



## A new long-snouted species of *Corydoras* Lacépède, 1803 (Siluriformes: Callichthyidae) from the rio Madeira basin

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### Abstract

A new species of *Corydoras* is described from the rio Aripuanã, rio Madeira basin, Mato Grosso State, Brazil. The new species can be distinguished from its congeners by the presence of the following features: long mesethmoid, with anterior tip well developed, conspicuously larger than 50% of bone length; posterior margin of dorsal-fin spine with serrations directed towards tip of spine; one to two longitudinal black stripes on flanks; absence of a black blotch across the eyes (mask); absence of a large black blotch on dorsal fin; and transversal black bars on caudal fin. Comments on endemism in interfluvial region between Madeira and Tapajós rivers are briefly discussed.

**Key words:** Neotropical region, Amazon, fish, Corydoradinae, taxonomy

### Resumo

Uma espécie nova de *Corydoras* é descrita do rio Aripuanã, bacia do rio Madeira, estado do Mato Grosso, Brasil. A espécie nova pode ser distinguida de suas congêneres pela presença das seguintes características: mesetmóide longo, com a extremidade anterior bem desenvolvida, conspicuamente maior do que 50% do comprimento do osso; margem posterior do espinho da nadadeira dorsal com serrilhas voltadas em direção à ponta do espinho; uma a duas faixas pretas longitudinais nos flancos; ausência de uma mancha preta através dos olhos (“máscara”); ausência de uma mancha preta grande na nadadeira dorsal; e barras transversais pretas na nadadeira caudal. Comentários sobre endemismos na região interfluvial entre os rios Madeira e Tapajós são brevemente discutidos.

**Palavras chave:** região Neotropical, Amazônia, peixe, Corydoradinae, taxonomia

### Introduction

The Callichthyidae are small- to medium-sized armored catfishes, which can be clearly recognized by the presence of two longitudinal series of dermal plates on the flanks (Reis, 2003). *Corydoras* Lacépède, 1803, the largest genus, comprises about 170 valid species (Britto *et al.*, 2009; Tencatt *et al.*, 2013; Tencatt & Pavanelli, 2015; Tencatt & Ohara, 2016), and is the most speciose genus of the Siluriformes. The genus is widely distributed in cis-andean South America, predominantly occurring in the Amazon basin, where more than the half of the known species can be found (Tencatt & Ohara, 2016). Despite the efforts to elucidate their taxonomy (e.g. Gosline, 1940; Nijssen, 1970; Nijssen & Isbrücker, 1980) and systematics (e.g. Britto, 2003; Alexandrou *et al.*, 2011), several species and their interrelationships remain poorly known.

The rio Madeira is a tributary to the rio Amazonas, and it harbors 42 species of *Corydoras*, nearly one quarter of the species of the genus (Tencatt & Evers, 2016; Tencatt & Ohara, 2016). Recently, Tencatt & Ohara (2016) described two new species from the rio Madeira basin with similar color patterns, *C. brittoi* and *C. pavanelliae*, and demonstrated that they are from clearly different lineages of species *sensu* Alexandrou *et al.* (2011). A third new

sympatric species also with similar color pattern and different lineage was known at that time, but there were not enough specimens to describe it. Recently, additional specimens were found mixed with other lots of *Corydoras* at the UFRO fish collection. Therefore, it is now possible to provide the formal description of this new species.

## Material and methods

Measurements were obtained using digital caliper to the nearest millimeter. Morphometric and meristic data were taken following Reis (1997) with the modifications of Tencatt *et al.* (2013). Morphometrics are reported as proportion of standard length (SL) or as proportions of head length (HL). Homology of barbels follows Britto & Lima (2003). For the osteological analysis, some specimens were cleared and stained (CS) according to the protocol of Taylor & Van Dyke (1985). Osteological terminology was based on Reis (1998), with the exception of parieto-supraoccipital instead of supraoccipital (Arratia & Gayet, 1995), compound pterotic instead of pterotic-supracleithrum (Aquino & Schaefer, 2002), and scapulocoracoid instead of coracoid (Lundberg, 1970). Nomenclature of the latero-sensory canals and preopercular pores are according to Schaefer & Aquino (2000) and Schaefer (1988), respectively. The supra-preopercle *sensu* Huysentruyt & Adriaens (2005) was treated here as a part of the hyomandibula according to Vera-Alcaraz (2013). Vertebral counts include only free centra, with the compound caudal centrum (preural 1+ ural 1) counted as a single element. Pharyngeal teeth were counted in both sides of the hyoid and branchial arches. The stripes were counted following Tencatt & Ohara (2016). In the description, numbers in parentheses represent the total number of specimens with those counts. Numbers with an asterisk refer to the counts of the holotype.

Comparative data of *Corydoras amapaensis* Nijssen, 1972, *C. coriatae* Burgess, 1997, *C. cortesi* Castro, 1987, *C. filamentosus* Nijssen & Isbrücker, 1983, *C. semiaquilus* Weitzman, 1964, *C. serratus* Sands, 1995, *C. solox* Nijssen & Isbrücker, 1983 and *C. vittatus* Nijssen, 1971 were obtained through their original descriptions and/or high resolution photographs of type specimens hosted in the Natural History Museum, London. Photographs of other pertinent type specimens were available for examination through the All Catfish Inventory website (Morris *et al.*, 2006). Institutional abbreviations are: AI, Asociación Ictiológica de La Plata, La Plata; ANSP, Academy of Natural Sciences of Drexel University, Philadelphia; BMNH, Natural History Museum, London; INPA, Instituto Nacional de Pesquisas da Amazônia, Manaus; LBP, Laboratório de Biologia de Peixes da Universidade Estadual Paulista “Júlio de Mesquita Filho”, Botucatu; MCP, Museu de Ciências e Tecnologia da Pontifícia Universidade Católica, Porto Alegre; MCZ, Museum of Comparative Zoology, Harvard University, Cambridge; MNRJ, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro; MUSM, Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima. MZUSP, Museu de Zoologia da Universidade de São Paulo, São Paulo; NMW, Naturhistorisches Museum, Wien; NRM, Naturhistoriska Riksmuseet, Stockholm; NUP, Coleção Ictiológica do Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura da Universidade Estadual de Maringá, Maringá; ROM, Royal Ontario Museum, Toronto; ZUFMS-PIS, Coleção Zoológica de Referência da Universidade Federal de Mato Grosso do Sul, Campo Grande.

## *Corydoras zawadzki*, new species

(Figs. 1, 2, 3, Table 1)

**Holotype.** MNRJ 45565, 48.7 mm SL, Brazil, Mato Grosso State, Colniza Municipality, Guariba District, Igarapé Pica-Pau, a tributary to the rio Juma, rio Aripuanã drainage, rio Madeira basin, 09°22'27"S 60°02'59"W; W. M. Ohara, D. B. Hungria & B. Barros, 16 Jul 2013.

