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Crenicichla taikyra (Teleostei: Cichlidae), a new species of pike cichlid from the middle río Paraná, Argentina

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Abstract

Crenicichla taikyra, new species, is described from the middle río Paraná, Argentina. *Crenicichla taikyra* is distinguished from the other species of the genus by the following combination of characters: lower pharyngeal tooth plate stout, bearing molariform teeth, ascending arm of premaxilla longer than the dentigerous arm, posterior edge of preoperculum serrated, a well developed suborbital stripe, and absence of scattered dark dots on flanks. Molariform teeth on pharyngeal jaws is a derived character among *Crenicichla* species, however this character state has appeared several times in unrelated species.

Key words: taxonomy, Misiones, Corrientes, molariform teeth, pharyngeal tooth plate

Resumen

Crenicichla taikyra, nueva especie, es descripta para el río Paraná medio en Argentina. *Crenicichla taikyra* se distingue de las otras especies del género por la siguiente combinación de caracteres: placa faríngea inferior robusta, llevando dientes molariformes, rama ascendente del premaxilar más larga que la rama dentígera, borde posterior del preopérculo aserrado, banda suborbital bien desarrollada y ausencia de pequeñas manchas oscuras en los flancos. Dientes molariformes en los huesos faríngeos inferiores es un carácter derivado entre las especies de *Crenicichla*. Sin embargo este estado de carácter ha aparecido varias veces en especies no relacionadas.

Introduction

The río Paraná basin with about 2,600,000 km^2 is the second largest basin of South America. Since 1911, the río Paraná basin was interrupted and modified by about 145 reservoirs, mostly for hydropower generation (Agostinho *et al*. 2008). This cumulative effect of dams generates habitat fragmentation, which may threaten biodiversity (Agostinho *et al*. 2004). One of the largest reservoirs is the Yacyretá Dam, located on the río Paraná between Paraguay and Argentina. During several collecting expeditions between 1997 and 2008 in the río Paraná, as part of intensive studies to assess the effects of Yacyretá Dam above and below it, fishes of a new species of *Crenicichla* were collected.

The genus *Crenicichla* Heckel with more than 85 species, is the most speciose genus within the family Cichlidae (Piálek *et al*. 2012). Fourteen species of *Crenicichla* were listed for the río Paraná basin (Piálek *et al.* 2010) and several are still undescribed (J.C., A.A., L.P. and O.R., pers. obs.). Some of them, like *C. haroldoi*

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Luengo & Britski, *C. jaguarensis* Haseman, and *C. britskii* Kullander are apparently restricted to the upper río Paraná basin. *Crenicichla jupiaensis* Britski & Luengo is found both in the upper and middle parts of the basin (Casciotta *et al*. 2007, Graça & Pavanelli 2007). *Crenicichla iguassuensis* Haseman and *C. tesay* Casciotta & Almirón are only known from the río Iguazú (Casciotta & Almirón 2008). *Crenicichla yaha* Casciotta, Almirón & Gómez inhabits the río Iguazú basin and the arroyo Urugua–í (middle Paraná basin). *Crenicichla semifasciata* (Heckel), *C. lepidota* Heckel, *C. scottii* (Eigenmann), and *C. vittata* Heckel, are found in the middle and lower Paraná basin (*C. scottii* exclusively in the lower part), and the last three species are also present in the río Uruguay basin (Casciotta 1987, Lucena & Kullander 1992). Finally, *Crenicichla mandelburgeri* Kullander, *Crenicichla ypo* Casciotta, Almirón, Piálek, Říčan & Gómez, *Crenicichla hu* Piálek, Říčan, Casciotta & Almirón, and *C. gillmorlisi* Kullander & Lucena are known only from one or a few streams in the middle Paraná basin.

So far known, only three species within the genus *Crenicichla* bear molariform teeth on the lower pharyngeal tooth plate: *C. semifasciata* and *C. yaha* of the río Paraná basin, and *C. jurubi* Lucena & Kullander of the río Uruguay basin. The aim of this paper is to describe a new species of *Crenicichla* from the middle río Paraná in Argentina, which also bears molariform teeth on lower pharyngeal tooth plate.

