Neotropical Ichthyology

Original article

https://doi.org/10.1590/1982-0224-2024-0021

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Two new species of *Neoplecostomus* (Siluriformes: Loricariidae) from high altitudes of the upper rio Paraná basin, Brazil

Pedro L. C. Uzeda[1], Isabel Paiola[2], Poliana S. Cesar[2], Vitor Kenzo N. Okubo[2], Wellington J. Marques-Frisoni[2], Breno N. Andrade[2] and Francisco Langeani[2]

Correspondence:
Pedro L. C. Uzeda
pedro.lc.uzeda@gmail.com

Two new species of *Neoplecostomus* are described from the headwaters of the rio Sapucaí drainage, affluent of the rio Grande in upper rio Paraná basin. The new species are most similar to each other, and can be diagnosed from congeners by having the exposed area of the first plates of mid-ventral and ventral series narrower than the naked area surrounding each plate; different tooth morphologies and numbers in males and females; arrangement of odontodes on caudal-peduncle plates; size of adipose fin and cranial osteological character states. Both new species are endemic to Serra da Mantiqueira, southeastern Brazil. Some comments are made on their intraspecific variation, genetics, and conservation.

Keywords: Armored catfish, Headwaters, Ichthyofauna, Serra da Mantiqueira, Sexual dimorphism.

Submitted March 6, 2024
Accepted September 13, 2024
by Bruno Melo
Epub December 6, 2024

1 Laboratório de Ecologia de Peixes, Departamento de Ecologia e Conservação, Universidade Federal de Lavras, Trevo Rotatório Professor Edmir Sá Santos, s/n, 37203-202 Lavras, MG, Brazil. (PLCU) pedro.lc.uzeda@gmail.com (corresponding author).

2 Departamento de Ciências Biológicas, UNESP - Universidade Estadual Paulista "Júlio de Mesquita Filho", Rua Cristóvão Colombo, 2265, Jardim Nazareth, 15054-000 São José do Rio Preto, SP, Brazil. (IP) isabel.p.goncalves@unesp.br, (PSC) poliana.siqueira@unesp.br, (VKNO) vitor.kenzo@unesp.br, (WJMF) wellington.m.frisoni@unesp.br, (BNA) nevesandrades@gmail.com, (FL) francisco.langeani@unesp.br.

Online version ISSN 1982-0224
Print version ISSN 1679-6225

Neotrop. Ichthyol.
vol. 22, no. 4, Maringá 2024

Official Journal of the Sociedade Brasileira de Ictiologia

Duas novas espécies de *Neoplecostomus* são descritas de cabeceiras da drenagem do rio Sapucaí, afluente do rio Grande no alto rio Paraná. As novas espécies são as mais similares entre si, e podem ser diagnosticadas das demais congêneres por terem a área exposta das primeiras placas das séries médio-ventral e ventral mais estreitas que as áreas nuas circundando cada placa; dentes com morfologias e quantidades diferentes em machos e fêmeas; arranjo dos odontódeos nas placas do pedúnculo caudal; tamanho da nadadeira adiposa e caracteres osteológicos craniais. Ambas são endêmicas da Serra da Mantiqueira, no sudeste brasileiro. Alguns comentários são feitos sobre suas variações intraespecíficas, genética e conservação.

Palavras-chave: Cascudo, Dimorfismo sexual, Ictiofauna, Riachos, Serra da Mantiqueira.

INTRODUCTION

Loricariidae is the most species-rich family within Siluriformes and the second most specious family of Neotropical freshwater fishes (Fricke *et al*., 2024), being widespread across Central and South America (Reis *et al*., 2003). Neoplecostomini is a tribe of reophilic loricariids restricted to the drainages of Brazilian Crystaline Shield, mostly inhabiting streams and medium sized rivers with high water flow (Pereira, Reis, 2017). Among them, *Neoplecostomus* Eigenmann & Eigenmann, 1888 is diagnosed by the presence of two to three series of hypertrophied papillae on the lower lip, posteriorly parallel to dentary rami; presence of abdominal plates arranged into a pentagonal or hexagonal shield between pectoral and pelvic fins; pectoral and dorsal-fin locking mechanisms not functional; and pectoral-fin spine strongly curved posteriorly, resembling an arch in dorsal view (Langeani, 1990; Pereira, Reis, 2017).

The genus is currently composed by the following 19 valid species, distributed across several drainages of central, southeastern and southern Brazil: *Neoplecostomus granosus* (Valenciennes, 1840) from coastal drainages of State of Rio de Janeiro; *N. microps* (Steindachner, 1877) and *N. variipictus* Bizerril, 1995 from the rio Paraíba do Sul basin; *N. franciscoensis* Langeani, 1990 from the rio São Francisco basin; *N. espiritosantensis* Langeani, 1990 from the rio Jucu basin; *N. ribeirensis* Langeani, 1990 from the rio Ribeira de Iguape basin; *N. paraty* Cherobim, Lazzarotto & Langeani, 2016 from the rio Perequê-Açú basin; *N. doceensis* Roxo, Silva, Zawadzki & Oliveira, 2014 and *N. pirangaensis* Oliveira & Oyakawa, 2019 from rio Doce basin; *N. paranensis* Langeani, 1990, *N. corumba* Zawadzki, Pavanelli & Langeani, 2008, *N. selenae* Zawadzki, Pavanelli & Langeani, 2008, *N. yapo* Zawadzki, Pavanelli & Langeani, 2008, *N. botucatu* Roxo, Oliveira & Zawadzki, 2012, *N. bandeirante* Roxo, Oliveira & Zawadzki, 2012, *N. langeanii* Roxo, Oliveira & Zawadzki, 2012, *N. jaguari* Andrade & Langeani, 2014, *N. canastra* Roxo, Silva, Zawadzki & Oliveira, 2017, and *N. watersi* Silva, Reia, Zawadzki & Roxo, 2019 from the upper rio Paraná basin.

In the last decade, expeditions to the headwaters of rio Sapucaí, affluent to rio Grande in upper rio Paraná basin, revealed populations of *Neoplecostomus* belonging to undescribed species (Lucena *et al*., 2012; Andrade, 2017). By comparing populations collected across the rio Sapucaí drainage, we found them to belong to two new species of the genus, which are formally described herein.

MATERIAL AND METHODS

Morphological analysis. Specimens were collected using dip-nets and sieves, anesthetized in 0.5 mL/L eugenol solution and fixed in 10% formalin for 15 days, and then transferred to 70% ethanol for morphological analysis and permanent storage.

Measurements and counts were taken from the left side of specimens using a digital caliper with precision of 0.1 mm. Specimens inferior to 50.0 mm in standard length (SL) were not included in morphological analysis and are categorized as unmeasured, following Cherobim *et al*. (2016). Measurements follow Langeani (1990) with modifications proposed by Zawadzki *et al*. (2008) and Andrade (2017): lower lip width (greatest distance between lateral margins of lower lip), lower lip length (distance between dentary and distal margin of lower lip, taken at the medial portion), and anal-fin length (from base to tip of longest ray), as percentage of head length (HL). Furthermore, we added the following measurements: adipose-fin length, presented as percents of SL, interorbital distance/orbital diameter, interorbital distance/mandibulary width, predorsal length/dorsal-fin spine length, pelvic-fin spine length/caudal peduncle depth, and lower caudal-fin unbranched ray/caudal peduncle depth. Counts and measurements of dermal plates and osteological structures follow Schaefer (1997). In counts, the size of adipose fin is given as the number of dorsal plates below it. Values of central tendency, mean (for measurements) and mode (for counts), minimum and maximum values, and standard deviation are also given.

Terminology used for cephalic sensory canals follow Arratia, Huaquin (1995) and Bockmann, Ribeiro (2003). For osteological analyses, specimens were cleared and stained (c&s) following Taylor, Van Dyke (1985). Dorsal-fin ray counts include the spinelet as the first unbranched ray.

A digital camera attached to stereomicroscope (Leica, M205C) was used to capture images (lateral series of plates, caudal peduncle and adipose fin, dorsal view of left infraorbital series) of the new species. Illustrations were made in Adobe Illustrator® software with a drawing tablet over pictures of preserved specimens.

Type-series are deposited in the following Brazilian institutions, named as: CI-UFLA (Coleção Ictiológica, Universidade Federal de Lavras), DZSJRP (Departamento de Ciências Biológicas, Universidade Federal Paulista "Júlio de Mesquita Filho", São José do Rio Preto), MNRJ (Museu Nacional, Universidade Federal do Rio de Janeiro), MCP (Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre), and MZUSP (Museu de Zoologia, Universidade de São Paulo). Juvenile specimens collected without adults at the same stream were considered as non-types.

Conservation status. The conservation status of both species were evaluated following the International Union for Conservation of Nature (IUCN) criteria (IUCN Standards and Petitions Subcommittee, 2022). The extent of occurrence of each species was calculated through QGIS v. 3.30.3 based on the HydroBASINS database, in which the minimum convex polygon was determined as the total area of the microbasins where each species occurs (Lehner, Grill, 2013).

RESULTS

Neoplecostomus altimontanus, new species

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(Figs. 1–7; Tab. 1)

Holotype. DZSJRP 24792, male, 90.2 mm SL, Brazil, Minas Gerais, Itamonte, rio Grande sub-basin, rio Sapucaí drainage, rio Capivari at Engenho da Serra district, 22°21'04.38"S 44°47'11.66"W, 1.357 m a.s.l., 12 Aug 2023, P. L. C. Uzeda & L. Sartori.

