

Rediscovery of *Crenicichla yaha* (Teleostei: Cichlidae).

Oldřich Říčan^{1*}, Adriana Almirón² & Jorge Casciotta^{2,3}

¹ University of South Bohemia, Faculty of Science, Department of Zoology, Branišovská 31, 370 05, České Budějovice, Czech Republic

² UNLP, Facultad de Ciencias Naturales y Museo, División Zoología Vertebrados, Paseo del Bosque, 1900 La Plata, Bs. As., Argentina

³ CIC Comisión de Investigaciones de la Provincia de Buenos Aires, 1900 La Plata, Bs. As., Argentina

* corresponding author: oldrich.rican@prf.jcu.cz

Abstract

Crenicichla yaha was described from the Urugua-í river (arroyo Urugua-í; and erroneously on one specimen from the Rio Iguazú) in Misiones, Argentina. The species was only known from nine specimens collected in 1986 during an environmental impact study prior to the construction of the Urugua-í hydroelectric dam in 1989. The species has not been collected since and is absent from the artificial lake where ecological conditions have been severely altered and where the diversity and biomass of non-native species are on the increase. We report here the rediscovery of *Crenicichla yaha* in the Urugua-í basin based on nine specimens collected in December 2016 at two localities outside the influence of the artificial lake. The species is distinct (especially in live coloration) from *Crenicichla tesay* which was previously treated as conspecific with it or confused with it. *Crenicichla yaha* is endemic to the Urugua-í river basin, while *Crenicichla tesay* is endemic to the Iguazú river basin. The original description of *Crenicichla yaha* was based on long preserved specimens lacking most coloration patterns. We expand the description and diagnosis of the species with the now known coloration patterns based on live specimens including breeding coloration and rediagnose the species by comparisons with the remaining closely related species of the *C. mandelburgeri* species group which were not known at the time of the original description of *C. yaha*.

Introduction

Crenicichla is currently the largest cichlid genus in the Neotropics (Eschmeyer et al., 2017; see Piálek et al., 2015 for the latest species descriptions). The genus has a widespread distribution in South America east of the Andes, with a comparatively high diversity in the subtropical regions of Southeastern South America. The subtropical groups form a monophylum (Kullander et al. 2010; Piálek et al., 2012) classified as the *C. lacustris* species group, one of five traditional groups within *Crenicichla* (Ploeg 1991; Stawikowski and Werner 2004; Kullander et al. 2010; Piálek et al. 2012) that were first defined using external morphological characters (coloration patterns, meristics) and geographic distributions and later supported by molecular phylogenies (that also include *Teleocichla* as a subgenus; Piálek et al. 2012; López-Fernández et al. 2010). So far 21 species have been reported from Argentina (Mirande & Koerber, 2015; Koerber et al., 2017).

Two species complexes within the *C. lacustris* species group (the *C. missioneira* and *C. mandelburgeri* species complexes) are highly untypical in their ecomorphological diversity compared to the rest of the large genus *Crenicichla*, which is a typical predatory/piscivore genus (except for the subgenus *Teleocichla*) with an elongated body and a large predatory head (i.e., their name 'Pike Cichlid'). The species of the *C. missioneira* and *C. mandelburgeri* complexes exhibit the largest range of ecomorphologies including also those which are otherwise not found or very rare within *Crenicichla* (e.g. molluscivores, grazers, thick-lipped invertivores) and thus strongly depart from the ancestral predatory ecomorphological type of the genus.

One of the molluscivorous species is *C. yaha* (originally erroneously described as a non-molluscivorous species; see Remarks), an Argentinean endemic from the Urugua-í river that is presently known only from the type material containing nine specimens collected in 1986 (Casciotta et al. 2006). The arroyo Urugua-í had a 28 m high waterfall located 8 km from the confluence with the rio

Paraná and several new endemic species were discovered within collections obtained before the construction of a hydroelectric dam and later collections (see Casciotta et al., 1999; 2000; 2006; 2010 for cichlids).

