PONTIFÍCIA UNIVERSIDADE CATÓLICA DO RIO GRANDE DO SUL

FACULDADE DE BIOCIÊNCIAS

PROGRAMA DE PÓS-GRADUAÇÃO EM ZOOLOGIA

Revisão taxonômica das espécies de *Hisonotus* Eigenmann & Eigenmann (Siluriformes: Loricariidae) da bacia do rio Uruguai e sistema da laguna dos Patos

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DISSERTAÇÃO DE MESTRADO
PORTO ALEGRE - RS - BRASIL
2008

SUMÁRIO

Agradecimentos

Agradeço ao meu orientador, de longa data, Roberto Reis pelo ótimo convívio durante esses anos, por sua atenção, e por fazer parte de minha formação acadêmica desde os primeiros anos da faculdade.

Agradeço aos colegas de laboratório de Ictiologia com os quais convivo diariamente durante todos estes anos. Ao Bertaco, Christian, Cardoso, e a Juliana meu agradecimento pela ajuda e companhia nas coletas, em especial ao Cardoso que foi em quase todas. Agradeço a todos do laboratório que de uma forma ou de outra contribuíram para a realização desta dissertação. Ao Edson, a Mónica e ao Pablo César, pelas discussões sobre os cascudos ao Pezzi pelas informações sempre precisas das localidades neste Rio Grande ao Malabarba e ao Lucena pela experiência a mim passada. As gurias do Laboratório pela ajuda com o material da coleção: Fernanda, Júlia, Juliana, Marta, Rita e Margarete.

Ao Museu de Ciência e Tecnologia da PUCRS e ao Laboratório de Microscopia Eletrônica da PUCRS pela infra-estrutura indispensável à realização deste trabalho. A Luiza, secretária do programa de Pós Graduação pela sua disposição e atenção ao resolver os "problemas" referentes ao curso.

Ao All Catfishes Species Inventory, pelo custeio da viagem para visitar coleções a São Paulo (MZUSP), Philadelphia (ANSP), e Londres (BMNH).

Em caráter mais pessoal agradeço a minha família, ao Pablo, ao Pai e a Mãe pelo apoio emocional e muitas vezes logístico durante estes anos.

Resumo

O gênero *Hisonotus* compreende aproximadamente 25 espécies validas, sendo um grupo de hipoptopomatíneos amplamente distribuídos nas bacias hidrográficas do sudeste da América do Sul. Entre elas destacam-se com um grande numero de espécies as bacias dos rios Paraná com sete espécies Uruguai com oito espécies e o sistema da laguna dos Patos com 12 espécies. No presente estudo o objetivo principal foi revisar a composição taxonômica do gênero na bacia do rio Uruguai e no sistema da laguna dos Patos. A bacia do rio Uruguai conta com as espécies de *Hisonotus*: *H. nigricauda*, *H. ringueleti*, *H. aky*, *H. charrua*, e as novas espécies aqui descritas, *H.* sp. "Chapecó", *H.* sp. "Passo Fundo", *H.* sp. "Ariranhas" e *H.* sp. "Canoas". Nesta revisão *H. candombe* é considerado sinônimo de *H. ringueleti* e *Epactionotus aky* é transferida para o gênero *Hisonotus.* O sistema da laguna dos Patos apresenta as seguintes espécies: *H. nigricauda*, *H. laevior*, *H. taimensis*, *H. armatus*, *H. charrua*, *H. aff. leucofrenatus* e as novas espécies *H.* sp. "Camaquã", *H.* sp. "Sinos", *H.* sp. "Felício", *H.* sp. "Prata", *H.* sp. "Carreiro" e *H.* sp. "Passo Novo". *Hisonotus laevior* e *H. nigricauda* são redescritas sendo *H. leptochilus* sinônimo da primeira. Entre as 18 espécies presentes na região estudada apenas uma (*H. aff. leucofrenatus*) é encontrada em outras bacias hidrográficas e duas (*H. nigricauda e H. charrua*) são compartilhadas entre os dois sistemas o que indicada um alto grau de endemismo destas drenagens.

Abstract

The genus *Hisonotus* presents about 25 valid species, and is a group of hypoptopomatines widely distributed in the southeastern basins of South America. Among these basins, presenting a high number of species are the rio Paraná basin with seven species the rio Uruguai with eight species and the laguna dos Patos system with 12 species. The main scope of this study is review the taxonomic composition of the genus in the laguna dos Patos system and in the rio Uruguai basin. The rio Uruguai basin presents the following species of *Hisonotus*: *H. nigricauda*, *H. ringueleti*, *H. aky*, *H. charrua*, and the new species herein described, *H.* sp. "Chapecó", *H.* sp. "Passo Fundo", *H.* sp. "Ariranhas", and *H.* sp. "Canoas". In this review *H. candombe* is synonym of *H. ringueleti* and *Epactionotus aky* is transferred to the genus *Hisonotus.* The laguna dos Patos system presents the following species: *H. nigricauda*, *H. laevior*, *H. taimensis*, *H. armatus*, *H. charrua*, *H. aff. leucofrenatus*, and the new species, *H.* sp. "Camaquã", *H.* sp. "Sinos", *H.* sp. "Felício", *H.* sp. "Prata", *H.* sp. "Carreiro" and *H.* sp. "Passo Novo". *Hisonotus laevior* and *H. nigricauda* are redescribed, and *H. leptochilus* is synonym of the first. Among the 18 species present in the studied region, just one (*H. aff. leucofrenatus*) is found in other basins, and two (*H. nigricauda e H. charrua*) are shared between both drainages studied here, suggesting a high degree of endemism of these areas.

Apresentação

A presente dissertação reúne resultados da revisão taxonômica do gênero *Hisonotus* da bacia do rio Uruguai e do sistema da laguna dos Patos. O primeiro capítulo apresenta a descrição de uma espécie nova amplamente distribuída na laguna dos Patos. Este capítulo já foi enviado e aceito para a publicação na revista científica Copeia, junto com os colaboradores Pablo Lehmann, Edson Pereira, e meu orientador Roberto Reis. O capítulo II compreende a revisão taxonômica de *Hisonotus* no sistema da laguna dos Patos e conta com a redescrição de duas espécies e a descrição de seis novas espécies. Já o capítulo III apresenta a revisão taxonômica do gênero na bacia do rio Uruguai contendo a descrição de quatro novas espécies. Ambos os capítulos II e III serão submetidos para a publicação na revista da Sociedade Brasileira de Ictiologia (Neotropical Ichthyology), junto com o meu orientador Roberto Reis.

... life has no meaning. There is nothing called meaning in nature. Meaning is a purely human concept which we put into existence.

Fridtjof Nansen

Capítulo I

A new species of *Hisonotus* (Siluriformes: Loricariidae: Hypoptopomatinae) from the Laguna dos Patos Basin, Southern Brazil.

TITLE: A NEW SPECIES OF *HISONOTUS* (SILURIFORMES: LORICARIIDAE: HYPOPTOPOMATINAE) FROM THE LAGUNA DOS PATOS BASIN, SOUTHERN BRAZIL.

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Key words: Neotropical, Loricariids, Cascudinhos, Taxonomy, Endemism, Color Pattern.
Suggested runing head: New species of *Hisonotus*.
Manuscript category: Major Article
Suggested *Copeia* section for review: General Ichthyology
text pages: 16
of figures: 4
tables: 1

Hisonotus armatus, a new hypoptopomatine species, is described from the Laguna dos Patos basin, Rio Grande do Sul State, southern Brazil. The new species is distinguished from other *Hisonotus* species by aspects of the morphology of the rostral plate, the arrangement of abdominal plates, and the caudal-fin color pattern.

Hisonotus armatus, nova espécie de hipoptopomatíneo, é descrita do sistema da laguna dos Patos, Rio Grande do Sul, sul do Brasil. A nova espécie se diferencia das demais do gênero *Hisonotus* pela morfologia da placa rostral, pelo arranjo das placas abdominais e pelo padrão de colorido da nadadeira caudal.

Hisonotus belongs to the Hypoptopomatinae, a monophyletic group consisting of 18 genera and more than 100 species (Schaefer, 2003 Reis and Carvalho, 2007) within the Loricariidae. As presently defined, *Hisonotus* consists of 15 species (Schaefer, 2003 Casciotta et al., 2006), occurring in the Atlantic coastal drainages of southern and southeastern Brazil, and the Paraná-Paraguay basin. Regan (1904) placed *Hisonotus*, *Parotocinclus*, and *Microlepidogaster* under the synonymy of *Otocinclus*. *Hisonotus* was thereafter retained in synonymy until resurrected by Schaefer (1998). Currently, the genus is diagnosed by its reduced or absent snout plates anterior to the nostril, the rostrum with enlarged odontodes, and the thickened plates forming the lateral rostral margin (Schaefer, 1998). Herein, we describe a new species of *Hisonotus*, widely distributed in the Laguna dos Patos basin, in southern Brazil.

MATERIAL AND METHODS

Measurements were made to the nearest 0.1 mm with digital calipers under a stereomicroscope on the left side of specimens following Boeseman (1968, fig. 5), with the exception of thoracic length, which is the distance of the origin of pectoral-fin spine to the origin of the pelvic-fin unbranched ray. Additional measurements are: suborbital depth, defined as the distance between the ventral margin of the bony orbit and ventrolateral limit of the head, and mandibular ramus, the longer axis of the dentary bone. Morphometric data were expressed as percents of standard length (SL), except subunits of the head which are expressed as percents of head length. Plate counts and nomenclature follow the schemes of serial homology proposed by Schaefer (1997). Vertebral counts included all vertebrae (including the first five vertebrae incorporated into the Weberian apparatus), with the compound caudal centrum (PU1+U1) counted as one element. Cleared and stained specimens (cs) were prepared according to the method

of Taylor and Van Dyke (1985). Scanning electron micrographs were taken from dissected alcohol preserved specimens. Species of *Hisonotus* referred to by numbers are those first mentioned in Reis and Carvalho (2007). Institutional abbreviations are as listed at http://199.227.217.251/files/codons.pdf, with the addition of ZVC-P for Facultad de Ciencias, Universidad de la República, Montevideo, Uruguay.

Hisonotus armatus, new species

Figure 1, Table 1

Hisonotus sp. 5, Reis and Carvalho, 2007: 84 [Catalog of fresh water fishes of Brazil].

Holotype.—MCP 41323, 44.4 mm SL, female, Brazil, Rio Grande do Sul, Pedro Osório: Arroio Arambaré, about 5 km south of Vila Basílio, on road to Pedro Osório, 31°51'51"S 052°49'24"W, 22 April 2005, R. E. Reis, P. Lehmann, and E. H. L. Pereira.

Paratypes.—All from Brazil, Rio Grande do Sul, São Gonçalo drainage: MCP 37682, 13 + 4 cs, 33.9–44.2 mm SL; ANSP 187116, 5, 33.7–42.5 mm SL; MZUSP 93884, 5, 37.7–45.1 mm SL, all collected with the holotype. MCP 40787, 20, 32.5–45.6 mm SL, Arroio Mata Olho, on road between Pedro Osório and Basílio, 31°54'56"S 53°00'16"W, 15 Nov 2003, R. E. Reis, P. Lehmann, M. C. Abreu, and C. S. Alho. MCP 34776, 31, 27.6–43.9 mm SL, Arroio Arambaré, on road from Pedro Osório to Herval, 31°58'37"S 53°06'15"W, 15 Nov 2003, R. E. Reis, P. Lehmann, M. C. Abreu, and C. S. Alho. MCP 25138, 9 + 3cs, 27.9–45.9 mm SL, Arroio Santa Fé on road between Pinheiro Machado and Piratini, 31°30'12"S 53°13'56"W, 21 Nov 1999, C. A. Lucena, Z. M. Lucena, E. H. L. Pereira, and V. A. Bertaco.

Non-type specimens.—All from Brazil, Rio Grande do Sul. São Gonçalo drainage: MCN 12617, 3, 37.1–37.3 mm SL, Pelotas, Arroio Pelotas on road BR116, 31°37'55"S

52°19’39”W□MCP 25140, 4, 37.6–46.7 mm SL, Pedro Osório, Arroio Mata Olho on road between Pedro Osório and Basílio, 31°54’56”S 53°00’17”W□MCP 25147, 2, 30.1–36.3 mm SL, Piratini, Arroio Piratinizinho on secondary road to BR-293, 31°43’02”S 52°59’34”W□MCP 25154, 14 + 1 cs, 28.0–45.4 mm SL, Piratini, Arroio Piratinizinho on secondary road to BR-293, 31°43’02”S 52°59’34”W□MCP 25158, 8, 34.4–45.2 mm SL, Piratini, Arroio Piratini Menor, about 500 m from road between Piratini and Pelotas, 31°30’03” S 53°05’35”W□MCP 25159, 24, 28.9–42.1 mm SL, Piratini, Rio Piratini on road BR293, 31°43’11’’S 52°54’00”W□MCP 34777, 1, 28.5 mm SL, Herval, Arroio Arambaré, on road from Pedro Osório to Herval, 31°58’37”S 53°06’15”W□MCP 34780, 4, 36.6–40.5 mm SL, Pedras Altas, headwaters of Arroio Alegria between Pedras Altas and Pinheiro Machado, 31°40’41”S 53°32’12”W□MCP 37685, 13, 27.7–44.2 mm SL, Pedro Osório, stream tributary to Arroio Arambaré near Carvalho de Freitas, about 35 km from Pedro Osório, on railroad bridge, 31°51’51”S 52°49’24”W. Rio Jaguarão drainage: MCP 11307, 2, 16.9–39.2 mm SL, Jaguarão, mouth of Rio Telho on Rio Jaguarão, approx. 32°31’S 53°27’W□MCP 27184, 5, 14.2–36.3 mm SL, Candiota, Arroio Quebra Jugo no passo dos Pinheiros, 31°32’59”S 53°46’17”W□UFRGS 4224, 3, 32.3–38.2 mm SL, Candiota, downstream of Arroio Candiota dam, approx. 31°32’S 53°40’W. Rio Camaquã drainage: MCN 11179, 1, 34.2 mm SL, Caçapava do Sul, Arroio Seival at dam, 30°43’04”S 53°43’42”W□MCP 11337, 5, 25.9–38.7 mm SL, Encruzilhada do Sul, Arroio dos Ladrões, 30°41’S 52°20’W□ MCP 25869, 1, 43.3 mm SL, Bagé, Arroio Camaquã Chico on road between Bagé and Lavras do Sul, 30°54’27”S 53°49’13”W□MCP 40647, 2, 22.7–27.3 mm SL, Bagé, Arroio do Tigre, on road between Bagé and Lavras do Sul, 31°04’47”S 53°54’03”W□ MCP 40748, 1, 33.0 mm SL, Bagé, Arroio das Traíras on road BR153, 31°05’29”S 53°43’33”W□MCP 40751, 1, 41.5 mm SL, Lavras do Sul, Arroio Mantiqueira, on road

between Bagé and Lavras do Sul, 30°54’22”S 53°58’02”W□MCP 40764, 1, 38.6 mm SL, Lavras do Sul, Arroio da Cria, on road between Bagé and Lavras do Sul, 30°57’19”S 53°57’22”W□MCP 41306, 1, 36.6 mm SL, Camaquã, Arroio Duro on road from Vila Aurora to Dom Feliciano, 30°45’34”S 51°51’57”W□UFRGS 8222, 5, 32.2–39.8 mm SL, Amaral Ferrador, creek on Fazenda Ferraria□UFRGS 8240, 1, 33.3 mm SL, Canguçu, Rio Camaquã on bridge of road RS471□UFRGS 8975, 3, 14.7–35.3 mm SL, Encruzilhada do Sul, Arroio Abranjo, 30°53’58”S 52°32’18”W. Lago Guaíba drainage: MCN 16246, 3, 31.9–43.9 mm SL, Porto Alegre, Parque Estadual Delta do Jacuí, Saco da Pólvora, approx. 30°01’S 51°14’W□MAPA 1735, 14, 21.3–38.9 mm SL, Barra do Ribeiro, açude dos Garcia, on road BR116, 30°23’14”S 51°26’10”W□MCP 10450, 2, 41.7–49.9 mm SL, Porto Alegre, Lago Guaíba at Ilha Mauá, approx. 30°01”S 51°14”□MCP 16010, 10, 14.8–42.3 mm SL, Viamão, Lago Guaíba at Praia de Itapuã, near to mouth of Riacho Itapuã, 30°15’0”S 51°02’20”W, UFRGS 6718, 1, 33.9 mm SL, Viamão, Lago Guaíba at Praia das Pombas, 30°20’44”S 51°01’32”W□UFRGS 8460, 1, 39.5 mm SL, Eldorado do Sul, Estação Agronômica da UFRGS. Rio Jacuí drainage: MAPA 1737, 10, 21.9–38.0, Gravataí, Arroio Passo dos Ferreiros□MAPA 1749, 1, 38.8 mm SL, Nova Petrópolis, Arroio Macaquinhos, Pinhal Alto, approx. 29°25’S 51°02’W□MAPA 2391, 3, 35.9–44.1 mm SL, Santo Antonio da Patrulha, Rio dos Sinos, bridge at Nossa Senhora de Mont Serrat, approx. 29°45’S 50°24’W□MCN 6660, 2, 24.0–37.5 mm SL, Três Coroas, Arroio Quilombo, approx. 29°27’S 50°49’W□MCN 16124, 4, 33.2–40.1 mm SL, Pinhal Grande, Rio Ferreira, 29°16’33”S 53°14’42”W□MCP 9294, 2, 23.4–34.0 mm SL, Cachoeira do Sul, Arroio Paraíso, Rincão da Porta, approx. 29°41’S 53°09”W□MCP 14640, 1, 23.7 mm SL, Caraá, Rio Caraá near Rio dos Sinos, 29°47’40”S 50°26’01”W□MCP 17166, 2, 27.1–27.9 mm SL, Porto Alegre, Rio Jacuí at Saco da Alemoa, approx. 30°00’S 51°14’W□MCP 17500, 1, 45.3 mm SL, Venâncio

Aires, Arroio at Linha Brasil, approx. 29°33’S 52°17’W□MCP 18632, 13, 26.1–38.0 mm SL, Candelária, Rio Pardo on road from Santa Cruz do Sul to Candelária, 29°40’36”S 52°46’17”W□MCP 25262, 5, 29.1–38.1 mm SL, Agudo, Lageado da Gringa between Linha da Ressaca and mouth of Rio Jacuizinho, 29°23’08”S 53°12’53”W□MCP 25458, 7 + 3 cs, 16.2–42.3 mm SL, Agudo, Arroio Corupá, on road between Agudo and Dona Francisca Dam, 29°33’54”S 53°17’09”W□MCP 25721, 5, 27.3–41.4 mm SL, Ibarama, Arroio da Gringa, about 12 km north from UHE Dona Francisca, 29°23’16”S 53°13”23”W□MCP 25722, 3, 25.3–40.2 mm SL, Ibarama, lageado do Gringo about 2 km from UHE Dona Francisca, 29°26’49”S 53°15’36”W□ MCP 26052, 1, 35.0 mm SL, Lindolfo Collor, Arroio Feitoria, 29°34’54”S 51°14’03”W□MCP 26528, 1, 28.7 mm SL, Santa Cruz do Sul, Rio Pardinho, downstream Corsan dam, approx. 29°40’S 52°28’W□MCP 26542, 3, 29.6–35.6 mm SL, Agudo, Rio Jacuí downstream from Dona Francisca dam, approx. 29°31’S 53°16’W□ MCP 33557, 1, 34.7 mm SL, Santa Bárbara, Rio das Antas, near mouth of Rio Carreiro, 29°05’29”S 51°42’42”W□MCP 38901, 6, 22.2–40.8 mm SL, Bento Gonçalves, Rio das Antas, 29°01’59”S 51°27’13”W□MCP 40512, 6, 22.1–40.9 mm SL, Santa Maria do Herval, Rio Cadeia on Farroupilha bridge, 29°29’43”S 51°02’50”W□UFRGS 2350, 1, 35.2 mm SL, Arroio dos Ratos, Arroio dos Ratos at bathing spot, approx. 30°03’S 51°37’W□UFRGS 8762, 3, 29.8–36.2 mm SL, São Sepe, creek on Fazenda São Sepe, 30°14’39”S 53°41’20”W□UFRGS 8768, 3, 31.6–35.4 mm SL, Rio Pardo, creek at Fazenda Velha□UFRGS 8805, 5, 38.5–43.1 mm SL, Lageado, mouth of Arroio Pinheirinho on Rio Forqueta, 29°19’21”S 52°14’03”W□Other drainages in Laguna dos Patos basin: MAPA 1747, 5, 25.8–39.9 mm SL, Camaquã, Arroio Velhaco on road BR116 between Tapes and Camaquã, approx. 30°45’S 51°38’W.

Diagnosis.—Hisonotus armatus differs from all congeners except *Hisonotus notatus* and *H. leucofrenatus* in having the anterior margin of the snout completely covered by odontodes (Fig. 2A, C), vs. anterior margin of the snout with a narrow or wide odontode-free band (Fig. 2B, D) and in having large plates in the abdominal median series, usually comprising one series of plates between the lateral abdominal plates (Fig. 3), vs. abdominal median series of plates small, with several plate series irregularly arranged between the lateral abdominal ones. The new species differs from *H. notatus* and *H. leucofrenatus* in the presence on the caudal fin of a series of light hyaline spots, forming a vertical light bar vs. a rounded hyaline blotch or no hyaline area in the midventral portion of caudal fin.

Description.—Morphometrics and meristics given in Table 1. Adult size moderate to large for members of this genus (maximum 46.0 mm SL). Body robust, without conspicuous keels, caudal peduncle round in cross section. Dorsal profile slightly convex from snout tip to parieto-supraoccipital bone, slightly concave posterior to rostral plate, almost straight from parieto-supraoccipital to anterior margin of nuchal plate, ascending from that point to dorsal-fin origin straight and descending at dorsal-fin base. Profile almost straight from last dorsal-fin ray to caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth at posterior end of caudal peduncle. Head and snout broad, snout rounded anteriorly in dorsal view, body progressively narrowing posterior of cleithrum. Snout region anteriorly to nares concave, interorbital region slightly convex to almost straight. Upper margin of orbit not elevated. Eye dorsolaterally positioned. Iris diverticulum present, large, its length more than half of pupil diameter.

Pectoral fin with six branched rays, posterior fin margin slightly rounded when depressed tip extending beyond middle of pelvic fin. Posterior margin of pectoral-fin spine smooth. Pectoral-fin axillary slit present, located below posterior bony margin of cleithral process. Pelvic fin moderately short, with five branched rays. Tip of depressed fin not reaching anal-fin origin in females, but extending beyond that point in males. Adult males with fleshy flap along dorsal margin of first thickened pelvic-fin ray. Flap widest basally and progressively narrowing distally. Dorsal fin with seven branched rays. Dorsal-fin origin located at vertical through pelvic-fin origin. Dorsal-fin spinelet present. Anal fin with five branched rays. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent.

Body almost entirely covered by plates except for region overlying opening of swim bladder capsule, area between pectoral girdle and lower lip, region around anus, and area around bases of paired fins. Rostral plate with posterior notch articulating with mesethmoid. Snout plates anterior to nostril reduced. Three rows of predorsal plates, including nuchal plate. Lateral median-plate series formed by 23–25 plates. Lateral line incomplete, with small gap without pores along middle length of body. Abdominal plates arranged in three rows anteriorly and irregularly arranged between pelvic-fin insertions. Lateral abdominal plates slightly larger and forming regular series. Median abdominal series usually formed by one plate row, posterior median abdominal plates sometimes smaller and greater in number (Fig. 3). Coracoid and cleithrum exposed and covered by odontodes, except for median region of cleithrum and area surrounding arrector fossa.

Head without crests in adults. Odontodes on posterior parieto-supraoccipital tip uniform in size, and not enlarged in adults. Somewhat prominent crest preceded by anterior pair of crests in small juveniles. Compound pterotic with small-to-median size

perforations along its anteroventral margin. Head, fin spines, and body plates covered with odontodes, largest odontodes found on anterior surface of all fin spines. Odontodes on head and trunk of uniform size and distribution, except for enlarged odontodes on ventral and dorsal margins of rostral plates. Plates forming lateral rostral margin thickened. Lips roundish and papillose.

Premaxillary and dentary teeth slender proximally and flattened distally□teeth bifid, with medial cusp large and rounded, lateral cusp minute and pointed. Accessory patch of teeth absent on dentary and premaxilla.

Posterior margin of caudal-fin skeleton usually with slight median notch. Notch in one specimen extends anteriorly, almost reaching half centrum of last vertebrae. Total vertebrae 29 (5 cs).

Color in alcohol.—Ground color of dorsolateral surface of head and body light to dark brown. Midlateral region of body dark gray and ventral region largely unpigmented. General color pattern of dorsal surface of body composed of dark blotches contrasting with somewhat reticular light areas. Ventrolateral portion of head more lightly pigmented with scattered dark blotches. Ventral portion of head and body pale yellowish with scattered chromatophores. Chromatophores more prominent on posterior region of lips and region surrounding base of pectoral and anal fins. All fins mostly hyaline, with chromatophores forming transverse dark bands□bands most conspicuous on unbranched rays. Dorsal fin with about seven narrow dark bands. Caudal fin darkly pigmented ventrally, unbranched rays with alternating dark and light spots. Two dorsal-most branched rays almost hyaline, except for transversal dark bands, one hyaline transverse band formed by round light spots crossing caudal fin. Some specimens with anterior portion of caudal fin lighter and forming second transverse light band with

caudal hyaline areas larger. Hyaline vertical band on caudal fin inconspicuous or even absent in juveniles.

Sexual dimorphism.—The sexual dimorphism is characterized mainly by the urogenital papilla, positioned just after the anal opening in males and absent in females. Adult males also possess a fleshy flap along the dorsal margin of first thickened pelvic-fin ray that is absent in females. In juvenile males the flap is smaller or absent. Males have a longer pelvic-fin unbranched ray that extends up to the anal-fin origin, with the spine never reaching that point in females.

Distribution and habitat.—Hisonotus armatus is widely distributed in the Laguna dos Patos system from the southern most Rio Jaguarão drainage, to the Rio Jacuí and Rio Taquari drainages (Fig. 4). The new species is unknown from the headwaters of the Rio Jacuí and Rio Taquari drainages. This species inhabits slow to median flowing watercourses, with clear to brown waters over sandy bottom and is found in marginal or submerged aquatic vegetation. *Hisonotus armatus* is sympatric throughout its distribution with *H. laevior* (see discussion for diagnostic features). It was also collected together with *H. nigricauda* in some localities of the Lago Guaíba drainage, with *Hisonotus* sp. 4 in the Rio Jacuí and Taquari drainages, and with *Hisonotus* sp. 6 in the upper reaches of the Rio Camaquã drainage.

Etymology.—The specific epithet, *armatus*, is from Latin meaning armed, alluding to the complete covering of odontodes on the anterior tip of the snout.

DISCUSSION

The most distinctive feature of *Hisonotus armatus* is the snout completely covered with odontodes, without an anterior odontode-free band, which easily distinguishes this new species from all other *Hisonotus* species in the Laguna dos Patos basin (a narrow naked band in *H. nigricauda*, sometimes absent in smaller specimens). The new species shares this and a few other features with the congeners *Hisonotus notatus* (type-species) and *Hisonotus leucofrenatus*, both species distributed in the southeastern Brazilian coastal drainages. These three species possess the anterior margin of the snout fully covered with odontodes, a similar pattern of abdominal plates, 23-25 median lateral plates, three predorsal plate rows, and absence of a raised tuft of odontodes on the parieto-supraoccipital.

Four species of *Hisonotus* were previously described from the Laguna dos Patos basin, *Hisonotus nigricauda*, *H. laevior*, *H. leptochilus*, and *H. taimensis*. The presence of *H. armatus*, plus five additional unnamed species listed in Reis and Carvalho (2007), is indicative of a successful group in the region as well as species richness and endemism in the Laguna dos Patos basin. Other loricariid genera with a large number of species in the basin are *Eurycheilichthys*, with eight species, seven of which are undescribed, and *Rineloricaria*, with six species.

MATERIAL EXAMINED

Hisonotus candombe: ZVC-P 5595, holotype, Uruguay, Departamento Salto, Rio Uruguay basin, arroyo Palomas. *Hisonotus charrua*: ZVC-P 5639, holotype, Uruguay, Departamento Tacuarembó, Canãda de los Pena. MCP 40256, 4 + 1 cs, same type-locality. *Hisonotus francirochai*: MCP 41341, 4, Brazil, São Paulo, Araras, stream tributary of Rio Mogi-Guaçu (Rio Grande drainage). *Hisonotus insperatus*: MZUSP 78957, holotype, Brazil, São Paulo, Botucatu, Rio Capivara (Rio Tietê drainage).

Hisonotus laevior: ANSP 21563, holotype, Brazil, Rio Grande do Sul, Rio Jacuí. MAPA 1755, 24 + 3 cs, Brazil, Rio Grande do Sul, São Sebastião do Caí, small creek in Rio Branco. *Hisonotus leptochilus*: ANSP 21564, holotype, Brazil, Rio Grande do Sul, Rio Jacuí. *Hisonotus leucofrenatus*: MZUSP 36565, 20, Brazil, São Paulo, Eldorado, small creek on the road Eldorado to Sete Barras (Rio Ribeira de Iguape drainage). *Hisonotus maculipinnis*: BMNH 1909.4.2.19–22, syntypes of *Otocinclus maculipinnis*, La Plata. *Hisonotus nigricauda*: BMNH 1891.3.16.53–62, syntypes of *Otocinclus nigricauda*, Brazil, Rio Grande do Sul, Rio Camaquã. MCP 17416, 20 + 3 cs, Brazil, Rio Grande do Sul, marsh at the side of Rio Camaquã on Pacheca. *Hisonotus notatus*: BMNH 1904.1.28.13–16, syntypes, Brazil, Rio de Janeiro, Rio Grande (Arroio Fundo) on Fazenda Santa Cruz. MCP 18098, 204 + 4 cs, Brazil, Espírito Santo, Rio São José dos Torres on road BR 101. *Hisonotus paulinus*: BMNH 1907.7.6.9, holotype of *Otocinclus paulinus*, Brazil, São Paulo, Rio Piracicaba. *Hisonotus ringueleti*: ILPLA 886, holotype, Uruguay, Rivera, creek at km 18 of route joining Santana do Livramento to Rivera (Rio Uruguay basin). *Hisonotus taimensis*: MCN 4835–4844, paratypes of *Microlepidogaster taimensis*, Brazil, Rio Grande do Sul, Santa Vitória do Palmar, new channel of Arroio Taim, Estação Ecológica do Taim. *Hisonotus* sp. 1: MCP 40942, 24, Brazil, Rio Grande Sul, Nova Prata, rio da Prata at Passo do Despraiado. *Hisonotus* sp. 2: MCP 40945, 8 + 2 cs, Brazil, Rio Grande Sul, Serafina Corrêa, rio Carreiro downstream Carreiro bathing spot. *Hisonotus* sp. 3: MCP 22701, 27 + 3 cs, Brazil, Rio Grande Sul, Cruz Alta, rio Passo Novo on road from Cruz Alta to Ibirubá. *Hisonotus* sp. 4: UFRGS 8812, 14, Brazil, Rio Grande do Sul, Lageado, mouth of Arroio Pinheirinho on Rio Forqueta. *Hisonotus* sp. 6: MCP 40748, 2, Brazil, Rio Grande do Sul, Bagé, Arroio da Traíras on road BR 153.