Paratypes. All from Brazil, Minas Gerais, Itamonte, rio Grande sub-basin, rio Sapucaí drainage, rio Verde microbasin. Rio Capivari, affluent to rio Verde: CI-UFLA 1785, 2, 71.4–76.8 mm SL, DZSJRP 24793, 5, 52.5–93.2 mm SL (1 c&s, 85.5 mm SL), collected with the holotype. Instituto Alto-Montana da Serra Fina, Albert Heilmann waterfall at Córrego Pinhão Assado. CI-UFLA 2176, 35, 25 unmeasured, 10, 51.1–88.6 mm SL, DZSJRP 24794, 17, 54.8–93.5 mm SL, 22°21'22.21"S 44°47'50.73"W, 1.427 m a.s.l., Dec 2010, P. Pompeu, R. Loures, N. Tadini & C. Gandini.

Diagnosis. *Neoplecostomus altimontanus* differs from all congeners, except *N. bandeirante* and *Neoplecostomus* sp. n. (described below), by having the exposed area of the first plates of mid-ventral and ventral series narrower than the naked area surrounding each plate (*vs.* all other congeners with exposed area of first plates of mid-ventral and ventral series equal to or wider than the naked area surrounding each plate) (Fig. 2). Furthermore, the new species differs from all congeners, except *N. jaguari*, *N. langeanii*, and *N.* sp. n., by presenting sexual dimorphism in dentition, with males having more robust and fewer teeth compared to females (Fig. 3) (*vs.* tooth morphology and number similar in both sexes in all other congeners). Additionally, *N. altimontanus* differs from *N. bandeirante* by the absence of azygous pre-adipose plates (*vs.* presence); from *N. jaguari* by having one or two posteronasal plates (*vs.* 5–7); from *N. langeanii* by the presence of an extra canal-bearing plate between supraopercle and dorsal opening of preopercular canal (Fig. 4) (*vs.* extra canal-bearing plate absent).

Neoplecostomus altimontanus is most similar to *Neoplecostomus* sp. n., from which differs by having conspicuous dark spots over body and fins (*vs.* transverse light bars); presence of slightly hypertrophied odontodes on the posterior portion of the plates of dorsal, mid-dorsal, median and mid-ventral series, resembling discontinuous keels on caudal peduncle (*vs.* odontodes on caudal-peduncle plates roughly equal in size; caudal-

FIGURE 1 | *Neoplecostomus altimontanus*, holotype, DZSJRP 24792, male, 90.2 mm SL, Itamonte, rio Capivari, rio Sapucaí drainage, rio Grande sub-basin, upper rio Paraná basin. Dorsal, lateral, and ventral views.

peduncle surface smooth and rounded in cross-section) (Fig. 5); well-developed adipose fin, extending over four or five dorsal plates, usually five (*vs.* reduced adipose fin, extending over three or four plates, usually three) (Fig. 5); absence of a lateronasal plate (*vs.* lateronasal plate present) (Fig. 6); smaller nares (nare length 3.0–9.0% *vs.* 9.9–14.1% of HL); and by the higher premaxillary (31–42, modally 35 *vs.* 24–33, modally 26) and dentary (31–40, modally 31 *vs.* 22–31, modally 26) teeth counts in females.

Description. Measurements and counts in Tab. 1. Body elongated and depressed. Greatest width at anterior portion of cleithrum, gradually narrowing towards caudal peduncle. Dorsal profile of body slightly convex, rising from snout tip to dorsal-fin origin, descending to procurrent rays of caudal fin. Body deepest at dorsal-fin origin. Trunk rounded and caudal peduncle polygonal in cross-section. Ventral profile depressed to origin of anal fin, slightly rounded to caudal fin.

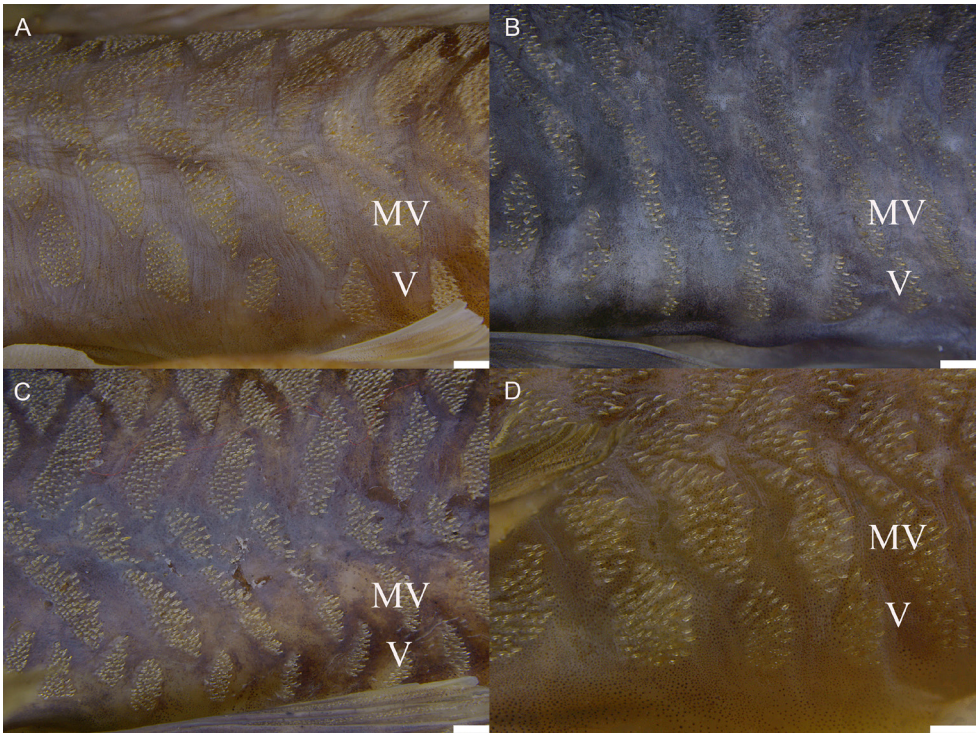

FIGURE 2 | Lateral series of plates, left view. **A.** *Neoplecostomus bandeirante*, paratype, DZSJRP 14881, male, 95.9 mm SL. **B.** *N. altimontanus*, paratype, DZSJRP 24793, female, 93.2 mm SL. **C.** *N.* sp.n., paratype, DZSJRP 14877, male, 84.7 mm SL. **D.** *N. botucatu*, paratype, DZSJRP 14879, male, 80.2 mm SL. MV = mid-ventral series; V = ventral series. Scale bars = 1 mm.

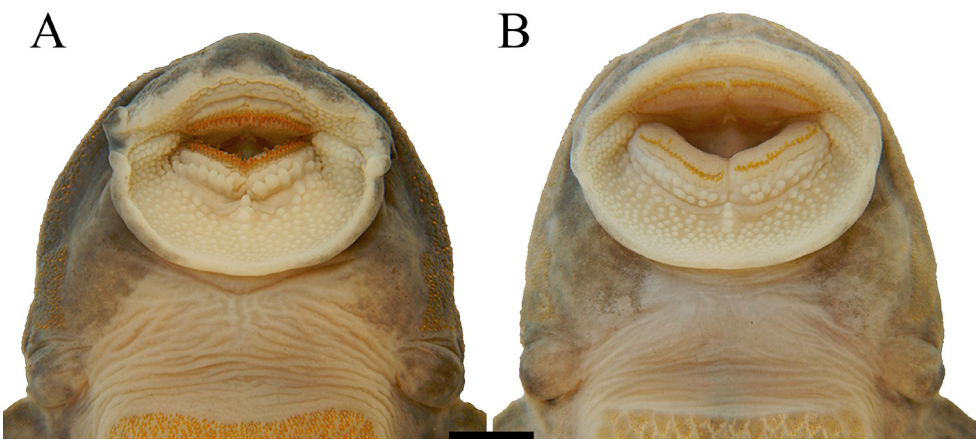

FIGURE 3 | Sexual dimorphism in dentition of *Neoplecostomus altimontanus*, also present in *N.* sp.n. **A.** Holotype, DZSJRP 24792, 90.2 mm SL, male with robust and few teeth. **B.** Paratype, DZSJRP 24793, 93.2 mm SL, female with slender and numerous teeth. Scale bar = 5 mm.

