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A new species of the catfish genus *Centromochlus* (Siluriformes: Auchenipteridae: Centromochlinae) from the upper rio Paraná basin, Brazil

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Centromochlus comprises twelve species, distributed in the main inland watersheds of South America, including the Orinoco, Essequibo, coastal rivers of Suriname, Amazon, upper Paraná and São Francisco basins. The new species is described from the upper rio Paraná based on material collected in 1965 during the construction of the UHE Ilha Solteira, São Paulo, Brazil. The new species is easily distinguished from all congeners due to absence of adipose fin, a condition otherwise restricted to *Gelanoglanis nanonocticolus*, among centromochlin catfishes. The new species comprises small catfishes (adults ranging from 35 to 39 mm SL), in which modified anal fin of males is devoid of denticulations or spines, and most posterior rays reduced in length. In addition, *Tatia simplex* Mees is transferred to *Centromochlus* and its generic reassignment discussed.

Centromochlus abriga doze espécies, com registros para os principais sistemas fluviais de águas interiores da América do Sul, como o Orinoco, Essequibo, rios costeiros do Suriname, Amazonas, alto Paraná e São Francisco. A nova espécie é descrita do alto rio Paraná, a partir de material coletado em 1965 durante a construção da UHE Ilha Solteira, São Paulo, Brasil. A espécie nova distingue-se facilmente de todas as suas congêneres pela ausência de nadadeira adiposa, uma condição até então restrita à *Gelanoglanis nanonocticolus*, dentre os bagres centromochlíneos. A nova espécie inclui pequenos bagres (adultos entre 35 e 39 mm CP), nos quais a nadadeira anal modificada em machos é desprovida de dentículos ou espinhos, e com os raios mais posteriores de tamanho reduzido. Adicionalmente, *Tatia simplex* Mees é transferida para *Centromochlus* e é fornecida uma discussão acerca de seu posicionamento genérico.

Keywords: Ostariophysi, South America, Systematics, Taxonomy, *Tatia simplex*.

Introduction

Centromochlus is a member of the family Auchenipteridae and, together with *Gelanoglanis*, *Glanidium* and *Tatia*, compose the subfamily Centromochlinae (Ferraris, 2007). *Centromochlus* was proposed by Kner (1858) to encompass his new species *C. megalops* and *C. aulopygius*, the former designated by Bleeker (1862) as the type species. Mees (1974) restricted *Centromochlus* to two nominal species, *C. existimatus* Mees, 1974, and *C. heckelii* (De Philippi, 1853) with *C. megalops* as a junior synonym of the latter. A comprehensive phylogenetic analysis of Centromochlinae (Soares-Porto, 1998) supported *C. existimatus* and *C. heckelii* as sister species derived within a clade that included species previously assigned to *Gelanoglanis* and *Tatia*. Subsequent studies (Sarmento-Soares & Martins-Pinheiro, 2008; Sarmento-Soares & Martins-Pinheiro, 2013) have revised *Centromochlus* to include *C. altae* Fowler, 1945, *C. bockmanni* (Sarmento-Soares & Buckup, 2005), *C. concolor* (Mees, 1974), *C. macracanthus* Soares-Porto, 2000, *C. meridionalis* Sarmento-Soares, Cabeceira, Carvalho, Zuanon & Akama, 2013, *C. perugiae* Steindachner, 1883, *C. punctatus* (Mees, 1974), *C. reticulatus* (Mees, 1974), *C. romani* (Mees, 1988) and *C. schultzi* Rössel, 1962, in addition to *C. existimatus*, and *C. heckelii*. *Tatia*, on the other hand, was described

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by Miranda Ribeiro (1911) to allocate *Centromochlus aulopygius*. Subsequently, Mees (1974) expanded *Tatia* to 14 species, and Soares-Porto (1998) redefined the genus to include only eight species. *Tatia* was revised by Sarmento-Soares & Martins-Pinheiro (2008), and now comprise 17 valid species with six of them described in the last five years (Sarmento-Soares & Martins-Pinheiro, 2008; Pavanelli & Bifi, 2009; Vari & Ferraris, 2013; Vari & Calegari, 2014). *Glanidium* was described by Lütken (1875) and includes the largest species of Centromochlinae, all geographically restricted to southern and southeastern Brazil, except for *G. leopardum* (Hoedeman, 1961) from the coastal rivers of the Guianas. *Gelanoglanis*, described by Böhlke (1980), is a genus encompassing three miniature species distributed in the Amazon and Orinoco basins (Soares-Porto *et al*., 1999; Rengifo *et al*., 2008).

The limits between the genera of Centromochlinae remain poorly defined. Although considered valid by most authors (Soares-Porto *et al*., 1999; Ferraris, 2003, 2007; Rengifo *et al*., 2008), *Gelanoglanis* nested deeply within *Centromochlus* in the phylogeny by Soares-Porto (1998). *Glanidium bockmanni* was recently transferred to *Centromochlus* (Sarmento-Soares & Martins-Pinheiro, 2013). *Tatia musaica* Royero, 1992 was recently transferred to *Centromochlus* (Sarmento-Soares & Martins-Pinheiro, 2008), but then returned to *Tatia* (Vari & Ferraris, 2013). In addition, the validity of some species assigned to *Centromochlus* need additional investigation, including *C. megalops*, considered as a *species inquirendae* in *Centromochlus* (Ferraris, 2007), "*Centromochlus*" *simplex* Mees, 1974, ranked as *incertae sedis* in Centromochlinae (Sarmento-Soares & Martins Pinheiro, 2008), and *C. steindachneri* Gill, 1870, tentatively considered a synonym of *C. heckelii* by Mees (1974) but possibly valid (LMSS, per. obs.).