ACKNOWLEDGEMENTS

We thank the following people for their help and support while visiting their institutions and for the loan of specimens: M. Sabaj and J. Lundberg (ANSP), J. Maclaine and R. Britz (BMNH), A. Miquelarena (ILPLA), F. Meyer (MAPA), M. Azevedo (MCN), M. Azpelicueta (MLP), O. Oyakawa (MZUSP), J. Ferrer and L. Malabarba (UFRGS). We thank J. Wingert and M. Lucena for support on the MCP collection. Thanks to the Centro de Microscopia e Microanálises – CEMM, PUCRS for the SEM preparations. This paper was financially supported by the "All Catfishes Species Inventory" Project (NSF DEB 0315963) that provided funding to visit museum collections and field work. Thanks are also due to the Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq, for a fellowship to TPC (process #132879/2006-9). RER is partially supported by CNPq (process #301748/2004-7).

LITERATURE CITED

Boeseman, M. 1968. The genus *Hypostomus* Lacépède, 1803, and its Surinam representatives (Siluriformes, Loricariidae). Zoologische Verhandelingen 99:1–89.

Casciotta J. R., M. M. Azpelicuta, A. E. Almirón and T. Litz. 2006. *Hisonotus candombe*, a new species from the rio Uruguay basin in the República Oriental del Uruguay. Spixiana 29:147–152.

Reis R. E., and T. P. Carvalho. 2007. Hypoptopomatinae, p. 83–84. In: Catálogo das espécies de peixes de água doce do Brasil. P. A. Buckup, N. A. Menezes and M. S. Ghazzi (eds.). Museu Nacional (Série Livros), Rio de Janeiro, Brazil.

Regan C. T. 1904. A monograph of the fishes of the family Loricariidae. Transactions of the Zoological Society of London 17:191–350.

Schaefer, S. A. 1997. The Neotropical cascudinhos: Systematics and biogeography of the *Otocinclus* catfishes (Siluriformes: Loricariidae). Proceedings of the Academy of Natural Sciences of Philadelphia 148:1–120.

Schaefer, S. A. 1998. Conflict and resolution: Impact of new taxa on phylogenetic studies of the neotropical cascudinhos (Siluriformes: Loricariidae), p. 375–400. In: Phylogeny and Classification of Neotropical Fishes. L. R. Malabarba, R. E. Reis, R. P. Vari, C. A. S. Lucena, and Z. M. S. Lucena (eds.). Edipucrs, Porto Alegre, Brazil.

Schaefer, S. A. 2003. Loricariidae – Hypoptopomatinae (Armored catfishes), p. 321–329. In: Checklist of the Freshwater Fishes of South and Central America. R. E. Reis, S. O. Kullander and C. J. Ferraris, Jr. (eds.). Edipucrs, Porto Alegre, Brazil.

Taylor, W. R., and G. C. Van Dyke. 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. Cybium 9:107–119.

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Figure Legends

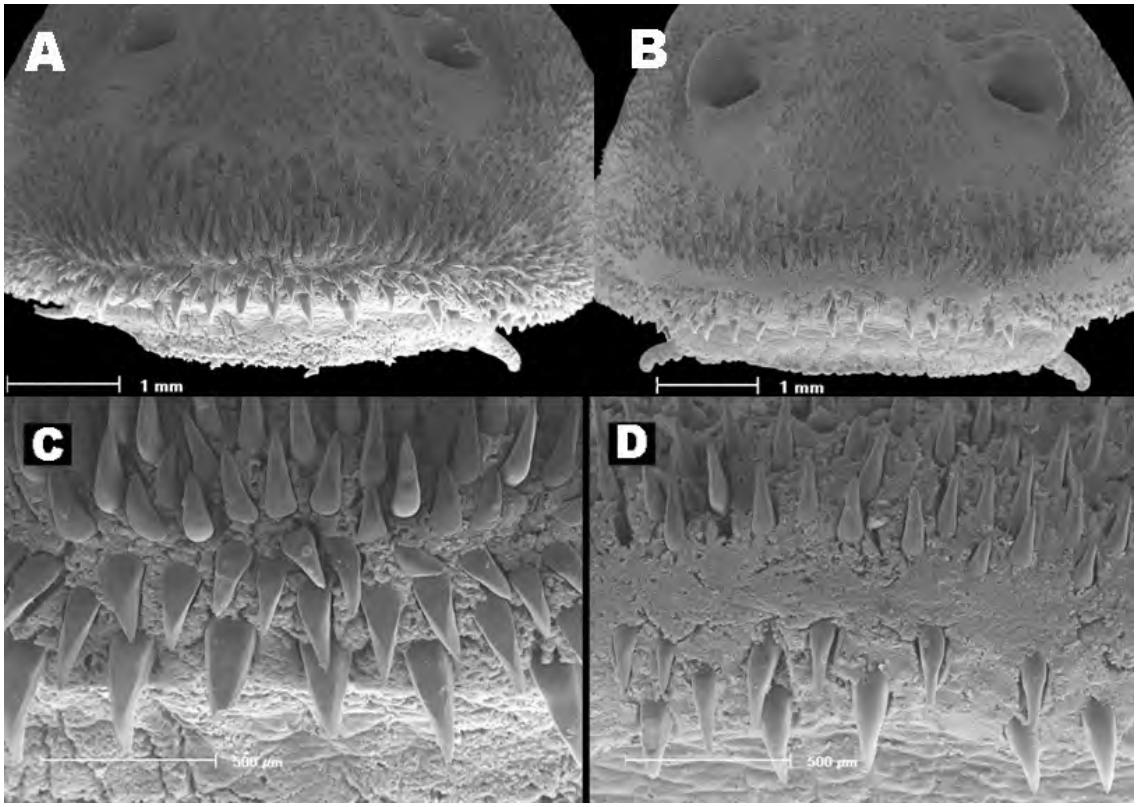


Fig. 2. Scanning electron microscope images of anterior tip of snout. *Hisonotus armatus*, MCP 37682, 40.1 mm SL (A, C), showing the snout completely covered by odontodes and *Hisonotus laevior*, MAPA 1755, 40.9 mm SL (B, D), showing a stripe devoid of odontodes.

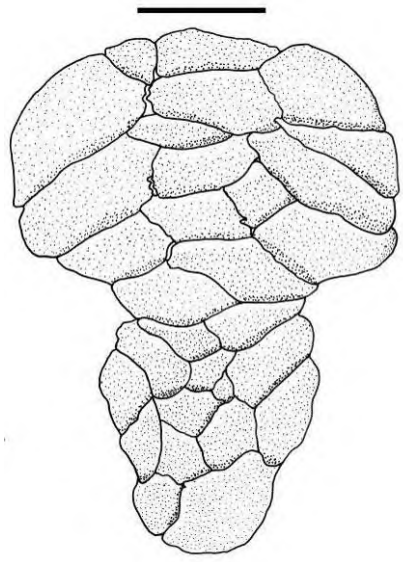


Fig. 3. Arrangement of abdominal plates in *Hisonotus armatus*, female, MCP 25138, 42.5 mm SL. Anterior toward top. Scale bar represents 2 mm.

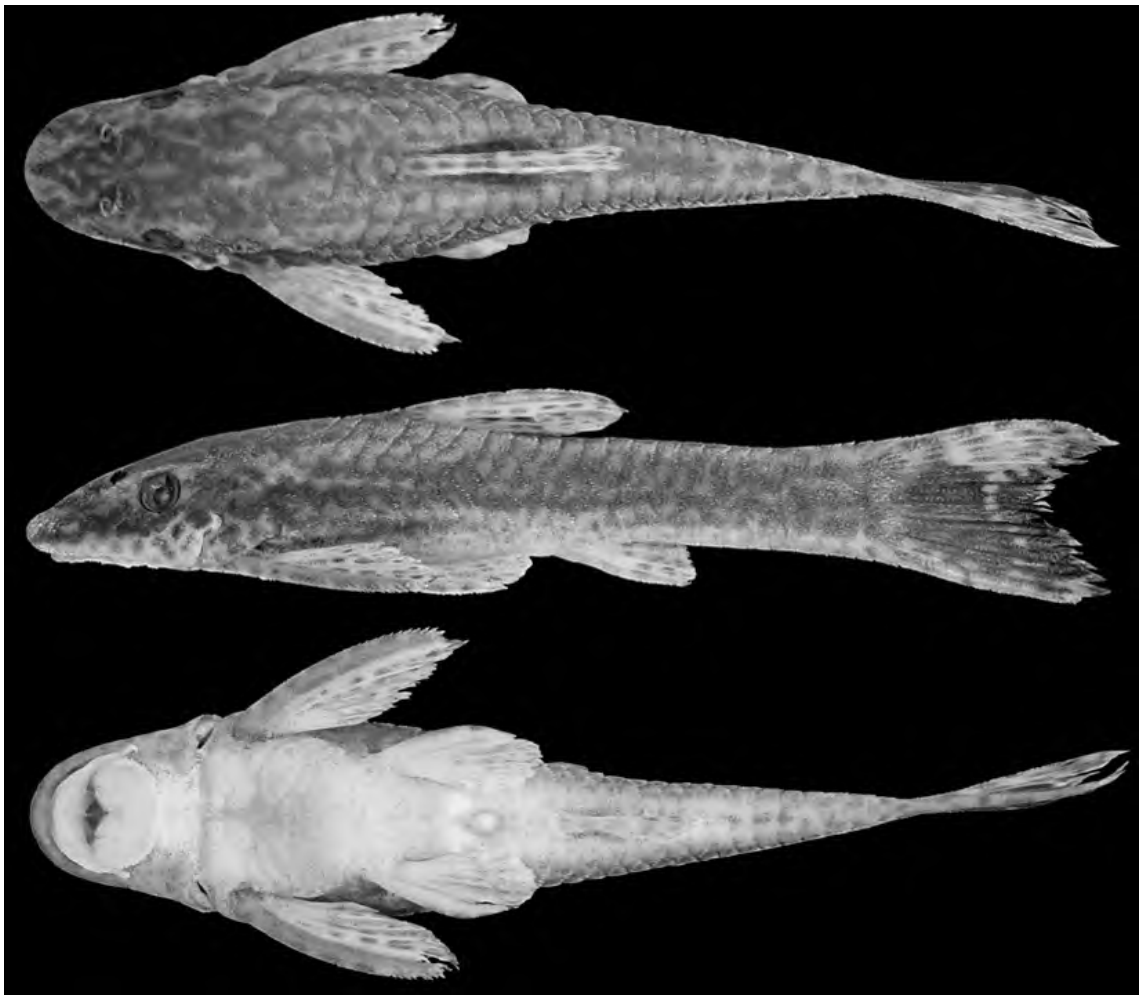


Fig. 1. *Hisonotus armatus*, holotype, MCP 41323, 44.4 mm SL, female, Brazil, Rio Grande do Sul, Pedro Osório, Arroio Arambaré, about 5 km south of Vila Basílio, on road to Pedro Osório.

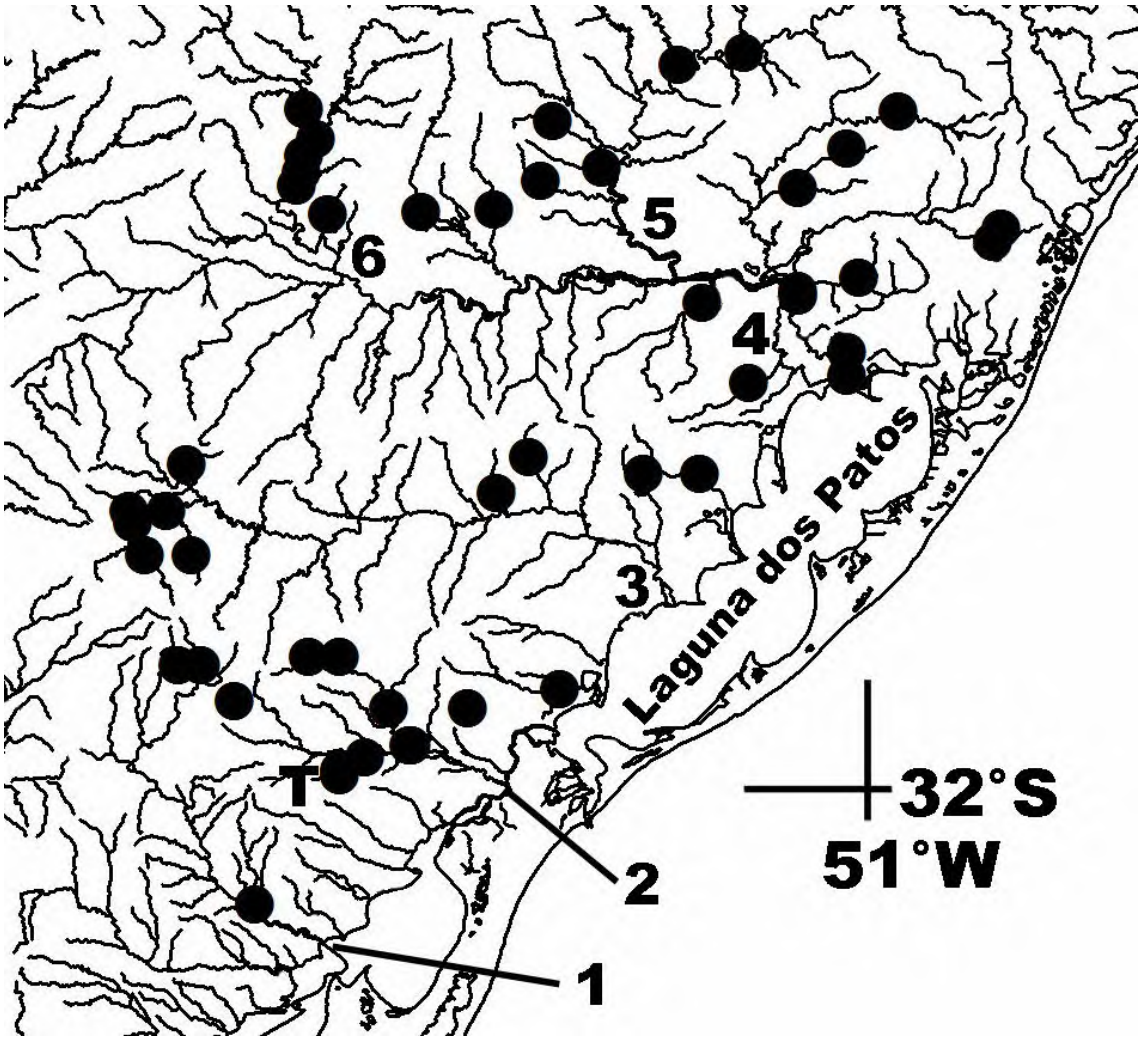


Fig. 4. Geographic distribution of *Hisonotus armatus* in the Laguna dos Patos basin, T indicates type-locality. 1 – Rio Jaguarão, 2 – Canal de São Gonçalo, 3 – Rio Camaquã, 4 – Lago Guaíba, 5 – Rio Taquari, 6 – Rio Jacuí.

TABLE 1. Morphometrics and meristics of *Hisonotus armatus* including 40 types plus 20 non-types specimens. SD = Standard deviation, n = number of specimens, and H = holotype.

	Types + non-types					
	H	n	Low	High	Mean	SD
Standard length (mm)		63	27	45.9	38.2	-
Percent of Standard Length						
Head length	34.4	63	31.7	38.2	34.3	1.22
Predorsal Length	47.4	63	44.0	51.3	46.7	1.27
Dorsal-finspine length	26.8	63	22.5	27.7	25.2	1.36
Anal-fin spine length	16.9	63	13.7	17.9	16.2	0.98
Pectoral-fin spine length	27.2	63	20.9	28.1	25.8	1.46
Pelvic-fin spine length	17.0	63	15.1	21.4	18.1	1.68
Cleitral width	25.0	63	21.9	25.4	23.7	0.81
Thoracic length	16.9	63	14.8	18.5	16.6	0.79
Abdominal length	21.9	63	16.4	22.4	20.6	1.13
Body depth at dorsal-fin origin	19.8	63	16.2	20.9	18.5	1.01
Caudal-peduncle length	31.9	63	30.3	35.0	32.8	1.16
Caudal-peduncle length	12.0	63	9.9	12.7	11.2	0.56
Percent of Head Length						
Snout Length	50.2	63	47.1	53.3	50.2	1.32
Orbital diameter	16.7	63	14.8	18.5	16.7	0.86
Interorbital width	40.5	63	37.8	46.5	42.5	1.90
Head depth	49.9	63	43.4	53.8	49.1	2.30
Suborbital depth	18.6	63	15.7	21.6	19.1	1.10
Mandibular ramus	8.6	63	6.9	10.5	8.5	0.75
Meristics						
Left premaxillary teeth	15	61	14	21	17.7	1.69
Right premaxillary teeth	17	62	15	23	17.7	1.66
Left dentary teeth	16	63	11	19	15.0	1.39
Rigth dentary teeth	15	63	12	20	15.0	1.65
Left lateral scutes	24	63	24	25	24.3	0.48
Rigth lateral scutes	24	63	23	25	24.3	0.54

Capítulo II

Taxonomic review of *Hisonotus* (Siluriformes: Loricariidae: Hypoptopomatinae) from the laguna dos Patos system, Southern Brazil and Northeastern Uruguay

Taxonomic review of *Hisonotus* (Siluriformes: Loricariidae: Hypoptopomatinae) from the laguna dos Patos system, Southern Brazil.

Abstract

The species of *Hisonotus* from the laguna dos Patos system are reviewed. Two species with wide distributions are redescribed: *Hisonotus laevior* and *H. nigricauda*. Six new species are described from that system: *Hisonotus* sp. "Camaquã" from the rio Camaquã drainage; *Hisonotus* sp. "Felício" and *Hisonotus* sp. "Passo Novo" from rio Jacuí drainage; *Hisonotus* sp. "Sinos", widely distributed in the tributaries of rio Jacuí basin; *Hisonotus* sp. "Prata" and *Hisonotus* sp. "Carreiro", both endemic from the headwaters of rio Taquarí drainage. *Hisonotus leptochilus* is here considered junior synonym of *H. laevior.* In total, twelve species of *Hisonotus* are present in the laguna dos Patos system. Their distributions are discussed, species are illustrated and a taxonomic key is provided.

Resumo

As espécies de *Hisonotus* do sistema da laguna dos Patos são revisadas. Duas espécies com amplas distribuições são redescritas: *Hisonotus laevior* e *H. nigricauda*. Seis novas espécies são descritas deste sistema. *Hisonotus* sp. "Camaquã", da drenagem do rio Camaquã; *Hisonotus* sp. "Felício" e *Hisonotus* sp. "Passo Novo", da drenagem do rio Jacuí; *Hisonotus* sp. "Sinos", amplamente distribuída nos tributários da bacia do rio Jacuí; *Hisonotus* sp "Prata" e *Hisonotus* sp. "Carreiro", ambas endêmicas das cabeceiras do rio Taquari. *Hisonotus leptochilus* é considerado sinônimo junior de *H. laevior.* No total, doze espécies de *Hisonotus* estão presentes no sistema da laguna dos Patos sendo suas distribuições aqui discutidas. As espécies são ilustradas e uma chave de identificação é fornecida.

Introduction

Hisonotus belongs to the Hypoptopomatinae, a monophyletic group of small loricariids including more than 80 species grouped in 18 genera (Schaefer, 2003 Reis & Carvalho, 2007), distributed in the cis-Andean drainages from Venezuela to northern Argentina. *Hisonotus* was described by Eigenmann & Eigenmann (1889) based on the following diagnostic characters: belly with large plates, eyes superior, and humeral plate imperforate. The type-species, *Hisonotus notatus*, was collected in the rio Grande (arroio Fundo), in the neighborhood of the city of Rio de Janeiro by the Emperor of Brazil, Dom Pedro II in 1865, for the Thayer Expedition (Higuchi, 1992). Regan (1904) conducted the first revision of loricariids, and placed *Hisonotus*, *Parotocinclus*, and *Microlepidogaster* under the synonymy of *Otocinclus*. After that, *Hisonotus* was considered as a junior synonym for a long period, with its species described first as *Otocinclus*, then as *Microlepidogaster*. *Hisonotus* was resurrected by Schaefer (1998), being diagnosed by reduced or absent snout plates anterior to the nostril, rostrum with enlarged odontodes, and plates forming the lateral rostral margin thickened (Schaefer, 1998, p. 387). Notwithstanding, those diagnostic features were discussed by Britski & Garavello (2007, p. 6), being considered variable among species of *Hisonotus* and not exclusive to the genus.

The position of *Hisonotus* within Hypoptopomatinae diverges to some degree in the phylogenetic analyses of the subfamily (Schaefer, 1998 Gauger & Buckup, 2005 and Lehmann, 2006). In the first analysis (Schaefer, 1998), *Hisonotus* appears relatively basal within Otothyrini, but more derived than *Parotocinclus* and "New Taxon 3". In the hypothesis proposed by Gauger and Buckup (2005), the monophyletic status of Otothyrini is not corroborated, and *Hisonotus* is the sister group to *Parotocinclus*. Finally, Lehmann's (2006) hypothesis corroborated the non-

monophyly of Otothyrini and *Hisonotus* is also relatively basal within hypoptopomatinae, more derived than *Eurycheilichthys*, the paraphyletic *Parotocinclus*, and *Epactionotus*.

The first hypoptopomatinae species described for the laguna dos Patos system was *Otocinclus nigricauda*. It was described by Boulenger (1891), based on the material collected by Dr. Hermann von Ihering and Herr Sebastian Wolff in the Province (presently State) of Rio Grande do Sul, which had been sent to the British Museum of Natural History. This species was transferred to *Hisonotus* by Cope (1894) based on the examination of a fish collection from the Rio Jacuhy (rio Jacuí) made by Mr. Herbert Smith. In that work, Cope described several new species including *Hisonotus laevior* and *Hisonotus leptochilus*, and presented diagnostic comparisons between the four species pertaining to the genus, at that time. After a long period, another species of *Hisonotus* was described from the laguna dos Patos system, *Microlepidogaster taimensis* Buckup, 1981 from the marshes of the Taim region. Nowadays, *Hisonotus* consists of 18 nominal species (Schaefer, 2003□Britski & Garavello, 2007□Azpelicueta et al., 2007), occurring in the Atlantic coastal drainages of southern and southeastern Brazil, Río de La Plata system, laguna dos Patos system, and recently extended to the Amazon basin in the rio Tapajós drainage (Britski & Garavello, 2007).

Buckup (1981, p. 19) had already cited the difficulties in the study of hypoptopomatines from southern Brazil were in part due to the limitation of the species description and the lack of recent reviews. The main purpose of this paper is to describe the taxonomic composition of the genus *Hisonotus* in the laguna dos Patos system, in southern Brazil. In this work I am redescribing *H. nigricauda* and *H. laevior* (senior synonym of *H. leptochilus*), and describing six new species, with an identification key for *Hisonotus* in this hydrographic system. Besides that, the endemism for the headwater tributaries, and for the system as a whole, is discussed. This work is part of my master in sciences thesis at the Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS),

71 entitled taxonomic review of the species of *Hisonotus* (Siluriformes: Loriicaridae) from the rio
72 Uruguay basin and the laguna dos Patos system.
73
74 **Material and Methods**
75
76 **Geography.** The laguna dos Patos system is located in the southeast portion of the Brazilian
77 state of Rio Grande do Sul and a minor portion in northeastern Uruguay. The main water bodies that
78 compose the system are the laguna dos Patos (9.280 km^2), the laguna Mirim (3.520 km^2), and its
79 main tributaries rio Jaguarão, rio Camaquã, and rio Jacuí (Fig. 1). The entire hydrographical system
80 is connected to the Atlantic Ocean by the barra de Rio Grande in the city of Rio Grande. The system
81 is limited at north by the tributaries of rio Uruguai and rio Pelotas; at northwest by the tributaries of
82 rio Ijuí; at west by the tributaries of rio Ibicuí; and at southwest by tributaries of the rio Negro, all
83 part of the rio Uruguai basin. In the eastern portion, the system is limited by the coastal plain, a
84 narrow sandy band (5 to 30 km wide), parallel to the coastal line, presenting a great number of
85 shallow lakes and lagoons, forming at the northeast portion, the rio Tramandaí system (Malabarba,
86 1989 and Schwartzbold & Schaefer, 1984). The major tributary of the laguna dos Patos system is
87 the rio Jacuí basin, which flows into the lago Guaíba in the northern portion of the laguna dos Patos.
88 That basin is formed by several tributaries, including the drainages of rio dos Sinos, rio Caí, rio
89 Taquari, and rio Jacuí itself (Fig. 1).
90 **Collections.** The specimens examined are deposited in the following institutions
91 (abbreviations in parentheses), listed in alphabetic order of the abbreviations: Asociación
92 Ictiológica, La Plata (AI); Academy of Natural Sciences of Philadelphia (ANSP); Natural History
93 Museum, London (BMNH); Coleção Ictiológica Morevy Cheffe, Pelotas (CIMF); Instituto de
94 Limnología “Dr. Raúl A. Ringuelet”, La Plata (ILPLA); Museo Argentino de Ciências Naturales

Bernadino Rivadavia, Buenos Aires, (MACN-ict) Museu Anchieta, Porto Alegre (MAPA) Fundação Zoobotânica do Rio Grande do Sul/Museu de Ciências Naturais, Porto Alegre (MCN) Museu de Ciências da Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre (MCP) Muséum d'Histoire Naturelle, Geneve (MHNG) Museo de La Plata, La Plata (MLP) Museu Nacional, Rio de Janeiro (MNRJ) Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP) Natuhistorisches Museum, Wien (NMW) Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicültura, Maringá (NUP) Universidade Federal do Rio Grande do Sul, Porto Alegre (UFRGS) Zoologisches Sammlung des Bayerischen Staates, Munique (ZSM) Faculdade de Ciências Universidad de La República, Montevideo (ZVC-P).

Morphology. Measurements were made to the nearest 0.1 mm with digital calipers under a stereomicroscope on the left side of specimens. The measurements and their abbreviations are the following: Standard length (SL), measured from the anterior margin of the snout to the end of vertebral column (hypural plate). Head length (HL) is the distance between the anterior margin of the snout and the posterior tip of the parieto-supraoccipital process. Predorsal length (PdL) is the distance between the anterior margin of the snout and the posterior portion of the dorsal-fin spinelet. Dorsal-fin spine length (DL), measured from the anterior origin of dorsal-fin spine to the posterior end of the dorsal-fin spine. Anal-fin unbranched ray length (AL), measured from the anterior origin of anal-fin to posterior end of anal-fin unbranched ray. Pectoral-fin spine length (PL) is the distance from the insertion of the pectoral-fin spine to the posterior end of the ossified portion of the spine. Pelvic-fin unbranched ray length (VL) measured from the anterior origin of the pelvic fin to the posterior end of the pelvic-fin unbranched ray. Cleithral width (CW) is the longer distance between the lateral portions of the cleithrum. Thoracic length (TL) is the distance between the insertion of the pectoral-fin spine and the insertion of the pelvic-fin unbranched ray. Abdominal length (AbL) is the distance between the pelvic-fin insertions and the anal-fin origin, along the median line of the

body. Body depth at dorsal-fin origin (BD) is the distance between the dorsal-fin spinelet and the ventral abdominal region. Caudal-peduncle length (CPL) is the distance between the posterior end of the anal-fin insertion and the posterior end the vertebral column (hypural plate). Caudal peduncle depth (CPD) is the transversal depth at the posterior end of caudal peduncle. Snout length (SnL) is the distance from the anterior margin of the snout to nearest edge of orbit. Orbital diameter (OD) is the horizontal diameter of bony orbit. Interobital width (IW) is the least distance between orbits. Head depth (HD) is the distance between the tip of parieto-supraoccipital bone to the ventral limit of the body. Suborbital depth (SD) is the distance between the lower margin of the bony orbit and ventrolateral limit of the head. Mandibular ramus (MR) is the width of the longer axis of the dentary. All measurements are shown in Figure 2. Morphometric data are expressed as percents of standard length (SL), except for subunits of the cephalic region that are expressed as percents of head length (HL). Plate counts and nomenclature follow the schemes of serial homology proposed by Schaefer (1997). Vertebral counts included all vertebrae (including the first five vertebrae incorporated into the Weberian apparatus), with the compound caudal centrum (PU1+U1) counted as one element. Accessory patch of teeth is that described by Reis & Schaefer (1992). Cleared and stained specimens (c&s) were prepared according to the method of Taylor & Van Dyke (1985). Whenever available, juvenile specimens were also cleared and stained. Juvenile designation was used for specimens not totally covered by plates with an anterior paired crest of odontodes on the parieto-supraoccipital and for males without a fleshy flap on the first thickened pelvic-fin ray, adults presenting the opposite states. Scanning electron microscope pictures were taken from dissected alcohol preserved specimens. Drawings were prepared from c&s specimens using a Zeiss SV8 stereomicroscope with camera lucida. Abbreviations of bones in Figures are: F = frontal io1-io5 = infraorbitals LEE = lateral ethmoid exposed area NA = nasal NP = nuchal plate OS = orbitosphenoid PD = predorsal plates PF = prefrontal plate PN = pre-nasal plates PO = prootic

pr1-pr4 = postrostral plates; PS = parasphenoid; PSB = palatine sesamoid bone; PTS = pterosphenoid; PT-SC = compound pterotic; RP = rostral plate; SOC = parieto-supraoccipital; SP = sphenotic.

