

An Enigmatic New Loricariid (Actinopterygii: Siluriformes) from Relictual Upper Reaches of Chapada Diamantina, Bahia, Brazil

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Parotocinclus adamanteus, new species, is described from a series of specimens collected in the upper portion of the Rio Paraguaçu basin, a coastal river within the Chapada Diamantina domain, a large plateau on the State of Bahia in northeastern Brazil. The description of this new species represents the first record of a member of the Hypoptopomatinae from this relictual area. The new species is diagnosed from other *Parotocinclus* by having a distinct rostral border forming a fleshy intumescence on the lateral portion of head ornamented with moderately hypertrophied odontodes in adult males. It is also diagnosed from congeners by a remarkable secondary sexual dimorphism in the shape of the pelvic fin, in which the branched rays of males decrease in size, resulting in a pointed posterior fin margin (branched pelvic-fin rays in females have approximately the same size, producing a round posterior fin margin). In addition, the new species can be further distinguished from other species of *Parotocinclus* by lacking a rostral plate covering the tip of the mesethmoid anteriorly, by lacking abdominal plates between the pectoral girdle and the anus, by having numerous premaxillary teeth (45–61), and by having a short and mesially expanded ventral portion of the cheek canal plate. Recent phylogenetic analysis indicates that *Parotocinclus adamanteus*, new species, is closely related to *P. jequi*, *P. prata*, and *P. robustus*.

Parotocinclus adamanteus, espécie nova, é descrito a partir de uma série de exemplares coletados na porção superior da bacia do rio Paraguaçu, um rio costeiro dentro do domínio da Chapada Diamantina, no estado da Bahia, nordeste do Brasil. A descrição desta nova espécie representa o primeiro registro de um Hypoptopomatinae nesta área relictual. A nova espécie é diagnosticada das demais espécies de *Parotocinclus* por possuir a borda rostral formando uma área carnosa intumescida ao longo da margem lateral da cabeça que está ornamentada por odontódeos moderadamente hipertrofiados em machos adultos. Ela também é diagnosticada de seus congêneres por um notável dimorfismo sexual secundário na forma da nadadeira pélvica, no qual os raios ramificados dos machos diminuem de tamanho tornando a margem posterior aguda (os raios ramificados da nadadeira pélvica das fêmeas tem aproximadamente o mesmo tamanho produzindo uma margem posterior arredondada). Além disso, a nova espécie pode ser distinguida das outras espécies de *Parotocinclus* pela ausência de uma placa rostral cobrindo a ponta do mesetmóide anteriormente, pela ausência de placas abdominais entre a cintura peitoral e o ânus, pelo grande número de dentes da pré-maxila (45–61), e pela porção ventral da placa da bochecha com canal que é curta e expandida mesialmente. Estudos filogenéticos recentes indicam que *Parotocinclus adamanteus*, espécie nova, é proximamente relacionado à *P. jequi*, *P. prata* e *P. robustus*.

THE Chapada Diamantina is an old plateau formed of pre-Cambrian terrain with an elevation around 1000 m asl in central Bahia State, Brazil, forming the northern portion of the Serra do Espinhaço range and dividing the Rio São Francisco basin to the west, and the coastal river basins to the east, chiefly the Paraguaçu and Contas rivers. The upper portion of the Rio Paraguaçu drainage is essential to water production in a region poor in superficial hydric resources in the Caatinga dry shrubland area (Sarmiento-Soares et al., 2018). The headwaters of the Rio Paraguaçu basin, partially protected by the Chapada Diamantina National Park, possess an endemic and remarkable ichthyofaunal assemblage, including all known representatives of the trichomycteridae subfamily Copionodontinae, the troglitic catfish *Rhamdiopsis krugi* (Heptapteridae), the puzzling and endangered *Kalyptodoras bahiensis* (Doradidae), *Aspidoras psammaticus* (Callichthyidae), *Geophagus diamantiniensis* (Cichlidae), and *Kolpotocheirodon figueiredoi*, *Lepidocharax diamantina*, and *Myxiops aphos* (Characidae), plus a few widespread species like *Astyanax scabripinnis* (Characidae).

Among the yet-undescribed species in the region, there is an enigmatic loricariid which superficially resembles a

member of the Neoplecostominae (*sensu* Pereira and Reis, 2017), but more detailed analyses demonstrated it to be a member of *Parotocinclus*. We herein describe this new species on the basis of several specimens from the Chapada Diamantina, Bahia, Brazil.

MATERIALS AND METHODS

Taxonomic methods followed Pereira et al. (2007). Measurements were taken point to point under a stereomicroscope with digital calipers to the nearest 0.1 mm and are expressed as percent of the standard length (SL), except subunits of head, expressed as percent of the head length (HL). Counts of vertebrae and procurrent caudal-fin rays were made in three cleared and counterstained specimens (CS) prepared according to Taylor and Van Dyke (1985). Vertebral counts include five anterior centra in the Weberian Apparatus, and the fused ural + preural centra are counted as one element. Tooth count for *Parotocinclus arandai* is from the original description (Sarmiento-Soares et al., 2009) and for *P. bahiensis* from Britski and Garavello (2009). Nomenclature of plate rows follows Schaefer (1997). Description of coloration was based on

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specimens preserved in ethanol, as well as specimens photographed immediately after being collected. In the list of examined material, museum abbreviation and catalog number come first, followed by the number and SL range of specimens in the respective lot and then locality data.