Species of *Centromochlus* are distributed widely in South American, occurring in the Orinoco basin in Venezuela and Colombia, in the Amazon basin from Ecuador to Brazil, and in the coastal rivers of northern South America between the mouths of the Orinoco and Amazon rivers from the Guianas to Brazil (Soares-Porto, 1998; Ferraris, 2003, 2007; Akama & Sarmento-Soares, 2007). *Centromochlus sensu* Soares-Porto (1998) was defined as monophyletic group based on the following synapomorphies: elongate maxilla, about 35 to 45% longer than palatine; anterior nuchal plate absent; elongate ventrolateral process of infraorbital 1 (lacrimal), forming the anterior border of the orbital rim, with the infraorbital canal extending through this process to its tip. However, *Gelanoglanis* can be distinguished from *Centromochlus* by having only a single pair of mental barbels; premaxillary tooth patches laterally oriented and widely separated anteriorly at midline; posterior naris large and immediately anterior to eye; oblique, sinuous mouth with free fleshy flange around angle of gape, and dorsal, anal, and paired fins with short base and few rays (Soares-Porto *et al*., 1999).

Large hydroelectric dams were built in São Paulo, the most populous state of Brazil, working since in the 1960s. Those large dams had a significant impact on the rivers and fish communities in the upper rio Paraná basin. The Usina Hidrelétrica de Ilha Solteira was one of the first dams built between 1965 and 1978 in a stretch of rio Paraná between Ilha Solteira (São Paulo) and Selvíria (Mato Grosso do Sul). It is the third largest dam in Brazil, and together with its neighbor, UHE Engenheiro Souza Dias (also known as UHE Jupiá), the both dams compose the sixth largest hydroelectric complex in the world (Shibatta & Dias, 2006). During the construction of the UHE Ilha Solteira, expeditions to the area resulted in the capture of several species now considered rare (*i.e*, collected only during that opportunity or very few times in other places), including *Apteronotus acidops* Triques, 2011, *Sternarchorhynchus britskii* Campos-da-Paz, 2000, and *Tembeassu marauna* Triques, 1998. The first two species are listed as threatened on the Brazilian Red List (Brasil. MMA, 2014). During the same expeditions, the new species of *Centromochlus* was collected. The new species was incorrectly identified as *Glanidium cesarpintoi*, a poorly known species of Centromochlinae described by Ihering (1928) to the rio Mogi Guaçu, upper rio Paraná basin. The misidentification left the new species undescribed for more than 50 years. The aim of the present contribution is to describe the species as new, diagnosing it from all other Centromochlinae. In addition, comments on *Centromochlus simplex* are provided and its generic placement discussed.

Material and Methods

Osteological features were examined in cleared and stained (CS) specimens prepared according to the procedures of Taylor & Van Dyke (1985). Prior to clearing and staining, specimens were dissected when possible to determine gut contents, sexual maturity of gonads, and to check myological characteristics. Osteological data for species poorly represented in collections were obtained from radiographs. Specimens examined via radiographs are noted as "R" in the Material examined section. Nomenclature for osteological elements is based on Weitzman (1962) , Fink & Fink (1981), Arratia (2003), including suggestions by Britto (2002, 13) and Birindelli (2014); most terms follow the Zebrafish Information Network (ZFIN). Muscle names follow Sarmento-Soares & Porto (2006). Drawings were rendered from *camera lucida* or digital photographs, preferably of CS specimens.

Straight-line measurements were made with a digital caliper, and recorded in tenths of a millimeter. Measurements and counts follow Sarmento-Soares & Martins-Pinheiro (2008). Counts of fin rays and bony elements were obtained from alcohol-preserved and CS specimens. Vertebral counts include the five elements incorporated into the Weberian complex and one terminal element associated with the hypural complex (following Vari & Ferraris, 2013). Counts of branchiostegal rays were performed only on CS specimens.

Institutional abbreviations are as follow: American Museum of Natural History, New York (AMNH); Natural History Museum (formely British Museum Natural History), London; Coleção de Peixes do Departamento de Zoologia e Botânica do Instituto de Biociências, Letras e Ciências Exatas, São José do Rio Preto (DZSJRP); Instituto Nacional de Pesquisas da Amazônia, Manaus (INPA); Museu de Biologia Professor Mello Leitão, Santa Teresa (MBML); Museu Nacional, Rio de Janeiro (MNRJ); Museu de Zoologia da Universidade Estadual de Londrina, Londrina (MZUEL); Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP); Netherlands Centre for Biodiversity Naturalis (formerly Rijksmuseum van Natuurlijke Historie), Leiden (RMNH. PISC); Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura,Universidade Estadual de Maringá, Maringá (NUP), and National Museum of Natural History, Smithsonian Institution, Washington DC (USNM).

Results

Centromochlus britskii, new species

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Fig. 1

Glanidium cesarpintoi (non Ihering, 1928). -Sarmento-Soares & Buckup, 2005: 846 (comparative material).

Holotype. MZUSP 115271, 39.2 mm SL, male, Brazil, São Paulo, rio Paraná where is now the UHE Ilha Solteira upper rio Paraná basin, approximately 20°18'S 51°10'W, Sep 1965, Excursion of Departamento de Zoologia da Secretaria de Agricultura do Estado de São Paulo, Heraldo A. Britski, Izáurio A. Dias & Gustavo A. S. de Melo.

