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A NEW SPECIES OF *RHAMDELLA* EIGENMANN & EIGENMANN, 1888 (SILURIFORMES: HEPTAPTERIDAE) FROM THE COASTAL BASINS OF SOUTHERN BRAZIL

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ABSTRACT

Rhamdella zelimai, new species, is described from the coastal river drainages in northeastern Rio Grande do Sul and southern Santa Catarina States, Brazil. The new species is readily distinguished from its congeners by the hypertrophy of the rictal fold, mainly its lower portion, consisting of a large and fleshy lobe that bends ventrally on itself. The phylogenetic relationships of the new species are assessed and it was recovered as belonging to the clade composed of *R. eriarcha* (from the laguna dos Patos basin), *R. longiuscula* (from the rio Uruguai), and *R. cainguae* (from the lower rio Paraná).

KEY-WORDS: Catfishes; Endemism; Neotropical; Rio Grande do Sul; Santa Catarina; Taxonomy; Systematics.

INTRODUCTION

Rhamdella Eigenmann & Eigenmann (1888) was for a long time a genus of difficult taxonomy, mainly because of its poor original diagnosis and overlap of distinguishing characters with the encompassing genera *Rhamdia* and *Pimelodella*. In a recent phylogenetic assessment of *Rhamdella*, however, Bockmann & Miquelarena (2008) phylogenetically diagnosed the genus to include five species, one of which described in that study, and advanced hypotheses of phylogenetic relationships for its species and for the generic placement among heptapterids.

According to Bockmann & Miquelarena (2008), *Rhamdella* is currently diagnosed by the possession of a very large opening in the frontal for the exit of the epiphyseal branch (s6) of the supraorbital laterosensory canal; an elongate optic foramen, distinctly larger than the foramen for the trigeminofacial nerve; and a dark stripe along the lateral surface of the body. Species of *Rhamdella* are divided in two clades, one being composed of *R. aymarae* Miquelarena & Menni, 1999 from the endorheic rio Ituyro in Salta, Argentina, and *R. rusbyi* Pearson, 1924 from the rio Colorado, rio Beni basin in Bolivia. The second clade is composed of the type-species, *R. eriarcha* (Eigenmann & Eigenmann, 1888) from laguna dos Patos system in Rio

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Grande do Sul, Brazil and northern Uruguay, and the sister species *R. longiuscula* Lucena & Silva, 1991 from the rio Uruguai in Rio Grande do Sul and *R. cainguae* Bockmann & Miquelarena, 2008 from creeks tributaries to the rio Parana in Misiones, Argentina.

Collecting efforts in the coastal river basins of southern Brazil, both in Rio Grande do Sul and Santa Catarina states, revealed the presence of an undescribed form of thick-lipped *Rhamdella* in the fast running tributaries of the rio Tramandaí basin (*sensu* Malabarba & Isaia, 1992) and rio Mampituba. This species is herein described and its phylogenetic position is hypothesized based on morphological data.

MATERIAL AND METHODS

Measurements and counts follow Lundberg & McDade (1986), with modifications of Bockmann & Miquelarena (2008) and with the addition of lower-lip rictal fold, which was measured ventrally. Measurements were taken as point-to-point linear distances with digital calipers under a magnifying lens on the left side of specimens whenever possible, and recorded to the nearest 0.1 mm. Morphometric data are expressed as percents of standard length (SL), except for subunits of the head, which are expressed as percents of head length (HL). Vertebral counts include all vertebrae including the five centra modified into the Weberian apparatus, and the compound caudal centrum (PU1 + U1) counted as one element. Vertebral elements, branchial rakers, unbranched anal-fin rays, and procurrent caudal-fin rays were counted in cleared and stained specimens only. Holotype values for counts are marked with an asterisk in the description. Data on *R. rusbyi* and *R. cainguae* are from Pearson (1924) and Bockmann & Miquelarena (2008); data on *R. aymarae* are from Miquelarena & Menni (1999). Osteological examinations were performed in specimens cleared and double stained for bones and cartilages (c&cs) prepared according to the technique of Taylor & Van Dyke (1985). Nomenclature for the cephalic laterosensory pores follows Bockmann & Miquelarena (2008).

The morphological data matrix of Bockmann & Miquelarena (2008) was used to access the phylogenetic relationships of the new species. Additivity of the two multistate characters followed those authors. Software Nona and Winclada were used to perform 1,000 replications of tree building with RAS (Random Addition Sequence) and branch swapping with TBR (Tree Bisection Reconnection), plus an additional round of TBR at the end.

The specimens examined are deposited in the following institutions: Laboratório de Ictiologia de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto (LIRP), Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre (MCP); Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP); and Departamento de Zoologia, Universidade Federal do Rio Grande do Sul, Porto Alegre (UFRGS).