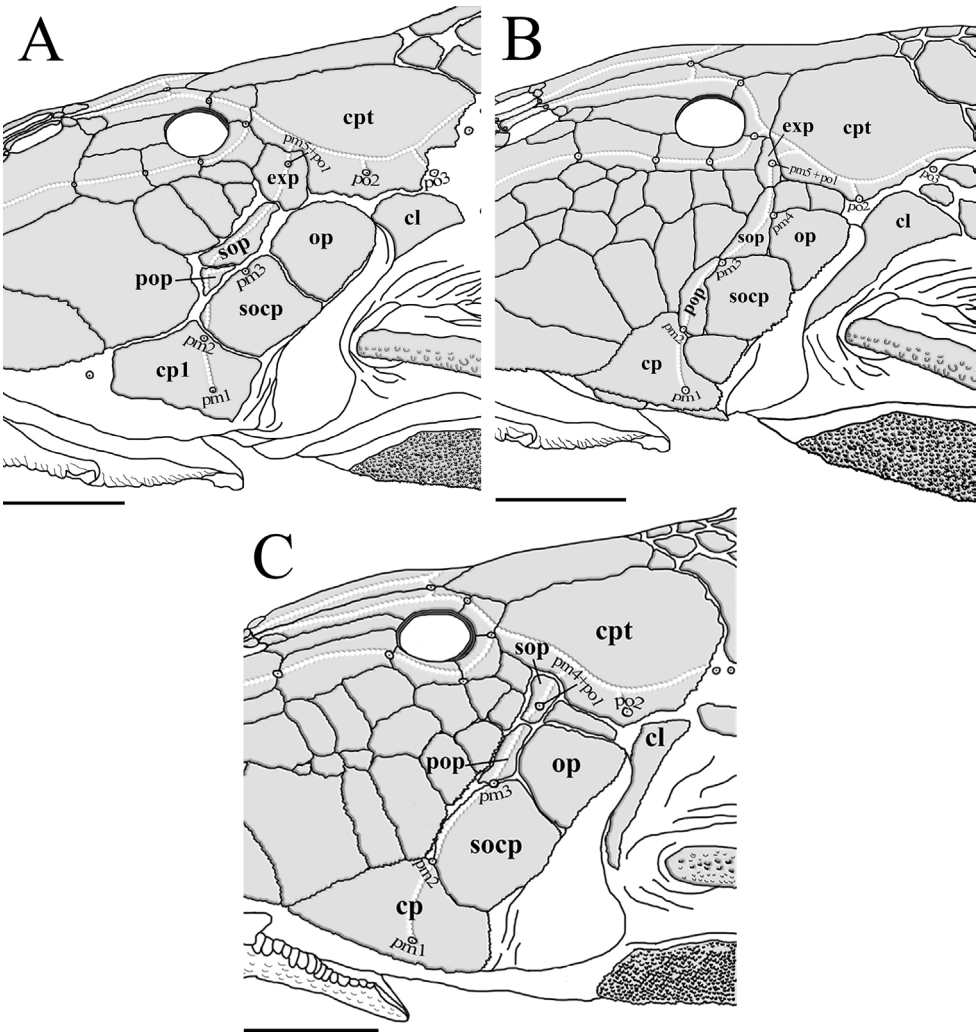

FIGURE 4 | Schematic view of left opercular series. **A.** *Neoplecostomus altimontanus*, paratype, CI-UFLA 2176, male, 88.6 mm SL. **B.** *N.* sp.n., paratype, DZSJRP 20586, female, 86.7 mm SL. **C.** *N. paranensis*, CI-UFLA 3186, male, 72.6 mm SL. Osteological and sensorial structures are represented as: cl (posterior process of cleithrum); cp (cheek plate); cpt (compound pterotic); exp (extra canal-bearing plate); op (opercle); po1–3 (postotic pores 1–3); pop (preopercle); pm1–5 (preoperculomandibular pores 1–5); socp (subocular cheek plate), and sop (supraopercle). Scale bars = 5 mm.

Body entirely covered with bony plates, except around dorsal-fin origin, ventral surface of head, lateral portion of trunk between pectoral and pelvic-fin base, and around ventral shield. Presence of minute keels on dorsal, mid-dorsal, lateral, and mid-ventral series of plates; exposed area of first plates on mid-ventral and ventral series narrower than naked areas surrounding each plate. Abdomen with small plates covered with odontodes, arranged into pentagonal to hexagonal shield between pectoral- and pelvic-fin origins.

Head broad and rounded. Snout tip naked, without bony plates. Lateral margins of head and snout lacking hypertrophied odontodes and swollen skin. Interorbital region slightly convex in frontal view. Eyes dorsolaterally located and moderate sized. Head naked ventrally, except for cheek plate, not divided and with mesial projection. Extra

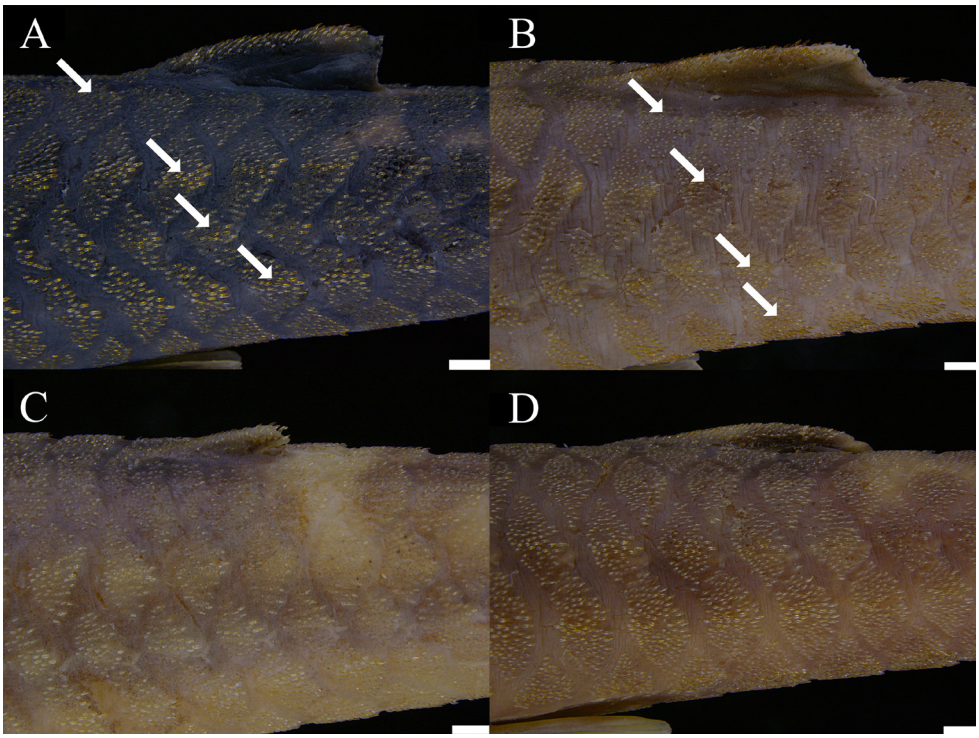

FIGURE 5 | Caudal peduncle and adipose fin, left view. **A.** *Neoplecostomus altimontanus*, holotype, DZSJRP 24792, male, 90.2 mm SL. **B.** *N. bandeirante*, paratype, DZSJRP 14881, male, 95.9 mm SL. **C.** *N.* sp.n., paratype, DZSJRP 13944, male, 76.3 mm SL. **D.** *N. microps*, DZSJRP 13913, male, 90.2 mm SL. White arrows indicate the slightly hypertrophied odontodes on caudal-peduncle plates, resembling discontinuous keels. Scale bars = 1 mm.

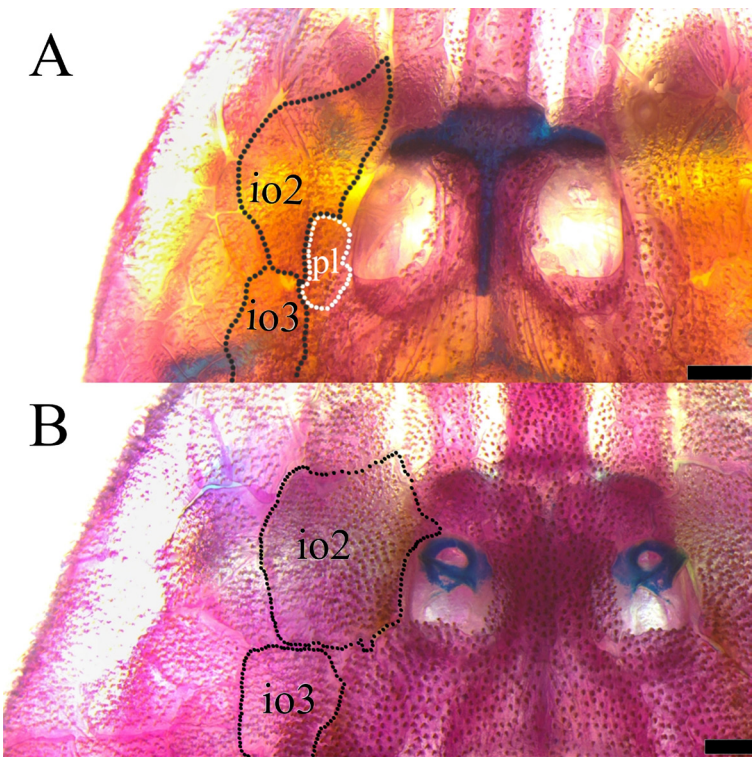

FIGURE 6 | Dorsal view of left infraorbital series, anterior to top. **A.** *Neoplecostomus* sp.n., paratype, MNRJ 23963, male, 55.8 mm SL; **B.** *N. altimontanus*, paratype, DZSJRP 24793, male, 85.5 mm SL. Infraorbital 2 (io2); infraorbital 3 (io3); lateronasal plate (pl). Black dots delimit the infraorbitals; white dots delimit the lateronasal plate. Scale bars = 1 mm.

TABLE 1 | Morphometric data and counts for the holotype and 27 paratypes of *Neoplecostomus altimontanus*. M = male, F = female.