Statistical analyses. Principal component analysis (PCA) was made to check overall variation among samples including differences in morphometrics among species, being an input to multiple regressions. Analyses were made using all measurements listed above except for the pelvic-fin unbranched ray length (VL), which is strongly correlated with the sexual dimorphism, and the mandibular ramus (MR) due to be an imprecise measurement. Fin-spine measurements were removed whenever presenting missing entries. PCA on covariances of logarithmically transformed measurements were obtained using Past version 1.28 2004 (Ryan et al., 1995). The first principal component was partioned out, considering that it mostly accounts for size variation (Strauss, 1985). Factor scores were plotted in the Sigma Plot version 6.10 2000 (Brannan et. al., 2000). Multiple linear regressions were applied to describe morphometric differences among species or populations of the same species.

Results

Hisonotus nigricauda (Boulenger, 1891).

(Figures 3-4, Table 1)

Otocinclus nigricauda Boulenger, 1891: 234 [original description, type locality: Rio Grande do Sul, Brazil].-Regan, 1904:268-269 [redescription, senior synonym of *Hisonotus laevior* and *Hisonotus leptochilus*].-Isbruecker, 1980:84 [listed].-Schaefer, 1991:23 [Phylogenetic relationships of Hypoptopomatinae]

Hisonotus nigricauda.-Cope, 1894:97 [compared with *Hisonotus laevior* and *Hisonotus leptochilus* and new generic combination].-Schaefer, 1998:383 [transferred to *Hisonotus*].-Schaefer, 2003:232 [listed].-Reis & Carvalho, 2007:84 [listed].-Ferraris, 2007:248 [listed].

Microlepidogaster nigricauda.-Eigenmann, 1910:413 [listed].-Gosline, 1945: 101 [listed].-Fowler, 1959:166-167 [listed and illustrated].-Schaefer, 1997:8 [listed].-Malabarba, 1989:150 [type-locality restricted to laguna dos Patos system, probably rio Camaquã].

Material examined. From laguna dos Patos system, Rio Grande do Sul, Brazil: BMNH 91.3.16.53-62, syntypes of *Otocinclus nigricauda*, 9, 24.8-31.8 mm SL, Rio Grande do Sul, Brazil. **Rio Jacuí drainage:** ANSP 21565, 2, 21.3-22.4, rio Jacuí. MCN 16246, 10, 23.7-34.1 mm SL, Porto Alegre, Parque Estadual Delta do Jacuí, Saco da Pólvora, 30°01'S 51°14'W. MCP 19834, 12, 25.6-40.2 mm SL, Amarópolis, creek tributary of rio Jacuí in the sylviculture Santo Amaro, 29°55'S 51°55'W. MCP 20543, 1, 31.1 mm SL, Porto Alegre, rio Jacuí on Saco da Alemoa, 30°00'00"S 51°14'51"W. **Rio Vacacaí drainage:** MCP 19584, 33 + 3 c&s, 22.7-39.1 mm SL, São Gabriel, bridge on road between São Gabriel and Tiaraju, 30°17'29"S 54°20'18"W. MCP 26756, 5, 24.2-29.5 mm SL, São Gabriel, marsh of arroio Piraí, 30°17'07"S 54°20'33"W. **Lago Guaíba drainage:** MAPA 1737, 1, 26.7 mm SL, Gravataí, arroio Passo dos Ferreiros tributary of rio Gravataí, 29°56'S 50°58'W. MCN 17416, 10, 22.0-32.3 mm SL, Tapes, arroio Guará tributary of arroio Araçá on road between Barra do Ribeiro and Tapes, 30°29'14"S 51°23'39"W. MCN 18048, 12, 17.8-34.8 mm SL, Tapes, arroio Guará tributary of arroio Araçá on road between Barra do Ribeiro and Tapes, 30°29'14"S 51°23'39"W. MCP 13781, 1, 28.4 mm SL, Eldorado do Sul, creek at highway BR-290, about 2 km from highway BR-116, 30°03'S 51°23'W. MCP 13949, 10, 22.3-31.8 mm SL, Eldorado do Sul, creek at highway BR-290, about 2 km from highway BR-116, 30°03'S 51°23'W. MCP 15059, 3, 29.4-30.6 mm SL, Gravataí, marsh at highway RS-118, about

500 meters from highway BR-290, 29°58’S 50°56’W. MCP 15766, 3, 27.1-30.1 mm SL, Eldorado do Sul, creek at highway BR-290, about 2 km from highway BR-116, 30°03’W 51°21’S. MCP 21165, 4, 26.8-29.5 mm SL, Eldorado do Sul, creek at margins of highway BR-290, 30°02’36”S 51°20’56”W. MCP 28589, 8, 23.1-32.3 mm SL, Eldorado do Sul, creek at highway BR-290, about 2 km from highway BR-116, 30°03’W 51°21’S. MCP 28986, 11, 24.7-34.3 mm SL, Eldorado do Sul, arroio Passo dos Carros, 30°05’S 51°23’W. UFRGS 2361, 25, 21.1-32.4 mm SL, Eldorado do Sul, arroio Passo dos Carros, 30°05’S 51°23’W. **Laguna dos Patos drainage:** MCP 17677, 6, 19.8-24.7 mm SL, Pelotas, old drainage channel near to Passo do Tabajara, marsh of Pontal da Barra in Laranjal, 31°47’S 52°14’W. MCP 23855, 33, 23.1-34.1 mm SL, Sentinela do Sul, arroio Velhaco on road between Cerro Grande do Sul and Camaquã, 30°41’22”S 51°41’51”W. MCP 23858, 4, 27.2-28.9 mm SL, Sentinela do Sul, arroio do Tigre tributary of arroio Velhaco on road from Cerro Grande do Sul to Camaquã, 30°44’30”S 51°46’26”W. **Rio Camaquã drainage**: MCP 17416, 20 + 3 c&s 25.5-39.1 mm SL, Camaquã, marsh at rio Camaquã in Pacheca, 31°08’S 51°47’W. MCP 19701, 1, 27.2 mm SL, Encruzilhada do Sul, arroio Passo da Miséria on road between Encruzilhada do Sul and Canguçu, 30°57’S 52°26’. MCP 25881, 51, 15.8-36.7 mm SL, Caçapava do Sul, creek tributary of arroio Seival on road between Lavras do Sul and Capaçava do Sul, 30°44’00”S 53°42’04”W. MCP 25875, 1, 34.2 mm SL, Caçapava do Sul, small creek tributary to arroio Hilário on road between Caçapava do Sul and Lavras do Sul, 30°44’24”S 53°44’51”W. MCP 40761, 10 + 3 c&s, 31.0-38.2 mm SL, Bagé, arroio Banhado Grande on highway BR-153 between Bagé and Caçapava do Sul, 31°14’34”S 053°52’50”W. **São Gonçalo drainage**: MCP 17415, 32, 27.7-34.9 mm SL, Pelotas, dead channel of rio Pelotas, marginal of highway BR-116 in Retiro, 31°37’S 52°20’W. MCP 17577, 4, 25.1-31.6 mm SL, Pelotas, arroio Totó on road to colonia Z-3, 31°46’S 52°20’W. **Laguna Mirim drainage:** MCP 11134, 2, 28.2-35.0 mm SL, Arroio Grande, arroio Xasqueiro on highway BR-116 between Pelotas and Arroio Grande, 32°09’ S 53°02 W. **From rio**

Uruguai basin: rio Ibicuí drainage: MCP 9270, 10, 17.0-29.7 mm SL, Brazil, Mata, creek on road Between Santa Maria and Mata, 29°33'S 54°27'W. MCP 9386, 10, 14.5-24.3 mm SL, Brazil, Cacequi, rio Ibicuí on bridge between São Rafael and Cacequi, 29°41'S 54°41'W. MCP 9473, 9, 20.3-32.5 mm SL, Brazil, São Vicente do Sul, arroio do Salso, road from São Vicente do Sul to Santiago, 29°34'S 54°42'W. MCP 9643, 33, 22.1-34.1 mm SL, Brazil, Dom Pedrito, rio Santa Maria at km 246 of highway BR-293, between Dom Pedrito and Santana do Livramento, 30°59'S 54°42'W. MCP 14145, 1, 24.5 mm SL, Brazil, Rosário do Sul, creek on road between Rosário do Sul and Santana do Livramento, 30°18'45"S 54°59'49"W. MCP 14166, 1, 34.1 mm SL, Brazil, Rosário do Sul, arroio Santo Antonio on road between Rosário do Sul and Santana do Livramento, 30°18'S54°59'W. MCP 14214, 1, 33.2 mm SL, Brazil, Santana do Livramento, pools at side of rio Santa Maria on road between Dom Pedrito and Santana do Livramento, 30°59'S 54°42'W. MCP 15831, 1, 25.6 mm SL, Brazil, Dom Pedrito, rio Santa Maria at km 246 of highway BR-293, between Dom Pedrito and Santana do Livramento, 30°59'S 54°42'W. MCP 16161, 2, 15.5-28.9 mm SL, Brazil, Santana do Livramento, lateral pools on road to Campo Seco, 15 km east from highway BR-158, 30°42'S 55°04'W. MCP 19593, 13, 22.3-33.5 mm SL, Brazil, São Gabriel, bridge over Banhado do Inhatium, highway BR-290, 30°15'43"S 54°31'33"W. MCP 23149, 11, 26.0-31.4 mm SL, Brazil, São Francisco de Assis, rio Inhacunda at São Francisco de Assis going to Manoel Viana, 29°32'51"S 55°08'11"W. MCP 25249, 1, 33.6 mm SL, Brazil, São Francisco de Assis, rio Inhacunda at São Francisco de Assis about 500 meters from pottery, 29°32'27"S 55°07'45"W. MCP 25250, 4, 27.4-32.3 mm SL, Brazil, São Francisco de Assis, rio Inhacunda at São Francisco de Assis going to Manoel Viana, 29°32'51"S 55°08'11"W. MCP 25251, 15, 29.1-34.9 mm SL, Brazil, São Francisco de Assis, creek affluent to rio Inhacunda at São Francisco de Assis about 300 meters from pottery. MCP 26865, 88 + 3 c&s, 22.7-38.5 mm SL, Brazil, Rosário do Sul, arroio do Salso on the highway BR-158, affluent of rio Ibicuí da Armada, 30°22'27"S

55°02’07”W. MCP 27608, 14, 16.2-35.9 mm SL, Brazil, São Francisco de Assis, arroio Caraí-Passo on road from São Francisco de Assis to Manoel Viana, 29°31’03”S 55°10’49”W. UFRGS 8241, 23, 23.7-34.5 mm SL, Brazil, Rosário do Sul, creek at the margin of highway BR-290, 10 km from Rosário do Sul, 30°12’S 55°03’W. **Río Negro drainage:** MCP 10000, 34, 15.4-30.1 mm SL, Uruguay, Cerro Largo, lagoon 10 m from Río Negro at Arreria, 31°50’S 54°28’W. UFRGS 7183, 17, 29.2-32.5 mm SL, Uruguay, Durazno, arroyo Maestre de Campo, on road to Polanco de Yi, tributary of Río Yí, 33°24’55”S 56°12’06”W. UFRGS 9243, 7, 29.3-35.5, Uruguay, Rivera, arroyo Batovi on ruta 27, at km 24, Rio Tacuarembó drainage. UFRGS 9241, 1, 37.3 mm SL, Uruguay, Rivera, arroyo Cunãpiru on km 12 of ruta 27, Río Tacuarémbo drainage, 31°02’21”W 55°29’31”S. UFRGS 9243, 5 + 1 c&s, 30.2-36.5 mm SL, Uruguay, Rivera, lateral pools and arroyo Corrales on ruta 27, tributary of Río Tacuarembó, 31°23’26”S 55°15’14”W. **Other drainages and rio Uruguai:** ILPLA 238, 9, 18.5-25.8 mm SL, Argentina, Corrientes, arroyo Cuay Grande, 28°41’S 56°14’W. MAPA 2493, 15, 23.6-33.6 mm SL, Brazil, Barra do Quarai, arroio Quaraí-Chico, MCP 11568, 4, 23.2-29.1 mm SL, Brazil, Uruguaiana, rio Touro Passo, 29°38’S 56°56’W. MCP 16190, 2, 24.4-26.2 mm SL, Brazil, São Marcos, marginal lagoon of rio Uruguai at praia da Formosa, 29°30’S 56°49’W. MCN 16592, 6, 18.7-33.7 mm SL, Brazil, Itaqui, pool at side of highway BR-472, in marsh drainage canal, Reserva Biológica Estadual de São Donato, 29°00’S 56°10’W. MCN 16639, 1, 28.9 mm SL, Brazil, Maçambará, canal at Reserva Biológica Estadual de São Donato, 29°00’S 56°10’W. MCN 16759, 7, 18.7-33.7 mm SL, Brazil, Itaqui, creek on highway BR-472 between Itaqui and São Borja, Reserva Biológica Estadual de São Donato, 29°00’S 56°10’W. MCN 16887, 5, 17.4-23.4 mm SL, MCN 16951, 29, 15.0-31.3 mm SL, Brazil, Itaqui, creek on highway BR-472 between Itaqui and São Borja, Reserva Biológica Estadual de São Donato, 29°00’S 56°10’W. MCP 16964, 5, 16.1-33.9 mm SL, Brazil, Itaqui, Reserva Biológica Estadual de São Donato, 29°00’S 56°10’W.

Diagnosis. *Hisonotus nigricauda* differs from its congeners, except from *Hisonotus maculipinnis* and *Hisonotus* sp. "Prata", by lacking the posterior portion of the lateral line (Fig. 5), vs. posterior portion of lateral line present. Differs from *H. maculipinnis* and *H.* sp. "Prata" by having an almost completely dark caudal fin, without hyaline areas in the middle portion, vs. caudal fin presenting hyaline areas in the middle portion (see remarks for *H. maculipinnis* diagnose).

Description. Morphometrics and meristics Table 1. Adult size small to medium for members of this genus (less than 40 mm in SL). Body robust, not elongated. Head and body without conspicuous keels. Caudal peduncle round in cross section. Dorsal profile slightly convex from snout tip to dorsal-fin origin except sligthly concave profile anterior to nares. Straight and posteroventrally sloped at dorsal-fin base, and almost straight from that point to caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth at posterior end of caudal peduncle. Posterior profile of caudal-fin margin slightly concave. Head and snout broad, snout rounded to somewhat square in dorsal view, body progressively narrowing posterior to pectoral-fin insertion. Snout region anterior of nares concave, interorbital region slightly convex. Upper margin of orbit somewhat elevate. Eye dorsolaterally positioned. Iris operculum present.

Pectoral fin I,6. Pectoral-fin posterior margin almost straight when depressed tip extending to middle of pelvic fin. Posterior margin of pectoral-fin spine smooth in adults and juveniles. Pectoral-fin axillary slit present, located below posterior bony margin of cleithral process. Pelvic fin i,5. Tip of depressed pelvic fin not reaching anal-fin origin in females, but extending beyond that point in males. Dorsal fin II,7. Dorsal-fin origin located just posterior of vertical through pelvic-fin origin. Dorsal-fin spinelet somewhat round in shape. Anal fin i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent. Caudal fin i,14,i.

Body almost entirely covered by plates except for region overlying opening of swim bladder capsule, area between pectoral girdle and lower lip, region around anus, and area around base of

paired fins. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened, with narrow odontode free band between dorsad and ventrad series of odontodes (Fig.6), odontode-free area sometimes absent or inconspicuous in smaller specimens (Fig. 7). Snout plates anterior to nares reduced, small unplated area between rostrum and nares (Fig. 8). Two or three rows of predorsal plates (modally three Fig. 9). Median series formed by 22–24 plates (Tab. 2). Lateral line incomplete, anterior portion short, formed by one to three plates. Posterior portion of lateral line absent. Median plate series usually truncated (Fig. 5). Plates of median abdominal plate series very small, great in number, irregularly arranged. Lateral abdominal plates larger, forming regular series of about four to seven plates on each side (Fig. 10). Coracoid and cleithrum exposed and covered by odontodes, except for median region of cleithrum between arrector fossae openings and medial region of coracoids.

Head without conspicuous crests. Head, fin-spines, and body plates covered with odontodes, these larger on anterior surface of all fin spines, medially directed on pelvic fin. Odontodes on head uniform in size and distribution, except for enlarged odontodes on ventral and dorsal margins of rostrum (Fig. 6 and 7). Odontodes on posterior parieto-supraoccipital tip not enlarged, about same size as surrounding areas. Anteroventral margin of compound pterotic with median-to-large size perforations. Infraorbital canal entering infraorbital series via sphenotic. Lips roundish and papillose. Maxillary barbel present.

Premaxillary and dentary teeth slender proximally and flattened distally bifid, major (medial) cusp large and rounded, minor (lateral) cusp pointed. Accessory patch of teeth absent on dentary and premaxilla.

Hypurals 1-2 and 3-5 not completely fused, median notch on posterior margin of caudal-fin skeleton extending anteriorly. Total vertebrae 27-28 (4 c&s), one c&s presenting 25 apparently anomalous.

Color in alcohol. Ground color of dorsal and lateral surfaces gray to almost black. Dorsal and dorsolateral body surfaces slightly lighter than lateral surface, except for head, which is darker. Ventral surface of body heavily pigmented. Area anterior to nares lighter but not forming conspicuous longitudinal light stripes. Fins mostly hyaline, except for several transverse dark bands. Caudal fin almost completely dark pigmented, except for hyaline area on posterior portion of three uppermost branched rays. That hyaline portion, and the unbranched rays of caudal fin with striped pattern of transverse dark bars.

Sexual dimorphism. Characterized by the urogenital papilla, positioned just behind the anal opening in males. Adult males also possess a developed fleshy flap along the dorsal margin of first thickened pelvic-fin ray, that is absent in females. Flap slightly wider basally and progressively narrowing distally. In adult males, the first and second branched rays of pelvic fin present a fleshy flap in its anteromedial portion. In juvenile males all flaps are smaller or absent. Males have a longer pelvic-fin unbranched ray that extends beyond the anal-fin origin, with the ray never reaching that point in females.

Distribution and habitat. *Hisonotus nigricauda* is widely distributed in the laguna dos Patos system and in the rio Uruguai basin. In the laguna dos Patos system that species is found mostly in the lower portions of the drainages near the laguna do Patos, being absent in the upper portions of rio Jacuí basin. In the same manner, *H. nigricauda* is most commonly collected in the lower portions of the rio Uruguai basin, but being found in the headwaters of rio Negro, rio Quaraí, and rio Ibicuí drainages (Fig. 11). *Hisonotus nigricauda* is apparently absent in the rio Uruguai basin above the mouth of rio Ibicuí. This species inhabits slow flowing watercourses, of brown waters running over dark organic matter and sandy bottom. The individuals were found in between marginal and aquatic vegetation (Fig. 12).

Remarks. *Hisonotus nigricauda* is morphologically similar to *Hisonotus maculipinnis* (Regan, 1912). Both nominal species are morphometrically identical (Fig. 13), however, they can be tentatively distinguished by the following features: *H. nigricauda* presents an almost completely dark caudal fin contrasting with a caudal fin presenting hyaline areas in most specimens of *H. maculipinnis* (including the type-series), especially in juvenile specimens (Fig. 14). Moreover, most specimens of *H. nigricauda* posses a narrow odontode-free area between dorsal and ventral series of odontodes on the anterior margin of snout, which is not seen in *H. maculipinnis* specimens. These features slightly distinguish the forms, and both seem to be part of a complex ihabiting the lower portions of the Paraná-Paraguay and laguna dos Patos systems. It is possible that *H. maculipinnis* and *H. nigricauda* are conspecific. Since a possible synonymization is beyond the purposes of this work, the priority (older) name is used for the laguna dos Patos system (type locality) and rio Uruguai basin.

Hisonotus laevior **Cope, 1894**

(Figures 15-16, Table 3)

Hisonotus laevior Cope, 1894: 95-96 [original description, type locality: Rio Jacuhy, Rio Grande do Sul, Brazil].-Regan, 1904:268-269 [synonym of *Otocinclus nigricauda*].-Gosline, 1945:101 [listed as synonym of *Microlepidogaster nigricauda*]. Fowler, 1959:167 [listed as synonym of *Microlepidogaster nigricauda*].-Schaefer, 2003:322 [listed].-Reis & Carvalho, 2007:83 [listed].-Ferraris, 2007:248 [listed].

Otocinclus laevior.-Isbruecker, 1980:83 [listed].

Microlepidogaster laevior.-Gomes, 1947:30-32 [removed from synonym and misidentified redescription].-Malabarba, 1989:150 [listed]. Schaefer, 1997:8 [listed].

Hisonotus leptochilus Cope, 1894:96 [original description, type locality: Rio Jacuhy, Rio Grande do Sul, Brazil – new synonym]. Regan, 1904:268-269 [synonym of *Otocinclus nigricauda*].-Gosline, 1945:101 [listed as synonym of *Microlepidogaster nigricauda*].-Fowler, 1959:167 [listed as synonym of *Microlepidogaster nigricauda*].-Schaefer, 2003:322-323 [listed].-Reis & Carvalho, 2007:83 [listed].-Ferraris, 2007:248 [listed].

Otocinclus leptochilus.-Isbruecker, 1980:83 [listed].

Microlepidogaster leptochilus.-Malabarba, 1989:150 [listed].-Schaefer, 1997:8 [listed].

Hisonotus nigricauda, non (Boulenger, 1891).-Ribeiro et al., 2007:60 [misidentification, listed and Illustrated].

Material examined. All from laguna dos Patos system, Rio Grande do Sul, Brazil. **Rio Jacuí drainage:** ANSP 21253, holotype of *Hisonotus laevior*, 39.2 mm SL, rio Jacuí. ANSP 21564, holotype of *Hisonotus leptochilus*, 40.9 mm SL, rio Jacuí MCP 9302, 2, 28.7-30.2 mm SL, Pantano Grande, arroio Dom Marcos, 30°13'32"S 52°37'09"W. MCP 9533, 3, 23.2-27.6 mm SL, Rio Pardo, arroio Francisquinho on highway BR-290 on border between Butiá and Rio Pardo, 30°09'S 52°08'W. MCP 19835, 12, 25.6-40.2 mm SL, Amarópolis, creek tributary of rio Jacuí in the sylviculture Santo Amaro, 29°55'S 51°55'W. MCP 27329, 2, 26.0-30.2 mm SL, Butiá, arroio Martins upstream of mina do Recreio, 30°09'S 51°59'W. MCP 17346, 28, 21.1-40.4 mm SL, Butiá, arroio Martins upstream of mina do Recreio, 30°09'S 51°59'W. MCP 17359, 11, 18.9-31.4 mm SL, Arroio dos Ratos, arroio da Porteira, 29°24'S 51°57'W. UFRGS 2577, 2, 29.7-39.9 mm SL, Triunfo, arroio Gil on road between Barreto and Montenegro, 29°48'S 51°37'W. **Rio Vacacaí drainage:** MCP 23131, 1, 33.5 mm SL, São Sepé, rio São Sepé at bridge lateral to highway BR-153, about 3 km south from São Sepé, 30°11'08"S 53°33'35"W. **Rio Caí drainage:** MAPA 1755, 24 + 3 c&s, 19.7-43.4 mm SL, São Sebastião do Caí, creek in Rio Branco, 29°35'S 51°22'W. MCN

15488, 2, 30.5-30.9 mm SL, Triunfo, arroio Bom Jardim upstream SITEL, 29°50'S 51°24'W. MCN 15823, 2, 36.3-45.4 mm SL, Triunfo, arroio Bom Jardim upstream SITEL, 29°50'S 51°24'W. MCN 15809, 1, 41.6 mm SL, Triunfo, arroio Bom Jardim in front of SITEL, 29°50'S 51°23'W. MCP 23005, 2, 14.6-39.6 mm SL, Triunfo, arroio Bom Jardim, III Polo Petroquímico near SITEL, 29°50'19"S 51°23'25"W. MCP 23008, 6, 33.8-38.1 mm SL, Triunfo, arroio Bom Jardim on the access road to III Polo Petroquímico, 29°50'S 51°23'W. MCP 26053, 1, 40.3 mm SL, Lindolfo Collor, arroio Feitoria tributary of rio Cadeia, 29°34'54"S 51°14'03"W. MCP 26054, 2, 22.1-39.7 mm SL, Lindolfo Collor, arroio Feitoria tributary of rio Cadeia, 29°34'54"S 51°14'03"W. UFRGS 8661, 23, 31.6-43.0 mm SL, Butiá, creek on property Cerro Vermelho, 30°08'S 51°59'W. UFRGS 8711, 12, 33.1-43.9 mm SL, Butiá creek on property Cerro Vermelho, , 30°08'S 51°59'W. UFRGS 8720, 38, 30.4-46.1 mm SL, Rio Pardo, creek at fazenda Limoeiro, 29°59'S 52°22'. UFRGS 8771, 8, 35.5-43.8 mm SL, Pantano Grande, creek on the limit of fazenda Sanga Funda, property of Aracruz, 30°08'S 52°23'W. UFRGS 8777, 2, 36.4-48.1 mm SL, Rio Pardo, creek tributary of arroio Iruí on fazenda Limoeiro, 30°02'S 52°22'W. UFRGS 8786, 16, 28.8-43.6 mm SL, Pântano Grande, creek on the limit of fazendas Tarumã I and Tarumã II, property of Aracruz, 30°08'S 52°23'W. **Lago Guaíba drainage:** MAPA 1737, 4, 32.9-38.0 mm SL, Gravataí, arroio Passo dos Ferreiros tributary to rio Gravataí, 29°56'S 50°58'W. MCP 14652, 5, 33.7-41.3 mm SL, Morungava, rio Morungava and an afluent in Morungava, 29°50'S 50°54'W. MCP 41574, 2, 36.2-40.8 mm SL, Gravataí, marsh at highway RS-118, about 500 meters from highway BR-290, 29°58'S 50°56'W. MCP 16034, 12, 20.6-31.4 mm SL, Viamão, lago Guaíba at praia de Itapuã near to mouth of riacho Itapuã, 30°15'00"S 51°02'20"W. MCP 23466, 1, 40.9 mm SL, Viamão, arroio at praia da Pedreira, Parque Estadual de Itapuã, 30°21'30"S 51°02'48"W. MCP 28116 27.1-42.8 mm SL,Viamão, arroio Sandu, 30°14'W 51°00'W. UFRGS 1239, 1, 38.1 mm SL, Viamão, arroio Alexandrina. **Laguna dos Patos drainage:** MCN 2622, 1, 44.4 mm SL, Rio Grande, arroio Vieira, 32°06'S 52°09'W.

