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Hypostomus hermanni redescription and a new species of *Hypostomus* (Siluriformes: Loricariidae) from Upper Paraná River basin, Brazil

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A redescription of *Hypostomus hermanni* is presented herein along with the description of a new species of *Hypostomus*, which is apparently endemic to the Ivaí River basin, a tributary of the Upper Paraná River basin, Brazil. *Hypostomus hermanni* is diagnosed from congeners mainly by having: usually large black blotches on body and fins; absence of keels on compound pterotic, on pre-dorsal plates, and on lateral series of bony plates; by having parieto-supraoccipital and predorsal region flat; and by having less than 46 teeth per each premaxilla or dentary ramus. The new species is distinguished from congeners mainly for lacking conspicuous blotches, parieto-supraoccipital non-carinate, and villiform bicuspid teeth.

Keywords: Armored catfishes, Hypostomini, Hypostominae, Neotropical fishes, Taxonomy.

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Uma redescricao de *Hypostomus hermanni* é aqui apresentada, juntamente com a descricao de uma nova espécie de *Hypostomus*, que é aparentemente endêmica da bacia do rio Ivaí, afluente do alto rio Paraná, Brasil. *Hypostomus hermanni* é diagnosticada de suas congêneres principalmente por apresentar: geralmente grandes manchas pretas ao longo do corpo e nadadeiras; ausência de quilhas no pterótico-composto, nas placas pré-dorsais e nas séries laterais de placas ósseas; por ter as regiões do parieto-supraoccipital e predorsal planas; e por ter menos que 46 dentes por cada ramo premaxilar ou dentário. A espécie nova distingue-se de suas congêneres principalmente pela ausência de manchas conspícuas no corpo, e supraoccipital não quilhado e dentes viliformes bicuspidados.

Palavras-chave: Cascudo, Hypostomini, Hypostominae, Peixes neotropicais, Taxonomia.

INTRODUCTION

Hypostomus Lacepède, 1803 is the richest genus of the subfamily Hypostominae, comprising about 140 valid species (Zawadzki *et al.*, 2018) as well as the second largest genus within Siluriformes. Besides that, *Hypostomus* is one of the most diverse and complex genera of South American catfishes (Carvalho *et al.*, 2010; Tencatt *et al.*, 2014). Its representatives are mainly differentiated from other Hypostominae genera by lacking a strong eversible operculum, unexposed scapular bridge, and oval-shaped caudal peduncle (Weber, 2003). The same author suggested that through morphological and molecular shreds of evidence, one-third of the species of the genus were not yet described. Despite some recent descriptions of new species (Oliveira *et al.*, 2020; Zawadzki *et al.*, 2020), this scenario has not been substantially changed. Additionally, to the high diversity of *Hypostomus*, the briefness of the descriptions from the former centuries allied to the absence of knowledge of the distribution patterns of each species lead to a common high amount of misidentifications in literature, museums, and conservation status lists.

Ihering (1905) presented the original description of *Hypostomus hermanni* as *Plecostomus hermanni*, from the Piracicaba River, in the state of São Paulo, Brazil, based solely on the analysis of the holotype, which was reported to have 240 mm in total length. In the original description, he reported traces of dark blotches on the upper surface of the head; however, he did not cite blotches being present on trunk or fins. The author also mentioned the dorsal fin with the posterior part of each interradiated membrane dusky. Other important remarks of Ihering's description was "snout moderately narrowed anteriorly; supraorbital edges not raised; parieto-supraoccipital nearly flat; temporal plates (compound pterotic) not carinate; scutes spinulose, not carinate; and a lower surface of head and abdomen in great part covered with small granular scales, with a naked area at the base of each ventral" (Ihering, 1905:560). However, the actual differentiation of *H. hermanni* from other congeners is commonly hampered by the relatively great ontogenetic and interspecific variation found in several species of the genus. Limits of a species sometimes superpose the limits of other species of the genus.

This scenario is especially seen in the Upper La Plata River basin. Some ancestral lineages of *Hypostomus* may have migrated to the basin to find an area relatively free from the competition of Amazonian algivorous/detritivorous fishes and this allowed them to experience adaptive radiation (Silva *et al.*, 2016). Therefore, the high species diversity creates great difficulty for most ichthyologists to identify species of *Hypostomus* in this basin. Then, as important as revealing the new species, redescrptions with emphasis on the morphological variability along the distribution area of each valid species from the La Plata River basin are needed.

Herein, a redescription of *H. hermanni* is provided based on the analysis of the holotype, and based on the analysis of a great amount of recently collect material of *H. hermanni* including some specimens from its type-locality, the Piracicaba River. A morphologically similar species to *H. hermanni* was also found. This species seems to be restricted to Ivaí River basin, a subbasin of the Upper Paraná River basin. This new species, which is syntopic to *H. hermanni* in the Ivaí River, is described in the present work.

MATERIAL AND METHODS

Meristic and morphometric data were obtained point-to-point with a 0.1 mm digital calipers according to the procedures of Boeseman (1968) with additions of Weber (1985) and Zawadzki *et al.* (2008, 2010). Bone and plate terminology followed Schaefer (1997) with modifications of Oyakawa *et al.* (2005), and Geerinckx, Adriaens (2006). *Hypostomus* super-groups are according to Queiroz *et al.* (2020). Vertebrae counts include five vertebrae of the Weberian apparatus and the ural complex was counted as one single structure. Some not well preserved specimens were considered as non-types.

Standard length (SL) is expressed in millimeters and all other measurements are expressed as percentages of the standard length or head length (HL), unless otherwise noted. Institutional abbreviations are: AMNH, American Museum of Natural History, New York; BMNH, Natural History Museum, London; CAS, California Academy of Sciences, San Francisco; CPUFMT, Coleção de Peixes da Universidade Federal de Mato Grosso, Cuiabá; LBP, Laboratório de Biologia e Genética de Peixes, Universidade Estadual Paulista, Botucatu; LIRP, Laboratório de Ictiologia de Ribeirão Preto, Ribeirão Preto; MCP, Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre; MCNIP, Museu de Ciências Naturais da PUC Minas, Minas Gerais; MHNG, Museum d'Histoire Naturelle, Département d'Herpétologie et Ichthyologie, Ville de Genève, Genève; MNRJ, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro; MZUEL, Museu de Zoologia da Universidade Estadual de Londrina, Londrina; MZUSP, Museu de Zoologia, Universidade de São Paulo, São Paulo; NUP, Coleção Ictiológica do Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura, Universidade Estadual de Maringá, Maringá.

RESULTS

Hypostomus hermanni (Ihering, 1905)

(Figs. 1–3; 9; Tabs. 1–2)

Plecostomus hermanni: Ihering, 1905:560 (original description; type-locality: Piracicaba River, São Paulo, Brazil). —Gosline, 1947:124 (brief description; *partim*).