**Paratypes.** All from Brazil, Mato Grosso State, Colniza Municipality, Guariba District, rio Aripuanã drainage, rio Madeira basin. MZUSP 118817, 5, 35.1–50.0 mm SL, tributary of Igarapé Água Branca, itself a tributary of rio Guariba, 09°06'47"S 60°25'14"W; W. M. Ohara, D. B. Hungria & B. Barros, 15 Jul 2013. INPA 52737, 4, 37.3–44.3 mm SL; MCP 49452, 3, 41.1–46.8 mm SL; NUP 17823, 4, 43.8–46.8 mm SL; NUP 17824, 1 CS, 39.9 mm SL; ZUFMS-PIS 4181, 1, 46.7 mm SL; same data as the holotype.

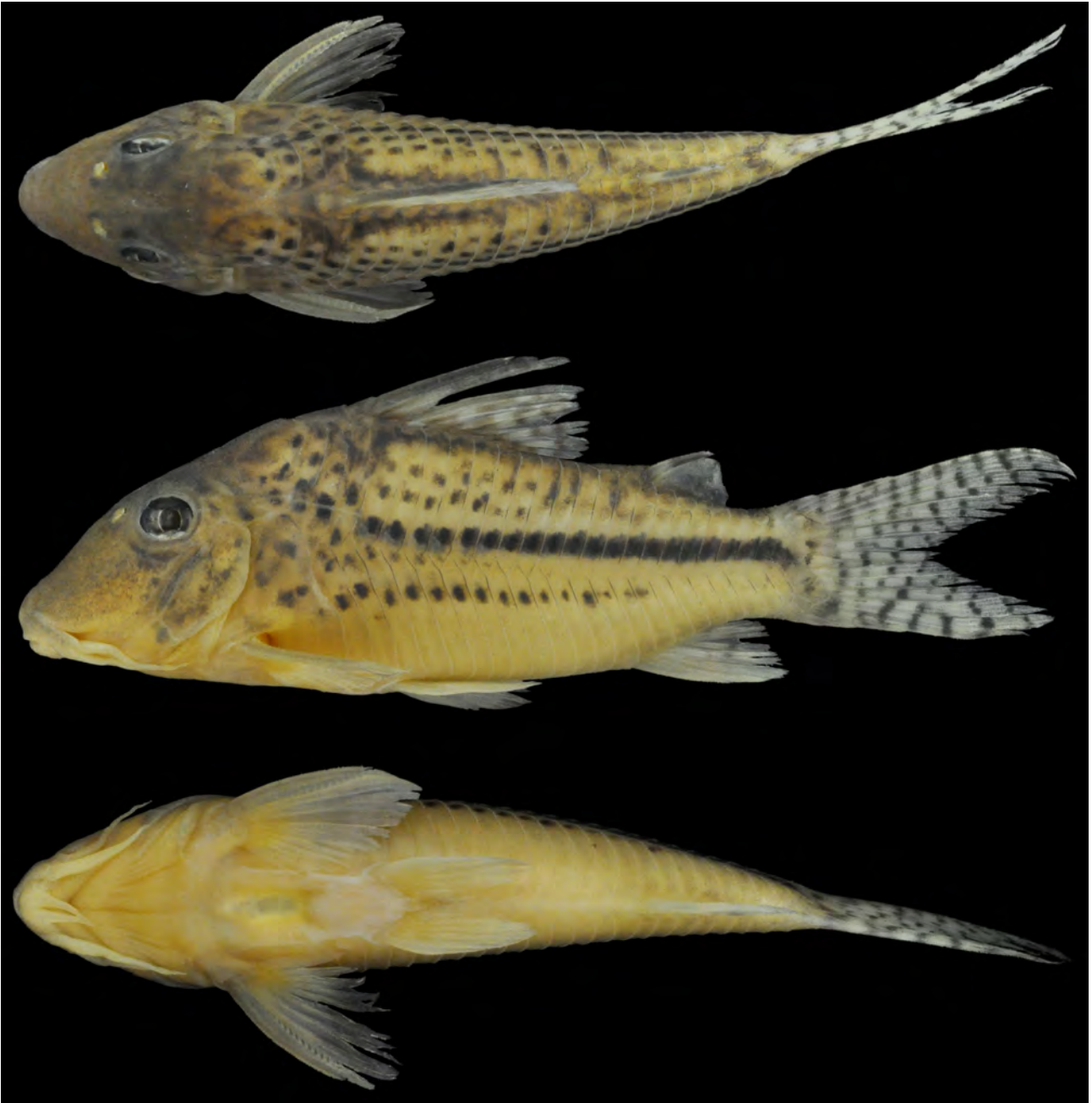
**Diagnosis.** *Corydoras zawadzki* can be distinguished from its congeners, with exception of the species from lineages 1 and 8 *sensu* Alexandrou *et al.* (2011), by the presence of a long mesethmoid, with anterior tip well

developed, conspicuously larger than 50% of the bone length (*vs.* short, with anterior tip smaller than 50% of the bone length). The new species can be distinguished from the species of lineage 8 by the presence of the posterior margin of dorsal spine with serrations directed towards tip of the spine (*vs.* directed towards origin of spine); from the species of lineage 1, except *C. acutus* Cope, 1872, *C. amapaensis*, *C. coriatae*, *C. cortesi*, *C. filamentosus*, *C. fowleri* Böhlke, 1950, *C. geoffroy* Lacépède, 1803, *C. narcissus* Nijssen & Isbrücker, 1980, *C. semiaquilus*, *C. serratus*, *C. solox*, *C. treitlii* Steindachner, 1906, and *C. vittatus*, by the presence of one to two longitudinal black stripes on flanks (*vs.* four to five longitudinal rows of black spots on flanks, which may be coalescent and form stripes in some specimens of *C. maculifer* Nijssen & Isbrücker, 1971; absence of stripes on flanks in remaining species). *Corydoras zawadzki* can be distinguished from *C. amapaensis*, *C. coriatae*, *C. cortesi*, *C. fowleri*, *C. narcissus*, *C. semiaquilus*, *C. serratus*, and *C. solox* by the absence of a black blotch across the eyes (or mask; *vs.* mask present); from *C. acutus* by the absence of a large black blotch on dorsal fin (*vs.* presence); from *C. treitlii* by the presence of transversal black bars on caudal fin (*vs.* absence).