Adult males are herein defined according to Pereira et al. (2007, 2010). Other specimens included in the list of material examined are a combination of females, young males, and immature specimens of both sexes. Extinction risk of the new species was assessed according to the categories and criteria of the International Union for Conservation of Nature (IUCN; IUCN Standards and Petitions Subcommittee, 2017). Institutional abbreviations follow Sabaj (2016). GenSeq nomenclature follows Chakrabarty et al. (2013). Genomic DNA was extracted using the DNeasy Blood & Tissue Kit (QIAGEN) from muscle fixed in 99% ethanol. Mitochondrial genes Cytochrome b (Cytb) and 16s were amplified through polymerase chain reaction using primers CytbFa and CytbRa (Lujan et al., 2015) and 16sAr and 16sBr (Palumbi et al., 2002), following established laboratory protocols. Amplicons were purified and sequenced in both directions at Functional Biosciences (Madison, WI).

***Parotocinclus adamanteus*, new species**

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Figure 1, Table 1

Neoplecostomus sp.—Zanata and Akama, 2004: 48 (species record).

New Taxon Cl.—Pereira and Reis, 2017: 12 (material examined; phylogenetic relationships); Reis et al., 2017 (phylogenetic relationships).

Holotype.—MZUSP 124560, 60.5 mm SL, Brazil, Bahia, Chapada Diamantina, Lençóis, Rio Roncador, tributary to Rio São José at Cachoeira Sonrisal, Roncador Farm on road from Lençóis to Andaraí, Rio Paraguaçu basin, 12°42'05"S, 41°21'40"W, elevation 389 m asl, M. de Pinna, F. de Pinna, and J. de Pinna, 26 January 2007.

Paratypes.—All from Brazil, Bahia, Chapada Diamantina: MCP 54158, 2, 30.8–51.2 mm SL, MZUSP 93280, 4, 28.0–57.3 mm SL, collected with holotype; MCP 54151, 4, 33.0–53.8 mm SL + 3 CS, 41.4–44.5 mm SL, MZFS 18110, 3, 28.1–49.5 mm SL, Lençóis, Ribeirão de Baixo near mouth into Rio São José, Rio Paraguaçu basin, 12°35'11"S, 41°22'58"W, A. Clistenes, 3 September 2005; MCP 54159, 4, 33.8–39.0 mm SL, MZUSP 93286, 9, 22.4–49.4 mm SL, Lençóis, Rio Capivara, tributary to Rio São José, near road from Lençóis to Andaraí, Rio Paraguaçu basin, 12°37'26"S, 41°22'35"W, elevation 341 m asl, M. de Pinna, F. de Pinna, and J. de Pinna, 26 January 2007; MCP 54160, 1 CS, 51.5 mm SL, MZUSP 93274, 8, 31.4–54.6 mm SL + 1 tissue sample, Andaraí, Rio Garapa, tributary to Rio São José approx. 600 m upstream road from Lençóis to Andaraí, Rio Paraguaçu basin, 12°44'44"S, 41°20'44"W, elevation 354 m asl, M. de Pinna, F. de Pinna, and J. de Pinna, 26 January 2007; UFBA 8498, 3, 37.9–41.8 mm SL + 1 tissue sample, Lençóis, Rio Lapão near mouth into Rio São José, Rio Paraguaçu basin, 12°32'34"S, 41°22'54.5"W, elevation 362 m asl, A. M. Zanata and R. Burger, 14 February 2018.

GenSeq-2 16s.—UFBA 8498; GenBank accession number MK770172.

GenSeq-2 Cytb.—UFBA 8498; GenBank accession number MK789723.

Diagnosis.—*Parotocinclus adamanteus* is distinguished from congeners by possessing thick, fleshy skin and an associated dense patch of hypertrophied odontodes on post-rostral plates of adult males from snout tip to opercle (Fig. 2; vs. thin skin covering post-rostral plates and odontodes not hypertrophied in adult males). It is also diagnosed from congeners by a remarkable secondary sexual dimorphism in the shape of the pelvic fin, in which the branched rays of males decrease in size, making the posterior margin of the fin pointed, while those of females have approximately similar lengths, resulting in a rounded posterior margin. The new species is also distinguished from congeners, except *P. arandai*, *P. bahiensis*, *P. jequi*, *P. prata*, and *P. robustus*, by lacking a conspicuous rostral plate covering the tip of the mesethmoid anteriorly (Fig. 3; vs. rostral plate clearly visible). *Parotocinclus adamanteus* is further distinguished from most congeners, except *P. bahiensis*, *P. jequi*, *P. prata*, and *P. robustus*, by lacking abdominal plates between the pectoral girdle and the anus (vs. abdomen variably plated from fully covered with large plates to just a few platelets near the pectoral-fin axilla or anterior to the anus). It is distinguished from *P. arandai*, *P. bahiensis*, *P. jequi*, *P. prata*, and *P. robustus* by the higher number of premaxillary teeth, 45–61 (vs. 21–28, 18–29, 21–27, 22–35, and 18–28, respectively). It is also distinguished from *P. jequi* and *P. prata* by the wider cleithrum (27.0–29.6 vs. 16.7–20.7 and 20.8–27.6% SL, respectively) and from *P. prata* by the ventral surface of head, behind the lower lip, smooth and unwrinkled in adults (vs. ventral surface of head rugose and wrinkled in adults). Finally, *P. adamanteus* is further distinguished from all species of *Parotocinclus* from the Amazon and Orinoco basins and the Guianas coastal drainages by having the ventral portion of the cheek canal plate short and expanded mesially (vs. ventral portion of the cheek canal plate elongate and expanded posteriorly, with a lamina towards the pectoral girdle).

