

Unexpectedly high diversity in a small basin: A taxonomic revision of *Eurycheilichthys* (Siluriformes: Loricariidae), with descriptions of seven new species

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A taxonomic revision of *Eurycheilichthys* is provided, and seven new species are described in addition to the two previously known species in this genus: *E. pantherinus* from the upper rio Uruguay, and *E. limulus* from the upper rio Jacuí. The genus is diagnosed based on the uniquely derived presence of seven branched pectoral-fin rays, and on the possession of reduced filamentous gill rakers in the oral surface of the hyobranchial skeleton, and presence of a distinct fleshy flap along the posterodorsal margin of the pectoral-fin spine in adult males. The seven new species are described from tributaries to the rio Taquari basin, itself a tributary to the rio Jacuí in Rio Grande do Sul State, southern Brazil. The new species are diagnosed based on color variation, abdominal plate morphology, lip size, parieto-supraoccipital shape, the number of dermal plates, the number of teeth, and body proportions. The high diversity and degree of species endemism in a limited area are discussed and compared to other fish groups. Genetic sequences (GenSeq) of mitochondrial and nuclear DNA, distribution maps, an identification key, and illustrations are presented for all species.

Keywords: Biodiversity, Catfish, Endemism, Identification key, Systematics.

Uma revisão taxonômica de *Eurycheilichthys* é apresentada e sete novas espécies são descritas além das duas previamente conhecidas, *E. pantherinus* do alto rio Uruguai e *E. limulus* do alto rio Jacuí. O gênero é diagnosticado com base na presença unicamente derivada de sete raios ramificados na nadadeira peitoral, bem como na presença de rastros branquiais filamentosos reduzidos na superfície oral do esqueleto hiobranquial e de abas carnosas distintas ao longo da margem posterodorsal do espinho da nadadeira peitoral em machos adultos. As sete novas espécies são descritas de tributários do alto rio Taquari, um afluente do rio Jacuí no Rio Grande do Sul, sul do Brasil. As novas espécies são diagnosticadas com base em variação de características do colorido, placas abdominais, tamanho dos lábios, forma do osso parieto-supraoccipital, número de placas dérmicas, número de dentes e proporções corporais. A alta diversidade e grau de endemismo das espécies em uma área limitada são discutidos e comparados com outros grupos de peixes. Sequências genéticas (GenSeq) de DNA nuclear e mitocondrial, mapas de distribuição, uma chave de identificação e ilustrações são fornecidas para todas as espécies.

Palavras-chave: Bagres, Biodiversidade, Chave de identificação, Endemismo, Sistemática.

Introduction

Eurycheilichthys Reis & Schaefer, 1993 is a member of the loricariid subfamily Hypoptopomatinae, and is composed of small size cascudinhos that live among rocks of fast flowing creeks and rivers in southern Brazil. The genus was originally described as a replacement name for *Eurycheilus* Reis & Schaefer, 1992 - a name discovered to be preoccupied by a fossil cephalopod soon after its description. The type species, *E. pantherinus*, from the upper reaches of the rio Uruguay in southern Brazil, was also described in Reis, Schaefer (1992). A few years later, Reis, Schaefer (1998) described a second species of *Eurycheilichthys*, *E. limulus*, from two localities in the upper portion of the rio Jacuí, main tributary to the laguna dos Patos system in Rio Grande do Sul State, South Brazil.

Eurycheilichthys was originally diagnosed by Reis, Schaefer (1992) based on the possession of a greatly expanded lower lip, the presence of seven branched rays in the pectoral fin, the accessory ceratobranchial flange reduced to a small, slender uncinat process, the loss of the filamentous gill rakers from the oral surfaces of the hyobranchial skeleton, and the possession of a very wide body. Of all these features, only the presence of seven branched pectoral-fin rays, instead of the typical six, remained as a uniquely-derived synapomorphy for the genus following the discovery of *E. limulus*. The accessory ceratobranchial flange is normally developed in *E. limulus* and in the seven additional new species described in the present study - its reduction becoming a trait diagnostic of *E. pantherinus* alone. The filamentous gill rakers on the oral surfaces of the hyobranchial skeleton are in fact absent in *E.*

pantherinus, though are present in all other *Eurycheilichthys* species. Nevertheless, filamentous gill rakers are highly reduced in all species of *Eurycheilichthys*, and this reduction itself remains a diagnostic trait for the genus. *Eurycheilichthys pantherinus* shares a wide body with at least three other new species, though broad variation in this feature precludes its use as a reliable distinguishing feature. Finally, *E. pantherinus* shares a greatly expanded lower lip with at least one of the new species, though a wide range of variation exists in this feature among the seven species being described in the present study. Nevertheless, despite not being shared by all species, the broad and posteriorly expanded lower lip - which in some cases extends beyond the anterior margin of the pectoral girdle - remains an auxiliary feature distinguishing *Eurycheilichthys*. Moreover, the presence of a distinct fleshy flap along the posterodorsal margin of the pectoral-fin spine in adult males (and females of some species; Fig. 1) represents a novel derived character useful for distinguishing the species of *Eurycheilichthys* within the hypoptopomatines.

In the years following the discovery and description of *Eurycheilichthys limulus*, several collecting expeditions were conducted by the Museu de Ciências e Tecnologia of the Pontifícia Universidade Católica do Rio Grande do Sul (MCP) in the upper reaches of the rio Taquari basin, the main tributary to the rio Jacuí. Those expeditions discovered much previously undetected diversity within *Eurycheilichthys*, and recognized seven additional new species occurring in small rivers and creeks located above 400 m in altitude; the present study describes these seven species.



Fig. 1. Left pectoral fin of *Eurycheilichthys paucidens*, AMNH 238572, 55.7 mm SL, paratype, male, dorsal view. Arrow indicates fleshy flap along posterodorsal margin of pectoral-fin spine. Scale = 2 mm.

Material and Methods

The methodology and terminology for linear measurements in the present study follow Pereira *et al.* (2007), while body plate counts and nomenclature follow Schaefer (1997). Morphological measurements were taken point-to-point to the nearest 0.1 mm with digital calipers under a dissecting scope.

Measurements of bilaterally symmetrical features were taken on the left side of the body whenever possible. Morphometric data are expressed as a percentage of the standard length (SL), with the exception of subunits of the cephalic region, which were expressed as a percentage of the head length (HL). Vertebral counts include the five centra modified into the Weberian apparatus, and the compound caudal centrum (PU1+U1) counted as one element. Vertebral elements and accessory teeth were counted in cleared and stained specimens only. Osteological examinations were performed on specimens cleared and double-stained for bone and cartilage (c&s) according to the procedure of Taylor, Van Dyke (1985).

The Unified Species Concept was employed in the present study (Queiroz, 2007), in which species are equated with independently evolving metapopulation lineages. In the absence of a phylogeny for *Eurycheilichthys*, consistent morphological difference among separate populations was used as a proxy for lineage independence. In the lists of material examined, museum abbreviations and catalog numbers are presented first, followed by the number of specimens examined and their size range, the number of specimens in different preparations (c&s or tissue samples vouchers originally preserved in absolute ethanol, marked as “tis”), if any, and the number of specimens measured for morphometric comparisons and their size range in parentheses. Locality, date of collection, and collector names follow the aforementioned information.

Genetic sequences from selected type specimens follow GenSeq nomenclature (Chakrabarty *et al.*, 2013). Total genomic DNA was extracted using the DNeasy blood and tissue extraction kit (Qiagen) from muscle samples fixed in 95% ethanol and stored at -20°C. DNA sequences of the mitochondrial 16S gene were amplified by PCR using 8 µl of Qiagen MasterMix, 1.25 µl of each 16S-AR and 16S-BR primers, and 2 µl of DNA template under the following protocol: an initial denaturation step of 3 minutes at 94°C followed by 35 cycles of 94°C for 1 min, annealing at 48°C for 1 min, and extension at 72°C for 1 min, followed by a final 3 min extension step at 72°C. PCR products were purified and sequenced at Macrogen Inc., South Korea.

Following the list of paratypes, additional specimens are listed as non-types for some species. Specimens were excluded from the type series for different reasons including poor state of preservation, inadequate size range, or due to an excessive number of specimens. None of these specimens were utilized in the characterization or description of new species in this study. The following institutions provided material for this study: The American Museum of Natural History, New York (AMNH); Fundación Miguel Lillo, Tucumán (CI-FML); Museu de Ciências Naturais da Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre (MCN); Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre (MCP); Museu Nacional, Rio de Janeiro (MNRJ); Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP); Departamento de Zoologia, Universidade Federal do Rio Grande do Sul (UFRGS).

Key to species of *Eurycheilichthys*

1. Body color plain dark brown, without blotches or spot, and with light stripe extending posteriorly from snout tip, medial to eye and onto predorsal area 2
- 1'. Body color with a different combination of dark blotches and spots 3
2. Both upper and lower lobes of caudal fin completely brown; spine and rays of the dorsal fin plain brown *E. castaneus*
- 2'. Lower lobe of caudal fin brown and upper lobe mostly hyaline; spine and rays of dorsal fin spotted ... *E. limulus*
3. Abdomen naked ventrally (Fig. 2h); head and predorsal region distinctly flat posterior to orbits *E. planus*
- 3'. Abdomen with plates (Figs. 2a-g, i); head, and predorsal region elevated posterior to orbits..... 4
4. Abdomen with irregular series of platelets medially, or incompletely covered by granular platelets embedded in skin and leaving naked areas laterally on abdomen (Figs. 2f, i) 5
- 4'. Abdomen extensively covered by plates (Figs. 2a-e, g)... 6
5. Body and head covered by many small, roundish, dark spots; lower lip large, reaching to, or beyond, anterior margin of pectoral girdle *E. luisae*
- 5'. Body with large, irregular dark spots, head mostly dark without conspicuous spots; lower lip narrow, not reaching anterior margin of pectoral girdle *E. vacariensis*
6. Lower lip extending beyond anterior margin of pectoral girdle; body and head covered by many regularly small and roundish dark spots.....*E. pantherinus*
- 6'. Lower lip not reaching or just reaching to anterior margin of pectoral girdle; spots on head and body absent, or if present, irregular in size and shape 7
7. Body color with uniformly brown background and occasional darker blotches; parieto-supraoccipital conspicuously elevated (Fig. 3); first pelvic-fin ray short (length 64.4-80.2% of pectoral-fin spine); 25-26 plates in middle lateral series..... *E. coryphaenus*
- 7'. Body color with light background and many dark blotches; parieto-supraoccipital without conspicuous elevation; first pelvic-fin ray long (length 80.6-100.6% of pectoral-fin spine); 27-30 (occasionally 26) plates in middle lateral series..... 8
8. Few (2-10) accessory teeth on premaxilla in one irregular series.....*E. paucidens*
- 8'. Numerous (27-38) accessory teeth on premaxilla in several irregular series.....*E. apocremnus*

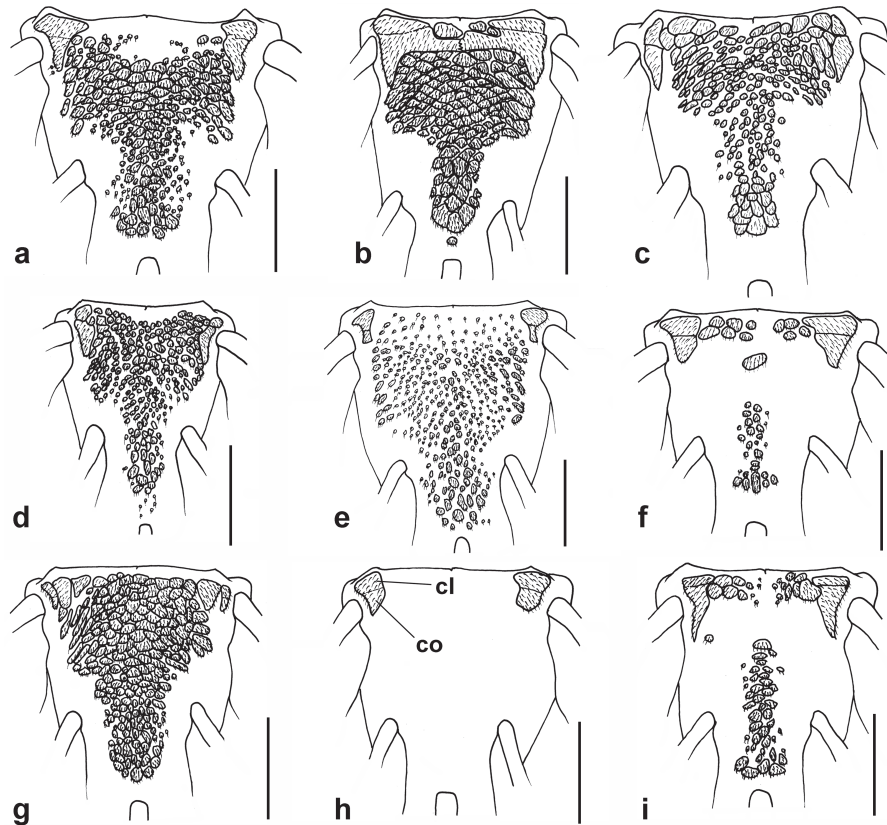


Fig. 2. Arrangement of abdominal plates and exposed area of pectoral girdle. **a.** *Eurycheilichthys pantherinus*, MCP 22373, 44.0 mm SL. **b.** *E. limulus*, MCP 13086, 42.2 mm SL. **c.** *E. apocremnus*, MCP 25678, 45.1 mm SL. **d.** *E. castaneus*, MCP 22134, 47.8 mm SL. **e.** *E. coryphaenus*, MCP 40667, 51.8 mm SL. **f.** *E. luisae*, MCP 25566, 38.5 mm SL. **g.** *E. paucidens*, MCP 22800, 46.1 mm SL. **h.** *E. planus*, MCP 22261, 42.2 mm SL. **i.** *E. vacariensis*, MCP 22782, 42.1 mm SL. cl = cleithrum, co = coracoid. Anterior towards top. Scale bars = 5 mm.

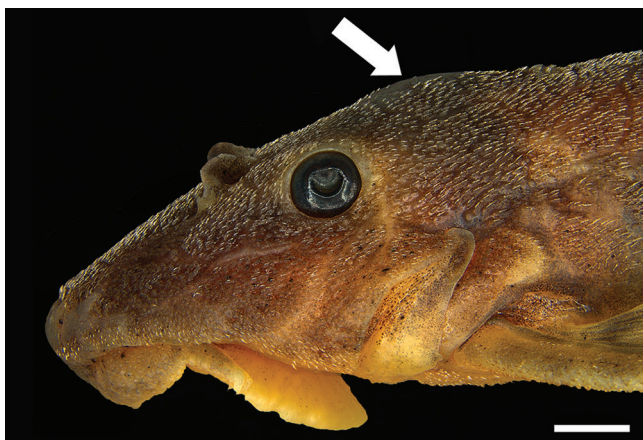


Fig. 3. Head and anterior portion of body of *Eurycheilichthys coryphaenus*, MCP 31160, 43.6 mm SL, paratype, male, lateral view. Arrow indicates conspicuous elevation of the parieto-supraoccipital. Scale = 2 mm.

Results

***Eurycheilichthys* Reis & Schaefer, 1993**

Eurycheilus Reis & Schaefer, 1992: 216. Type species: *Eurycheilus pantherinus* Reis & Schaefer, 1992. Type by monotypy. Gender: masculine. Preoccupied by *Eurycheilus* Septfontaine, 1970, in fossil cephalopods.

Eurycheilichthys Reis & Schaefer, 1993: 894. Type species: *Eurycheilus pantherinus* Reis & Schaefer, 1992. Type by being a replacement name. Gender: masculine. Replacement for *Eurycheilus* Reis & Schaefer, 1992.

Type species. *Eurycheilichthys pantherinus* (Reis & Schaefer, 1992), by original designation.

Diagnosis. *Eurycheilichthys* is diagnosed within the Hypoptopomatinae by the uniquely derived presence of seven branched pectoral-fin rays (*vs.* five or six rays). It is also diagnosed by the possession of reduced filamentous gill rakers on the oral surfaces of the hyobranchial skeleton (*vs.* filamentous gill rakers large), and the presence of a distinct fleshy flap along the posterodorsal margin of the pectoral-fin spine in adult males (Fig. 1). It is further differentiated from most other hypoptopomatines by the presence of unicuspid accessory teeth on both the premaxilla and dentary (shared with *Epactionotus*, a few *Parotocinclus* species, *Niobichthys ferrarisi*, and *Rhinolekos schaeferi*), and the possession of a greatly expanded lower lip, which extends close to or beyond the anterior margin of the pectoral girdle.