We designated a paragenotype *sensu* Chakrabarty (2010). Total genomic DNA was isolated with cetyltrimethyl ammonium bromide (CTAB) and the mitochondrial gene Cytochrome c Oxydase subunit I (COI) was amplified by PCR using the universal primers COI-H2198 and COI-L1490. PCR product was sequenced at Macrogen Inc. and sequences were subsequently edited and uploaded to GenBank.

Rhamdella zelimai, new species

Figs. 1 and 2, Table 1

Rhamdella sp. – Malabarba *et al.*, 2013: 72 (brief description, photo of paratype UFRGS 4537).

Holotype: MCP 47745, 108.5 mm SL, Brazil, Santa Catarina, Praia Grande, rio Faxinalzinho, tributary to rio Mampituba, at Mãe dos Homens (29°14'16"S, 50°02'47"W), 9 June 1985, C. Lucena, L. Malabarba & R. Reis.

Paratypes: Brazil, Santa Catarina: MCP 10631, 3, 77.8-106.1 mm SL (3 measured, males), same data as holotype. Rio Grande do Sul: MCP 10799, 1, 86.9 mm SL (1 measured), Três Forquilhas, rio Três Forquilhas near Porto Alágio (approx. 29°32'30"S, 50°02'45"W), 25 May 1986, C. Lucena, L. Malabarba & R. Reis. MCP 14805, 1, 30.9 mm SL, Terra de Areia, rio Três Pinheiros, 8 km from highway BR 101 towards Itati (29°31'36"S, 50°06'19"W), 15 January 1991, N. Menezes, E. Pereira & R. Reis. MCP 10771, 4, 67.0-114.8 mm SL (2 measured, 105.9-114.8 mm SL), Maquiné, arroio Água Parada near Maquiné (approx. 29°40'30"S, 50°11'57"W), 25 May 1986, C. Lucena, L. Malabarba & R. Reis. MCP 25408, 2, 84.4-108.3 mm SL (2 measured), Maquiné, rio Maquiné near Maquiné (29°39'07"S, 50°12'33"W), 30 November 1995, F. Becker. MCP 28112, 6 + 2 c&cs, 97.7-124.4 mm SL (2 measured, 108.2-116.0 mm SL), Maquiné, arroio Forqueta, tributary to rio Maquiné (approx. 29°32'S, 50°14'W), 13 March 2001, F. Vilella, A. Thomas & J. Anza. UFRGS 4537, 3, 81.7-136.0 mm SL (2 measured,

81.7-136.0 mm SL), Maquiné, arroio do Ouro and rio Maquiné, between the towns of Maquiné and Barra do Ouro (29°35'02"S, 50°16'50"W), 19 November 1990, L. Malabarba & A. Kindel. MCP 27315, 1, 101.7 mm SL and LIRP 10243, 2, 92.0-97.4 mm SL, arroio Lageado Cerrito, tributary to rio Maquiné (29°34'16"S, 50°16'51"W), 23 March 2001, F. Becker & F. Vilella. UFRGS 16901, 9 + 2 c&s, 72.7-96.2 mm SL, rio Maquiné near Maquiné

(29°39'10"S, 50°12'32"W), May 2009, L. Caetano and others. UFRGS 17568, 1, 103.2 mm SL, arroio Pinheiro, Barra do Ouro, Maquiné (29°37'21"S, 50°15'18"W), 7 November 2012, R. Dala-Corte. UFRGS 18255, 4, 65.5-106.8 mm SL, creek tributary of rio Maquiné, Maquiné (29°39'40.4"S, 50°12'43.0"W), 7 November 2013, L.R. Malabarba, R. Angrizani, K.O. Bonato, J. Giora, C. Hartmann, U. Santos & P.C. Silva. UFRGS 18256,



FIGURE 1: *Rhamdella zelimai*, MCP 47745, holotype, 108.5 mm SL, female, Brazil, Santa Catarina, Praia Grande, rio Faxinalzinho, tributary to rio Mampituba, at Mãe dos Homens.

14, 47.0-99.5 mm SL, rio Maquiné, Maquiné (29°39'09.2"S, 50°12'33.5"W), 7 November 2013, L.R. Malabarba, R. Angrizani, K.O. Bonato, J. Giora, C. Hartmann, U. Santos & P.C. Silva.

Paragenotype COI: GenBank Accession Number KF273107 from tissue voucher UFRGS 17568.

