andes and the Brazilian Shield, and the Chaco-Beniana plain plays a role as geographic barrier (Navarro & Maldonado 2002). Wilkinson *et al.* (2006) suggested that megafan formation appears to have implications for the fragmentation and reconnection or riverine habitats and therefore in the diversification and freshwater of fishes in the upper and lower portion of the rivers.

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Appendix 1: Comparative material

Farlowella altocorpus: Bolivia – CBF 6450, 1 ex., Inicua River, near Suapi Community, -15.5044-67.1703, Beni River System, La Paz Department, 17 November 1996.

Farlowella nattereri: Bolivia – CBF 8617, 6 ex., Chaparina River, under the bridge near the road to San Borja- Santa Rosa,-14.7764-66.7722, Mamoré River system, Beni State, 08 August 1997; CIRA-UTB 782, 1 ex., Tahuamanu River, Porvenir Community, -11.2403 -68.6889, Orthon River system, Pando Department, August 1999; CIRA-UTB 783, 1 ex., Tahuamanu River, Porvenir Community, -11.2403 -68.6889, Orthon River system, Pando Department, August 1999; UMSS 15000, 3 ex., Beni River, near Charque Community, -14.6648 -67.5582, Beni River system, La Paz Department, 09 September 2015; UMSS 15001, 1 ex., Beni River, 50 m upstream from the mouth of Saguacale stream -14.7370 -67.6080, Beni River system, La Paz Department, 12 September 2015; UMSS 15002, 1 ex., Beni River, 2 Km downstream from Torewa tream, -14.7123 -67.5963, Beni River system, La Paz Department, 11 September 2015; UMSS 15003, 1 ex., Beni River, Cielito stream, -15.0616 -67.7061, Beni River system, Beni State, 29 September 2015; UMSS 15004, 1 ex., Naranjani stream, 5 Km downstream from the mouth of Quendeque River, -14.9888-67.7050, Beni River system, La Paz Department, 18 September 2015; UMSS 15005, 1 ex., La Paz River, 100 m downstream from Posponendo stream, -15.2394-67.5389, Beni River system, Beni Department, 27 September 2015.

Farlowella smithi: Bolivia – CBF 835, 3 ex., unnamed stream near San Miguel Community, -11.6670 -67.7156, Madre de Dios River system, Pando Department, 10 October 1991; CIRA-UTB 781, 1 ex., Tahuamanu River, Porvenir Community, -11.2403-68.6889, Orthon River system, Pando Department, 12 August 1999; CIRA-UTB 1816, 1 ex. Ivirgarzama River, -17.0318 -64.8702, Ichilo-Mamoré River system, Cochabamba Department, 18 December 2009.

Farlowella paraguayensis: Bolivia – CBF 5089, 1 ex., Tahuamanu River, 15 min near Nareuda River, -11.2942 -68.7397, Orthon River system, Pando Department, 10 September 1996.

Farlowella oxyrrhyncha: Bolivia – CIRA-UTB 2950, 1 ex., 7 km from Riberalta on Riberalta - Guayaramerín road, -11.0101 -66.0011, Beni River system, Beni Department, 30 October 2012; CIRA-UTB 2951, 1 ex., 7 km from Riberalta on Riberalta - Guayaramerín road, -11.0101 -66.0011, Beni River system, Beni Department, 30 October 2012; CIRA-UTB 2952, 5 ex., Florida River, 15 km from Riberalta on the Riberalta - Guayaramerín road, -11.0127 -65.9284, Beni River system, Beni Department, 30 October 2012; UMSS 362, 1 ex., Chipiriri River, San Carlos Community, -16.8524 -65.3262, Sécure-Mamoré River system, Cochabamba Department, 05 October 2004; UMSS 771, 4 ex., Lágrimas River, near Entre Rios Community, -17.1614 -64.6285, Ichilo-Mamoré River system, Cochabamba Department, 01 July 2005; UMSS 1216, 1 ex., tributary of Cristal River, -17.0908

-64.8271, Ichilo-Mamoré River system, Cochabamba Department, 16 October 2005; UMSS 1678, 1 ex., Zabala River, -17.1258 -64.7161, Ichilo-Mamoré River system, Cochabamba Department, 16 October 2005; UMSS 2651, 1 ex., Blanco River, -13.2349 -63.7283, Iténez River system, Beni Department, 17 December 2004; UMSS 4332, 1 ex., Ibuelo River, -16.8452 -65.3956, Ichilo-Mamoré River system, Cochabamba Department, 24 September 2004; UMSS 5057, 1 ex., Sajta River, near Ivirgarzama Community in the University Mayor de San Simón property, -17.1150 -64.7642, Ichilo-Mamoré River system, Cochabamba Department, 19 July 2001; UMSS 7337, 1 ex., San Joaquín River, near San Joaquín Community, -13.3071 -63.5727, Iténez River system, Beni Department, 10 December 2004; UMSS 13302, 1 ex., Ívon River, Riberalta – Rurrenabaque road, -11.1341-66.1049, Beni River system, Beni Department, 03 November 2012; UMSS 15006, 1 ex., Caigene stream, -14.4026 -67.5626, Beni River system, La Paz Department, 4 October 2015; UMSS 15007, 1 ex., Suapi stream, -14.8464, -67.6176, Beni River system, La Paz Department, 15 September 2015.