We report here the rediscovery of *Crenicichla yaha* after thirty years since its last and only collection and after ten years of our dedicated intensive field work in the province of Misiones (2007-2016). In December 2016 we have first collected a single young male during a whole day of collecting at a single locality in the arroyo Falso Uruguay-í (25°58'26.27"S, 54°15'25.44"W). In a second whole day at the same locality we have collected a single adult female. The effort to collect the species has been substantial in our previous field trips from 2007 but in 2016 we have for the first time collected in the Uruguay-í basin exhaustively for whole days at one locality with a total of 100m of specialized gillnets that were repeatedly moved during the day to new places within the localities (cichlids, being territorial, especially during the breeding season, are relatively quickly fished-out from the given spots and nets need to be moved). With this exhaustive collecting strategy we have then in one day at another locality in the arroyo Uruguay-í proper (25°58'19.97"S, 54° 9'2.19"W) collected seven additional specimens that also include two large males. *Crenicichla yaha* appears to occur at the two favorable localities in ratios between 1 in 30 in the arroyo Falso Uruguay-í to 1 in 10 in the arroyo Uruguay-í to *C. ypo*. At other riverine localities the ratio must be much lower if the species is present there at all and in the artificial lake *C. yaha* is completely absent due to lack of suitable habitat and prey items.

Crenicichla yaha was described prior the discovery of the *C. mandelburgeri* species group (Piálek et al., 2012) which includes all endemic *Crenicichla* species of the Middle Paraná and its tributaries including the Iguazú (Piálek et al., 2015). In the original description and diagnosis, *C. yaha* was thus not compared with the most closely related and also most similar species, most of which were at that time still undescribed (*C. ypo*) or in the majority unknown (*C. mandelburgeri*, *C. gillmorlisi*, *C. hu*, *C. tesay*, *C. tapii*, *C. tuca* and several still undescribed species). The original description and diagnosis of *C. yaha* thus presently does not convey necessary information and needs to be adjusted according to the now available knowledge. In a similar way *C. tesay* and *C. iguassuensis* were recently also redescribed (Piálek et al., 2015).

Material and Methods

Specimens for anatomical study were cleared and counterstained (c&s) following the method of Taylor and Van Dyke (1985). Measurements were taken as described by Kullander (1986) for *Crenicichla*. Counts were taken following Kullander (1986). Pharyngeal teeth and frayed zone descriptions follow Casciotta and Arratia (1993). An asterisk denotes holotype values. Body length is expressed as standard length (SL). E1 scale counts refer to the scales in the row immediately dorsal to that containing the lower lateral line (Lucena and Kullander, 1992). Institutional abbreviations follow Ferraris (2007). Voucher specimens are deposited in the Museo Argentino de Ciencias Naturales (MACN), Museo de La Plata (MLP), and Asociación Ictiológica (AI).

Results and Discussion

Crenicichla yaha Casciotta, Almirón & Gómez, 2006

Rediagnosis. A molluscivorous species as suggested by stout lower pharyngeal jaw (LPJ) with molariform teeth along midline and posterior edge, and robust head (head depth, interorbital width) with short jaws and subterminal (hypognathous) mouth. Most similar in these characters and in overall body and head shape and coloration patterns to the other two molluscivorous species in the *C. mandelburgeri* group (*C. tesay* from the Iguazú and *C. taikyra* from the lowermost Middle Paraná). *Crenicichla yaha* is the most robust of the three species. Distinguished from *C. tesay* by 1) lacking spotted body in both sexes (vs. present in both), 2) developing an orange branchiostegal membrane and an orange diffuse area on lateral belly below midlateral blotches in breeding females (vs. absent), 3) having the suborbital stripe composed of neatly arranged horizontal rows of equally-sized and equally-spaced spots (vs. more irregular spotted pattern as in most other *Crenicichla* species except *C. taikyra* and *C. hu* which have a similar suborbital stripe spot-arrangement), 4) midlateral blotches usually with an H-like shape and dorsally continuing double bars (as in the sympatric species *C. ypo*, but otherwise unique among the *C. mandelburgeri* species group vs. rectangular or roundish with much less distinct laterodorsal double bars), 5) dorsal body and head of a slightly different color (usually more brownish) compared with the rest of the body rather than the uniform coloration in *C.*