	Holotype	Range	Mean	SD
Standard length (mm)	90.2	52.5–93.5	77.6	11.1
Percents of standard length				
Predorsal length	42.9	42.8–47.7	44.7	1.2
Head length	30.9	30.0–34.4	32.5	1.0
Head width	28.3	25.9–29.8	27.8	1.1
Cleithrum width	27.7	25.8–29.9	28.0	0.8
Occipital-dorsal distance	11.8	9.6–14.8	12.2	1.2
Thoraxic length	16.3	13.9–18.2	16.1	1.1
Interdorsal length	19.0	17.6–22.5	20.0	1.5
Caudal-peduncle length	29.4	25.4–31.7	28.8	1.6
Caudal-peduncle depth	7.2	6.3–8.1	7.0	0.4
Body depth	18.1	16.8–22.1	18.8	1.3
Preanal length	62.4	60.8–66.4	63.3	1.3
Adipose-fin length	9.8	7.2–10.9	9.4	0.9
Percents of head length				
Head width	91.8	80.0–93.2	85.6	3.5
Head depth	53.2	42.3–59.0	49.4	3.9
Snout length	64.6	60.3–67.4	64.1	1.5
Orbital diameter	8.3	7.2–9.2	8.1	0.6
Interorbital distance	32.6	28.3–35.7	31.8	1.6
Mandibular width	17.1	12.5–23.4	18.7	2.3
Lower-lip width	53.0	45.7–74.5	63.4	7.3
Lower-lip length	20.0	12.9–30.3	20.6	4.2
Nare length	3.6	3.0–9.0	4.5	1.3
Nare width	3.0	2.6–4.9	3.3	0.6
Anal-fin length	53.9	49.0–58.6	54.3	2.6
Other percents				
Interorbital distance/orbital diameter	28.2	21.9–29.5	25.6	2.3
Predorsal length/dorsal-fin spine length	44.6	35.9–49.6	44.7	3.1
Pelvic-fin spine length/caudal peduncle depth	32.5	26.1–33.5	29.4	2.1
Lower caudal-fin unbr. ray/caudal peduncle depth	32.3	24.5–32.3	28.8	2.2
Counts	**Holotype**	**Range**	**Mode**	**SD**
Dorsal plates	27	26–30	29	1.0
Mid-dorsal plates	25	24–29	25	1.3
Median plates	28	25–33	29	2.0
Mid-ventral plates	26	24–29	26	1.3
Ventral plates	25	18–29	24	2.0
Predorsal plates	5	4–6	6	0.6
Plates at dorsal-fin base	5	5–7	6	0.6
Plates between dorsal and caudal	17	16–18	17	0.6
Plates between adipose and caudal	6	5–7	6	0.5
Plates between anal and caudal	11	11–14	12	0.8
Plates below adipose fin	4	4–5	5	0.5
Premaxillary teeth (M)	17	17–22	17	1.7
Dentary teeth (M)	16	12–19	16	1.8
Premaxillary teeth (F)	–	31–42	35	4.2
Dentary teeth (F)	–	31–40	31	3.6

canal-bearing plate between supraopercle and compound pterotic. Lips moderately developed and rounded; posterior margin of lower lip slightly convex, reaching or almost reaching pectoral girdle. Lower lip covered with small rounded papillae; two or three series of hypertrophied papillae immediately posterior to dentary teeth. Dentary rami angled towards each other at about 110°–115°. Maxillary barbel poorly developed, entirely coalesced to lower lip. All teeth bicuspid e copper colored; lateral cusp smaller than mesial cusp.

Dorsal fin ii,7, originating slightly posterior to vertical through pelvic-fin origin. Spinelet always present and larger than base of unbranched ray; locking mechanism not functional. Posterior margin straight and roughly emarginate, reaching vertical through anal-fin origin when adpressed. Adipose fin well developed, extending over four or five dorsal plates; preadipose azygous plates absent; adipose-fin spine homogeneously covered with odontodes. Pectoral fin i,6; unbranched ray dorsoventrally depressed, curved posteriorly and shorter than first branched ray; posterior margin straight, surpassing first third of pelvic fin when adpressed. Pelvic fin i,5; unbranched ray slightly curved inwards; ventral surface flattened and covered with spatulate odontodes. Anal fin i,5; unbranched ray covered with small odontodes, except for naked area on anterior surface; posterior margin straight. Caudal fin i,7,7,i; inferior lobe longer than superior lobe; posterior margin concave.

Supraorbital sensory canal with four pores; pore s1 at anteromesial margin of anterior nare; pore s3 at posteromesial margin of posterior nare; pore s6+s6 at interorbital region, approximately near middle of eye length in transverse line; pore s8 located posteromesially to eye, longitudinally aligned to nares. Infraorbital sensory canal with six pores; pore io1 at anterior margin of first infraorbital; pore io2 between posterior margin of first infraorbital and anterior margin of second infraorbital; pore io3 between second and third infraorbitals; pore io4 between third and fourth infraorbitals; io5 between fourth and fifth infraorbitals; io6 between superior margin of fifth infraorbital and inferior margin of sphenotic. Preoperculomandibular sensory canal with four pores; pore pm1 on ventral margin of cheek plate, pore pm2 between superior margin of cheek plate and inferior margin of preopercle; pore pm3 between superior margin of preopercle, and inferior margin of supraopercle; pore pm5+po1 rising on surface of extra canal-bearing plate. Three postotic sensory pores; pore po1 fused to pore pm5; pore po2 above branchial slit, and pore po3 on skin overlying opening of swim-bladder capsule.

Coloration in alcohol. Coloration variable; body normally covered with dark spots bigger than eye diameter and fainted vermiculations over brownish to grayish background (see Discussion for comments on coloration patterns). Dark spots over fin rays, forming three to four diffuse bars; interradial membranes hyaline in life (Fig. 7). Juveniles present four conspicuous transverse light bars on dorsal region of body, located at predorsal region, dorsal-fin base, region between dorsal and adipose fin, and between adipose and caudal fin. Coloration in alcohol similar to that in life, but with slightly less contrasting patterns.

FIGURE 7 | Live specimen of *Neoplecostomus altimontanus*, DZSJRP 24793, paratype, male.

Sexual dimorphism. Males have a urogenital papilla posterior to anal opening and a skin flap along the dorsal surface of unbranched pelvic-fin ray (both absent in females). Additionally, males have teeth short, robust and fewer in number (17–22 premaxillary and 12–19 dentary teeth) compared to females, which have slender and more numerous teeth (31–42 premaxillary and 31–40 dentary teeth).

Geographical distribution. The new species is known from two streams on the northern slope of Serra da Mantiqueira, southeastern Brazil. These two streams are located in the rio Capivari within rio Verde microbasin, affluent to rio Sapucaí, rio Grande sub-basin, upper rio Paraná basin. The headwaters of rio Sapucaí are separated from those of the rio Paraíba do Sul basin by Serra da Mantiqueira, and the localities of *N. altimontanus* are situated approximately four kilometers from the latter basin (Fig. 8).

Ecological notes. *Neoplecostomus altimontanus* is found in environments typically inhabited by members of Neoplecostomini: streams with shallow depth (<1 m), crystal clear water, high flow, low temperature and high oxygen levels. Specimens were more frequently captured at the portions with highest water flow, where small waterfalls are formed. The two streams where the species is known to occur have relatively high slope and drain valleys on the foothill of Parque Nacional do Itatiaia, at altitudes between 1.300 and 1.500 m above sea level, and are mainly composed of big boulders with sandy substrate. The localities mostly presented pristine riparian covering of upper montane Atlantic Forest, with high abundance of Bryophytes, Pteridophytes, and Orchidaceae associated to trees and exposed stones (Fig. 9). The aforementioned features make the streams to receive few moments of direct sunlight during the day. The only sympatric species found with *N. altimontanus* at the two localities was *Trichomycterus* (*Paracambeva*) sp. The invasive rainbow trout, *Oncorhynchus mykiss* (Walbaum, 1792), was also found in the type-locality, probably due to the high density of trout farms implemented along Serra da Mantiqueira.