Diagnosis: *Rhamdella zelimai* differs from all its congeners by the hypertrophy of the rictal fold, mainly its lower portion consisting of a large and fleshy lobe whose posterior limit reaches the level of the transverse line through the preoperculomandibular sensory pore 5 and almost reaches the transverse plane through the base of the mental barbels (Fig. 3) (*vs.* lower portion of the rictal fold not hypertrophied). It is further distinguished from *R. aymarae* and *R. rusbyi* by having a shorter maxillary barbel in adults (barbel tip reaching from just anterior to just posterior the base of the pectoral-fin ray *vs.* tip falling short or reaching to vertical through dorsal-fin origin in *R. aymarae* or reaching to or passing the vertical through the

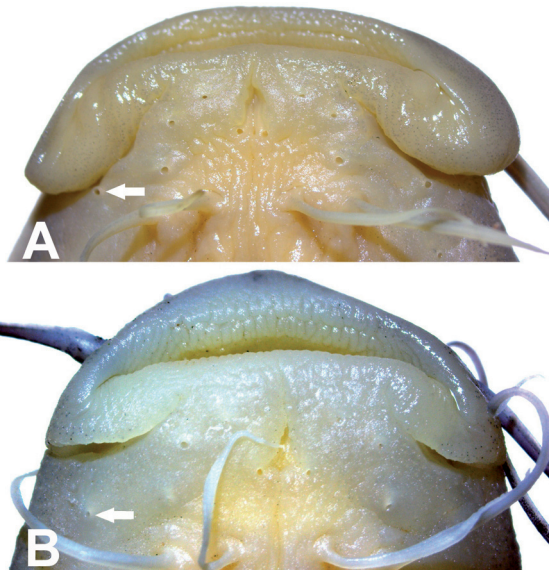


FIGURE 3: Ventral view of anterior portion of head of *Rhamdella*. (A) *Rhamdella zelimai*, holotype, MCP 47745, 108.5 mm SL. (B) *Rhamdella eriarcha*, MCP 19509, 110.4 mm SL. Arrow indicates preoperculomandibular sensory pore 5.



FIGURE 2: *Rhamdella zelimai*, live specimens. (A) UFRGS 18256, paratype, 99.5 mm SL, Brazil, Rio Grande do Sul, rio Maquiné, at Maquiné. (B) UFRGS 18255, paratype, 84.8 mm SL, Brazil, Rio Grande do Sul, creek tributary of rio Maquiné, at Maquiné.

TABLE 1: Morphometric data of holotype (H) and 12 paratypes of *Rhamdella zelimai*. SD = Standard deviation.

	Paratypes				
	H	Low	High	Mean	SD
Standard length (mm)	108.5	77.8	136.0	98.6	—
Percent of Standard Length					
Body depth	18.0	16.3	18.8	18.1	0.67
Body width	18.9	18.7	20.0	19.4	0.41
Head length	27.2	25.7	30.1	27.4	1.15
Head width	19.4	19.3	21.0	20.2	0.55
Prepectoral length	25.1	24.0	27.5	25.6	1.00
Predorsal length	36.8	36.2	40.8	38.0	1.53
Prepelvic length	48.7	46.8	50.5	49.0	1.13
Prealanal length	62.1	61.2	66.5	63.3	1.46
Preadipose length	58.7	58.0	62.2	60.0	1.32
Length of pectoral spine	12.6	11.6	14.3	12.8	0.76
Length of dorsal spine	8.7	8.7	12.6	10.1	1.06
Length of pelvic fin	15.8	15.3	16.9	16.1	0.63
Dorsal-fin base	12.4	11.2	13.5	12.4	0.68
Anal-fin base	17.9	14.9	18.5	17.0	1.11
Adipose-fin base	36.0	32.2	36.0	33.7	1.09
Caudal-peduncle length	22.4	19.5	23.2	21.4	1.12
Caudal-peduncle height	9.4	9.0	9.8	9.3	0.30
Adipose height	4.9	4.6	6.9	5.6	0.69
Distance dorsal-adipose	10.6	10.0	12.6	11.1	0.71
Urogen. Papilla-anal-fin origin	3.5	2.7	4.7	3.6	0.61
Percent of Head Length					
Bony-interorbital width	19.5	14.7	19.5	17.5	1.43
Eye diameter	21.9	18.8	24.4	21.7	1.65
Head height	54.6	49.5	57.9	53.1	2.38
Mouth width	45.3	34.3	46.6	39.0	3.87
Snout length	40.3	35.8	42.1	39.4	1.81
Internarial length	15.3	14.2	16.6	15.3	0.73
Internarial width	15.2	14.0	17.3	15.0	0.85
Lower-lip rictal fold	17.4	15.0	22.0	19.7	2.07

posterior end of the dorsal-fin base in *R. rusbyi*); by having more numerous branchiostegal rays (seven *vs.* six); and shorter interorbital width (14.7-19.5% HL *vs.* 31.0-44.9% in *R. aymarae* and 26.5-27.1% in *R. rusbyi*). It is further distinguished from *R. aymarae* by its larger horizontal eye diameter (18.8-24.4% of HL *vs.* 11.5-17.3%), shorter interdorsal length (10.0-12.6% SL *vs.* 16.9-23.4%), and longer adipose-fin base (32.2-36.0% SL *vs.* 18.5-27.9%); and from *R. rusbyi*, by its shorter pelvic fin (15.3-16.9% SL *vs.* 17.0-19.1%), longer anal-fin base (14.9-18.5% SL *vs.* 11.8-14.0%), the dorsal and ventral caudal-fin lobes subequal in both sexes (*vs.* dorsal caudal-fin lobe longer than the ventral lobe); and by the presence of a distinct narrow dark mid lateral stripe (*vs.* stripe absent).