fig. 1. Adult female of *Crenicichla yaha* (MLP 11215) in breeding coloration. Arroyo Falso Uruguay-i. Note lack of spotting on body distinguishing *C. yaha* from *C. tesay*. Note orange coloration on flank also distinguishing *C. yaha* from *C. tesay*, but similar to sympatric *C. ypo* and all related species in the Middle Paraná. Note black elongated spot in dorsal fin with white margin as in all related species in the Paraná/Iguazu (including *C. tesay*) except the sympatric *C. ypo* (where there is a orange band in ventral portion of the dorsal fin and a black band above it without a white margin). This character difference in the dorsal fin from the sympatric *C. ypo* suggests sexual selection and species recognition.

tesay (usually whole more greyish) and 6) slightly less scales in E1 row. Distinguished from the other molluscivorous species *C. taikyra* by points 4 and 5 (point 2, breeding coloration of females, is not known in *C. taikyra*), by having a distinctly more robust head and body (both almost without overlap) and by having distinctly less scales in E1 row (also without overlap). Distinguished from all other species in the *C. mandelburgeri* group by the molluscivorous-associated characters (robust LPJ, robust LPJ teeth, robust head with short jaws and hypognathous mouth). Distinguished from all species in the *C. missioneira* group (that also include molluscivorous species) by well developed suborbital stripe (vs. very weakly developed and diffuse, composed of a few isolated spots at best).

Remarks. Specimens from AI 199 (1 ex., 116.6 mm SL, Argentina, Misiones Province, arroyo Benavente, coll. Gómez et al. February, 1983) and AI 315 (1 ex. (C&S) 77.6 mm SL, río Iguazú superior, Parque Nacional Iguazú) were previously erroneously included in the type material (AI 199) or referred to *C. yaha*, respectively. Both specimens represent *C. tesay*. The AI 199 lacks the distinguishing spotting on body of *C. tesay* because of its long-term exposure to sunlight during storage at NP Iguazú.

In the original diagnosis and description erroneously reported as a non-molluscivorous species due to examination of a juvenile specimen (47.7 mm SL, Figure 2 in the original description; Casciotta et al., 2006). In the description of *C. taikyra* specimens referred to *C. yaha* represent both *C. yaha* (the majority of specimens but one) and *C. tesay* (one specimen AI 315; see below) and this *C. yaha* is correctly reported as a molluscivorous species. Adult specimens of *C. yaha* as treated here and in Piálek et al. (2015; i.e. as a distinct species from *C. tesay*) and as examined here (partial dissections including large female MLP 11215 DNA1043, 122.0 mm SL) have stout LPJs and robust molariform LPJ teeth. The figured LPJ referred to a larger young *C. yaha* (Figure 2b in Casciotta et al., 2013) is from a specimen from the Iguazú river and hence based on our reexamination (Piálek et al., 2015) belongs to *C. tesay*. The comparison of LPJ shape and LPJ teeth (and microbranchispines) in the original diagnosis of *C. taikyra* (Casciotta et al., 2013) is thus with *C. tesay* and not with *C. yaha*. Comparable sized young fish of *C. taikyra* and *C. tesay* (Figure 2 in Casciotta et al., 2013) show that the LPJ and LPJ teeth are more robust in *C. taikyra* than in *C. tesay*. The LPJ of the adult female *C. yaha* (MLP 11215, 122.0 mm SL) is more robust with more robust teeth than in *C. tesay* and more similar in robustness to *C. taikyra*.