**Description.** Morphometric data presented in Table 1. Head compressed with acutely convex dorsal profile; roughly triangular in dorsal view. Snout conical and long; conspicuously pointed. Head profile slightly concave from tip of snout to anterior nares; ascending and slightly convex from this point to dorsal-fin origin; region between eye and posterior tip of parieto-supraoccipital slightly concave in some specimens. Profile slightly convex along dorsal-fin base. Postdorsal-fin body profile slightly concave to adipose-fin spine; concave from this point to caudal-fin base. Ventral profile of body nearly straight from isthmus to pectoral-fin origin; slightly convex from this point to pelvic-fin origin; slightly convex from this point to anal-fin origin; abruptly concave until caudal-fin base. Body roughly elliptical in cross section at pectoral girdle, gradually becoming more compressed toward caudal fin. Greatest body depth slightly anterior to vertical through dorsal-fin origin.

**TABLE 1.** Morphometric data for holotype and paratypes of *Corydoras zawadzki*. Values for holotype (included in range, n = 19), range and median  $\pm$  SD = (standard deviation).

	Holotype	Range	Mean $\pm$ SD
Standard length (mm)	48.7	35.1–50.0	42.6 $\pm$ 4.4
Percents of standard length			
Depth of body	37.0	33.6–37.9	35.9 $\pm$ 1.1
Predorsal distance	49.9	43.7–51.8	49.6 $\pm$ 1.7
Prepelvic distance	47.6	46.2–49.1	47.7 $\pm$ 0.9
Preanal distance	80.1	79.2–82.4	80.4 $\pm$ 0.9
Preadipose distance	84.4	82.1–85.3	83.7 $\pm$ 0.9
Length of dorsal-fin spine	22.6	21.3–24.7	22.9 $\pm$ 1.0
Length of pectoral-fin spine	20.3	20.1–23.0	21.2 $\pm$ 0.8
Length of adipose-fin spine	8.4	8.4–11.4	10.0 $\pm$ 0.8
Depth of caudal peduncle	14.0	13.7–16.0	14.7 $\pm$ 0.6
Length of dorsal-fin base	19.1	17.4–19.5	18.5 $\pm$ 0.6
Dorsal to adipose distance	17.7	17.1–20.2	18.5 $\pm$ 0.9
Maximum cleithral width	25.3	22.8–25.3	24.1 $\pm$ 0.7
Head length	42.5	41.4–45.2	43.5 $\pm$ 0.9
Length of maxillary barbel	18.9	13.4–22.1	18.4 $\pm$ 1.7
Percents of head length			
Head depth	81.2	74.4–81.2	77.6 $\pm$ 2.1
Least interorbital distance	23.7	21.2–24.8	23.1 $\pm$ 0.9
Horizontal orbit diameter	18.8	18.8–23.8	20.6 $\pm$ 1.3
Snout length	47.3	42.9–47.9	45.9 $\pm$ 1.5
Least internarial distance	11.6	9.5–13.0	11.2 $\pm$ 1.1



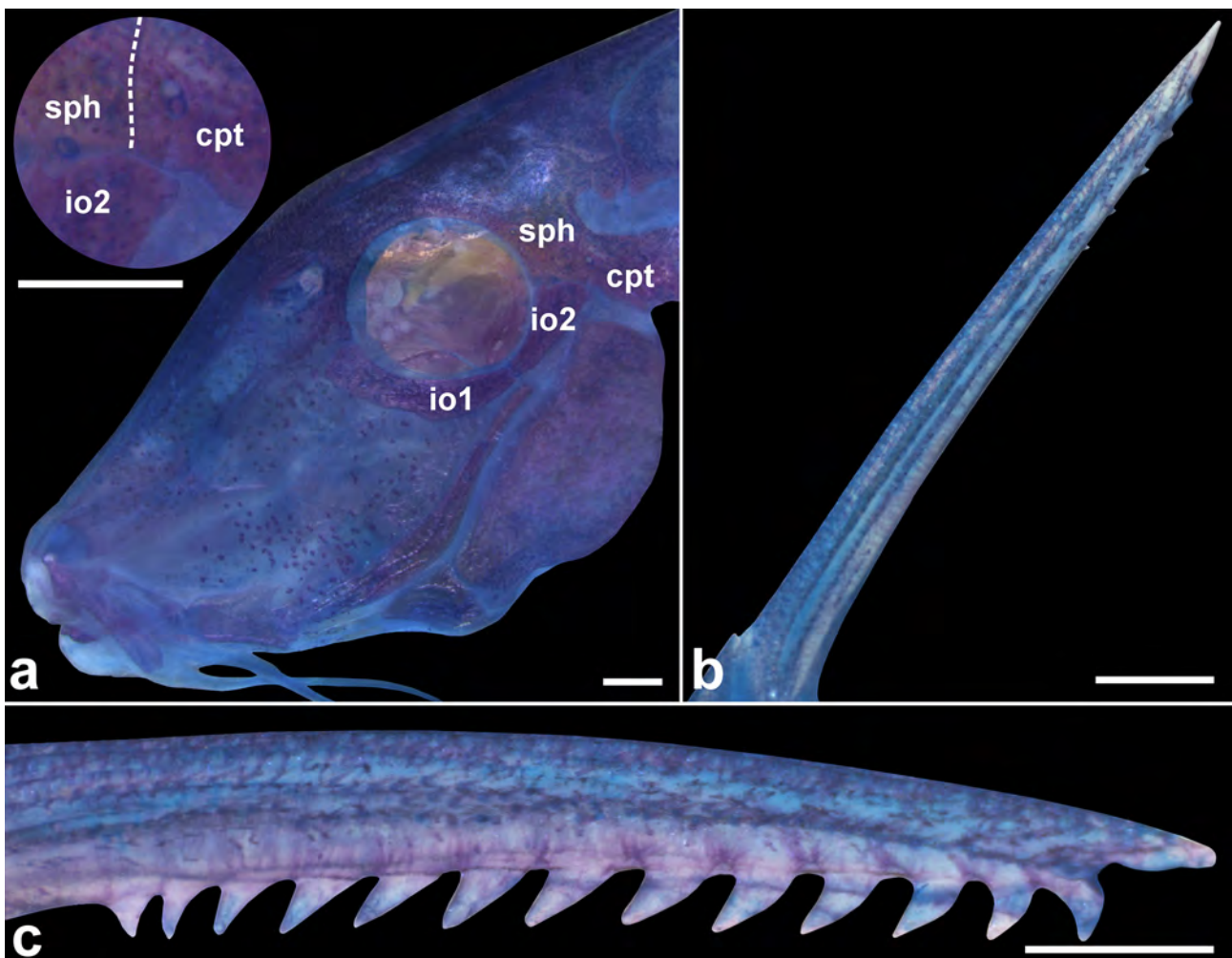
**FIGURE 1.** Dorsal (top), lateral (middle) and ventral (bottom) views of *Corydoras zawadzki*, holotype, MNRJ 45565, 48.7 mm SL. Photo by Celso Ikedo.