Material and methods

In this paper, the río Paraná is divided into three sections following Casciotta *et al.* (2010). The middle Paraná is the section between Itaipú (Saltos del Guairá) and the confluence with the río Paraguay. The Upper Paraná is the section above Itaipú Dam and lower Paraná the section below the confluence with the río Paraguay.

Specimens were cleared and counterstained (C&S) following the method of Taylor & Van Dyke (1985). Measurements and counts were taken as described by Kullander (1986). Pharyngeal teeth and frayed zone descriptions follow Casciotta & 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 & Kullander 1992).

Institutional abbreviations follow Leviton *et al.*(1985), except for AI (Asociación Ictiológica, La Plata, Argentina).

Results

Crenicichla taikyra sp. n.

Figs. 1–5, Table 1

Crenicichla sp. 'Paraná'—Piálek *et al.* 2012 [inclusion in molecular phylogeny; MACN-ict 9466, Corrientes province, río Paraná at Ituzaingó, 27°30'04.3"S 56°42'41.6"W]

Holotype. MACN-ict 9461, 98.3 mm, Argentina, Misiones province, río Paraná at Candelaria, 27º21’43.0”S 55º51’54.7”W, Feb 1999, Aichino D. (Fig. 1).

Paratypes. All from Argentina. MACN-ict 9462, 3 ex., 83.9–107.0 mm, Misiones province, río Paraná at Candelaria, 27º21’43.0”S 55º 51’54.7”W, Nov 2008, Aichino D. MACN-ict 9463, 7 ex., 78.2–111.4 mm, same data as holotype. MACN-ict 9464, 4 ex., 97.7–115.6 mm, Misiones province, río Paraná at Posadas, 27º21’43.0”S 55º51’54.7”, Nov 1999, Aichino D. MACN-ict 9465 , 4 ex., 56.2–71.4 mm, Corrientes province, río Paraná at Ituzaingó, 27°30'04.3"S 56°42'41.6"W, May 2007, Casciotta *et al*. MACN-ict 9466, 13 ex., 49.6–101.0 mm, Corrientes province, río Paraná at Ituzaingó, 27°30'04.3"S 56°42'41.6"W, Nov 2009, Casciotta *et al*. AI 306, 3ex., 70.4–97.2 mm, Corrientes province, río Paraná at Yahape, 27º22’12.1”S 57º39’14.6”W, Nov 2008, Casciotta *et al*. AI 264, 4 ex. (C&S), 39.3–76.0 mm, Corrientes province, río Paraná at Ituzaingó, 27°30'04.3"S 56°42'41.6"W, May 2008, Casciotta *et al*. MLP 10398, 5 ex., 50.0–67.6 mm, Corrientes province, río Paraná at Ituzaingó, 27°30'04.3"S 56°42'41.6"W, Nov 2009, Casciotta & Almirón

Diagnosis. *Crenicichla taikyra* is distinguished from all remaining species of *Crenicichla* except *C. jurubi*, *C. semifasciata*, and *C. yaha* by having a stout lower pharyngeal tooth plate with molariform teeth (vs. slender pharyngeal tooth plate without molariform teeth).

Crenicichla taikyra differs from *C. jurubi* in having a serrated vs. smooth preopercle, a well developed suborbital stripe vs. suborbital stripe absent or reduced to a spot at margin of orbit, and by the absence vs. presence of scattered dots on back and sides. *Crenicichla taikyra* differs from *C. semifasciata* in having an ascending arm of the premaxilla longer (vs. shorter than the dentigerous one), caudal fins subtruncated (vs. deeply rounded), caudal fin scaled only on its basal third (vs. mostly scaled), caudal spot without light ring (vs. caudal spot surrounded by a silvery or orange ring), and a narrower interorbital width (17.1–23.3% vs. 32.0–40.0% of HL). Finally, *Crenicichla taikyra* can be distinguished from *C. yaha* by having a stouter lower pharyngeal tooth plate with about 16 molariform teeth (Fig. 2a) (vs. about 4 molariform teeth; Fig. 2b), and absence of microbranchiospines on gill arches (vs. presence).