The three molluscivorous species of the *C. mandelburgeri* complex (*C. yaha*, *C. tesay*, *C. taikyra*) are distinct in a number of characters (see rediagnosis of *C. yaha* above). *Crenicichla yaha* is the most robust species in both head and body while *C. taikyra* is the least robust species. *Crenicichla yaha* has the largest interorbital distance (*id* in percents of SL; mean 8.1, SD 0.56, range 7.5–9.0), the largest head depth (*hd* mean 18.9, SD 1.02, range 17.9–20.8) and the largest body depth (*bd* mean 25.7, SD 1.61, range 23.3–27.7). Intermediate is *C. tesay* (*id* mean 7.2, SD 0.61, range 6.1–8.6; *hd* mean 18.2,

SD 1.15, range 16.4–19.9; *bd* mean 23.4, SD 1.22, range 20.9–25.9) while the *C. taikyra* is the least robust (*id* mean 6.7, SD 0.50, range 5.7–7.5; *hd* mean 17.3, SD 0.79, range 16.2–19.4; *bd* mean 22.1, SD 0.90, range 20.8–23.8).

The three species differ also in the number of scales in E1 row where *C. yaha* and *C. taikyra* do not overlap and *C. yaha* again is the most robust species (i.e. with the lowest number of largest scales). The type series of *C. yaha* (Casciotta et al., 2006) has 48–51 (mean 51) scales in E1 row [48(2), 49(1), 51(7)], the type series of *C. taikyra* (Casciotta et al., 2013) has 54–60 (mean 56–57) scales in E1 row [54(2), 55(1), 56(7), 57(5*), 58(3), 60(3)] and the rediagnosed *C. tesay* (Piálek et al., 2015) has 49–59 (mean 54) scales in E1 row [49(1), 50(1), 52(4), 53(3), 54(10), 55(3), 56(5), 57(2), 58(2), 59(1)]. Based on morphological character distribution it is possible that the three molluscivorous species in the *C. mandelburgeri* group (i.e. *C. yaha*, *C. tesay* and *C. taikyra*) are closely related and that the molluscivory has originated only once. In fact a close relationship between *C. tesay* and *C. taikyra* is supported by both mtDNA (Piálek et al., 2012) and nDNA (Piálek et al., in prep.) phylogenies suggesting separation of one ancestral species into two by dispersal of *C. taikyra* ancestors downstream over the Iguazú falls (as already postulated by Casciotta et al., 2013). *Crenicichla yaha* however on the other hand uniquely among the three species shares several characteristics (H-like midlateral blotches, orange flank coloration of breeding females, the lowest number of E1 scales) with the sympatric *C. ypo* [number of E1 scales 47–55, mean 53; 47(2*), 48(1), 51(3), 53(5), 54(3), 55(3)], while *C. tesay* is uniquely identical in coloration to the sympatric *C. iguassuensis* (Piálek et al., 2015). The phylogenetic position of *C. yaha* (whether it is with *C. tesay* and *C. taikyra* or with *C. ypo*) and the potential of hybridization (e.g. with the sympatric *C. ypo* or with other species in the Paraná) thus remains to be ascertained with nuclear phylogenomic data (Piálek et al., in prep.).

Live coloration constitutes the most important character complex in morphologically very similar (and often closely related) species of cichlids. Several examples of this fact are available from the studied genus in our study area and from the three here treated molluscivorous species. The lack of live coloration lead e.g. Varella (2011) to conclude that two very dissimilar species (*Crenicichla tapii* and *C. tuca*; Piálek et al., 2015) in live coloration (and in a number of morphological characters) are conspecific (treated as *C. sp. Iguacu* in Varella, 2011). The species treated by Varella (2011) as *C. tesay* is in fact an undescribed species from the Rio Jordão (and possibly Rio Areia and other nearby rivers including the mainstem of the Iguazu in this area (Frota et al. 2016; pers. comm. 14.12.2016) distinctive from *C. tesay* in live (and also preserved) coloration patterns and in phylogenetic relationships based on both mtDNA and nDNA markers (Řičan et al., unpublished results) while the *C. yaha* of Varella (2011) is *C. tesay* (Piálek et al., 2015). Apart from the aquarist community and a handful of dedicated cichlid researchers it is unfortunately still very rare to photograph cichlids in the field immediately after capture during general collection efforts and very valuable and all-important information is thus still being lost. Live coloration of cichlid fishes is of key importance for both cichlids systematics and their biology and we urge all Neotropical ichthyologists to photograph all cichlids when still alive immediately after collection.