Eye rounded, located dorsolaterally on head; orbit delimited dorsally by lateral ethmoid, frontal and sphenotic, ventrally by infraorbitals. Anterior and posterior nares close to each other, only separated by flap of skin. Anterior naris tubular. Posterior naris close to anterodorsal margin of orbit, separated from it by distance equal to naris diameter. Mouth small, subterminal, width smaller than bony orbit diameter. Maxillary barbel long, almost reaching to anteroventral limit of gill opening. Outer mental barbel slightly longer than maxillary barbel. Inner mental barbel fleshy, with base close to its counterpart. Area at the corner of the mouth, ventral to the maxillary barbel, with a reduced fleshy flap. Small rounded papillae covering entire surface of all barbels, upper and lower lips, and isthmus.

Mesethmoid long; anterior tip well developed, conspicuously larger than 50% of bone length (see Britto, 2003: 123, character 1, state 0; Fig. 1A); posterior portion relatively narrow, covered by thick layer of skin. Nasal slender, curved laterally, inner margin with moderately-developed laminar expansion; outer margin with reduced laminar expansion; mesial border contacting only frontal. Frontal elongated, relatively narrow, with width smaller than half

of entire length; anterior projection short, size smaller than nasal length. Frontal fontanel large, conspicuously slender; posterior tip markedly entering anterior margin of parieto-supraoccipital. Parieto-supraoccipital wide, posterior process long, contacting nuchal plate.

Two laminar infraorbitals with minute odontodes; infraorbital 1 large, ventral laminar expansion moderately developed; anterior portion with poorly-developed expansion (Fig. 2a); infraorbital 2 small, thickened; with posterior laminar expansion well developed; posteroventral margin contacting posterodorsal ridge of hyomandibula, dorsal tip contacting sphenotic and compound pterotic (Fig. 2a). Posterodorsal ridge of hyomandibula close to its articulation with opercle oblong; exposed, conspicuously slender; dorsal ridge of hyomandibula between compound pterotic and opercle covered by thick layer of skin; exposed areas bearing small odontodes. Interopercle covered by thin layer of skin, somewhat triangular, anterior projection well developed. Preopercle slender, elongated, minute odontodes on external surface. Opercle dorsoventrally elongated, width smaller than half of entire length; free margin convex; posterodorsal region with slightly concave area in some specimens; without serrations and covered by small odontodes. Anteroventral portion of cleithrum partially exposed; posterolateral portion of scapulocoracoid exposed; minute odontodes placed sparsely on exposed areas. Vertebral count 23 (1); ribs 5 (1), first pair conspicuously large; complex vertebra slender. Neural and haemal spines with serrated laminar expansions on anterior margin of proximal region.



**FIGURE 2.** *Corydoras zawadzki*, NUP 17824, paratype, 39.9 mm SL, showing (a) the poorly-developed ventral expansion of the infraorbital 1 (io1) and infraorbital 2 (io2) in contact with compound pterotic (cpt) (detail), (b) dorsal-fin spine with serrations directed towards the tip of the spine and disposed distally, and (c) pectoral-fin spine with conical well-developed serrations directed towards origin of spine. In detail, the dotted line represents the suture between sphenotic (sph) and compound pterotic bones. Scale bar = 1.0 mm.





**FIGURE 3.** *Corydoras zawadzki* immediately after capture, showing the iridescent greenish yellow coloration of the body.

Four branchiostegal rays decreasing in size posteriorly. Hypobranchial 2 somewhat triangular, tip ossified and directed towards anterior portion, posterior margin cartilaginous; ossified portion moderately developed, about same size of cartilaginous portion. Five ceratobranchials with expansions increasing posteriorly; ceratobranchial 1 lacking small process on anterior margin of mesial portion; ceratobranchial 3 notched on posterolateral margin; ceratobranchial 5 toothed on posterodorsal surface, 22–25 (1) teeth aligned in one row. Four epibranchials with similar size; epibranchial 2 slightly larger than others, with small pointed process on laminar expansion of posterior margin; epibranchial 3 with triangular uncinat process on laminar expansion of posterior margin. Two wide pharyngobranchials (3 and 4); pharyngobranchial 3 with triangular laminar expansion on posterior margin. Upper tooth plate oval; 44–47 (1) teeth aligned in three rows on posteroventral surface.

Lateral-line canal entering neurocranium through compound pterotic, branching twice before entering sphenotic: pterotic branch with single pore; preoperculo-mandibular branch conspicuously reduced, with single pore opening close to postotic main canal. Sensory canal continuing through compound pterotic, entering sphenotic as temporal canal, which splits into two branches: one branch giving rise to infraorbital canal, with single pore; other branch entering frontal through supraorbital canal, with two pores. Supraorbital canal branched, running through nasal bone. Epiphyseal branch of supraorbital canal long, pore opening close to frontal fontanel. Nasal canal with two openings, first on posterior edge and second on anterior edge. Infraorbital canal running through entire second infraorbital, extending to infraorbital 1 and opening into two pores. Preoperculo-mandibular branch giving rise to preoperculo-mandibular canal, which runs through entire preopercle with three openings, leading to pores 3, 4, and 5, respectively.

Dorsal fin triangular, located just posterior to third dorsolateral body plate. Dorsal-fin rays II,8 (19), posterior margin of dorsal fin with up to five poorly-developed serrations directed towards tip of spine; serrations disposed on distal half of posterior margin (Fig. 2b). Nuchal plate well developed; almost entirely exposed, with minute odontodes on exposed area; anterior tip covered by thick layer of skin; spinelet short; spine relatively long, adpressed distal tip slightly surpassing origin of last dorsal-fin branched ray; anterior margin with small odontodes. Pectoral fin triangular, its origin just posterior to gill opening. Pectoral-fin rays I,10 (19); posterior margin of pectoral spine with 13–18 well-developed conical serrations along its entire length; serrations directed towards pectoral-fin origin (Fig. 2c). Pelvic fin oblong, located just below second ventrolateral body plate, and at vertical through first branched dorsal-fin ray. Pelvic-fin rays i,5 (19). Adipose fin roughly triangular, separated from base of last dorsal-fin ray by generally six (19) dorsolateral body plates. Anal fin somewhat triangular, located just posterior to 13<sup>th</sup> ventrolateral body plates, and at vertical through anterior margin of adipose-fin spine. Anal-fin rays, ii,6 (19). Caudal-fin rays i,11,i (1), i,12,i\* (18), four to five dorsal and ventral procurent rays; bilobed; dorsal lobe slightly larger than ventral lobe.