MCN 12682, 7, 32.0-46.7 mm SL, São Lourenço do Sul, arroio Inhuquipá (Turuçu) near Formosa, 31°28’S 52°05’W. MCN 17632, 3, 18.5-40.0 mm SL, Palmares do Sul, channel of lagoa dos Gateados at Fazenda São Sebastião do Fundo, 30°27’S 50°39’W. MCN 17549, 1, 38.7 mm SL, Palmares do Sul, channel of lagoa dos Gateados at Fazenda São Sebastião do Fundo, 30°27’S 50°39’W. MCN 17801, 1, 45.6 mm SL, Palmares do Sul, lagoa do Casamento west of mouth of channel to lagoa dos Gateados, 30°22’S 50°39’W. MCN 18138, 2, 32.5-32.6 mm SL, Palmares do Sul, south margin of lagoa do Casamento, 30°29’S 50°36’W. MCP 16016, 6, 14.7-34.8 mm SL, Viamão, creek on Varzinha in Itapuã, 30°19’S 50°56’W. MCP 19068, 1, 34.2 mm SL, Rio Grande, arroio Bolacha, 32°09’S 52°11’W. MCP 21375, 6, 25.6-40.5 mm SL, São José do Norte, laguna dos Patos at Barra Falsa upstream dam, 31°34’19”S 51°27’35”W. MCP 23856, 10, 31.6-43.8 mm SL, Sentinela do Sul, arroio Faxinal tributary of arroio Velhaco on road from Cerro Grande do Sul to Camaquã, 30°43’48”S 51°45’24”W. MCP 23859, 2, 27.1-41.8 mm SL, Sentinela do Sul, arroio Capivaras on road between Sentinela do Sul and Vila Aurora. 30°39’27”S 51°36’12”W. MCP 23860, 23, 27.6-46.2 mm SL, Tapes, arroio Texeira on highway BR-116, 30°37’26”S 51°32’45”W. MCP 31157, 4, 31.7-33.2 mm SL, Rio Grande, Saco da Mangueira, 32°05’S 52°09’W. MCP 41575, 23, 25.1-42.7 mm SL, Sentinela do Sul, arroio do Tigre tributary of arroio Velhaco on road from Cerro Grande do Sul to Camaquã, 30°44’30”S 051°46’26”W. MCP 41576, 2, 31.4-31.9 mm SL, Sentinela do Sul, arroio Velhaco on road from Cerro Grande do Sul to Camaquã, 30°41’22”S 51°41’51”W. UFRGS 4200, 8, 18.7-37.2 mm SL, Tapes, arroio Velhaco. UFRGS 4220, 3, 22.2-35.9 mm SL, Tapes, arroio Velhaco between Tapes and Camaquã, about 24 km from mouth in laguna dos Patos, 30°45’S 51°38’W. UFRGS 6698, 10, 13.8-38.3 mm SL, Viamão, lagoa Negra, 30°21’35”S 050°58’34”W. **Rio Camaquã drainage:** MCP 23854, 12, 34.8-44.7 mm SL, Cristal, creek tributary to arroio Santa Isabel on Highway BR-116, about 17 km south from Cristal, 30°08’55”S 52°01’50”W. MCP 23857, 21, 27.8-38.9 mm SL, Camaquã, arroio Duro on road

between Vila Aurora and Dom Feliciano, 30°45’34”S 51°51’57”W. MCP 25754, 4, 25.0-37.2 mm SL, Camaquã, arroio Maria Ulghim on road between Camaquã and Vila Aurora, 30°49’S 50°49’W. MCP 26042, 1, 42.3 mm SL, Caçapava do Sul, arroio do Banhado highway BR-153 about 8 km northwest from Minas do Camaquã, 30°51’48”S 53°29’50”W. MCP 41607, 1, 36.7 mm SL, Caçapava do Sul, small creek tributary to arroio Hilário on road between Caçapava do Sul and Lavras do Sul, 30°44’24”S 53°44’51”W. UFRGS 8239, 4, 32.5-41.3 mm SL, Canguçu, creek tributary to rio Camaquã on highway RS-471, 31°23’S 52°40’W. UFRGS 8469, 1, 31.4 mm SL, Canguçu, creek tributary to rio Camaquã on divergence of highway RS-471, 31°23’S 52°40’W. UFRGS 8758, 13, 23.9-40.5 mm SL, Amaral Ferrador, creek at fazenda Ferraria, 30°52’S 52°15’W. **São Gonçalo drainage:** MCP 17398, 16, 30.8-40.8 mm SL, Pedro Osório, arroio Mata Olho tributary of arroio Arambaré between Pedro Osório and Herval, 31°57’S 53°06W. MCP 17406, 2, 37.9-38.7 mm SL, Pedro Osório, arroio Reduzino, 31°54’S 52°55’W. MCP 20821, 6, 37.8-39.4 mm SL, Pedro Osório, arroio Reduzino, 31°54’S 52°55’W. MCP 21424, 13, 33.4-48.9 mm SL, Herval, small creek tributary to arroio Arambaré, between Pedro Osório and Airosa Galvão, 31°58’19”S 53°05’39”W. MCP 21144, 4, 31.5-37.3 mm SL, Piratini, arroio Piratinizinho on lateral road to highway BR-293, 31°43’02”S 52°59’34”W. MCP 25153, 19, 33.1-46.3 mm SL, Pedro Osório, arroio Arambaré on road between Pedro Osório and Basílio, tributary of rio Piratini, 31°54’35”S 53°01’40”W. MCP 34778, 1, 37.6 mm SL, Herval, arroio Arambaré on road between Pedro Osório and Herval, 31°58’37”S 53°06’15”W. MCP 34779, 8, 33.3-48.8 mm SL, Pedro Osório, arroio Mata Olho on road between Pedro Osório and Basílio, 31°54’56”S 53°00’16”. MCP 34781, 1, 43.0 mm SL, Pedro Osório, arroio Arambari on road from Pedro Osório to Basílio, 31°54’35”S 53°01’41”W. MCP 34781, 4, 35.3-43.0 mm SL, Pedro Osório, arroio Arambari on road from Pedro Osório to Basílio, 31°54’35”S 53°01’41”W. MCP 37683, 4, 31.7- 41.7 mm SL, Pedro Osório, creek tributary to arroio Arambaré near Carvalho de Freitas, about 35 km from Pedro Osório on the railroad bridge,

31°57’52”S 53°06’17”W. MCP 37684, 59, 28.8-49.5 mm SL, Pedro Osório, arroio Arambaré about 5 km south from Vila Basílio on road to Pedro Osório, 31°54’34”S 53°01’39”W. MCP 41304, 1, 36.2 mm SL, Pedro Osório, arroio Mata Olho on road between Pedro Osório and Basílio, 31°54’56”S 53°00’17”. **Laguna Mirim drainage.** MCP 26074, 2, 38.9-41.22 mm SL, Rio Grande, new channel of arroio Taim, Estação Ecológica do Taim, 32°37’S 52°34’W.

Diagnosis. *Hisonotus laevior* differs from its congeners, except from *Hisonotus* sp. “Camaquã” and *Hisonotus taimensis* by the higher number of median plate series 25-27 vs. 20-25, by the number of predorsal plates 3-4 (modally 4Fig 17) vs. 2-3 predorsal plates, and by the vertebral count 30-31 vs. 25-29. *Hisonotus laevior* distinguishes from *Hisonotus* sp. “Camaquã” by the presence of a posterior notch articulation in the rostral plate vs. absence of a notch articulation in the rostral plate, and by the possession of a rounded caudal peduncle in cross section vs. a slight square caudal peduncle in cross section. *Hisonotus laevior* can be distinguished from *Hisonotus taimensis* by the wider cleithral width 20.6-24.6% SL, mean 22.9% vs. 18.5-21.3% SL, mean 20.0% (Fig 18), and by the higher body depth at dorsal-fin origin 16.2-20.8 % SL, mean 18.1% vs. 13.3-16.3%, mean 15.1% (Fig 19).

Description. Morphometrics and meristics in Table 3. Adult size moderate to large for members of this genus (larger specimen with 47.2 mm in SL). Body robust, somewhat elongated, without conspicuous keels. Caudal peduncle round in cross section. Dorsal profile straight to concave from tip of snout to nares, slightly convex from that point to dorsal-fin origin. Straight and posteroventrally sloped at dorsal-fin base and almost straight from that point to caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth at posterior end of caudal peduncle. Posterior profile of caudal fin concave. Head and snout broad, snout rounded to slightly square in dorsal view, body progressively narrowing posterior of pectoral-fin insertion. Snout region anterior

of nares concave, interorbital region convex. Upper margin of orbit slightly elevated. Eye dorsolaterally positioned. Iris operculum present.

Pectoral fin I,6. Pectoral fin posterior margin almost straight when depressed tip extending to middle of pelvic fin. Posterior margin of pectoral-fin spine smooth. Half portion of spine length serrate in smaller individuals (about or less than 30 mm in SL). Pectoral-fin axillary slit present, located below posterior bony margin of cleithral process. Pelvic fin i,5. Tip of depressed fin not reaching anal-fin origin in females, but extending beyond that point in males. Dorsal fin II,7. Dorsal-fin origin located slightly posterior of vertical through pelvic-fin origin. Dorsal-fin spinelet present, laterally extended. Anal fin I,5. First anal-fin pterygiophore exposed anterior to anal fin or covered by ventral plate series. Adipose fin absent. Caudal fin i,14,i.

Body almost entirely covered by plates except for region overlying opening of swim bladder capsule, area between pectoral girdle and lower lip, region around anus, and area around base of paired fins. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened, with an odontode free band between dorsad and ventrad series of odontodes. Snout plates anterior to nares reduced, large paired unplated region between rostrum and nostril. Three or four rows of predorsal plates (modally four Fig 17), smaller specimens frequently presenting three rows. Median series formed by 25–27 plates (Tab. 2). Lateral line incomplete, with small gap without pores along middle length of body, posterior portion of lateral line present. Median plate series extending to posterior end of caudal peduncle, not truncated. (Fig. 20). Median abdominal plate series small, irregularly arranged, sometimes presenting a naked area between median and lateral abdominal plate series. Lateral abdominal plates larger, forming a regular series variable in number (Fig. 21). Coracoid and cleithrum exposed and covered by odontodes, except for median region of cleithrum between arrector fossae openings and medial region of coracoids.

Head without conspicuous crests. Head, fin-spines, and body plates covered with odontodes, these larger on anterior surface of all fin spines, medially directed on pelvic fin. Odontodes on head and trunk of uniform size and distribution, except for enlarged odontodes on ventral and dorsal margin of rostrum. Anterior margin of rostrum presenting an odontode-free area. Odontodes on posterior parieto-supraoccipital tip not enlarged. Anteroventral margin of compound pterotic with median-to-large size perforations. Infraorbital canal entering infraorbital series via sphenotic. Lips roundish and papillose.

Premaxillary and dentary teeth slender proximally and flattened distally bifid, major (medial) cusp large and rounded, minor (lateral) cusp pointed. Accessory patch of teeth absent on dentary and premaxilla.

Hypurals 1-2 and 3-5 completely fused or with slight median notch on the posterior margin of caudal-fin skeleton, Total vertebrae 30-31 (5 c&s).

Color in alcohol. Ground color of dorsal and lateral surfaces of body, light to dark brown. Dorsal and dorsolateral surface lighter than lateral surface. Ventral surface of body almost unpigmented except for scattered chromatophores. Dorsolateral surface of head and body with light longitudinal stripes. Stripes narrow, beginning at tip of snout anterior to nares, passing above orbit and reaching the posterior end of parieto-supraoccipital, bifurcated and inconspicous at this point and completely disappearing at vertical above dorsal-fin origin. All fins mostly hyaline, with chromatophores forming narrow transverse dark bands bands most conspicuous on unbranched rays. Caudal fin completely dark brown pigmented, except for hyaline posterior portion of uppermost rays. That hyaline portion, and unbranched rays of caudal fin with striped pattern of transverse dark bars. Caudal fin in some specimens with inconspicuous light transverse band formed by rounded clear spots.

520 **Sexual dimorphism.** Characterized by the urogenital papilla positioned just behind the anal
521 opening in males. Adult males possess a fleshy flap along the dorsal margin of first thickened
522 pelvic-fin ray, that is absent in females. Flap slightly wider basally and progressively narrowing
523 distally. Adult males presenting a fleshy flap in the medial portion of first and second branched rays
524 of pelvic fin. In juvenile males flaps are smaller or absent. Males have a longer pelvic-fin
525 unbranched thickened ray that extends beyond the anal-fin origin, with the ray never reaching that
526 point in females.

527 **Distribution and habitat**. *Hisonotus laevior* is widely distributed in the laguna dos Patos
528 system from southernmost tributaries of the laguna Mirim and canal São Gonçalo drainage to the
529 tributaries of the northern rio Jacuí basin (Fig. 22). The new species is absent in the headwaters of
530 the rio Jacuí basin. This species inhabits slow to median flowing watercourses, with clear to brown
531 waters and a sandy bottom, and is found in marginal or submerged aquatic vegetation. *Hisonotus*
532 *laevior* is sympatric along its distribution with several species of the genus. *Hisonotus laevior*
533 occurs in synpatry with *Hisonotus armatus* along almost all its distribution. *Hisonotus laevior* is
534 collected together with *H. nigricauda* in some localities of the laguna dos Patos system, mainly in
535 the lower portions of the streams. *Hisonotus laevior* occurs in the banhado do Taim together with *H.*
536 *taimensis* and in coastal plain of the Rio Grande do Sul with *Hisonotus* aff. *leucofrenatus*.

537 **Comments on synonymy.** *Hisonotus laevior* is herein designated as senior synonym of
538 *Hisonotus leptochilus* (Fig. 23). Both species were published in the same paper by Cope (1894).
539 These species were collected by H. Smith in 1882, together with a collection of fishes sent to
540 Academy of Natural Sciences of Philadelphia. The material was studied by Cope with the
541 description of several new species including the two species of *Hisonotus*, collected at rio Jacuhy
542 (rio Jacuí). According to Papavero (1973) and Malabarba (1989), H. Smith itinerary in the state of
543 Rio Grande do Sul includes several cities in the laguna dos Patos system and the localities of Caí

(actually São Sebastião do Caí), Jacuí (actually Restinga Seca), São João do Montenegro (Montenegro), and Porto Alegre. The later localities mentioned are situated in the lower portion of rio Jacuí and rio Caí drainages, where the species *H. laevior* is the most predominant taxa of the genus. The descriptions of *H. laevior* and *H. leptochilus* were based on one specimen of each species. The differences between these taxa according to Cope (1894:96) are: "The important characters which distinguish this species [*H. leptochilus*] from the *H. laevior*, are the thin and truncate lower lip with feeble tuberculation the numerous ventral plates the narrower orbital space, and the greater hispidity, especially of the head". Nevertheless, no substantial differences were found in the lower lip tuberculation between all *Hisonotus* species examinated including the holotypes of *H. laevior* and *H. leptochilus*. The holotype of *H. leptochilus* presents more plates in the abdominal median series than *H. laevior* (see Cope, 1894 fig. 11b and fig 12b, respectively). The degree of development of abdominal plates (in *Hisonotus*) is strongly related with age, younger and smaller individuals usually possesing fewer and smaller plates, than older and larger specimens. However, this ontogenetic variation in the belly plating process seems not the cause for the variation observed by Cope (1894), but a polymorphic feature observed within several species. The Figures 21 and 24 show differences in the development of the abdominal plates in specimens of *H. laevior*, similar variations were found in individuals of *Hisonotus* sp. "Camaquã" and cannot be used to differentiate the former species from *H. leptochilus*. Another diagnostic feature used by Cope (1894) to differ *H. leptochilus* from *H. laevior* was its narrower interorbital space. Although the holotype of *H. leptochilus* has a narrow interorbital width (39.5% of head length, vs. 41.6% of head length in the holotype of *H. laevior*), that measurement is whithin the range of *H. laevior* (36.9-46.2% of head length Fig. 25). Finally, no difference in the hispidity of odontodes, in any portion of the body, was found that could suggests the separation of two species in the laguna dos Patos system. For these reasons *Hisonotus laevior* Cope, 1894:95 is considered senior synonym of

Hisonotus leptochilus Cope, 1894:96. *Hisonotus leptochilus* is here, for the first time, suggested as junior synonym of *H. laevior*, although, both species had already been considered synonym of *H. nigricacauda* before (see synonym list).

***Hisonotus taimensis* (Buckup, 1981).**

(Figure 26, Table 4)

Microlepidogaster taimensis Buckup, 1981: 19-31, (original description, type locality: novo canal do arroio Taim, Estação Ecológica do Taim, Rio Grande, Rio Grande do Sul, Brasil). -Buckup & Malabarba, 1983 [listed]. -Malabarba, 1989:150 [listed]. -Grosser *et al.*, 1994 [listed].

Hisonotus taimensis.-Schaefer, 2003: 323 [listed].-Bemvenuti & Moresco, 2005:55 [listed and illustrated].-Reis & Carvalho, 2007:84 [listed].-Ferraris, 2007:248 [listed].

Material examined. All from laguna dos Patos system, Rio Grande do Sul, Brazil: MAPA 1054, paratype of *M. taimensis*, 1, 36.3 mm SL, Santa Vitória do Palmar, channel at km 114 on highway BR-471, Estação Ecológica do Taim. MAPA 1055, 1059-1061, paratypes of *M. taimensis*, 4, 37.5-51.1 mm SL, Rio Grande, channel at east of lagoa do Jacaré, Estação Ecológica do Taim. MAPA 1070, paratype of *Microlepidogaster taimensis*, 1, 26.1 mm SL, Santa Vitória do Palmar, old course of arroio Taim, Estação Ecológica do Taim. MAPA 1013, 1014, 1016, 1018, 1019, 1024, 1026-1028, 1063-1065, 1067-1069, 15, 30.1-47.4 mm SL paratypes of *M. taimensis*, Rio Grande, new channel of arroio Taim, Estação Ecológica do Taim. MCN 4835-4844, paratypes of *M. taimensis*, 10, 34.7-45.9 mm SL, Rio Grande, new channel of arroio Taim, Estação Ecológica do Taim. MCP 14467, 2 + 3 c&s, 21.8-42.5 mm SL, Rio Grande, new channel of arroio Taim, Estação Ecológica do Taim. MCP 17417, 27 + 3 c&s, 24.6-41.8 mm SL, Rio Grande, new channel of arroio Taim. MCP 21375, MCN 7660, 2, 23.9-50.0 mm SL, Rio Grande, north channel of lagoa do Jacaré,

Estação Ecológica do Taim. UFRGS 352-353, paratypes of *M. taimensis*, 2, 40.4-43.5 mm SL, Rio Grande, new channel of arroio Taim, Estação Ecológica do Taim. UFRGS 396, paratypes of *M. taimensis*, 1, 37.3 mm SL. Rio Grande, new channel of arroio Taim near the highway BR-471. UFRGS 697, 2, 32.8-37.4, Rio Grande, Estação Ecológica do Taim. UFRGS 2462, 5, 21.1-42.3, Rio Grande, Estação Ecológica do Taim, curve in the new channel of arroio Taim on highway BR-471. UFRGS 2583, 1, 36.2 mm SL, Rio Grande, Estação Ecológica do Taim, southeast margin of lagoa das Flores. MCN 6474, 1, 46.2 mm SL, Chuí, Barra do Chuí, 33°44'S 53°22'W. CIMC 2341, 2, 28.0-30.7 mm SL, Rio Grande, canal near Estação Ecológica do Taim. CIMC 2405, 67, 20.6-37.3 mm SL, Capão do Leão, canal São Gonçalo near sanga das Traíras.

Diagnosis. *Hisonotus taimensis* differs from its congeners, except from *Hisonotus* sp. "Camaquã" and *Hisonotus laevior* by the larger number of lateral plates 26-29 vs. 20-25, by the number of predorsal plates 3-4 (usually 4) vs. 2-3 and by vertebral count 31-32 vs 25-29 vertebrae. *Hisonotus taimensis* differs from *Hisonotus* sp. "Camaquã" by the presence of a posterior notch articulation in the rostral plate vs. absence of a notch articulation in the rostral plate, and by having a round caudal peduncle in cross section vs. a slight square caudal peduncle in cross section. *Hisonotus taimensis* can be distinguished from *H. laevior* by the narrow cleithral width 18.5-21.3% SL, mean 20.0% vs. 20.6-24.6% SL, mean 22.9% (Fig 18), and by the lower body depth at dorsal-fin origin 13.3-16.3% SL, mean 15.1%, vs. 16.2-20.8% SL, mean 18.1% (Fig. 19).

Description. This species was described by Buckup (1981) and will not be redescribed here.

Distribution and habitat. *Hisonotus taimensis* is known from localities nearby the laguna Mirim (Fig 27). This species inhabits, at type locality, slow flowing watercourses with brown waters of muddy and sandy bottom. The individuals are found in between aquatic vegetation of the genus *Eichhornia*, in grasses or similar kind of submersed vegetation. According to Buckup (1981) the enlarged rostral odontodes (Fig. 28) and pelvic-fin odontodes contribute to helping them cling

the stems and roots of *Eichhornia*. See Grosser *et al.* (1994) for detailed description of the species habitat and distribution in the Taim region.

Hisonotus armatus Carvalho, Lehmann, Pereira & Reis

Figures 29-30, Table 5

Hisonotus armatus Carvalho, Lehmann, Pereira & Reis, *in press* [original description, type locality: Brazil, Rio Grande do Sul, Pedro Osório, arroio Arambaré, about 5 km south of Vila Basílio on the road to Pedro Osório].

Hisonotus nigricauda non Boulenger, 1981. - Lucena *et al*., 1994 [listed misindentified].

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

Examined material. All from laguna dos Patos system, Rio Grande do Sul, Brazil. **São Gonçalo drainage:** MCP 41323, holotype, 44.4 mm SL, Pedro Osório, arroio Arambaré, about 5 km south of Vila Basílio, on road to Pedro Osório, 31°51'51"S 052°49'24"W. MCP 37682, paratypes, 13 + 4 c&s, 33.9–44.2 mm SL; ANSP 187116, 5, 33.7–42.5 mm SL; MZUSP 93884, 5, 37.7–45.1 mm SL, all collected with the holotype. MCP 40787, paratypes, 20, 32.5–45.6 mm SL, Pedro Osório, arroio Mata Olho, on road between Pedro Osório and Basílio, 31°54'56"S 53°00'16"W. MCP 34776, paratypes, 31, 27.6–43.9 mm SL, Herval, arroio Arambaré, on road from Pedro Osório to Herval, 31°58'37"S 53°06'15"W. MCP 25138, paratypes, 9 + 3c&s, 27.9–45.9 mm SL, Piratini, arroio Santa Fé on road between Pinheiro Machado and Piratini, 31°30'12"S 53°13'56"W. MCN 12617, 3, 37.1–37.3 mm SL, Pelotas, arroio Pelotas on highway BR-116, 31°37'55"S 52°19'39"W. MCP 25140, 4, 37.6–46.7 mm SL, Pedro Osório, arroio Mata Olho on road between Pedro Osório and Basílio, 31°54'56"S 53°00'17"W. MCP 25147, 2, 30.1–36.3 mm SL, Piratini, arroio Piratinizinho on secondary road to BR-293, 31°43'02"S 52°59'34"W. MCP 25154, 14 + 1 c&s, 28.0–45.4 mm

SL, Piratini, arroio Piratinizinho on secondary road to BR-293, 31°43’02”S 52°59’34”W. MCP 25158, 8, 34.4–45.2 mm SL, Piratini, arroio Piratini Menor about 500 m from road between Piratini and Pelotas, 31°30’03” S 53°05’35”W. MCP 25159, 24, 28.9–42.1 mm SL, Piratini, rio Piratini on highway BR-293, 31°43’11’’S 52°54’00”W. MCP 34777, 1, 28.5 mm SL, Herval, arroio Arambaré on road from Pedro Osório to Herval, 31°58’37”S 53°06’15”W. MCP 34780, 4, 36.6–40.5 mm SL, Pedras Altas, headwaters of arroio Alegria between Pedras Altas and Pinheiro Machado, 31°40’41”S 53°32’12”W. MCP 37685, 13, 27.7–44.2 mm SL, Pedro Osório, stream tributary to arroio Arambaré near Carvalho de Freitas, about 35 km from Pedro Osório on railroad bridge, 31°51’51”S 52°49’24”W. **Rio Jaguarão drainage:** MCP 11307, 2, 16.9–39.2 mm SL, Jaguarão, mouth of rio Telho on rio Jaguarão, 32°31’S 53°27’W. MCP 27184, 5, 14.2–36.3 mm SL, Candiota, arroio Quebra Jugo at Passo dos Pinheiros, 31°32’59”S 53°46’17”W. UFRGS 4224, 3, 32.3–38.2 mm SL, Candiota, arroio Candiota downstream of dam, 31°32’S 53°40’W. **Rio Camaquã drainage:** MCN 11179, 1, 34.2 mm SL, Caçapava do Sul, arroio Seival at dam, 30°43’04”S 53°43’42”W. MCP 11337, 5, 25.9–38.7 mm SL, Encruzilhada do Sul, arroio dos Ladrões, 30°41’S 52°20’W. MCP 25869, 1, 43.3 mm SL, Bagé, arroio Camaquã Chico on road between Bagé and Lavras do Sul, 30°54’27”S 53°49’13”W. MCP 40647, 2, 22.7–27.3 mm SL, Bagé, arroio do Tigre on road between Bagé and Lavras do Sul, 31°04’47”S 53°54’03”W. MCP 40748, 1, 33.0 mm SL, Bagé, arroio das Traíras on highway BR-153, 31°05’29”S 53°43’33”W. MCP 40751, 1, 41.5 mm SL, Lavras do Sul, arroio Mantiqueira on road between Bagé and Lavras do Sul, 30°54’22”S 53°58’02”W. MCP 40764, 1, 38.6 mm SL, Lavras do Sul, arroio da Cria on road between Bagé and Lavras do Sul, 30°57’19”S 53°57’22”W. MCP 41306, 1, 36.6 mm SL, Camaquã, arroio Duro on road from Vila Aurora to Dom Feliciano, 30°45’34”S 51°51’57”W. UFRGS 8222, 5, 32.2–39.8 mm SL, creek on Fazenda Ferraria, Amaral Ferrador. UFRGS 8240, 1, 33.3 mm SL, Canguçu, rio Camaquã on bridge of highway RS-471. UFRGS 8975, 3, 14.7–35.3 mm SL, Encruzilhada do Sul,

arroio Abranjo, 30°53’58”S 52°32’18”W. **Lago Guaíba drainage:** MCN 16246, 3, 31.9–43.9 mm SL, Porto Alegre, Parque Estadual Delta do Jacuí, Saco da Pólvora, 30°01’S 51°14’W. MAPA 1735, 14, 21.3–38.9 mm SL, Barra do Ribeiro, açude dos Garcia, on highway BR-116, 30°23’14”S 51°26’10”W. MAPA 1737, 10, 21.9–38.0, Gravataí, arroio Passo dos Ferreiros, MCP 10450, 2, 41.7–49.9 mm SL, Porto Alegre, lago Guaíba at ilha Mauá, 30°01”S 51°14”. MCP 16010, 10, 14.8–42.3 mm SL, Viamão, lago Guaíba at praia de Itapuã, near to mouth of riacho Itapuã, 30°15’00”S 51°02’20”W. UFRGS 6718, 1, 33.9 mm SL, Viamão, lago Guaíba at Praia das Pombas, 30°20’44”S 51°01’32”W. UFRGS 8460, 1, 39.5 mm SL, Eldorado do Sul. Estação Agronômica da UFRGS, **Rio dos Sinos drainage:** MAPA 2391, 3, 35.9–44.1 mm SL. Santo Antonio da Patrulha, rio dos Sinos at Nossa Senhora de Mont Serrat, 29°45’S 50°24’W. MCN 6660, 2, 24.0–37.5 mm SL, Três Coroas, arroio Quilombo, 29°27’S 50°49’W. MCP 14640, 1, 23.7 mm SL, Caraá, rio Caraá near rio dos Sinos, 29°47’40”S 50°26’01”W. **Rio Caí drainage:** MAPA 1749, 1, 38.8 mm SL, Nova Petrópolis, arroio Macaquinhos at Pinhal Alto, 29°25’S 51°02’W. MCP 26052, 1, 35.0 mm SL, Lindolfo Collor, arroio Feitoria, 29°34’54”S 51°14’03”W. MCP 40512, 6, 22.1–40.9 mm SL, Santa Maria do Herval, rio Cadeia on Farroupilha bridge, 29°29’43”S 51°02’50”W. **Rio Taquari drainage:** MCP 33557, 1, 34.7 mm SL, Santa Bárbara, rio das Antas, near mouth of rio Carreiro, 29°05’29”S 51°42’42”W. MCP 38901, 6, 22.2–40.8 mm SL, Bento Gonçalves, rio das Antas, 29°01’59”S 51°27’13”W. MCP 41549, 4, 12.8-19.0 mm SL, Cotiporã, rio Carreiro on road between Dois Lageados and Cotiporã, 28°59’43”S 051°45’16”W. UFRGS 8805, 5, 38.5–43.1 mm SL, Lageado, mouth of arroio Pinheirinho on rio Forqueta, 29°19’21”S 52°14’03”W. **Rio Jacuí drainage:** MCN 16124, 4, 33.2–40.1 mm SL, Pinhal Grande, rio Ferreira, 29°16’33”S 53°14’42”W. MCP 9294, 2, 23.4–34.0 mm SL, Cachoeira do Sul, arroio Paraíso at Rincão da Porta, 29°41’S 53°09”W. MCP 17166, 2, 27.1–27.9 mm SL, Porto Alegre, rio Jacuí at Saco da Alemoa, 30°00’S 51°14’W. MCP 17500, 1, 45.3 mm SL, Venâncio Aires, arroio at linha Brasil, 29°33’S

52°17’W. MCP 18632, 13, 26.1–38.0 mm SL, Candelária, rio Pardo on road from Santa Cruz do Sul to Candelária, 29°40’36”S 52°46’17”W. MCP 25262, 5, 29.1–38.1 mm SL, Agudo, lageado da Gringa between linha da Ressaca and mouth of rio Jacuizinho, 29°23’08”S 53°12’53”W. MCP 25458, 7 + 3 cs, 16.2–42.3 mm SL, Agudo, arroio Corupá on road between Agudo and Dona Francisca dam, 29°33’54”S 53°17’09”W. MCP 25721, 5, 27.3–41.4 mm SL, Ibarama, arroio da Gringa, about 12 km north from Dona Francisca dam, 29°23’16”S 53°13”23”W. MCP 25722, 3, 25.3–40.2 mm SL, Ibarama, lageado do Gringo about 2 km from Dona Francisca dam, 29°26’49”S 53°15’36”W. MCP 26528, 1, 28.7 mm SL, Santa Cruz do Sul, rio Pardinho downstream Corsan dam, 29°40’S 52°28’W. MCP 26542, 3, 29.6–35.6 mm SL, Agudo, rio Jacuí downstream Dona Francisca dam, 29°31’S 53°16’W. UFRGS 2350, 1, 35.2 mm SL, Arroio dos Ratos, arroio dos Ratos at bathing spot, 30°03’S 51°37’W. UFRGS 8768, 3, 31.6–35.4 mm SL, rio Pardo, creek at Fazenda Velha. **Rio Vacacaí drainage:** UFRGS 8762, 3, 29.8–36.2 mm SL, São Sepé, creek on Fazenda São Sepe, 30°14’39”S 53°41’20”W. **Laguna dos Patos drainage:** MAPA 1747, 5, 25.8–39.9 mm SL, Camaquã, arroio Velhaco on highway BR-116 between Tapes and Camaquã, 30°45’S 51°38’W.

Diagnosis. *Hisonotus armatus* differs from all congeners except *Hisonotus notatus* and *H. leucofrenatus* by having the anterior margin of the snout completely covered by odontodes vs. anterior margin of the snout with a narrow or wide odontode-free band and by having large plates in the abdominal median series, usually comprising one series of plates between the lateral abdominal plates vs. abdominal median series of plates small, with several plate series irregularly arranged between the lateral abdominal plates. *Hisonotus armatus* differs from *H. notatus* and *H. leucofrenatus* by the presence on caudal fin of a series of light hyaline spots, forming a vertical light bar vs. a rounded hyaline blotch or no hyaline area in the midventral portion of caudal-fin.

Description. This species was described in chapter I and will not be repeated here.