Coloration in live. Overall coloration on head and upper back brownish (with orange tones in breeding females) contrasting with paler greyish-whitish flanks and belly up to the midlateral blotches (vs. uniform head and body coloration in *C. tesay* and *C. taikyra*). *Crenicichla yaha* lacks the black spotting on body of *C. tesay* (present in both sexes). Orange coloration in form of a diffuse band below the midlateral blotches on flank in breeding females also distinguishes *C. yaha* from *C. tesay*, but is similar to the sympatric *C. ypo* and all related species in the Middle Paraná. Orange coloration of branchiostegal membrane in breeding females also distinguishes *C. yaha* from *C. tesay* and the sympatric *C. ypo* (where in both cases grey). Breeding females with a black elongated spot in dorsal fin with white margin as in all related species in the Paraná/Iguazú (including *C. tesay*) except the sympatric *C. ypo* (among the *C. mandelburgeri* complex the orange band in ventral portion of the dorsal fin and a black band above it without a white margin is unique). This character difference in the dorsal fin from the sympatric *C. ypo* suggests sexual segregation and species recognition suggesting long-term sympatry. Males of *C. yaha* with spotted dorsal fin distinguishing them from females. Midlateral blotches are distinctly H-shaped (as in the sympatric *C. ypo*) and the double bars dorsad from the H-shaped blotches are also distinct (as in *C. ypo*). Suborbital stripe composed of neatly arranged horizontal rows of equally-sized and equally-spaced spots (shared with *C. taikyra* and *C. hu* vs. more irregular spotted pattern as in most other *Crenicichla* species including *C. tesay* and the sympatric *C. ypo*).



fig. 2. Detail of head of the same female of *C. yaha*. Note sub-terminal hypognathous mouth similar to *C. tesay* but different from the prognathous mouth of the sympatric *C. ypo*.



fig. 3. Detail of lower portion of head of the same female of *C. yaha* showing orange branchiostegal membrane distinguishing *C. yaha* from *C. tesay* and the sympatric *C. ypo* (where in both cases grey).



fig. 4. Young female of *C. yaha* (MLP 11217) from arroyo Urugua-í. Note black elongated spot in dorsal fin.



fig. 5. Adult male of *C. yaha* (MLP uncatalogued) from the arroyo Urugua-í. Note spotted dorsal fin distinguishing males from females.

Distribution and ecology. *Crenicichla yaha* is endemic to the Urugua-í basin above the original 28 m high waterfall, i.e. above the present dam. It does not however occur in the artificial lake which has everywhere a muddy bottom but is apparently only found in the middle stretches of the main stream and its main tributary (arroyo Falso Urugua-í; figure 6) in areas with bottoms made of stones, boulders and solid rock. Here *C. yaha* is syntopic with the much more common *C. ypo* and in rare cases with the undescribed predatory *C. sp.* Urugua-í line which is common only in the artificial lake. *Crenicichla yaha* is apparently not present in the upper parts of the main river and the larger tributaries (Falso Urugua-í, Uruzu) and also not in the small tributaries where in all cases only *C. ypo* is present or where cichlids are absent (headwaters of small tributaries).

Crenicichla yaha has only been collected in pools and not in the shallow running stretches. *Crenicichla yaha* is a molluscivorous species and its prey item, the snail *Potamolithus*, is absent from the artificial lake and present in only very small numbers in the riverine rocky stretches compared to other tributaries of the Middle Paraná, Iguazú and Uruguay which all also include specialized molluscivores (*C. taikyra*, *C. tesay* and *C. minuano* plus *C. jurubi*, respectively) and which occur at much higher densities (pers. obs.). The generalistic *C. ypo* is on the other hand common throughout the Urugua-í basin.