Four to six laterosensory canals on trunk; first ossicle tubular, second ossicle laminar, third, fourth, fifth and sixth, when present, lateral-line canals encased in third, fourth, fifth and sixth dorsolateral body plates, respectively. Body plates with minute odontodes scattered over exposed area, conspicuous line of odontodes

confined on posterior margins; dorsolateral body plates 24 (2), 25\* (14), 26 (3); ventrolateral body plates 21 (1), 22\* (15), 23 (3); dorsolateral body plates along dorsal-fin base 7; dorsolateral body plates between adipose- and caudal-fin 8\* (12), 9 (7); preadipose platelets 2 (2), 3\* (15), 4 (2); small platelets covering base of caudal-fin rays; small platelets disposed dorsally and ventrally between junctions of lateral plates on posterior portion of caudal peduncle. Anterodorsal margin of orbit, above the junction of frontal and lateral ethmoid, ventral margin of nasal capsule, and snout with small platelets (Fig. 2a). Ventral surface of head and trunk covered by small irregular platelets.

**Color in alcohol.** Overall color of body in Figure 1. Ground color of body light yellow, with top of head dark brown; region of nasal bone, ventral portion of nasal capsule, and ventral portion of infraorbital 1 dark brown or black. Snout densely covered by black chromatophores on dorsal and lateral portions; presence of diffuse slender oblique black stripe directed towards snout tip on dorsolateral portion of snout in some specimens. Maxillary barbel and proximal region of outer mental barbel covered by black chromatophores. Anterior portion of body with irregular black blotches. Dorsal portion of body with black chromatophores, more concentrated around nuchal plate and dorsal-fin base, becoming sparse towards caudal peduncle. Body with one to two longitudinal black stripes. Dorsal half of dorsolateral body plates with irregular black blotches anteriorly to adipose fin; blotches not well aligned. Ventral portion of dorsolateral body plates just above midline of flank blackened, forming thicker conspicuous longitudinal stripe along flank; intensely black spots well aligned on ventral portion of stripe. Ventral portion of dorsal half of ventrolateral body plates blackened with well-aligned series of irregular black blotches, generally forming slender longitudinal black stripe along flank; blotches not coalescent in some specimens; stripe absent or diffuse posteriorly to anal-fin last branched ray region. Posterior margin of lateral body plates blackened, becoming diffuse towards their distal portions. Dorsal fin with sparse brown blotches; dorsal half of region between dorsal spine and first branched ray, including membrane, with more concentrated black chromatophores; dorsal-fin spine blackish. Pectoral fin brownish yellow. Pelvic fin hyaline. Adipose fin with posterodorsal margin with black chromatophores; dorsal portion of adipose-fin spine black. Caudal fin covered by black spots; spots arranged in five to 10 transversal black bars.

**Color in life.** Similar to preserved specimens, but with dorsal region of body yellowish olive; ventral region whitish yellow. Longitudinal black stripes conspicuous. Body covered by greenish yellow iridescent coloration (Fig. 3).

**Sexual dimorphism.** Males have a lanceolate genital papilla (*vs.* narrow), which is common to all Corydoradinae (see Nijssen & Isbrücker, 1980; Britto, 2003), but no other dimorphism was observed.

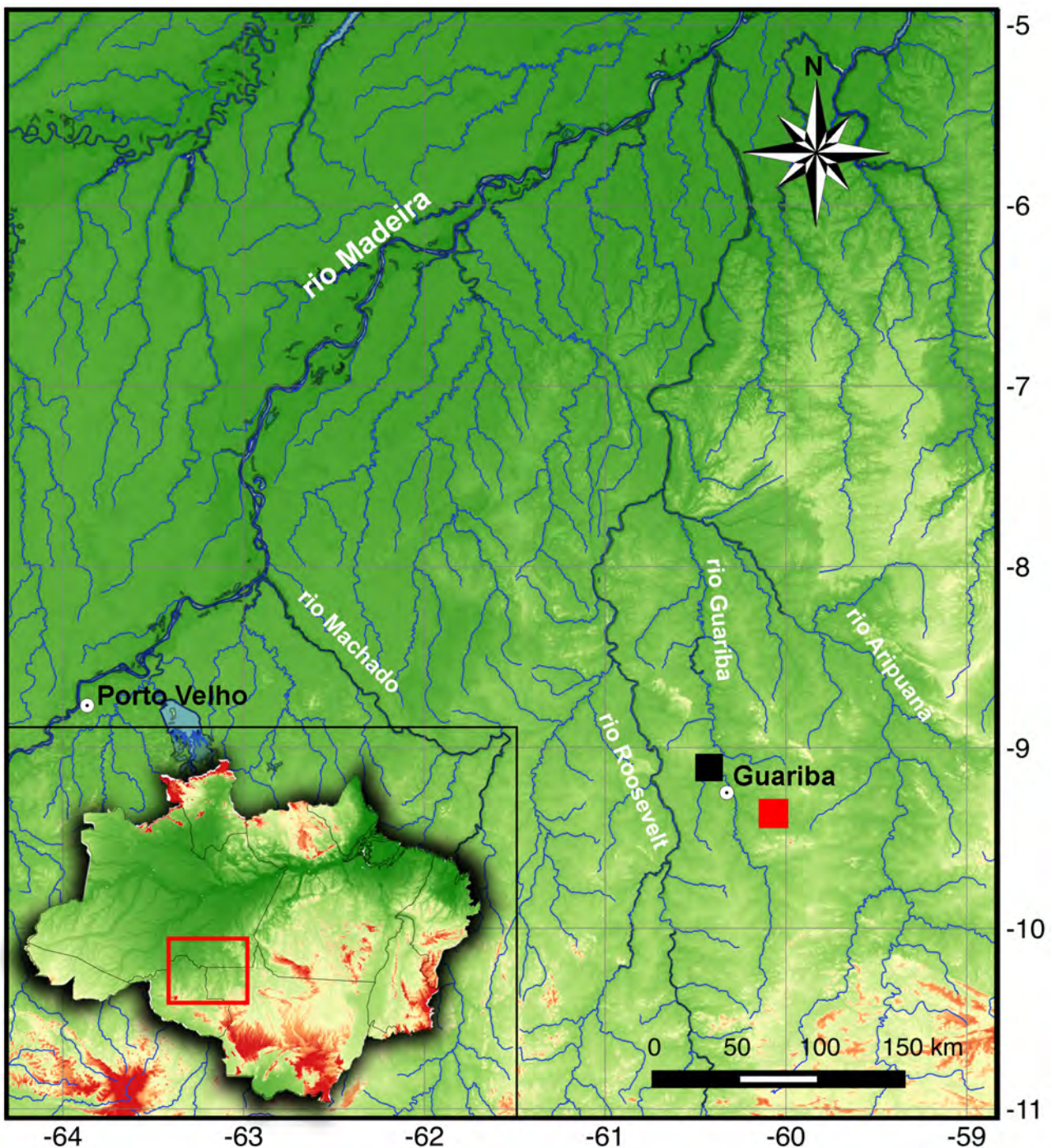
**Geographical distribution.** *Corydoras zawadzki* is known from two localities, both tributaries of the rio Guariba, middle rio Aripuanã, rio Madeira basin, Mato Grosso State, Brazil (Fig. 4).