***Eurycheilichthys pantherinus* (Reis & Schaefer, 1992)**

Fig. 4; Tabs. 1, 3, 4



Fig. 4. *Eurycheilichthys pantherinus*, MCP 22373, 46.3 mm SL, male, Brazil, Rio Grande do Sul, São José dos Ausentes, rio Silveira at Silveira.

Eurycheilus pantherinus Reis & Schaefer, 1992: 217, figs. 1-5.

Type locality: Brazil: Rio Grande do Sul, creek tributary of rio dos Touros, at road from Silveira to Rondinha, Bom Jesus, rio Uruguay basin, approx. 28°42'S 50°10'W.

Eurycheilichthys pantherinus.-Reis & Schaefer, 1993: 894 (new combination).

Diagnosis. *Eurycheilichthys pantherinus* is distinguished from all congeners, except *E. luisae*, by possessing a very large lower lip extending to or beyond the anterior margin of the pectoral girdle, and sometimes past the posterior margin (*vs.* lower lip not reaching the anterior margin of the pectoral girdle). It is distinguished from *E. luisae* by having the abdomen fully covered by small platelets (*vs.* partially plated with a middle stripe of platelets), and by a shallower caudal peduncle (7.8-10.2 *vs.* 10.1-12.5% SL). *Eurycheilichthys pantherinus* is further distinguished from *E. castaneus* and *E. limulus* by the color pattern of its body and head, which are covered by many regular small and roundish dark spots (*vs.* body and head plain dark brown, without blotches or spot, and possessing a light stripe from the snout tip crossing above the eye and predorsal area); from *E. limulus* by the wider cleithrum (27.3-32.0 *vs.* 23.8-26.8% SL); from *E. planus* and *E. vacariensis* by the abdomen being fully covered by small platelets (*vs.* naked or incompletely covered by granular platelets); from *E. apocremnus* by a shallower caudal peduncle (7.8-10.2 *vs.* 10.2-12.3% SL); from *E. coryphaenus* by the parieto-supraoccipital lacking a conspicuous elevation (*vs.* parieto-supraoccipital conspicuously elevated); and from

E. paucidens by the larger orbital diameter (13.4-18.8 *vs.* 9.3-12.4% HL), and the presence of numerous (27-51) accessory teeth on the premaxilla in several irregular series (*vs.* fewer, 2-10 accessory teeth on premaxilla in one irregular series).

Distribution and habitat. *Eurycheilichthys pantherinus* is most commonly found in the upper rio Uruguay basin in the most northeasterly region of Rio Grande do Sul and southern Santa Catarina, Brazil (Fig. 5). It also occurs in the upper rio Piratini in Santo Ângelo, rio Buricá in Ijuí, and in the upper rio Uruguay itself and lower courses of its tributaries, as well as the rio Yaboti-Guazu, a tributary to the rio Uruguay in Misiones, Argentina (Azpelicueta, Koerber, 2014). This species is likely distributed widely in the upper rio Uruguay basin. Most of the localities are small rivers and creeks with fast flowing clear water with a substrate comprised of rocks and stones. The capture in the mainstream of the rio Uruguay (MCP 21740) was made during a severe drought in which a rocky portion of the river bed was exposed. These fishes are typically associated with the river bottom, dwelling among the stones and rocks.

Conservation status. *Eurycheilichthys pantherinus* is relatively frequent and abundant in the upper rio Uruguay basin. The species has an Extent of Occurrence (EOO) of approximately 52,600 km² and despite many hydroelectric dams exist in that basin, no specific threats were detected, and the species can be categorized as Least Concern (LC) according to IUCN criteria (IUCN, 2016).

Tab. 1. Descriptive morphometrics of *Eurycheilichthys* species. Values are given as percents of standard length or of head length. Hol = holotype. SD = standard deviation. Data in bold are distinguishing features among species.

Character	<i>E. pantherinus</i> n=23			<i>E. limulus</i> n=26			<i>E. apocremnus</i> n=18				<i>E. castaneus</i> n=25				<i>E. coryphaenus</i> n=10			
	Low	High	Mean	Low	High	Mean	Hol	Low	High	Mean	Hol	Low	High	Mean	Hol	Low	High	Mean
Standard length (mm)	33.0	48.1	42.6	41.3	50.4	45.8	47.0	38.1	54.1	45.5	48.1	37.2	49.6	44.0	46.7	36.2	49.7	41.2
	Percents of SL																	
Head length	30.6	37.6	35.1	30.4	34.7	32.4	35.8	32.9	36.6	34.6	32.9	31.2	35.3	32.9	33.3	31.5	35.8	34.4
Predorsal length	43.5	49.4	45.6	42.9	47.6	45.3	45.0	40.8	47.0	44.3	42.9	40.6	47.4	43.4	44.1	41.0	45.0	43.7
Dorsal-fin spine length	19.9	24.5	22.2	18.3	23.5	20.4	23.7	21.1	24.6	23.2	21.4	19.8	23.8	21.8	21.8	21.8	24.0	23.0
First anal-fin ray length	14.9	19.0	17.3	16.1	22.3	18.3	20.3	18.3	22.1	20.7	19.9	17.6	22.1	19.8	18.0	16.7	19.3	18.0
Pectoral-fin spine length	21.8	27.4	24.1	19.8	24.7	22.4	23.6	21.6	26.1	24.2	22.4	20.9	25.5	23.2	26.2	24.1	27.4	26.2
First pelvic-fin ray length	16.4	20.8	18.7	13.0	21.4	16.9	21.7	20.4	23.3	21.8	20.4	17.5	21.1	19.4	16.9	16.9	20.1	18.3
Trunk length	12.6	15.6	14.0	12.7	16.4	15.0	15.2	14.1	16.4	15.2	14.5	12.4	14.9	13.9	14.7	12.7	15.8	14.8
Abdominal length	20.1	26.6	23.9	20.8	26.2	23.0	24.2	22.6	26.7	23.9	22.3	21.0	25.1	23.1	23.8	20.6	25.8	22.7
Cleithral width	27.3	32.0	29.9	23.8	26.8	25.2	30.4	28.4	31.8	30.1	27.8	24.9	29.7	26.8	27.8	26.2	29.5	27.4
Body depth at dorsal fin	13.2	18.0	14.8	14.1	19.2	16.3	17.8	14.7	18.4	16.7	15.4	13.8	16.7	15.2	17.3	15.1	18.7	16.8
Body width at anal fin	11.5	14.6	12.8	11.2	14.5	13.1	12.8	12.0	14.0	12.9	12.5	11.9	13.9	12.9	12.9	12.2	13.9	13.1
Caudal peduncle length	27.2	35.5	31.0	26.0	35.3	32.8	29.5	24.7	33.4	28.7	34.9	25.4	34.9	31.9	31.7	23.6	32.6	30.2
Caudal peduncle depth	7.8	10.2	8.7	9.6	11.5	10.5	11.6	10.2	12.3	11.1	10.6	9.8	12.4	10.5	10.0	9.5	10.6	10.0
	Percents of HL																	
Snout length	48.6	63.2	54.5	49.0	60.0	53.2	53.2	50.0	59.3	55.8	52.5	50.8	58.3	53.5	50.5	48.5	54.1	51.8
Orbital diameter	13.4	18.8	16.0	10.9	14.5	12.1	10.0	9.5	14.2	11.4	12.0	10.8	14.9	12.2	13.9	13.8	18.5	15.7
Interorbital width	31.3	42.3	34.2	35.9	44.3	39.2	34.2	29.6	38.3	35.0	35.5	31.9	37.5	35.1	35.0	32.8	37.3	35.6
Head depth	42.2	53.9	45.3	43.3	53.8	47.6	46.4	43.2	48.6	46.5	48.7	44.7	53.3	47.8	49.2	47.8	54.0	50.0
Left mandibular ramus	9.2	12.5	10.4	10.0	14.1	11.8	12.6	9.1	14.4	12.4	9.6	8.2	11.1	9.7	12.2	9.3	13.2	11.7

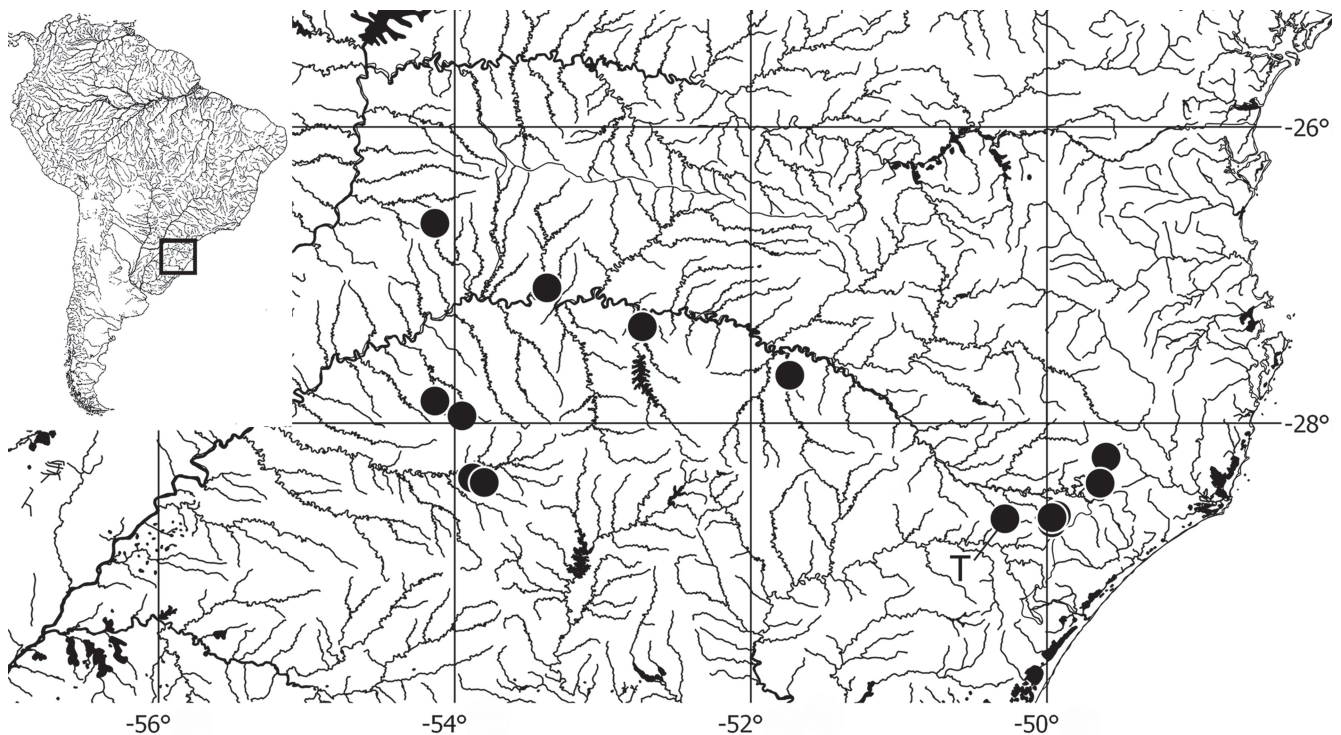


Fig. 5. Geographic distribution (black dots) of *Eurycheilichthys pantherinus* in the upper rio Uruguay basin, South Brazil.

Material examined. Upper rio Uruguay drainage: Brazil: Rio Grande do Sul State: MCP 13077, holotype, 37.9 mm SL, creek tributary of rio dos Touros on road from Silveira to Rondinha, Bom Jesus (approx. 28°42'S 50°10'W). MCP 13590, 1 paratype, 41.1 mm SL, and MCP 13591, 1 c&s paratype, 40.0 mm SL, collected with the holotype. MZUSP 40337, 1 paratype, 30.2 mm SL, mouth of creek emptying into rio Pelotas where it crosses the road BR-116, Vacaria (approx. 28°12'S 50°45'W). MCP 13079, 2 paratypes, 16.7-33.0 mm SL, rio Piratini at Fazenda Hinz, district of Coimbra, Santo Ângelo (approx. 28°47'S 54°20'W). MCP 22373, 28, 21.5-48.8 mm SL, 2 c&s, 44.0-46.2 mm SL, rio Silveira at Silveira, where it crosses the road to Bom Jesus da Serra, São José dos Ausentes (28°37'20"S 49°56'09"W). MCP 35042, 17, 24.3-38.2 mm SL, 3 c&s, 23.3-34.8 mm SL, 53 tis, 23.0-31.9 mm SL, rio dos Touros on road from Rondinha to Silveira, downstream dam, Bom Jesus (28°38'42"S 50°17'01"W). MCP 26047, 2, 29.4-30.6 mm SL, rio da Divisa, 4 km W of Silveira, São José dos Ausentes (28°38'16"S 49°57'56"W). MCP 22370, 1, 35.1 mm SL, rio da Divisa, between São Jose dos Ausentes and Silveira, São Jose dos Ausentes (28°40'17"S 49°57'57"W). UFRGS 4892, 21, 27.5-46.3 mm SL, rio da Divisa, São José dos Ausentes (28°38'16"S 49°57'56"W). UFRGS 4914, 28, 25.0-48.2 mm SL, 2 alizarin stained, 44.9-45.5 mm SL, rio do Marco, São José dos Ausentes (28°36'43"S 49°55'11"W). MCP 25590, 6, 26.9-36.5 mm SL, rio Buricá on vicinal road from Ijuí to Chiapeta, Chiapeta (approx. 27°57'S 53°57'W). MCP 18775, 1, 27.8 mm SL, rio Buricá, downstream from dam, Independência. Santa Catarina State: MCP 47840, 12, 23.8-36.2 mm SL, rio das Flores, on road from São Miguel do Oeste to Paraíso, Paraíso (26°37'28"S 53°38'55"W). MCP 22372, 1, 43.1 mm SL,

rio Capivaras on road from Silveira to Bom Jardim da Serra, Bom Jardim da Serra (28°24'21"S 49°38'26"W). MCP 21740, 10, 14.5-20.3 mm SL, rio Uruguai at Mondai, Santa Catarina (27°05'12"S 53°22'37"W). MCP 22371, 1, 45.1 mm SL, rio Taimbezinho, ca. 300m upstream from mouth into rio Pelotas, ca. 20 km from Bom Jardim da Serra towards Santa Bárbara, Bom Jardim da Serra (28°13'45"S 49°36'03"W). **Argentina:** Misiones: CI-FML 5875, 6; CI-FML 5876, 2 c&s; MCP 48035, 2, 32.9-33.2 mm SL, Arroyo Garibaldi, tributary to rio Yaboti-Guazu, near San Pedro (approx. 26°53'S 54°05'W).

Genseq-3 16S. MCP 35042; GenBank accession number KX355637.

Genseq-4 RAG1, RAG2. Sequence data published by Cramer *et al.* (2011) for RAG1 (MCP 22373; GenBank accession number GQ214580) and RAG2 (MCP 22373; GenBank accession number GQ225454).

Genseq-4 COI. Sequences deposited in GenBank by Cristian Cramer for COI (MCP 22373; GenBank accession number EU371000).

Eurycheilichthys limulus Reis & Schaefer, 1998

Fig. 6; Tabs. 1, 3, 4

Eurycheilichthys limulus Reis & Schaefer, 1998: 15, fig. 7. Type locality: Rio Jacuí on road RS-010, between Marau and Passo Fundo, 28°18'S, 52°18'W, Rio Grande do Sul State, Brazil.



Fig. 6. *Eurycheilichthys limulus*, MCP 41143, 44.6 mm SL, male, Brazil, Rio Grande do Sul, Julio de Castilhos, arroio Passo dos Buracos.