Conservation. All original localities of *C. yaha* were riverine habitats with bottoms of stones, boulders and solid-rock. These are the same habitats in which we have rediscovered the species. Two of the original localities are now within the artificial lake with completely altered conditions (stagnant water with muddy bottoms). Based on our ten year efforts (2007-2016) to capture *C. yaha* we can claim that the species is absent from these artificial environments and the construction of the dam has thus severely limited the distribution and abundance of *C. yaha*, one of several endemic species of the Urugua-í river. *Crenicichla yaha* probably lives within the Urugua-í basin only in a limited central area between the lake influence and most upper reaches where it also appears to be absent. Only the right bank of the Urugua-í river falls within an area of nature protection while the whole arroyo Falso Urugua-í and the left bank of the Urugua-í are areas of severe degradation for agriculture and non-native tree plantations (pine). *Crenicichla yaha* should thus be considered a rare and vulnerable species in addition to its narrow endemism.

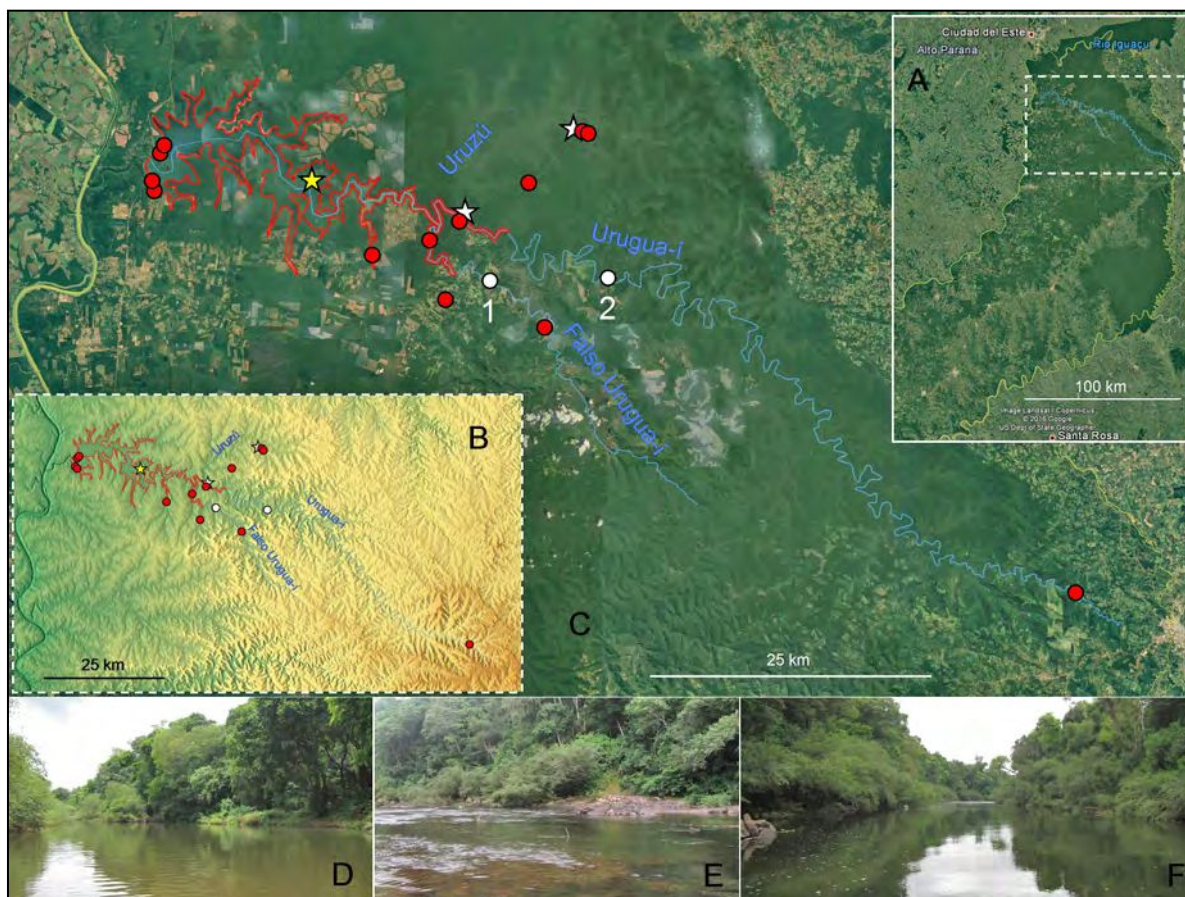


fig. 6. Map showing the collecting sites in arroyo Urugua-í basin, Misiones Province, Argentina. A. Satellite map of Misiones Province with arroyo Urugua-í basin. B. Topographic map of arroyo Urugua-í basin with collecting sites. White dots show sites where *C. yaha* was rediscovered, red dots show localities where *C. yaha* was not collected, stars show type localities of *C. yaha*, yellow star the holotype locality, red outline shows the extent of the artificial Lago Urugua-í. C. Satellite map of arroyo Urugua-í basin. Symbols as in B with 1 – pool in arroyo Falso Urugua-í where two specimens of *C. yaha* were collected (25°58'26.27"S, 54°15'25.44"W), 2 – pool in arroyo Urugua-í at Reserva Rubichana (25°58'19.97"S, 54° 9'2.19"W) where seven specimens of *C. yaha* were collected. D: Pool in the arroyo Falso Urugua-í (locality 1). E, F. Running stretch and pool in the arroyo Urugua-í at Reserva Rubichana (locality 2).