**Ecological notes.** The type locality of *Corydoras zawadzki* is located at 130 meters above sea level, and it is a small clear water stream, 2–3 m wide and 0.5–1.8 m deep, with preserved riparian vegetation, swift water current, and bottom composed mainly by sand and dead leaves. Specimens of *C. zawadzki* were observed at night during capture in shallow portions of the stream in small groups (three individuals), and sometimes associated with *Corydoras pavanelliae* and *Corydoras brittoi*. Other species collected syntopically were *Aphyocharax* sp., *Bryconops* cf. *giacopinii* (Fernández-Yépez), *Gymnorhamphichthys rondoni* (Miranda Ribeiro), *Hemigrammus bellottii* (Steindachner), *Hemigrammus melanochrous* Fowler, *Hoplias malabaricus* (Bloch), *Hypostomus pyrineusi* (Miranda Ribeiro), *Moenkhausia collettii* (Steindachner), *Moenkhausia oligolepis* (Günther), *Parotocinclus* cf. *aripuanensis* Garavello, *Phenacogaster* cf. *beni* Eigenmann, *Poptella compressa* (Günther), *Potamorhaphis guianensis* (Jardine), and *Xenobrycon polyancistrus* Weitzman.

**Etymology.** *Corydoras zawadzki* is named in honor of Dr. Cláudio Henrique Zawadzki, professor at the Universidade Estadual de Maringá (UEM), for his comprehensive contributions to the knowledge of Neotropical ichthyofauna, especially of the Loricariidae. Cláudio is a dear friend that directly participates in the professional formation of the first author. Treated as a genitive.

**Conservation status.** *Corydoras zawadzki* is so far known only from two tributaries to the rio Aripuanã and its conservation status is uncertain based on the currently available data of its geographic distribution. Despite that, no imminent threats to the species were detected in the area, and considering that it occurs in a protected area (Reserva Extrativista Guariba Roosevelt), *Corydoras zawadzki* would be classified as Least Concern (LC) according to the International Union for Conservation of Nature (IUCN) categories and criteria (IUCN Standards and Petitions Subcommittee, 2014).





**FIGURE 4.** Map showing the known geographical distribution of *Corydoras zawadzki*. The red square represents its type-locality, the igarapé Pica-Pau, a tributary to the rio Juma, and the black square represents the igarapé Água Branca, itself a tributary of rio Guariba, rio Aripuanã drainage, rio Madeira basin.

## Discussion

The presence of convergent color patterns in *Corydoras* has been supported by a series of studies (e.g. Britto *et al.*, 2009; Alexandrou *et al.*, 2011; Tencatt *et al.*, 2013; Tencatt & Pavanelli, 2015; Tencatt & Britto, 2016; Tencatt & Ohara, 2016). Initially, the simplest way to recognize the species with homoplastic color pattern is through the morphological pattern of their snout, which is specific to each lineage of species, as demonstrated by Alexandrou *et al.* (2011). *Corydoras zawadzki* has the typical long-snouted pattern of species from lineage 1 of Alexandrou *et al.* (2011). In addition to the peculiar long snout, *C. zawadzki* can be unequivocally considered as a member of lineage 1 by the presence of an upper pharyngeal tooth plate with three series of teeth (*vs.* two), which is an



exclusive feature of this lineage. Species of lineage 8, such as *C. brittoi*, also have a long mesethmoid, and the species of lineage 1 can be promptly distinguished from those of lineage 8 by the presence of conical serrations on posterior margin of pectoral spine (*vs.* laminar), and the posterior margin of the dorsal-fin spine with serrations directed towards the tip of the spine (*vs.* directed towards the origin of the spine).

Among the species of lineage 1, *Corydoras zawadzki* has a unique color pattern. Generally, specimens of *C. zawadzki* have two longitudinal black stripes along the midline of the flank, being thus promptly diagnosed from all other lineage 1 species. Uncommonly, the new species can have only one black stripe along flanks, as in other lineage 1 congeners, however, even in this case, its pattern is clearly different from them. In *C. acutus*, *C. coriatae*, *C. cortesi*, *C. filamentosus*, *C. fowleri*, *C. semiaquilus*, *C. treitlii* and *C. vittatus* the stripe partially or entirely covers the midline of the flank (*vs.* not touching midline of flank). It differs from *C. amapaensis*, *C. geoffroy*, *C. narcissus*, *C. serratus* and *C. solox* by having the black stripe slender (*vs.* wider, at least two times thicker).

*Corydoras zawadzki*, as well as *C. pavanelliae* and *C. brittoi*, is known only from the middle rio Aripuanã. According to Benine (2002) the rio Aripuanã is apparently an area of endemism for fishes. Many endemic species have been recorded from the rio Aripuanã drainage, with some species known only upstream of the Dardanelos and Andorinha waterfalls (e.g. *Geophagus mirabilis* Deprá, Kullander, Pavanelli & Graça, *Leporinus gomesi* Garavello & Santos, *Trachycorystes menezesi* Britski & Akama), downstream them (e.g. *Hypostomus dardanelos* Zawadzki & Hollanda-Carvalho, *Jupiaba citrina* Zanata & Ohara, *Parotocinclus aripuanensis* Garavello), or in both of them (e.g. *Crenicichla hemera* Kullander, *Moenkhausia levidorsa* Benine, *Utiaritchthys longidorsalis* Jégu, Tito de Moraes & Santos) (Kullander, 1995; Benine, 2002; Zanata & Ohara, 2009; Deprá *et al.*, 2014; Zawadzki & Hollanda-Carvalho, 2015).

The interfluvial region between the Madeira and Tapajós rivers, is considered an important area of endemism in the Amazon basin for birds (e.g. Haffer, 1978; Bates *et al.*, 1998; Cracraft, 1985), primates (Silva & Oren, 1996), terrestrial vertebrates (Ron, 2000; Silva *et al.*, 2005), butterflies (Hall & Harvey, 2002) and vascular plants (Prance, 1982). Some apparently endemic species of fish occur in other tributaries (not the rio Aripuanã) of the right margin from the rio Madeira basin (e.g. *Acestridium scutatatum* Reis & Lehmann, *Acestrorhynchus isalineae* Menezes & Géry, *Archolaemus santosi* Vari, de Santana & Wosiacki), while others are known only from tributaries of the left margin from rio Tapajós basin (e.g. *Hasemania nambiquara* Bertaco & Malabarba, *Hyphessobrycon peugeoti* Ingenito, Lima & Buckup, *Leporinus reticulatus* Britski & Garavello). However, other species of fish are distributed in both systems (e.g. *Inpaichthys kerri* Géry & Junk, *Hemigrammus silimoni* Britski & Lima, *Moenkhausia levidorsa*). Thus, for the fish, the interfluvial region between the Madeira and Tapajós rivers agrees with the patterns already found in other groups of organisms, as mentioned above. Additionally, other patterns of endemism can also occur, as discussed by Ohara & Lima (2015).