Rhamdella zelimai is further distinguished from *R. eriarcha* by the shape of the premaxilla, which becomes broader laterally, making the anterior margin

of both premaxillae an almost straight line (Fig. 4; *vs.* premaxilla homogeneously broad from mesial to lateral ends, so that the anterior margin of both premaxillae draw a gentle curve). It is further distinguished from *R. cainguae* by absence of the “frontal-sphenotic space” a distinct and large ovoid area in the supraorbital laterosensory canal between the frontal and sphenotic delimited by the apparently slender dorsal walls of these bones (*vs.* presence, see Bockmann & Miquelarena, 2008: fig. 7); by its larger interdorsal length (10.0-12.6% SL, mean = 11.1% *vs.* 7.6-10.3%, mean = 8.9%), shorter adipose-fin base (32.2-36.0% SL *vs.* 37.5-41.6%), shorter dorsal-fin base (11.2%-13.5% SL, mean = 12.4% *vs.* 13.3-16.5%, mean = 14.5%), shorter anal-fin base (14.9-18.5% SL *vs.* 18.6-22.0%); large internarial length (14.2%-16.6% HL *vs.* 21.6-24.7%), smaller internarial width (14.0-17.3% HL *vs.* 19.4-21.4%). The new species is further distinguished from *R. longiuscula*, by the dorsal and ventral caudal-fin lobes subequal in both sexes (*vs.* dorsal caudal-fin lobe longer than ventral lobe, mainly in males); and longer predorsal length (36.2-40.8% SL, mean = 38.0% *vs.* 31.6-37.0%, mean = 34.5%).

It is further distinguished from *R. cainguae* and *R. aymarae* by the absence of a dense concentration of long and slender papillae on the lateral body surface

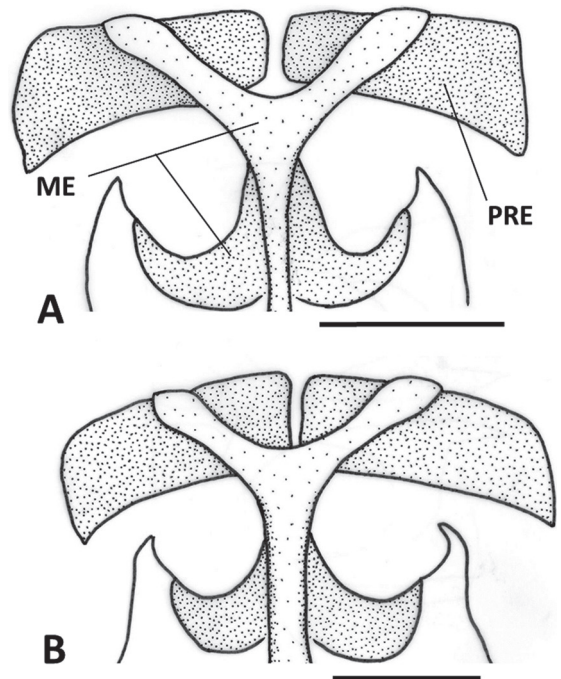


FIGURE 4: Mesethmoid and premaxilla of *Rhamdella*. (A) *Rhamdella zelimai*, paratype, MCP 16901, 85.6 mm SL. (B) *Rhamdella eriarcha*, MCP 17490, 115.0 mm SL. Dorsal view, anterior towards top. ME, mesethmoid; PRE, premaxilla. Scale bar = 2 mm.

in the pectoral and abdominal regions (*vs.* presence of such papillae, resulting in a hairy aspect).

Description: Measurements in Table 1. Cross section of trunk roughly elliptical at level of dorsal-fin origin, gradually more compressed posterior to dorsal-fin base. Caudal peduncle compressed, merging with caudal fin in dorsal view. Anterodorsal profile of body gently convex, curving in even arch from snout to dorsal-fin base, except for discrete depression at base of supra-occipital process. Dorsal profile gently concave to straight from dorsal-fin base to adipose-fin origin and approximately straight or gently convex from that point to base of caudal fin. Ventral body profile in continuous convex curve from mouth to pelvic-fin base. Ventral profile of body straight from pelvic-fin insertion to caudal-fin base. No deposits of fatty material in globose bodies. Pectoral pore absent. Skin of top and underside of head, opercular and branchiostegal regions not covered with papillae. Skin of ventral surface of body apparently without papillae. Number of total vertebra 43(2) or 44(2); pleural ribs 9(4).