FIGURE 1. *Crenicichla taikyra*, holotype, MACN-ict 9461, 98.3 mm, Argentina, Misiones province, río Paraná at Candelaria.

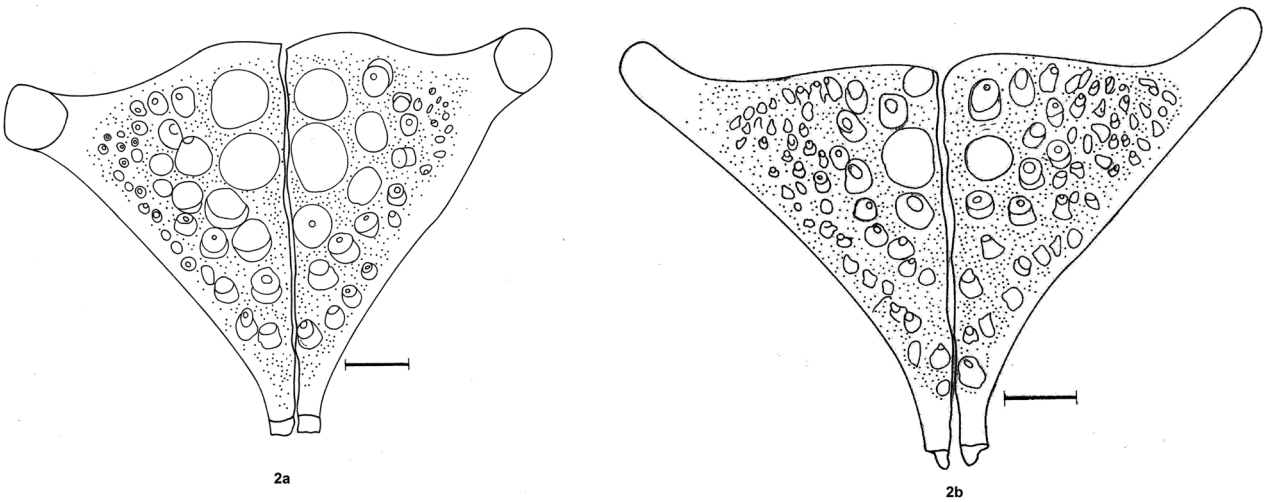

FIGURE 2. Lower pharyngeal tooth plate in occlusal view. a. *C. taikyra*, AI 264, 77.0 mm SL. b. *C. yaha*, AI 315, 77.6 mm SL. Scale bar: 1 mm.

Other characters besides the presence of molariform teeth on lower pharyngeal jaw separate *C. taikyra* from other species inhabiting the río Paraná basin: *C. taikyra* differs from *C. iguassuensis* and *C. tesay* in having isognathous jaws vs. lower jaw prognathous. *Crenicichla taikyra* is different from *C. hu* in having a colour pattern with a gray or olive green background vs. dark brown to black, and E1 row scales 54–60 vs. 47–54. *Crenicichla taikyra* can be distinguished from *C. mandelburgeri* in having more scales in E1 row scales (54–60 vs. 44–56), jaws isognathous vs. lower jaws prognathous, and absence of lateral band in adults vs. presence. *Crenicichla taikyra* has isognathous jaws and the blotches on flanks placed below the upper lateral line whereas *C. ypo* has a lower jaw slightly prognathous and the blotches are extending 3 to 4 scale rows above and below lateral line. *Crenicichla taikyra* lacks brown dots on each lateral line scale and lateral band on flanks, which are present in *C. haroldoi*. The absence of a lateral band distinguishes *C. taikyra* from *C. jaguarensis*. *Crenicichla jupiaensis* differs from *C. taikyra* in having the suborbital stripe reduced to a few spots posterior to the orbit, a thin black line on the

posterior margin of preoperculum, cheek naked, and numerous vertical stripes. *Crenicichla lepidota* and *C. britskii* have a humeral spot absent in *C. taikyra*. *Crenicichla scottii* has parallel and thin longitudinal bands and *C. gillmorlisi* has small dark dots all over the sides, features not present in *C. taikyra*. *Crenicichla vittata* has 78–85 in E1 row scales, lateral band, and a particular colour pattern on top of the head forming a crown design whereas *C. taikyra* has 54–60 E1 row scales, absence of lateral band, and the pattern of pigmentation on head described above.