Paratypes. MZUSP 43251, 2 R + 1 CS, 33.5-36.3 mm SL, MNRJ 41787, 2 R, 36.0-38.6 mm SL, collected with holotype, prior to the river dam.

Fig. 1. *Centromochlus britskii*, new species, holotype, MZUSP 115271, male, 39.2 mm SL, UHE Ilha Solteira, upper rio Paraná basin, Ilha Solteira, São Paulo State, Brazil. Lateral (a), dorsal (b) and ventral (c) views.

Diagnosis. *Centromochlus britskii* is distinguished from all Centromochlinae, except *Gelanoglanis nanonocticolus* Soares-Porto, Walsh, Nico & Netto, 1999, by absence (*vs.* presence) of adipose fin. The new species differs from *G. nanonocticolus* by having two pairs (*vs.* one pair) of mental barbels, premaxillary tooth patches anteriorly united (*vs.* separated) and mouth gape straight and short (*vs.* large and sinuous).

The new species differs from congeners *Centromochlus altae*, *C. existimatus*, *C. heckelii*, *C. perugiae*, *C. reticulatus*, *C. romani* and *C. meridionalis* by having seven branched rays in the anal fin (*vs.* 5 or 6). Further distinguished from *C. altae*, *C. existimatus*, *C. heckelii* and *C. perugiae* by lacking anterior nuchal plate (*vs.* anterior nuchal plate present); from *C. meridionalis* and *C. romani* by having anterior margin of dorsal-fin spine with serrae (*vs.* dorsal-fin spine smooth); from *C. existimatus* and *C. heckelii* by having shorter pectoral-fin spine 20.7-22.7% of SL (*vs.* 29.3-41.6% of SL).

Among species group that share the absence of anterior nuchal plate and seven branched anal-fin rays (*i.e*, *C. punctatus*, *C. schultzi*, *C. macracanthus*, *C. bockmanni*, *C. simplex*), the new species differs from both *C. schultzi* and *C. macracanthus* by having posterior border of dorsal-fin spine smooth (*vs.* with denticules); from *C. punctatus* by the morphology of male modified anal fin, specifically, the last branched anal-fin ray progressively shorter than anterior most (*vs.* last ray abruptly reduced, size half that of preceding one and visible only through dissection).

Description. Morphometric data in Table 1. Small size, examined adult specimens 33.6-39.2 mm SL. Body short, head slightly depressed. In dorsal view, profile of head longer than broad, slightly convex from snout tip to pectoral-fin insertion. In lateral view, dorsal profile of body from dorsal-fin base to caudal fin slightly to distinctly convex. Ventral profile of head and abdomen almost straight. Ventral profile of body gently concave between anal-fin base and caudal-fin origin. Trunk from dorsal-fin base to caudal peduncle gradually compressed. Head integument thick, bones of cranial roof not discernible; adipose eyelid weakly developed; eye dorsolateral on anterior portion of head; mouth terminal, upper lip extended posterolaterally, fleshy rictal fold well developed; snout margin rounded in dorsal view; anterior nostril tubular, located on anterior border of snout; posterior nostril somewhat larger, rounded, limited anteriorly by small skin flap; transverse distance between anterior nostrils almost equal to distance between posterior ones. Maxillary barbel elongate, extending well beyond membranous border of opercle, reaching approximately vertical through dorsal-fin origin; adpressed maxillary barbel fits in groove on the lateral portion of head, immediately above rictal fold and below eye; mental barbels short, tips not reaching pectoral-fin base; bases of barbels arranged in arc along ventral surface of jaw; inner mental barbel about two-thirds outer mental. Posterior process of cleithrum moderately large, almost reaching vertical through base of dorsal-fin spine.

Osteological description. Rostral border of cranium with mesethmoid longer than broad; premaxilla with synchondral articulation; cranial fontanel narrowly elliptical, enclosed by mesethmoid and frontals (Fig. 2). Nasal ossified as short tubular bone situated between mesethmoid cornua and lateral ethmoid, not sutured to mesethmoid. Autopalatine rod-like, oriented almost parallel to longitudinal axis of body; maxilla very small, less than half the size of autopalatine; vomer short, arrow-shaped with lateral processes. Jaws of equal size; premaxilla and dentary slender with three or four rows of robust conical teeth. Anterior nuchal plate absent; middle nuchal plate slightly concave along lateral margins; posterior nuchal plate thin, projected laterally, with prominent tip. Epioccipital process very small.

Hyomandibula broad, projected anteriorly, connected to both quadrate and metapterygoid through cartilage and deeply dentate suture. Metapterygoid as a wide lamina, joined to quadrate via suture (Fig. 3). Quadrate trapezoidal, with broad base, sutured to preopercle, hyomandibula and metapterygoid; long preopercle ventral margins sutured to both quadrate and hyomandibula; suprapreopercle present as short canal bone; opercle laminate, ornamented and broadly subtriangular.

Hyoid arch with parurohyal well developed with a robust ventral process; short dorsal hypohyal associated with comparatively large ventral hypohyal; anterior ceratohyal well developed, posterior ceratohyal smaller than others one; branchiostegal ray articulated to hyoid arch; six branchiostegal rays, four slender rays associated with anterior ceratohyal, two flattened rays with posterior ceratohyal (Fig. 4).