Hypostomus hermanni: Isbrücker, 1980:24 (validation of *Hypostomus hermanni* (Ihering, 1905)). —Burgess, 1989:431 (checklist). —Gómez, Chebez, 1996:64 (checklist). —Isbrücker, 2001:28–31 (checklist). —Isbrücker, 2002:19 (revision of Loricariidae). —Weber, 2003:358 (checklist). —López *et al.*, 2003:51 (checklist). —Armbruster, 2004:79 (phylogeny). —Menni, 2004:81 (checklist). —Ferraris, 2007:254 (checklist). —Galves *et al.*, 2007:256 (checklist). —Langeani *et al.*, 2007:188 (checklist). —Bueno *et al.*, 2012:245 (check list cytogenetic data). —Bueno *et al.*, 2013,104 (cytogenetics). —Oliveira *et al.*, 2013:265 (checklist). —Paiva *et al.*, 2013:571–578 (allozymes; fig. 1c, p. 572). —Bueno *et al.*, 2014:3 (cytogenetics). —Frota *et al.*, 2016:6 (checklist). —Silva *et al.*, 2016:12 (phylogeny; fig. 7d, p. 14). —Zawadzki *et al.*, 2016:264 (reference to color pattern and comparative material). —Zawadzki *et al.*, 2018:257 (diagnosis from *Hypostomus latirostris* and from *H. renestoi*). —Dias, Zawadzki, 2018:394 (identification key; fig. 6, p. 401). —Zawadzki *et al.*, 2019:240 (cited as additional specimens examined). —Queiroz *et al.*, 2020:9 (phylogenetic relationship).

Diagnosis. *Hypostomus hermanni* is distinguished from the species of the super-group *H. cochliodon* Kner, 1854 by having viliform teeth and dentaries usually angled more than 100° (*vs.* spoon- or shovel-shaped teeth and dentary rami angled to each other up to 80°; from the species of the super-group *H. hemiurus* (Eigenmann, 1912) by having round dark blotches (*vs.* somewhat horizontally elongate dark blotches); from the species of the super-group *H. plecostomus* (Ihering, 1905) by lacking rows of odontodes on keels along lateral series of plates (*vs.* with moderate to well-developed rows of odontodes on keels); from *H. nematopterus* Isbrücker & Nijssen, 1984 by lacking elongate dorsal-fin ray (*vs.* extremely elongate dorsal-fin ray). From the congeners of the *H. auroguttatus* Kner, 1854 super-group *Hypostomus hermanni* is diagnosed from *H. alatus* Castelnau, 1855, *H. albopunctatus* (Regan, 1908), *H. arecuta* Cardoso, Almirón, Casciotta, Aichino, Lizarralde & Montoya-Burgos, 2012, *H. faveolus* Zawadzki, Birindelli & Lima, 2008, *H. fluviatilis* (Schubart, 1964), *H. francisci* (Lütken, 1874), *H. krishnamurtii* Zawadzki, Penido & Lucinda, 2020, *H. luteomaculatus* (Devincenzi, 1942), *H. luteus* (Godoy, 1980), *H. margaritifer* (Regan, 1908), *H. meleagris* (Marini, Nichols & LaMonte, 1933), *H. microstomus* Weber, 1987, *H. multidens* Jerep, Shibatta & Zawadzki, 2007, *H. regani* (Ihering, 1905), *H. roseopunctatus* Reis, Weber & Malabarba, 1990, *H. strigaticeps* (Regan, 1908), *H. tietensis* (Ihering, 1905) and *H. variipictus* (Ihering, 1911) by having dark spots or blotches on a clear background (*vs.* pale spots or vermiculations on a darker background); from *H. asperatus* Castelnau, 1855, *H. brevicauda* (Günther, 1864), *H. johnii* (Steindachner, 1877), *H. leucophaeus* Zanata & Pitanga, 2016, *H. nigropunctatus* Garavello, Britski & Zawadzki, 2012, *H. renestoi* Zawadzki, da Silva & Troy, 2018 and *H. uruguayensis* Reis, Weber & Malabarba, 1990 by having large dark

blotches, that is, similar to or larger than eye diameter on trunk and fins (*vs.* small spots, similar to or smaller than eye pupil diameter); from *H. atropinnis* (Eigenmann & Eigenmann, 1890), *H. denticulatus* Zawadzki, Weber & Pavanelli, 2008, *H. freirei* Penido, Pessali & Zawadzki, 2021, *H. goyazensis* (Regan, 1908), *H. iheringii* (Regan, 1908), *H. macrops* (Eigenmann & Eigenmann, 1890), *H. latirostris* (Regan, 1904) and *H. ternetzi* (Boulenger, 1895) by having parieto-supraoccipital and predorsal region flat (*vs.* parieto-supraoccipital medially raised and with raised parallel keels on predorsal region); from *H. brevis* (Nichols, 1919), *H. garmani* (Regan, 1904), *H. goyazensis* (Regan, 1908), *H. lima* (Lütken, 1874) and *H. topavae* (Godoy, 1969) by having parieto-supraoccipital and predorsal region flat (*vs.* predorsal region high and convex in frontal view); from *H. denticulatus*, *H. jaguar* Zanata, Sardeiro & Zawadzki, 2013, *H. latirostris*, *H. mutucae* Knaack, 1999, *H. paulinus* (Ihering, 1905) and *H. ternetzi* by having tooth number less than 46 on each premaxillary or dentary (*vs.* more than 50); from *H. agna* (Miranda Ribeiro, 1907), *H. angipinnatus* (Leege, 1922), *H. isbrueckeri* Reis, Weber & Malabarba, 1990, *H. latifrons* Weber, 1986, *H. luetkeni* (Steindachner, 1877) and by having a single predorsal plate bordering parieto-supraoccipital (*vs.* two to three plates); from and *H. perdido* Zawadzki, Tencatt & Froehlich, 2014 by having bicuspid teeth (*vs.* unicuspid teeth); from *H. peckoltoides* Zawadzki, Weber & Pavanelli, 2010 by having dark large blotches on body and fins (*vs.* wide dark transverse bars on body and bands on fins); from *H. guajupia* Penido, Pessali & Zawadzki, 2021 by having conspicuous blotches or marks on body and fins (*vs.* lacking conspicuous blotches or marks); from *H. heraldoi* Zawadzki, Weber & Pavanelli, 2008 by having pectoral-fin spine length smaller than pelvic-fin unbranched ray (*vs.* larger than); from *H. nigromaculatus* (Schubart, 1964) by lacking curved club-shaped pectoral-fin spine (*vs.* curved club-shaped pectoral-fin spine); *H. wuchereri* (Günther, 1864) by having abdomen plated in specimens about 100 mm SL (*vs.* abdomen mostly naked in specimens up to 150 mm SL); from *H. yaku*



FIGURE 1 | *Hypostomus hermanni*, NUP 16526, topotype, 134.4 mm SL; Brazil, São Paulo State, Piracicaba, Piracicaba River, Upper Paraná River basin. Dorsal, lateral and ventral views.

Martins, Langeani & Zawadzki, 2014 by lacking hypertrophied odontodes on laterals of trunk (*vs.* mature males with hypertrophied odontodes on laterals of trunk) and from *H. garmani* and *H. guajupia* by compressed caudal peduncle, almost triangular shaped, lateral surface of caudal peduncle straight (*vs.* oval-shaped caudal peduncle, lateral surface of caudal peduncle convex).