The fish fauna from the middle and lower areas between the Madeira and Tapajós rivers is poorly known, further extensive studies on the distribution will be necessary to corroborate or contradict the delimitation of this area of endemism for fish. Then we may see that the interfluvial area of fish endemism contradicts the idea that river basins correspond to major areas of endemism, which was previously assigned for the rio Araguaia (Lima & Moreira, 2003), rio Tocantins (Bertaco & Lucinda 2005; Bertaco & Lucinda, 2006; Ribeiro *et al.*, 2008; Lucinda *et al.*, 2010), upper rio Tapajós (Carvalho & Bertaco, 2006; Britski & Lima, 2008; Vari & Calegari, 2014), and upper rio Xingu (Birindelli *et al.*, 2009). Future studies should evaluate if other interfluvial areas, mainly of Guiana and Brazilian shields, can represent endemic areas for fishes.

**Comparative material examined.** All the following specimens were examined: *Corydoras acutus*: MNRJ 3985, 2, 47.1–54.8 mm SL; Peru: unknown Department; Sansho-Caño. *Corydoras adolfoi*: MZUSP 26641, 1, holotype, 32.5 mm SL; Brazil: Amazonas: tributary to the upper rio Negro. *Corydoras ambiacus*: MCP 26178, 1, 42.5 mm SL; Peru: Loreto: rio Pacaya. MCP 26209, 10 of 19, 25.0–33.3 mm SL; Caño Yarina: rio Ucayali. MZUSP 26053, 2, 41.8–47.2 mm SL; Iamiriacochoa. *Corydoras approuaguensis*: MZUSP 27895–6, 2, paratypes, 43.0–46.1 mm SL; French Guyana: Cayenne: rio Approuague. *Corydoras araguaiaensis*: MZUSP 87155, 4 of 33, 24.9–46.7 mm SL, 2 CS, 27.6–31.8 mm SL; Brazil: Mato Grosso: Corixo da Saudade. *Corydoras areio*: ZUFMS-PIS 1314, 15, 34.4–41.9 mm SL, 2 CS, 38.1–38.5 mm SL; Brazil: Mato Grosso do Sul: Periquito stream. *Corydoras armatus*: MZUSP 49567, 1, 45.3 mm SL; Brazil: Amazonas: rio Acre. *Corydoras aurofrenatus*: NRM 23529, 10 of 33, 31.4–45.7 mm SL; Paraguay: Concepción: Arroyo Laguna Penayo. *Corydoras bifasciatus*: MZUSP 38976, 16, paratypes, 23.6–30.0 mm SL; Brazil: Pará: rio Cururu. *Corydoras blochi*: MZUSP 8580, 3, paratypes, 31.0–42.6 mm SL; Brazil: Roraima: rio Uraricoera. *Corydoras bondi*: ROM 66202, 7 of 134, 33.8–39.9 mm SL, 3 CS of 134, 36.7–38.6 mm SL; Guyana: Barima-Waini: Waikerebi Creek. *Corydoras brevirostris*: LBP

3080, 10, 23.8–27.7 mm SL, 3 CS, 25.8–27.9 mm SL; Venezuela: Bolívar: río Orinoco. *Corydoras britskii*: ZUFMS-PIS 862, 12, 72.0–78.0 mm SL; Brazil: Mato Grosso do Sul: rio Vermelho. *Corydoras brittoi*: MNRJ 43316, holotype, 38.1 mm SL; Brazil: Mato Grosso: rio Guariba. *Corydoras carlae*: NUP 711, 1, 47.9 mm SL; Brazil: Paraná: rio Tormenta. NUP 4425, 1 CS, 45.0 mm SL; rio Tormenta. *Corydoras cochui*: MZUSP 89055, 6, 18.7–23.6 mm SL; Brazil: Goiás: Tocantins: rio do Peixe II. MZUSP 35838, 4 of 6, 16.1–18.5 mm SL; Brazil: Goiás: Tocantins: rio Javaés. *Corydoras condiscipulus*: MZUSP 38957, 7, paratypes, 34.1–40.3 mm SL; French Guyana: Cayenne: Cumuri Creek. *Corydoras coppenamensis*: MZUSP 13995–99, 5, paratypes, 28.2–34.9 mm SL; Suriname: Saramacca: rio Coppename. *Corydoras crimmeni*: MZUSP 52490, 1, holotype, 36.1 mm SL; Brazil: Roraima: aquarium specimens said to be from near the town of Boa Vista, possibly from the rio Branco. *Corydoras davidsandsi*: MZUSP 110066, 4 of 40, 36.0–41.9 mm SL, 2 CS of 40, 40.9–42.1 mm SL; Brazil: Amazonas: rio Inambú. *Corydoras difluviatilis*: MZUSP 75268, 1, holotype, 39.8 mm SL; Brazil: São Paulo: Paulicéia stream. *Corydoras diphyses*: ANSP 169756, 2, 40.7–43.1 mm SL; Paraguay: Alto Paraná: drainage ditches north of km 250 (2 km east of Juan E. O’Leary on route 7). *Corydoras ehrhardti*: NUP 11255, 15, 36.5–46.8 mm SL; Brazil: Paraná: rio São Pedro. *Corydoras elegans*: MZUSP 26017, 6, 25.9–28.3 mm SL; Peru: Ucayali: Lobococha.

*Corydoras ephippifer*: MZUSP 31605, 2, 44.9–49.1 mm SL; Brazil: Amapá: rio Cupixi.

*Corydoras eques*: MCZ 8204, 4 of 12, paratypes, 37.6–44.4 mm SL; Brazil: Amazonas: rio Amazonas at Codajás. *Corydoras eversi*: MNRJ 43195, holotype, 44.5 mm SL; Brazil: Goiás: tributary to the rio Araguaia. *Corydoras flaveolus*: MZUSP 424, holotype, 33.4 mm SL; Brazil: São Paulo: rio Piracicaba. *Corydoras fowleri*: LBP 12462, 9, 44.3–59.9 mm SL, 1 CS, 50.4 mm SL; Peru: Loreto: tributary to the rio Ampiyacu. *Corydoras garbei*: MNRJ 18089, 14, 19.2–25.3 mm SL, 2 CS, 25.9–27.4 mm SL; Brazil: Minas Gerais: Perta-Pé lagoon.