Description.—Morphometrics in Table 1. Small-sized loriciariid with maximum measured SL 60.5 mm. Overall view of body in Figure 1. Body dorsoventrally flattened, progressively narrowing from cleithrum to end of caudal peduncle. Dorsal profile of head and body convex, gently elevating from snout tip to dorsal-fin origin, almost straight from that point to end of adipose fin, then slightly concave to caudal-fin base. In adult males, dorsal profile somewhat concave at parieto-supraoccipital and distinctly concave from terminus of adipose fin to caudal-fin base. Ventral profile of body nearly straight from snout tip to pelvic girdle, slightly elevating posteriorly along anal-fin base, and almost straight along caudal peduncle. Greatest body depth at dorsal-fin origin. Least body depth at shallowest part of caudal peduncle.

Head and predorsal region without conspicuous crests. Greatest body width at opercular region. Trunk and caudal peduncle mostly oval in cross-section, flattened ventrally and more compressed caudally. Lateral-line canal in median plate series complete, pored tube visible from compound pterotic to last plate in middle lateral series. Dorsal surface of body covered by plates except for narrow naked area around dorsal-fin base and opening of swimbladder capsule posteroventrally to compound pterotic. Predorsal plates arranged in three or four pairs or without noticeable arrangement. Mid-dorsal and mid-ventral series of lateral plates incomplete, ending 4–6 plates before caudal fin.



Fig. 1. Holotype of *Parotocinclus adamanteus*, male, MZUSP 124560, 60.5 mm SL, Brazil, Bahia, Chapada Diamantina, Lençóis, Rio Roncador, tributary to Rio São José at Cachoeira Sonrisal, Roncador Farm on road from Lençóis to Andaraí, Rio Paraguaçu basin.

Lower surface of head around lips and portion of body from pelvic-fin to anal-fin origin naked. Lateral abdominal plates absent. Abdomen mostly naked but with few scattered odontodes irregularly arranged from pectoral girdle to region between pelvic-fin bases. Pectoral girdle covered by thick skin, but sometimes one or two, usually few, odontodes attached laterally to coracoid and visible externally. Arrector

fossa widely open medially, with ventral expansion of cleithrum and coracoid only laterally. First anal-fin pterygiophore not exposed as plate-like structure in front of anal fin. Anus positioned midway between pelvic fins and anal-fin origin.

Head wide and depressed; outline rounded in dorsal view, broadly rounded in adult males. Interorbital space flat to

Table 1. Morphometric and meristic data of *Parotocinclus adamanteus*. Values are given as percent of standard length or head length. Ranges include the holotype. H = holotype, *n* = number of specimens, and SD = standard deviation.

	H	<i>n</i>	Low	High	Mean	SD
Standard length (mm)	60.5	15	38.9	60.5	49.1	
Percent of standard length						
Head length	32.9	15	32.9	36.9	34.1	1.11
Predorsal length	43.6	15	43.3	46.5	44.7	0.94
Postdorsal length	42.6	15	41.8	44.5	43.0	0.72
Preanal length	61.8	15	60.8	64.2	62.8	0.97
Preadipose length	78.5	15	77.5	80.1	78.6	0.79
Dorsal-fin spine length	19.1	15	19.1	23.2	20.5	1.29
Anal-fin unbranched ray length	14.0	14	14.0	17.8	15.4	1.29
Pectoral-fin spine length	20.3	15	17.6	22.8	20.1	1.41
Ventral-fin unbranched ray length	17.6	15	16.8	24.4	20.1	2.29
Upper principal caudal-fin ray	20.6	15	20.6	27.2	23.9	1.78
Lower principal caudal-fin ray	22.5	15	22.5	29.5	26.0	2.07
Adipose-fin spine length	6.9	15	6.5	9.9	8.5	1.09
Adipose to caudal fin distance	21.2	15	19.5	23.2	21.2	1.06
Trunk length	16.5	15	15.8	18.0	16.9	0.62
Abdominal length	22.7	15	20.3	24.0	22.3	0.99
Cleithral width	28.7	15	27.0	29.6	28.2	0.95
Body depth at dorsal-fin origin	20.7	15	16.7	21.3	18.9	1.46
Body width at dorsal-fin origin	21.6	15	16.8	25.8	19.9	2.64
Body width at anal-fin origin	14.6	14	10.8	14.9	12.6	1.18
Caudal peduncle length	39.3	15	34.8	39.3	37.1	1.21
Caudal peduncle depth	8.3	15	6.8	8.3	7.6	0.42
Caudal peduncle width	5.8	15	3.5	6.1	4.7	0.69
Percent of head length						
Snout length	59.3	15	55.3	59.9	57.7	1.46
Orbital diameter	13.2	15	13.2	17.5	14.8	1.22
Interorbital width	34.6	15	30.5	34.7	32.5	1.31
Head depth	53.8	15	43.2	53.8	49.7	2.85
Mandibular ramus left	23.4	15	15.8	23.4	19.7	2.24
Mandibular ramus right	23.0	15	13.5	23.0	19.4	2.41
Counts						
Premaxillary teeth left	60	14	45	61	52.6	4.36
Premaxillary teeth right	58	14	47	59	53.9	3.79
Dentary teeth left	54	13	41	59	50.6	5.38
Dentary teeth right	56	13	44	56	50.2	3.92
Plates in median lateral series left	24	15	24	26	24.9	0.80
Plates in median lateral series right	24	15	24	26	25.3	0.62
Plates at dorsal-fin base	6	15	5	6	5.9	0.26
Plates between dorsal and adipose	6	15	6	8	6.9	0.52
Plates between adipose and caudal	4	15	2	5	3.6	0.74
Plates at anal-fin base	3	15	2	4	3.1	0.52
Plates between anal and caudal	12	15	9	12	10.4	0.74
Azygous plates	1	13	1	2	1.1	0.28