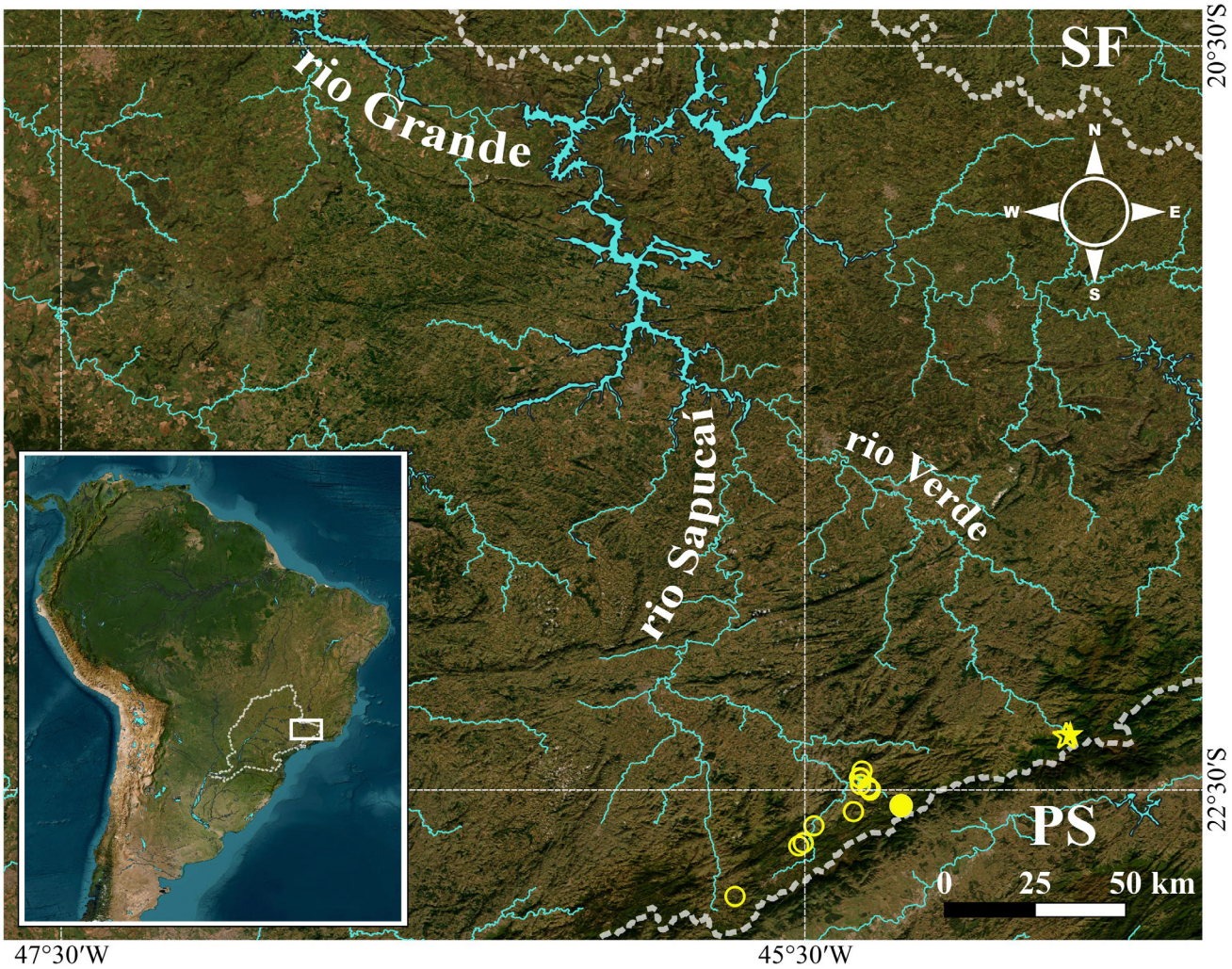

FIGURE 8 | Distribution map of the new species of *Neoplecostomus*. Stars represent the localities of *N. altimontanus* and circles represent the localities of *N.* sp.n. Full symbols indicate the locality of each holotype. The white dashed line represents the limits between Paraná and neighboring basins, shown as SF (São Francisco basin) and PS (Paraíba do Sul basin).

Etymology. The specific epithet "altimontanus" is given in reference to the Upper Montane Atlantic Forest (Mata Atlântica Alto-Montana in Portuguese), a vegetation type only found in few mountain ranges above 1.000 m a.s.l. in south and southeastern Brazil. This vegetation type is known for sheltering several water springs across drainages in Brazilian Crystaline Shield, especially affluents of the upper rio Paraná. Due to its restrict geographical distribution and highly specialized ecological conditions, the Upper Montane Atlantic Forest shelters highly endemic species, and is an alarmingly endangered ecosystem, mainly due to habitat loss and climate change. *Neoplecostomus altimontanus* inhabits one the few remnants of Upper Montane Atlantic Forest in Brazil, on Serra da Mantiqueira. A latinized adjective, meaning "inhabitant of high mountains".

Conservation status. *Neoplecostomus altimontanus* is known from only two localities, with and extent of occurrence estimated as 196 km^2. The species was only found in localities with highly preserved environmental conditions; the type-locality in rio Capivari on the surroundings of Parque Nacional do Itatiaia and Córrego Pinhão Assado inside Instituto Alto-Montana da Serra Fina, a Private Natural Heritage Reserve. A few kilometers downstream from the type-locality, rio Capivari and several affluent streams run into urban environments, being subject to channelization, removal of riparian covering and pollution, and no specimens were found. Besides, the wild boar (*Sus scrofa* Linnaeus, 1758) presents an intense invasive process in environmentally protected areas in this region (Morais *et al*., 2019), and its impacts on stream ichthyofauna, including *N. altimontanus*, should not be overlooked. Our findings indicate that this species is highly endemic and sensitive to environmental changes, but more sampling efforts should be considered to better evaluate the conservation status of *Neoplecostomus altimontanus*. Therefore, we suggest that this species should be categorized as Data Deficient (DD) according to IUCN's criteria (IUCN, 2022).

FIGURE 9 | Type-locality of *Neoplecostomus altimontanus* in rio Capivari, Itamonte, rio Sapucaí drainage, rio Grande sub-basin, upper rio Paraná basin.

Neoplecostomus sapucai Andrade, Uzeda, Paiola, Siqueira-Cesar, Okubo, Marques-Frisoni & Langeani, new species

urn:lsid:zoobank.org:act:8D17A28B-4C35-4F2C-A1AC-968B9DD3684B

(Figs. 10–11; Tab. 2)

Neoplecostomus sp. 3. —Roxo *et al.* (2012b):35 (tab. 1), 38 (fig. 2). —Roxo *et al.* (2012c):2444 (fig. 2).

Neoplecostomus sp. 4. —Roxo *et al.* (2012b):35 (tab. 1), 38 (fig. 2). —Roxo *et al.* (2012c):2444 (fig. 2).

Neoplecostomus sp. "Sapucaí" - population 6. —Lucena *et al.* (2012):325 (reference in abstract), 326 (fig. 1f), 327 (fig. 2), 328 (tab. 1, reference in results), 329 (tab. 2, reference in discussion, tab. 3), 330 (fig. 3, reference in discussion), 331 (fig. 4, reference in discussion).

Neoplecostomus sp. "Monjolo" - population 7. —Lucena *et al.* (2012):325 (reference in abstract), 326 (fig. 1g), 327 (fig. 2), 328 (tab. 1, reference in results), 329 (tab. 2, reference in discussion, tab. 3), 330 (fig. 3, reference in discussion), 331 (fig. 4, reference in discussion).

Neoplecostomus sp. —Thereza, Langeani (2019):23 (identification key), 45–46, 102 (fig. 10c).

Holotype. DZSJRP 14015, male, 88.4 mm SL, Brazil, State of Minas Gerais, Delfim Moreira, rio Grande sub-basin, rio Sapucaí drainage, unnamed stream on Highway AMG-1915 (Piquete - Delfim Moreira), 22°32'31.3"S 45°14'28.8"W, 1.331 m a.s.l., 6 Aug 2011, B. N. Andrade, F. O. Martins & F. Langeani.

Paratypes. All from Brazil, rio Grande sub-basin, rio Sapucaí drainage. **State of Minas Gerais, Delfim Moreira:** DZSJRP 24791, 6, 53.0–57.5 mm SL, collected with holotype. DZSJRP 13944, 1, 76.3 mm SL, rio Santo Antônio, 22°29'59"S 45°19'29"W, 1.165 m a.s.l., 13 Jun 2011, J. E. Souza. DZSJRP 13952, 2, 76.1–81.0 mm SL, rio Santo Antônio, 22°29'37"S 45°19'47"W, 1.150 m a.s.l., 15 Jun 2011, J. E. Souza. DZSJRP 13955, 9, unmeasured, rio Santo Antônio, 22°29'07"S 45°21'01"W, 950 m a.s.l., 15 Nov 2011, J. E. Souza. DZSJRP 14024, 2, 55.5–69.2 mm SL, rio Santo Antônio, Highway between Delfim Moreira and Itajubá, 22°29'06.4"S 45°21'01.5"W, 948 m a.s.l., 7 Aug 2011, B. N. Andrade, F. O. Martins & F. Langeani. DZSJRP 14028, 1, 50.1 mm SL, stream affluent to PCH Ninho da Águia, 22°29'35.1"S 45°19'44.7"W, 1.163 m a.s.l., 7 Aug 2011, B. N. Andrade, F. O. Martins & F. Langeani. DZSJRP 14029, 7, unmeasured, rio Santo Antônio, 22°29'52.9"S 45°19'26.7"W, 1.171 m a.s.l., 7 Aug 2011, B. N. Andrade, F. O. Martins & F. Langeani. DZSJRP 14876, 2, unmeasured, rio Santo Antônio, Delfim Moreira, 22°28'04"S 45°20'58"W, 882 m a.s.l., 18 Nov 2011, Nicatec team. DZSJRP 14877, 2, 8.7–85.2 mm SL, rio Santo Antônio, 22°29'37.6"S 45°19'47.44"W, 1.146 m a.s.l., 16 Nov 2011, Nicatec team. DZSJRP 17758, 2, 81.0–82.8 mm SL, rio Santo Antônio, upstream PCH Ninho da Águia reservoir, 22°29'58"S 45°19'29"W, 1.167 m a.s.l., 27–28 Nov 2012, L. L. Santiago & Nicatec team. DZSJRP 20586, 1, 84.6 mm SL, rio Santo Antônio, downstream Ninho da Águia waterfall, 22°28'05"S 45°20'58"W, 882 m a.s.l., 11 Jul 2014, Nicatec team. DZSJRP 23243, 4, unmeasured, rio Santo Antônio, Delfim Moreira, 22°28'00"S 45°21'12"W, 884 m a.s.l., 26 Sep 2022, I. Langeani & F. Langeani. MNRJ 22251, 26, 38.0–50.1 mm SL, left tributary to ribeirão do Machado or Tabuão, 22°32'21"S 45°14'27"W, 1.323 m a.s.l., 14 Nov 2001, P. A. Buckup, O. M. Filho & A. T. Aranda. **State of São Paulo:** MZUSP