Description. Morphometric and meristic data are presented in Tabs. 1–2. Head broad and stout. Body width at cleithral region greater than head depth and approximately equal to head length. Snout and anterior profile of head rounded in dorsal view. Snout rising at approximately 40° from horizontal in lateral profile. Dorsal profile convex and sloped upward from snout tip to interorbital region, convex again from that point to dorsal-fin origin; sloped downward from dorsal-fin origin to region just anterior of dorsal procurrent caudal-fin rays, then elevating again to caudal-fin insertion. Caudal peduncle deep, strongly compressed laterally and slightly flattened ventrally. Eye comparatively moderate to large, dorsolaterally positioned. Interorbital space straight in frontal view; orbit barely raised. Mesethmoid region with inconspicuous median ridge on dorsal surface of snout to nares. Pair of low rounded ridges on the dorsolateral surface of head, from lateral margins of nares to anterodorsal margin of eyes, and from that longitudinally through superior portion of compound pterotic. Cheek plates usually lacking developed odontodes even in larger specimens. Exposed surface of opercle large, its horizontal length usually slightly smaller than eye diameter. Parieto-supraoccipital generally flat anteriorly; with posterior weak median ridge; with short posterior process; and posteriorly bordered by large single plate. Dorsal and lateral surfaces of head and body covered with dermal plates, except for small naked patch on tip of snout and at dorsal-fin base. Dermal plates with slightly enlarged odontodes on posterior border. Predorsal region flat, lacking ridges. Body lateral surface with five longitudinal series of plates. Dorsal series of plates dorsally flattened from dorsal-fin base origin to caudal-fin origin. Mid-dorsal and median series lacking keels. Median series bearing complete lateral-line pores. Mid-ventral series with first four to five plates bent, without keels to caudal peduncle. Ventral series gently bent.

Mouth short to moderate, dentary width approximately 15–28% of cleithral width. Lips round, short to moderate, lower lip length 16.2–30.3% of lower lip width. Outer edge of upper lip with odontodes. Lower lip not reaching gill openings line. Lower lip inner surface covered with numerous small papillae, larger proximally to dentary. Maxillary barbel moderate in size, shorter than orbital diameter. Median buccal papilla moderately developed. Villiform bicuspid teeth. Teeth moderate to robust, with elongated main cusp and smaller and pointed lateral cusp. Teeth crown ventrally arched in lateral view. Intermandibular tooth row angle about 120°.

Lower surface of head mostly plated except beneath lower lip. Abdomen largely plated except moderate to large areas around pelvic-fin insertions and around urogenital openings. Dorsal fin II,7; moderate in size; its distal border slightly to moderately convex; when adpressed usually reaching azygous plate of adipose fin; spine flexible. Adipose-fin spine inflexible and well developed, slightly curved and posteriorly oriented, with distal tip of spine usually reaching first dorsal procurrent caudal-fin ray. Pectoral fin I,6, its distal border straight; pectoral-fin spine inflexible, slightly curved with rounded tip, and usually with distally slightly developed hooked odontodes, especially in larger



FIGURE 2 | *Hypostomus hermanni*, BMNH 1905.6.9.5, holotype, 201.8 mm SL; Brazil, São Paulo State, Piracicaba, Piracicaba River, Upper Paraná River basin. Dorsal, lateral and ventral views.

specimens (about 150 mm SL, NUP 16526); when adpressed reaching from one third to half pelvic-fin spine. Pelvic fin i,5 with branched rays slightly decreasing in size posteriorly; its distal border straight to slightly convex. Pelvic-fin spine flexible, curved inward; when adpressed surpassing anal-fin insertion. Anal fin i,4; when adpressed, distal tip of posterior rays reaching sixth to seventh plate posterior to its origin. Caudal fin i,7,7,i; truncate to slightly emarginate.

Coloration in alcohol. Dorsal ground color of body and fins grayish brown. Body dorsolaterally covered with dark blotches; ventral region of body clearer and lacking blotches. Numerous blotches on head, slightly smaller than eye pupil diameter, equally set. Blotches on trunk and fins moderately spaced to each other, usually slightly larger than eye pupil. In some populations blotches on trunk and fins can be equal to eye diameter or even slightly larger (Fig. 1). In some specimens blotches inconspicuous towards caudal peduncle. Dorsal, pectoral, pelvic, and caudal fins with one series of blotches on each interradiation membrane. Adult specimens with a narrow black line bordering distal margins of dorsal and caudal fins. Dorsal fin with longitudinal inconspicuous dark stripe anteriorly margining branched rays. Blotches on caudal fin transversely aligned to form four to five bands. Usually all spines and unbranched-fin rays with blotches or dark marks, except anal-fin unbranched ray. In specimens from the Piracicaba River, blotches on dorsal fin sometimes blurred or mottled. In specimens from other localities blotches usually sharply defined and very conspicuous. blotches on anal fin more faded than on other fins.



FIGURE 3 | *Hypostomus hermanni*, in life. NUP 16526, topotype, 134.4 mm SL; Brazil, São Paulo State, Piracicaba, Piracicaba River, Upper Paraná River basin.

Coloration in life. The same pattern which was described for alcohol preserved specimens, but with greenish background color tan and blotches darker (Fig. 3).

Sexual dimorphism. Not found.

Geographical distribution and type-locality. *Hypostomus hermanni* was described from the type-locality Piracicaba. The species is known from the Piracicaba River (Fig. 4), and the Tietê River basin in the state of São Paulo, Southeastern Brazil. Additionally, the species is herein also recorded in the Paraná River main channel and three of its left tributaries, Paranapanema, Ivaí, and Piquiri basin, in the state of Paraná, Southern Brazil (Fig. 7). As specimens of *H. hermanni* are mainly found in shallow to moderate shallow running waters, if Ihering (1911) referred the type-locality Piracicaba River as the Piracicaba city, the most probable collecting spot of the holotype was the Salto de Piracicaba, a single rocky rapid stretch in the Piracicaba River at Piracicaba city (Fig. 4).



FIGURE 4 | Salto de Piracicaba, Piracicaba River, tributary of Tietê River, Upper Paraná River basin. The most probable type-locality spot of *Hypostomus hermanni*. Brazil, São Paulo State, Piracicaba, 22°43'15"S 47°39'22"W, 474 m.

TABLE 1 | Counts and morphometric data of *Hypostomus hermanni* from the Ivaí, Piquiri, Tibagi and Tietê river basins. H, holotype; SD, standard deviation; n = number of specimens.