Branchial (gill) arches with urohyal close to basibranchial 2; basibranchial 2 cartilaginous, broadest anteriorly, usually separated by gap from basibranchial 3; basibranchial 3 shorter, forming osseous rod; basibranchial 4 large, flattened and cartilaginous; basibranchial 2 bordered laterally by cartilaginous head of hypobranchial 1; basibranchial 3 between cartilaginous head of hypobranchial 2 and cartilaginous hypobranchial 3; basibranchial 4 bordered laterally by cartilaginous head of ceratobranchial 4 and caudally by cartilaginous head of ceratobranchial 5. Hypobranchials 1 and 2 subtriangular, mostly osseous, elongate and expanded laterally, with cartilaginous tips; hypobranchial 3 completely cartilaginous, trapezoidal; hypobranchial 4 absent. Five ceratobranchials, mostly ossified, with cartilage on both ends. Ceratobranchials supporting single row of rakers; fifth ceratobranchial expanded postero-medially to support lower pharyngeal toothplate with short conical teeth. Four epibranchials, all largely ossified except for cartilaginous ends, supporting few rakers each, close to articulation with ceratobranchials. Epibranchials 1 and 2 rod-like; epibranchial 3 with posterior uncinate process in articulation to epibranchial 4; epibranchial 4 with laminar extension; reduced accessory cartilage, located on angle between cartilaginous ends of epibranchial 4 and ceratobranchial 4.

Table 1. Morphometric data for *Centromochlus britskii*. SD = Standard deviation; N = holotype plus 5 specimens.

	Holotype	Range	Mean	SD	N
Standard length	39.2	33.5-39.2	36.6		6
Percent of standard length					
Body depth	16.6	14.6-17.1	16.2	0.85	6
Body width	19.1	17.9-19.7	19.1	0.67	6
Caudal peduncle depth	9.4	9.4-10.9	9.8	0.53	6
Caudal peduncle length	22.7	20.0-22.7	20.9	1.25	6
Predorsal length	32.4	31.7-33.4	32.5	0.75	6
Preanal length (male)	77.0	75.4-77.0	76.2	1.17	3
Preanal length (female)		72.2-72.5	72.3	0.17	3
Prepelvic length	57.9	56.7-59.6	58.4	1.11	6
Dorsal origin to pectoral origin	19.1	17.6-20.0	19.0	0.81	6
Dorsal origin to pelvic origin	30.6	30.6-33.1	32.2	0.85	6
Pectoral origin to pelvic origin	35.2	35.2-37.2	36.2	0.65	6
Prepectoral length	25.0	22.5-25.4	24.1	1.13	6
Dorsal-fin base length	9.9	9.9-12.5	11.0	1.03	6
Anal-fin base length (male)	5.4	5.4-6.2	5.8	0.613	
Anal-fin base length (female)	-	8.38-10.7	9.7	0.983	
Dorsal-fin spine length	13.3	13.3-15.6	14.3	0.91	6
Pectoral-fin spine length	22.7	20.7-22.7	22.1	0.86	6
Posterior process of cleithrum length	16.6	15.8-17.1	16.5	0.42	6
First branched pelvic-fin ray length	11.7	10.9-12.2	11.5	0.53	6
Longest anal fin ray (male)	14.5	14.5-15.0	14.8	0.34	3
Longest anal fin ray (female)	-	30.9-31.6	31.2	0.40	3
Maxillary barbel length	32.4	24.9-32.4	30.3	2.74	6
Outer mental barbel length	11.5	9.3-11.5	9.8	0.84	6
Mental barbel length	7.1	6.2-7.8	6.7	0.61	6
Head length	23.2	22.5-26.6	24.6	1.58	6
Percent of head length					
Head width	64.8	61.1-65.5	64.0	1.68	6
Head depth	52.7	46.3-52.7	49.5	2.36	6
Interorbital distance	42.9	40.0-46.0	42.6	2.17	6
Left internarial distance	26.4	21.1-26.4	25.1	2.04	6
Anterior internarial distance	33.0	29.2 – 33.0	31.2	1.53	6
Posterior internarial distance	31.9	31.5-34.7	33.5	1.41	6
Snout length	30.8	28.4-31.0	29.9	0.97	6
Orbital diameter	20.9	19.5-23.6	21.8	1.51	6
Mouth width	40.7	33.7-40.7	38.0	2.41	6

Pharyngobranchial 1 absent; pharyngobranchial 2 short, cartilaginous, somewhat ellipsoid, placed between anteromedial cartilaginous tips of epibranchials 1 and 2; pharyngobranchial 3 elongate, ossified, with expanded posterior border; pharyngobranchial 4 ossified. Upper pharyngeal tooth plate with conical teeth, supported by pharyngobranchial 3 and 4, and also epibranchials 3 and 4 (Fig. 5).

Infraorbital 1 with ventro-lateral process restricted to anterior border of eye. Infraorbital series completed by four thin and canal-like bones. Lateral line on body straight, inconspicuous, with ossified canal bones only anteriorly, unbranched at caudal fin.

Dorsal fin I,5, dorsal-fin spine with 9 minute serrations becoming progressively smaller towards fin base; spine smooth anteriorly and posteriorly. Pectoral fin I,5, pectoral-fin spine with 16-17 retrorse serrations along entire anterior margin; 13 retrorse serrations along posterior margin; anterior serrations smaller than posterior ones. Pelvic-fin i,5, lateral margin rounded. Adipose fin absent in all specimens. Anal fin iii,7; anal-fin pterygiophores with eight rod-like proximal radials and six cartilaginous distal radials. Caudal fin deeply forked, lobes with rounded tips, 8+9 principal rays, all branched plus first branched in each lobe; 10-14 upper and 8-13 lower procurrent rays.

Ribs 9 (one specimen with 10) attached to consecutive vertebrae 6-14, becoming progressively smaller posteriorly. Total vertebrae 32 (N= 2) or 33 (3), observed in cleared and stained (CS) and radiographed specimens (R).