Description. Body elongate. Head deeper than wide. Snout short, bluntly pointed in lateral view. Mouth small and narrow, upper and lower jaws isognathous. Tip of maxilla usually not reaching anterior margin of orbit. Lower lip folds widely separated anteriorly. Nostrils dorsolateral, nearer anterior margin of orbits than snout tip. Posterior margin of preopercle serrated. Scales on flanks strongly ctenoid. Head scales cycloid. Predorsal scales small, superficially embedded in skin. Prepelvic scales smaller than predorsal ones. Interopercle naked. Cheek scaled, 4 to 5 scale series below eye. Scales in E1 row: 54(2), 55(1), 56(7), 57(5*), 58(3), 60(3). Scales in transverse row: 9/14(2), 10/13(3), 10/14(7), 10/15(3), 10/16(2), 11/13(1), 11/14(2*), 12/14 (1). Two (17) or three (4) scale rows between lateral lines. Upper lateral line scales: 21(1), 23(3), 24(9*), 25(7), 26(1). Lower lateral line scales: 8(1), 9(3), 10(13*), 11(2), 13(2). Dorsal, anal, pectoral, and pelvic fins naked. Dorsal fin: XX,10(2); XX,11(1); XX,12(1); XXI,10(1); XXI,11(12); XXI,12(2); XXII,10 (1); XXII,11(1*). Anal fin: III,7(1); III,8(20*). Pectoral fin 15(10), 16(10*), 17(1). Caudal-fin squamation not reaching half of caudal fin length. Tip of soft-dorsal fin rounded or pointed, surpassing caudal-fin base. Tip of anal fin usually not reaching caudal-fin base, reaching in 5 specimens. Caudal fin slightly rounded. Pectoral fin rounded, not reaching tip of pelvic fin. No microbranchiospines on gill arches (4 C&S). Gill rakers externally on first gill arch: 1–2 on epibranchial, 1 on angle, and 6 on ceratobranchial. Absence of patches with unicuspidate teeth on fourth ceratobranchial (4 C&S). Lower pharyngeal tooth plate stout, bearing molariform, unicuspid, and few bicuspid crenulated, curved anteriorly teeth restricted to horn bases (Fig. 2a). Upper pharyngeal tooth plates with unicuspidate and molariform teeth. Frayed zone bearing one concavity with small unicuspid teeth (4 C&S). Premaxillary ascending process longer than the dentigerous one. Premaxilla with 19–21(2) unicuspid teeth on outer row, larger than inner ones. Four teeth rows near symphysis. Dentary with 23–24(2) unicuspid teeth in outer row, 4 rows near symphysis. Teeth of outer row in premaxilla and dentary, slightly movable, inner ones fully depressible. Total vertebrae 35–36(4 C&S).

Colour in alcohol. Background of body pale gray or olive green. Preorbital stripe between snout tip and anterior margin of orbit, gray. Postorbital stripe between posterior margin of orbit to opercle distal margin, deep gray. Suborbital stripe black and composed of dots, one to five dots wide, usually not reaching ventral margin of cheek (13). Flanks with 5 to 7 quadrangular dark blotches, reaching faintly dorsal-fin base. Posteriormost blotch extending onto caudal peduncle. Dorsal, anal, and caudal fins, smoky; adults with some dark dots on middle caudal fin. Pectoral and pelvic fins pale yellowish. Females with a dark and wide longitudinal stripe limited below and above by a narrow white stripe on distal region of dorsal fin. Caudal spot black and subcircular, well separated from base of fin, just above of midline of caudal fin. Juveniles (55.6–69.4 mm SL) with vertical bars on flanks and scattered dots on dorsal, anal and caudal fins.