Diagnosis. *Eurycheilichthys limulus* is distinguished from all congeners by having the pectoral girdle widely exposed ventrally (Fig. 2b; *vs.* pectoral girdle exposed only laterally; Figs. 2a, c-i), and, except for *E. castaneus*, by possessing a body and head plain dark brown in color, without blotches or spots, and with thin light stripes from the snout tip crossing above the eye and predorsal area (*vs.* body and head with a combination of dark blotches and spots). It is distinguished from *E. castaneus* by having the upper lobe of the caudal fin mostly hyaline (*vs.* upper caudal-fin lobe plain brown), and the spine and rays of the dorsal fin spotted (*vs.* spine and rays of the dorsal fin plain brown). *Eurycheilichthys limulus* is further distinguished from *E. luisae*, *E. planus*, and *E. vacariensis* by the abdomen being fully covered by small platelets (*vs.* naked, partially plated with a middle stripe of platelets, or incompletely covered with granular platelets), and by possessing 27-28 plates in middle lateral series (*vs.* 23-26 plates); from *E. luisae* and *E. pantherinus* by the lower lip not extending to the anterior margin of the pectoral girdle (*vs.* lower lip clearly extending past the anterior margin of the pectoral girdle) and by a narrower cleithral width (23.8-26.8 *vs.* 27.3-34.0% SL); from *E. coryphaenus* by possessing 27-28 plates in middle lateral series (*vs.* 25-26 plates), and by having the parieto-

supraoccipital without conspicuous elevation (*vs.* parieto-supraoccipital conspicuously elevated); from *E. paucidens* by possessing numerous (23-33) accessory teeth on the premaxilla in several irregular series (*vs.* 2-10 accessory teeth on premaxilla in one irregular series); and from *E. apocremnus* by the narrower cleithral width (23.8-26.8 *vs.* 28.4-31.8% SL).

Distribution and habitat. *Eurycheilichthys limulus* is known from several localities in the upper rio Jacuí basin, in central Rio Grande do Sul, Brazil (Fig. 7). The species is very common and found in nearly every creek with medium to fast flowing water and a substrate covered with stones or sand. Individuals are also commonly collected in the leaves of grasses and other marginal vegetation.

Conservation status. *Eurycheilichthys limulus* is frequent and abundant in the upper rio Jacuí basin. Despite the relatively small Extent of Occurrence (EOO) of approximately 8,300 km², the presence of hydroelectric dams and extensive agriculture that occur in that basin, no specific threats were detected, and the species can be categorized as Least Concern (LC) according to IUCN criteria (IUCN, 2016).

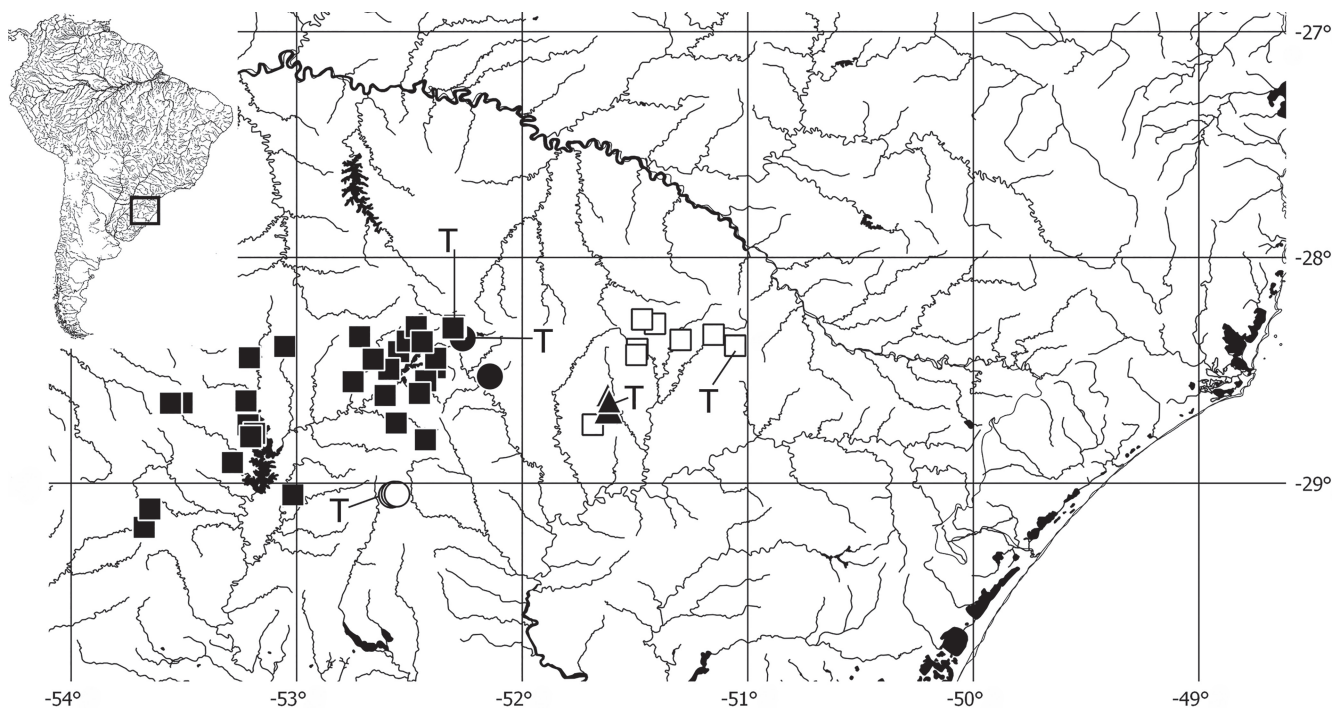


Fig. 7. Geographic distribution of *Eurycheilichthys* in South Brazil. *Eurycheilichthys apocremnus* (white dots), *E. castaneus* (black dots), *E. limulus* (black squares), *E. planus* (triangles), and *E. vacariensis* (white squares). T = type-locality.

Material examined. Brazil: Rio Grande do Sul State: upper rio Jacuí drainage: MCP 20283, holotype, 43.6 mm SL, rio Jacuí on road RS-010, between Marau and Passo Fundo (approx. 28°18'S 52°18'W). MCP 13086, 46 paratypes, 20.0-48.5 mm SL, 2 c&s 31.6-42.2 mm SL, collected with the holotype. MCP 14528, 1 paratype, 40.2 mm SL, rio Umbu at Victor Graeff (approx. 28°35'S 52°45'W). MCP 22181, 10, 23.4-46.2 mm SL, rio Jacuí on road RS-324, between Passo Fundo and Marau, Passo Fundo (28°18'45"S 52°18'28"W). MCP 22195, 3, 34.0-48.5 mm SL, arroio Pinheiro Torto, on road between Capinzal and Santa Gema, Passo Fundo (28°22'23"S 52°26'38"W). MCP 22252, 17, 22.6-46.9 mm SL, arroio Carreta Quebrada, ca. 8 km SSE of Capinzal, Passo Fundo (28°26'48"S 52°23'4"W). MCP 21500, 3, 39.3-48.9 mm SL, rio Espraiado at road BR-386 between Soledade and Passo Fundo, Soledade (28°43'20"S 52°33'33"W). MCP 21214, 1, 35.3 mm SL, arroio Despraído, on road between Soledade and Arvorezinha, ca. 4 km SW of road BR-386, Soledade (28°48'26"S 52°25'47"W). MCP 22700, 48, 17.9-46.7 mm SL, 2 c&s, 44.6-47.3 mm SL, rio Passo Novo, on the way out from Cruz Alta to Ibirubá, Cruz Alta (28°38'43"S 53°33'35"W). MCP 22693, 34, 24.5-47.4 mm SL, rio Lageado das Pedras, ca. 6.2 km East of Cruz Alta on road to Ibirubá, Cruz Alta (28°38'41"S 53°30'30"W). MCP 22167, 2, 34.5-42.1 mm SL, arroio Pessegueiro, on road RS-153, between Ernestina and Passo Fundo, Ernestina (28°25'4"S 52°32'55"W). MCP 22170, 20, 22.1-47.5 mm SL, creek ca. 2 km West of Ernestina, Ernestina (28°29'45"S 52°35'33"W). MCP 35120, 14 tis, 28.1-43.5 mm SL, riacho Chifranzinho, on road from Ernestina to Passo Fundo, Ernestina (28°22'14"S 52°30'37"W). MCP 21507, 31, 25.7-38.5 mm SL, creek tributary to rio Lageado Fortaleza, ca. 3 km East of Fortaleza dos Valos, Fortaleza dos Valos (28°47'39"S 53°12'17"W). MCP 21521, 11, 27.9-48.9 mm SL, creek tributary

to rio Ingaí, ca. 300m SW of Fazenda Colorados, Fortaleza dos Valos (28°54'29"S 53°17'8"W). MCP 21465, 1, 35.8 mm SL, arroio Lageado Fortaleza ca. 5 km NE of Fortaleza dos Valos, Fortaleza dos Valos (28°46'45"S 53°11'15"W). MCP 21270, 15, 32.2-48.6 mm SL, arroio Passo das Éguas, on road between Tunas and Jacuizinho, Tunas (29°03'03"S 53°01'02"W). MCP 21532, 4, 29.0-44.5 mm SL, creek crossing road BR-386 between rio Jacuí and exit to Ibirapuitã, Ibirapuitã (28°36'40"S 52°36'31"W). MCP 21475, 26, 27.0-47.5 mm SL, arroio Bonito, on road between Cruz Alta and Ibirubá, Ibirubá (28°38'08"S 53°13'33"W). MCP 22126, 13, 35.0-45.4 mm SL, rio da Glória, ca. 1.5 km East of road BR-386, between Tio Hugo and Carazinho, Santo Antônio do Planalto (28°21'02"S 52°43'16"W). MCP 22210, 6, 22.4-40.9 mm SL, arroio Estivinha, between Carreta Quebrada and Nicolau Vergueiro, Nicolau Vergueiro (28°29'18"S 52°23'12"W). MCP 22179, 1, 37.9 mm SL, arroio Erval, on road BR-386, between Tio Hugo and Carazinho, Santo Antônio do Planalto (28°27'02"S 52°39'43"W). MCP 22749, 13, 28.3-43.9 mm SL, rio Pinheirinho, on road between Saldanha Marinho and Carazinho, Saldanha Marinho (28°23'39"S 53°03'11"W). MCP 21446, 11, 34.9-49.8 mm SL, creek tributary to Passo Real hydroelectric dam, ca.7.1 km NNW of Fortaleza dos Valos on road to Santa Clara do Ingaí, Quinze de Novembro (28°44'31"S 53°13'01"W). MCP 41143, 26, 20.1-49.0 mm SL, arroio Passo dos Buracos on road from Julio de Castilhos to Cruz Alta, Julio de Castilhos (29°06'48"S 53°39'01"W). MCP 22760, 29, 28.1-47.9 mm SL, arroio Tapiaia, ca. 13 km N of Julio de Castilhos, on road to Cruz Alta, Júlio de Castilhos (29°06'49"S 53°39'04"W). MCP 22774, 7, 27.3-44.2 mm SL, arroio das Figueiras, on road from Cruz Alta to Saldanha Marinho, Santa Bárbara do Sul (28°26'39"S 53°12'37"W). MCP 22218, 3, 32.5-43.5 mm SL, arroio Quebra Dentes at Quebra

Dentes, Nicolau Vergueiro (28°36'9"S 52°27'23"W). MCP 22213, 8, 31.4-46.7 mm SL, creek tributary to arroio Resvalador in Arroio Bertolino, Nicolau Vergueiro (28°32'47"S 52°25'42"W). MCP 22153, 9, 23.3-49.3 mm SL, arroio Resvalador in Arroio Bertolino, Nicolau Vergueiro (28°32'54"S 52°25'59"W). MCP 35118, 8 tis, 27.8-46.0 mm SL, arroio Pinheiro Torto, na estrada de Ernestina para Passo Fundo, Passo Fundo (28°18'24"S 52°28'13"W).

Genseq-4 16S. MCP 35118; GenBank accession number KX355630.

Genseq-4 RAG1, RAG2. Sequence data published by Cramer *et al.* (2011) for RAG1 (MCP 21270; GenBank accession number GQ214579) and RAG2 (MCP 21270; GenBank accession number GQ225453).

Genseq-4 COI. Sequences deposited in GenBank by Cristian Cramer for COI (MCP 21270; GenBank accession numbers EU370989.1 and EU370990.1).

Eurycheilichthys apocremnus, new species

urn:lsid:zoobank.org:act:FE8E4E7B-7CBB-4430-A00D-832ED531C10D

Fig. 8; Tabs. 1, 3, 4

Eurycheilichthys sp. 1.-Reis, Carvalho, 2007: 84 [listed].

Holotype. MCP 40660, 47.0 mm SL, male, Brazil, Rio Grande do Sul, Barros Cassal, creek tributary to rio Fão, rio Taquari basin, ca. 7 km North of Barros Cassal (29°03'09"S 52°34'50"W), 11 Apr 2000, R. E. Reis *et al.*

Paratypes. Brazil: Rio Grande do Sul: upper rio Taquari drainage: MCP 25678, 10, 30.8-50.6 mm SL, 2 c&s, 45.1-45.4 mm SL (9, 38.1-50.6 mm SL), MZUSP 92422, 3, 30.5-50.0 mm SL (2, 41.6-50.0 mm SL), AMNH 238571, 3, 31.5-50.2 mm SL (2, 43.9-50.2 mm SL), collected with the holotype. MCP 21544, 2, 1 c&s, 46.1 mm SL (2, 46.9-49.0 mm SL), creek tributary to rio Fão, ca. 7 km North of Barros Cassal, Barros Cassal (29°03'09"S 52°34'50"W), 12 Oct 1998, R. E. Reis *et al.* MCP 35071, 2 (2, 49.9-54.1 mm SL) and 8 tis, 32.3-50.5 mm SL, arroio Fãozinho near Vila Nova, Barros Cassal (29°02'51"S 52°34'06"W), 21 May 2004, R. E. Reis *et al.* MCP 35124, 3 tis, 30.7-36.0 mm SL, creek tributary to arroio Fãozinho near Vila Nova, Barros Cassal (29°02'53"S 52°33'19"W), 21 May 2004, R. E. Reis *et al.*



Fig. 8. *Eurycheilichthys apocremnus*, new species, holotype, MCP 40660, 47.0 mm SL, male, Brazil, Rio Grande do Sul, Barros Cassal, creek tributary to rio Fão.

Genseq-2 16S. MCP 35071; GenBank accession number KX355631.

Genseq-2 COI. Sequences deposited in GenBank by Cristian Cramer for COI (MCP 35071; GenBank accession number EU370997).

Genseq-4 COI. Sequences deposited in GenBank by Cristian Cramer for COI (MCP 35124; GenBank accession number EU370996).

Diagnosis. *Eurycheilichthys apocremnus* is distinguished from *E. limulus* and *E. castaneus*, by exhibiting many irregularly shaped dark blotches and spots on the body and head (*vs.* body and head plain dark brown, without blotches or spots); from *E. limulus* by exhibiting a wider cleithrum (28.4-31.8 *vs.* 23.8-26.8% SL); from *E. luisae*, *E. planus*, and *E. vacariensis* by the abdomen being fully covered by small platelets (*vs.* naked or partially plated with a middle stripe of platelets, or incompletely covered with granular platelets), and by possessing 27-28 (and occasionally 26) plates in the middle lateral series (*vs.* 23-26 plates); from *E. planus*, *E. coryphaenus*, and *E. vacariensis* by a longer first pelvic-fin ray (20.4-23.3% SL *vs.* 16.9-20.1 in *E. coryphaenus*, 15.6-19.2 in *E. planus*, and 14.6-20.1 in *E. vacariensis*); from *E. pantherinus* by the lower lip hardly reaching the anterior margin of the pectoral girdle (*vs.* lower lip clearly extending past the anterior margin of the pectoral girdle), and by the deeper caudal peduncle (10.2-12.3 *vs.* 7.8-10.2% SL); from *E. planus* by the deeper caudal peduncle (10.2-12.3 *vs.* 8.9-10.0% SL); from *E. coryphaenus* by possessing 27-28 (occasionally 26) plates in middle lateral series (*vs.* 25-26 plates), and the parieto-supraoccipital without a conspicuous elevation (*vs.* parieto-supraoccipital conspicuously elevated); and from *E. paucidens* by possessing numerous (27-38) accessory teeth on premaxilla in several irregular series (*vs.* fewer, 2-10 accessory teeth on premaxilla in one irregular series).

Description. Proportional measurements and counts in Tabs. 1, 3, and 4. Dorsal body profile gently arched from snout tip to dorsal-fin origin. Trunk generally straight and tapering slightly toward caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at and behind base of dorsal and anal fins and compressed caudally. Greatest body depth at parieto-supraoccipital or dorsal-fin origin. Head and snout broad, flat, and rounded anteriorly; body progressively narrowing caudally from cleithrum. Interorbital space slightly convex; superior margin of orbits slightly elevated. Snout slightly convex anterior to nares. Nostrils located at posterior terminus of pair of elongate, shallow depressions beginning close to snout tip. Eye comparatively small, orbit diameter 9.5-14.2% HL, dorsolaterally placed.