Head long, triangular shaped in dorsal view. Deep longitudinal facial ridge marking dorsal limit of adductor mandibulae muscle, extending from base of maxillary barbel to or just anterior of level of fourth infraorbital pore. Distance between posterior nares slightly smaller, or equal, than that between anterior nares. Mouth wide, subterminal, with snout projecting slightly beyond jaw. Gape transverse, slightly ventrally curved at corners, with fleshy rictal fold at corners. Rictal fold hypertrophied, its lower portion consisting mainly of large and fleshy lobe (Fig. 3). Upper portion of rictal fold partially covering basal region of maxillary barbel. Both upper and lower lips with several longitudinal plicae.

Anterior tooth-bearing portion of premaxilla long, narrow, broadening from mesial to lateral end, with small posterolateral projections, and not contacting its antimere at symphysis. Dentary tooth patch slender and posteriorly elongate. Palate edentulous. Upper and lower oral valves thin, covered by papillae, with posterior margins concave. Upper oral valve totally free posteriorly. Lower oral valve broadly attached anteriorly to mouth floor just behind dentary teeth, and with free rounded flaps posteriorly. Mouth roof and floor with sparse papillae. Barbels short, slender, and tapering progressively towards their distal extremities. Barbels approximately ovoid in cross section, without fringing membrane. Maxillary barbel longest, inserted above upper lip, lateral to anterior nare and adjacent to anteriormost pore of infraorbital

laterosensory canal (i1). Tip of adpressed maxillary barbel reaching branchiostegal membrane, but not surpassing branchial slit, in larger specimens; and falling between posterior end of pectoral-fin base and dorsal-fin origin in smaller specimens (*ca.* 20.4 mm SL). Mental-barbel base inserted midway between anterior border of lower jaw and gular fold or nearer former. Outer mental barbel longer than inner barbel, and inserted nearly behind fourth pore of preoperculo-mandibular laterosensory canal. Tip of adpressed outer mental barbel slightly surpassing posterior margin of branchiostegal membrane. Inner mental barbel inserted slightly in advance of vertical through origin of outer mental barbel, approximately behind second pore of preoperculo-mandibular laterosensory canal. Tip of adpressed inner mental barbel extending somewhat beyond posterior margin of branchiostegal membrane. Gular fold distinct, fleshy, and broadly V-shaped with rounded apex. Posteroventral portion of opercle and branchiostegal region delimited by distinct ridge on lateral surface of head extending from distal tip of opercle to point between eighth and ninth pores of preoperculo-mandibular canal.

Branchiostegal membranes well developed, thick, united to isthmus only at median apex, and firmly connected to each other anteriorly. Branchiostegal membrane reaching base of first pectoral-fin ray; not overlapping ventrally. Branchiostegal rays 7(8); two specimens with 8 in one side. Gill rakers thick and moderately long, with: 9(1), 10(1) or 12(2) rakers on first ceratobranchial, and 2(1), 3(1) or 4(2) on first epibranchial, plus 1(4) on angle formed by these bones.

Eye large, elliptical (greatest length in longitudinal axis), with rim circumscribed with deep, continuous invagination, distinctly more pronounced at anterodorsal border. Skin over eye thin and transparent, with lens clearly visible. Eye dorsolaterally positioned, centered approximately at midpoint between tip of snout and corner of opercular membrane, and separated by space slightly larger than longitudinal diameter of eye. Pupil rounded.

Dorsal fin distally rounded in profile, reaching adipose-fin origin when adpressed. First dorsal-fin ray (spinelet) very small (not externally visible), triangular and with two ventral limbs, followed by one long unbranched, and 6*(16) branched rays. Second dorsal-fin ray with most of proximal portion stiffened and with segmentation perceptible solely distally, forming delicate spine, and shorter distal portion flexible and clearly segmented. Spiny portion of second dorsal-fin ray straight, approximately ovoid in cross-section, and lacking marginal dentations. Second dorsal-fin ray

slightly shorter than third and fourth rays (first and second branched rays, respectively), tips of latter two rays projecting beyond tip of second dorsal-fin ray. Origin of dorsal fin approximately at vertical through mid or posterior third of adpressed pectoral fin.

Pectoral fin with distal margin slightly convex, with one unbranched and 8(4) or 9*(12) branched rays. First pectoral-fin ray covered by thick integument; convex anteriorly and straight to slightly concave dorsally. Most of proximal part of first ray rigid and with hardly perceptible segmentation, forming distinct spine; shorter distal portion flexible and clearly segmented. First pectoral-fin ray approximately as long as second (first branched) and third (second branched) rays, but tips of second and third rays projecting slightly beyond tip of first ray. Spiny part of first pectoral-fin ray with 15-19 conspicuous, regularly spaced dentations along internal margin, and 27-34 dentations smaller than posterior dentations along its external margin (seven specimens counted, 108.5-122.6 mm SL). Pectoral fin slightly directed upwards when adpressed to body.