712 **Distribution and habitat.** *Hisonotus armatus* is widely distributed in the laguna dos Patos
713 system from the southern rio Jaguarão to the northern rio Jacuí drainage (Fig. 31). The new species
714 is unknown from the headwaters of the rio Jacuí and rio Taquari drainages. That species inhabits
715 slow to median flowing watercourses, with clear to brown waters over sandy bottom and is found in
716 marginal or submerged aquatic vegetation. *Hisonotus armatus* is sympatric through its distribution
717 with *H. laevior*. It was also collected together with *H. nigricauda* in some localities of the lago
718 Guaíba drainage, with *Hisonotus* sp. "Sinos" in the rio Jacuí drainage, and with *Hisonotus* sp.
719 "Camaquã" in the upper rio Camaquã drainage.
720
721 ***Hisonotus* sp. "Camaquã "**, new species
722 Figures 32-33, Table 6
723 *Hisonotus* sp. 6. -Reis & Carvalho (2007: 84) [listed].
724
725 **Holotype.** MCP uncataloged, 45.0 mm SL, female, Brazil, Rio Grande do Sul, Lavras do Sul,
726 small creek tributary of arroio das Lavras on road from Lavras do Sul to Bagé, 30°50'18"S
727 053°55'43"W, 31 Jul 2006, T. P. Carvalho, A. R. Cardoso, J. M. Wingert.
728 **Paratypes.** All from laguna dos Patos system, Rio Grande do Sul, Brazil. **Rio Camaquã**
729 **drainage:** MCP 40757, 4, 35.4-41.6 mm SL, collected with the holotype. MCP 25803, 5, 31.8-34.9
730 mm SL, Bagé, arroio do Tigre, on secondary road between Bagé and Lavras do Sul, 27 Apr 2000,
731 C. A. Lucena, J. P. Silva & V. A. Bertaco, 31°04'47"S 53°54'03"W. MCP 25924, 1 + 2 c&s 34.8-
732 44.4 mm SL, Lavras do Sul, arroio da Mantiqueira on secundary road between Bagé and Lavras do
733 Sul, 30°54'24"S 053°58'06"W, 26 April 2000, C. A. Lucena, J. P. Silva & V. A. Bertaco. MCP
734 40762, 3, 31.6-41.8 mm SL, Lavras do Sul, arroio da Mantiqueira on secundary road between Bagé
735 and Lavras do Sul, 30°54'24"S 053°58'06"W, 31 Jul 2006, T. P. Carvalho, A. R. Cardoso & J. M.

Wingert. MCP 40749, 2, 35.5-39.0 mm SL, Bagé, arroio das Traíras on highway BR-153, 31°05’29”S 053°43’33”W, 1 Aug 2006, T. P. Carvalho, A. R. Cardoso & J. M. Wingert. MCP 40763, 1, 51.7 mm SL, Lavras do Sul, small creek tributary to arroio das Lavras, about 2 km from Lavras on road to Bagé, 30°50’02”S 053°53’52”W, 31 Jul 2006, T. P. Carvalho, A. R. Cardoso & J. M. Wingert.

Non-type material. UFRGS 8966, 43 + 3 c&s 17.4-39.2 mm SL, Brazil, Rio Grande do Sul, Encruzilhada do Sul, small creek in Encruzilhada do Sul tributary to rio Camaquã drainage, 30°35’17”S 052°33’54”W, 14 Dec 2006, J. Anza & R. Hirano.

Diagnosis. *Hisonotus* sp. “Camaquã” differs from its congeners by the absence of rostral plate posterior notch articulation with the mesethmoid, rostral plate is reduced and thinned, with an unplated area, medially between the dorsad and ventrad series of odontodes vs. presence of a rostral plate with the posterior notch articulation with the mesethmoid, rostral plates thickened. The new species also distinguishes from other species of *Hisonotus*, except *H. laevior* and *H. taimensis*, by its great number of median plate series 25-27 vs. low number of median plate series 20-25 by having four predorsal plates vs. three predorsal plates, and by having 30-31 vertebrae vs. 25-29. *Hisonotus* sp. “Camaquã” further differs from *H. laevior* and *H. taimensis* by having caudal peduncle slightly square in cross section vs. round peduncle in cross section.

Description. Morphometrics and meristics in Table 6. Adult size large for members of this genus (a female reaching 51.7 mm SL). Body elongate, without conspicuous keels. Caudal peduncle slightly square in cross section. Dorsal profile convex from snout to parieto-supraoccipital tip, slightly convex from that point to dorsal-fin origin straight and posteroventrally sloped from dorsal-fin origin to caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth at posterior end of caudal peduncle. Posterior profile of caudal-fin margin concave. Head and snout broad, snout rounded anteriorly in dorsal view, body progressively narrowing posterior of pelvic-fin

760 insertion. Snout region anterior of nares not depressed, interorbital region convex. Upper margin of
761 orbit slightly elevated. Eye dorsolaterally positioned. Iris operculum present.

762 Pectoral fin I,6. Pectoral-fin posterior margin almost straight when depressed tip extending
763 beyond middle of pelvic fin (tip of pectoral-fin reaching just anterior third of pelvic fin in some
764 specimens). Posterior margin of pectoral-fin spine serrate. In juveniles entire length of spine is
765 serrate, reduced to distal portion of spine in adults. Pectoral-fin axillary slit present, located below
766 posterior bony margin of cleithral process. Pelvic fin i,5. Tip of depressed fin not reaching anal-fin
767 origin in females, but extending beyond that point in males. Dorsal fin II,7. Dorsal-fin origin
768 located slightly posterior of vertical through pelvic-fin origin. Dorsal-fin spinelet present, laterally
769 extended. Anal fin i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent.
770 Caudal fin i,14,i.

771 Body almost entirely covered by plates except for region overlying opening of swim bladder
772 capsule, area between pectoral girdle and lower lip, region around anus, and area around base of
773 paired fins. Rostral plate without posterior notch articulation with mesethmoid, rostral plate reduced
774 and thinned, rostral area between dorsad and ventrad series of odontodes unplated medially.
775 Prenasal plates anterior to nares present, not reduced (Fig. 34). Four rows of predorsal plates (Fig
776 35). Median series formed by 25–27 plates (Tab. 2). Lateral line incomplete, with small gap without
777 pores along middle length of body. Median plates series reaching the posterior end of caudal
778 peduncle, not truncated (Fig. 36). Median abdominal plates small, irregularly arranged, often
779 leaving naked area between median and lateral abdominal plate series. Lateral abdominal plates
780 larger, forming a regular series of about five to seven plate in each side (Fig. 37). Coracoid and
781 cleithrum exposed and covered by odontodes, except for median region of cleithrum between
782 arrector fossae opening.

Head without conspicuous crests. Odontodes on posterior parieto-supraoccipital tip not enlarged in adults, slightly enlarged odontodes in juvenile specimens. Head, fin-spines, and body plates covered with odontodes, these larger on anterior surface of all fin spines, medially directed in pelvic fin. Odontodes on head and trunk of uniform size and distribution, except for enlarged odontodes on ventral margin of rostrum, ventrad series of odontodes sometimes absent in medial portion of rostrum plate. Dorsad series slightly enlarged compared to remainder odontodes. Rostrum anterior margin with wide free-odontode band (Figs. 38-39). Compound pterotic with median-to-large size perforations from middle portion to ventral margin. Infraorbital canal entering infraorbital series via sphenotic. Lips roundish and papillose. Maxillary barbel present.

Premaxillary and dentary teeth slender proximally and flattened distally bifid, major (medial) cusp large and rounded, minor (lateral) cusp pointed (Fig. 40 C). Accessory patch of teeth absent on dentary and premaxilla.

Hypurals 1-2 and 3-5 completely fused on the posterior margin of caudal-fin skeleton. In juveniles not completely fused. Total vertebrae 31 (3 c&s).

Color in alcohol. Ground color of dorsal and lateral surfaces of body light to dark gray, brownish in some specimens. Dorsal and ventrolateral regions slightly lighter, darker in lateral surface forming a longitudinal band. Ventral surface of body less pigmented than lateral and dorsal portions, belly region with small scattered chromatophores. Dorsolateral surface of head and body, with light longitudinal stripes. Stripes beginning on rostrum anterior to nares, passing above orbit and reaching the posterior end of parieto-supraoccipital, bifurcating at this point and disappearing lateral to dorsal-fin base. Light longitudinal stripe on trunk located at lateral line. Tip of parieto-supraoccipital and corners of square caudal peduncle lighter than surrounding areas. All fins mostly hyaline, with chromatophores forming transverse dark bands (inconspicuous in pelvic fin) bands most conspicuous on unbranched rays. Caudal fin dark pigmented ventrally, unbranched rays with

807 striped pattern. Upper branched rays of caudal fin, almost hyaline except for transversal dark bands.
808 Middle portion of caudal fin with hyaline transverse band formed by round light spots. larger
809 specimens with second hyaline band located posteriorly, on lower caudal lobe.

810 **Sexual dimorphism.** Characterized by the urogenital papilla, positioned just behind the anal
811 opening in males. Adult males possess a fleshy flap along the dorsal margin of first thickened
812 pelvic-fin ray, that is absent in females. Flap widest basally and progressively narrowing distally.
813 Adult males with first branched ray of pelvic fin presenting a feeble fleshy flap in its medial
814 portion. In juvenile males, flaps are smaller or absent. Males have a longer pelvic-fin thickned
815 unbranched ray that extends up to the anal-fin origin, with the spine never reaching that point in
816 females.

817 **Distribution and habitat.** *Hisonotus* sp. "Camaquã" is endemic to the upper reaches of rio
818 Camaquã drainage in the laguna dos Patos system, southern Brazil (Fig. 27). This species inhabits
819 slow to median flow, clear water and a sandy bottom, and is found in marginal or aquatic
820 submersed vegetation (Fig. 41). *Hisonotus* sp. "Camaquã" is collected together with *Hisonotus*
821 *armatus* in some localities.

822 **Geographic variation.** Some morphological diferences were observed between a population
823 of a north tributary in the left margin of the rio Camaquã drainage, near city of Encruzilhada do Sul,
824 and the population of the tributaries in the southwestern portion of the rio Camaquã drainage, near
825 city of Lavras do Sul. Specimens from southwestern tributaries possesses a longer pectoral-fin spine
826 19.2-25.7% SL, mean 23.5% vs. 17.7-20.7% SL, mean 19.5% in the by north tributary population
827 (Fig. 42). The southwestern population is relatively darker and possesses a conspicuous light
828 transversal band on the middle portion of the caudal fin contrasting with the population near
829 Encruzilhada do Sul, which presents a lighter overall coloration, and lighter areas on the anterior
830 portion of the upper and lower caudal-fin lobes (Fig. 33). Another feature presented by the

831 population of Encruzilhada do Sul is the often absence of the ventrad series of odontodes along the
832 middle margin of the snout, which leaves a wide free-odontode area at the anterior margin of the
833 snout (Fig. 39). For these reasons, specimens from lot UFRGS 8966 from Encruzilhada do Sul are
834 listed as non-types.
835
836 ***Hisonotus* sp. "Carreiro",** new species
837 Figure 43, Table 7
838 *Hisonotus* sp. 2. -Reis & Carvalho (2007: 84) [listed].
839
840 **Holotype.** MCP uncataloged, 35.4 mm SL, female, Brazil, Rio Grande do Sul, Serafina
841 Corrêa, rio Carreiro downstream Carreiro bathing spot, 28°42'10"S 051°50'57"W, 25 Out 2006, T.
842 P. Carvalho & V. A. Bertaco.
843 **Paratypes.** All from Brazil, Rio Grande do Sul, rio Carreiro drainage, MCP 40495, 8 + 2
844 c&s, 27.5-31.2 mm SL, collected with the holotype. MCP 41548, 1, 32.0 mm SL, collected at type
845 locality, 11 Jan 2006, J. P. Silva & T. P. Carvalho. MCP 40943, 3, 33.6-35.8 mm SL, Guabiju,
846 arroio Guabiju on secondary road between Guabiju and vila São Jorge, 28°30'49"S 051°41'22"W,
847 24 Out 2006, T. P. Carvalho & V. A. Bertaco. MCN 16361, 3, 34.4-35.4 mm SL, Nova Araçá,
848 arroio Guabiju on road between Guabiju and vila São Jorge, 28° 30'S 51°41'W, Out 2000, W.
849 Koch. UFRGS 6961, 7, 31.7-37.8 mm SL, Serafina Corrêa, rio Carreiro, 28°44' 51°50', Nov 2004,
850 J. Anza.
851 **Diagnosis.** *Hisonotus* sp. "Carreiro" differs from its congeners, except *Hisonotus*
852 *francirochai* and *Hisonotus* sp. "Prata" by the presence of a conspicuous tuft of enlarged odontodes
853 on the tip of the parieto-supraoccipital vs. odontodes on the tip of parieto-supraocipital similar in
854 size, not enlarged or slightly enlarged. Differs from *H. francirochai* by having the anterior portion

855 of snout with a narrow odontode-free band (Fig. 44) vs. snout completely covered with odontodes,
856 without an anterior odontode-free band. *Hisonotus* sp. "Carreiro" can be distinguished from
857 *Hisonotus* sp. "Prata" by having a longer dorsal-fin spine 24.3-29.0% SL, mean 26.6% vs. 22.6-
858 25.5% SL, mean 24.5% (Fig. 45) longer pectoral-fin spine 24.7-29.0% SL, mean 26.7 % vs. 22.0-
859 25.6% SL, mean 24.0% (Fig. 46) and by its general color pattern of the body, which is yellowish in
860 life and pale yellow to light brown in alcohol preserved specimens vs. a dark green general color
861 pattern of the body in life and a dark gray to dark brown color in alcohol preserved specimens.

862 **Description.** Morphometrics and meristics in Table 7. Adult size small to medium for
863 members of this genus (maximum size 37.8 mm SL). Body relatively stocky, not elongated, without
864 conspicuous keels. Caudal peduncle round in cross section. Dorsal profile slightly concave from tip
865 of snout to nares, convex from nares to tip of parieto-supraoccipital, almost straight and
866 posterodorsally inclined from that point to dorsal-fin origin. Dorsal-fin base straight and
867 posteroventrally sloped, almost straight to slightly concave from posterior end of dorsal-fin base to
868 caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth at middle of caudal
869 peduncle. Posterior profile of caudal fin concave. Head and snout broad, snout rounded in dorsal
870 view, body progressively narrowing posterior of pectoral-fin insertion. Snout region anterior of
871 nares concave, interorbital region convex. Upper margin of orbit somewhat elevated. Eye
872 dorsolaterally positioned. Iris operculum present.

873 Pectoral fin I,6. Pectoral-fin posterior margin almost straight when depressed tip extending
874 beyond middle of pelvic fin. Posterior margin of pectoral-fin spine smooth in adults, juveniles with
875 feeble serrae at distal portion. Pectoral-fin axillary slit present, located below posterior bony margin
876 of cleithral process. Pelvic fin i,5. Tip of depressed fin not reaching anal-fin origin in females, but
877 extending beyond that point in males. Dorsal fin II,7. Dorsal-fin origin located just posterior of
878 vertical through pelvic-fin origin. Dorsal-fin spinelet present, laterally extended, one c&s specimen

879 lacking spinelet. Anal fin with i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose
880 fin absent. Caudal fin i,14,i.

881 Body almost entirely covered by plates except for region overlying opening of swim bladder
882 capsule, area between pectoral girdle and lower lip, region around anus, and area around base of
883 paired fins. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened,
884 with narrow odontode-free band between dorsad and ventrad series of odontodes (Fig. 44),
885 sometimes absent at medial portion of some specimens. Snout plates anterior to nares reduced,
886 small unplated area between rostrum and nostril at lateral portion. Two or three rows of predorsal
887 plates (rarely two). Median series formed by 22–24 plates (Tab. 2). Lateral line incomplete, with
888 small gap without pores along middle length of body. Median plate series truncated (Fig. 47).
889 Abdominal plates arranged in three rows anteriorly and irregularly arranged between pelvic-fin
890 insertions. Lateral abdominal plates slightly larger and forming regular series. Median abdominal
891 series usually formed by one plate row. Area between lateral and median abdominal plate series
892 naked in some specimens (Fig. 48). Coracoid and cleithrum exposed and covered by odontodes,
893 except for median region of cleithrum between arrector fossae openings and medial region of
894 coracoids.

895 Head without conspicuous crests. Odontodes on parieto-supraoccipital tip greatly enlarged,
896 arranged in rounded patch. Odontodes approximately five times larger than those of surrounding
897 areas. Head, fin-spines, and body plates covered with odontodes, these larger on anterior surface of
898 all fin spines, and on ventral and dorsal margin of rostrum medially. Odontodes medially directed in
899 pelvic-fin thickened unbranched ray. Anteroventral margin of compound pterotic with median-to-
900 large size perforations. Infraorbital series entering infraorbital canal via sphenotic. Lips roundish
901 and papillose, posterior border of lower lip fimbriate. Maxillary barbel present.

Premaxillary and dentary teeth slender proximally and flattened distally bifid, major (medial) cusp large and rounded, minor (lateral) minute pointed. Accessory patch of teeth absent on dentary and premaxilla.

Hypurals 1-2 and 3-5 almost completely fused, a median notch on the posterior margin of caudal-fin skeleton extending anteriorly. Total vertebrae 28 (2 c&s).

Color in alcohol. Ground color of dorsal and lateral surfaces pale yellow to light brown. Dorsal and lateral body surfaces with scattered dark brown round spots. Dorsal and lateral portions of head darker than body. Ventral and ventrolateral surface of body yellowish except for scattered chromatophores, these grouped forming spots on ventral surface of caudal peduncle. Region anterior to nares lighter than surrounding areas, but not forming conspicuous longitudinal light stripes posteriot to that point. Fins mostly brown pigmented, sometimes with light transverse bands, forming a striped pattern. Caudal fin almost completely brown, except for a pair of somewhat round hyaline areas in the middle portion of upper and lower lobes. Unbranched rays of caudal fin with alternating transverse light bars and dark areas.

Sexual dimorphism. Characterized by the urogenital papilla, positioned just behind the anal opening in males. Adult males also possess a developed fleshy flap along the dorsal margin of first thickened pelvic-fin ray that is absent in females. Flap slightly wider basally and progressively narrowing distally. In males, first and second branched rays of pelvic fin with a fleshy flap in its medial portion. In juvenile males, flaps are smaller or absent. Males have a longer pelvic-fin thickened unbranched ray that extends far beyond the anal-fin origin, with the pelvic-fin ray reaching just to the origin of anal fin in females.

Distribution and habitat. *Hisonotus* sp. “Carreiro” is endemic from the upper portions of the rio Carreiro drainage a tributary of the rio Taquari, which flows into the rio Jacuí basin in the laguna dos Patos system (Fig. 49). This species inhabits relative high altitudes, above 400 m, the

habitat in rio Carreiro is a rapid flow watercourse, a wide river with about 0.5 m deep, with clear water and rocky bottom (Fig. 50). The specimens were caught between aquatic vegetation of the genus *Echinodorus* which form green islands on the faults of the rocky substrate. The arroio Guabiju is a small stream about 3 m wide and up to 1 m deep, with clear water, of sandy and rocky bottom. There, the species is caught in marginal submersed vegetation. *Hisonotus* sp. "Carreiro" is sympatric with the Hypoptopomatinae *Eurycheilichthys* sp. 1 in arroio Guabiju.

***Hisonotus* sp. "Prata"**, new species

Figure 51, Table 8

Hisonotus sp. 1 in Reis & Carvalho (2007: 84) [listed].

Holotype. MCP uncataloged, 31.8 mm SL, female, Brazil, Rio Grande do Sul, Nova Prata, rio da Prata on Passo do Despraiado, 28°38'01"S 051°36'51"W, 24 Out 2006, T. P. Carvalho & V. A. Bertaco.

Paratypes. All from Brazil, Rio Grande do Sul, rio da Prata drainage, MCP 40492, 24, 19.5-33.2 mm SL [collected with the holotype. MCP 22204, 9 + 3 c&s, 14.3-29.3 mm SL, collected at type locality, 20 Jan 2006, R. E. Reis, J. P. Silva & E. H. Pereira.

Diagnosis. *Hisonotus* sp. "Prata" differs from its congeners, except *Hisonotus francirochai* and *Hisonotus* sp. "Carreiro" by the presence of a conspicuous tuft of enlarged odontodes on the tip of the supraoccipital (Fig. 52), vs. odontodes on the tip of parieto-supraocipital similar in size, not enlarged or slightly larger over the remaining odontodes on the parieto-supraoccipital. Differs from *H. francirochai* by having the anterior portion of snout with an odontode-free band (Fig. 53) vs. snout complete covered with odontodes, without anterior odontode-free band. *Hisonotus* sp. "Prata" can be distinguished from *Hisonotus* sp. "Carreiro" by having a shorter dorsal-fin spine 22.6-25.5%

SL, mean 24.5% vs. 24.3-29.0% SL, mean 26.6% (Fig. 45) shorter pectoral-fin spine 22.0-25.6% SL, mean 24.0 % vs. 24.7-29.0% SL, mean 26.7%. (Fig. 46) and by its general color pattern of dorsal surface of body which is dark green in life specimens and dark gray to dark brown pattern in alcohol preserved specimens vs. a yellowish pattern in life, pale yellow to light brown coloration in alcohol preserved specimens.

Description. Morphometrics and meristics in Table 8. Adult size small for members of this genus (maximum size 33.2 mm in the SL). Body stocky, robust, without conspicuous keels. Caudal peduncle round in cross section. Dorsal profile convex from tip of snout to nares to parieto-supraoccipital, convex bump at parieto-supraoccipital tip, almost straight and posterodorsally inclined from that point to dorsal-fin origin. Dorsal-fin base straight and posteroventrally sloped, almost straight from posterior end of dorsal-fin base to caudal-fin origin. Ventral profile almost straight from snout tip to anal-fin origin, concave from that point to caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth at middle of caudal peduncle. Posterior profile of caudal fin slightly concave. Head and snout broad, snout rounded in dorsal view, body progressively narrowing posterior to pelvic-fin insertion. Snout region anterior of nares concave, interorbital region convex. Upper margin of orbit not elevated. Eye dorsolaterally positioned. Iris operculum present.

Pectoral fin I,6. Pectoral-fin posterior margin slightly rounded when depressed tip extending anterior to middle of pelvic fin. Posterior margin of pectoral-fin spine smooth in adults, juveniles with serrae along distal third of pectoral-fin spine. Pectoral-fin axillary slit present, located below posterior bony margin of cleithral process. Pelvic fin i,5. Tip of depressed fin just reaching anal-fin origin in females, but extending beyond that point in males. Dorsal II,7. Dorsal-fin origin located slightly posterior to vertical through pelvic-fin origin. Dorsal-fin spinelet present, laterally

973 extended. Anal fin i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent.
974 Caudal fin i,14,i.

975 Body almost entirely covered by plates except for region overlying opening of swim bladder
976 capsule, area between pectoral girdle and lower lip, region around anus, and area around base of
977 paired fins. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened,
978 with an odontode-free band between dorsad and ventrad series of odontodes (Fig. 52). Snout plates
979 anterior to nares reduced, small unplated area between rostral plate and nostril. Two or three rows
980 of predorsal plates (rarely two). Median series formed by 22–24 plates (Tab. 2). Lateral line
981 incomplete, with gap without pores along middle length of body, posterior portion of lateral line
982 sometimes absent. Median plate series truncated, not reaching posterior end of caudal peduncle
983 (Fig. 54). Abdominal plates arranged in three rows anteriorly and irregularly arranged between
984 pelvic-fin insertions. Lateral abdominal plates slightly larger and forming regular series. Median
985 abdominal series usually formed by one plate row. Naked area between lateral and median
986 abdominal plate series in most specimens (Fig. 55). Coracoid and cleithrum exposed and covered by
987 odontodes, except for median region of cleithrum between arrector fossae openings and medial
988 region of coracoids.

989 Head without conspicuous crests. Odontodes on parieto-supraoccipital tip greatly enlarged,
990 raised odontodes arranged in rounded patch, approximately five times larger than those of
991 surrounding areas (Fig. 52). Head, fin-spines, and body plates covered with odontodes, these larger
992 on anterior surface of all fin spines, and on ventral and dorsal margin of rostrum. Odontodes
993 medially directed on pelvic-fin thickened unbranched ray. Anteroventral margin of compound
994 pterotic with median-to-large size perforations. Infraorbital canal entering infraorbital series via
995 sphenotic. Lips roundish and papillose, posterior margin of lower lip fimbriate. Maxillary barbel
996 present.

997 Premaxillary and dentary teeth slender proximally and flattened distally bifid, major (medial)
998 cusp large and rounded, minor (lateral) minute pointed (Fig. 40B). Accessory patch of teeth absent
999 on dentary and premaxilla.
1000 Hypurals 1-2 and 3-5 completely fused, without median notch on the posterior margin of
1001 caudal-fin. Total vertebrae 28 (2 c&s).
1002 **Color in alcohol**. Ground color of dorsal and lateral surfaces dark gray. Dorsal and lateral
1003 body surfaces with rounded darker gray spots. Dorsal and lateral portions of head darker than body,
1004 except for lighter cheek region. Ventral surface of body pale yellow, except for scattered
1005 chromatophores, these forming spots on ventral surface of caudal peduncle. Region anterior to nares
1006 lighter than surrounding areas, but not forming longitudinal light stripes beyond this point. Parieto-
1007 supraoccipital tip lighter than remaining dorsal surface. Fins mostly gray pigmented, presenting
1008 light transverse bands, forming a striped pattern. Caudal fin almost completely dark pigmented,
1009 except for a pair of rounded to somewhat triangular hyaline areas in the middle portion of upper and
1010 lower lobes. Unbranched rays of caudal fin with striped pattern of transverse light bars. Ground
1011 color in life dark green.
1012 **Sexual dimorphism.** Characterized by the urogenital papilla, positioned just behind the anal
1013 opening in males. Adult males also possess a developed fleshy flap along the dorsal margin of first
1014 thickened pelvic-fin ray, that is absent in females. Flap slightly wider basally and progressively
1015 narrowing distally. In juvenile males, flap smaller or absent. Males have a longer thickned pelvic-
1016 fin unbranched ray that extends beyond anal-fin origin, with pelvic-fin ray reaching just to anal-fin
1017 origin in females.
1018 **Distribution and habitat.** *Hisonotus* sp. “Prata” is endemic to the rio da Prata, tributary of
1019 rio das Antas, in the rio Taquari drainage, which is a tributary to the rio Jacuí basin in the laguna
1020 dos Patos system. Rio da Prata, in the type-locality, is a rapid flow watercourse, wide and shallow,

with an average depth of 0.5 m, shallower in most of its extension, with clear water, rocky bottom and great amounts of submersed vegetation (Fig. 56). The specimens are caught between aquatic vegetation, most individuals associated with plants of the genus *Echinodorus*, which form green islands on the faults of the rocky substrate. *Hisonotus* sp. "Prata" is collected in the vegetation with the Hypoptopomatinae *Eurycheilichthys* sp. 2.

***Hisonotus* sp. "Sinos"**, new species

Figures 57-58, Table 9

Hisonotus sp. 4 in Reis & Carvalho (2007: 84) [listed].

Holotype. MCP uncataloged, 38.2 mm SL, female, Brazil, Rio Grande do Sul, Caraá, rio dos Sinos, brigde 7 km north of Caraá, road to Fundo Quente, 29°47'S 050°19'W, 12 Jan 1995, L. R. Malabarba, P. Buckup, A. R. Cardoso & G. Guazelli.

Paratypes. All from Brazil, Rio Grande do Sul, rio Jacuí basin, **rio dos Sinos drainage:** MCP 17643, 10, 11.3-39.2 mm SL, collected with the holotype. MCP 14619, 8 + 3 c&s, 28.3-42.0 mm SL, Caraá, rio do Sinos, about 5 km north of Caraá, 29°46'S 050°20'W, 17 Jan 1991, N. A. Menezes, R. E. Reis & E. H. L. Pereira. MCP 17620, 9, 30.0-40.3 mm SL, Caraá, rio dos Sinos, at praia João Fernandes, about 4 km of Caraá and 5 km of vila Rodolfo Tetour, 29°45'53"S 050°25'41"W, 12 Jan 1995, L. R. Malabarba, P. Buckup, A. R. Cardoso & G. Guazelli.

Non-type material. All from Brazil, Rio Grande do Sul, laguna dos Patos system. **Rio Jacuí drainage:** MCP 25459 15, 16.3-38.7 mm SL, Ibarama, lageado do Gringo about 2 km from hidroeletrical power plant Dona Francisca, 29°26'49"S 53°15'36"W. MCP 25719, 15 + 3 c&s, 24,1-39,1 mm SL, Ibarama, lageado do Gringo about 2 km from hidroeletrical power plant Dona

Francisca, 29°26’49”S 53°15’36”W. MCP 26223, 3, 21.5-39.3 mm SL, Ibarama, lageado do Gringo about 2 km from hidroeletrical power plant Dona Francisca, 29°26’49”S 53°15’36”W. MCP 26568, 6, 26.5-36.8 mm SL, Nova Palma, arroio Caemborá near Caemborá, 29°28’50”S 053° 17’50”W. **Rio Taquari drainage:** MCP 38766, 15 + 3 c&s, 16.9-38.2 mm SL, Lageado, arroio Saraquá, near Botanic Garden of Lageado, 29°27’42”S 052°00’14”W. UFRGS 8812, 14, 32.5-39.9 mm SL, Lageado, mouth of arroio pinheirinho with rio Forqueta. 29°19’21”S 052°14’03”W. MCP 41550, 4, 14.6-20.0 mm SL, Cotiporã, rio Carreiro at bridge on road between Dois Lageados and Cotiporã, 29°59’43”S 51°45’16”W. **Rio Caí drainage:** MAPA ex 1749, 1, 40.4 mm SL, Nova Petrópolis, arroio Macaquinhos tributary of rio Cadeia. MAPA 1750, 1, 40,6 mm SL, Nova Petrópolis, rio Cadeia, between Joaneta and Pinhal Alto. **Rio dos Sinos drainage:** MAPA 1868, 3, 32.9-41.2 mm SL, Santo Antonio da Patrulha, rio dos Sinos, bridge at Santo Antonio da Patrulha. MAPA ex-2391, 4, 29.7-41.2 mm SL, Santo Antonio da Patrulha, rio dos Sinos, bridge at Nossa Senhora de Monte Serrat. MCN 6455, 1, 38.7 mm SL, Três Coroas, arroio José Velho between Canastra Alta and Linha Café. MCN 6863, 1, 39,3 mm SL, Três Coroas, arroio Quilombo at Sander. **Lago Guaíba drainage:** MCP 23875, 3, 29.7-35.2 mm, arroio Itajacu, Glorinha, tributary of rio Gravataí, 29°47’34”S 50°42’07”W.