Pectoral fin of moderate size, spine strongly arched. Posterior fin margin straight or slightly rounded and extending to middle of pelvic fin when depressed. Fleshy

flap along posterodorsal margin of pectoral-fin spine in both male and female adults. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithrum. Pelvic fin of females short, extending to point midway between anus and anal-fin origin when depressed. Thickened first pelvic-fin ray of males longer, extending to anal-fin origin. Males possess well developed fleshy flap along posterodorsal margin of thickened first pelvic-fin ray. Dorsal-fin origin at vertical line through end of pelvic-fin base; reduced and plate-like spinelet present; dorsal-fin locking mechanism non-functional. Adipose fin absent.

Body entirely covered by dermal plates except for area around anus, opening of swimbladder capsule posteroventral to compound pterotic, around pectoral- and pelvic-fin insertions, and ventral surface of head around lips. Body and head without crests. Coracoid and cleithrum exposed laterally, covered medially by skin and abdominal platelets. Arrector fossa open. Lateral abdominal plates absent. Middle abdominal plates small, irregularly arranged, and covering most of abdominal surface between pectoral girdle and anal opening (Fig. 2c). Posterior tip of parieto-supraoccipital with small patch of enlarged but not raised odontodes compared to those of remainder of head and predorsal area, especially in smaller individuals. Head and body plates covered with odontodes, these larger on ventral face of pelvic and pectoral spines. Odontodes on head and trunk otherwise of uniform size and distribution, not arranged in conspicuous rows.

Lips roundish and wide, papillose, extending posteriorly to end of canal-bearing lateral cheek plate or between that point and anterior margin of pectoral girdle. Lower lip margin slightly fringed. Maxillary barbel short, mostly adnate to lower lip. Teeth slender, bifid; major (medial) cusp large, bladelike, and slightly rounded; minor (lateral) cusp minute, pointed. Accessory patch of unicuspid teeth on premaxilla and dentary, attached to dermal bone posterior (premaxilla) and anterior (dentary) margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth elongate, sharply pointed, directed posteroventrally (premaxilla) and anteroventrally (dentary).

Color in alcohol. Background color of dorsal surface of head and body tan to light brown with many dark brown blotches of irregular shape, larger on caudal peduncle; marks on head coalesced such that lighter lines appear especially on snout and cheeks; yellowish tan, mostly unpigmented ventrally. Hypertrophied odontodes on tip of parieto-supraoccipital bone lighter than background. First thickened ray of dorsal, pectoral, pelvic, and anal fins and external rays of caudal fin with chromatophores arranged in two or three discernible blotches. Branched rays in these fins with similar color pattern. Caudal fin primarily dark brown with light middle vertical band.

Distribution and habitat. *Eurycheilichthys apocremnus* is only known from three localities in the upper reaches of rio Fão, a tributary to the rio Forqueta, rio Taquari basin, Rio

Grande do Sul, Brazil (Fig. 7). The localities are in a small creek with fast flowing clear water and a substrate covered with rocks and stones.

Etymology. The specific epithet of *Eurycheilichthys apocremnus* is from the Greek *apo*, meaning from, and *kremnos*, meaning cliff or precipice, in allusion to the steep landscape of the type locality. An adjective in the nominative.

Conservation status. *Eurycheilichthys apocremnus* is not abundant and is only known from three sites in one creek tributary to the arroio Fãozinho, with Extent of Occurrence (EOO) of approximately 0.37 km² and Area of Occupancy (AOO) of approximately 0.05 km², estimated considering the 14 km of creek extension and an average of 4 m width. In addition, collecting attempts in the lower portion of the Fãozinho revealed the presence of *E. luisae*, which is probably replacing *E. apocremnus* downstream. Since the species is found only in that creek and intense agriculture occurs in the area, the

creek is considered as one location and a continuing decline in habitat quality is inferred. Based on the above evidence *E. apocremnus* can be categorized as Critically Endangered (CR) by the IUCN criteria B1B2ab(iii); D2 (IUCN, 2016).

***Eurycheilichthys castaneus*, new species**

urn:lsid:zoobank.org:act:D9548A02-EE9C-4612-9C35-B8C776C17BE1

Fig. 9; Tabs. 1, 3, 4

Eurycheilichthys sp. 4.-Reis, Carvalho, 2007: 84 [listed].

Holotype. MCP 40664, 48.1 mm SL, male, Brazil, Rio Grande do Sul, Marau, arroio Burro Preto, tributary to rio Guaporé, rio Taquari basin, on road RS-324, between Passo Fundo and Marau (28°21'29"S 52°15'51"W), 19 Jan 1999, R. E. Reis *et al.*



Fig. 9. *Eurycheilichthys castaneus*, new species, holotype, MCP 40664, 48.1 mm SL, male, Brazil, Rio Grande do Sul, Marau, arroio Burro Preto, tributary to rio Guaporé. Lateral view of right side and image digitally inverted.

Paratypes. Brazil: Rio Grande do Sul: upper rio Taquari drainage: MCP 22134, 13, 22.9-49.6 mm SL, 2 c&s, 36.3-47.8 mm SL (7, 40.1-49.6 mm SL), MZUSP 92426, 2 (2, 37.5-47.4 mm SL), AMNH 238575, 2 (2, 44.3-47.4 mm SL), collected with the holotype. MCP 22270, 4, 33.7-41.9 mm SL (2, 38.0-41.9 mm SL), arroio Burro Preto on road to Balneário Capingui, Passo Fundo (28°21'08"S 52°15'56"W), 31 Jan 1999, L. Hahn *et al.* MCP 22234, 1 (1, 44.0 mm SL), arroio Porongos, ca. 1.5 km NE of Vila Maria, Vila Maria, Marau (28°31'34"S 52°08'22"W), 20 Jan 1999, R. E. Reis *et al.* MCP 35049, 13, 27.6-48.2 mm SL (7, 37.2-48.2 mm SL) and 15 tis, 28.6-49.2 mm SL, arroio Burro Preto on road to Balneário Capingui, Passo Fundo (28°21'08"S 52°15'56"W), 22 May 2004, R. E. Reis *et al.* MCP 35043, 3 (3, 40.2-44.9 mm SL) and 8 tis, 30.1-42.8 mm SL, arroio Porongos at Vila Maria, Marau (28°31'36"S 52°08'37"W), 22 May 2004, R. E. Reis *et al.*

Genseq-2 16S. MCP 35043; GenBank accession number KX355632.

Genseq-4 COI. Sequences deposited in GenBank by Cristian Cramer for COI (MCP 35049; GenBank accession number EU370999).

Non-types. Brazil: Rio Grande do Sul: upper rio Taquari drainage: MCP 35121, 11 tis, 27.3-47.0 mm SL, arroio Burro Preto, on road RS-324, between Passo Fundo and Marau, Marau (28°21'29"S 52°15'51"W), 22 May 2004, R. E. Reis *et al.*

Diagnosis. *Eurycheilichthys castaneus* is distinguished from all congeners, except *E. limulus*, by possessing a plain dark brown body and head, without blotches or spots, and with thin light stripes from the snout tip, crossing above the eye and predorsal area (*vs.* body and head with a different combination of dark blotches and spots). It is distinguished from *E. limulus* by having the upper lobe of the caudal fin plain brown in color (*vs.* upper caudal-fin lobe primarily hyaline), and the spine and rays of the dorsal fin plain brown (*vs.* spotted). *Eurycheilichthys castaneus* is further distinguished from *E. coryphaenus*, *E. luisae*, *E. pantherinus*, *E. planus*, and *E. vacariensis* by possessing 27-29 plates in the middle lateral series (*vs.* 23-26 plates, though one specimen of *E. pantherinus* had 27 in one side); from *E. luisae*, *E. planus*, and *E. vacariensis* by possessing an abdomen fully covered by small platelets (*vs.* naked, partially plated with a middle stripe of platelets, or incompletely covered by granular platelets); from *E. pantherinus* by the lower lip not reaching the anterior margin of the pectoral girdle (*vs.* lower lip clearly going past the anterior margin of the pectoral girdle); from *E. paucidens* by possessing more numerous (14-17) accessory teeth on the premaxilla in two or three irregular series (*vs.* fewer, 2-10 accessory teeth on the premaxilla in one irregular series); and from *E. apocremnus* by a narrower cleithral width (23.8-26.8 *vs.* 28.4-31.8% SL).

Description. Proportional measurements and counts in Tabs. 1, 3, and 4. Dorsal body profile gently arched from snout tip to parieto-supraoccipital posterior process; straight to slightly concave from that point to dorsal-fin origin. Trunk generally straight and tapering slightly toward caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at and behind base of dorsal and anal fins, and compressed caudally. Greatest body depth at dorsal-fin origin. Head and snout broad and rounded anteriorly, with body progressively narrowing caudally from cleithrum. Interorbital space flat to slightly convex; superior margin of orbits slightly elevated. Snout straight to slightly convex anterior to nares. Nostrils located at posterior terminus of pair of elongate, shallow depressions beginning close to snout tip. Eye comparatively small, orbit diameter 10.8-14.9% HL, dorsolaterally placed.

Pectoral fin of moderate size, spine moderately arched, posterior fin-margin straight or slightly concave; extending to middle of pelvic fin when depressed. Fleshy flap along posterodorsal margin of pectoral-fin spine in both male and female adults. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithrum. Pelvic fin of females short; extending to point midway between anus and anal-fin origin when depressed. Thickened first pelvic-fin ray of males longer, sometimes reaching to anal-fin origin. Males with well-developed fleshy flap along posterodorsal margin of thickened first pelvic-fin ray; females with small, low fleshy flap. Dorsal-fin origin slightly posterior to vertical line through end of pelvic-fin base; spinelet present, reduced and plate-like; dorsal-fin locking mechanism non-functional. Adipose fin absent.

Body entirely covered by dermal plates except for area around anus, opening of swimbladder capsule posteroventrally to compound pterotic, around pectoral- and pelvic-fin insertions, and ventral surface of head around lips. Body and head without crests. Coracoid and cleithrum exposed laterally and covered medially by middle abdominal platelets. Arrector fossa open. Lateral abdominal plates absent. Middle abdominal plates small, irregularly arranged, and covering most of abdominal surface between pectoral girdle and anal opening (Fig. 2d). Posterior tip of parieto-supraoccipital with small raised patch of larger odontodes than those on remainder of head and predorsal area, especially in smaller individuals. Head and body plates covered with odontodes, these larger on ventral face of pelvic and pectoral spines. Odontodes on head and trunk otherwise of uniform size and distribution, not arranged in conspicuous rows.

Lips roundish and wide, papillose, extending posteriorly to point between end of canal-bearing lateral cheek plate and anterior margin of pectoral girdle. Lower lip margin fringed. Maxillary barbel short, mostly adnate to lower lip. Teeth slender, bifid; major (medial) cusp large, bladelike, and slightly rounded; minor (lateral) cusp minute, pointed. Accessory patch of unicuspid teeth on premaxilla and dentary, attached to dermal bone posterior (premaxilla)

and anterior (dentary) to margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth elongate, sharply pointed, directed posteroventrally (premaxilla) and anteroventrally (dentary).

Color in alcohol. Background color of dorsal surface of head and body dark grayish brown; yellowish tan, primarily unpigmented ventrally. Inconspicuous longitudinal light stripes on each side, beginning on snout tip, crossing between nostrils and orbits on each side, becoming fainter and disappearing on predorsal area. Hypertrophied odontodes on tip of parieto-supraoccipital bone lighter than background. Opercle with small lighter spot. All fin rays dark brown, without concentrated chromatophores. Interradial membranes mostly hyaline.

Distribution and habitat. *Eurycheilichthys castaneus* is known from a few localities in the upper reaches of rio Guaporé basin, a tributary to the rio Taquari, Rio Grande do Sul, Brazil (Fig. 7). The localities are small creeks with medium to fast flowing clear water and a substrate covered with rocks and stones. Fishes were collected among rocks only.

Etymology. The specific epithet of *Eurycheilichthys castaneus* is from the Latin *castaneus*, meaning brown, chestnut colored, in allusion to the primarily plain dark brown color. An adjective.

Conservation status. *Eurycheilichthys castaneus* is relatively abundant in tributaries to the upper rio Guaporé, with Extent of Occurrence (EOO) of approximately 110 km². Despite the continuing decline in habitat quality because of land use change, especially agriculture, the population is neither severely fragmented nor presenting extreme fluctuations, and the species can be categorized as Near Threatened (NT) according to IUCN criteria B1b(iii) (IUCN, 2016).

Eurycheilichthys coryphaenus, new species

urn:lsid:zoobank.org:act:6C1D354A-CE40-48B9-96FF-B48025296287

Fig. 10; Tabs. 1, 3, 4

Eurycheilichthys sp. 7.-Reis, Carvalho, 2007: 84 [listed].



Fig. 10. *Eurycheilichthys coryphaenus*, new species, holotype, MCP 40665, 46.7 mm SL, female, Brazil, Rio Grande do Sul, Tainhas, arroio Contendas.

Holotype. MCP 40665, 46.7 mm SL, female, Brazil, Rio Grande do Sul, Tainhas, arroio Contendas, rio Taquari basin (approx. 29°17'S 50°14'W), 4 Dec 2002, J. P. Silva & J. Anza.

Paratypes. Brazil: Rio Grande do Sul: upper rio Taquari drainage: MCP 31160, 3, 16.5-43.6 mm SL (2, 39.1-43.6 mm SL), collected with the holotype. MCP 35044, 2 (2, 36.2-44.3 mm SL) and 15 tis, 25.4-33.2 mm SL, arroio Contendas, ca. 1 km NE of road from Aratinga to Tainhas, Tainhas (29°16'41"S 50°14'42"W), 23 May 2004, R. E. Reis. UFRGS 6905, 1, 35.3 mm SL, MCP 40667, 1 c&s, 51.8 mm SL, MZUSP 92427, 1, 35.1 mm SL, AMNH 238576, 2, 34.1-36.3 mm SL, creek tributary to rio Tainhas, ca. 4 km North of Tainhas, Tainhas (29°15'06"S 50°16'39"W), 27 Nov 2004, J. Anza *et al.* MCP 22375, 3, 33.8-49.7 mm SL (1, 49.7 mm SL), and MNRJ 18341, 4, 17.5-37.7 mm SL (2, 36.4-37.7 mm SL), creek tributary to rio Tainhas, 1.7 km NW of roads intersection near Tainhas, Tainhas (29°15'44"S 50°19'54"W), 16 Dec 1998, R. E. Reis *et al.* MCP 25674, 2, 1 c&s, 30.1 mm SL (2, 36.8-42.0 mm SL), arroio Contendas on road from Aratinga to Tainhas, Tainhas (approx. 29°17'S 50°15'W), 20 Mar 2000, W. Bruschi Jr. UFRGS 5075, 2, 31.0-42.7 mm SL, creek tributary to rio Tainhas on road RS-230 ca. 2 km West of Tainhas, Tainhas (29°15'47"S 50°19'56"W), 30 Mar 2001, L. R. Malabarba *et al.* UFRGS 5022, 1, 44.2 mm SL, rio Tainhas near Tainhas (29°15'30"S 50°13'12"), 11 Sep 1999, G. B. Buckup *et al.* MCN 18563, 3, 33.8-44.8 mm SL, rio Tainhas at Passo da Ilha, São Francisco de Paula (29°07'24.8"S 50°21'29.9"W), 6 Mar 2006, M. Azevedo & R. Hirano.

Genseq-2 16S. MCP 35044; GenBank accession number KX355633.