slightly concave; upper margin of orbit slightly elevated. Three weakly elevated ridges between orbits and snout tip, more conspicuous in adult males. One in front of each nostril and two from middle of snout to anterior margins of orbits slightly more prominent. Parieto-supraoccipital slightly concave posterior to orbit in adult males. Posterior tip of parieto-supraoccipital with slightly enlarged odontodes even in smaller individuals. Snout tip with small ovoid area of naked skin, devoid of odontodes. Rostral plate absent; four to six post-rostral plates along lateral margin of snout, increasing in size posteriorly and covered by small odontodes. Preopercle exposed and supporting small odontodes. Canal-bearing lateral cheek plate with unbranched canal and not expanded mesially. Adult males with short hypertrophied odontodes and relatively thick skin over plates along lateral margin of snout forming soft fleshy area. Hypertrophied

odontodes on plates passing through skin, but small, pointed portion apparent. Eye small, dorsolaterally situated. Iris operculum absent or very reduced. Snout plates anterior to nostrils forming one or two paired plates. Nostrils approximately ovoid, slightly longer than wide, positioned closer to anterior margin of orbit than snout. Adult males with pair of shallow depressions in front of nostrils, beginning close to snout tip and area occupied by plates of infraorbital series.

Oral disk ovoid; lips well developed, occupying most of ventral surface of head. Upper lip narrow, covered with small rounded papillae. Lower lip wide, reaching to or almost reaching to pectoral girdle. Ventral surface of lower lip covered with small rounded papillae anteriorly and fading to none posteriorly, forming wide, smooth band devoid of papillae before edge. Papillae surrounded by narrow naked areas, decreasing in size towards edge. Posterior border of



Fig. 2. Lateral view of head of *Parotocinclus adamanteus*, holotype, male, MZUSP 124560.

lower lip smooth or slightly fringed. Maxillary barbel moderately developed, mostly adnate to lip but with distinct free portion distally. Tooth series in both premaxilla and dentary with mesial ends slightly curved inwards. Tooth series in premaxillae almost straight and slightly longer than those in dentary. Teeth slender and asymmetrically bifid. Medial cusp large, slightly curved inward and rounded. Lateral cusp small and pointed, not reaching half length of medial cusp in unworn teeth. Accessory patch of unicuspid teeth absent from both premaxilla and dentary bones.

Dorsal-fin origin along vertical passing through or slightly posterior to origin of pelvic fin. Dorsal fin short, rays not contacting preadipose azygous plates when adpressed; posterior margin straight. Nuchal plate and dorsal-fin spinelet exposed, not covered by skin. Dorsal-fin spinelet transversely trapezoidal, slightly wider than base of dorsal-fin spine. Dorsal-fin locking mechanism non-functional. Dorsal-fin spine moderately flexible, followed by seven branched rays. Adipose fin with well-ossified leading spine bearing odontodes. Adipose-fin membrane short or extended slightly beyond adipose-fin spine. Adipose fin preceded by 1–2 (usually 1) median preadipose azygous plates. Pectoral fin situated more dorsally than pelvic-fin insertion. Pectoral fin short with posterior margin straight. Tip almost reaching or reaching to half-length of pelvic-fin spine when adpressed. Pectoral-fin spine slightly curved, flattened dorsally and

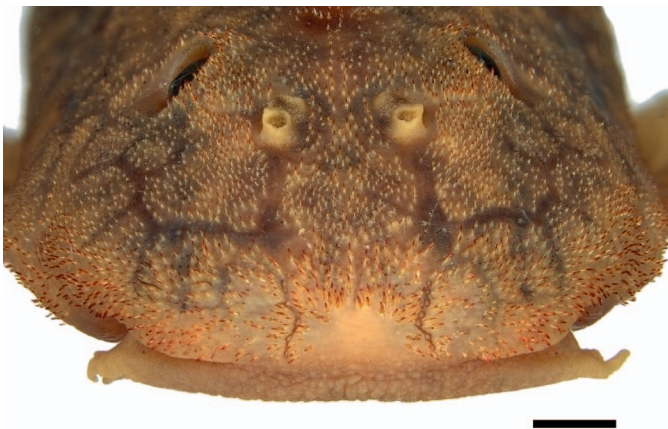


Fig. 3. Detail of snout of *Parotocinclus adamanteus*, MCP 54151, showing tip of snout lacking rostral plate. Scale bar = 2 mm.