	H	Ivaí n = 18	Piquiri n = 13	Tibagi n = 24	Tietê n = 26		
		Range	Range	Range	Range	mean	SD
Standard length (mm)	201.8	111.2–199.4	94.8–209.2	132.9–219.7	110.5–187.1	145.7	21.9
Percents of standard length							
Predorsal length	39.3	38.3–43.0	39.2–43.4	36.8–42.4	38.8–43.0	40.9	1.2
Head length	31.0	31.2–34.9	30.8–35.1	29.6–34.4	30.4–34.2	32.5	1.0
Cleithral width	31.7	30.7–34.0	30.7–33.5	28.8–32.2	30.5–34.1	32.0	0.8
Head depth	18.2	17.6–21.7	16.6–20.5	15.7–19.8	15.0–21.0	18.0	1.6
Interdorsal length	16.7	14.7–17.1	14.6–19.9	11.0–22.4	16.2–20.9	18.0	1.1
Thoracic length	23.7	20.7–26.6	20.6–27.7	15.6–27.3	20.6–26.8	23.8	1.7
Abdominal length	22.7	22.2–25.0	21.9–26.3	21.1–33.0	21.4–25.7	23.6	0.9
Dorsal-fin spine length	30.2	28.8–36.3	26.2–32.9	26.8–33.9	25.7–31.6	29.1	1.5
Pectoral-fin spine length	31.1	29.8–35.0	28.5–34.6	26.7–34.6	27.4–34.4	30.1	1.3
Pelvic unbranched ray length	23.8	21.7–27.6	23.9–28.6	23.5–27.5	24.2–29.2	26.6	1.4
Caudal-peduncle length	31.0	30.8–34.5	28.9–32.9	30.4–36.4	30.0–33.3	31.5	1.0
Caudal-peduncle depth	11.6	11.0–12.4	10.7–12.4	9.6–11.5	10.7–43.7	13.0	6.3
Percents of head length							
Cleithral width	102.2	91.7–101.5	90.0–105.7	85.2–100.3	93.6–106.2	98.3	2.6
Head depth	58.9	52.5–63.9	48.5–58.9	49.4–60.3	47.7–65.5	55.5	4.8
Snout length	69.9	60.0–68.9	61.7–68.9	58.5–68.4	62.0–67.1	64.9	1.5
Orbital diameter	17.9	20.0–24.4	18.5–24.4	15.1–21.4	17.6–22.2	19.9	1.3
Interorbital width	35.8	31.6–38.4	30.7–37.5	30.6–38.7	30.4–38.7	35.4	1.9
Dentary width	19.5	19.0–27.5	15.6–26.9	16.6–24.8	17.2–22.6	20.2	1.3
Other percents							
Orbital diameter/snout length	25.6	29.1–40.6	27.6–39.2	23.8–33.8	26.6–35.3	30.7	2.3
Orbital diameter/interorbital distance	50.0	54.6–74.8	52.3–74.6	43.5–62.6	45.6–66.2	56.3	5.3
Dentary width/interorbital distance	54.5	54.1–79.4	42.2–77.3	47.9–67.0	48.9–69.4	57.1	4.9
Dorsal-fin spine length/predorsal length	76.9	71.6–91.6	68.2–85.8	65.6–90.0	67.5–85.5	73.6	3.9
Lower unbranched caudal-fin ray/predorsal length	73.0	73.4–86.1	71.5–85.8	71.0–93.0	69.4–93.1	80.2	5.6
Adipose-spine length/caudal-peduncle depth	77.9	33.3–90.3	65.0–95.0	77.2–95.3	66.9–93.0	82.9	6.4
Caudal-peduncle depth/caudal-peduncle length	37.6	19.6–32.9	33.2–41.4	28.0–36.9	34.2–42.3	37.4	2.2
Dentary width/cleithral width	19.1	21.1–98.2	15.2–28.2	17.6–25.0	17.0–23.5	20.5	1.5
Interdorsal length/dorsal-fin base length	63.8	53.6–68.1	55.8–73.9	40.3–81.0	67.2–89.6	74.5	5.6
Lower lip width/lower lip length	28.0	16.1–32.0	19.5–37.4	19.0–33.9	16.2–30.3	22.9	3.6
Counts						mode	
Median plate series	26	25–26	24–26	24–27	25–28	26	
Pre-dorsal plates	3	3–4	3–3	3–3	3–4	3	
Plates bordering supraoccipital	1	1–1	1–3	1–3	1–3	1	
Dorsal plates below dorsal-fin base	8	7–9	7–10	7–9	7–10	8	
Plates between dorsal and adipose fin	6	4–5	5–6	4–7	4–8	6	
Plates between adipose and caudal fin	3	3–5	3–5	3–5	3–4	4	
Plates between end of anal-fin base and caudal fin	13	13–14	12–14	12–14	11–14	13	
Premaxillary teeth	39	18–55	20–42	30–52	23–45	33	
Dentary teeth	29	21–51	18–44	32–50	26–42	34	

TABLE 2 | Counts and morphometric data of *Hypostomus hermanni* from Upper Paraná River basin. H, holotype; SD, standard deviation. Range includes the holotype and 76 specimens.

	Holotype	Range	Mean	SD
Standard length (mm)	201.8	94.8–219.7	156.7	–
Percents of standard length				
Predorsal length	39.3	36.8–43.4	40.7	1.4
Head length	31.0	29.6–35.1	32.9	1.3
Cleithral width	31.7	28.8–34.1	31.7	1.2
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Thoracic length	23.7	15.6–27.3	23.2	2.0
Abdominal length	22.7	21.4–33.0	23.9	1.4
Dorsal-fin spine length	30.2	25.7–36.3	30.3	2.3
Pectoral-fin spine length	31.1	26.7–35.0	31.2	1.8
Pelvic unbranched ray length	23.8	21.7–29.2	26.2	1.5
Caudal-peduncle length	31.0	28.9–36.4	32.2	1.5
Caudal-peduncle depth	11.6	9.6–13.0	11.4	0.7
Percents of head length				
Cleithral width	102.2	85.2–106.2	96.5	3.1
Head depth	58.9	47.7–65.5	55.4	3.9
Snout length	69.9	58.5–69.9	64.4	2.0
Orbital diameter	17.9	15.1–24.4	20.0	2.3
Interorbital width	35.8	30.4–38.7	34.8	1.9
Dentary width	19.5	16.6–27.5	20.6	2.5
Other percents				
Orbital diameter/snout length	25.6	23.8–40.6	31.1	4.0
Orbital diameter/interorbital distance	50.0	43.5–74.8	57.8	8.3
Dentary width/interorbital distance	54.5	47.9–79.4	59.4	7.6
Dorsal-fin spine length/predorsal length	76.9	64.3–91.6	74.4	5.3
Lower unbranched caudal-fin ray/predorsal length	73.0	69.4–99.1	81.6	6.7
Adipose-spine length/caudal-peduncle depth	77.9	23.5–95.3	82.6	9.0
Caudal-peduncle depth/caudal-peduncle length	37.6	28.0–42.3	35.4	3.0
Dentary width/cleithral width	19.1	17.0–28.2	21.4	2.5
Interdorsal length/dorsal-fin base length	63.8	40.3–89.6	67.6	8.6
Lower lip width/lower lip length	28.0	16.1–37.4	24.6	4.3
Counts				
Median plate series	26	24–28	26	26
Pre-dorsal plates	3	3–4	3	3
Plates bordering supraoccipital	1	1–3	1	1
Dorsal plates below dorsal-fin base	8	7–10	8	8
Plates between dorsal and adipose fin	6	4–8	5	5
Plates between adipose and caudal fin	3	3–5	4	4
Plates between end of anal-fin base and caudal fin	13	11–14	13	14
Premaxillary teeth	39	18–55	36	45
Dentary teeth	29	21–51	38	41