*Corydoras geoffroy*: MZUSP 38984, 2, paratypes, 38.7–45.2 mm SL; Suriname: Marowijne: fall in the rio Oelemari. *Corydoras gossei*: MZUSP 38977, 6, paratypes, 48.4–53.4 mm SL; Brazil: Rondônia: tributary to the rio Mamoré. *Corydoras griseus*: MZUSP 108896, 4 of 13, 31.5–36.2 mm SL, 2 CS of 13, 30.6–34.5 mm SL; Guyana: Potaro-Siparuni: tributary to the rio Kuribrong. *Corydoras guapore*: ZUFMS-PIS 4000, 5, 26.9–33.6 mm SL, 2 CS, 28.8–29.2 mm SL; Brazil: Mato Grosso: rio Guaporé. *Corydoras gryphus*: MNRJ 40770, holotype, 32.3 mm SL; Brazil: Paraná: rio Paraná (near Ponte da Amizade). NUP 14676, 3 CS, paratypes, 27.7–32.4 mm SL; Brazil: Paraná: rio Paraná (near Ponte da Amizade). *Corydoras hastatus*: NUP 6862, 116, 13.1–20.7 mm SL; Brazil: Mato Grosso: baía Caiçara. *Corydoras incolicana*: MZUSP 45717, holotype, 47.6 mm SL; Brazil: Amazonas: rio Içana. *Corydoras julii*: NUP 16225, 1, 46.8 mm SL; Brazil: Piauí: rio Atalaia. *Corydoras kanei*: MZUSP 52489, holotype, 36.6 mm SL; Brazil: Roraima: aquarium specimens said to be from near the town of Boa Vista, possibly from the rio Branco. *Corydoras knaacki*: MUSM 52730, holotype, 35.6 mm SL; Peru: Madre de Dios: draining into the rio Inambari. *Corydoras lacrimostigmata*: MNRJ 40725, holotype, 31.8 mm SL; Brazil: Paraná: rio Maria Flora. NUP 14657, 3 CS, paratypes, 30.9–34.5 mm SL; rio Nestor. *Corydoras longipinnis*: AI 221, holotype, 59.5 mm SL; Argentina: Santiago del Estero: río Sali. NUP 14440, 2 CS, 29.9–33.4 mm SL; Pampa-Mayo stream. *Corydoras lymnades*: MNRJ 15765, 6, 15.8–17.7 mm SL, 2 CS, 18.1–18.4 mm SL; Brazil: Minas Gerais: rio Peruaçu. MNRJ 40186, holotype, 29.7 mm SL; Brazil: Minas Gerais: rio Guarda-Mor. *Corydoras maculifer*: NUP 8970, 2, 42.0–46.0 mm SL; Brazil: Tocantins: ribeirão Xambioazinho. *Corydoras melanistius*: BMNH 1864.1.21.86, 1, lectotype, 35.0 mm SL; Guyana: Unknown region: rio Essequibo. *Corydoras melini*: MZUSP 81163, 2, 37.0–45.0 mm SL; Brazil: Amazonas: rio Tiquié. *Corydoras multimaculatus*: MCP 29025, 2, 20.1–25.4 mm SL; Brazil: Minas Gerais: rio Peruaçu. *Corydoras napoensis*: MZUSP 26341, 1, paratype, 27.8 mm SL; Peru: Loreto: Moronacocha. *Corydoras narcissus*: LBP 10094, 1, 64.0 mm SL; Brazil: Amazonas: tributary to the rio Purus. *Corydoras nattereri*: MZUSP 110255, 4 of 31, 32.0–32.8 mm SL, 2 CS of 31, 32.3–34.4 mm SL; Brazil: São Paulo: rio Paraitinga. *Corydoras panda*: ROM 55815, 6, 26.5–39.7 mm SL; Peru: Huánuco: above Panguana in Llullapichis drainage. *Corydoras pantanalensis*: NUP 10188, 1 CS, 46.4 mm SL; Brazil: Mato Grosso: Baía Sinhá Mariana; NUP 12593, 21, 38.7–51.2 mm SL; Brazil: Mato Grosso do Sul: tributary to the rio Miranda. *Corydoras parallelus*: MZUSP 45716, holotype, 47.4 mm SL; Brazil: Amazonas: rio Içana. *Corydoras pavanelliae*: MNRJ 43317, holotype, 45.1 mm SL; Brazil: Mato Grosso: rio Guariba. *Corydoras pinheiroi*: MZUSP 48099, holotype, 54.3 mm SL; Brazil: Rondônia: tributary to the rio Ribeiro, at Guajará-Mirim. *Corydoras potaroensis*: ROM 61526, 3 of 15, 35.0–44.8 mm SL, 2 CS of 15, 32.6–35.1 mm SL; Guyana: Potaro-Siparuni: rio Potaro. *Corydoras pygmaeus*: MZUSP 26344, 4, 13.5–20.0 mm SL; Peru: Loreto: Moronacocha. *Corydoras reticulatus*: MZUSP 28752, 3, 37.3–45.1 mm SL; Peru: Ucayali: Iamiriacochoa, Masisea. *Corydoras robineae*: MZUSP 27175, holotype, 33.7 mm SL; Brazil: Amazonas: rio Aiuana. *Corydoras sarareensis*: MZUSP 48100, holotype, 40.9 mm SL; Brazil: Mato Grosso: rio Sararé. *Corydoras septentrionalis*: MZUSP 27953, 12, 28.7–41.9 mm SL; Venezuela:

Apure: Caño Caiçara. *Corydoras seussi*: MZUSP 49323, 10, paratypes, 44.3–54.0 mm SL; Brazil: Rondônia: tributary to the rio [Pacaás Novos], near Guajará-Mirim. *Corydoras similis*: LBP 10648, 7, 21.4–34.3 mm SL; Brazil: Acre: rio Iquiri. *Corydoras splendens*: NUP 12990, 1, 43.7 mm SL; Brazil: Goiás: tributary to the rio Araguaia. NUP 10195, 1 CS, 54.6 mm SL; Brazil: Mato Grosso: Pai Caetano lake. *Corydoras stenocephalus*: MNRJ 3625, 3, 31.2–62.3 mm SL; Brazil: Amazonas: rio Javari. *Corydoras sterbai*: MZUSP 94998, 1, 39.9 mm SL; Brazil: Mato Grosso: rio Guaporé. *Corydoras treitlii*: NUP 16224, 3, 21.5–45.6 mm SL; Brazil: Maranhão: rio Medonho. *Corydoras trilineatus*: MZUSP 30857, 3 of 25, 40.9–44.1 mm SL, 2 CS of 25, 44.2–43.8 mm SL; Brazil: Acre: rio Tarauacá. *Corydoras tukano*: MZUSP 82100, holotype, 40.9 mm SL; Brazil: Amazonas: rio Tiquié. *Corydoras xinguensis*: MZUSP 38987, 1, paratype, 34.5 mm SL; Brazil: Mato Grosso: igarapé upstream Porori village. *Corydoras zygatus*: MZUSP 30858, 4 of 15, 41.7–47.3 mm SL; Brazil: Acre: rio Tarauacá.

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