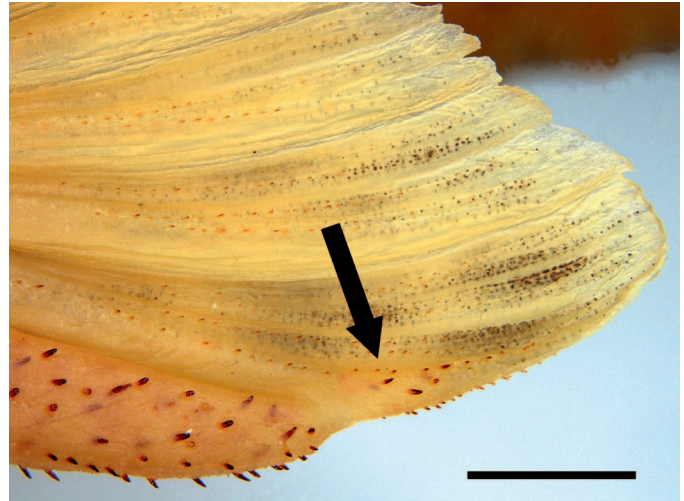


Fig. 4. Detail of pelvic fin of *Parotocinclus adamanteus*, holotype, male, MZUSP 124560, showing thickening of first branched rays near tip of unbranched ray. Scale bar = 2 mm.

more rounded ventrally; spine bearing minute odontodes on entire surface. Pectoral-fin spine not thickened in adult males; its dorsal surface with discrete dermal flap along its entire length in adult males. Six branched rays, first and second slightly longer than spine. Subsequent branched rays decrease gradually in size. Pectoral axillary slit present, located below posterior bony margin of posterior cleithral process in both adults and juveniles. Pelvic fin well developed, equal to or slightly longer than pectoral fin, its origin positioned slightly anterior to dorsal fin. Pelvic fin with one unbranched and five branched rays. Tip of adpressed pelvic-fin unbranched ray falling short of anal-fin origin; posterior margin reaching anal-fin origin in adults. Posterior margin of pelvic fin pointed in males, rounded in females. Pelvic-fin unbranched ray depressed, covered with minute odontodes ventrally and laterally. Unbranched pelvic-fin ray slightly thickened and wider than pectoral-fin spine, with odontodes on ventral margin slightly turned mesially. Well-developed dermal flap on dorsal surface of first pelvic-fin unbranched ray; flap of males distinctly higher near fin base, extending to ray tip; flap of females reduced or absent. First branched ray of adult males with small thickening near tip of unbranched ray, which supports slightly enlarged odontodes (Fig. 4). Anal fin with one unbranched and five branched rays. Tip of adpressed fin slightly passing vertical at adipose-fin origin. Caudal-fin posterior margin forked or concave; with 14 branched rays; ventral lobe longer than dorsal lobe. Dorsal caudal-fin lobe with four to five and ventral lobe with three to five plate-like procurrent rays; posteriormost elongate. Hypural plate asymmetrical with ventral lobe slightly longer than dorsal. Total vertebral centra 29 (3 CS).

Color in alcohol.—Head and trunk mostly light brown dorsally with many dark brown vermiculations, darkening entire dorsal surface. Dark blotches concentrated in four inconspicuous transverse bands; first on anterior portion of dorsal-fin base, second immediately posterior to dorsal-fin base, third anterior to adipose fin, and fourth at end of caudal peduncle. Vermiculations thicker and darker on dorsal surface of head and on continuous stripe along lateral portion of flank from parieto-supraoccipital to end of caudal peduncle. Ventral surface of head and trunk pale yellow, with



Fig. 5. Paratype of *Parotocinclus adamanteus*, female, MZUSP 93280, 57.3 mm SL, Brazil, Bahia, Chapada Diamantina, Lençóis, Rio Roncador, tributary to Rio São José at Cachoeira Sonrisal, Roncador Farm on road from Lençóis to Andaraí, Rio Paraguaçu basin.

dark chromatophores concentrated between vent and anal-fin base and around anal fin, forming squarish blotch. Dorsal fin with 2–3 conspicuous transverse, wide, dark lines. Pectoral fin with 3–4 and pelvic fin with 2–3 transverse dark lines. Anal fin with 2–3 inconspicuous transverse dark lines, faded in some specimens. Caudal fin with transverse, dark brown band basally and 3–4 irregular transverse, wide, dark brown bands across rays. All fins with hyaline inter-radial membranes.

Color in life.—Color pattern as above, but light background bright yellow with hypertrophied odontodes golden yellow to reddish orange, especially on lateral margin of head of mature males and leading rays of dorsal, pectoral, and anal fins.