Material examined. All from Brazil. All from Upper Paraná River basin: Tietê River basin: BMNH 1905.6.9.5, 1, 201.8 mm SL, holotype of *H. hermanni* (Ihering, 1905). LIRP 11440, 15, 56.1–111.4 mm SL. LIRP 11464, 3, 106.1–124.6 mm SL. MZUSP 1977, 1, 168.1 mm SL. MZUSP 1978, 16, 64.6–84.1 mm SL. MZUSP 2115, 2, 150.6–183.1 mm SL. MZUSP 2116, 2, 135.8–195.1 mm SL. MZUSP 2132, 1, 120.8 mm SL. MZUSP 3748, 2, 64.3–77.5 mm SL. MZUSP 10680, 4, 52.2–75.8 mm SL. MZUSP 14859, 4, 52.2–75.8 mm SL. MZUSP 14860, 1, 166.8 mm SL. MZUSP 22371, 1, 111.4 mm SL. MZUSP 24539, 2, 181.7–187.1 mm SL. MZUSP 24768, 1, 217.4 mm SL. MZUSP 53801, 7, 125.3–166.8 mm SL. MZUSP 87135, 1, 137.9 mm SL. MZUSP 87150, 1, 92.2 mm SL. MZUSP 87712, 4, 56.2–104.5 mm SL. MZUSP 87713, 6, 78.5–152.5 mm SL. MZUSP 87738, 1, 191.0 mm SL. MZUSP 92999, 8, 75.7–182.9 mm SL. MZUSP 95258, 1, 145.1 mm SL. NUP 2563, 4, 146.7–208.4 mm SL. NUP 3996, 10, 50.5–156.2 mm SL. NUP 4014, 3, 93.9–132.4 mm SL. NUP 4791, 12. NUP 5406, 3, 94.5–125.1 mm SL. NUP 6410, 15, 47.5–139.2 mm SL. NUP 6432, 19, 50.5–159.6 mm SL. NUP 16526, 11, 104.7–161.6 mm SL. Tibagi River basin: MZUEL 4464, 2, 143.4–155.9 mm SL. MZUEL 4474, 3, 127.1–135.0 mm SL. MZUEL 4644, 1, 171.7 mm SL. MZUEL 4663, 1, 87.3 mm SL. MZUEL 5528, 6, 94.0–162.5 mm SL. MZUEL 6447, 1, 109.8 mm SL. NUP 4863, 10, 169.0–230.0 mm SL. NUP 6403, 5, 146.2–189.9 mm SL. NUP 9826, 4, 149.0–228.2 mm SL. NUP 10544, 1, 165.5 mm SL. NUP 10994, 1, 37.6 mm SL. NUP 14995, 4, NUP 15005, 14, 139.0–219.7 mm SL. NUP 17245, 6. NUP 17252, 3, 77.7–196.1 mm SL. Piquiri River basin: NUP 4927, 4, 142.8–183.6 mm SL. NUP 5584, 2, 116.8–128.9 mm SL. NUP 5585, 1, 144.7 mm SL. NUP 5586, 1, 128.9 mm SL. NUP 5587, 1, 153.8 mm SL. NUP 9085, 1, 94.8 mm SL. Ivaí River basin: NUP 5402, 9, 113.2–181.4 mm SL. NUP 5403, 10, 87.4–173.3 mm SL. NUP 6409, 21, 104.6–206.3 mm SL. NUP 9806, 1, 180.6 mm SL.

Hypostomus robertsoni, new species

urn:lsid:zoobank.org:act:B2898D72-357C-43CC-AFD3-5965C06298F8

(Figs. 5–6; Tab. 3)

Hypostomus hermanni —Zawadzki *et al.*, 2004:251 (allozymes). —*Hypostomus* sp. 2 Viana *et al.*, 2013:222 (checklist). —*Hypostomus* sp. 1 Frota *et al.*, 2016:6 (checklist; fig. 2k, p. 9). —*Hypostomus* aff. *hermanni* Kamei *et al.*, 2017:2 (cytogenetic). —*Hypostomus* sp. 1 Dias, Zawadzki, 2018:394 (identification key; fig. 13, p. 408).

Holotype. NUP 22740, 127.9 mm SL; Brazil, Paraná State, Município de Marialva, Upper Paraná River basin, tributary of Ivaí River, Keller River, 23°38'28"S 51°51'31"W, 18 Aug 2014, C. H. Zawadzki, L. F. Pesenti, H. B. Ruiz & R. Vieira.

Paratypes. Brazil: state of Paraná: Upper Paraná River basin: Ivaí River basin: LBP 26253, 2, 108.1–121.6 mm SL, Marialva, Keller River, 23°38'48"S 51°52'52"W, 8 Feb 2016, C. H. Zawadzki, G. C. Zawadzki, Luiz F. Pesenti & H. P. da Silva. LIRP 15555, 3, 91.4–102.4 mm SL, divide between Floresta and Engenheiro Beltrão, Ivaí River, 23°40'30"S 52°07'12"W, 16 May 2003, C. H. Zawadzki. MCNIP 3218, 3, 105.0–110.2 mm SL; Marialva, Keller River, 23°38'48"S 51°52'52"W, 8 Feb 2016, C. H. Zawadzki, G. C. Zawadzki, L. F. Pesenti & H. P. da Silva. MZUEL 18886, 3, 90.2–102.9 mm SL; Marialva, Keller River, 23°38'48"S 51°52'52"W, 8 Feb 2016, C. H. Zawadzki, G. C. Zawadzki, L. F. Pesenti & H. P. da Silva. NUP 2597, 34, 58.4–147.5 mm SL (18, 84.3–135.7 mm SL), Município de Marialva, Keller River, 23°38'28"S 51°31'31"W, 10

Dec 1996, C. H. Zawadzki & H. F. Julio Jr. NUP 3744, 37, 58.7–119.4 mm SL (19, 93.5–119.4 mm SL), Marialva, Keller River, 23°38'25"S 51°51'32"W, 1 Mar 2005, C. H. Zawadzki & W. J. Graça. NUP 4842, 27, 89.8–122.0 mm SL (16, 92.0–121.6 mm SL), Floresta, Ivaí River, 23°42'01"S 52°07'02"W, 6 May 2003, C. H. Zawadzki. NUP 7062, 1, 89.4 mm SL; Campo Mourão, Mourão River, 24°02'23"S 52°16'22"W, 7 Apr 2009, C. H. Zawadzki, R. Ota, H. Message & L. Mommenshon. NUP 8535, 1, 172.5 mm SL; Turvo, Pedrinho River, 25°46'44"S 51°25'35"W, 28 Feb 2009, D. Viana. NUP 8536, 3, 139.3–156.9 mm SL, Turvo, Bonito River, 24°45'30"S 51°24'49"W, 23 Feb 2009, D. Viana. NUP 17253, 5, 88.9–108.9 mm SL, Marialva, Keller River, 23°38'28"S 51°51'31"W, 15 Jun 2011, L. Mommenshon. NUP 17255, 2, 76.2–111.9 mm SL, Marialva, Keller River, 23°38'28"S 51°51'31"W, Jun 2011, H. B. Ruiz.

Non-types. Brazil, Paraná State, Upper Paraná River basin, Ivaí River basin. NUP 3031, 29, 70.5–89.8 mm SL; Campo Mourão, Mourão River, Ivaí River basin, 24°02'23"S 52°16'22"W, 19 Nov 2003, C. H. Zawadzki & V. S. Ferreira. NUP 3641, 2, 84.1–85.7 mm SL; Manoel Ribas, Água Fria River, 24°31'14"S 51°40'12"W, 24 Jan 2015, V. Hillmann. NUP 4436, 3, 45.3–67.1 mm SL; Campo Mourão, do Campo, 23°59'22"S 52°20'00"W, 29 May 2006, C. H. Zawadzki & W. J. Graça. NUP 5806, 7, 32.7–56.9 mm SL; Marialva, Keller River, 23°38'30"S 51°51'33"W, 17 Apr 2008, C. H. Zawadzki, A. G. Bifi & H. V. Alcaraz. NUP 7078, 3, 63.2–81.2 mm SL; Ourizona, ribeirão Andirá, 23°22'02"S 52°11'42"W, 3 Apr 2009, C. H. Zawadzki, R. Ota, C. M. Oliveira & H. Message.