Non-types. Brazil: Rio Grande do Sul: upper rio Taquari drainage: UFRGS 5077, 3, 30.8-44.0 mm SL, rio Tomé at road RS-020, Vacaria (29°02'21"S 50°34'12"W), 31 Mar 2001, L. R. Malabarba *et al.*

Diagnosis. *Eurycheilichthys coryphaenus* is distinguished from all congeners by having the parieto-supraoccipital conspicuously elevated (Fig. 3) (*vs.* parieto-supraoccipital without a conspicuous elevation); and the abdominal plates granular and partially embedded in skin such that mostly only odontodes are visible (*vs.* abdominal plates absent or large and conspicuous). *Eurycheilichthys coryphaenus* is further distinguished from *E. castaneus* and *E. limulus* by the spotted pattern of its body and fins (*vs.* body plain dark brown, without blotches or spot, and with a light stripe from snout tip, crossing above the eye and predorsal area), and 25-26 plates in middle lateral series (*vs.* 27-29 plates); from *E. planus*, *E. luisae*, and *E. vacariensis* by having the abdomen completely covered by small platelets (*vs.* naked, partially plated with a middle stripe of platelets, or incompletely covered with granular platelets); from *E. planus* by the longer dorsal-fin spine (21.8-24.0 *vs.* 16.5-21.6% SL) and deeper head (47.8-54.0 *vs.* 41.6-46.9% HL); from *E. paucidens* and *E. apocremnus* by the shorter

pelvic-fin spine (64.4-80.2 *vs.* 80.6-100.6% of the pectoral-fin spine) and 25-26 plates in middle lateral series (*vs.* 27-30 plates, occasionally 26); from *E. paucidens* by larger orbital diameter (13.8-18.5 *vs.* 9.3-12.4% HL); and from *E. pantherinus* by the lower lip hardly reaching the anterior margin of the pectoral girdle (*vs.* lower lip clearly extending past the anterior margin of the pectoral girdle).

Description. Proportional measurements and counts in Tabs. 1, 3 and 4. Dorsal body profile straight to gently arched from snout tip to parieto-supraoccipital, straight from that point to dorsal-fin origin; parieto-supraoccipital with conspicuous elevation, more salient in larger individuals. Trunk generally straight and tapering slightly toward caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at and behind base of dorsal and anal fins, and compressed caudally. Greatest body depth at parieto-supraoccipital bone or dorsal-fin origin. Head and snout broad and rounded anteriorly, with body progressively narrowing caudally from cleithrum. Interorbital space flat to slightly concave; superior margin of orbits slightly elevated. Snout flat to slightly convex anterior to nares. Nostrils located at posterior terminus of pair of elongate, shallow depressions beginning close to snout tip. Eye comparatively large, orbit diameter 13.8-18.5% HL, dorsolaterally placed.

Pectoral fin of moderate size, spine slightly arched, posterior fin-margin straight to slightly rounded; extending to between middle and distal third of pelvic fin when depressed. Fleishy flap along posterodorsal margin of pectoral-fin spine low in adult males, and absent in females. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithrum. Pelvic fin of females short, extending to point midway between anus and anal-fin origin when depressed. Thickened first pelvic-fin ray of males longer, typically extending to anal-fin origin. Males with well-developed fleshy flap along posterodorsal margin of thickened first pelvic-fin ray. Dorsal-fin origin at or slightly posterior to vertical line through end of pelvic-fin base; spinelet present, reduced and plate-like; dorsal-fin locking mechanism non-functional. Adipose fin absent.

Body entirely covered by dermal plates except for area around anus, opening of swimbladder capsule posteroventrally to compound pterotic, around pectoral- and pelvic-fin insertions, and ventral surface of head around lips. Body and head without crests. Coracoid and cleithrum exposed laterally, covered medially by skin and few isolated platelets. Arrector fossa open. Lateral abdominal plates absent. Middle abdominal plates granular and somewhat embedded in skin, irregularly arranged and interspaced, covering most of abdominal surface between pectoral girdle and anal opening (Fig. 2e). Posterior tip of parieto-supraoccipital with conspicuous patch of enlarged and raised odontodes compared to those of remainder of head and predorsal area, especially in smaller individuals. Head and body plates covered with odontodes, these larger on ventral face of pelvic and pectoral spines. Odontodes on

head and trunk otherwise of uniform size and distribution, not arranged in conspicuous rows.

Lips roundish and wide, papillose, extending posteriorly to a point between end of canal-bearing lateral cheek plate and anterior margin of pectoral girdle. Lower lip margin fringed. Maxillary barbel short, mostly adnate to lower lip. Teeth slender, bifid; major (medial) cusp large, bladelike, and slightly rounded; minor (lateral) cusp minute, pointed. Accessory patch of unicuspid teeth on premaxilla and dentary, attached to dermal bone posterior (premaxilla) and anterior to (dentary) margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth large, elongate, sharply pointed, directed posteroventrally (premaxilla) and anteroventrally (dentary).

Color in alcohol. Background color of dorsal surface of head and body tan to brown with few large, dark brown spots throughout head and body; yellowish tan, mostly unpigmented ventrally. Head primarily dark, predorsal region lighter; two inconspicuous lighter saddles on dorsum, at end of dorsal-fin base and caudal peduncle. Hypertrophied odontodes on tip of parieto-supraoccipital bone lighter than background. First thickened ray of dorsal, pectoral, pelvic, and anal fins and external rays of caudal fin with chromatophores arranged in four to six discernible blotches. Branched rays in these fins with similar color pattern. Caudal fin with three or four irregular dark vertical bands.

Distribution and habitat. *Eurycheilichthys coryphaenus* is known from localities in the upper reaches of the rio Tainhas basin, which is a tributary to the rio das Antas, rio Taquari basin, Rio Grande do Sul, Brazil (Fig. 11), an area located at the extreme eastern headwaters of the rio Taquari basin, in

the *Araucaria* forest area. One lot from rio Tomé (UFRGS 5077) is tentatively assigned to this species and specimens are considered non-types. The localities are small creeks with medium flowing clear water and substrate covered with rocks and stones. Despite dense vegetation including marginal grasses and aquatic macrophytes being present in these localities, fishes are found dwelling among loose stones on the substrate.

Etymology. The specific epithet of *Eurycheilichthys coryphaenus* is from the Greek *koryphe*, meaning head, crown, top, or highest point, in allusion to the distinctly elevated parieto-supraoccipital bone. An adjective.

Conservation status. *Eurycheilichthys coryphaenus* is not abundant and is known from tributaries to the rio Tainhas and the rio Tomé, with Extent of Occurrence (EOO) of approximately 104 km². Despite the continuing decline in habitat quality because of land use change, especially agriculture and *Pinus* reforestation, the population is neither severely fragmented nor presenting extreme fluctuations, and the species can be categorized as Near Threatened (NT) according to IUCN criteria B1b(iii) (IUCN, 2016).

Eurycheilichthys luisae, new species

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Fig. 12; Tabs. 2-4

Eurycheilichthys sp. 2.-Reis, Carvalho, 2007: 84 [listed].

Eurycheilichthys sp. 1.-Cramer *et al.*, 2011: 48 [phylogeny].

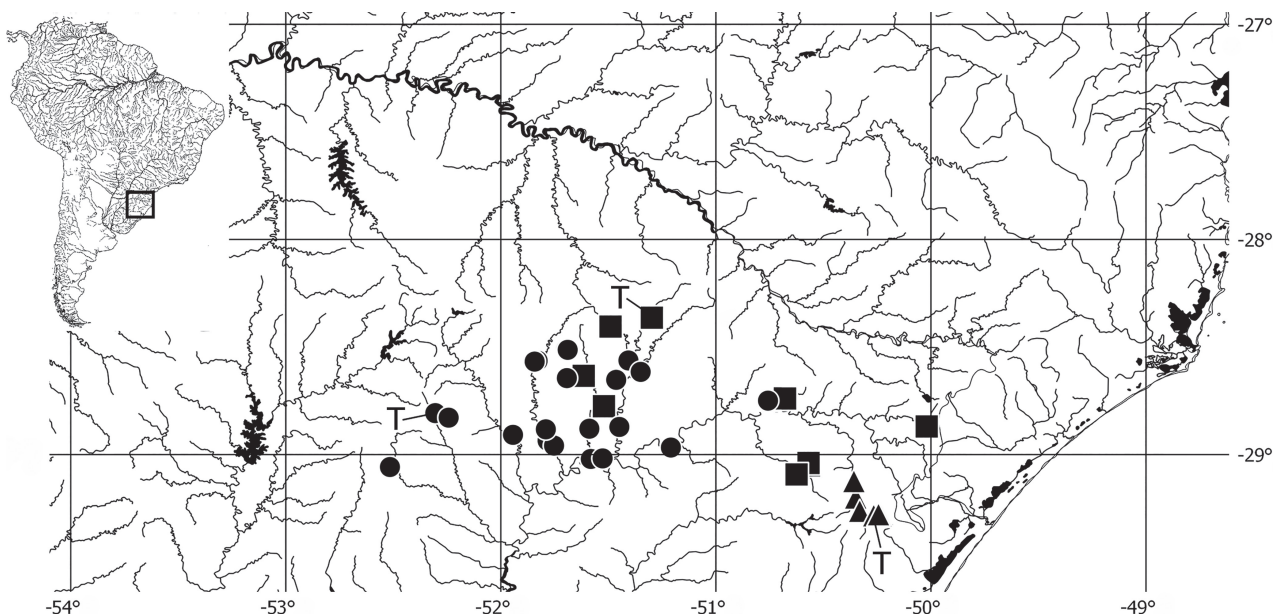


Fig. 11. Geographic distribution of *Eurycheilichthys* in South Brazil. *Eurycheilichthys coryphaenus* (triangles), *E. luisae* (black dots), and *E. paucidens* (black squares). T = type-locality.



Fig. 12. *Eurycheilichthys luisae*, new species, holotype, MCP 40662, 42.5 mm SL, male, Brazil, Rio Grande do Sul, Arvorezinha, arroio Três Pontes.

Holotype. MCP 40662, 42.5 mm SL, male, Brazil, Rio Grande do Sul, Arvorezinha, arroio Três Pontes, rio Taquari basin, on road from Soledade to Arvorezinha, ca. 18 km SE of road BR-386 (28°48'24"S 52°18'14"W), 21 May 2004, R. E. Reis *et al.*

Paratypes. Brazil: Rio Grande do Sul: upper rio Taquari drainage: MCP 35057, 10, 34.2-44.3 mm SL (3, 40.4-44.3 mm SL), 16 tis, 33.8-42.9 mm SL, MZUSP 92424, 3, 35.3-42.7 mm SL, AMNH 238573, 3, 38.5-43.8 mm SL, collected with the holotype. MCP 25566, 17, 24.8-43.0 mm SL, 2 c&s, 37.9-38.5 mm SL (10, 37.7-43.0 mm SL), arroio Jabuticaba near its mouth into rio das Antas, Veranópolis (29°01'13"S 51°31'41"W), 19 Mar 2000, R. E. Reis *et al.* MCP 35058, 12, 28.9-47.3 mm SL (10, 37.1-47.3 mm SL), arroio Fãozinho at Vila Nova, Barros Cassal (29°03'30"S 52°30'58"W), 21 May 2004, R. E. Reis *et al.* MCP 21208, 11, 28.4-45.4 mm SL (3, 44.2-45.4 mm SL), arroio Jeremias, on road from Soledade to Arvorezinha, ca. 25 km SE of road BR-386, Arvorezinha (28°49'44"S 52°14'35"W), 25

Aug 1998, J. F. Pezzi *et al.* MCP 21207, 12, 30.3-47.7 mm SL (3, 41.4-47.7 mm SL), arroio Três Pontes, on road from Soledade to Arvorezinha, ca. 18 km SE of road BR-386, Arvorezinha (28°48'24"S, 52°18'14"W), 25 Aug 1998, J. F. Pezzi *et al.* MCP 21679, 3, 31.9-35.2 mm SL, 1 c&s, 33.6 mm SL, arroio Jabuticaba, at Monte Claro, Veranópolis (29°01'15"S 51°34'55"W), 15 Oct 1998, W. Bruschi Jr. MCP 25490, 1, 40.9 mm SL, arroio Jabuticaba, at Monte Claro, Veranópolis (29°01'15"S 51°34'55"W), 5 Mar 1999, W. Bruschi Jr. MCP 43968, 12, 21.7-44.3 mm SL, arroio Governador, tributary to rio das Antas, Bom Jesus (28°44'23"S 50°40'42"W), 19 Dec 2008, J. F. Pezzi & E. H. L. Pereira.

Genseq-2 16S. MCP 35057; GenBank accession number KX355634.

Genseq-2 COI. Sequences deposited in GenBank by Cristian Cramer for COI (MCP 21207; GenBank accession numbers EU370995 and EU370998).

Tab. 2. Descriptive morphometrics of *Eurycheilichthys* species. Values are given as percents of standard length or of head length. Hol = holotype. SD = standard deviation. Data in bold are distinguishing features among species.

Character	<i>E. luisae</i> n=30				<i>E. paucidens</i> n=23				<i>E. planus</i> n=17				<i>E. vacariensis</i> n=23			
	Hol	Low	High	Mean	Hol	Low	High	Mean	Hol	Low	High	Mean	Hol	Low	High	Mean
Standard length (mm)	42.5	37.1	47.7	41.2	61.8	37.0	61.8	49.1	49.3	41.4	56.6	46.9	47.6	32.9	47.6	40.0
	Percents of SL															
Head length	35.6	33.4	38.3	36.3	30.4	29.4	37.5	33.3	32.6	31.1	35.8	33.2	33.6	30.5	37.8	34.6
Predorsal length	48.0	44.4	49.6	47.4	42.3	40.3	48.6	43.0	45.2	42.4	48.5	45.0	45.0	42.6	50.4	46.0
Dorsal-fin spine length	24.5	20.1	25.4	23.1	18.8	18.1	22.9	21.1	19.9	16.5	21.6	19.1	20.6	20.1	23.7	21.8
First anal-fin ray length	17.2	16.3	20.5	18.6	18.5	18.2	22.2	19.8	15.7	13.9	17.0	15.4	16.1	14.5	19.3	17.4
Pectoral-fin spine length	26.9	23.8	30.9	27.3	20.5	20.5	27.1	23.6	24.3	19.3	26.9	23.8	24.5	22.0	27.3	24.8
First pelvic-fin ray length	22.6	17.2	24.1	21.4	19.9	19.4	24.2	21.5	18.3	15.6	19.2	17.3	18.7	14.6	20.1	18.0
Trunk length	14.0	13.6	16.2	14.6	14.2	13.0	15.9	14.5	17.9	14.3	18.5	16.4	13.9	12.1	16.0	13.9
Abdominal length	23.9	21.6	26.3	23.6	26.4	21.7	26.4	24.1	23.4	19.9	24.3	22.2	22.5	19.5	24.0	22.1
Cleithral width	31.6	28.6	34.0	31.3	25.1	25.1	30.3	27.4	28.5	26.6	29.4	28.1	26.7	25.7	29.5	27.4
Body depth at dorsal fin	15.9	15.2	19.7	17.0	14.6	14.0	18.2	16.0	15.8	13.4	16.0	14.8	15.5	14.2	17.5	15.8
Body width at anal fin	13.4	13.2	15.4	14.2	12.5	11.6	14.5	12.6	13.3	12.5	14.6	13.2	13.2	11.2	16.2	13.2
Caudal peduncle length	32.9	23.6	32.9	28.9	34.1	27.2	36.8	32.3	32.4	28.2	35.7	30.9	33.3	25.9	33.7	30.1
Caudal peduncle depth	11.1	10.1	12.5	11.2	9.2	8.5	11.1	9.9	9.7	8.9	10.0	9.5	10.7	9.7	11.4	10.5
	Percents of HL															
Snout length	52.1	49.7	56.2	52.5	55.0	51.2	59.4	54.2	53.9	48.1	54.8	52.1	54.9	50.9	58.9	53.4
Orbital diameter	14.4	12.1	14.5	13.4	10.3	9.3	12.4	10.6	14.0	12.4	14.9	13.8	13.9	12.5	16.9	14.3
Interorbital width	36.8	32.0	38.9	35.7	31.4	30.0	35.7	33.0	40.8	33.9	40.8	37.5	39.4	33.9	39.9	36.9
Head depth	48.6	42.8	48.6	45.8	43.1	40.3	47.2	43.8	46.5	41.6	46.9	44.1	47.5	44.7	53.8	48.1
Left mandibular ramus	12.6	11.1	14.7	13.0	9.1	7.0	10.8	9.2	12.3	9.8	15.9	12.3	14.2	10.2	15.6	12.2

Tab. 3. Frequency distribution of variable counts of *Eurycheilichthys* species. Vertebrae and body plates. * = counted in c&s specimens; ** = Both sides of body counted; holotype values are underlined.