Comparative material

Crenicichla hadro stigma: Argentina, Misiones, Uruguay River basin. AI 220, 1, 72.8 mm SL, Itacaruaré.

Crenicichla hu: Argentina, Misiones, arroyo Piray–Miní, Paraná River basin. MACN-ict 9429, holotype, 118.0 mm SL. MACN-ict 9430, paratypes, 17 ex., 76.9–153.0 mm, same data as holotype. AI 261, paratypes 2 ex., 96.3–110.0 mm, same data as holotype. AI 262, paratype, 1 ex. (c&s) 93.9 mm, same data as holotype.

Crenicichla iguassuensis: Brazil, Rio Iguazú, Porto União da Victoria. FMNH 54159, holotype, 137.0 mm SL. Argentina, Misiones Province, lower Iguazú River above Iguazú Falls, Paraná River basin. MACN 9550, 4 ex., 89.3–117.9 mm SL, Rio Iguazú. MACN 9551, 3 ex., 120.6–150 mm SL, arroyo Deseado.

Crenicichla jupiaensis: Argentina, Corrientes, Paraná River at Yahapé: AI 226, 2, 87.7–93.0 mm SL; AI 227, 1, 60.7 mm SL.

Crenicichla lepidota: Argentina, Buenos Aires, Isla Martín García: MACN-ict 2314, 6, 59.9–104.2 mm SL. Chaco, Esteros del Palmar: MACN-ict 7275, 1, 151.6 mm SL. Corrientes, Isla Apipé Grande, Ituzaingó: FML 312, 1, 138.0 mm SL. Entre Ríos, Uruguay River, Concepción del Uruguay: MACN-ict 4091, 1, 98.4 mm SL. Formosa, Riacho de Oro: MACNict 3656, 2, 116.0–165.7 mm SL. Misiones, Represa Estación Experimental Cerro Azul: MACN-ict 5067, 4, 67.7–113.4 mm SL. Salta, Luna Muerta, Hickman: FML 528, 1, 111.5 mm SL. Uruguay, Departamento Colonia, arroyo Limetas: MNHNM 2087, 1, 72.9 mm SL.

Crenicichla mandelburgeri: Argentina, Misiones, Paraná River basin. MACN-ict 9442, 2, 102.2-208.0 mm SL, arroyo Chapa at route 6. MACN-ict 9440, 2, 72.6-82.3 mm SL, arroyo Cuñapirú, at route 223 near Ruiz de Montoya. MACN-ict 9441, 7, 56.0-93.0 mm SL, arroyo Cuñapirú (arroyo Tucangua). MACN-ict 9439, 2, 83.7-93.0 mm SL, arroyo Guaruhapé at route 220.

Crenicichla ocellata: Paraguay, Puerto 14 de Mayo, Bahía Negra, Chaco Boreal. holotype MSNG 33700, , 257.5 mm SL.