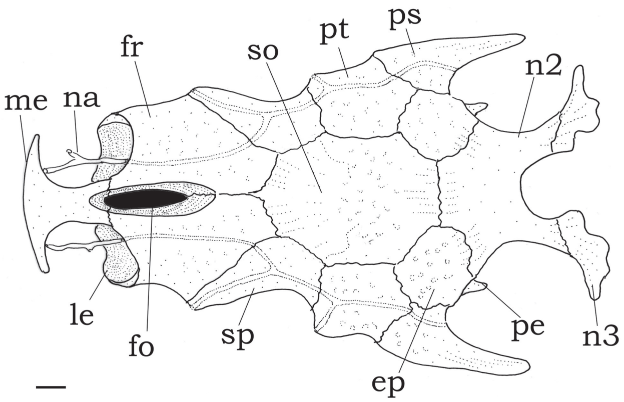

Fig. 2. Neurocranium of *Centromochlus britskii*, MZUSP 43251, paratype, 35.9 mm SL. Dorsal view. Abbreviations: **ep**, epioccipital; **fo**, cranial fontanel, **fr**, frontal; **le**, lateral ethmoid; **me**, mesethmoid; **na**, nasal; **n2**, second nuchal plate; **n3**, third nuchal plate; **pe**, posterior epioccipital process; **ps**, posttemporal-supracleitrum; **pt**, pterotic; **so**, supraoccipital; **sp**, sphenotic. Scale bar =1 mm.

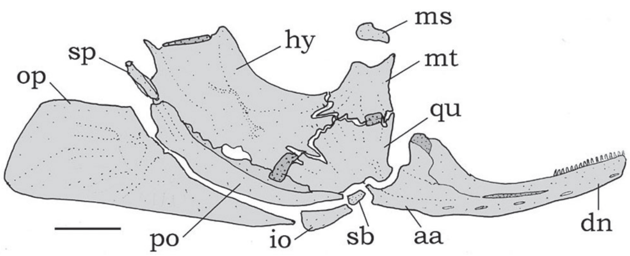

Fig. 3. Right suspensorium of *Centromochlus britskii*, MZUSP 43251, paratype, 35.9 mm SL. Lateral view. Abbreviations: **aa**, angulo-articular; **dn**, dentary; **hy**, hyomandibula; **io**, interopercle; **mt**, metapterygoid; **ms**, mesopterygoid; **op**, opercle; **po**, preopercle; **qu**, quadrate; **sb**, subpreopercle; **sp**, suprapreopercle. Scale bar = 1 mm.

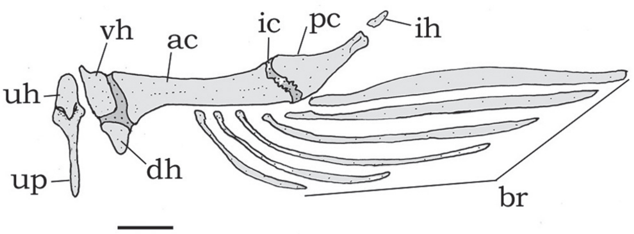

Fig. 4. Right hyoid arch of *Centromochlus britskii*, MZUSP 43251, paratype, 35.9 mm SL. Ventral view. Abbreviations: **ac**, anterior ceratohyal; **br**, branchiostegal rays; **dh**, dorsal hypohyal; **ic**, interceratohyal cartilage; **ih**, interhyal; **pc**, posterior ceratohyal; **vh**, ventral hypohyal; **uh**, urohyal; up, urohyal ventral process. Scale bar = 1 mm.

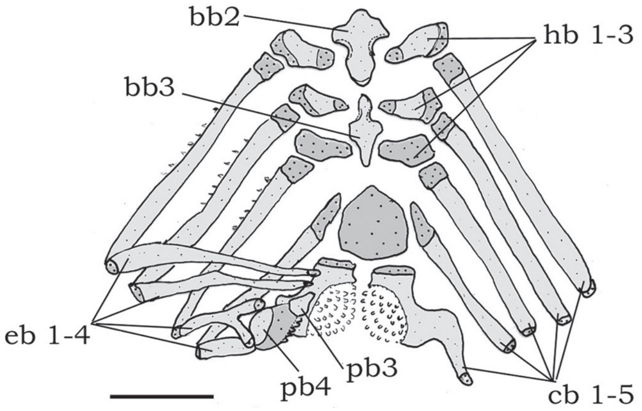

Fig. 5. Pharyngeal arches of *Centromochlus britskii*, MZUSP 43251, paratype, 35.9 mm SL. Dorsal view. Abbreviations: **bb2**, basibranchial 2; **bb3**, basibranchial 3; **bb4**, basibranchial 4; **cb1-5**, ceratobranchials 1 to 5 (anterior to posterior); **eb1-4**, epibranchials 1 to 4 (anterior to posterior); **hb1-3**, hypobranchials 1 to 3; **pb3**, pharingobranchial 3; **pb4**, pharingobranchial 4. Scale bar = 1 mm.

Color in alcohol. Color dark brown with chromatophores scattered on the head and mid-dorsal portions of body; dorsal surface of head and mid-dorsal line darker, with more concentrated chromatophores. Sides of body with light brown chromatophores, becoming sparse towards belly. Fins almost hyaline; rays mottled with pale brown spots along base. Caudal-fin base with irregular black to brown spots; fin becoming hyaline towards distal margin.