Pelvic fin convex posteriorly, with 6*(16) rays. Lateralmost ray unbranched, completely flexible, segmented, and distinctly shorter than second and third rays (first and second branched rays, respectively). Tip of pelvic fin reaching vertical through anal-fin origin. Pelvic-fin origin approximately at or slightly in advance of midpoint of SL, and at vertical through base of last dorsal-fin ray.

Anal-fin margin rounded in lateral profile, vi(2) or vii(2) + 8(1), 9(3), 10(6) or 11*(6) rays (unbranched rays counted in four c&s specimens). Anal-fin base medium-sized; covered basally with thick fleshy tissue. Origin of anal-fin base approximately at vertical through anterior fifth of adipose-fin base. Posterior limit of anal-fin base approximately at vertical through middle of last two-thirds of adipose-fin base.

Adipose fin long, forming ascending elevated curve in lateral profile, with highest point approximately at last third. Adipose fin merging gradually with back anteriorly, its origin difficult to pinpoint. Distance from dorsal fin to adipose fin less than, or equal to, length of dorsal-fin base. Origin of adipose fin anterior to middle of trunk, and approximately at vertical through middle of adpressed pelvic fin and through, or just behind, anus. Posterior adipose-fin base well defined, forming posterior free lobe markedly distinct from anteriormost portion of dorsal caudal-fin fold. Vertical through end of adipose-fin base distinctly posterior of tip of last anal-fin rays.

Caudal fin deeply forked, lobes broad, with rounded contours and 7*(14) branched rays in dorsal

lobe and 8(12) or 9*(2) branched rays in ventral lobe. Total caudal fin-rays 24(2) or 25(2) rays in dorsal lobe and 27(1), 28(1) or 29(1), rays in ventral lobe (counted in three c&s specimens only). Lobes of caudal fin roughly equal in length; ventral lobe slightly deeper than dorsal one. Membrane uniting dorsal and ventral caudal-fin lobes extending approximately to tip of median caudal-fin rays.

Color in alcohol: Overall body coloration varying from uniform dark, grayish brown to light pale. Upper portion of head and cheeks covered by dark or gray pigmentation, gradually less intense ventrally to orbital rim. Maxillary barbel darkly pigmented dorsally and unpigmented ventrally. Mental barbels completely unpigmented. Lateral surface of trunk with well-defined narrow stripe of constant width along lateral line. Lateral stripe extending from region immediately behind posterodorsal margin of opercle to base of median caudal-fin rays. Pectoral and abdominal areas unpigmented except for scattered melanophores behind and below base of pectoral-fin rays, and on areas near base of pelvic-fin rays, and medial portion of basipterygia. Ventral midline posterior to pelvic-fin insertion and along anal-fin base, weakly pigmented. Dorsal-fin rays and adjacent areas of interradial membrane pigmented with dark gray or brown; most densely pigmented on interradial membranes along anterior border of branched rays. Dorsal surface of pectoral fin with high concentration of dark brown chromatophores along rays; interradial membrane translucent, dorsally unpigmented, except for areas adjacent to pectoral-fin rays. Ventral surface of pectoral fin unpigmented or with few scattered small melanophores along rays. Dorsal surface of pelvic-fin rays and adjacent interradial membranes densely covered with brown or gray melanophores. Ventral surface of pelvic fin unpigmented or with few scattered, small chromatophores along rays. Adipose fin with intense concentration of brown or gray chromatophores, and with darker line on its outer margin. Anal-fin rays with dark chromatophores but with most of interradial membrane lacking pigmentation except for areas adjacent to fin rays. Fleshy basal portion of anal fin and region immediately anterior well pigmented. Caudal-fin rays densely brown-pigmented. Interradial caudal-fin membrane devoid of chromatophores.

Color in life: Overall pigmentation uniformly light brown with yellowish reflection under intense light. Narrow light line with greenish reflections under intense light along lateral line. Lateral stripe hardly visible in live specimens. Belly ventrally white. Fins

pale yellow and plain, without marks, except for distal tip of dorsal fin rays dark gray pigmented. Suborbital region iridescent white to yellowish. Mental barbels white; maxillary barbels gray dorsally and light yellow laterally and ventrally. Snout somewhat translucent in dorsal view with two medial curved black lines along the nasal bones and two black lines directed posteriorly from base of maxillary barbel.

Phylogenetic relationships: *Rhamdella zelimai* was included in the 23-character data matrix of Bockmann & Miquelarena (1998), and the assessment of each character state is as follows: 111210 2110 1110011110 101. The new species shares the three synapomorphies of *Rhamdella*, a very large opening in the frontal for the exit of the epiphyseal (s6) branch of the supra-orbital laterosensory canal; an elongate optic foramen, much larger than the foramen for the trigeminofacial nerve; and a dark stripe along the lateral surface of the body. *Rhamdella zelimai* also possesses the derived state of the 12 characters proposed as synapomorphies of the clade composed of *R. eriarcha*, *R. longiuscula*, and *R. cainguae*. For this season, *R. zelimai* was recovered as belonging to the clade composed of (*R. eriarcha* (*R. longiuscula* and *R. cainguae*)) in an unresolved polytomy (Fig. 5).