Diagnosis. *Hypostomus robertsoni* is distinguished from the species of the super-group *H. cochliodon* by having viliform teeth and dentaries usually angled more than 100° (*vs.* spoon- or shovel-shaped teeth and dentary rami angled to each other up to 80°); from the species of the super-group *H. hemiurus* by having round dark blotches (*vs.* somewhat horizontally elongate dark spots); from the species of the super-group *H. plecostomus* by lacking rows of odontodes on keels along lateral series of plates (*vs.* with moderate to well-developed rows of odontodes on keels); from *H. nematopterus* by lacking elongate dorsal-fin ray (*vs.* extremely elongate dorsal-fin ray). From the congeners of the *H. auroguttatus* super-group *Hypostomus robertsoni* is distinguished from *H. alatus*, *H. albopunctatus*, *H. arecuta*, *H. faveolus*, *H. francisci*, *H. krishnamurtii*, *H. luteus*, *H. luteomaculatus*, *H. margaritifera*, *H. meleagris*, *H. microstomus*, *H. multidentis*, *H. regani*, *H. roseopunctatus*, *H. scabriceps* (Eigenmann & Eigenmann, 1888), *H. strigaticeps*, *H. tietensis* and *H. variipictus* by having dark blotches on a clear background (*vs.* pale spots or vermiculations on a darker background); from *H. asperatus*, *H. brevicauda*, *H. johnnii*, *H. melanephelis* Zawadzki, Oliveira, de Oliveira & Rapp Py-Daniel, 2015, *H. nigropunctatus*, and *H. uruguayensis* by having faded dark blotches similar to or slightly larger than eye diameter on trunk and fins (*vs.* similar to eye pupil); from *H. denticulatus*, *H. iheringii*, *H. macrops*, *H. latirostris*, and *H. ternetzi* by having parieto-supraoccipital and predorsal region flat (*vs.* parieto-supraoccipital medially raised and with raised parallel keels on predorsal region); from *H. brevis*, *H. fluviatilis*, *H. goyazensis*, and *H. topavae* by having parieto-supraoccipital and predorsal region flat (*vs.* predorsal region high and convex in frontal view); from *H. denticulatus*, *H. freirei*, *H. kuarup* Zawadzki, Kullander & Lima, 2012 *H. latirostris*, *H. mutucuae*, *H. paulinus*, and *H. ternetzi* by having tooth number less

than 46 on each premaxillary or dentary (*vs.* more than 50); from *H. agna*, *H. isbrueckeri*, and *H. luetkeni* by having a single predorsal plate bordering parieto-supraoccipital (*vs.* two to three plates in *H. luetkeni* and three in *H. agna* and *H. isbrueckeri*); from *H. guajupia* by having conspicuous blotches or marks on body and fins (*vs.* lacking conspicuous blotches or marks); from *H. heraldoi* by having pectoral-fin spine length smaller than pelvic-fin unbranched ray (*vs.* larger than); from *H. nigromaculatus* by having pectoral-fin spine slightly curved, with diameter almost homogeneous along its length (*vs.* curved club-shaped pectoral-fin spine); *H. wuchereri* by having abdomen plated in specimens about 100 mm SL (*vs.* abdomen mostly naked in specimens up to 150 mm SL); from *H. garmani* and *H. lima* by having triangular-shaped caudal peduncle, its lateral surface straight (*vs.* oval-shaped caudal peduncle, its lateral surface convex); from *H. guajupia* by having abdominal area mostly naked, larger specimens with transverse row of platelets in cleithral region and medially along abdomen (*vs.* abdominal area densely plated, from pectoral girdle to anus); from *H. hermanni* by lacking or with inconspicuous dark (faded brown) blotches on body and fins (*vs.* usually having conspicuous black blotches), and by having truncate caudal fin (*vs.* emarginate).



FIGURE 5 | *Hypostomus robertsoni*, holotype, NUP 22740, 127.9 mm SL; Brazil, Paraná State, Marialva, Keller River, tributary of Ivaí River, Upper Paraná River basin. Dorsal, lateral and ventral views.

Description. Morphometric and meristic data are presented in Tab. 3. Head broad and moderately depressed. Body width in cleithral region greater than head depth and approximately equal to head length. Snout and anterior profile of head rounded in dorsal view. Snout rising at approximately 30° from horizontal in lateral profile. Dorsal profile weakly convex and sloped upward from snout tip to interorbital region, and from that point to dorsal-fin origin; sloped downward from dorsal-fin origin to region just anterior of dorsal procurrent caudal-fin rays, then elevating again to caudal-fin insertion. Caudal peduncle elliptically compressed, slightly flattened ventrally. Eye large, dorsolaterally positioned. Interorbital space straight in frontal view; orbit barely raised. Mesethmoid forming inconspicuous median ridge on dorsal surface of snout to nares. Pair of inconspicuous ridge on dorsolateral surface of head, from lateral margins of nares to anterodorsal margin of eyes, and from that longitudinally and softly through superior portion of compound pterotic. Exposed surface of opercle of moderate size. Parieto-supraoccipital flat, with short posterior process and bordered by a large single plate. Dorsal and lateral surfaces of head and body covered with dermal plates, except for a small naked patch on tip of snout and at dorsal-fin base. Dermal plates with very weakly hypertrophied odontodes mostly on posterior border. Predorsal region lacking ridges. Body lateral surface with five longitudinal series of plates. Dorsal series of plates dorsally flattened from dorsal-fin base origin to adipose-fin posterior edge. Mid-dorsal and median series lacking keels. Median series bearing complete lateral-line pores. Mid-ventral series with first four to five plates bent, without keels, to caudal peduncle. Ventral series gently bent, without rows of odontodes.

Mouth short to moderate. Median buccal papilla moderately developed. Lips moderate in size, transversely oval. Outer edge of upper lip covered by odontodes. Lower lip not reaching gill openings line. Lower lip inner surface covered with numerous small papillae, larger proximally to dentary. Maxillary barbel short, similar in length to eye pupil diameter, or even shorter. Villiform bicuspid teeth. Teeth moderate to robust, with lanceolated main cusp and smaller pointed lateral cusp. Teeth crown ventrally arched in lateral view. Intermandibular tooth row angle about 120°.

Lower surface of head with plated area anteriorly to gill opening. Abdomen usually mostly naked in specimens up to 130 mm SL. Larger specimens with transverse row of platelets in cleithral region and medially along abdomen. Dorsal fin II,7; moderate in size; its distal border convex; when adressed posterior rays usually reaching azygous plate of adipose fin; spine flexible. Adipose-fin spine short, inflexible, moderately curved, and backward oriented, with distal tip usually not reaching first dorsal procurrent caudal-fin ray. Pectoral fin I,6, its distal border straight; pectoral-fin spine inflexible, slightly curved with rounded tip, and usually with distally moderately developed hooklets, especially in larger specimens (*i.e.*, about 150 mm SL; NUP 8536); when adressed reaching about one-third pelvic-fin spine. Pelvic fin i,5 with anterior branched rays slightly larger than posterior ones; its distal border straight to slightly convex; pelvic-fin spine flexible, slightly curved inward; when adressed surpassing anal-fin insertion. Anal fin i,4; when adressed, distal tip of posterior rays reaching fifth to sixth plate posterior to its origin. Caudal fin i,7,7,i; truncate to slightly emarginate.

Color in alcohol. Dorsal surface of head and trunk dark, varying between brown to grey (Fig. 5). Fins of the same color as body dorsal surface. Body surface usually

without blotches; some juvenile specimens with inconspicuous dark blotches of similar size on head. Compound pterotic usually without blotches. Dorsal fin without blotches; interradial membrane with inconspicuous dark stripe anteriorly margin each branched ray. Few small specimens with inconspicuous blotches at the base of dorsal-fin posterior rays. Adipose and caudal fins without blotches. Pectoral and pelvic fins usually without blotches; few specimens with inconspicuous dark blotches on the proximal region of both fins. Saddles sometimes present, which may be the so-called “stress color” saddles (Glaser, Glaser, 1995:63). Ventral region of body without blotches; whiter than dorsal region.

Color in life. Color in life similar to that on fixed specimens, but being more brown to grayish brown. Sometimes with faded dark blotches mainly on the dorsal region of head and trunk (Fig. 6). Black pupil bordered by a golden yellow ring.



FIGURE 6 | Specimens of *Hypostomus robertsoni* in life, with inconspicuous dorsal fin dark blotches.

Sexual dimorphism. Not found.