TABLE 1. Proportional measurements in percents of standard length of holotype and 20 paratypes of *Crenicichla taikyra* **sp. n.** SD=standard deviation.

	Holotype	Range	Mean	SD
Standard length (mm)	98.3	71.3–115.6		
Head length	32.6	30.0–33.4	32.3	0.96
Snout length	13.7	11.7–13.7	12.1	0.86
Head depth	18.1	16.2–19.4	17.3	0.79
Body depth	22.3	20.8–23.8	22.1	0.90
Orbital diameter	6.5	6.2–7.7	6.7	0.44
Interorbital width	6.7	5.7–7.5	6.7	0.50
Pectoral fin length	20.2	18.0–21.3	19.9	0.90
Caudal peduncle depth	11.8	11.2–12.7	11.8	0.43
Caudal peduncle length	15.4	14.0–16.5	15.0	0.68

FIGURE 3. *Crenicichla taikyra*, paratype, live specimen, MACN-ict 9466, 74.9 mm, Argentina, Corrientes province, Ituzaingo city.

Colour upon capture. Colours not greatly different from coloration in alcohol, background of body pale gray or olive green (Fig. 3). Dorsal, anal, and caudal fins pale gray or olive green. Pectoral fin hyaline, pelvic fin pale gray.

Etymology. The species epithet *taikyra* is a combination of Guaraní words tãi (tooth) and kyra (thick) referring to the thick molariform teeth and the stout lower pharyngeal tooth plate of the species.

Distribution. *Crenicichla taikyra* was found in the middle río Paraná in Misiones and Corrientes Provinces, Argentina (Figs. 4–5).

Habitat. Below the Yacyretá Dam the specimens were collected in stony environment. Secchi disk 212 mm, water temperature 25.1ºC, pH 7.14, conductivity 51.4 µS cm^{-1}, dissolved oxygen 8.2 mg l^{-1}(99.7% saturation), alkalinity 9.0 mg l^{-1}.

Stomach contents. The two specimens examined contained snails (*Potamolithus* sp. and *Limnoperna fortunei*) and remains of fishes.

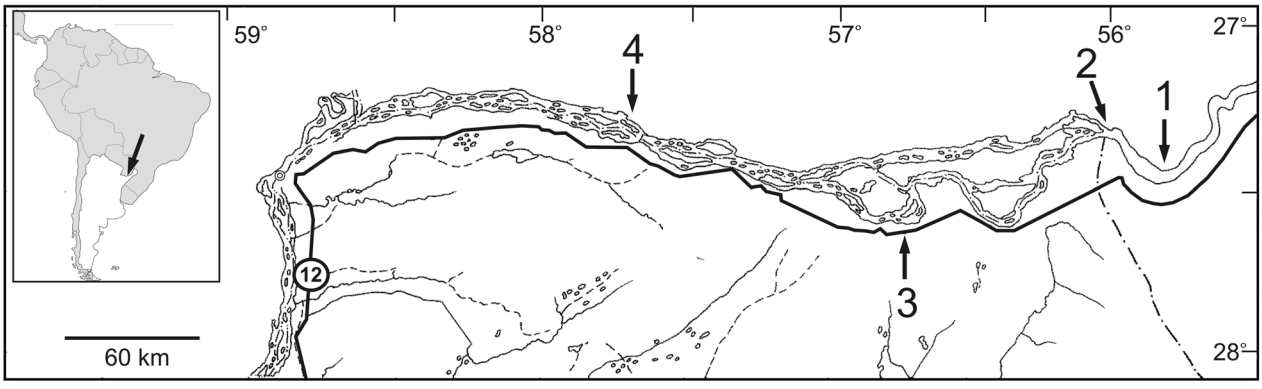

FIGURE 4. Distribution of *Crenicichla taikyra* in the río Paraná in Argentina. 1—Candelaria (type locality), 2—río Paraná at Posadas, 3—Ituzaingó city, and 4—Yahapé city. The number 12 inside the circle corresponds to national route 12.