Distribution and habitat: *Rhamdella zelimai* is known from streams tributaries to the rivers Maquiné, Três

Forquilhas and Mampituba, in the northeastern coastal plains of Rio Grande do Sul and southern Santa Catarina States, Brazil (Fig. 6). Streams in these river basins are small to medium sized, with clear water running on a bottom composed of boulders, stones and gravel. Despite the extensive deforestation affecting the region, various portions of these rivers still preserve their original Atlantic forest vegetation (Castro & Mello, 2012). The species is so far unknown to occur in the lagoons or rivers located in the coastal plain in the lower portion of these drainages.

Etymology: The species epithet *zelimai* is in honor to our beloved friend José Lima de Figueiredo (nick name Zé Lima), a remarkable person and ichthyologist that helped to shape our personal histories and Brazilian ichthyology.

DISCUSSION

The description of this new species brings to six the number of species currently recognized in *Rhamdella*, and expands the geographic range of the genus to the coastal basins of southern Brazil. The area of endemism of *Rhamdella zelimai*, which encompasses the rivers Maquiné, Três Forquilhas and Mampituba, was already recognized as a general area of fish endemism by Malabarba & Isaia (1992) and as a freshwater

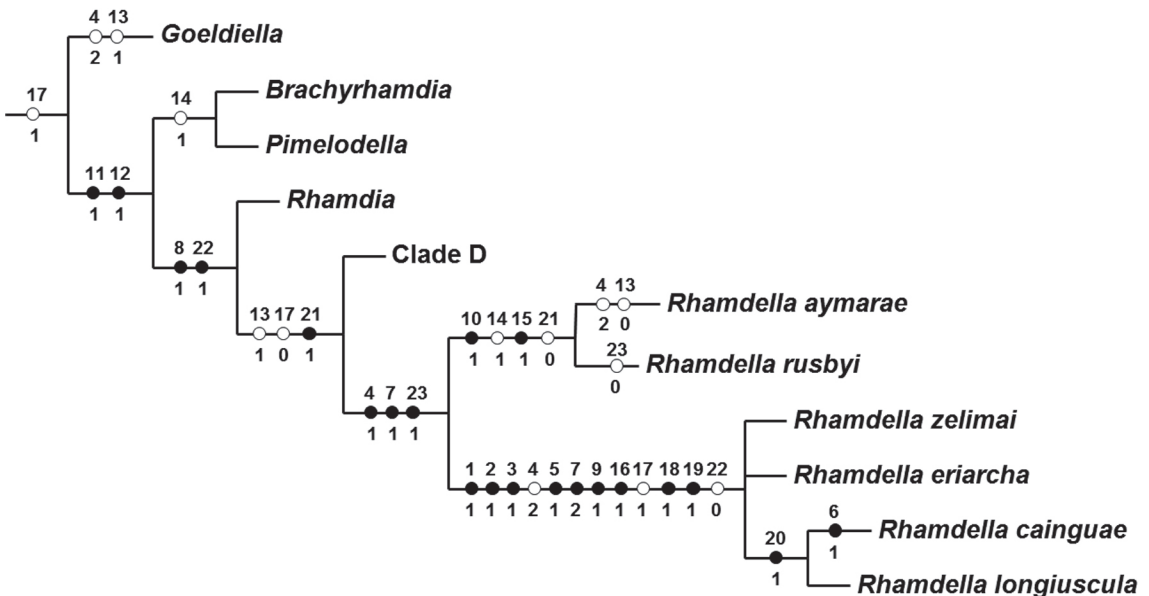


FIGURE 5: Strict consensus of two cladograms showing relationships among species of *Rhamdella* and their closest relatives. Character and state numbers and clade names correspond to those of Bockmann & Miquelarena (2008). Character transformations are depicted under Accelerated Transformation – ACCTRAN optimization. Black dots denote unique transformations and white dots represent reversions or parallelisms. Tree length 36 steps, Consistency Index 0.69, and Retention Index 0.84 in primary trees.

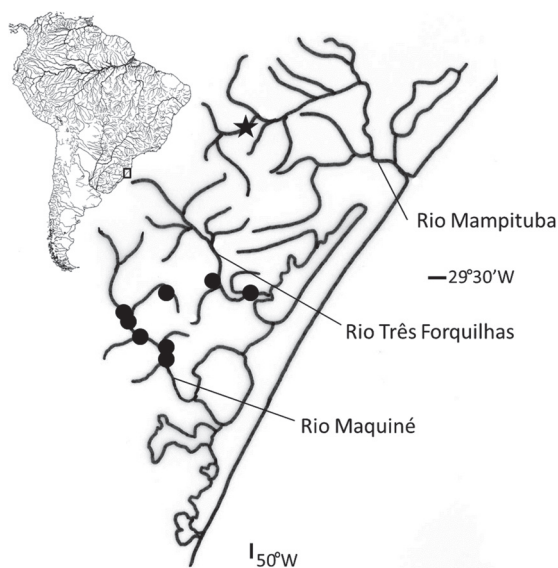


FIGURE 6: Drainage map of coastal basins in southern Brazil, showing the distribution of *Rhamdella zelimai*. Star represents the type locality.