Geographical distribution. *Hypostomus robertsoni* is only known from the Ivaí River basin (Fig. 7). Specimens of the new species were found in some main tributaries as the Keller River (Fig. 8), the type-locality, Bonito River, and Água Fria River.

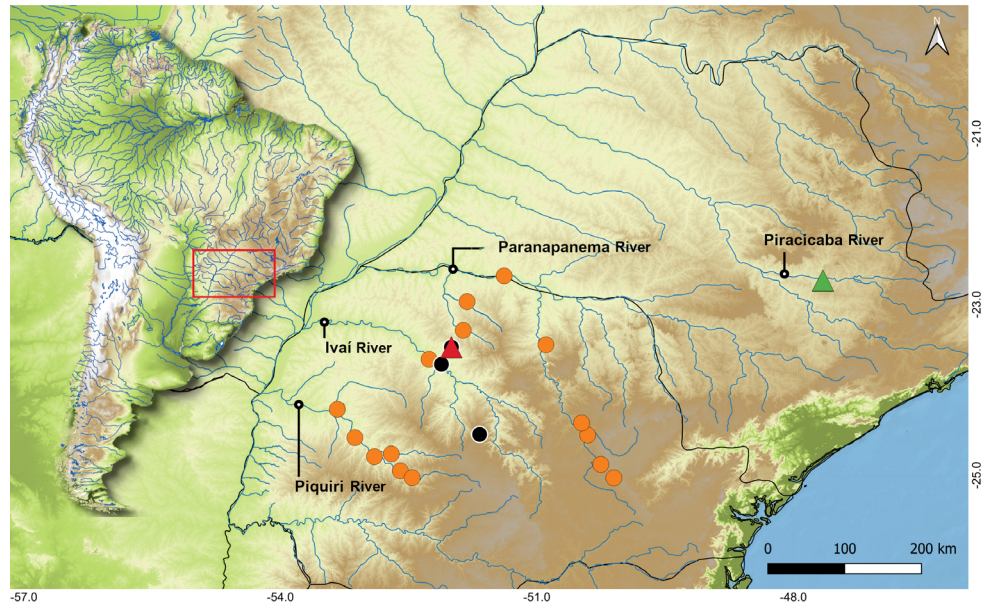


FIGURE 7 | Distribution of *Hypostomus hermanni* (green triangle, type-locality, and orange circles) and *H. robertsoni* (red triangle, type-locality, and black circles) among Upper Paraná River basin. Some marks may represent more than one record.



FIGURE 8 | Keller River, tributary of Ivaí River, Upper Paraná River basin. Brazil, Paraná State, Marialva. Type-locality of *Hypostomus robertsoni*.

TABLE 3 | Counts and morphometric data of *Hypostomus robertsoni*. SD, standard deviation. Range includes the holotype and 68 paratypes.

	Holotype	Range	Mean	SD
Standard length (mm)	127.9	82.8–135.7	103.6	–
Percents of standard length	Holotype	Range	Mean	Mode
Predorsal length	41.0	38.0–42.5	40.6	1.0
Head length	32.5	29.7–40.9	32.5	1.4
Cleithral width	31.9	21.9–33.2	30.9	1.3
Head depth	17.0	13.9–19.6	16.5	1.0
Interdorsal length	16.8	15.7–23.7	18.3	1.5
Thoracic length	21.7	19.5–30.4	23.0	1.8
Abdominal length	22.8	21.3–25.3	23.8	0.8
Dorsal-fin spine length	28.8	23.4–33.9	29.6	1.8
Pectoral-fin spine length	31.3	23.0–34.1	30.0	1.9
Pelvic unbranched ray length	28.7	22.6–32.1	26.0	1.4
Caudal-peduncle length	30.5	28.7–34.4	31.1	1.1
Caudal-peduncle depth	10.8	9.7–12.5	10.8	0.5
Percents of head length	Holotype	Range	Mean	Mode
Cleithral width	98.1	67.3–103.1	95.3	4.8
Head depth	52.2	39.6–60.8	51.0	3.4
Snout length	64.4	49.1–69.1	62.8	2.6
Orbital diameter	18.7	17.0–23.6	21.3	1.3
Interorbital width	32.2	23.2–35.2	31.4	1.8
Dentary width	20.4	14.7–23.2	19.7	1.6
Other percents	Holotype	Range	Mean	Mode
Orbital diameter/snout length	29.0	28.3–40.1	33.6	2.6
Orbital diameter/interorbital distance	58.0	56.7–83.9	67.3	5.6
Dentary width/interorbital distance	63.6	48.9–75.2	62.8	5.4
Dorsal-fin spine length/predorsal length	70.2	54.9–82.6	72.7	4.4
Lower unbranched caudal-fin ray/predorsal length	76.9	65.9–86.9	76.2	4.2
Adipose-spine length/caudal-peduncle depth	91.0	53.6–99.9	79.8	8.7
Caudal-peduncle depth/caudal-peduncle length	35.3	30.2–41.2	34.8	2.1
Dentary width/cleithral width	20.8	16.1–29.7	20.7	1.9
Interdorsal length/dorsal-fin base length	66.7	59.9–93.8	72.6	7.2
Lower lip width/lower lip length	22.2	14.9–31.3	23.5	2.8
Counts	Holotype	Range	Mean	Mode
Median plate series	26	25–28	26	26
Pre-dorsal plates	4	3–4	3	3
Plates bordering supraoccipital	1	1–3	1	1
Dorsal plates below dorsal-fin base	8	7–9	8	8
Plates between dorsal and adipose fin	6	4–7	6	6
Plates between adipose and caudal fin	4	3–5	4	4
Plates between end of anal-fin base and caudal fin	14	12–15	13	13
Premaxillary teeth	33	20–40	30	35
Dentary teeth	35	22–44	30	35

Ecological notes. The Ivaí River basin can be geographically divided into three portions. The upper portion with steep slopes ranging from about 1200 to 600 m a.s.l. is a high gradient system; from this section, the median portion goes down to about 400 m a.s.l. having strong to moderate declivities; and finally, the lower section of this river is marked by a very low declivity (Parolin *et al.*, 2010). *Hypostomus robertsoni* occurs syntopically with *H. hermanni* in this basin (e.g., NUP 4842). However, while *H. hermanni* is most frequently captured in the Ivaí River main channel, *H. robertsoni* commonly occurs either in the Ivaí River and in smaller tributaries.

Etymology. The specific epithet is in honor of Robertson Fonseca de Azevedo due to his large and constant efforts to preserve natural landscapes in the Paraná State, Brazil. Robertson fought to prevent unnecessary small hydroelectric power plants in the high gradient stretches along two main Upper Paraná River left tributaries, the Ivaí and Piquiri Rivers.

Conservation status. *Hypostomus robertsoni* is not abundant in scientific collections and does not present a wide distribution in the Upper Paraná River basin. Up to now, the species is only found in the Ivaí basin, however it is possible that it occurs in adjacent basins. Furthermore, there are no known imminent threats that would put the species at risk of extinction. Therefore, this species may be categorized as Least Concern (LC), according to the International Union for Conservation of Nature (IUCN) categories and criteria (IUCN Standards and Petitions Subcommittee, 2019).