99333, 10, 31.0–60.3 mm SL, Ribeirão Marmelos, 22°38'32"S 45°30'17"W, 1.192 m a.s.l., 22 Feb 2008, A. K. Zeinad; MZUSP 99680, 3, 72.5–87.6 mm SL, ribeirão Lajeado, Highway SP-42 near SP-050, São Bento do Sapucaí, 22°47'09"S 45°41'17"W, 1.007 m a.s.l., date and collectors undetermined. CI-UFLA 3191, 6, 4 unmeasured, 2, 52.2–55.0 mm SL, rio Sapucaí-mirim, São Bento do Sapucaí, 22°47'18.71"S 45°40'28.00"W, 1.017 m a.s.l, 30 Jul 2024, P. L. C. Uzeda & L. Sartori. MCP 48676, 3, 57.9–63.4 mm SL, waterfall in Parque Estadual de Campos de Jordão (Horto Florestal), Campos do Jordão, 22°39'00"S 45°31'00"W, 1.291 m a.s.l., 1 Jan 2013, M. Soares & K. Leite. MCP 48677, 3, 68.0–75.4 mm SL, waterfall in Parque Estadual de Campos do Jordão (Horto Florestal), Campos do Jordão, 22°39'00"S 45°31'00"W, 1.291 m a.s.l., 1 Jan 2013, M. Soares & K. Leite. MNRJ 22252, 5, 40.2–67.9 mm SL, rio Comprido, tributary to Usina

FIGURE 10 | *Neoplecostomus sapucai*, holotype, DZSJRP 14015, male, 88.4 mm SL, Delfim Moreira, unnamed stream on highway AMG-1915, rio Sapucaí drainage, rio Grande sub-basin, upper rio Paraná basin. Dorsal, lateral, and ventral views.

Hidrelétrica de Piquete, rio Bicas microbasin, Highway BR-459, Piquete, 22°33'29"S 45°22'11"W, 1.135 m a.s.l., 15 Nov 2001, P. A. Buckup, O. M. Filho & A. T. Aranda. MNRJ 23963, 35, 38.0–65.7 mm SL (1 c&s, 55.8 mm SL), Campos do Jordão near Piranguçu, 22°35'46"S 45°28'33"W, 978 m a.s.l., 30 May 2002, P. A. Buckup, O. M. Filho, A. T. Aranda & C. Chamon.

Non-type. Brazil, State of Minas Gerais, rio Grande sub-basin, rio Sapucaí drainage. MNRJ 23949, 1, unmeasured, ribeirão do Salto, Itajubá, 22°26'55"S 45°20'47"W, 910 m a.s.l., 30 May 2002, P. A. Buckup, O. M. Filho, A. T. Aranda & C. Chamon.

Diagnosis. *Neoplecostomus sapucai* differs from all congeners, except *N. altimontanus* and *N. bandeirante*, by having the exposed area of first plates of mid-ventral and ventral series narrower than the naked areas surrounding each plate (*vs.* all other congeners with exposed area of first plates of mid-ventral and ventral series equal to or wider than the naked area surrounding each plate) (Fig. 2). Furthermore, the new species differs from all congeners, except *N. altimontanus*, *N. jaguari*, and *N. langeanii* by presenting sexual dimorphism in dentition, with males having more robust and fewer teeth compared to females (Fig. 3) (*vs.* tooth morphology and number similar in both sexes in all other congeners). Additionally, *N. sapucai* differs from *N. bandeirante* by the presence of a lateronasal plate (Fig. 6), absence of keels along the lateral series of plates and absence of preadipose azygous plates (*vs.* lateronasal plate absent, keels and preadipose azygous plates present) (Fig. 5); from *N. jaguari* by having two posteronasal plates (*vs.* five to seven posteronasal plates) and females with 24–33, modally 26 premaxillary and 22–31, modally 26 dentary teeth (*vs.* females with 30–39 premaxillary and 30–38 dentary teeth); and from *N. langeanii* by the presence of an extra canal-bearing plate located between supraopercle and dorsal opening of the preopercular canal (Fig. 4) (*vs.* extra canal-bearing plate absent).

Neoplecostomus sapucai is most similar to *N. altimontanus*, from which differs by having transverse light bars over body (*vs.* conspicuous dark spots over body and fins); plates of the lateral series bearing odontodes roughly equal in size, making caudal-peduncle surface smooth and rounded in cross-section (*vs.* plates of dorsal, mid-dorsal, median and mid-ventral series with slightly hypertrophied odontodes on posterior portion, resembling discontinuous keels on caudal peduncle) (Fig. 5); reduced adipose fin, extending over three or four plates, usually three (Fig. 5) (*vs.* well-developed adipose fin, extending over four or five dorsal plates, usually five); presence of a lateronasal plate (*vs.* lateronasal plate absent) (Fig. 6); larger nares (nare length 9.9–14.1% *vs.* 3.0–9.0% of HL); and by the lower premaxillary (24–33, modally 26 *vs.* 31–42, modally 35) and dentary (22–31, modally 26 *vs.* 31–40, modally 31) teeth counts in females.

Description. Measurements and counts in Tab. 2. Body elongated and dorsoventrally depressed. Greatest width at anterior portion of cleithrum, gradually narrowing towards caudal peduncle. Dorsal profile of body slightly convex, elevating from snout tip to dorsal-fin origin; descending from dorsal-fin origin to dorsal procurrent caudal-fin rays. Greatest body depth at dorsal-fin origin. Trunk and caudal peduncle dorsally rounded in cross-section. Ventral profile depressed to anal-fin origin and slightly rounded to caudal fin.

TABLE 2 | Morphometric data and counts for the holotype and 29 paratypes of *Neoplecostomus sapucai*. The adipose-fin length was taken from 25 specimens. M = male, F = female.

	Holotype	Range	Mean	SD
Standard length (mm)	88.4	49.6–88.4	66.3	13.1
Percents of standard length				
Predorsal length	43.1	40.7–45.4	43.8	1.0
Head length	32.8	30.9–33.7	32.3	0.8
Head width	29.0	26.2–29.2	28.1	0.8
Cleithrum width	29.1	25.9–29.1	28.1	0.8
Occipital-dorsal distance	10.4	10.4–13.4	12.1	0.8
Thoraxic length	13.6	13.6–19.0	15.9	1.3
Interdorsal length	20.2	17.4–21.6	19.4	1.2
Caudal-peduncle length	28.8	26.5–31.7	29.2	1.3
Caudal-peduncle depth	8.2	7.6–9.5	8.2	0.4
Body depth	21.7	15.5–22.3	19.2	1.2
Preanal length	61.0	59.3–66.9	63.3	1.9
Adipose-fin length	7.2	2.5–7.7	7.01	1.4
Percents of head length				
Head with	91.4	78.5–94.0	85.6	4.3
Head depth	56.2	37.1–57.2	46.9	4.8
Snout length	62.0	59.9–67.2	63.9	1.8
Orbital diameter	7.3	6.8–11.1	9.0	1.1
Interorbital distance	36.4	31.2–37.7	33.5	1.7
Mandibulary width	16.0	14.9–23.9	18.8	2.4
Lower-lip width	56.8	46.9–70.9	58.4	6.2
Lower-lip length	21.9	11.8–42.6	18.8	5.9
Nare length	12.2	9.9–14.1	12.0	1.0
Nare width	7.9	7.4–9.6	8.3	0.5
Anal-fin length	46.5	41.8–63.1	52.5	4.1
Other percents				
Interorbital distance/orbital diameter	20.1	21.1–33.3	27.0	3.0
Predorsal length/dorsal-fin spine length	45.6	35.4–51.8	45.4	4.3
Pelvic-fin spine length/caudal peduncle depth	36.3	26.5–39.4	31.1	3.0
Lower caudal-fin unbr. ray/caudal peduncle depth	42.7	24.6–36.7	29.2	3.2
Counts	**Holotype**	**Range**	**Mode**	**SD**
Dorsal plates	30	29–31	29	0.6
Mid-dorsal plates	25	23–25	24	0.8
Median plates	30	29–31	30	0.6
Mid-ventral plates	26	24–27	25	0.8
Ventral plates	25	24–26	24	0.8
Predorsal plates	4	4–6	5	0.6
Plates at dorsal-fin base	6	5–6	6	0.2
Plates between dorsal and caudal	18	17–19	18	0.7
Plates between adipose and caudal	7	7–8	7	0.5
Plates between anal and caudal	13	11–13	12	0.6
Plates under adipose fin	3	3–4	3	0.7
Premaxillary teeth (M)	15	11–21	15	2.5
Dentary teeth (M)	13	11–20	13	2.4
Premaxillary teeth (F)	–	24–33	26	2.8
Dentary teeth (F)	–	22–31	26	2.6

Body entirely covered with bony plates, except around dorsal-fin base, ventral surface of head, regions around ventral shield, lateral portion of trunk between pectoral- and pelvic-fin origin, and between ventral shield and anal-fin origin. Lateral series of plates without keels. Exposed area of first plates of mid-ventral and ventral series narrower than naked area surrounding each plate. Abdomen with small plates covered with odontodes, arranged into pentagonal or hexagonal shield between pectoral- and pelvic-fin origins.