	Vertebrae*					Plates in middle lateral series **					Plates at dorsal-fin base			Plates between dorsal and caudal fins				Plates at anal-fin base		Plates between anal and caudal fins							
	28	29	30	31	32	23	24	25	26	27	28	29	30	4	5	6	14	15	16	17	3	4	10	11	12	13	
<i>E. pantherinus</i>	1	4	1			3	<u>12</u>	<u>30</u>	1						21	2	3	9	<u>11</u>		<u>22</u>	1				<u>20</u>	3
<i>E. limulus</i>		1	1	1	1					18	<u>34</u>			<u>14</u>	12				13	<u>12</u>	<u>26</u>					<u>20</u>	<u>6</u>
<i>E. apocremnus</i>			3						2	<u>15</u>	<u>10</u>	4	5		<u>15</u>	3		12	<u>6</u>		5	<u>13</u>	<u>5</u>	8	5		
<i>E. castaneus</i>			2							27	<u>22</u>	1			<u>25</u>				<u>15</u>	10	<u>20</u>	5		5	<u>14</u>	6	
<i>E. coryphaenus</i>			2					<u>8</u>	<u>12</u>						<u>10</u>			8	<u>2</u>		<u>10</u>			1	<u>9</u>		
<i>E. luisae</i>	2	1				1	9	<u>49</u>							<u>27</u>	3	<u>11</u>	17	2		<u>28</u>	2	2	<u>18</u>	10		
<i>E. paucidens</i>			2						1	21	<u>13</u>	11			12	<u>11</u>	1	9	<u>13</u>		12	<u>11</u>		3	<u>13</u>	7	
<i>E. planus</i>			2				3	<u>22</u>	<u>9</u>					1	<u>16</u>		1	<u>11</u>	5		<u>17</u>				<u>17</u>		
<i>E. vacariensis</i>			2				4	29	<u>13</u>						<u>22</u>	1	2	18	<u>3</u>		<u>23</u>				<u>23</u>		

Tab. 4. Frequency distribution of variable counts of *Eurycheilichthys* species. Premaxillary and dentary teeth, counted in both sides; holotype values are underlined.

	Teeth on premaxilla											Teeth on dentary																							
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
<i>E. pantherinus</i>			4	<u>2</u>	2	<u>2</u>	3	4	11	10	7	1						2	4	2	<u>3</u>	9	7	12	2	3	2								
<i>E. limulus</i>		1	1	4	3	5	<u>10</u>	13	<u>8</u>	1	4									1			1	<u>5</u>	9	<u>12</u>	7	12	2	2					
<i>E. apocremnus</i>							<u>3</u>	1	3	<u>8</u>	10	5	4		1	1								1	1	2	<u>7</u>	12	<u>8</u>	3	1	1			
<i>E. castaneus</i>			1	2	8	18	7	<u>8</u>	<u>4</u>	1										1	4	11	13	14	2	<u>3</u>	2								
<i>E. coryphaenus</i>		2		2	2	3	2	2	<u>2</u>	<u>4</u>	1									2	1	3	3	1	2	4	<u>1</u>	<u>1</u>	1	1					
<i>E. luisae</i>							1	2	5	<u>12</u>	<u>12</u>	13	5	5		2									9	5	<u>15</u>	<u>14</u>	10	4		1	1		
<i>E. paucidens</i>			1	1		1	2	6	13	<u>12</u>	6	<u>4</u>										2	4	<u>11</u>	5	<u>11</u>	12	1							
<i>E. planus</i>			3	<u>6</u>	6	9	4	3		2												1	4	6	<u>11</u>	<u>4</u>	2	5	1						
<i>E. vacariensis</i>	1		3	2	8	7	8	5	7	<u>2</u>	2	1											4	4	7	12	3	10	<u>5</u>		<u>1</u>				

Non-types. Brazil: Rio Grande do Sul: upper rio Taquari drainage: MCP 22150, 1, 39.7 mm SL, arroio dos gordos, on road RS-324 between Casca and Nova Araça, Paraí, (28°38'42"S 51°41'36"W), 20 Jan 1999, R. E. Reis *et al.* MCP 22225, 2, 35.3-45.6 mm SL, rio Carreiro, on road between São Domingos do Sul and Paraí, São Domingos do Sul (28°33'51"S 51°49'45"W), 20 Jan 1999, R. E. Reis *et al.* MCP 22247, 8, 20.1-42.3 mm SL, arroio Quebra Perna, on road between São Domingos do Sul and Paraí, São Domingos do Sul (28°34'01"S 51°50'36"W), 20 Jan 1999, R. E. Reis *et al.* MCP 23046, 2, 17.6-20.0 mm SL, rio Turvo, on road from Vila Flores to Antonio Prado, Antonio Prado (28°52'19"S 51°26'57"W), 21 Jan 1999, R. E. Reis *et al.* MCP 23051, 1, 22.7 mm SL, arroio Palmara, upstream from mouth into rio das Antas near Nossa Senhora das Graças, on road from Antonio Prado to Caxias do Sul, Antônio Prado (28°58'04"S 51°12'34"W), 21 Jan 1999, R. E. Reis *et al.* MCP 29953, 7, 25.0-27.5 mm SL, rio Ituim, downstream Saltinho waterfall, Antonio Prado (approx. 28°37'S 51°21'W), 27 Jun 2002, A. R. Cardoso & V. A. Bertaco. MCP 35045, 5, 38.1-41.9 mm SL, 11 tis, 23.2-40.4 mm SL, arroio Quebra Perna near Santa Gema, São Domingos do Sul (28°34'06"S 51°50'35"W), 22 May 2004, R. E. Reis *et al.* MCP 35058, 14 tis, 33.7-40.5 mm SL, arroio Fãozinho at Vila Nova, Barros Cassal (29°03'30"S 52°30'58"W), 21 May 2004, R. E. Reis *et al.* MCP 35122, 4 tis, 24.9-45.0 mm SL, arroio Jeremias, on road from Soledade to Arvorezinha, ca. 25 km East of road BR-386, Arvorezinha (28°49'44"S 52°14'35"W), 21 May 2004, R. E. Reis *et al.* MCP 36837, 5 tis, 31.3-43.4 mm SL, arroio Jabuticaba near its mouth into rio das Antas, Veranópolis (29°01'06"S 51°31'37"W) 3 Sep 2004, T. P. Carvalho *et al.* MCP 40937, 1, 40.9 mm SL, arroio Guabiju, on road between Guabiju and Vila São Jorge, Guabiju (28°30'49"S 51°41'22"W), 24 Oct 2006, T. P. Carvalho & V. A. Bertaco. UFRGS 6425, 1, 30.4 mm SL, creek near mouth of rio Carreiro, Cotiporã (28°57'32"S 51°45'10"W), 8 Oct 2003, J. Anza & F. Vilella. UFRGS 6418, 11, 31.2-44.8 mm SL, creek tributary to rio Carreiro at Linha Emilia, Dois Lageados (28°56'08"S 51°46'59"W), 7 Oct 2003, J. Anza & F. Vilella. UFRGS 6422, 2, 32.9-33.8 mm SL, rio Carreiro near mouth of arroio Sabiá at Linha São Pedro, Fagundes Varela (28°53'04"S 51°47'28"W), 5 Oct 2003, J. Anza & F. Vilella.

Diagnosis. *Eurycheilichthys luisae* is distinguished from all congeners, except *E. pantherinus*, by possessing a very large lower lip extending to or beyond the anterior margin of the pectoral girdle (*vs.* lower lip not reaching the anterior margin of the pectoral girdle). It is distinguished from *E. pantherinus* by having the abdomen partially plated with a middle stripe of platelets (*vs.* completely covered by small platelets), and by the deeper caudal peduncle (10.1-12.5 *vs.* 7.8-10.2% SL). It is also distinguished from all congeners, except *E. planus* and *E. vacariensis*, by an abdomen partially plated with a middle stripe of platelets (*vs.* abdomen fully

covered by small platelets). It is distinguished from *E. apocremnus*, *E. castaneus*, *E. limulus*, and *E. paucidens* by possessing 23-25 plates in middle lateral series (*vs.* 27-30 plates, occasionally 26). *Eurycheilichthys luisae* is further distinguished from *E. castaneus* and *E. limulus* by the color pattern of its body and a head covered with many regularly small and roundish dark spots (*vs.* body and head plain dark brown, without blotches or spots, and with a light stripe from snout tip, crossing above the eye and predorsal area); from *E. limulus* by the wider cleithrum (28.6-34.0 *vs.* 23.8-26.8% SL); from *E. coryphaenus* by the parieto-supraoccipital lacking a distinct elevation (*vs.* parieto-supraoccipital conspicuously elevated); from *E. planus* by the deeper caudal peduncle (10.1-12.5 *vs.* 8.9-10.0% SL); from *E. vacariensis* by the body and head being covered with many small, roundish, dark spots (*vs.* large, irregular, dark spots on body, head mostly dark), and by the lower lip extending past the anterior margin of the pectoral girdle (*vs.* lower lip hardly reaching that point); and from *E. paucidens* by possessing numerous (26-62) accessory teeth on premaxilla in several irregular series (*vs.* fewer, 2-10 accessory teeth on premaxilla in one irregular series), and the longer mandibular ramus (11.1-14.7 *vs.* 7.0-10.8% HL).

Description. Proportional measurements and counts in Tabs. 2, 3, and 4. Dorsal body profile gently arched from snout tip to parieto-supraoccipital, slightly arched to straight from that point to dorsal-fin origin; parieto-supraoccipital with discrete elevation, more salient in larger individuals. Trunk generally straight and tapering slightly toward caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at and behind base of dorsal and anal fins, and compressed caudally. Greatest body depth at parieto-supraoccipital bone or dorsal-fin origin. Head and snout broad and rounded anteriorly, with body progressively narrowing caudally from cleithrum. Interorbital space slightly concave; superior margin of orbits elevated. Snout slightly convex anterior to nares. Nostrils located at posterior terminus of pair of elongate, shallow depressions beginning close to snout tip. Eye comparatively small, orbit diameter 12.1-14.5% HL, dorsolaterally placed.

Pectoral fin of moderate size, spine slightly arched, posterior fin-margin straight; extending to distal third of pelvic fin when depressed. Fleishy flap along posterodorsal margin of pectoral-fin spine in both male and female adults. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithrum. Pelvic fin of females short, extending to point midway between anus and anal-fin origin when depressed. Thickened first pelvic-fin ray of males longer, usually extending to anal-fin origin. Males exhibit well-developed fleshy flap along posterodorsal margin of thickened first pelvic-fin ray. Dorsal-fin origin at vertical line through end of pelvic-fin base; spinelet present, reduced and plate-like; dorsal-fin locking mechanism non-functional. Adipose fin absent.

Body entirely covered by dermal plates except for area around anus, opening of swimbladder capsule posteroventrally to compound pterotic, most of the abdomen, and ventral surface of head around lips. Body and head without crests. Coracoid and cleithrum exposed laterally, covered medially by skin and few isolated platelets. Arrector fossa open. Lateral abdominal plates absent. Middle abdominal plates small to granular, irregularly arranged in a middle patch in front of the anal opening that can extend to anterior portion of abdomen, leaving large unplated areas laterally (Fig. 2f). Posterior tip of parieto-supraoccipital with small patch of larger odontodes than those on remainder of head and predorsal area, especially in smaller individuals. Head and body plates covered with odontodes, these larger on ventral face of first pelvic-fin ray and pectoral spine. Odontodes on head and trunk otherwise of uniform size and distribution, not arranged in conspicuous rows.

Lips roundish and wide, papillose, and extending posteriorly to a point between end of canal-bearing lateral cheek plate and anterior margin of pectoral girdle. Lower lip margin smooth to fringed. Maxillary barbel short, mostly adnate to lower lip. Teeth slender, bifid; major (medial) cusp large, bladefike, and slightly rounded; minor (lateral) cusp minute, pointed. Accessory patch of unicuspid teeth on premaxilla and dentary attached to dermal bone posterior (premaxilla) and anterior (dentary) margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth large, elongate, sharply pointed, directed posteroventrally (premaxilla) and anteroventrally (dentary).

Color in alcohol. Background color of dorsal surface of head and body light brown with many roundish dark brown dots scattered throughout head and body; dots smaller and more concentrated on head; yellowish tan, mostly unpigmented ventrally except for caudal peduncle. Hypertrophied odontodes on tip of parieto-supraoccipital bone lighter than background. First thickened ray of dorsal, pectoral, pelvic, and anal fins and external rays of caudal fin with chromatophores arranged in three or four discernible blotches. Branched rays in these fins with similar color pattern. Caudal fin mostly primarily dark brown, with three or four light irregular vertical bands.

Distribution and habitat. *Eurycheilichthys luisae* is known from several localities in both the upper and lower courses of the rivers Forqueta, Carreiro, Turvo, and the rio das Antas - all tributaries to the rio Taquari, Rio Grande do Sul, Brazil (Fig. 11). All localities are creeks or rivers with medium to fast flowing water and substrate covered with rocks and stones. Fish are commonly found among the loose stones on the substrate.

Etymology. *Eurycheilichthys luisae* is named in honor of my daughter Luisa F. Reis, who loves nature and occasionally assisted on weekend field trips for collecting specimens. A

noun in the genitive case.

Conservation status. *Eurycheilichthys luisae* is frequent and abundant in the upper rio Taquari basin. Despite the Extent of Occurrence (EOO) is approximately 7,700 km² and hydroelectric dams exist and are planned in that basin, no specific threats were detected, and the species can be categorized as Least Concern (LC) according to IUCN criteria (IUCN, 2016).

Eurycheilichthys paucidens, new species

urn:lsid:zoobank.org:act:2F206D68-6F47-4ADE-9931-4A92E0FD2CB2

Fig. 13; Tabs. 2-4

Eurycheilichthys sp. 5.-Reis, Carvalho, 2007: 84 [listed].

Holotype. MCP 40661, 61.8 mm SL, female, Brazil, Rio Grande do Sul, Muitos Capões, arroio Tavoqua, rio Taquari basin, near fazenda Cambará (28°21'51"S 51°17'53"W), 3 Apr 1999, V. A. Bertaco *et al.*

Paratypes. Brazil: Rio Grande do Sul: upper rio Taquari drainage: MCP 22800, 4, 50.9-59.7 mm SL, 2 c&s, 46.1-51.4 mm SL (2, 56.7-59.7 mm SL), MZUSP 92423, 2 (2, 47.9-56.7 mm SL), AMNH 238572, 2 (2, 42.4-55.7 mm SL), collected with the holotype. MCP 22374, 3, 35.8-48.1 mm SL (1, 48.1 mm SL), and MNRJ 18342, 3, 20.0-43.5 mm SL (2, 40.3-43.5 mm SL), rio Lageado Grande near Lageado Grande, on road RS-476 to Jaquirana, Lageado Grande (29°05'34"S 50°37'30"W), 16 Dec 1998, R. E. Reis *et al.* MCP 22202, 1 (1, 37.0 mm SL), rio da Prata at Passo do Respraiado, on road between Guabiju and André da Rocha, Guabiju (28°38'04"S 51°36'53"W), 20 Jan 1999, R. E. Reis *et al.* MCP 29958, 2, 35.5-49.7 mm SL (1, 49.7 mm SL), arroio São Gonçalo next to bridge on road RS-020, between São José dos Ausentes and Cambará do Sul, Cambará do Sul (28°52'11"S 50°01'11"W), 21 Jul 2002, G. M. Mauricio & C. M. Joenck. MCP 20688, 3 (3, 49.3-50.6 mm SL), rio Lageado Grande, downstream Certaja hydroelectric dam and upstream waterfall, São Francisco de Paula, 11 Mar 1998, W. Koch. MCP 20689, 3, 36.5-45.2 mm SL (1, 45.2 mm SL), arroio dos Moreira, downstream Certaja hydroelectric dam, São Francisco de Paula, 11 Mar 1998, W. Koch. MCN 14843, 3 (3, 42.2-47.4 mm SL), rio Tomé, tributary to rio das Antas, São Francisco de Paula, 21 Jun 1997, W. R. Koch & L. F. Guterrez. MCN 14901, 1, 36.1 mm SL, arroio dos Novilhos on Road to Capão Alto, São Francisco de Paula, 11 Jul 1997, W. R. Koch & L. F. Guterrez. MCN 14925, 1 (1, 49.4 mm SL), rio Tomé, tributary to rio das Antas, São Francisco de Paula, 11 Jul 1997, W. R. Koch & L. F. Guterrez. UFRGS 4882, 2 (2, 44.4-53.7 mm SL), rio das Antas, near São José dos Ausentes (28°49'43"S 50°00'42"W), 6 Apr 2000, L. R. Malabarba *et al.* UFRGS

4853, 1 (1, 52.6 mm SL), creek tributary to rio das Antas, São José dos Ausentes (28°49'21"S 49°59'52"W), 6 Jan 2000, A. Schwarzbald *et al.* UFRGS 7865, 5, 39.8-56.3 mm SL, rio das Antas downstream from Sítio Vale das Trutas, near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), 1 Jan 2001, D. Gelain *et al.* UFRGS 7877, 8, 32.8-48.6 mm SL, rio das Antas downstream from Sítio Vale das Trutas, near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), 16 May 2001, J.