Sexual dimorphism. Based on examination of gonads, *Centromochlus britskii* attains sexual maturity at about 33.0 mm SL. Abdominal cavity previously opened in all specimens, revealing most to be adults, the smallest one a maturing female. Genital papilla prominent with a small fleshy tissue around opening in females. The genital papilla of mature males is visible as an emergent deferent duct (Fig. 6, dd). The anal fin of mature males is strongly modified with all proximal radials basally fused to each other, forming a singular structure. Third unbranched ray elongated and thickened, ending in a rounded tip, together with the slim first branched ray (Fig. 6, uiii, b1). First unbranched anal-fin ray thickened and short. Second unbranched ray elongated, with an intermediate size between the neighboring first and third rays. Third unbranched ray longest, twice the width of first branched ray, bearing 13-15 segments (Fig. 6, uiii, b1). Posterior branched rays progressively shorter; last ray the smallest one (Fig. 6, b7). No tegumentary keel preceding the first unbranched anal-fin ray; denticulations absent from anterior rays. No modifications observed in the maxillary barbel and in the dorsal-fin spine of males, unlike some species of Auchenipteridae (*e.g.*, *Auchenipterus*), wherein modified males have stiff and/or spiny ossified maxillary barbels, and an elongated dorsal-fin spine (Ferraris & Vari, 1999; Reis & Borges, 2006; Ribeiro & Rapp Py-Daniel, 2010).

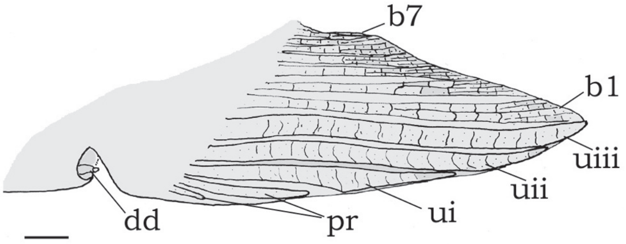

Fig. 6. Male modified anal fin of *Centromochlus britskii*, MZUSP 43251, paratype, 38.6 mm SL. Left side in lateral view. Abbreviations: **b1**, first branched ray; **b7**, seventh branched ray; **dd**, deferent duct; **pr**, unsegmented procurrent anal fin rays (not counted); **ui**, unbranched first ray; **uii**, second unbranched ray; **uiii**, third unbranched ray. Scale bar =1 mm.

Distribution. *Centromochlus britskii* is known from its type locality in the rio Paraná basin near Ilha Solteira, where now is the reservoir of the UHE Ilha Solteira (Fig. 7), in the upper rio Paraná basin, São Paulo, Brazil.

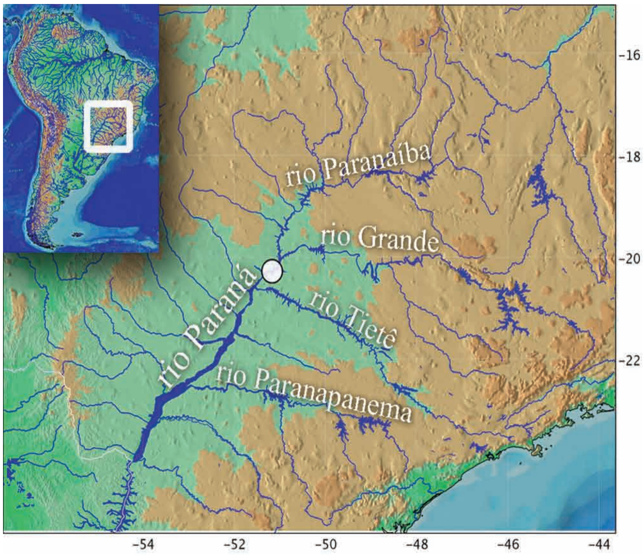

Fig. 7. Map of southeast South America indicating the rio Paraná in UHE Ilha Solteira, type-locality of *Centromochlus britskii*.

Ecological notes. The species is known only from a single sample in 1965, prior to the completion of UHE Ilha Solteira; specimens were collected in places with rocks and rapids near cofferdams in the main channel of the upper rio Paraná. The rio Paraná in that area is now modified as a large reservoir. Analysis of the stomach contents revealed the presence of insect larvae, including Chironomidae, and other invertebrate fragments.

Etymology. The specific name honors Dr. Heraldo Antonio Britski, who collected the type material, for his significant contributions and pioneer studies on the systematics of the catfish family Auchenipteridae (*i.e*, Britski, 1972).

Discussion

Three species of Centromochlinae occur in the upper rio Paraná basin: *Tatia neivai* (Ihering, 1930), *Glanidium cesarpintoi*, and *Centromochlus britskii*, described herein. *Tatia neivai* was described based on the unique holotype that is currently lost (Britski, 1969), and recently redescribed (Sarmento-Soares & Martins-Pinheiro, 2008). Specimens of *Centromochlus britskii* were previously misidentified as *Glanidium cesarpintoi* (Sarmento-Soares & Buckup, 2005). Specimens recently collected confirm the distinctiveness of *G. cesarpintoi* and *C. britskii*. *Glanidium cesarpintoi* differs by having an adipose fin (*vs.* absent in *C. britskii*), anterior nuchal plate present (*vs.* absent), anal-fin radials of mature males only partially fused (*vs.* completely fused), anal fin with 8 branched rays (*vs.* 7) and bearing 21-23 segments in mature males (*vs.* 13-15). *Glanidium cesarpintoi* is currently known from specimens collected from its type locality, rio Mogi Guaçu, a tributary of rio Grande, rio Tibagi, a tributary of rio Paranapanema, and rio Corumbá, a tributary of rio Paranaíba (see Material Examined).