Head broad and rounded. Snout tip without bony plates. Lateral margins of snout and anterior portion of head lacking hypertrophied odontodes and swollen skin. Interorbital region slightly convex in frontal view. Eyes moderately sized and dorsolaterally located. Ventral surface of head naked, except for canal cheek plate, undivided and with triangular medial projection. Extra canal-bearing plate between supraopercle and compound pterotic. Lips moderately developed and rounded; lower lip covered with small rounded papillae. Hypertrophied papillae arranged into two or three irregular series immediately posterior to dentary teeth. Posterior margin of lower lip strongly convex, reaching or almost reaching pectoral girdle. Maxillary barbel poorly developed, entirely coalesced to lower lip. Dentary rami angled towards each other at about 110°–115°. Premaxillary teeth bicuspid and copper colored; lateral cusp smaller than mesial cusp.

Dorsal fin i-ii,7; origin slightly posterior to vertical through pelvic-fin origin; spinelet absent or present, wider than base of unbranched ray when present; locking mechanism not functional. Distal margin straight, surpassing vertical through anal-fin origin when adpressed. Adipose fin short and low, extending over three to four (normally three) dorsal plates; absent in some specimens, replaced by azygous plates; preadipose azygous plates normally absent. Pectoral fin i,6; unbranched ray dorsoventrally depressed and curved posteriorly, shorter than first branched ray. Distal margin straight, surpassing first third of pelvic fin when adpressed. Pelvic fin i,5; unbranched ray slightly curved inwards; ventral surface flattened, covered with spatulate odontodes. Distal margin roughly straight. Caudal fin i,7,7,i; lower lobe longer than upper lobe; distal margin slightly concave.

Supraorbital sensory canal with four pores; pore s1 at anteromesial margin of anterior nare; pore s3 at posteriomesial margin of posterior nare; pore s6+s6 at interorbital region, at transverse line through posterior half of eyes; pore s8 posteromesially to eye, longitudinally aligned with nares. Infraorbital sensory canal with six pores; pore io1 at anterior margin of first infraorbital; pore io2 between posterior margin of first infraorbital and anterior margin of second infraorbital; pore io3 between second and third infraorbitals; pore io4 between third and fourth infraorbitals; pore io5 between fourth and fifth infraorbitals; and pore io6 located between superior margin of fifth infraorbital and inferior margin of sphenotic. Preoperculomandibular sensory canal with five pores; pore pm1 at ventral surface of cheek plate; pore pm2 between superior margin of cheek plate and inferior margin of preopercle; pore pm3 between superior margin of preopercle and inferior margin of supraopercle; pore pm4 between superior margin of supraopercle and anterior margin of opercle; pore pm5+po1 rising on surface of extra canal-bearing plate. Three postotic sensory pores; pore po1 fused to pore pm5; pore po2 above branchial slit, and pore po3 on skin overlying opening of swimbladder capsule.

Coloration in alcohol. Head and trunk light to dark brown in adults and juveniles. Head, dorsum, trunk and fins covered with inconspicuous and diffuse dark saddles.

Coloration pattern in juveniles composed by four transverse dark bars; bars surrounded by light areas in adults: first at dorsal-fin base, second between dorsal and adipose fin, and third at posterior portion of adipose fin. Head with two slender light stripes anterior to nare, reaching anterior portion of snout; in some specimens, additional stripe between nares present. Region around orbit with light blotches, especially anterior and posterior to orbit. One or two light areas between orbits, fused into transverse lines in some specimens.

All fins with diffuse dark blotches over branched rays; blotches on unbranched rays well delimited. Caudal fin with conspicuous dark blotches at distal portion. Adipose-fin spine laterally dark; dorsal surface of spine with coalesced light and dark blotches. Ventral surface unpigmented, except for some brown colored regions of upper lip and next to anal-fin origin. Live coloration with slightly more contrasting patterns and blotches (Fig. 11).

Sexual dimorphism. Males present a urogenital papilla posterior to anal opening and a skin flap along the dorsal surface of unbranched pelvic-fin ray (both absent in females). Additionally, males have teeth short, robust and in fewer number (11–20 premaxillary and 13–20 dentary teeth) compared to females, which have slender and more numerous teeth (24–33 premaxillary and 22–31 dentary teeth).

Geographical distribution. *Neoplecostomus sapucai* is known from eight streams in the upper portion of rio Sapucaí drainage, rio Grande sub-basin, at the Northern slope of Serra da Mantiqueira, within the states of Minas Gerais and São Paulo (Fig. 8).

Ecological notes. *Neoplecostomus sapucai* is found in small streams with low depth (< 1 m), rapid flow and crystal-clear waters. The localities, situated at altitudes between 900 and 1.400 m above sea level, presented substrate composed mainly of pebbles (1–4 cm) and cobbles (4–15 cm) over sand. The type-locality is poorly covered by riparian vegetation and is prone to receive direct sunlight over most part of the day (Fig. 12). The species is sympatric to *Phalloceros harpagos* Lucinda, 2008, *Psalidodon paranae* (Eigenmann, 1914), and *Trichomycterus* cf. *brasiliensis* (Lütken, 1874).

FIGURE 11 | Live specimen of *Neoplecostomus sapucai*, CI-UFLA 3191, paratype, male.

FIGURE 12 | Type-locality of *Neoplecostomus sapucai* at unnamed stream on highway AMG-1915, Delfim Moreira, rio Sapucaí drainage, rio Grande sub-basin, upper rio Paraná basin.

Etymology. The specific epithet "sapucai" is in reference to rio Sapucaí, the drainage where the species is known to occur. A noun in apposition.

Conservation status. *Neoplecostomus sapucai* is known from 16 localities distributed across eight small to medium size streams in the upper portion of rio Sapucaí drainage, with an extent of occurrence estimated as 1.013 km^2. At the time of our last expeditions, most localities presented riparian vegetation and tree covering, and were situated outside conservation units; one of them is located inside of an environmentally protected area, in Campos do Jordão State Park. The species was found in streams draining areas of pasture, highway infrastructure, and areas upstream and downstream from Ninho da Águia reservoir in rio Santo Antônio. The aforementioned factors indicate that *Neoplecostomus sapucai* is a relatively cosmopolitan species, and the current anthropogenic activities along its distribution do not appear to pose significant threats to the viability of its populations. Therefore, we suggest that this species should be categorized as Least Concern (LC) according to IUCN's criteria (IUCN, 2022). Nonetheless, we encourage ecological assessments to better understand its population dynamics and the environmental changes along its distribution.

DISCUSSION

Neoplecostomus altimontanus and *N. sapucai* occur in relatively close localities within the same drainage and are more similar to each other than to any other congener, but are diagnosed by differences in coloration pattern, shape of caudal peduncle in cross-section, size of adipose fin and osteological characters. *Neoplecostomus altimontanus* presents conspicuous dark spots over the head, dorsum, flank and fins, with a dark brownish or grayish background; minute keels on lateral series of plates and a well-developed adipose fin. Comparatively, *N. sapucai* presents a coloration pattern more broadly distributed across the genus, with a brown background color with light transverse bars over the dorsum; keels absent and a poorly developed adipose fin. The lateronasal plate is also a strong character to distinguish the new species, being always absent in *N. altimontanus* and always present in *N. sapucai*. Noteworthy, the new species are also diagnosable by the arrangement of the cephalic sensory canals, specifically the preoperculomandibular segment; *N. altimontanus* has four preoperculomandibular pores, with pm4 being absent, and *N. sapucai* has five preoperculomandibular pores, with pm4 being present. This is the first time cephalic sensory canals are used in the description and diagnosis among species of *Neoplecostomus*, and this character should not be overlooked.

The two known populations of *N. altimontanus* have a coloration pattern with head, dorsum, flank, and fins covered with conspicuous dark spots over a brownish background. However, specimens from the population from Córrego Pinhão Assado present less concentration of dark pigmentation compared to those from rio Capivari, resulting in a brownish ground coloration with more conspicuous spots (Fig. 13), a pattern very similar to that seen in *N. canastra* (fig. 1; Roxo *et al*., 2017).

Two populations of *Neoplecostomus sapucai* from rio Sapucaí drainage were used in molecular analyses by Lucena *et al*. (2012) and Roxo *et al*. (2012b,c). In Lucena *et al*. (2012), the lowest genetic distance (D = 0.042) and a high genetic identity (I = 0.958) were found between the "Sapucaí" and "Monjolo" populations, being considered the same species according to the criterion proposed by Thorpe, Solé-Cava (1994), which was also confirmed here. However, according to Lucena *et al*. (2012), the populations differed by the absence of adipose fin in "Sapucaí" and presence in "Monjolo". The

FIGURE 13 | Coloration pattern of *Neoplecostomus altimontanus* from Córrego Pinhão Assado. DZSJRP 24794, paratype, male, 93.5 mm SL.

specimens of *Neoplecostomus sapucai* examined by us presented two conditions: adipose fin poorly developed (short and shallow) or even absent with azygous plates; however, these states were independent to the geographical distribution. This polymorphism in the adipose fin is similar to that in *N. paranensis* and *N. botucatu* (Langeani, 1990; Roxo *et al*., 2012b). Additionally, in most specimens of *N. sapucai* the dorsal-fin spinelet is absent, as seen in *N. ribeirensis*; however, when present, the spinelet is always larger than the base of the unbranched dorsal-fin ray, while it is always narrower in *N. ribeirensis*.