Anza *et al.* UFRGS 7897, 12, 32.2-54.1 mm SL, rio das Antas downstream from Sítio Vale das Trutas, São José dos Ausentes (28°47'08"S 49°58'55"W), 21 Apr 2001, A. Cardoso *et al.* UFRGS 7876, 12, 40.0-58.9 mm SL, rio das Antas downstream from Sítio Vale das Trutas, near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), Jul 2001, J. Anza *et al.* MCP 35119, 1 tis, 46.6 mm SL, arroio Tavoqua, near fazenda Cambará, Muitos Capões (28°21'51"S 51°17'53"W), 23 May 2004, R. E. Reis *et al.*



Fig. 13. *Eurycheilichthys paucidens*, new species, holotype, MCP 40661, 61.8 mm SL, female, Brazil, Rio Grande do Sul, Muitos Capões, arroio Tavoqua.

Genseq-2 16S. MCP 35119; GenBank accession number KX231811.

Genseq-2 COI. Sequences deposited in GenBank by Cristian Cramer for COI (MCP 22800; GenBank accession number EU370994 and MCP 22374; GenBank accession number EU370992).

Non-types. Brazil: Rio Grande do Sul: upper rio Taquari drainage: MCP 35040, 1 tis, 47.8 mm SL, rio Turvo near Turvo, on road from André da Rocha to Barretos, Turvo

(28°24'19"S 51°29'25"W), 22 May 2004, R. E. Reis *et al.* MCP 43344, 1, 53.1 mm SL, arroio Governador, tributary to rio das Antas near Bom Jesus (28°44'23"S 50°40'42"W), 4 Oct 2008, J. F. Pezzi *et al.* UFRGS 4896, 1, 30.9 mm SL, creek tributary to rio das Antas, São José dos Ausentes (28°49'11"S 49°59'40"W), 6 Apr 2000, L. R. Malabarba *et al.* UFRGS 7898, 5, 37.2-48.7 mm SL, rio das Antas downstream from Sítio Vale das Trutas, near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), 22 Jun 2001, J. Anza *et al.* UFRGS 7885, 1, 30.2 mm SL, rio das Antas downstream

from Sítio Vale das Trutas, near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), 2 Jun 2001, J. Pezzi da Silva *et al.* UFRGS 7893, 2, 40.1-53.5 mm SL, rio das Antas downstream from Sítio Vale das Trutas, near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), 16 Jan 2001, D. Gelain *et al.* UFRGS 7894, 5, 36.5-47.4 mm SL, rio das Antas downstream from Sítio Vale das Trutas, near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), 17 Mar 2001, L. R. Malabarba *et al.* UFRGS 7875, 2, 47.5-48.4 mm SL, rio das Antas downstream from Sítio Vale das Trutas, near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), 29 Sep 2000, J. Anza *et al.* UFRGS 7869, 1, 33.4 mm SL, rio das Antas downstream from Sítio Vale das Trutas, near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), 28 Jul 2000, J. Anza *et al.* UFRGS 7939, 1, 31.1 mm SL, rio das Antas downstream from Sítio Vale das Trutas, near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), 25 Nov 2000, D. Gelain *et al.* UFRGS 7937, 3, 40.6-50.3 mm SL, rio das Antas downstream from "Pesque-Pague" near road from Cambará to São José dos Ausentes, São José dos Ausentes (28°47'08"S 49°58'55"W), 20 Dec 2000, J. Anza *et al.* UFRGS 6906, 1, 44.8 mm SL, rio Camisa at road RS-020, Cambará do Sul (29°05'00"S 50°10'48"W), 27 Nov 2004, J. Anza *et al.*

Diagnosis. *Eurycheilichthys paucidens* is distinguished from all congeners by possessing few (2-10) accessory teeth on the premaxilla in one irregular series (*vs.* numerous, 14-62 accessory teeth on the premaxilla in two to several irregular series). It is also distinguished from five other species by the relatively small orbital diameter (9.3-12.4% HL *vs.* 13.8-18.5 in *E. coryphaenus*, 13.4-18.8 in *E. pantherinus*, 12.4-14.9 in *E. planus*, 12.5-16.9 in *E. vacariensis*, and 12.1-14.5 in *E. luisae*), and by possessing 27-29 (one specimen with 26 on one side) plates in middle lateral series (*vs.* 23-26 in *E. coryphaenus*, *E. pantherinus* (one specimen with 27 in one side), *E. planus*, *E. vacariensis* and *E. luisae*). *Eurycheilichthys paucidens* is further distinguished from *E. limulus* and *E. castaneus* by exhibiting many dark, irregularly shaped blotches and spots on the body and head (*vs.* body and head plain dark brown without blotches or spots); from *E. planus* by the longer pelvic-fin spine (19.4-24.2 *vs.* 15.6-19.2% SL) and longer anal-fin spine (18.2-22.2 *vs.* 13.9-17.0% SL); and from *E. luisae* by the shorter mandibular ramus (7.0-10.8 *vs.* 11.1-14.7% HL).

Description. Proportional measurements and counts in Tabs. 2, 3, and 4. Dorsal body profile gently arched from snout tip to dorsal-fin origin. Trunk generally straight and tapering slightly toward caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at and behind base of dorsal and anal fins, and compressed caudally.

Greatest body depth located at dorsal-fin origin. Head and snout broad and flat, rounded anteriorly; body progressively narrowing caudally from cleithrum. Interorbital space flat to slightly convex; superior margin of orbits slightly elevated. Snout slightly convex anterior to nares. Nostrils located at posterior terminus of pair of elongate, shallow depressions beginning close to snout tip. Eye comparatively very small, orbit diameter 9.3-12.4% HL, dorsolaterally placed.

Pectoral fin of moderate size, spine strongly arched, posterior fin-margin straight or slightly concave; extending to middle to second third of pelvic fin when depressed. Fleshy flap along posterodorsal margin of pectoral-fin spine in both male and female adults. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithrum. Pelvic fin of females short, extending to point midway between anus and anal-fin origin when depressed. Thickened first pelvic-fin ray of males longer, slightly extending past anal-fin origin. Males with well-developed fleshy flap along posterodorsal margin of thickened first pelvic-fin ray; females exhibit smaller flap. Dorsal-fin origin slightly posterior to vertical line through end of pelvic-fin base; spinelet present, reduced and plate-like; dorsal-fin locking mechanism non-functional. Adipose fin absent.

Body entirely covered by dermal plates except for area around anus, opening of swimbladder capsule posteroventrally to compound pterotic, around pectoral- and pelvic-fin insertions, and ventral surface of head around lips. Body and head lacking crests. Coracoid and cleithrum exposed laterally, covered medially by skin and abdominal platelets. Arrector fossa open. Lateral abdominal plates absent. Middle abdominal plates small, irregularly arranged and covering most of abdominal surface between pectoral girdle and anal opening (Fig. 2g). Posterior tip of parieto-supraoccipital lacking a conspicuous patch of enlarged odontodes. Head and body plates covered with odontodes, these larger on ventral face of pelvic and pectoral spines. Odontodes on head and trunk otherwise of uniform size and distribution, not arranged in conspicuous rows.

Lips roundish and wide, papillose, with posterior margin falling short of or extending posteriorly to end of canal-bearing lateral cheek plate. Lower lip margin smooth. Maxillary barbel short, mostly adnate to lower lip. Teeth slender, bifid; major (medial) cusp large, bladellike, and slightly rounded; minor (lateral) cusp minute, pointed. Accessory patch of unicuspid teeth on premaxilla and dentary attached to dermal bone posterior (premaxilla) and anterior (dentary) margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth elongate, sharply pointed and very small, arranged in single series and directed posteroventrally (premaxilla) and anteroventrally (dentary).

Color in alcohol. Background color of dorsal surface of head and body tan to light brown with many dark brown blotches of irregular shape, larger on caudal peduncle; head

primarily dark with thin lighter lines, especially on snout and cheeks; yellowish tan, mostly unpigmented ventrally. First thickened ray of dorsal, pectoral, pelvic, and anal fins and external rays of caudal fin with chromatophores arranged in two or three discernible blotches. Branched rays in these fins with similar color pattern. Caudal fin variably spotted, with middle light vertical band and lighter distal half.

Distribution and habitat. *Eurycheilichthys paucidens* is known from various tributaries to the rio Turvo and rio das Antas, of the rio Taquari basin, Rio Grande do Sul, Brazil (Fig. 11). All localities are creeks or small rivers with medium to fast flowing water and substrate covered with rocks and stones. Fish are commonly found among the loose stones on the substrate.

Etymology. The specific epithet of *Eurycheilichthys paucidens* is from the Latin *paucus*, meaning few, little, and *dens*, meaning tooth, in allusion to the small number of accessory teeth in both premaxilla and dentary. An adjective in the nominative.

Conservation status. *Eurycheilichthys paucidens* is frequent and moderately abundant in the upper rio Taquari basin. Despite the Extent of Occurrence (EOO) is approximately 7,500 km² and hydroelectric dams exist and are planned in that basin, no specific threats were detected, and the species can be categorized as Least Concern (LC) according to IUCN criteria (IUCN, 2016).

Eurycheilichthys planus, new species

urn:lsid:zoobank.org:act:14864AFA-7C7A-4493-A30F-5257522B73A0

Fig. 14; Tabs. 2-4

Eurycheilichthys sp. 3.-Reis, Carvalho, 2007: 84 [listed].

Holotype. MCP 40663, 49.3 mm SL, male, Brazil, Rio Grande do Sul, Guabiju, rio da Prata at Passo do Respraiado, rio Taquari basin, on road from Guabiju to André da Rocha (28°38'04"S 51°36'53"W), 20 Jan 1999, R. E. Reis *et al.*



Fig. 14. *Eurycheilichthys planus*, new species, holotype, MCP 40663, 49.3 mm SL, male, Brazil, Rio Grande do Sul, Guabiju, rio da Prata at Passo do Respraiado.

Paratypes. Brazil: Rio Grande do Sul: upper Rio Taquari drainage: MCP 22199, 176, 14.3-50.2 (3, 44.3-45.2 mm SL), MZUSP 92425, 10, 22.6-50.3 mm SL, AMNH 238574, 10, 26.3-47.4 mm SL, UFRGS 8483, 10, 26.6-45.4 mm SL, collected with the holotype. MCP 22122, 22, 34.8-55.1 mm SL (4, 43.1-55.1 mm SL), arroio Herval, between Nova Prata and Guabiju, Guabiju (28°39'35"S 51°37'05"W), 20 Jan 1999, R. E. Reis *et al.* MCP 40941, 12, 30.4-49.1 mm SL, arroio Herval, between Nova Prata and Guabiju, Guabiju (28°39'33"S 51°37'03"W), 24 Oct 2006, T. P. Carvalho & V. A. Bertaco. MCP 35041, 7, 35.8-56.6 mm SL (3, 43.8-56.6 mm SL), 9 tis, 43.2-57.0 mm SL, arroio Herval, between Nova Prata and Guabiju, Guabiju (28°39'35"S 51°37'05"W), 22 May 2004, R. E. Reis *et al.* MCP 35062, 25, 22.6-46.2 mm SL (3, 41.7-46.2 mm SL), rio da Prata at Passo do Respraiado, on road from Guabiju to André da Rocha, Guabiju (28°38'04"S 51°36'53"W), 22 May 2004, R. E. Reis *et al.* MCP 22261, 41, 31.7-50.4 mm SL, 2 c&s, 42.2-46.9 mm SL (3, 41.4-50.4 mm SL), arroio Água Branca at Água Branca, ca. 20 km N of Nova Prata, Guabiju (28°36'27"S 51°37'15"W), 20 Jan 1999, R. E. Reis *et al.* MCP 40930, 25, 29.9-45.4 mm SL, rio da Prata at Passo do Respraiado, on road from Guabiju to André da Rocha, Guabiju (28°38'01"S 51°36'51"W), 24 Oct 2006, T. P. carvalho & V. A. Bertaco.

Genseq-2 16S. MCP 35041; GenBank accession number KX355635.

Genseq-2 COI. Sequences deposited in GenBank by Cristian Cramer for COI (MCP 22199; GenBank accession number EU370991).

Non-types. Brazil: Rio Grande do Sul: upper Rio Taquari drainage: MCP 35062, 33 tis, 23.0-43.2 mm SL, rio da Prata at Passo do Respraiado, on road from Guabiju to André da Rocha, Guabiju (28°38'04"S 51°36'53"W), 22 May 2004, R. E. Reis *et al.*

Diagnosis. *Eurycheilichthys planus* is distinguished from all congeners by its naked abdomen (*vs.* abdomen fully covered by small platelets in *E. luisae* and *E. vacariensis*), and by having the posterior portion of the head and the predorsal region distinctly flat (*vs.* head and predorsal region elevated posterior to orbits). It is further distinguished from *E. luisae* by the lower caudal peduncle length (8.9-10.0 *vs.* 10.1-12.5% SL), and by the shorter lower lip not extending to the anterior margin of the pectoral girdle (*vs.* large lower lip, extending past the anterior margin of the pectoral girdle). *Eurycheilichthys planus* is further distinguished from *E. castaneus* by possessing 24-26 plates in middle lateral series (*vs.* 27-29 plates), and a shorter anal-fin spine (13.9-17.0 *vs.* 17.6-22.1% SL); from *E. limulus* by possessing 24-26 plates in the middle lateral series (*vs.* 27-28 plates) and by having the body and head with dark blotches and spots (*vs.*

body and head plain dark brown, without blotches or spot, and with thin light stripes from snout tip, crossing above the eye and predorsal area); from *E. apocremnus* by possessing 24-26 plates in middle lateral series (*vs.* 26-30 plates, occasionally 26), by possessing a shorter pelvic-fin spine (15.6-19.2 *vs.* 20.4-23.3% SL), shorter anal-fin spine (13.9-17.0 *vs.* 18.3-22.1% SL), and narrower caudal peduncle (8.9-10.0 *vs.* 10.2-12.3% SL); from *E. coryphaenus* by the parieto-supraoccipital lacking conspicuous elevation (*vs.* parieto-supraoccipital conspicuously elevated), shorter dorsal-fin spine length (16.5-21.6 *vs.* 21.8-24.0% SL), and flatter head (depth 41.6-46.9 *vs.* 47.8-54.0% SL); and from *E. paucidens* by possessing a shorter first pelvic-fin ray (15.6-19.2 *vs.* 19.4-24.2% SL), shorter first anal-fin ray (13.9-17.0 *vs.* 18.2-22.2% SL), larger orbital diameter (12.4-14.0 *vs.* 9.3-12.4% HL), 24-26 plates in middle lateral series (*vs.* 26-30 plates, rarely 26), and more numerous (26-37) accessory teeth on the premaxilla in several irregular series (*vs.* fewer, 2-10 accessory teeth on premaxilla in one irregular series).

Description. Proportional measurements and counts in Tabs. 2, 3, and 4. Dorsal body profile straight to slightly arched from snout tip to orbits; straight to slightly arched from that point to dorsal-fin origin; parieto-supraoccipital bone and predorsal area wide and flat, especially in larger individuals. Trunk generally straight and tapering slightly toward caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at and behind base of dorsal and anal fins, and compressed caudally. Greatest body depth at dorsal-fin origin. Head and snout rounded anteriorly, with body progressively narrowing caudally from cleithrum. Interorbital space flat; superior margin of orbits not elevated. Snout convex anterior to nares. Nostrils at posterior terminus of pair of elongate, shallow depressions beginning close to snout tip. Eye comparatively small, orbit diameter 12.4-14.9% HL, dorsolaterally placed.