***Hisonotus* cf. “Sinos”:** All from Brazil, Rio Grande do Sul, laguna dos Patos system. **Rio Jacuí drainage:** MCP 26855, 3, 36.0-41.7 mm SL, Julio de Castilhos, arroio Tipiáia, about 13 km north of Julio de Castilhos on road to Cruz Alta, 29°06’14”S 53°34’24”W. MCP 41074, 4, 39.0-44.2 mm SL, arroio Tipiáia (or arroio Passo dos Buracos), on road from Júlio de Castilhos to Cruz Alta, 29°06’48”S 053°39’01”W.

Diagnosis. *Hisonotus* sp. “Sinos” differs from its congeners, except from *H. ringueleti*, *H. charrua*, *H. nigricauda*, *H. taimensis*, *H. laevior*, *Hisonotus* sp. “Camaquã”, *Hisonotus* sp. “Prata”, *Hisonotus* sp. “Carreiro”, *Hisonotus* sp. “Passo Novo”, and *Hisonotus* sp. “Felício” by having the

anterior margin of the snout with an odontode-free band (Fig. 59) vs. anterior margin of the snout complete covered by odontodes. Differs from those above, except *Hisonotus ringueleti*, *Hisonotus* sp. "Prata", and *Hisonotus* sp. "Carreiro" by the caudal-fin pigmentation, when well defined, composed of a dark background with a pair of hyaline areas, in the middle portion of upper and lower lobes, vs. a dark background without hyaline areas or a transverse hyaline band at the middle of caudal-fin length. *Hisonotus* sp. "Sinos" differs from *H. ringueleti* by having the posterior margin of the pectoral fin smooth vs. posterior portion of spine serrate. Differs from *Hisonotus* sp. "Prata" and *Hisonotus* sp. "Carreiro" by the absence of a raised tuft of odontodes on the posterior parieto-supraoccipital tip on adults, juvenile specimens presenting slightly enlarged odontodes at this portion (Fig. 60), vs. a conspicuous tuft of enlarged odontodes at posterior supraoccipital tip.

Description. Morphometrics and meristics in Table 9. Adult size moderate for members of this genus (larger than 40.0 mm in SL). Body stocky, robust, without conspicuous keels. Caudal peduncle round in cross section. Dorsal profile convex from tip of snout to dorsal-fin origin, except for almost straight portion anterior to parieto-supraoccipital. Dorsal-fin base straight and posteroventrally sloped, straight to slightly concave from posterior end of dorsal-fin base to caudal-fin origin. Ventral profile almost straight from snout tip to anal-fin origin, concave from this point to caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth at middle of caudal peduncle. Posterior profile of caudal-fin margin pronounced concave. Head and snout broad, snout rounded to slightly pointed in dorsal view, body progressively narrowing posterior of pelvic-fin insertion. Snout region anterior of nares slightly concave, interorbital region convex. Upper margin of orbit slightly elevate. Eye dorsolaterally positioned. Iris operculum present.

Pectoral fin I,6, posterior-fin margin almost straight, when depressed tip extending beyond middle of pelvic fin. Posterior margin of pectoral-fin spine smooth in adults, juveniles with serrae along distal half of pectoral-fin spine. Pectoral-fin axillary slit present, located below ventral margin

of cleithral process. Pelvic fin i,5. Tip of depressed fin almost reaching anal-fin origin in females, but extending far beyond anal fin origin in males. Dorsal II,7. Dorsal-fin origin located slightly posterior of vertical through pelvic-fin origin. Dorsal-fin spinelet somewhat rounded. Anal fin i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent. Caudal fin i,14,i.

Body almost entirely covered by plates except for region overlying opening of swim bladder capsule, area between pectoral girdle and lower lip, region around anus, and areas around base of paired fins. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened, with odontode-free band between dorsad and ventrad series of odontodes (Fig. 59). Snout plates anterior to nares reduced, small unplated area at lateral portion between rostral plate and prenasal plates. Three rows of predorsal plates. Median series formed by 22–24 plates (Tab. 2). Lateral line incomplete, with gap without pores along middle length of body. Median plate series complete, not truncated (Fig. 61). Abdominal plates arranged in three rows anteriorly and irregularly arranged between pelvic-fin insertions. Lateral abdominal plates slightly larger and forming regular series. Median abdominal series usually formed by one row, pre-anal shield region formed by small to median size plates (Fig. 62). Coracoid and cleithrum exposed and covered by odontodes, except for median region of cleithrum between arrector fossae openings and medial region of coracoids.

Head without conspicuous crests. Odontodes on parieto-supraoccipital tip slightly larger than those of surrounding areas, mostly in smaller specimens (Fig. 60). Head, fin-spines, and body plates covered with odontodes, these larger on anterior surface of all fin spines, and on ventral margin of rostrum, slightly enlarged on dorsal margin. Odontodes medially directed on pelvic-fin unbranched ray. Anterior margin of compound pterotic with median-to-large size perforations. Infraorbital canal entering infraorbital series via sphenotic. Lips roundish and papillose, posterior margin of lower lip fimbriate. Maxillary barbel present.

Premaxillary and dentary teeth slender proximally and flattened distally bifid, major (medial) cusp rounded to spatulate, minor (lateral) minute pointed (Fig. 40A). Accessory patch of teeth absent on dentary and premaxilla.

Hypurals 1-2 and 3-5 almost completely fused or with slight median notch on the posterior margin of caudal-fin skeleton. Total vertebrae 27-29 (3 c&s).

Color in alcohol. Ground color of dorsal and lateral light to dark brown. Dorsal and lateral surfaces of head darker than body, except for a light area in ventrolateral region contrasting with dark blotches. Region anterior to nares lighter than surrounding areas, forming paired longitudinal light stripes from snout tip to posterior end of parieto-supraoccipital, bifurcating and inconpicous after that point. Midlateral surface of body darkish, forming a darker brown wide longidinal stripe above lateral line. Ventral surface of body pale yellow, sometimes with scattered rounded blotches, mostly on cheeks and belly. Unbranched rays of pectoral, pelvic, dorsal, and anal fins mostly brown pigmented, except for narrow lighter bands, forming a striped pattern. Branched rays of these fins mostly hyaline except for darker transverse bands. Caudal fin most dark brown pigmented, except for a pair of hyaline areas, somewhat triangular, on the anterior portion of upper and lower lobes caudal fin rays. Hyaline areas, sometimes contacting each other at middle of caudal fin, forming an hour-glass-like mark. Posterior portion of the branched rays of caudal-fin hyaline. Unbranched rays of caudal fin with striped pattern of transverse light bars. In life, ground color of dorsum and flanks bright green (Fig. 58).

Sexual dimorphism. Characterized by the urogenital papilla, positioned just behind the anal opening in males. Adult males also possess a developed fleshy flap along the dorsal margin of first thickened pelvic-fin ray, that is absent in females. Flap slightly wider basally and progressively narrowing distally. Presence of a fleshy flap on medial portion of the first and second branched rays of pelvic fin. In juvenile males, flaps are smaller or absent. Males have a longer pelvic-fin that

extends far beyond the anal-fin origin, with the pelvic fin never reaching the anal-fin origin in females.

Distribution and habitat. *Hisonotus* sp. "Sinos" is widely distributed in the rio Jacuí basin from the eastern rio Gravataí and rio dos Sinos drainage to the lower portions of the western rio Jacuí drainage (Fig. 49). In the rio Jacuí basin, the new species was not found in the southern tributaries or in the headwaters of rio Jacuí and rio Taquari drainages. This species inhabits medium to fast flow watercourses, with clear waters with sandy or rocky bottoms, being collected in marginal or aquatic submersed vegetation. *Hisonotus* sp. "Sinos" is sympatric along almost its entire distribution with *Hisonotus armatus*.

Geographic variation. The specimens from arroio Tipiáia (Fig. 49) differ to a degree in pigmentation from other populations in the rio Jacuí basin. These specimens of arroio Tipiáia differ from other conspecifics by the darker pigmentation of caudal fin, which present reduced hyaline areas to complete dark brown in some specimens, contrasting with a pair of hyaline triangular areas on upper and lower lobes and no pigments at posterior portion of caudal fin rays (Fig. 63). The condition observed in the caudal-fin pigmentation in specimens from arroio Tipiáia, resemble that of *Hisonotus* sp. "Passo Novo" or *Hisonotus* sp. "Felício". However, when well defined, the hyaline areas in the specimens from arroio Tipiáia clearly are alike the triangular hyaline areas presented by other populations of *Hisonotus* sp. "Sinos". A PCA was performed to compare morphometric data of that population to others of *Hisonotus* sp. "Sinos", in rio Jacuí, rio Taquari, and rio dos Sinos (type locality). No discriminant differences were found between the populations of *Hisonotus* sp. "Sinos", except when compared with the species *Hisonotus* sp. "Passo Novo" (Fig. 64). For these reasons, I tentatively identified these specimens from arroio Tipiáia as belonging to the species *Hisonotus* cf. "Sinos", and restricted the type series to specimens near to type-locality.

***Hisonotus* sp. "Passo Novo"**, new species

Figure 65, Table 10

Hisonotus sp. 3 in Reis & Carvalho (2007: 84) [listed].

Holotype. MCP uncataloged, 41.5 mm SL, female, Brazil, Rio Grande do Sul, Cruz Alta, Rio Passo Novo, on road from Cruz Alta to Ibirubá, rio Jacuí drainage, 28°38'43"S 053°33'35"W, 2 Apr 1999, R. E. Reis, E. H. L. Pereira & V. A. Bertaco.

Paratypes. All from Brazil, Rio Grande do Sul, rio Jacuí drainage: MCP 22701, 27 + 3 c&s, 26.3-41.1 mm SL, collected with the holotype. MCP 41072, 21 46, 29.0-41.0 mm SL, collected at the type locality, 13 Dec 2006, T. P. Carvalho & A. R. Cardoso.

Diagnosis. *Hisonotus* sp. "Passo Novo" differs from its congeners, except from *H. ringueleti*, *H. charrua*, *H. nigricauda*, *H. taimensis*, *H. laevior*, *Hisonotus* sp. "Camaquã", *Hisonotus* sp. "Prata", *Hisonotus* sp. "Carreiro", *Hisonotus* sp. "Sinos", and *Hisonotus* sp. "Felício" by having the anterior portion of snout with an odontode-free band (Fig. 66), vs. snout completely covered with odontodes. It Differs from those above, except from *H. laevior*, *H. taimensis*, and *Hisonotus* sp. "Felício", by a darkly pigmented caudal fin, without a hyaline area in the middle portion vs. caudal fin presenting hyaline areas in the middle portion. *Hisonotus* sp. "Passo Novo" differs from *H. laevior*, *H. taimensis*, and by *Hisonotus* sp. "Felício" by having the abdominal median plate series large, one or two series of plates regularly arranged between the lateral abdominal series (Fig. 67) vs. abdominal median plate series with several small plates irregularly arranged between the lateral abdominal plates in *H. laevior* and *H. taimensis*, or abdominal medium series absent, midline portion of the belly naked without plates in *Hisonotus* sp. "Felício".

Description. Morphometrics and meristics in Table 10. Adult size small to median for members of this genus (usually less than 40.0 mm SL). Body relatively stocky, robust, without conspicuous keels. Caudal peduncle round in cross section. Dorsal profile convex from tip of snout

to parieto-supraoccipital tip, slightly convex from that point to dorsal-fin origin. Dorsal-fin base straight and posteroventrally sloped, straight from posterior end of dorsal-fin base to caudal-fin origin. Ventral profile almost straight from snout tip to anal-fin origin, concave from this point to caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth at posterior end of caudal peduncle. Posterior profile of caudal fin concave to slightly forked. Head and snout broad, snout rounded to slightly square in dorsal view, body progressively narrowing posterior of pelvic-fin insertion. Snout region anterior of nares concave, interorbital region convex. Upper margin of orbit slightly elevated. Eye dorsolaterally positioned. Iris operculum present.

Pectoral fin I,6. Pectoral-fin posterior margin slightly rounded to straight, when depressed tip extending just anterior to middle of pelvic fin. Posterior margin of pectoral-fin spine smooth in adults, juveniles with feeble serrae along distal third of pectoral-fin spine. Pectoral-fin axillary slit present, located below posterior bony margin of cleithral process. Pelvic fin i,5. Tip of depressed fin just reaching anal-fin origin in females, but extending far beyond that point in males. Dorsal-fin II, 7. Dorsal-fin origin located slightly posterior to vertical through pelvic-fin origin. Dorsal-fin spinelet slight laterally extended. Anal i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent. Caudal fin i,14,i.

Body almost entirely covered by plates except for region overlying opening of swim bladder capsule, area between pectoral girdle and lower lip, region around anus, and area around base of paired fins. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened, with odontode-free area between dorsad and ventrad series of odontodes (Fig. 66). Snout plates anterior to nares reduced, small unplated area at lateral portion between rostral plate and nostril. Three rows of predorsal plates. Median series formed by 22–24 plates (Tab 2). Lateral line incomplete, with gap without pores along middle length of body. Median plate series truncated, not reaching posterior end of caudal peduncle (Fig. 68). Abdominal plates arranged in three rows

anteriorly and irregularly arranged between pelvic-fin insertions. Lateral abdominal plates slightly larger and forming regular series. Median abdominal series formed by one or two plate series, pre-anal shield region formed by median to large plates (Fig. 67). Coracoid and cleithrum exposed and covered by odontodes, except for median region of cleithrum between arrector fossae openings and medial region of coracoids.

Head without conspicuous crests. Odontodes on parieto-supraoccipital tip slightly larger than those of surrounding areas, most in smaller specimens. Head, fin-spines, and body plates covered with odontodes, these larger on anterior surface of all fin spines, and on ventral margin of rostrum slightly enlarged in dorsal margin. Odontodes medially directed on pelvic-fin unbranched ray. Anterior margin of compound pterotic with median-to-large size perforations. Infraorbital canal entering infraorbital series via compound pterotic. Lips roundish and papillose, posterior margin of lower lip fimbriate. Maxillary barbel present.

Premaxillary and dentary teeth slender proximally and flattened distally□bifid, major (medial) cusp large and rounded, minor (lateral) minute pointed. Accessory patch of teeth absent on dentary and premaxilla.

Hypurals 1-2 and 3-5 almost completely fused, with slight median notch on the posterior margin of caudal-fin skeleton. Total vertebrae 27-28 (2 c&s).

Color in alcohol. Ground color of dorsal and lateral surfaces pale to dark brown. Dorsal and lateral body surfaces with rounded gray spots. Dorsal and lateral portions of head darker than body, except for a lighter area in the ventrolateral region contrasting with dark blotches. Ventral surface of body pale yellow, except for scattered chromatophores. Region anterior to nares lighter than surrounding areas, forming a longitudinal light stripe from snout tip to posterior end of parieto-supraoccipital. Unbranched rays of fins mostly brown pigmented, sometimes presenting hyaline transverse bands, forming a striped pattern. Caudal fin almost completely brown pigmented, except

for a hyaline area on the posterior end of upper caudal fin rays. Unbranched rays of caudal fin with alternating transverse light bars and dark areas. General color pattern in life dark green (Fig. 69)

Sexual dimorphism. Characterized by the urogenital papilla, positioned just behind the anal opening in males. Adult males also possess a developed fleshy flap along the dorsal margin of first thickened pelvic-fin ray, that is absent in females. Flap slightly wider basally and progressively narrowing distally. Presence of a fleshy flap in the medial portion of the first and second branched rays of pelvic fin. In juvenile males, flaps smaller or absent. Males have longer pelvic-fin unbranched ray that extends far beyond anal-fin origin, with pelvic-fin reaching just to anal-fin origin in females.

Distribution and habitat. *Hisonotus* sp. "Passo Novo" is endemic to the upper rio Jacuí basin, in the laguna dos Patos system. The new species is known only from the rio Passo Novo an affluent of the rio Ingaí tributary of the upper portion of rio Jacuí basin (Fig. 49). This species inhabits a median to fast flowing watercourse, with clear to brown waters running over sand or stones. Being found in marginal submersed grasses, *Hisonotus* sp. "Passo Novo" could be collected in the vegetation together with *Eurycheilichthys limulus*. Rio Passo Novo in the type-locality is a small creek, about 3m wide and shallow with a maximum depth of 0.5 m at 400 m above sea level (Fig. 70). The stream is somewhat degradated, crossing the urban area of Cruz Alta, and has deforested riparian vegetation and amounts of rubbish along the margins.

***Hisonotus* sp. "Felício"**, new species

Figure 71, Table 11

Holotype. MCP uncataloged, 43,0 mm SL, female, Brazil, Rio Grande do Sul, Júlio de Castilhos, arroio Felício on road from Nova Palma to Júlio de Castilhos, 29°19'04"S 53°37'54"W, 12 Dec 2006, T. P. Carvalho & A. R. Cardoso.

Paratypes. All from Brazil, Rio Grande do Sul, rio Jacuí drainage: MCP 41073, 11+2 c&s, 37.4-44.3 mm SL, collected with the holotype. MCP 26802, 1, 43.0 mm SL, at type locality, 28 Nov 2000, L. Malabarba, V. Bertaco, M. Azevedo, J. Bastos & C. Ricken.

Diagnosis. *Hisonotus* sp. "Felício" differs from its congeners, except from *H. ringueleti*, *H. charrua*, *H. nigricauda*, *H. taimensis*, *H. laevior*, *Hisonotus* sp. "Camaquã", *Hisonotus* sp. "Prata", *Hisonotus* sp. "Carreiro", *Hisonotus* sp. "Sinos", and *Hisonotus* sp. "Passo Novo" by having the anterior margin of the snout with an odontode-free band (Fig. 72) vs. anterior margin of the snout complete covered by odontodes. It differ from those above by its lack of the median abdominal plate series, leaving a large naked abdominal area, plates at ventral midline restricted to small platelets at pre-anal shied region (Fig. 73) vs. presence of the median abdominal plate series, pre-anal shield region plated.

Description. Morphometrics and meristics in Table 11. Adult size moderate to large for members of this genus (larger than 40.0 mm in the SL). Body robust, without conspicuous keels. Caudal peduncle round in cross section, slightly flattened dorsally. Dorsal profile convex from tip of snout to dorsal-fin origin. Dorsal-fin base straight and posteroventrally sloped, straight from posterior end of dorsal-fin base to caudal-fin origin. Ventral profile somewhat concave from snout tip to posterior portion of head, almost straight from that point to anal-fin origin. Concave at anal fin base and straight from that point to caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth at middle of caudal peduncle. Posterior profile of caudal-fin margin slightly concave. Head and snout broad, snout rounded to slightly pointed in dorsal view, body progressively narrowing posterior of pectoral-fin insertion. Snout region anterior of nares straight,

not depressed□interorbital region straight to slightly convex. Upper margin of orbit not elevated. Eye dorsolaterally positioned. Iris operculum present.

Pectoral fin I,6. Pectoral-fin posterior margin almost straight, when depressed tip extending beyond middle of pelvic fin. Posterior margin of pectoral-fin spine smooth in adults, smaller specimens with feeble serrae along posterior third of pectoral-fin spine. Pectoral-fin axillary slit present, located below ventral margin of cleithral process. Pelvic fin i,5. Tip of depressed fin just reaching anal-fin origin in females, but extending far beyond that point in males. Dorsal II,7. Dorsal-fin origin located slightly posterior of vertical through pelvic-fin origin. Dorsal-fin spinelet laterally extended. Anal fin i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent. Caudal fin i,14,i.

Body almost entirely covered by plates except for region overlying opening of swim bladder capsule, area between pectoral girdle and lower lip, region around anus, and base of paired fins, and belly region between lateral abdominal plate series. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened, with odontode-free area between dorsad and ventrad series of odontodes (Fig. 72). Snout plates anterior to nares reduced, small unplated area at lateral portion between rostral plate and prenasal plates. Three rows of predorsal plates. Median series formed by 23–24 plates (Tab. 2). Lateral line incomplete, with gap without pores along middle length of body. Median plate series not truncated, reaching posterior end of caudal peduncle (Fig. 74). Median abdominal plate series absent. Irregularly arranged platelets in pre-anal shield region, absent in some specimens. Lateral abdominal plates relative small and forming regular series of three to six plates in each side (Fig. 73). Coracoid and cleithrum exposed and covered by odontodes, except for median region of cleithrum between arrector fossae openings and medial region of coracoids.

Head without conspicuous crests. Odontodes on parieto-supraoccipital tip slightly larger than those of surrounding areas. Head, fin-spines, and body plates covered with odontodes, these larger on anterior surface of all fin spines, and on ventral margin of rostrum, slightly enlarged on dorsal margin of rostrum. Anteroventral margin of compound pterotic with median-to-large size perforations. Infraorbital canal entering infraorbital series via sphenotic. Lips roundish and papillose, posterior margin of lower lip fimbriate. Maxillary barbel present.

Premaxillary and dentary teeth slender proximally and flattened distally□bifid, major (medial) cusp round□minor (lateral) minute pointed. Accessory patch of teeth absent on dentary and premaxilla.

Hypurals 1-2 and 3-5 completely fused or with median notch on posterior margin of caudal-fin skeleton. Total vertebrae 29 (2 c&s).

Color in alcohol. Ground color of dorsal and lateral surfaces brownish to gray. Dorsal and lateral portions of head darker than body, except for a yellowish area, contrasting with dark blotches, in the ventrolateral region of head. Region anterior to nares lighter than surrounding areas, forming a paired longitudinal light stripe from snout tip to posterior end of parieto-supraoccipital, bifurcating and inconpicous since that point. Ventral surface of body pale yellow, with scattered chromatophores, mostly grouped on cheeks and bases of pectoral fin forming dark blotches. Unbranched rays of pectoral, pelvic, dorsal, and anal fins mostly brown, except for narrow lighter bands, forming a striped pattern. Branched rays of these fins mostly hyaline except for darker transverse bands. Caudal mostly dark brown, except for a hyaline area on posterior portion of upper rays. Unbranched rays of caudal fin with striped pattern of transverse light bars. In life, ground color of dorsum and flanks dark green.

Sexual dimorphism. Characterized by the urogenital papilla, positioned just behind the anal opening in males. Adult males also possess a developed fleshy flap along the dorsal margin of first

thickened pelvic-fin ray, that is absent in females. Flap slightly wider basally and progressively narrowing distally. Presence of a fleshy flap in the medial portion of first and second branched rays of pelvic fin. In juvenile males, flaps smaller or absent. Males have longer pelvic fin that extends far beyond anal-fin origin, with the pelvic fin just reaching anal-fin origin in females.

Distribution and habitat. *Hisonotus* sp. "Felício" is known only from the arroio Felício, a stream affluent to the rio Soturno that is a western tributary of rio Jacuí basin (Fig. 49). This species inhabits a median to fast flowing watercourse, with clear water running over sand or rocks, being collected mostly in the marginal submersed vegetation composed of bamboos (Fig. 75).

***Hisonotus* spp.** In addition to the species formally included in this revision, two other species are present in the laguna dos Patos system. One of then, tentatively identified here as *Hisonotus* aff. *leucofrenatus* (Fig. 76), is distributed along the coastal plan at eastern laguna dos Patos in Rio Grande do Sul (Fig. 27) and is sympatric with *H. laevior* in this region. *Hisonotus* aff. *leucofrenatus* can be distinguished from all other congeners by the combination of having the snout completely covered by odontodes, without an anterior odontode-free band, by its caudal fin coloration, which is almost completely pigmented without a hyaline area in the midventral portion of the caudal fin, and by the number of predorsal and lateral plates, three and 24-25 respectively. This taxon is found also in the rio Tramandaí system, where it has been misidentified by Gomes (1947) in the resurrection and redescription of *Hisonotus laevior*. Although the three specimens used in the redescription of Gomes (1947) were not examined, extensive material from the same river (rio Maquiné) and other localities in the rio Tramandaí system were examined. *Hisonotus laevior* is absent in this system being *H.* aff. *leucofrenatus* the only *Hisonotus* in that region. The tentative identification of this taxon is due to its high degree of similarity with *H. leucofrenatus* (see discussion for details).

The other species, identified here as *Hisonotus charrua* (Fig. 77), is known only from the arroio dos Pires, a stream tributary to rio Piratini in the upper portions of the São Gonçalo drainage (Fig. 27). *Hisonotus charrua* can be diagnosed by the combination of an odontode-free area in the anterior margin of the snout, by its coloration on caudal fin, which presents a hyaline transverse band in the middle portion, and by the number of predorsal and lateral plates, three and 23-25 respectively. No differences were found between *Hisonotus charrua* from the rio Uruguai basin and arroio dos Pires in the laguna dos Patos system (see discussion for details). Here both species are illustrated and included in the taxonomic key, however, their identification should be limited to those areas mentioned above.

Material examined. *Hisonotus* aff. *leucofrenatus*: MCN 17790, 1, 33.2 mm SL, lagoa do Casamento at southeast coast of ilha Grande, Palmares do Sul, 30°24'11"S 50°36'56"W. MCN 18137, 5, 25.4-28.9 mm SL, lagoa do Casamento at southern margin, Palmares do Sul, 30°29'S 50°35'W. MCP 21373, 1, 36.4 mm SL, laguna dos Patos at Barra Falsa, downstream dam, São José do Norte, 31°34'19"S 51°27'35"W. MCP 41630, 7, 26.3-39.0 mm SL, laguna dos Patos at Barra Falsa, upstream dam, São José do Norte, 31°34'19"S 51°27'35"W. *Hisonotus charrua*: MCP 25139, 15 + 2 c&s, 32.4-46.4 mm SL, arroio dos Pires on bridge of railroad at Passo dos Pires, São Gonçalo drainage, Pinheiro Machado, 31°38'S 53°27'W.

Key to the species of *Hisonotus* from the laguna dos Patos system

1a. Dorsal and ventral series of odontodes along anterior margin of the snout separated by a narrow or large odontode-free band ……....2

1b. Absence of an odontode-free band, anterior margin of snout completely covered by odontodes.....……..11

2a. Presence of a tuft of enlarged odontodes on the parieto-supraoccipital tip, odontodes with aproximately four to five times larger than the surrounding areas …….…….3

2b. Absence of a tuft of enlarged odontodes on the parieto-supraoccipital tip, odontodes with approximately same size or slightly larger than surrounding areas ...……..4

3a. Pectoral-fin spine short (22.0-25.6% of SL, mean 24.0%), just reaching the vertical trough dorsal-fin origin□general color pattern in life dark green, in alcohol grayish ....…….....*Hisonotus* sp."Prata" (rio da Prata, in the rio Taquari drainage).

3b. Pectoral-fin spine long (24.7 -29.0 % of SL, mean 26.7%), far surpassing the vertical trough dorsal-fin origin□general color pattern in life yellowish, in alcohol yellow to brownish ……...……...…..……*Hisonotus* sp. "Carreiro" (rio Carreiro, in the rio Taquari drainage).

4a. Three predorsal plate series, 22-25 plates in median series, and 27-29 vertebrae….…….…...5

4b. Three or four predorsal plate series (modally four), 25-29 plates in median series, and 30-32 vertebrae ……..……..…..9

5a. Caudal fin with paired hyaline areas (somewhat triangular) at the middle portion of lower and upper lobes …….……*Hisonotus* sp. "Sinos" (rio Jacuí basin)

5b. Caudal fin mostly dark, or presenting a tranversal hyaline band at the middle portion ……6

6a. Posterior portion of lateral line absent□median abdominal plate series composed of several small plates, irregularly arranged …….……*Hisonotus nigricauda* (lower portions of laguna dos Patos system and rio Uruguai basin)

6b. Posterior portion of lateral line present, median abdominal plate series absent or composed of larger plates, arranged in one to three series ……...7

7a. Caudal fin with transversal hyaline band..……*Hisonotus charrua* (upper rio Piratiní drainage)

7b. Caudal fin mosly dark, without tranversal hyaline band……8

8a. Median abdominal plate series present, formed by one or two series of median to large plates median lateral plate series truncated, not reaching the posterior end of caudal peduncle ……*Hisonotus* sp. "Passo Novo"(upper rio Jacuí drainage)

8b. Median abdominal plate series absent, scattered platelets at pre-anal shield region median lateral plate series not truncated, reaching the posterior end of caudal peduncle ……*Hisonotus* sp. "Felício" (lower rio Jacuí drainage)

9a. Caudal peduncle slightly square in cross section odontode-free band on snout wide rostral plate thin without the posterior notch articulation with the mesethmoid…… ……*Hisonotus* sp. "Camaquã" (rio Camaquã drainage)

9b. Caudal peduncle round in cross section odontode-free band on snout narrow rostral plate thick with a posterior notch articulation ……10

10a. Body relatively slender, body shallow at dorsal-fin origin (body depth 13.3-16.3% in SL) ……*Hisonotus taimensis* (lower portions of laguna Mirim)

10b. Body relatively robust, body deep at dorsal-fin origin (body depth 16.2-20.8 % in SL) ……..... *Hisonotus laevior* (laguna dos Patos system)

11a. Posterior portion of lateral line absent small plates in the median abdominal series, irregularly arranged ……..*Hisonotus nigricauda* (lower portions of laguna dos Patos system and rio Uruguai basin).

11b. Posterior portion of lateral line present large plates in median abdominal series regularly arranged usually in a single row …….....12

12a. Caudal fin with a tranversal hyaline band, dorsal surface of head and body with dark marks contrasting with somewhat reticular light areas…….*Hisonotus armatus* (laguna dos Patos system)

12b. Caudal fin mostly dark, without a tranversal hyaline band□dorsal surface of head and body yellowish to pale brown, without dark marks……*Hisonotus* aff. *leucofrenatus* (eastern coastal plain of laguna dos Patos)

Discussion

Hisonotus was resurrected by Schaefer (1998) and diagnosed by having reduced or absent snout plates anterior to nares, yelding a large paired unplated region in either side of midline from rostrum to nostril, and by having the margins of rostral plates thickened with enlarged odontodes (Schaefer, 1998, p. 387). However, the monophyly of the genus have been questioned by several authors (Britski & Garavello, 2003, 2007 and Azpelicueta et al., 2007), because some species do not present the diagnostic characters proposed by Schaefer (1998). As stated by Britski & Garavello (2007) some specimens of *Hisonotus notatus*, the type species, do not present reduction in plates anterior to nares. Moreover, these authors argue that the condition of the thickened rostral plates is shared with other hypoptopomatinae taxa, as for example *Parotocinclus*, and cannot be considered exclusive to *Hisonotus*. Apparently no specimens of *H. notatus* was examined by Schaefer for his proposed diagnosis (1998). The *H. notatus* cited in the material examined (Schaefer 1998, p. 399, *Hisonotus notatus*: CAS 56717 Brazil: rio Ribeira do Iguape) is likely a misidentification since that species do not occurs in the rio Ribeira de Iguape and the only species of the genus occurring in that basin is *H. leucofrenatus* (Oyakawa et al., 2006 and pers. obs.). In fact, my examination indicates that *H. notatus* as well other species of the genus do not present an unplated area anterior to nares (Fig. 78 and Fig. 34). However, the reduction in different degrees of the prenasal plates anterior to nostril occur in most species of *Hisonotus* (Fig. 79 and Fig. 8). This character state condition should

be tested to find out wheter it constitutes a synapomorphy for *Hisonotus* with posterior reversions or rather a derived feature for some species within the genus.