Neoplecostomus altimontanus and *N. sapucai* resemble *N. bandeirante*, from upper Tietê basin, for being the only species within the genus to have the exposed area of first plates of mid-ventral and ventral series narrower than the naked area surrounding each plate (see Roxo *et al*., 2012a, fig. 3). However, the distribution areas of the species are biogeographically distant, since Paraíba do Sul basin is interposed between the headwaters of upper Tietê and upper rio Grande. Therefore, headwater capture events between the latter basins seem unlikely. Additionally, as presented by Roxo *et al*. (2012c), *N. bandeirante* and *N. sapucai* (= *Neoplecostomus* sp. 3 and sp. 4) are not closely related in their molecular phylogeny, so the narrowing of the first plates of mid-ventral and ventral series probably has evolved independently in each basin.

In Loricariidae, the most common state of sexual dimorphism is the presence of highly developed odontodes in males, normally concentrated on snout tip, lateral margins of head, interopercular, supraoccipital and predorsal regions, as well as on pectoral-fin spine and caudal peduncle (Rapp Py-Daniel, Cox-Fernandes, 2005). Also, males of many groups (*e.g*., Hypoptopomatinae) present a skin fold along the dorsal margin of pectoral-fin spine and a conspicuous urogenital papilla posterior to anal opening (Rapp Py-Daniel, Cox-Fernandes, 2005; Covain, Fisch-Muller, 2007). *Neoplecostomus altimontanus* and *N. sapucai*, along with *N. langeanii*, *N. jaguari*, *N. selenae*, and *N. yapo*, are diagnosed among congeners by the presence of sexual dimorphism, expressed as different features: males of *N. selenae* and *N. yapo* have hypertrophied odontodes and swollen skin along lateral margins of head, snout and anterior to orbit (less developed in *N. yapo*) (Zawadzki *et al*., 2008); in *N. altimontanus*, *N. sapucai*, *N. langeanii*, and *N. jaguari*, females have teeth more slender and numerous compared to males (Andrade, Langeani, 2014; Roxo, Oliveira, Zawadzki, 2012; Andrade, 2017). To date, the presence of conspicuous sexual dimorphism in species of *Neoplecostomus* is only known to occur in species of upper Paraná basin.

With the description of the new species, the upper Paraná basin contains 12 out of 20 valid species of *Neoplecostomus*. As brought up by Chamon *et al*. (2005) and Zawadzki *et al*. (2008), samplings in headwater streams have been promising in the discovery of undescribed species of small sized loricariids. In terms of conservation, ichthyofauna inventories and taxonomic studies have special importance for species of *Neoplecostomus*, since members of the genus are morphologically similar, but represent independent evolutionary units with relatively restricted geographic distributions.

Comparative material examined. All from Brazil. *Neoplecostomus bandeirante*: DZSJRP 14881, 2 paratypes, 90.9–93.5 mm SL, rio Paraitinga, affluent to rio Tietê, upper rio Paraná. *Neoplecostomus botucatu*: DZSJRP 14879, 6 paratypes, 54.1–78.9 mm SL, rio Pardo, affluent to rio Paranapanema, upper rio Paraná. *Neoplecostomus* cf. *canastra*: all from surroundings of Parque Nacional Serra da Canastra, São Roque de Minas, State of Minas Gerais. DZSJRP 11464, 1 of 2, 77.9 mm SL, Córrego Grande; DZSJRP 11477, 1 of 2, 72.2 mm

SL, Córrego Cerrado; DZSJRP 11494, 1 of 2, 70.7 mm SL, Córrego Cerrado. *Neoplecostomus corumba*: all from Córrego Gameleira, affluent to rio Corumbá, rio Paranaíba, upper rio Paraná. DZSJRP 6713, holotype, 76.1 mm SL; DZSJRP 6193, 4 of 5 paratypes, 50.1–71.5 mm SL. *Neoplecostomus espiritosantensis*: MZUSP 38574, 1 paratype, 94.7 mm SL, rio Jucu (Southern arm). *Neoplecostomus granosus*: DZSJRP 20664, 5, 58.6–90.6 mm SL, rio Guapiaçu. *Neoplecostomus jaguari*: all from Ribeirão da Forja, affluent to rio Jaguari, rio Tietê, upper rio Paraná. LIRP 2277, holotype, 86.3 mm SL; LIRP 2278, 3 of 30 paratypes, 66.1–74.7 mm SL. *Neoplecostomus langeanii*: all from rio Grande, upper rio Paraná. DZSJRP 14048, 1, 65.5 mm SL, stream affluent to rio Muzambinho, rio Pardo; DZSJRP 14049, 2 of 15, 63.2–73.9 mm SL, stream affluent to rio Muzambinho, rio Pardo; DZSJRP 14880, 2 of 3, 67.6–69.6 mm SL, rio São Domingos. *Neoplecostomus microps*: all from rio Paraíba do Sul. DZSJRP 13913, 2 of 5, 72.5–90.2 mm SL; DZSJRP 20417, 5, 64.2–87.6 mm SL, Ribeirão das Cobras; DZSJRP 20342, 3, 67.0–77.4 mm SL, Ribeirão Taquaral. *Neoplecostomus paranensis*: all from rio Grande, upper rio Paraná. DZSJRP 8590, 2 of 7, 58.9–59.8 mm SL, stream at 4 km from Highway MG050/BR265; DZSJRP 16159, 2, 78.1–89.5 mm SL, affluent to rio Carandaí. CI-UFLA 3186, 15, 51.2–72.6 mm SL. *Neoplecostomus paraty*: all from State of Rio de Janeiro. DZSJRP 20425, 2 paratypes, 85.3–89.2 mm SL, rio Perequê-Açu; DZSJRP 20440, 2 paratypes, 82.0–88.4 mm SL, stream affluent to rio Graúna. *Neoplecostomus ribeirensis*: MZUSP 35432, 9 of 14 paratypes, 52.9–87.9 mm SL, stream affluent to rio Bananal. *Neoplecostomus selenae*: all from State of São Paulo. DZSJRP 7449, 2 paratypes, 76.7–91.4 mm SL, ribeirão Grande, affluent to Ribeirão das Batéias; DZSJRP 15331, 1 of 4, 81.8 mm SL, rio Taquaral, affluent to rio Paranapanema, upper rio Paraná. *Neoplecostomus variipictus*: MNRJ 12806, holotype, 88.4 mm SL, rio Bengala. *Neoplecostomus yapo*: all from riacho Fortaleza, affluent to rio Yapó, rio Paranapanema, upper rio Paraná. DZSJRP 6714, holotype, 97.4 mm SL; DZSJRP 6194, 5 paratypes, 65.2–102.7 mm SL.

ACKNOWLEDGEMENTS

We are grateful to Paulo S. Pompeu (UFLA), Flávio Bockmann, Ricardo M. C. Castro (LIRP), Heraldo Britski (MZUSP), Paulo A. Buckup (MNRJ), and Roberto Reis (MCP), for the loan of specimens. We thank Luana Sartori for the help during fieldwork and collecting part of the type-series of the new species. We also thank Fernando B. Noll (Lab. Aculeata - IBILCE-UNESP, S.J.R.P.), for sharing multi-user equipment (FAPESP proc. 2020/07895–7). Finally, we thank the two anonymous reviewers for their valuable suggestions for improving our manuscript. This study was supported by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), proc. 88887.924502/2023–00, IP; 88887.928253/2023–00, PSC; 88887.817883/2023–00, VKNO; Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq proc. 313769/2023–0, FL) and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP proc. 2013/24047–6, BN).

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AUTHORS' CONTRIBUTION

Pedro L. C. Uzeda: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Writing-original draft, Writing-review and editing.

Isabel Paiola: Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Writing-original draft, Writing-review and editing.

Poliana S. Cesar: Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Writing-original draft, Writing-review and editing.

Vitor Kenzo N. Okubo: Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Writing-original draft, Writing-review and editing.

Wellington J. Marques-Frisoni: Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Writing-original draft, Writing-review and editing.

Breno N. Andrade: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing-original draft, Writing-review and editing.

Francisco Langeani: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing-original draft, Writing-review and editing.

ETHICAL STATEMENT

The specimens were collected with the collection permits #16984–6 and #10327 from Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio).

COMPETING INTERESTS

The author declares no competing interests.

HOW TO CITE THIS ARTICLE

- **Uzeda PLC, Paiola I, Cesar PS, Okubo VKN, Marques-Frisoni WJ, Andrade BN, Langeani F.** Two new species of *Neoplecostomus* (Siluriformes: Loricariidae) from high altitudes of the upper rio Paraná basin, Brazil. Neotrop Ichthyol. 2024; 22(4):e240021. https://doi.org/10.1590/1982-0224-2024-0021

Neotropical Ichthyology

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Official Journal of the
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