Pectoral fin of moderate size, spine moderately arched, posterior fin-margin rounded; extending to middle of pelvic fin when depressed. Fleshy flap along posterodorsal margin of pectoral-fin spine low in both male and female adults. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithrum. Pelvic fin of females slightly shortened compared to that of males, extending to point midway between anus and anal-fin origin when depressed. Males with well-developed fleshy flap along posterodorsal margin of pectoral-fin spine and thickened first pelvic-fin ray. Dorsal-fin origin slightly posterior to vertical line through end of pelvic-fin base; spinelet present, reduced and plate-like; dorsal-fin locking mechanism non-functional. Adipose fin absent.

Body entirely covered by dermal plates except for abdominal surface from head to anus, opening of swimbladder capsule posteroventrally to compound pterotic, and surrounding pectoral- and pelvic-fin insertions, and ventral surface of head around lips. Body and head

lacking crests. Coracoid and cleithrum exposed laterally, covered medially by thick skin. Arrector fossa open. Lateral abdominal plates absent. Middle abdominal plates absent; occasionally few small, granular platelets embedded in skin posteriorly, near pelvic-fin insertions (Fig. 2h). Posterior tip of parieto-supraoccipital with small patch of enlarged and raised odontodes compared to remainder of head and predorsal area in smaller individuals; absent in large adults. Head and body plates covered with odontodes, being larger on ventral face of pelvic and pectoral spines. Odontodes on head and trunk otherwise of uniform size and distribution, not arranged in conspicuous rows.

Lips roundish, papillose, extending posteriorly to end of canal-bearing lateral cheek plate or extending slightly past that point. Lower lip margin smooth to slightly fringed. Maxillary barbel short, mostly adnate to lower lip. Teeth slender, bifid; major (medial) cusp large, bladefike, and slightly rounded; minor (lateral) cusp minute, pointed. Accessory patch of unicuspid teeth on premaxilla and dentary attached to dermal bone posterior (premaxilla) and anterior (dentary) margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth elongate, sharply pointed, directed posteroventrally (premaxilla) and anteroventrally (dentary).

Color in alcohol. Background color of dorsal surface of head and body grayish brown; yellowish tan, mostly unpigmented ventrally. Dorsal surface with many dark, grayish brown, roundish dots scattered throughout head and predorsal area; dots coalesce to form larger blotches on trunk and caudal peduncle. Lateral-line pores relatively unpigmented, forming very thin longitudinal stripe along middle of dark sides of body. First thickened ray of dorsal, pectoral, pelvic, and anal fins and external rays of caudal fin with chromatophores arranged in three to five discernible blotches. Branched rays in these fins with similar color pattern forming bands. Caudal fin hyaline to yellowish tan, with three or four dark irregular vertical bands.

Distribution and habitat. *Eurycheilichthys planus* is known from few localities in the rio da Prata, a tributary to the rio Turvo - itself a tributary to the rio das Antas, rio Taquari basin, Rio Grande do Sul, Brazil (Fig. 7). The localities are creeks or small rivers with medium flowing water and a substrate formed by flat rock beds or covered with stones. Large amounts of aquatic macrophytes are present in some areas, though fish are commonly found among the loose stones of the substrate.

Etymology. The specific epithet of *Eurycheilichthys planus* is from the Latin *planus*, meaning flat, level, smooth, in allusion to the distinctly flat head and predorsal area. An adjective.

Conservation status. *Eurycheilichthys planus* is known from two tributary creeks and the upper rio da Prata itself,

with Extent of Occurrence (EOO) of approximately 1.8 km². The intense agriculture in the area causes continuing decline in habitat quality but the population is neither severely fragmented nor presenting extreme fluctuations, and the species can be categorized as Near Threatened (NT) according to IUCN criteria B1b(iii) (IUCN, 2016).

Eurycheilichthys vacariensis, new species

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Fig. 15; Tabs. 2-4

Eurycheilichthys sp. 6.-Reis, Carvalho, 2007: 84 [listed].

Holotype. MCP 40659, 47.6 mm SL, male, Brazil, Rio Grande do Sul, Muitos Capões, arroio Espeto, also known as rio Soares, rio Taquari basin, on road from Muitos Capões to Vacaria (28°23'26"S 51°03'22"W), 3 Apr 1999, V. A. Bertaco *et al.*

Paratypes. Brazil: Rio Grande do Sul: upper rio Taquari drainage: MCP 22782, 16, 26.1-47.5 mm SL, 2 c&s, 42.1-45.0 mm SL (10, 36.2-44.8 mm SL), MZUSP 92421, 3 (3, 35.4-40.0 mm SL), and AMNH 238570, 3 (3, 37.6-46.1 mm SL), collected with the holotype. MCP 22790, 6, 23.4-46.4 mm SL (1, 46.4 mm SL), arroio Carazinho, on road between Lagoa Vermelha and Vacaria, Lagoa Vermelha (28°17'36"S 51°24'42"W), 3 Apr 1999, V. A. Bertaco *et al.* MCP 22801, 8, 30.8-40.6 mm SL (5, 32.9-40.6 mm SL), arroio Tavoqua, near Fazenda Cambará, Muitos Capões (28°21'51"S 51°17'53"W), 3 Apr 1999, V. A. Bertaco *et al.* MCP 35037, 7, 41.9-48.7 mm SL, 13 tis, 28.9-46.9 mm SL, arroio Atanásio, on road from Nova Bassano to Nova Prata, Nova Bassano (28°44'25"S 51°41'15"W), 22 May 2004, R. E. Reis *et al.*

Genseq-2 16S. MCP 35037; GenBank accession number KX355636.

Genseq-2 COI. Sequences deposited in GenBank by Cristian Cramer for COI (MCP 22790; GenBank accession number EU370993).

Non-types. Brazil: Rio Grande do Sul: upper rio Taquari drainage: MCP 35125, 10, 35.0-46.1 mm SL, 15 tis, 23.0-43.4 mm SL, rio Turvo near Turvo, on road from André da Rocha to Barretos, Turvo (28°24'19"S 51°29'25"W), 22 May 2004, R. E. Reis *et al.* MCP 35123, 10 tis, 22.4-44.7 mm SL, arroio Espeto or rio Soares, on road from Muitos Capões to Vacaria, Muitos Capões (28°23'26"S 51°03'22"W), 23 May 2004, R. E. Reis *et al.* MCP 22257, 11, 44.5-52.6 mm SL, arroio Atanásio, on road from Nova Bassano to Nova Prata, Nova Bassano (28°44'25"S 51°41'15"W), 20 Jan 1999, R. E. Reis *et al.*



Fig. 15. *Eurycheilichthys vacariensis*, new species, holotype, MCP 40659, 47.6 mm SL, male, Brazil, Rio Grande do Sul, Muitos Capões, arroio Espeto or rio Soares.

Diagnosis. *Eurycheilichthys vacariensis* is distinguished from *E. limulus*, *E. castaneus*, *E. paucidens*, and *E. apocremnus* by possessing 24-26 plates in middle lateral series (vs. 27-30 plates – occasionally 26 in *E. paucidens*, and *E. apocremnus*). It is further distinguished from *E. limulus* and *E. castaneus* by possessing a body and head with dark blotches and spots (vs. body and head plain dark brown, without blotches or spot, and with thin light stripes from snout tip, crossing above the eye and predorsal area); from *E. paucidens* by a shorter pelvic-fin spine (14.6-20.1 vs. 19.4-24.2% SL), larger orbital diameter (12.5-16.9 vs. 9.3-12.4% HL), and numerous (35-45) accessory teeth on premaxilla in several irregular series (vs. fewer, 2-10 accessory teeth on premaxilla, in one irregular series); and from *E. apocremnus* by a shorter pelvic-fin spine (14.6-20.1 vs. 20.4-23.3% SL). *Eurycheilichthys vacariensis* is distinguished from *E. coryphaenus* by having the parieto-supraoccipital without a conspicuous elevation (vs. parieto-supraoccipital conspicuously elevated - Fig. 3); from *E. pantherinus* and *E. planus* by having the abdomen incompletely covered with granular platelets (vs. abdomen naked in *E. planus* and fully plated in *E. pantherinus*); and from *E. luisae* by the large, irregular, dark spots on body, with head mostly dark (vs. body and head covered with many small, roundish, dark spots), and by the lower lip hardly reaching the anterior margin of the pectoral girdle (vs. lower lip extending past the pectoral girdle).

Description. Proportional measurements and counts in Tabs. 2, 3, and 4. Dorsal body profile gently arched from snout tip to parieto-supraoccipital bone, straight to slightly arched from that point to dorsal-fin origin. Trunk generally straight and tapering slightly to caudal-fin base. Trunk and caudal peduncle rounded in cross section, slightly flattened at and behind base of dorsal and anal fins and compressed caudally. Greatest body depth at dorsal-fin origin. Head and snout broad and rounded anteriorly, with body progressively narrowing from cleithrum to caudal peduncle. Interorbital space flat to slightly convex; superior margin of orbits slightly elevated. Snout slightly convex anterior to nares. Nostrils located at posterior terminus of pair of elongate, shallow depressions beginning close to snout tip. Eye comparatively small to medium, orbit diameter 12.5-16.9% HL, dorsolaterally placed.

Pectoral fin of moderate size, spine moderately arched, posterior fin-margin rounded; reaching from half to two-thirds length of pelvic fin when depressed. Fleshy flap along posterodorsal margin of pectoral-fin spine low in both male and female adults. Pectoral-fin axillary slit present, with large opening ventral to tip of posterior process of cleithrum. Pelvic fin of females short, reaching to point midway between anus and anal-fin origin when depressed. Thickened first pelvic-fin ray of males slightly longer, falling short of anal-fin origin. Males with well-developed

fleshy flap along posterodorsal margin of thickened first pelvic-fin ray. Dorsal-fin origin slightly posterior to vertical line through posterior of pelvic-fin base; spinelet present, reduced and plate-like; dorsal-fin locking mechanism non-functional. Adipose fin absent.

Body entirely covered by dermal plates except for area around anus, opening of swimbladder capsule posteroventrally to compound pterotic, around pectoral- and pelvic-fin insertions, and ventral surface of head around lips. Body and head lacking crests. Coracoid and cleithrum exposed laterally, covered medially by skin or few isolated platelets. Arrector fossa open. Lateral abdominal plates absent. Middle abdominal plates few and granular, typically arranged longitudinally on middle of abdomen, though sometimes covering most of abdominal surface between pectoral girdle and anal opening (Fig. 2i). Posterior tip of parieto-supraoccipital with small patch of enlarged odontodes compared to those on remainder of head and predorsal area - especially in smaller individuals. Head and body plates covered with odontodes, these larger on ventral face of pelvic and pectoral spines. Odontodes on head and trunk otherwise of uniform size and distribution, not arranged in conspicuous rows.

Lips roundish and wide, papillose, and extending posteriorly to end of canal-bearing lateral cheek plate or between that point and anterior margin of pectoral girdle. Lower lip margin smooth to slightly fringed. Maxillary barbel short, mostly adnate to lower lip. Teeth slender, bifid; major (medial) cusp large, bladelike, and slightly rounded; minor (lateral) cusp minute, pointed. Accessory patch of unicuspid teeth on premaxilla and dentary attached to dermal bone posterior (premaxilla) and anterior (dentary) margin of tooth cup, which encloses main series of emergent and pre-emergent bifid teeth. Accessory teeth elongate, sharply pointed, directed posteroventrally (premaxilla) and anteroventrally (dentary).

Color in alcohol. Background color of dorsal surface of head and body grayish brown; yellowish tan, mostly unpigmented ventrally. Dorsal surface with many dark grayish brown, roundish dots scattered all over head and occasionally predorsal area; dots coalesce into larger blotches on trunk and caudal peduncle. Dorsum with four inconspicuous dark saddles: first on dorsal-fin origin, second posterior to dorsal-fin base, and two on caudal peduncle. First thickened ray of dorsal, pectoral, pelvic, and anal fins and external rays of caudal fin with chromatophores arranged in three to five discernible blotches. Branched rays in these fins with similar color pattern, forming bands. Caudal fin hyaline to yellowish tan, with three or four dark irregular vertical bands.

Distribution and habitat. *Eurycheilichthys vacariensis* is known from localities in the upper reaches of rio Turvo, a tributary to the rio das Antas, rio Taquari basin, Rio Grande do Sul, Brazil (Fig. 7) - an area located at the extreme northern headwaters of the rio Taquari basin. One

population from the rio Atanásio in the rio Guaporé basin differs slightly in color pattern from those in the rio Turvo basin and this population is excluded from the type series. The localities are small creeks with medium flowing water and substrate covered with rocks and stones.

Etymology. *Eurycheilichthys vacariensis* is named after the town of Vacaria, a historical place in the highlands of Rio Grande do Sul that exemplifies the traditional Gaucho culture of the region in which this species occurs.

Conservation status. *Eurycheilichthys vacariensis* is relatively frequent and moderately abundant in the upper rio Turvo basin. Despite the small Extent of Occurrence (EOO) of approximately 2,700 km², no specific threats were detected, and the species can be categorized as Least Concern (LC) according to IUCN criteria (IUCN, 2016).

Discussion

Eurycheilichthys presents high species diversity in a limited geographic area, with nine species inhabiting the headwaters of two river basins in the southern portion of the *Araucaria* forest plateau of southern Brazil, in an area of approximately 80,000 km². *Eurycheilichthys pantherinus* is the most widespread species, occupying more than half of that area in the upper rio Uruguay basin (Fig. 5), while *E. limulus* is endemic to and the only species found in the upper rio Jacuí basin (Fig. 7). The seven new species described herein, however, occur in the upper rio Taquari basin, itself a tributary to the lower rio Jacuí, but whose headwaters are in close proximity to those of the Jacuí and Uruguay rivers (Figs. 7 and 11) - in an area that barely comprises 20,000 km².

The species of *Eurycheilichthys* are restricted to river sectors that run on the ancient crystalline rock of the Serra Geral formation at an altitudinal range from approximately 400 to 1,400 meters above sea level, and never reach the lower portion of the rivers. Within the rio Taquari basin, only *E. paucidens* and *E. luisae* are somewhat widespread and sympatric to other species, while each of the remaining five species is endemic to a single stream or microbasin. Rivers in the upper rio Taquari basin are particularly high energy streams, with high average declivity and deeply excavated valleys. The shallow, fast-flowing habitats used by *Eurycheilichthys* are isolated from each other by deeper and wider sectors of the middle or lower course of the rivers, which act as barriers to their dispersal. Considering this distribution pattern, isolation and subsequent diversification must have occurred predominantly by headwater stream captures between the upper tributaries of the Uruguay, Jacuí and Taquari rivers and among streams tributary of the rio Taquari themselves.

The aforementioned pattern of species distribution, however, is apparently contrary to the pattern observed in other recently studied fish groups. While only *E. pantherinus*

occurs along most of the upper rio Uruguay, five species of *Hisonotus* (Loricariidae; Carvalho, Reis, 2009), seven species of *Rineloricaria* (Loricariidae; Ghazzi, 2008), 11 species of *Crenicichla* (Cichlidae; Lucena, Kullander, 1992), and four species of *Australoheros* (Cichlidae; Řičan, Kullander, 2006; 2008) are found in the same area. On the other hand, while seven species of *Eurycheilichthys* occur in the rio Taquari basin, only *Hisonotus carreiro* and *H. prata* are endemic to that region. Two widespread species: *H. vireo* and *H. armatus* also occur there as part of their wider distributions (Carvalho, Reis, 2011). Moreover, five species of *Rineloricaria* occur in the area occupied by *Eurycheilichthys* as part of their broader distributions (Rodríguez, Reis, 2008), while *Crenicichla lucenai* is endemic to a tributary of rio Taquari and two other species occur there as part of their broader distribution (Mattos *et al.*, 2014). Only *Australoheros taura* is present in the rio Taquari basin (Ottoni, Cheffe, 2009).

The upper rio Uruguay basin has been severely altered by a series of large hydroelectric dams for many years, which has significantly impacted most large-sized, migratory species. This seems not to be the case of *Eurycheilichthys pantherinus*, which is restricted to creeks and headwater streams that are usually unaffected by the reservoirs. The same situation appears to occur with *E. limulus* in the upper rio Jacuí basin, where at least three large hydroelectric dams are in place in the rio Jacuí itself, while the fish population apparently remains healthy and survives in the headwater streams. In the rio Taquari basin, however, several small-scale dams are being planned or constructed in the tributary rivers, which have the potential to be very harmful to *Eurycheilichthys* populations, especially those species with very small distributions. If proper care is not taken, the construction of hydroelectric dams could easily bring some of these species to extinction.

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