Comparative material examined. All from Brazil. Paraguai River basin: *Hypostomus latifrons*: NUP 4369, 5, 43.3–253.0 mm SL; NUP 12206, 7, 92.6–174.8 mm SL; NUP 12513, 1, 65.9 mm SL; NUP 13413, 1, 80.4 mm SL; NUP 13415, 1, 36.1 mm SL; NUP 15063, 2, 40.8–147.3 mm SL; NUP 17800, 1, 104.5 mm SL. *Hypostomus microstomus*: MHNG 2367.90, 1, 197.5 mm SL, holotype; NUP 15173, 1, 78.3 mm SL. *Hypostomus mutucaea*: MCP 28669, 1, 67.7 mm SL, holotype; NUP 6641, 13, 52.4–109.2 mm SL; NUP 6642, 4, 62.1–98.1 mm SL. *Hypostomus peckoltoides*: MZUSP 105226, 1, 110.7 mm SL, holotype; NUP 5216, 2, 88.9–92.8 mm SL, paratypes; NUP 5217, 3, 85.5–98.2 mm SL, paratypes; NUP 5218, 3, 80.7–86.4 mm SL, paratypes. *Hypostomus renestoi*: NUP 12339, 1, 109.1 mm SL; NUP 17796, 1, 108.5 mm SL; NUP 17798, 2, 82.4–99.4 mm SL. *Hypostomus ternetzi*: BMNH 1895.5.17.64, 1, 210.2 mm SL, holotype. **Paraná basin:** *Hypostomus albopunctatus*: MZUSP 87176, 2, 120.5–154.8 mm SL; NUP 16531, 7, 77.7–222.3 mm SL; NUP 16137, 28, 42.4–139.4 mm SL. *Hypostomus brevis*: AMNH 7150, 1, 74.0 mm SL, holotype. *Hypostomus denticulatus*: MZUSP 98770, 1, 161.9 mm SL, holotype; NUP 4306, 2, 144.31–158.46 mm SL, paratypes; NUP 5635, 1, 156.6 mm SL, paratype; NUP 5637, 1, 120.1 mm SL, paratype. *Hypostomus iheringii*: NUP 2444, 1, 100.9 mm SL; NUP 9192, 1, 82.0 mm SL. *Hypostomus margaritifer*: BMNH 1907.7.6.14, 1, 120.7 mm SL, holotype; NUP 4041, 2, 131.3–161.1 mm SL; NUP 10566, 1, 142.2 mm SL; NUP 13911, 2, 147.5–173.7 mm SL. *Hypostomus meleagris*: AMNH 12246, 1, 252.8 mm SL, holotype. *Hypostomus multidentis*: NUP 2561, 5, 96.3–155.4 mm SL, paratypes; NUP 4821, 2, 160.0–169.3 mm SL; NUP 4829, 1, 184.3 mm SL, paratype; NUP 5340, 1, 157.0 mm SL, paratype; NUP 6776, 1, 167.0 mm SL. *Hypostomus nigromaculatus*: MZUSP 22674, 9, 43.8–75.9 mm SL. *Hypostomus paulinus*: BMNH 1905.6.9.4, 1, 135.0 mm SL, holotype. *Hypostomus regani*: BMNH 1905.6.7.3, 1, 174.2 mm SL, holotype; NUP 5601, 5, 138.4–209.4 mm SL; NUP 6117, 1, 147.0 mm SL; NUP 14225, 2, 136.9–150.1 mm SL. *Hypostomus strigaticeps*: BMNH 1907.7.6.1012, 3, 75.7–160.0 mm SL, syntypes; NUP 4017, 2, 72.8–100.0 mm SL; NUP 4538, 11, 82.0–140.0 mm SL. *Hypostomus tietensis*: BMNH 1905.6.9.1, 1, 127.9 mm SL, holotype. *Hypostomus topavae*: NUP 2596, 13, 79.9–108.2 mm SL; NUP

4458, 4, 65.9–102.9 mm SL; NUP 4460, 5, 62.6–108.8 mm SL; NUP 4529, 12, 49.9–116.4 mm SL; NUP 4742, 1, 136.0 mm SL; NUP 9630, 11, 29.1–118.5 mm SL; NUP 13644, 3, 34.8–76.3 mm SL. *Hypostomus variipictus*: MZUSP 2114, 1, 289.0 mm SL, holotype. *Hypostomus yaku*: MNRJ 41722, 3, 28.3–50.2 mm SL, paratypes; MZUSP 115072, 3, 24.0–53.5 mm SL, paratypes; NUP 15348, 6, 29.8–58.1 mm SL, paratypes. *Hypostomus* sp.: NUP 11769, 1, 104.5 mm SL.

DISCUSSION

Hypostomus hermanni is easily distinguished from congeners from the Upper Paraná River basin by its usually conspicuous, large and widely spaced dark blotches, its smooth body, without keels, and by its wide and somewhat depressed head. Ihering (1905) described *H. hermanni* based on a single specimen from the Piracicaba River, in the State of São Paulo and pointed out as main characteristics: snout moderately narrow anteriorly, supraorbital edges not raised, temporal plates not carinate, parieto-supraoccipital entirely bordered by a single scute, traces of dark blotches on the upper surface of the head and dorsal fin with the posterior part of each interradial membrane dusky.

The Fig. 9 shows some morphological divergences among populations of *H. hermanni*. The main divergences are eye diameter, caudal peduncle length and caudal peduncle depth. However, no population from the studied localities was fully distinguishable from those of the *H. hermanni* type-locality basin, the Tietê River basin, as revealed by data from Tab. 1. Differences in color pattern were also found among populations, however, none of those were considered strong enough to support a species distinction. As stated by Ihering (1905) specimens from the Piracicaba/Tietê Rivers have dark blotches mainly conspicuous on the head, while those along the trunk and fins are larger and less conspicuous. In the light of the material collected recently, we found most specimens with the dorsal fin showing inconspicuous dark blotches (Fig. 6). Specimens from the rios Ivaí and Piquiri Rivers have dark blotches more conspicuous, their limits better defined and the blotches are closer to each other than those in the specimens from Piracicaba/Tietê Rivers. Therefore, the morphometric and color differences found among populations of *H. hermanni* do not corroborate the statement of Gosline (1947) that “this species is relatively lacking in variability”. Gosline’s (1947) incorrect assertion was very probably due to the smaller number of specimens of *H. hermanni* he had studied. We even doubt that specimens from the Mogi Guaçu River (Grande River basin) studied by Gosline (1947) were representatives of *H. hermanni*. This proposition is based on the analysis of the material (NUP 11769) from that region. The specific status of that population is to be further considered as more material is available for morphological and molecular taxonomy.

In this context, we can recognize *H. hermanni* as having large black blotches, which can be more or less conspicuous along the distribution of the species. Besides that, although the differences found herein indicate some degree of isolation among the populations, it was not considered strong enough to break them into different species. Finally, *H. hermanni* and *H. robertsoni* were surveyed by cytogenetic procedure techniques, and both species presented $2n = 72$ chromosomes. The specimens of *H. hermanni* from the



FIGURE 9 | *Hypostomus hermanni*, from different sub basins in the Upper Paraná River basin. From top to bottom: NUP 16526, 134.4 mm SL, Tietê River; NUP 14995, 152.2 mm SL, Tibagi River; NUP 5584, 128.1 mm SL, Piquiri River; NUP 5402, 175.1 mm SL, Ivaí River.

Piquiri River (Bueno *et al.*, 2013, 2014) and those from its type-locality the Piracicaba River (Rubert *et al.*, 2016) presented multiple sites of the 5S rRNA through the 5S rDNA-FISH technique, while Kamei *et al.* (2017) found to *H. robertsoni* (*Hypostomus* aff. *hermanni* in that work) a single 5S rRNA fluorescent site.

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Angelica Corrêa Dias: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing–original draft, Writing–review and editing.

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The authors declare no competing interests.

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