The new species occurred in sympatry with *Tatia neivai*, in the rio Paraná prior to the Ilha Solteira reservoir. *Tatia neivai* has the diagnostic features of *Tatia*, such as the suspensorium with metapterygoid bone united to the quadrate only (*vs.* joined to both quadrate and hyomandibula in *C. britskii*; see fig. 2 in Sarmento-Soares & Martins-Pinheiro, 2008 and Fig. 3 in present paper); caudal peduncle with a middorsal keel posterior to adipose fin (*vs.* caudal peduncle rounded dorsally, lacking keel in *C. britskii*). *Tatia neivai* also has an anterior nuchal plate (*vs.* absent in *C. britskii*); penultimate centrum without ribs (*vs.* pleural ribs attached to consecutive vertebra in *C. britskii*); and head, body and fins dark with small pale blotches (*vs.* head, body and fins light brown with scattered dark chromatophores).

The new species is particularly similar to *Centromochlus simplex* (see below for comments on the latter), which has a diminutive adipose fin, 6-7 branched anal-fin rays and retrorse serrations along both margins of pectoral-fin spine. The new species is distinguished from *C. simplex* by having an adipose fin (*vs.* adipose fin absent in *C. britskii*); 17 upper plus 15 lower caudal fin procurrent rays (*vs.* 9 upper plus 8 lower) and longer posterior cleithral process, 20% of SL (*vs.* 16% of SL). The new species is also very similar to *Centromochlus bockmanni*, a species apparently endemic to the rio São Francisco basin. *Centromochlus bockmanni* is distinguished by having adipose fin (*vs.* absent in *C. britskii*), caudal fin procurrent rays 14 upper plus 13 lower (*vs.* 9 upper plus 8 lower); pectoral-fin spine with antrorse serrations along anterior margin and retrorse serrations along posterior margin (*vs.* retrorse serrations along both anterior and posterior margins).

The new species is herein described in the genus *Centromochlus* by possessing an elongated maxilla that extends into the maxillary barbel; infraorbital 1 with an elongate ventrolateral process, forming anterior border of orbit; and a longitudinal crest on the parasphenoid and orbitosphenoid for attachment of the *adductor arcus palatini* (Soares-Porto, 1998; Sarmento-Soares & Porto, 2006). In addition, *Centromochlus britskii* lacks the features used to diagnose the other genera of Centromochlinae, namely *Tatia*, *Glanidium* and *Gelanoglanis*. *Tatia* was defined by Sarmento-Soares & Martins-Pinheiro (2008) as having hyomandibula elongated anterodorsally, not contacting the narrow metapterygoid, anal-fin base of adult males reduced and caudal peduncle compressed and deep, somewhat keeled posterior to adipose fin. *Glanidium* is diagnosed by having sphenotic and pterotic excavated, resulting in strongly concave lateral margin of neurocranium (Ferraris, 1988; Soares-Porto, 1998); presence of anterior nuchal plate, and anal-fin radials not completely fused in mature males. *Gelanoglanis* is a miniature and derived taxon of Centromochlinae with several autapomorphies (see Introduction). Although the new species is demonstrably valid, problems persist concerning the taxonomy of some species of *Centromochlus*.

Comments on *Centromochlus simplex*. Until recently, *Tatia simplex* Mees, 1974 was only known from the holotype collected in the rio das Mortes, rio Araguaia basin. *Tatia simplex* is a valid taxon within the centromochlin subfamily, a clade characterized by the following three synapomorphies, exclusive to adult males: modified anal-fin rays and proximal radials with a posterior orientation; urogenital papillae emerging from a skin flap at anal-fin origin; and proximal radials basally fused to each other, forming a single ossification (Soares-Porto, 1998). Sarmento-Soares & Martins-Pinheiro (2008) recently revised *Tatia*, diagnosing it based on the following exclusive characteristics: suspensorium with metapterygoid united to quadrate but not to hyomandibula and caudal peduncle with a middorsal keel posterior to adipose fin. Based on examinations of the holotype and additional specimens from the Tocantins and Xingu river basins, Sarmento-Soares & Martins-Pinheiro (2008) treated *T. simplex* as "*Centromochlus*" *simplex incertae sedis* in Centromochlinae because it lacks all characteristics diagnostic of *Tatia* (*e.g.*, suspensorium is joined to both quadrate and hyomandibula in *C. simplex*). *Centromochlus simplex* also lacks the features used to diagnose *Glanidium* (Soares-Porto, 1998; Sarmento-Soares & Martins-Pinheiro, 2013), such as voluminous section A2 of the *adductor mandibulae* muscle associated with a deep concavity between sphenotic and pterotic, and anterior nuchal plate present. *Centromochlus simplex* does not share the unique features present in *Gelanoglanis* described in Soares-Porto *et al.* (1999) and Rengifo *et al.* (2008), already mentioned in the introduction.

At present, *Centromochlus* is a morphologically heterogeneous assemblage of species supported by the following synapomorphies: presence of an elongate maxilla that extends into the maxillary barbel; an elongate ventrolateral process of infraorbital 1, forming anterior border of orbit; and a longitudinal crest on the parasphenoid and orbitosphenoid for attachment of the muscle *adductor arcus palatini* (Soares-Porto, 1998; Sarmento-Soares & Porto, 2006). Although some variation occurs within *Centromochlus* and further investigation of its monophyly are necessary, *C. simplex* shares all those features hypothesized for *Centromochlus* as synapomorphies. In addition, the lack of anterior nuchal plate is a feature common to some species of *Centromochlus* and *Gelanoglanis*. Based on our observations, *Tatia simplex* is herein considered as a member of genus *Centromochlus*.