Another character used by Schaefer refers to the truncation of the median lateral plate series on the posterior end of caudal peduncle (Schaefer, 1998, ch. 33). According to Schaefer's topology (1998) the truncation involving the median series evolved independently in *Hisonotus* and *Microlepidogaster*. This character was discussed by Britski & Garavello (2003, 2007), and reported as being highly variable. Bristski & Garavello also noted that *H. notatus* and *H. nigricauda* have a complete median plate series, being variable in individuals of same species or even bilaterally variable in the same individual. Therefore, they conclude that this character is inappropriate to define the genus. I agree with those authors and confirm the presence of the complete median series in *H. notatus* (Fig. 80), in other *Hisonotus* species, and a polymorphic nature of this character in *H. nigricauda*. However, from 13 cleared and stained specimens examined of *H. nigricauda*, only three (two specimens in just one side) present a complete median series, in most specimens the last one or two plates in dorsal and ventral series contact each other at lateral midline. Among the species of *Hisonotus* described in this work, having the truncation of median series, *H. nigricauda* is unique showing variation of this feature. For these reason, that characteristic could be useful to diagnose some species within *Hisonotus* and, if not derived for the genus as stated by Schaefer (1998), its a feature shared by some species.

Besides that, *Hisonotus*, as stated by Schaefer (1998, character 37), do not present the fourth infraobital expanded ventrally, which is a reversal within Otothyrini in *Hisonotus* and *Pseudotocinclus*. However, my examination indicates a ventrally expanded fourth infraorbital in *Hisonotus* (Fig. 81), rejecting Schaefer's proposition, and not being useful to diagnosis *Hisonotus*.

Another derived feature presented by *Hisonotus* in Schaefer's hypothesis (1998) is the enlarged swimbladder capsule. Most species of *Hisonotus* clearly present an enlarged swimbladder

capsule that extends just to the joint between the Weberian complex centrum and the sixth centrum. However, in some species (e.g. *Hisonotus armatus*) the swimblader capsule extends anteriorly to the joint of the Weberian complex centrum and the sixth centrum. This character should be reanalyzed since the degree of expansion of the swimbladder capsule is highly variable in the supposed derived condition. Besides that, the homoplastic condition of this character, appearing independently in different hypoptopomatinae taxa is weekly useful as a diagnostic character for *Hisonotus*.

In the context of a non-diagnosable *Hisonotus*, Britski and Garavello described three species of *Hisonotus*, *H. insperatus* (2003), and *H. chromodontus* plus *H. luteofrenatus* (2007). These species do not present most of the mentioned diagnostic features of the genus and *H. chromodontus* and *H. luteofrenatus* strangely extended the distribution of the genus into the Amazon basin in the rio Tapajós drainage. The Amazon taxa seems to be the same species treated as New Taxon 3 in Schaefer (1998), which remains undescribed nowadays. According to Schaefer (1998 p. 387) New Taxon 3 can be defined among other characters by its rostrum pointed and elongated□thickened paired rostral plate□dorsal and ventral margins of trunk plates without odontode ridges□and pectoral arrector fossae open. This features fit with those presented by *H. luteofrenatus* and it is likely that these species represent Schaefer's New taxon 3. Moreover, most of the material examined by Schaefer (1998) come from the rio Xingú basin, neighbor to the rio Tapajós basin, in which *H. luteofrenatus* is also encountered (per. obs.). In Schaefer's analysis, the New Taxon 3 is basal within Otothyrini and not closely related to *Hisonotus*. In the same manner, Gauger & Buckup (2005) included both *H. luteofrenatus* and *H. chromodontus* in their phylogeny as part of the seven unnamed taxa. These species of *Hisonotus* do not grouped with *Hisonotus notatus* in both hypotheses proposed by Gauger & Buckup (2005). Lehmann (2006□named "new taxon TT") also analyzed the species of *Hisonotus* described by Britksi & Garavello (2003 and 2007) and did not

find these species related to *Hisonotus*, but forming a well supported clade relatively basal in Hypoptopomatinae. For these reasons, these taxa should be removed from *Hisonotus* in a future phylogenetic analysis. Excluding these, there are no evidences to support the paraphyly of the remaining *Hisonotus* species.

Some character states shared by the species of *Hisonotus* could be tentatively polarized and therefore constituting derived features for groups of species. In this manner some relationships are putatively inferred. Three species of *Hisonotus* in the laguna dos Patos system present some features which are likely synapomorphies for these species. *Hisonotus laevior*, *H. taimensis*, and *H.* sp. "Camaquã" have an increased number of vertebrae, predorsal plates, and lateral plates, contrasting with other species of *Hisonotus*. These species have 30-32 vertebrae which seems to be a derived feature contrasting with the low number of other species of Hypoptopomatinae > 29 vertebrae (Schaefer, 1997). Moreover, this putative clade presents 3-4 (modally 4) predorsal plates, and 25-29 lateral plates, versus 2-3 (modally 3) predorsal plates, and 20-25 lateral plates in other species of *Hisonotus*. The above mentioned derived features might be related with the elongated body presented by the species.

Other derived feature presented by species of *Hisonotus* described by Aquino et al. (2001) is the odontode-free area between the dorsad and ventrad series of odontodes. Most hypoptopomatines having thickened rostral plates present no odontode-free band, being its anterior portion of rostrum completely covered by odontodes (eg. *Epactionotus bilineatus*, *Parotocinclus maculicauda*, and *Hisonotus notatus* Fig. 82-84 respectively). Contrastingly, a large number of species of *Hisonotus* presents a band devoid of odontodes on the anterior portion of the snout. The width of the odontode-free band is somewhat variable between species of *Hisonotus*, however, its presence seems to be homologous.

Some species of *Hisonotus* present a peculiar green coloration in life (Fig. 58, 69). That color pattern and the capacity to change color was described and discussed by Azpelicueta et al. (2004) for *Hisonotus aky*. The greenish coloration was previously observed among hypoptopomatines by Retzer et al. (1999), who shown that *Acestridium dichromum* is able to change color (greenish to brownish) for camouflage. Field examination of this feature revealed that the green color pattern is more widespread among species of *Hisonotus* and not exclusive to *H. aky*. In the other hand, some species of *Hisonotus* never presented this green pattern, even when collected syntopically with species presenting the green coloration (eg. *Hisonotus armatus* collected with the "green" *Hisonotus* sp. "Sinos"). This green feature is shared by several species of *Hisonotus* inhabiting the rio Uruguai basin and the laguna dos Patos system, and its homology should be tested in a phylogenetic framework.

Geographic distribution. Twelve species of *Hisonotus* are herein reported for the laguna dos Patos system. That diversity greatly surpasses that presented by other hydrographic basins. As cited previously by Carvalho et al. (in press), *Hisonotus* is not the only high diverse genus of loricariids in that system, which indicates a species richness and endemisms for that region. From the species of *Hisonotus* treated in this review only three are not endemic to the laguna dos Patos system (*Hisonotus nigricauda*, *Hisonotus* aff. *leucofrenatus*, and *Hisonotus charrua*).

Hisonotus nigricauda has a wide distribution compared to other congeners, and is likely to be part of a widespread taxa (see remarks for *H. nigricauda*) distributed in the lower portions of Río de La Plata and laguna dos Patos systems. The species is present in the marshlands of the rio Vacacaí drainage and rio Ibicuí headwaters. The watershed of these drainages is located in a flat region separated from each other by no more than a few hundred meters. During periods of floodings, both drainages maybe connected permiting fish, which lives in these marsh habitats, to

disperse from one to the other. Recently, several fishes pertaining to rio Uruguai basin (*Aphyocharax anistsi*, *Acestrorhynchus pantaneiro*, *Pyrrhulina australis*, etc…) were caught in the rio Vacacaí drainage. The probable cause of these recent introductions is the connection of these two drainages by irrigation channels used in the rice culture. Since *Hisonotus nigricauda* has a wide distribution in the system, and syntypes collection predates the rice culture in Rio Grande do Sul, the human-influenced introduction hyphotesis is rejected. Therefore its dispersion is likely to be part of a historical event. *Hisonotus nigricauda* distribution overlaps that presented by *Otocinclus flexilis* Cope, 1894 (Schaefer, 1997), and both are frequently collected together in slow flowing, lowland watercourses. Recently, Lehmann (2006, p. 403) proposed the resurrection of *Otocinclus arnoldi* Regan, 1909, which is distributed in the Río de La Plata system, from the synonym of *O. flexilis* to the laguna dos Patos system. That split, based on morphological traits, between monophyletic assemblages distributed in both laguna dos Patos system and rio Uruguai basin is common (e.g. *Heterocheirodon jacuiensis*/*H. yatai* □ *Parapimelodus valenciennes*/*P. nigribarbis* and *Bunocephalus doriae*/*Bunocephalus* sp. nov.). The laguna dos Patos system is thought to have been formed in the quartenary and apparently its origins includes captures of some rio Uruguai headwaters (Beurlen, 1970). Since the vicariance, populations from these isolated river systems can be morphologicaly recognized as different lineages, receiving different formal names. That could suggest the split between *Hisonotus nigricauda* from laguna dos Patos system and rio Uruguai basin, however, no apparent difference is found between these two geographically isolated populations hence considered as a single species.

Also noteworthy is the presence of *Hisonotus* aff. *leucofrenatus* in the laguna dos Patos system. That species has a punctuated distribution in that region contrasted with its wider distributions in neighboring basins. *Hisonotus leucofrenatus* Miranda Ribeiro, 1908 was described from the rio Ribeira de Iguape basin, a brazilian atlantic coastal drainage in southern São Paulo

state. No difference was found between examined populations from rio Ribeira do Iguape and rio Tramandaí and both can be diagnosed by identical traits. Recently, a kariologycal characterization by Andreata *et al.* (2006) of *H. leucofrenatus* and other species of *Hisonotus*, revealed no differences between *H. leucofrenatus* populations along the coastal drainages from Ribeira de Iguape to rio Itapocú drainage at northeast Santa Catarina, indicating not only morphological similarity, related here, but karyotype homogeneity. An accurate review of *Hisonotus leucofrenatus* populations from Brazilian eastern coastal drainages should be made to discover whether they constitute a complex of similar species or a single species. Considering the wide range of that species the term "*aff.*" is used to refer to the populations from the rio Tramandaí system and eastern laguna dos Patos. Malabarba and Isaia (1992) recorded several species shared between the lower portions of rio Tramandai system and laguna dos Patos system, and discussed the relationships between those areas. According to them the dispersion between the laguna dos Patos system and the rio Tramandaí system was the main source of the fish fauna of coastal plain. *Hisonotus* aff. *leucofrenatus* presents a distribution similar to that presented by other hypoptopomatine, *Otothyris rostrata*, which is complementary to the pattern described above. *Otothyris rostrata* is known from the lower portions of rivers draining to the coast of Santa Catarina and Rio Grande do Sul states and laguna dos Patos system, while the genus *Otothyris* is distributed along the Atlantic coastal drainages from Bahia state to southern Brazil (Garavello et al. 1998). Both, *O. rostrata* and *H.* aff. *leucofrenatus* are widely distributed in the lowlands of northern coastal drainages, therefore their presence in the laguna dos Patos system is likely to be due to dispersion through the coastal plain of southern Brazil. A review of the geological origin of the coastal province of Rio Grande do Sul state is presented by Schwarbold & Schäfer (1984), and according to them, the eastern coastal plain in southern Brazil was formed during the pleistocene glaciations. In that period, the laguna Mirim and laguna dos Patos were formed as freshwater habitats, however becaming part of a marine

environment during sea transgressions. The presence of *Hisonotus* aff. *leucofrenatus* in the laguna dos Patos system should be relatively recent, since its actual distribution area in the eastern laguna dos Patos coastal plain was submerged by sea water during the Sangamon interglacial period (80.000 years).

The distribution of *Hisonotus charrua* is also puzzling. That species is widely distributed in the rio Uruguai basin contrasting with single collecting site in the laguna dos Patos system. The headwaters of the rio Piratini are relatively close to the headwaters of the rio Negro, and a stream capture event between those drainages could have been the responsible for the interchange of *H. charrua* from rio Uruguay basin to laguna dos Patos system. However, no subsequent dispersion of that species occurred in the São Gonçalo drainage. Recently, specimens of *Jenynsia onca*, which is widespread in the rio Negro and rio Ibicuí drainage tributaries to the rio Uruguay basin (Lucinda et al., 2002), were collected in a single nearby locality near in the rio Camaquã drainage. That finding reinforces that dispersion through streams capture events without subsequent dispersion of the species may be frequent. Additional samples from the headwater fish fauna of those drainages is necessary for a better understanding of the complex faunal pattern of these regions.

Several species of *Hisonotus* presented in this review are endemic to the headwaters of the rio Jacuí basin. Two of then (*Hisonotus* sp. "Carreiro" and *Hisonotus* sp. "Prata) are collected in fast flowing watercourses of high altitudes, which are uncommon habitats to *Hisonotus*. Both can be caught syntopically with species of *Eurycheilichthys*. That genus is endemic to southern Brazil and restricted to the high altitudes of the Serra Geral formation in Rio Grande do Sul and Santa Catarina states (Reis & Schaefer, 1998), presenting a great diversity in the rio Taquari drainage (Reis, in prep.). According to Liedke (2007), who study the inter- and intraspecific relationships of the genus, one possible explanation for the high degree of endemicity in the headwaters of rio Taquari drainage is its features. The headwaters of the Taquari basin present a high declivity and shallow

riverbeds where most species are isolated from each other by deeper sections of large rivers or by waterfall barriers. For both *Eurycheilichthys* and *Hisonotus* the mountain relief on which the Taquari drainage flows is responsible for dividing species distribution. That allopatry is observed in the species *Hisonotus* sp. "Carreiro" whose distribution in the rio Carreiro drainage is limited to the upper reaches upstream the Salto do Carreiro fall. The species was never caught downstream that waterfall, but other species of the genus, *Hisonotus* sp. "Sinos" and *Hisonotus armatus*, are collected in that region of rio Carreiro. The distribution of some species of *Hisonotus* is coincident with that presented by some *Eurycheilichthys*. *Hisonotus* sp. "Passo Novo" can be collected with *Eurycheilichthys limulus* in the upper rio Jacuí drainage, as well as *Hisonotus* sp. "Carreiro" and *Hisonotus* sp. "Prata" are sympatric with two different undescribed species of *Eurycheilichthys*. The events which promoted the divergence of both groups are likely to be related. Liedke (2007) hypothesized that *Eurycheilichthys pantherinus* (distributed in several tributaries of rio Uruguai) as sister group of a clade cointaining *Eurycheilichthys limulus* (upper rio Jacuí) and a clade of several undescribed species in upper rio Taquari. According to the author, using a molecular clock estimation, the vicariance of *Eurycheilichthys* clades should had occurred in the early and late Pleistocene, which predates the separation of rio Uruguai and rio Jacuí drainages. Therefore the presence of most derived forms of the genus in the rio Jacuí and rio Taquari, are more likely to be capture events between its headwater streams. Besides, some *Hisonotus* seem to have congruent distributions with those presented by other families of fishes. For instance, *Cyanocharax tipiaia* (Malabarba & Weitzmann, 2003) has exactly the same distribution of *Hisonotus* sp. "Felicio" and *Hisonotus* sp. cf. "Sinos". That pattern could suggest some endemic areas within rio Jacuí basin. As proposed by those authors, *Cyanocharax tipiaia* is hypothesized as the sister group of all *Cyanocharax* species from the rio Uruguai basin, indicating that stream capture events between that portion of rio Jacuí and rio Uruguai basin may occurred. I want therefore mention that the rio Jacuí

1636 basin is relatively well sampled and this congruence is not due to collecting site bias, but seems to
1637 be a natural overlap of species distribution.

1638 Contrasting with the species of *Hisonotus* present in the headwaters of the rio Jacuí basin, a
1639 putative clade of the genus formed by *H. taimensis*, *H. laevior*, and *Hisonotus* sp. "Camaquã" are
1640 distributed in relatively lower portions of the laguna dos Patos system. Along with the fact that
1641 these species are not alopatric, the lower portions of the laguna dos Patos system do not present
1642 clear geographical barriers. *Hisonotus laevior* and *H. taimensis* are morphologicaly very similar and
1643 can be differed only by morphometric features of a relatively more elongated and lower body of the
1644 latter species. A similar body form is observed between *Rineloricaria cadeae* and *Rineloricaria*
1645 *longicauda*, distinguished only by morphometric traits also related to a lower body shape of the
1646 later (cf. Rodriguez & Reis, in press). Although we lack a phylogenetic hypothesis for both groups,
1647 the similarity with their relatives inhabiting more elevated regions seems to indicate a close
1648 relationship between them. Geographic distributions of *Hisonotus taimensis* and *Rineloricaria*
1649 *longicauda* species are mostly overlapping, with species inhabiting the coastal plans of southern
1650 Brazil. That similarity in body shape seems to play a significant role in the adaptation for lowland
1651 habits for both *H. taimensis* and *R. longicauda*. In the same manner, *Heptapterus sympterigium*,
1652 which is distributed throughout the coastal lowlands of eastern Rio Grande do Sul state (Buckup
1653 1988), present some morphological specializations compared to its relative, *Hepapterus mustelinus*,
1654 inhabiting the upstream portions of the laguna dos Patos system. As previously discussed the
1655 eastern coastal plain of laguna dos Patos system is relatively recent (Schwarbold & Schäfer, 1984),
1656 therefore the speciation events of species inhabiting these portion should postdate the pleistocene
1657 formation of the coastal plain.

As demonstrated by *Hisonotus* and other taxa, the fish fauna of the laguna dos Patos system seems to have a hybrid nature, receiving both elements from upper and lower portions of the rio Uruguai basin, as well as from coastal atlantic drainages of southeastern Brazil.

Comparative Material. *Epactionotus bilineatus*: MCP 29293, 29 + 3 c&s, Brazil, Rio Grande do Sul, arroio das Bananeiras. *Eurycheilichthys pantherinus*: MCP 35042, 17 + 3 c&s, Brazil, Rio Grande do Sul, rio dos Touros on road from Rondinha to Silveira. *Lampiella gibosa*: MCP 31588, 1 + 1 c&s, Brazil, São Paulo, rio Bonito tributary to Rio Pardo. *Eurycheilichthys* sp. 1: MCP 40973, 1, Brazil, Rio Grande do Sul, arroio Guabiju. *Eurycheilichthys* sp. 2: MCP 35062, 25, Brazil, Rio Grande do Sul, rio da Prata at Passo do Respraiado. *Hisonotus aky*: AI 124, holotype of *Epactionotus aky*, Argentina, Missiones, arroyo Garibaldi. AI 125, 7 + 1 c&s, paratypes of *Epactionotus aky*, collected with the holotype. *Hisonotus candombe*: ZVC-P 5595, holotype, Uruguay, Salto, arroyo Palomas. *Hisonotus charrua*: ZVC-P 5639, holotype, Uruguay, Tacuarembó, Canãda de los Peña. MCP 40256, 4 + 1 cs, same type-locality. *Hisonotus chromodontus*: MCP 35873, 194 + 5 c&s, Brazil, Mato Grosso, rio Sauê-Uina on highway BR-364. *Hisonotus depressicauda*: MCP 20100, 2, Brazil, São Paulo, rio Taiaçupeba near eletrical station of Tijuco Preto, tributary of rio Tiête drainage. *Hisonotus depressinotus*: MZUSP 86167, 6, Brazil, Paraná, creek tributary to rio Tibagi. *Hisonotus francirochai*: MCP 41341, 4, Brazil, São Paulo, stream tributary of rio Mogi-Guaçu. *Hisonotus insperatus*: MZUSP 78957, holotype, Brazil, São Paulo, rio Capivara. MZUSP 78958, 5, collected with the holotype. MZUSP 78966, 7, paratypes, Brazil, São Paulo, rio Capivara. *Hisonotus* aff. *leucofrenatus*: MCP 20722, 3, Brazil, Rio Grande do Sul, creek tributary to rio Maquiné near Maquiné. MCP 21342, 7, Brazil, Rio Grande do Sul, canal between lagoa Emboaba and lagoa Emboabinha. MCP 22454, 5, Brazil, Rio Grande do Sul, canal between lagoa Emboaba and lagoa Emboabinha. MCP 29298, 2, Brazil, Rio Grande do Sul, rio Três

Forquilhas on vila Itati. UFRGS 4986, 4, Brazil, Rio Grande do Sul, arroio Água Parada tributary to rio Maquiné. *Hisonotus leucofrenatus*: MCP 11540, 60 + 3 c&s, Brazil, Santa Catarina, rio Cubatão (north). MZUSP 36565, 20, Brazil, São Paulo, small creek on road from Eldorado to Sete Barras. MZUSP 60220, 11, Brazil, São Paulo, córrego Fria. *Hisonotus luteofrenatus*: MCP 32670, 9 + 1 c&s, Brazil, Mato Grosso, igarapé Ribeirão Preto on highway MT-338. MCP 32666, 2, Brazil, Mato Grosso, rio Azul on highway MT-140. *Hisonotus maculipinnis*: BMNH 1909.4.2.19–22, syntypes of *Otocinclus maculipinnis*, La Plata. BMNH 1934. 8. 20. 321-5, San Lorenzo, Paraguay. BMNH 1934.8.20:220-240, + 500, Paraguay, near Asunción. ANSP 187011, 507, Argentina, Corrientes, side channels and backwaters of Rio Paraná and lower Río Guayquiraro, about 25 km south from Esquina. ILPLA 235, 6 + 1, Argentina, Corrientes, Arroyo Batel. MACN 3240, +50, Argentina, Buenos Aires. MACN 7594, +50, Argentina Santa Fé, Arroyo Ciquenã. *Hisonotus notatus*: BMNH 1904.1.28.13–16□MNRJ 28882, 3□NWM 45380-4, NMW 45380-7, NMW 45381-6, NMW 45381-4□ANSP 166924, 6□all syntypes, Brazil, Rio de Janeiro, rio Grande (arroio Fundo) on fazenda Santa Cruz. MCP 18098, 204 + 4 cs, Brazil, Espírito Santo, rio São José dos Torres on road BR 101. *Hisonotus paulinus*: BMNH 1907.7.6.9, holotype of *Otocinclus paulinus*, Brazil, São Paulo, rio Piracicaba. *Hisonotus ringueleti*: ILPLA 886, holotype, Uruguay, Rivera, creek at km 18 of route joining Santana do Livramento to Rivera. ILPLA 883, 95, and MLP 9536, 4, paratypes, collected with the holotype. *Hisonotus yasi*: AI 159, 4, paratypes of *Epactionotus yasi*, Argentina, Missiones, Arroyo Lobo. NUP 790, 15, Brazil, Paraná, Caxias reservoir. UFRGS 4187, 2, Brazil, Paraná, Ampére, small creek tributary to rio dos Macacos. *Microlepidogaster perforatus*: MCP 17717, 4 + 1 c&s, Brazil, Minas Gerais, rio Carandaí. *Otothyropsis marapoama*: MCP 38303, paratypes, 9 + 1 c&s, Brazil, São Paulo, córrego Cubatão. *Otocinclus flexilis*: MCP 17414, 11 + 2 c&s, Brazil, Rio Grande do Sul, Capão do Leão, arroio Itaetá at Passo das Pedras. *Parotocinclus*

maculicauda: MCP 31591, 50 + 4 c&s, Brazil, São Paulo, rio Bonito tributary to Rio Pardo. MCP 20087, 17, Brazil, Paraná, Cerro Azul, arroio Ribeirão Bonito.

Acknowledgements

I would like thank the following people for their help and support while visiting their institutions and/or for the loan of specimens: M. Sabaj and J. Lundberg (ANSP), J. Maclaine (BMNH), M. Cheffe (CIMC), A. Miquelarena (ILPLA), G. Chiaramonte and F. Firpo (MACN), F. Meyer (MAPA), M. Azevedo (MCN), M. Azpelicueta (MLP), P. Buckup (MNRJ), O. Oyakawa (MZUSP), H. Wellendorf (NMW), C. Pavanelli (NUP), J. Ferrer and L. Malabarba (UFRGS). I am grateful to, F. Mayer, J. Verba, J. Wingert, and M. Lucena for support at the MCP collection. Thanks also to V. Bertaco, J. Wingert, C. Cramer, and especially to A. Cardoso for help in collecting *Hisonotus* in field trips. Thanks to L. Malabarba and J. Pezzi for provide photos of live specimens of *Hisonotus* sp. "Sinos" and *Hisonotus armatus*, respectively. Thanks to the Centro de Microscopia e Microanálises – CEMM, PUCRS for the SEM preparations. This paper was financially supported by the "All Catfishes Species Inventory" Project (NSF DEB 0315963) that provided funding to visit museum collections. Thanks are also due to the Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq, for a studentship to TPC (process #132879/2006-9).

Literature Cited

Andreata, A. A., C. Oliveira, & F. Foresti. 2006. Karyological characterization of four Neotropical fish species of the genus *Hisonotus* (Teleostei, Loricariidae, Hypoptopomatinae) from distinct Brazilian river basins. Genetics and Molecular Biology 29:62-66.

Aquino, A. E., S. A. Schaefer & A. M. Miquelarena. 2001. A new species of *Hisonotus* (Siluriformes, Loricariidae) of the Upper Río Uruguay Basin. American Museum Novitates 3333: 1-12.

Azpelicuta, M. M., J. R. Casciotta, A. E. Almirón, & S. Koerber. 2004. A new species of Otothyrini (Siluriformes:Loricariidae:Hypoptopomatinae) from the Río Uruguay basin, Argentina. Verhandlungen der Gesellschaft für Ichthyologie Band 2004:81-90.

Azpelicueta, M. M., A. E. Almirón, J. R. Casciotta & S. Koerber. 2007. *Hisonotus hungy* sp. n. (Siluriformes, Loricariidae) a new species from arroyo Tirica, Misiones, Argentina. Revue suisse de Zoologie 114 (3): 591-598.

Brannan, T. B., Althof, L. J. Jacobs, J. Norby & S. Rubenstein. 2000. SigmaPlot. Exact Graphics For Exact Science. Version 6.1 for Windows. SPSS.INC.

Bemvenuti, M. A. & A. Moresco. 2005. Peixes: áreas de banhados e lagoas costeiras do Extremo Sul do Brasil. Editora ABRH, Porto Alegre, Brazil.

Beurlen, K. 1970. Geologie von Brasilien, Stuttgart, Germany.

Boulenger, G. A. 1891. An account of the siluroid fishes obtained by Dr. H. von Ihering and Herr Sebastian Wolff in the Province Rio Grande do Sul, Brazil. Proceedings of Zoological Society of London, 1891:231-235.

Bristski, H. A. & J. C. Garavello. 2003. *Hisonotus insperatus*: New Species from the Upper Rio Paraná Basin (Pisces: Ostariophysi: Loricariidae). Copeia 2003: 588-593.

1749 Bristski, H. A. & J. C. Garavello. 2007. Description of two new sympatric species of the genus
1750 *Hisonotus* Eigenmann & Eigenmann, 1889 from the upper rio tapajós, Mato Grosso state,
1751 Brazil (Pisces: Ostariophysi: Loricariidae). Brazilian Journal of Biology 67: 631-637.
1752 Buckup, P. A. 1981. *Microlepidogaster taimensis* sp. n., novo Hypoptopomatinae da Estação
1753 Ecológica do Taim, Rio Grande do Sul, Brasil (Ostariophysi, Loricariidae). Iheringia 60:19-
1754 31.
1755 Buckup, P. A. & L. R. Malabarba. 1983. A list of the fishes of the Taim Ecological Station, Rio
1756 Grande do Sul, Brazil. Iheringia 63:103-113.
1757 Buckup, P. A. 1988. The genus *Heptapterus* (Teleostei, Pimelodidae) in southern Brazil and
1758 Uruguay, with the descriptionof a new species. Copeia, 1988 (3):641-653.
1759 Carvalho, T. P., P. A. Lehmann, E. H. L. Pereira & R. E. Reis. In press. A new species of *Hisonotus*
1760 (Siluriformes: Loricariidae: Hypoptopomatinae) from the Laguna dos Patos Basin, Southern
1761 Brazil. Copeia 2008.
1762 Cope, E. D. 1894. On the Fishes obtained by the Naturalist Expedition in Rio Grande do Sul.
1763 Proceedings of American Philosophical Society of Philadelphia. 33:84-108.
1764 Eigenmann, C. H., & R. S. Eigenmann. 1889. Preliminary notes on South American Nematognathi.
1765 2. Procedings of the California Academy of Sciences 1:119-172.
1766 Eigenmann, C. H. 1910. Catalogue of the fresh-water fishes of tropical and south temperate
1767 America. *In*: Reports of the Princeton University expeditions to Patagonia 1896-1899.
1768 Zoology. Catalogue v. 3 (pt 4):375-511.
1769 Fowler, H. W. 1954. Os Peixes de Água doce do Brasil. Arquivos de Zoologia do Estado de São
1770 Paulo. Departamento de Zoologia da Secretária da Agricultura. São Paulo, Brazil
1771 Ferraris, C. J. 2007. Checklist of Catfishes, recent and fossil (Osteichthyes: Siluriformes), and
1772 catalogue of siluriform primary types. Zootaxa 1418:1-628.