Sexual dimorphism.—Secondary sexual dimorphism common to other hypoptopomatines occurs in the form of a pelvic-fin skin flap on the dorsal surface of the first, unbranched pelvic-fin ray of males (vs. absent in females) and the conical urogenital papilla of males, located immediately posterior to the anal opening (vs. absent in females). In addition to those, adult males of *Parotocinclus*

adamanteus are ornamented with hypertrophied odontodes on the cheeks, a type of modification unusual among hypoptopomatines. The cheeks have thick, fleshy skin and a dense patch of large odontodes on the post-rostral plates, from the snout tip to the opercle, forming voluminous cheeks (Fig. 2). The shape of the pelvic fin is also sexually dimorphic in *P. adamanteus*. The first ray of the pelvic fin of males is thicker and stronger than that of females, and the branched rays of males decrease in size, making the posterior margin of the fin pointed (Fig. 1). In females, the pelvic-fin rays are similar in size, producing a rounded posterior margin (Fig. 5).

Geographic distribution.—*Parotocinclus adamanteus* is known from five creeks of the Rio São José basin, itself a headwater river of the Rio Paraguaçu drainage, in the municipalities of Lençóis and Andaraí, Bahia, Brazil (Fig. 6).

Habitat and ecological notes.—Specimens of *Parotocinclus adamanteus* are usually associated with large continuous rock surfaces, usually on the dark or hidden side of large submerged boulders, often in strong currents or just next to torrential sectors. Fish are adhered to the rock at all times and

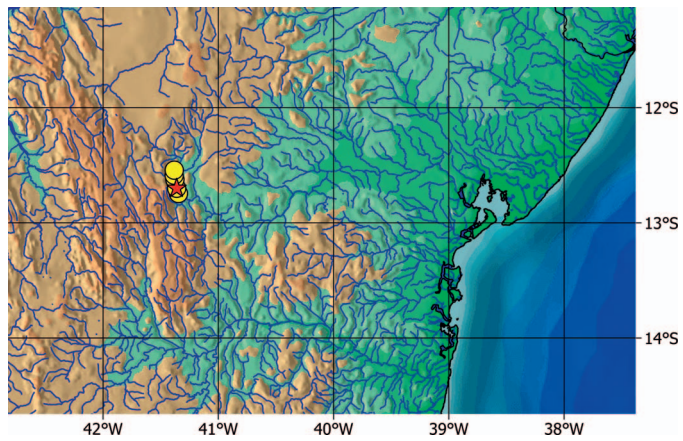


Fig. 6. Distribution of *Parotocinclus adamanteus* in the Chapada Diamantina, Bahia, Brazil. Star represents type locality.

their evasive maneuvers, when disturbed, are invariably in paths adjacent to the rock surface. At the type locality, *P. adamanteus* is virtually syntopic with *Copionodon pecten*, but no specific interaction was seen between the two species during underwater observation.

The Rio São José and its tributaries where *Parotocinclus adamanteus* was collected are fast-running, black-water rivers

on a substrate composed of rocks and large boulders, with occasional stretches of sand and no submerged vegetation. One of the creeks, the Ribeirão de Baixo (Fig. 7), is 2.2–8.2 m wide, 0.09–0.42 m deep, with water current speed of 0.05–0.9 m/s, conductivity at the collecting site of 26 μS , and water temperature of 21.4°C. Two other fish species found with *P. adamanteus* in the Ribeirão de Baixo are the recently described callichthyid catfish *Aspidoras psammatides* and the cichlid *Geophagus diamantinensis*. In the type locality, the new species co-occurs with the trichomycterid *Copionodon pecten*.

Conservation status.—The species appears to be endemic to the Rio São José sub-basin of the upper Rio Paraguaçu. It is known from five localities representing creeks of the right margin of the Rio São José, all running off the Chapada Diamantina National Park, and there is no reason to believe that it is not widespread in that portion of the Rio São José basin. The estimated Extent of Occurrence (EOO) based on the five localities, however, is only 16 km², and there is continuing decline in habitat quality caused by the human development in the towns of Andaraí and Lençóis, by the concession for excessive water withdrawal for crop irrigation, and by increased tourist interest in the area. On the other hand, the area is not severely fragmented, there is not a rationale to establish a low number of locations, and there



Fig. 7. Ribeirão de Baixo near mouth into Rio São José, Rio Paraguaçu basin, Lençóis, Bahia, Brazil, at the fish collection event. Photo A. Clistenes.

are no records of extreme fluctuation in area or of individuals. For these reasons, the species is assessed as Near Threatened (NT) according to the categories and criteria of the IUCN (IUCN Standards and Petitions Subcommittee, 2017). Additional collecting efforts should be conducted in that region in order to better understand the geographic distribution of *P. adamanteus*.

Etymology.—The specific epithet is from Latin *adamas*, diamond, hence *adamanteus*, of the diamond, in reference to the old plateau where the species occurs, the Chapada Diamantina in central Bahia State, Brazil. A noun in apposition.