FIGURE 5. Río Paraná at Candelaria, type locality of *Crenicichla taikyra*.

Discussion

In spite of the genus *Crenicichla* having more than 85 described species, only four of them, *C. semifasciata*, *C. jurubi*, *C. yaha*, and *C. taikyra*, are known to have molariform teeth on pharyngeal jaws.

Crenicichla semifasciata is a member of the *C. reticulata* group (Kullander *et al*. 2010, Piálek *et al.* 2012) and inhabits the río Paraguay and the lower/middle Paraná basins. *Crenicichla jurubi* is a member of the *C. missioneira* group (Lucena & Kullander 1992, Kullander *et al*. 2010) and is known only from the upper río Uruguay basin in Brazil.

Crenicichla taikyra is most similar and also most closely related to *C. yaha* (Piálek *et al.* 2012; as *Crenicichla* sp. 'Paraná' and *C*. aff. *yaha* ´Iguazú 2´, respectively). Both are members of the *Crenicichla mandelburgeri* complex (Piálek *et al*. 2012), with *C. yaha* inhabiting the río Iguazú basin above Iguazú falls and the arroyo Urugua–í, also a waterfall-separated tributary of the middle río Paraná immediately south from the Iguazú, while *C. taikyra* occurs in the main course of the middle río Paraná. During our 2012 expedition we have collected one specimen of *Crenicichla* that is very similar to *C. taikyra* just below the Iguazú falls within the Iguazú National Park. This specimen shares the same colour pattern and body proportions and other characters, but is distinct in not having the well-developed stout lower pharyngeal jaw and its associated molariform teeth. The discovery of this intermediate specimen possibly sheds some light on the evolution of *C. taikyra*. In the phylogeny of Piálek *et al.* (2012) *C. taikyra* is found in a clade with *C. yaha* and with two additional putative new species. The newly found intermediate specimen would thus support the origin of *C. taikyra* in the northern part of the middle río Paraná in Misiones, while the species is today caught only in the southern part. This would suggest a larger distribution of the species than is currently known. Among the three species and indeed among all species of the *Crenicichla*

mandelburgeri complex *C. taikyra* is most similar to *C. yaha* and its more derived durophagous dentition thus seems to be directly derived from the less developed condition in *C. yaha*.

Molariform teeth on pharyngeal jaws is a derived character among *Crenicichla* species, however this character state has appeared several times in unrelated species. It is quite surprising that so few molariform forms have evolved in general and especially in the context of the *C. mandelburgeri* species flock, since all the tributaries with endemic species have *Potamolithus* and other snail species, but this niche is likely being utilized by *Crenicichla* only in the main stream of the Paraná and in the Iguazú, but not in those endemic-rich smaller tributaries of the Middle Paraná.