Crenicichla semifasciata: Argentina, Entre Ríos, arroyo Curupí: MACN-ict 6239, 1, 176.6 mm SL. Formosa, Riacho de Oro: MACN-ict 3683, 1, 68.8 mm SL.

Crenicichla taikyra: Argentina, Misiones, Paraná River at Candelaria. holotype MACN-ict 9461, 98.3 mm.

Crenicichla tapii: Argentina, Misiones Province, lower Iguazú River above Iguazú Falls, Paraná River basin. MLP 10560, holotype, 105.4 mm, Iguazú main channel at the mouth of arroyo Ñandú, Parque Nacional Iguazú. MLP 10561, paratypes, 20 ex., 78.3-117.5 mm, collected with the holotype. MLP 10804, paratypes, 10 ex., 62.3- 120.3 mm, collected with the holotype. MLP 10805 (ex AI 307), paratypes, 2 c&s ex., 76.0-94.4 mm, collected with the holotype. MACN-ict 9553, paratypes, 2 ex., 86.0-111.0 mm, arroyo Deseado.

Crenicichla tesay: Argentina, Misiones Province, lower Iguazú River above Iguazú Falls, Paraná River basin. MACN-ict 9016, holotype, 115.1 mm SL, arroyo Verde. MACN 9552, 2 ex., 81.5-134.9 mm SL, arroyo Deseado. MLP 10822, 1 ex., 137.9 mm SL, Iguazú main channel at the mouth of arroyo Ñandú, Parque Nacional Iguazú. MLP 10824, 16 ex., 83-140 mm SL, Iguazú main channel at the mouth of arroyo Ñandú, Parque Nacional Iguazú. MLP 10823, 4 ex., 82.6-115.0 mm SL, Rio San Antonio. AI 199, 1 ex., 116.6 mm SL, arroyo Benavente. AI 315, 1 ex. (C&S), 77.6 mm SL, río Iguazú, Parque Nacional Iguazú.

Crenicichla tuca: Argentina, Misiones Province, lower Iguazú River above Iguazú Falls, Paraná River basin. MLP 10818 (ex MACNict 9522), holotype, 150.3 mm SL, arroyo Deseado. MLP 10817 (ex MACNict 9523), paratype, 1 ex, 124.1 mm SL, Iguazú main channel. MLP10819, paratypes, 3 ex, 86.0-117.2 mm SL, Iguazú main channel at the mouth of arroyo Ñandú, Parque Nacional Iguazú. MLP 10821, (ex CIES 65), paratype, 1 ex., (c&s), Parque Nacional Iguazú.

Crenicichla yaha: Argentina, Misiones, Paraná River basin, arroyo Urugua-í. MACN-ict 8924, holotype, 103.7 mm SL, at Isla Palacio. MTD-F 30606, paratype, 1, 105.9 mm SL, arroyo Urugua-í at provincial route 19, Parque Provincial Islas Malvinas. AI 200, paratype, 1, 135.8 mm SL, arroyo Urugua-í at provincial route 19, arroyo Uruzú, Parque Provincial Islas Malvinas. AI 202, paratypes, 4(1 c&s), 37.4-48.5 mm SL, arroyo Urugua-í at Isla Palacio. MLP 11215., 1 ex., 122.0 mm SL, arroyo Falso Urugua-í, 5/12/2016. MLP 11217, 3 ex., 80.0-96,5 mm SL., arroyo Urugua-í, 9/12/2016. MLP 11216, 1 ex., 85.2 mm SL., arroyo Falso Urugua-í, 4/12/2016. MLP uncatalogued, 4 ex., arroyo Urugua-í, 9/12/2016.

Crenicichla ypo: Argentina, Misiones, arroyo Urugua-í, Paraná River basin. MACN-ict 9431, holotype, 105.5 mm SL, , arroyo Urugua-í at Establecimiento "Alto Paraná". MACNict 9432, paratypes 3, 101.0-116.0 mm SL, arroyo Grapia, 6 km north from Colonia Gobernador J. J. Lanusse.

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