DISCUSSION

Parotocinclus adamanteus represents the first hypoptopomatine described from the Rio Paraguaçu basin and the only loricariid known to inhabit the Chapada Diamantina National Park. It very much resembles, at first examination, a member of the Neoplecostominae (*sensu* Pereira and Reis, 2017) because of its broad, depressed head and somewhat hypertrophied odontodes on the cheeks, which superficially resemble the habitus of species of *Pareiorhaphis*. Closer inspection, however, reveals some diagnostic characteristics of the Hypoptopomatinae, like the odontodes from the pectoral girdle passing through the skin and exposed on the ventral surface of the coracoids and the odontodes on the ventral surface of the first pelvic-fin ray directed mesially, not aligned with the main axis of the ray. In order to test its phylogenetic position and correct placement in loricariid classification, the taxon was included in the morphology-based phylogenetic analyses of Pereira and Reis (2017) and in the combined morphology and DNA based phylogenetic analysis of Reis et al. (2017), as New Taxon Cl. In the former analysis, the new species was recovered along with other species of *Parotocinclus* forming a non-monophyletic, asymmetrical sequence of sister taxa to a clade composed of other hypoptopomatine genera. The latter analysis, however, recovered *Parotocinclus* as monophyletic and *P. adamanteus* deeply nested among the species of *Parotocinclus*, closely related to *P. prata* and *P. robustus*, from Rio São Francisco, and *P. jequi*, from Rio Jequitinhonha. For this reason, it is herein included as a member of that genus.

The hypertrophied odontodes on the cheek plates of males of *Parotocinclus adamanteus* represent the main diagnostic feature that distinguish the new species from its congeners. Despite the similarity in this sexually dimorphic feature in species of *Pareiorhaphis*, odontodes in *P. adamanteus* are not as well developed as those of *Pareiorhaphis* (Pereira et al., 2010, 2017, 2018), and their growth does not modify the underlying cheek plates with odontode scars as in the latter genus (Pereira and Reis, 2017). The hypertrophied odontodes in *P. adamanteus* are about twice or three times the length and thickness of those on the remainder of the head (Fig. 2), while in species of *Pareiorhaphis*, odontodes easily reach more than ten times the length of those in the remainder of the head. An additional and unique feature of *P. adamanteus* so far unknown among loricariids is a small swollen or thickened area on the outer branch of the first branched ray of the pelvic fin, located near the tip of the unbranched ray, which supports slightly enlarged odontodes (Fig. 4). This structure is only found in adult males and its function is currently unknown.

The description of a new loricariid from the headwaters of the Rio Paraguaçu highlights the high degree of endemism in the Chapada Diamantina domain, as already stated by Zanata et al. (2018) and Burger et al. (2019), and suggests the existence of further unrecognized diversity. Such an incompletely known fish fauna is increasingly threatened by the growing human population, deforestation, and water diversion, which severely impact the area and the fishes. The region is home to several endangered fish species, such as *Glaphyropoma spinosum*, *Kalyptodoras bahiensis*, *Kolpotocheiron figueirodoi*, *Lepidocharax diamantine*, and *Rhamdiopsis krugi* (ICMBio, 2018), which demand immediate conservation action. Development projects are emerging in the region, stressing the need for accurate biodiversity inventories of the headwaters and some of the main tributaries of the Chapada Diamantina and appropriate measures to protect this diversity hotspot.

MATERIAL EXAMINED

Comparative material examined is that listed in Lehmann and Reis (2012) with the addition of the following specimens (all from Brazil, except where noted).

Parotocinclus halbothi: MCP 48029, holotype, Pará, Oriximiná, creek tributary to Igarapé do Moura at Monte Branco Plateau, Rio Trombetas drainage; MCP 48030, 6 paratypes, collected with the holotype; INPA 39890, 4, MCP 48098, 1 CS, same locality as holotype; MPEG 17299, 2, Pará, Igarapé 1500 on track 4, Grão-Pará Ecological Station, upper Rio Mapuera, Rio Trombetas basin.

Parotocinclus jequi: MCP 47533, holotype, Minas Gerais, Serro, headwater creek of the Rio Jequitinhonha at Cachoeira do Moinho de Esteira, on road BR-259 from Serro to Pedro Lessa; MCP 42425, 2 paratypes, MCP 44959, 6 + 2 CS paratypes, same locality as holotype.

Parotocinclus variola: ICNMHN 18685, holotype, Colombia, Departamento Amazonas, Leticia, Quebrada Tacana, tributary to Rio Amazonas at km 6.5 of road from Leticia to Tarapacá; MCP 48245, 4 + 2 CS paratypes, collected with holotype; MCP 48244, 5, same locality as the holotype.

Parotocinclus yaka: MZUSP 123655, holotype, Amazonas, Rio Tiquié drainage, Igarapé Açaí near São Pedro Village; MZUSP 81408, 20 and MCP 53639, 5 + 2 CS paratypes, collected with holotype.

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LITERATURE CITED

Britski, H. A., and J. C. Garavello. 2009. Redescription of *Parotocinclus bahiensis* (Miranda-Ribeiro, 1918) (Pisces, Ostariophysi, Loricariidae). *Zootaxa* 2143:59–67.