Material examined. A list of comparative material of *C. scottii* and *C. vittata* is available in Casciotta (1987). In addition, the following material was studied: *Crenicichla hadrostigma*: **Argentina**. AI 220, 1 ex., 72.8 mm, Misiones, Itacaruaré, río Uruguay basin. *Crenicichla hu*: **Argentina**. MACN-ict 9429, 118.0 mm, Misiones, río Paraná basin, arroyo Piray–Miní. MACN-ict 9430, 17 (paratypes), 76.9–153.0 mm. *Crenicichla iguassuensis*: **Brasil**. FMNH 54159 (holotype), 137.0 mm, Porto Uniao da Victoria, Rio Iguassu. *Crenicichla jupiaensis*: **Argentina**. AI 226, 2 ex., 87.7–93.0 mm, Corrientes, río Paraná at Yahapé. AI 227, 1 ex., 60.7 mm, Corrientes, río Paraná at Yahapé. *Crenicichla lepidota*: **Argentina**. MACN-ict 5067, 4 ex., 67.7–113.4 mm, Misiones, Represa Estación Experimental Cerro Azul. FML 00528, 1 ex., 111.5 mm, Salta, Luna Muerta, Hickman. MACN-ict 3656, 2 ex., 116.0–165.7 mm, Formosa, Riacho de Oro. MACN-ict 7275, 1 ex., 151.6 mm, Chaco, Esteros del Palmar. FML 00312, 1 ex., 138.0 mm, Corrientes, Isla Apipé Grande, Ituzaingó. MACN-ict 4091, 1 ex., 98.4 mm, Entre Ríos, río Uruguay, Concepción del Uruguay. MACN-ict 2314, 6 ex., 59.9–104.2 mm, Buenos Aires, Isla Martín García. **Uruguay**. MNHNM 2087, 1 ex., 72.9 mm, Departamento Colonia, arroyo Limetas. *Crenicichla mandelburgeri*: **Argentina,** Misiones, río Paraná basin. MACN-ict 9439, 2 ex., 83.7–93.0 mm, arroyo Guaruhape en ruta 220. MACN-ict 9440, 2 ex., 72.6–82.3 mm, arroyo Cuñapirú, in route 223 near Ruiz de Montoya. MACN-ict 9441, 7 ex., 56.0–93.0 mm, arroyo Cuñapirú (arroyo Tucangua). MACN-ict 9442, 2 ex., 102.2–208.0 mm, arroyo Chapa, ruta 6. *Crenicichla ocellata*: **Paraguay**. MSNG 33700 (holotype), 257.5 mm, Puerto 14 de Mayo, Bahía Negra, Chaco Boreal. *Crenicichla semifasciata*: **Argentina**. MACN-ict 3683, 1 ex., 68.8 mm, Formosa, Riacho de Oro. MACN-ict 6239, 1 ex., 176.6 mm, Entre Ríos, arroyo Curupí. *Crenicichla tesay*: **Argentina** MACN-ict 9016 (holotype), 115.1 mm, **Argentina**, Misiones, río Iguazú basin, arroyo Verde. *Crenicichla yaha*: **Argentina**, Misiones. MACN-Ict 8924 (holotype), 103.7 mm, arroyo Urugua–í in Isla Palacios. AI 199, 1 ex., 116.6 mm, río Iguazú basin, arroyo Benavente. MTD-F 30606 (paratype), 1 ex., 105.9 mm, arroyo Urugua–í in ruta provincial 19, Parque Provincial Islas Malvinas. AI 200 (paratype), 1 ex., 135.8 mm SL, arroyo Uruzú (affluent of Arroyo Urugua–í) in ruta provincial 19, Parque Provincial Islas Malvinas. AI 202 (paratypes), 4 ex., 1 (C&S) 37.4–48.5 mm, arroyo Urugua–í in Isla Palacios. AI 315, 1 ex. (C&S) 77.6 mm SL, río Iguazú superior, Parque Nacional Iguazú. *Crenicichla ypo*: **Argentina**, Misiones, río Paraná basin. MACN-ict 9431 (holotype), 105.5 mm, arroyo Urugua–í, at Establecimiento “Alto Paraná”. MACN-ict 9432 (paratype), 3 ex., 101.0–116.0 mm, arroyo Urugua–í basin, arroyo Grapia, 6 km north from Colonia Gobernador J. J. Lanusse. MACN-ict 9433 (paratype), 1 ex., 133.0 mm, arroyo Uruzú and route 19, Parque Provincial Islas Malvinas. MACN-ict 9434 (paratype), 1 ex., 111.0 mm, arroyo Urugua–í and route 19, Parque Provincial Islas Malvinas. MACN-ict 9435 (paratype), 1 ex., 137.0 mm, arroyo Urugua–í and route 19, Parque Provincial Islas Malvinas. MACN-ict 9436 (paratype), 1 ex., 123.0 mm, arroyo Urugua–í in Isla Palacio. MACN-ict 9438 (paratype), 3 ex., 89.8–109.0 mm, arroyo Falso Urugua–í.

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