ecoregion by Abell *et al.* (2008; Ecoregion 331 Tramandaí-Mampituba). Various other fish species or clades are endemic to that area which, as discussed by Reis & Schaefer (1998), also includes the rio Araranguá basin in southern Santa Catarina State. Other examples of fishes endemic to such area are the three species of *Epaenionotus* Reis & Schaefer, 1998, *Rineloricaria maquinensis* Reis & Cardoso, 2001, *R. aequaliscuspis* Reis & Cardoso, 2001, *Pareiorhaphis nudulus* Reis & Pereira, 1999, and *P. hypselurus* Pereira & Reis, 2002 (loricariids), *Cyanocharax itaimbe* Malabarba & Weitzman, 2003, *Deuterodon stigmaturus* Gomes, 1947, *Odontostoechus lethostigmus* Gomes, 1947, and *Mimagoniates rheocharis* Menezes & Weitzman, 1990 (characids), *Microglanis cibela* Malabarba & Mahler, 1998 (pseudopimelodid), and *Jenynsia unitaenia* Ghedotti & Weitzman, 1995 (anablepid). *Rhamdella zelimai* was not recorded for the rio Araranguá basin so far, but it is likely to occur in that drainage.

The phylogenetic position of *Rhamdella zelimai* as belonging to the clade formerly composed of *R. eriarcha*, *R. longiuscula*, and *R. cainguae* is corroborated by 12 synapomorphies. The hypertrophied lip fold of *Rhamdella zelimai* is unique among *Rhamdella* species and other heptapteriids examined, likely representing an autapomorphy of the new species. The obtained phylogenetic tree (Fig. 5) supports the species of *Rhamdella* from rio Paraná (*R. cainguae*), rio Uruguai (*R. longiuscula*), laguna dos Patos (*R. eriarcha*) and rio Tramandaí and rio Mampituba (*R. zelimai*) as sharing a single ancestor, and sister group to

the *Rhamdella* species from Bolívia and Northwestern Argentina.

Comparative material: Brazil: Rio Grande do Sul: *Rhamdella eriarcha*: MCP 17490, 6, 101.3-115.2 mm SL (1 c&s, 115.0 mm SL), rio Sampaio, tributary to rio Taquari, at Santo Antônio, Lageado. MCP 26544, 2 (1 c&s, 101.4 mm SL), rio Jacuí downstream the Dona Francisca hydroelectric dam, Agudo. MCP 14433, 2 (1 c&s, 111.6 mm SL), Guaíba lake at Ponta Grossa, Porto Alegre. MCP 21296, 1, 89.8 mm SL, lagoado do Gringo, ca. 2 km upstream of Dona Francisca Hydroelectric Plant, Agudo. MCP 19509, 1, 110.4 mm SL, rio Taquari at Cruzeiro do Sul. MCP 19532, 2, 102.9-146.0 mm SL, rio Taquari at Muçum. MCP 41505, 1, 128.2 mm SL, arroio Candiota near Candiota. MCP 32545, 1, 112.3 mm SL, rio Pardino at Lago Dourado dam, Pardino. MCP 19299, 2, 131.1-137.0 mm SL, rio dos Sinos at Praia João Fernandes, Caraá. MCP 26978, 14, 2 measured 126.0-129.7 mm SL, rio Jacuí immediately downstream of Itaúba hydroelectric dam, Arroio do Tigre. *Rhamdella longiuscula*: MCP 12623, 16, 8.0-123.2 mm SL, paratypes, arroio Canoin on road from Pirapó to São Nicolau. MCP 12722, 79 (90.0-133.8 mm SL (2 c&s, 121.1-122.0 mm SL), paratypes, arroio Passo do Alto near Mineral, São Nicolau.

RESUMO

Rhamdella zelimai, espécie nova, é descrita das drenagens costeiras do nordeste do Rio Grande do Sul e sul de Santa Catarina, Brasil. A nova espécie difere dos seus congêneres pela hipertrofia da prega labial, especialmente a sua porção ventral, consistindo de um grande lóbulo carnosos que se dobra ventralmente sobre si mesmo. O estudo das relações filogenéticas da nova espécie suporta a hipótese de que ela pertence ao clado composto por *R. eriarcha* (da bacia da laguna dos Patos basin), *R. longiuscula* (do rio Uruguai), e *R. cainguae* (do baixo rio Paraná).

PALAVRAS-CHAVE: Siluriformes; Endemismo; Neotropical; Rio Grande do Sul; Santa Catarina; Taxonomia; Sistemática.

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