Material examined. *Centromochlus altae*. **Colombia.** USNM 121965, 1, 35.5 mm SL, río Dedo, tributary of río Orteguazo. *Centromochlus concolor*. **Brazil.** Pará State. MZUSP 31878, 1, 48.7 mm, rio Tapajós, Alter do Chão. MZUSP 8535, 6, 1 CS, 46.5-76.5 mm SL, rio Tapajós, Santarém. *Centromochlus existimatus*. **Brazil.** Acre State. MZUSP 48880, 1, 90.2 mm SL, Porto de rio Branco, rio Branco. *Centromochlus heckelii*. **Brazil.** Acre State. MZUSP 48910, 2, 80.0-83.2 mm SL, rio Acre between seringal Paraíso and lagoa Amapá. Pará State. MZUSP 8336, 2 CS, 53.4-62.0 mm SL, rio Tapajós, Santarém. Amazonas State. INPA 8203, 2, 73.3-81.8 mm SL, Manacapuru. INPA 10967, 2, 106.2-108.7 mm SL, rio Jamari. *Centromochlus macracanthus*. **Brazil.** Amazonas State. INPA 6565, 1, 129.7 mm SL, rio Negro. MZUSP 30605, 2, 65.7-71.8 mm SL, paratypes, rio Negro, Cachoeira de São Gabriel. *Centromochlus meridionalis*. **Brazil.** Mato Grosso State. MBML 5616, 1 CS, 39.1 mm SL, MBML 5617, 3, 32.2-46.2 mm SL, MNRJ 40702, 3, 32.6-38.3 mm SL, Córrego Loanda, a small tributary of rio Roquete, Cláudia. *Centromochlus perugiae*. **Brazil.** Acre State. MZUSP 31880, 1, 28.2 mm SL, rio Tarauacá, Tarauacá. **Ecuador.** MNRJ 30489, 1, 38.5 mm SL, rio Aguari, Napo. **Peru.** MNRJ 30490, 1, 38.4 mm SL, Huanuco, Amazonas. MZUSP 26029, 2, 22.3-29.8 mm SL, rio Chiriaco, provincia Bagua. MZUSP 26684, 4, 26.2-35.9 mm SL, arroyo de Ivita-Pucallpa, Caserio Neshuya, Provincia Coronel Portillo, Ucayali. *Centromochlus punctatus*. **Brazil.** Pará State. INPA 18480, 2, 35.8-37.0 mm SL, rio Tocantins, Tucurui, Igarapé Tucuruizinho. MZUSP 31877, 1, 29.7 mm, rio Itacaiunas, Caldeirão, Cachoeira Carreira Comprida, Serra dos Carajás. *Centromochlus reticulatus*. **Guyana.** RMNH. PISC 26744, 2 R, 18.3-39.8 mm SL, paratypes, Karanambo, Rupununi. *Centromochlus romani*. **Venezuela**. AMNH 91382, 2, 32.5-32.7 mm SL, rio Siapa, Amazonas. *Centromochlus schultzi*. **Brazil.** Goiás State. MNRJ 12139, 10 of 38, 1 CS, 85.0-108.9 mm SL, Serra da Mesa dam, upper rio Tocantins. Mato Grosso State. MNRJ 9417, 2, 32.7-60.8 mm SL, upper rio Xingu. *Centromochlus simplex*. **Brazil.** Mato Grosso: BMNH 1971.7.29: 5, 1, 28.2 mm SL, holotype of *Tatia simplex*: Xaventina, rio das Mortes; MZUSP 47506, 1 CS, Igarapé do Aeroporto, Humboldt, Aripuanã. MZUSP 36862, 2, 28.4- 29.6 mm SL, rio Xingu. MZUSP 82350, 3, 26.2-27.1 mm SL, rio Tocantins. Pará: MZUSP 36862, 3, 28.1-29.3 mm SL, rio Xingu. MZUSP 44071, 2, 45.0-47.7 mm SL, lake in front of Jatobal, rio Tocantins; MZUSP 44074, 1, 27.9 mm SL, lake near Capitariquara channel, near Jatobal, rio Tocantins. INPA 18475, 1, 19.9 mm SL, rio Tocantins, Jatobal rapids.

Glanidium cesarpintoi. **Brazil.** Goiás: MNRJ 41724, 3, 1 CS, 65.2-83.2 mm SL, NUP 5699, 7, 77.7-87.9 mm SL, rio Corumbá (Areia), tributary of rio Paranaíba, Pires do Rio near boundary with Ipameri. São Paulo: DZSJRP 4570, 1 R, 89.7 mm SL, Salto Grande Reservoir, downstream. DZSJRP 6343, 1, 13.6 mm SL, rio Borá, between Nova Aliança and Potirendaba. Paraná: MZUEL 108, 1, 85.5 mm SL, 1 CS, 95.7 mm SL, rio Tibagi, 23°21'9"S 51°00'52"W; MZUEL 5392, 1, 94.3 mm SL, rio Tibagi at Limoeiro, 23°21'9"S 51°00'52"W.

Tatia neivai. **Brazil.** São Paulo: MZUSP 42570, 1 CS, 60.5 mm SL, lake on rio Atibaia, near Jaguariuna; MZUSP 47505, 7, 53.1-62.1 mm SL, Ilha Solteira, rio Paraná, Ilha Solteira dam.

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