- Burger, R., F. R. Carvalho, and A. M. Zanata.** 2019. A new species of *Astyanax* Baird & Girard (Characiformes: Characidae) from western Chapada Diamantina, Bahia, Brazil. *Zootaxa* 4604:369–380.
- Chakrabarty, P., M. Warren, L. M. Page, and C. C. Baldwin.** 2013. GenSeq: an updated nomenclature and ranking for genetic sequences from type and non-type sources. *ZooKeys* 346:29–41.
- ICMBio.** 2018. Livro vermelho da fauna brasileira ameaçada de extinção. Vol. 1. Instituto Chico Mendes de Conservação da Biodiversidade, Ministério do Meio Ambiente, Brasília, Brazil.
- IUCN Standards and Petitions Subcommittee.** 2017. Guidelines for using the IUCN Red List Categories and Criteria. Version 13. Prepared by the Standards and Petitions Subcommittee. <http://www.iucnredlist.org/documents/RedListGuidelines.pdf> (accessed May 2018).
- Lehmann A., P., and R. E. Reis.** 2012. A new species of *Parotocinclus* (Siluriformes: Loricariidae) from the upper Rio São Francisco, Brazil. *Zootaxa* 3390:56–64.
- Lujan, N. K., J. W. Armbruster, N. R. Lovejoy, and H. López-Fernández.** 2015. Multilocus molecular phylogeny of the suckermouth armored catfishes (Siluriformes: Loricariidae) with a focus on subfamily Hypostominae. *Molecular Phylogenetics and Evolution* 82:269–288.
- Palumbi, S., A. Martin, S. Romano, W. O. McMillan, L. Stice, and G. Grabowski.** 2002. The Simple Fool's Guide to PCR. University of Hawaii, Honolulu, Hawaii.
- Pereira, E. H. L., T. C. Pessali, F. Andrade, and R. E. Reis.** 2017. Description of a new species of *Pareiorhaphis* (Loricariidae: Neoplecostominae) from the rio Jequitinhonha basin, Minas Gerais, eastern Brazil. *Neotropical Ichthyology* 15:e170007.
- Pereira, E. H. L., T. C. Pessali, and R. E. Reis.** 2018. A new species of *Pareiorhaphis* (Loricariidae: Neoplecostominae) from the Mucuri River basin, Minas Gerais, eastern Brazil. *Copeia* 106:632–640.
- Pereira, E. H. L., and R. E. Reis.** 2017. Morphology-based phylogeny of the suckermouth armored catfishes, with emphasis on the Neoplecostominae (Teleostei: Siluriformes: Loricariidae). *Zootaxa* 4264:1–104.
- Pereira, E. H. L., F. Vieira, and R. E. Reis.** 2007. A new species of sexually dimorphic *Pareiorhaphis* Miranda Ribeiro, 1918 (Siluriformes: Loricariidae) from the rio Doce basin, Brazil. *Neotropical Ichthyology* 5:443–448.
- Pereira, E. H. L., F. Vieira, and R. E. Reis.** 2010. *Pareiorhaphis scutula*, a new species of neoplecostomine catfish (Siluriformes: Loricariidae) from the upper rio Doce basin, Southeastern Brazil. *Neotropical Ichthyology* 8:33–38.
- Reis, R. E., B. B. Calegari, T. P. Carvalho, C. A. Cramer, M. L. S. Delapieve, P. Lehmann A., and E. H. L. Pereira.** 2017. A phylogeny of the armored catfishes, with emphasis on the Neoplecostominae–Hypoptopomatinae clade (Siluriformes: Loricariidae): integrating phenotypical and molecular data. II International Symposium on Phylogeny and Classification of Neotropical Fishes, Londrina, Brazil.
- Sabaj, M. H.** 2016. Standard symbolic codes for institutional resource collections in herpetology and ichthyology: an online reference. Version 6.5 (16 August 2016). Electronically accessible at <http://www.asih.org/>, American Society of Ichthyologists and Herpetologists, Washington, D.C.
- Sarmiento-Soares, L. M., P. Lehmann A., and R. F. Martins-Pinheiro.** 2009. *Parotocinclus arandai*, a new species of Hypoptopomatine catfish (Siluriformes: Loricariidae) from the upper rios Jucuruçu and Buranhém, states of Bahia and Minas Gerais, Brazil. *Neotropical Ichthyology* 7:191–198.
- Sarmiento-Soares, L. M., A. C. A. Santos, R. F. Martins-Pinheiro, S. F. Martins, and A. K. Takako.** 2018. RE: The paradox of irrigation efficiency. *Science eLetter*, 21 Nov 2018. <https://science.sciencemag.org/content/361/6404/748/tab-e-letters>
- Schaefer, S. A.** 1997. The neotropical cascudinhos: systematics and biogeography of the *Otocinclus* catfishes (Siluriformes: Loricariidae). *Proceedings of the Academy of Natural Sciences of Philadelphia* 148:1–120.
- Taylor, W. R., and G. C. Van Dyke.** 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. *Cybio* 9:107–119.
- Zanata, A. M., and A. Akama.** 2004. *Myxiops aphos*, new characid genus and species (Characiformes: Characidae) from the rio Lençóis, Bahia, Brazil. *Neotropical Ichthyology* 2:45–54.
- Zanata, A. M., R. Burger, and P. Camelier.** 2018. Two new species of *Astyanax* Baird & Girard (Characiformes: Characidae) from the upper rio Paraguaçu basin, Chapada Diamantina, Bahia, Brazil. *Zootaxa* 4438:471–490.