1773 Garavello, J. C., H. A. Britski, & S. A. Schaefer. 1998. Systematis of the genus *Otothyris* Myers
1774 1927, with comments on geographic distribution(Siluriformes: Loricariidae:
1775 Hypoptopomatinae). American Museum Novitates 3222:1-19.
1776 Gauger, M. F. W., & P. A. Buckup. 2005. Two new species of Hypoptopomatinae from rio Paraíba
1777 do Sul basin, with comments on the monophyly of *Parotocinclus* and Otothyrini
1778 (Siluriformes: Loricariidae). Neotropical Ichthyology 3:509-518.
1779 Gomes, A. L. 1947. A small collection of fishes from Rio Grande do Sul Brazil. Miscellaneous
1780 Publications Museum of Zoology University of Michigan 67:1-39.
1781 Gosline, W. A. 1945. Catálogo dos nematognatos de água-doce da América do Sul e Central.
1782 Boletim do Museu Nacional do Rio de Janeiro. 33:1-138.
1783 Grosser, K. M., W. R. Koch & S. Drügg-Hahn. 1994. Ocorrência e distribuição de peixes na estação
1784 ecológica do Taim, Rio Grande do Sul, Brasil (Pisces, Teleostomi). Iheringia 77:89-98.
1785 Higuchi, H. 1992. An updated list of ichthyological collecting stations of the Thayer Expedition to
1786 Brazil. Eletronic version (1996). http:// www.oeb.havard.edu/thayer.htm.
1787 Isbrücker, I. J. H. 1980. Classification and Catalogue of the mailed Loricariidae (Pisces,
1788 Siluriformes, Loricariidae) Verslagen em Techniche Gegevens, 22: 1-170.
1789 Lehmann, P. A. 2006. Anatomia e relações filogenéticas da família Loricariidae (Ostariophysi:
1790 Siluriformes) com ênfase na subfamília Hypoptopomatinae. Unpublished Ph.D. Dissertation.
1791 Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil.
1792 Liedke, A. M. R. 2007. Filogenia e Filogeografia gênero *Eurycheilichthys* (Siluriformes:
1793 Loricariidae. Unpublished M.Sc. Dissertation. Pontifícia Universidade Católica do Rio
1794 Grande do Sul, Porto Alegre, Brazil.

1795 Lucena, C. A. S., A. S. Jardim & E. S. Vidal. 1994. Ocorrência, Distribuição e Abundância da
1796 Fauna de Peixes da Praia de Itapuã, Viamão, Rio Grande do Sul, Brasil. Comunicações do
1797 Museu de Ciências e Tecnologia da PUCRS 7:3-27.
1798 Lucinda, P. H. F., R. E. Reis & R. Quevedo. 2002. *Jenynsia onca*, a new species of anablepid fish
1799 (Teleostei: Cyprinodontiformes) from southern Brazil and its phylogenetic position.
1800 Ichthyological Exploration of Freshwaters. 13:33-40.
1801 Malabarba L. R. 1989. Histórico sistemático e lista comentada das espécies de peixes de água doce
1802 do sistema da laguna dos Patos, Rio Grande do Sul, Brasil. Comunicações do Museu de
1803 Ciências da PUCRS 2:107-179.
1804 Malabarba L. R. & E. A. Isaia. 1992. The fresh water fish fauna of the rio Tramandaí drainage, Rio
1805 Grande do Sul, Brazil, with a discussion of its historical origin. Comunicações do Museu de
1806 Ciências da PUCRS 5:197-223.
1807 Malabarba L. R. & S. H. Weitzman. 2003. Description of a new genus with six new species from
1808 southern Brazil, Uruguay and Argentina, with a discussion of a putative characid clade
1809 (Teleostei: Characiformes: Characidae). Comunicações do Museu de Ciências da PUCRS
1810 16:67-151.
1811 Oyakawa O. T., A. Akama, K. C. Mautari & J. C. Nolasco. 2006. Peixes de riachos da Mata
1812 Atlântica nas Unidades de Conservação do Vale do Rio Ribeira de Iguape no Estado de São
1813 Paulo. Editora Neotrópica, São Paulo, Brazil
1814 Papavero N. 1973 Essays on the history of Neotropical Dipterology, with special reference to
1815 collectors (1750-1905), V. II. Museu de Zoologia Universidade de São Paulo, São Paulo,
1816 Brazil
1817 Reis R. E. & S. A. Schaefer. 1992. *Eurycheilichthys pantherinus* (Siluriformes: Loricariidae), a new
1818 genus and species of Hypoptopomatinae from Southern Brazil. Copeia 1992:215-223.

1819 Reis R. E. & T. P. Carvalho. 2007. Hypoptopomatinae. p. 83–84. In: P. A. Buckup, N. A. Menezes
1820 and M. S. Ghazzi. Catálogo das espécies de peixes de água doce do Brasil. Museu Nacional
1821 (Série Livros), Rio de Janeiro, Brazil.
1822 Regan C. T. 1904. A monograph of the fishes of the family Loricariidae. Transactions of the
1823 Zoological Society of London 17:191–350.
1824 Retzer M. E., L. G. Nico & F. R. Provenzano. 1999. Two new species of *Acestridium* (Siluriformes:
1825 Loricaridae) from southern Venezuela, with observations on camouflage and color change.
1826 Ichthyological Exploration of Freshwaters 10:313-326.
1827 Ribeiro M. F., A. Köhler, A. Dupont & E. C. G. Azevedo. 2007. Os peixes do rio Pardinho.
1828 Edunisc, Santa Cruz do Sul, Brazil.
1829 Rodriguez M. S. & R. E. Reis. In press. Taxonomic review of *Rineloricaria* (Loricariidae:
1830 Loricariinae) from the Laguna dos Patos drainage, Southern Brazil, with the descriptions of
1831 two new species and the proposition of two species groups. Copeia 2008.
1832 Ryan, P. D., D. A. T. Harper & J. S. Whalley. 1995. PALSTAT, Statistics for paleontologists.
1833 Chapman & Hall, (now Kluwer Academic Publishers).
1834 Schaefer, S. A. 1991. Phylogenetic analysis of the loricariids subfamily Hypoptopomatinae (Pisces:
1835 Siluroidei: Loricariidae), with comments on generic diagnoses and geographic distribution.
1836 Zoological Journal of the Linnean Society 102:1-41
1837 Schaefer, S. A. 1997. The Neotropical cascudinhos: Systematics and biogeography of the
1838 *Otocinclus* catfishes (Siluriformes: Loricariidae). Proceedings of the Academy of Natural
1839 Sciences of Philadelphia 148:1–120.
1840 Schaefer, S. A. 1998. Conflict and resolution: Impact of new taxa on phylogenetic studies of the
1841 neotropical cascudinhos (Siluriformes: Loricariidae) p. 375–400. *In*: L. R. Malabarba, R. E.

Reis, R. P. Vari, C. A. S. Lucena, and Z. M. S. Lucena (Eds.). Phylogeny and Classification of Neotropical Fishes. Edipucrs, Porto Alegre, Brazil.

Schaefer, S. A. 2003. Loricariidae – Hypoptopomatinae (Armored catfishes) p. 321–329. *In*: R. E. Reis, S. O. Kullander & C. J. Ferraris, Jr. (Eds.). Checklist of Freshwater Fishes of the South and Central America. Edipucrs, Porto Alegre, Brazil

Schwarzbold, A. & A. Schäfer, 1984. Gênese e Morfologia das Lagoas Costeiras do Rio Grande do Sul – Brasil. Amazoniana, Kiel, 9:87-104.

Strauss, R. E. 1985. Evolutionary allometry and variation in body form in the South American catfish genus *Corydoras* (Callichthyidae). Systematic Zoology, 34: 381-396.

Taylor, W. R. & G. C. Van Dyke. 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. Cybium, 9:107–119.

Figure Legends

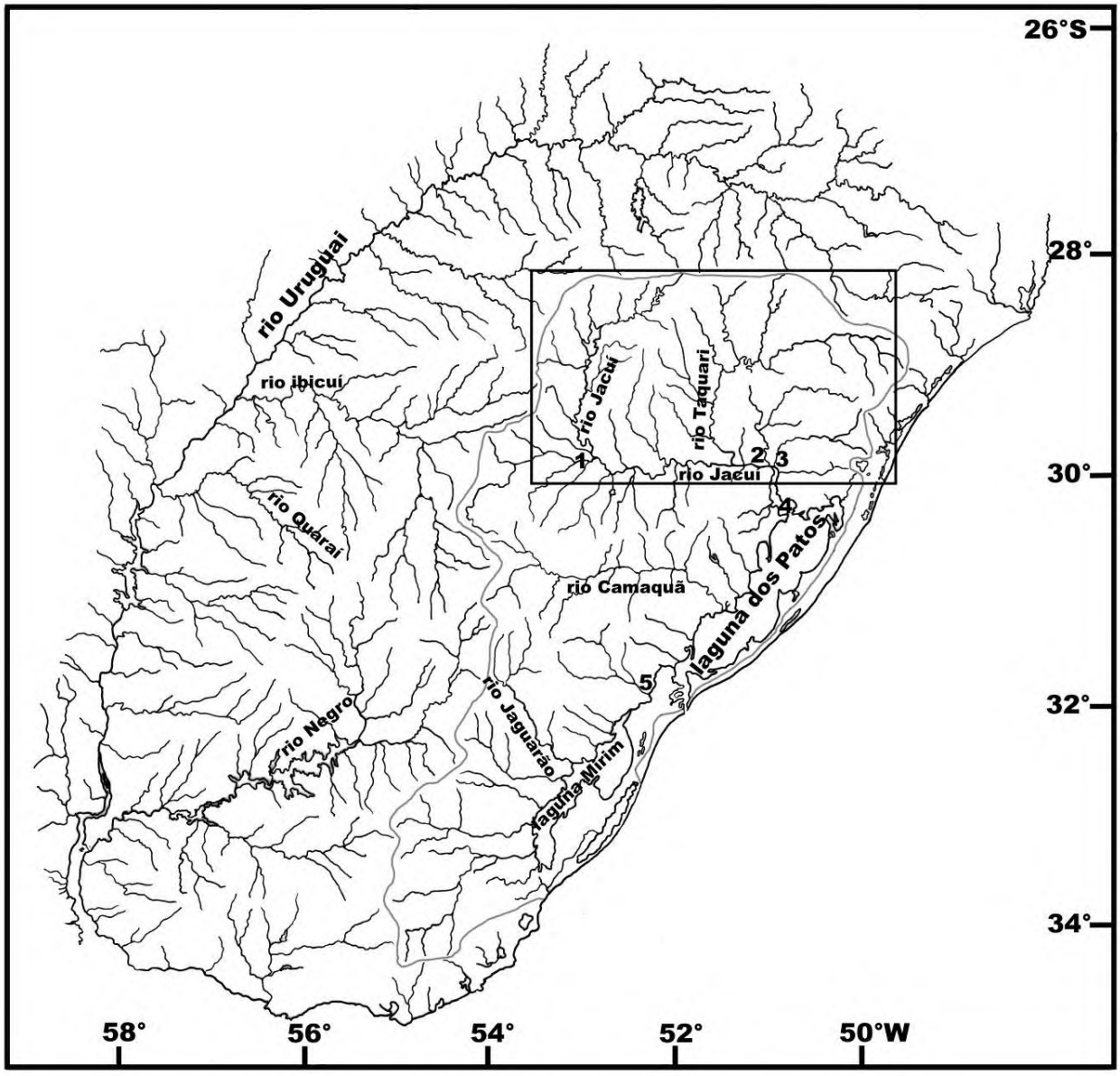
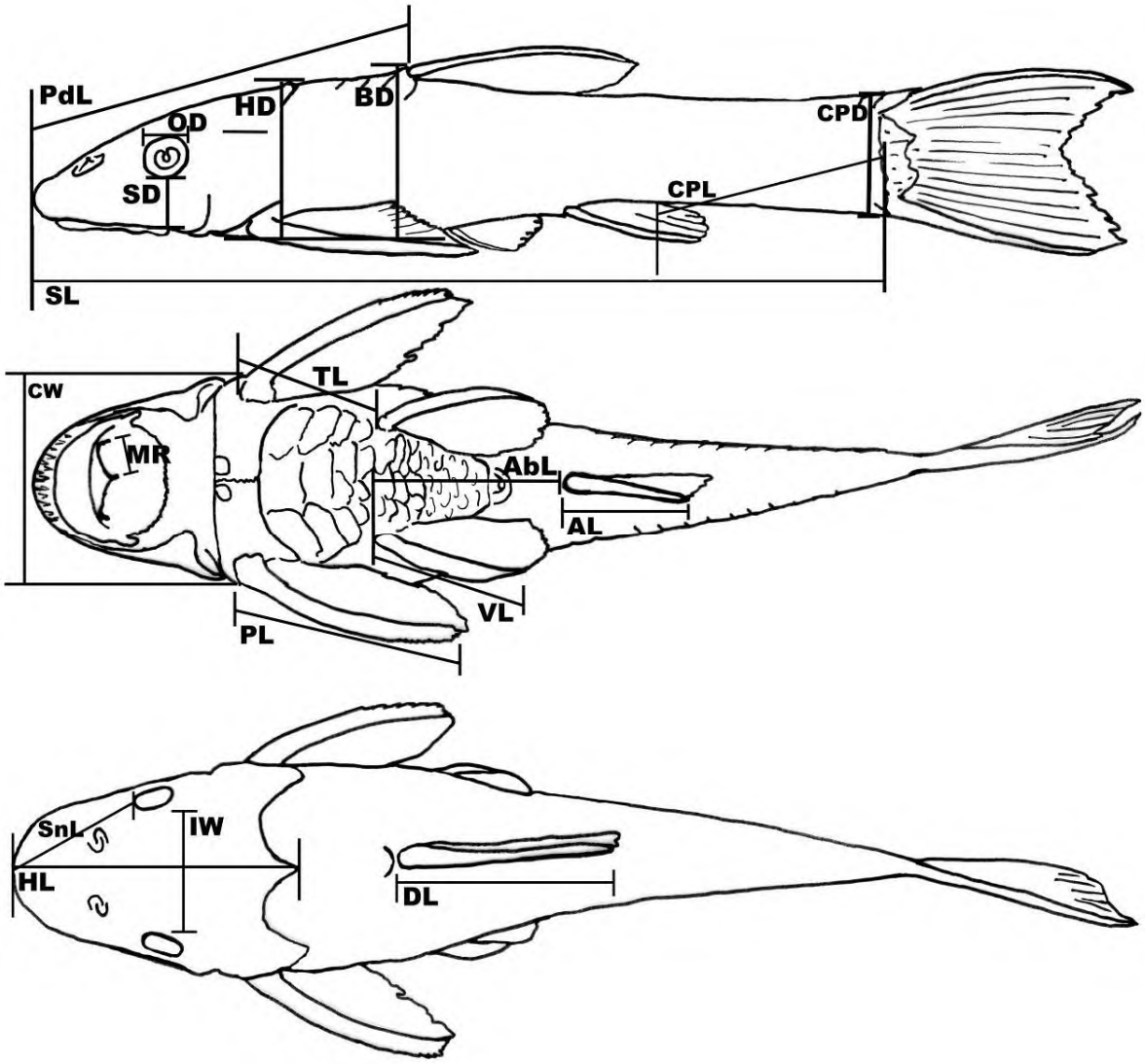


Figure 1. Drainage map of laguna dos Patos system (circulate area) and the neighboring rio Uruguai basin. Rectangle represents the rio Jacuí basin. 1-mouth of rio Vacacaí drainage 2-mouth of rio Caí drainage 3-mouth of rio dos Sinos drainage 4-lago Guaíba 5-São Gonçalo drainage.



1868

1869 Figure 2. Measurements and terminology: **SL**, standard length□**HL**, head length□**PdL,** predorsal

1870 length□**DL**, dorsal-fin spine length□**AL**, First anal-fin unbranched ray length□**PL**, pectoral-fin spine

1871 length□**VL**, First pelvic-fin unbranched ray length□**CW**, cleithral width□**TL**, thoracic length□**AbL**,

1872 abdominal length□**BD**, body depth at dorsal-fin origin□**CPL**, caudal peduncle length□**CPD**, caudal

1873 peduncle depth□**SnL**, snout length□**OD**, orbital diameter□**IW**, interorbital width□**HD**, head depth□

1874 **SD**, suborbital depth□**MR**, mandibular ramus.

Figure 3. Syntype of *Otocinclus nigricauda*, BMNH 91.3.16.53-62, female, 29.9 mm SL, Rio Grande do Sul, Brazil.

Figure 4. *Hisonotus nigricauda*, MCP 40761, female, 37.2 mm SL. Arroio Banhado Grande on road between Bagé and Caçapava do Sul, Bagé, Brazil.

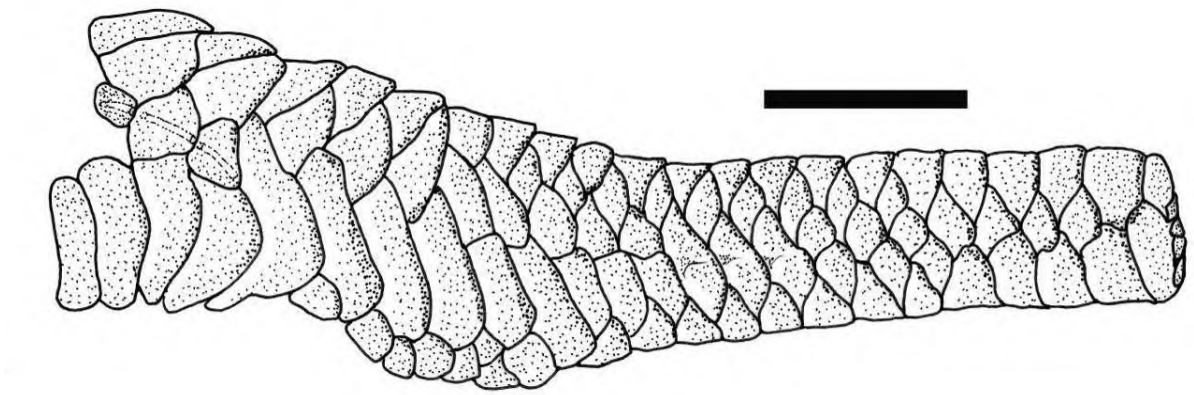


Figure 5. Trunk lateral plate series of *Hisonotus nigricauda*, lateral view of left side, MCP 40761, 37.4 mm SL. Scale bar 4 mm.

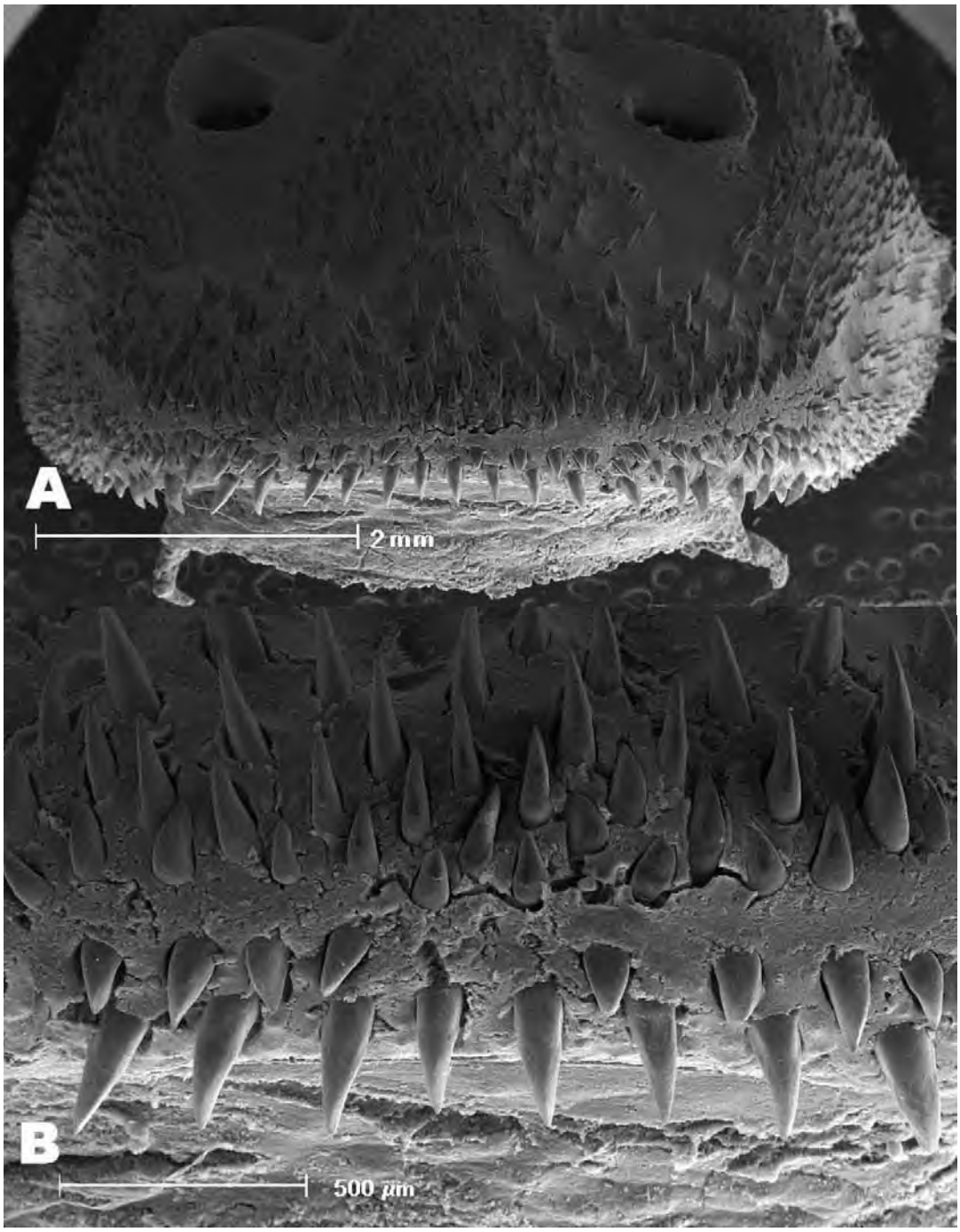


Figure 6. Scanning electron micrograph of anterior rostral margin of *Hisonotus nigricauda*, MCP 17416, 36.7 mm SL. A-anterior view of rostrum B-magnification of medial portion.

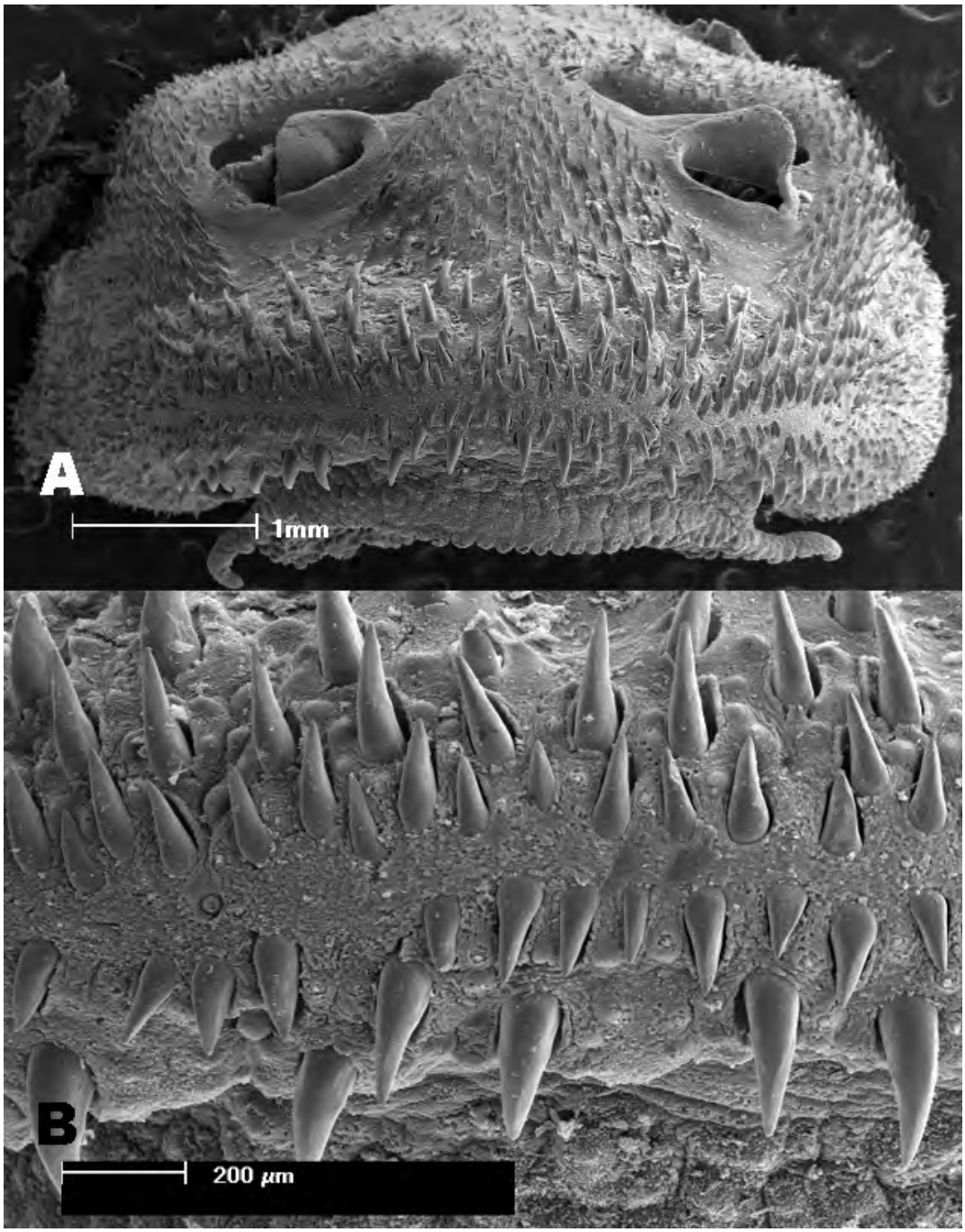


Figure 7. Scanning electron micrograph of anterior rostral margin of a small specimen of *Hisonotus nigricauda*, MCP 26865, 28.3 mm SL. A-anterior view of rostrum B-magnification of medial portion.

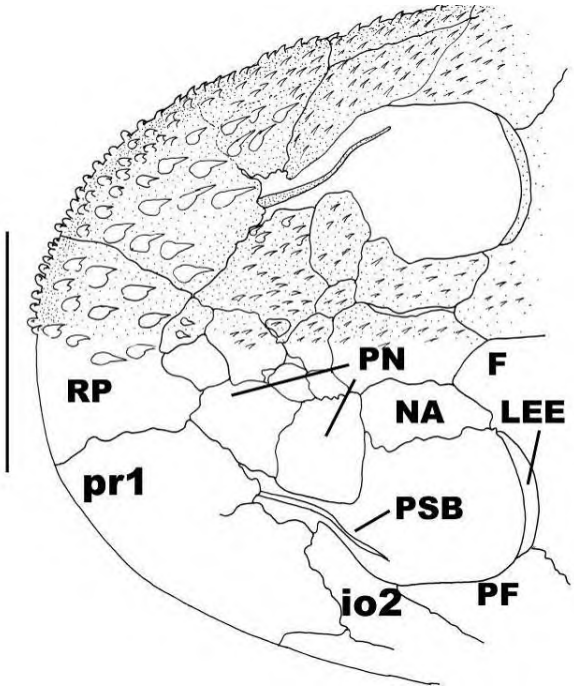


Figure 8. Snout in dorsal view of *Hisonotus nigricauda* showing reduced snout plates, MCP 19548 35.4 mm SL. Scale bar 2 mm.

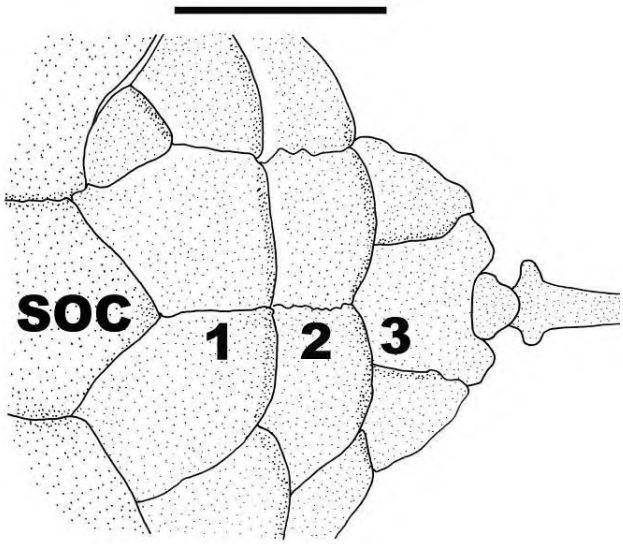


Figure 9. Predorsal region in dorsal view of *Hisonotus nigricauda* showing arrangement of predorsal plates, MCP 40761 32.4 mm SL. 1-2 – paired predorsal plates, 3 – nuchal plate, SOC – parieto-supraoccipital. Anterior portion toward left. Scale bar 2 mm.

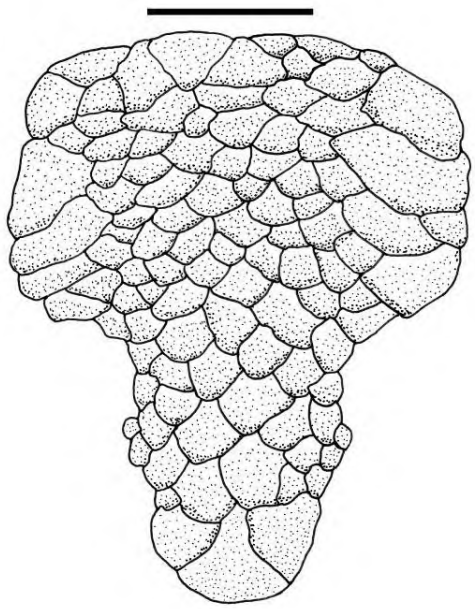


Figure 10. Arrangement of abdominal plates, *Hisonotus nigricauda*, MCP 40761, 37.4 mm SL anterior portion toward top. Scale bar 2 mm.

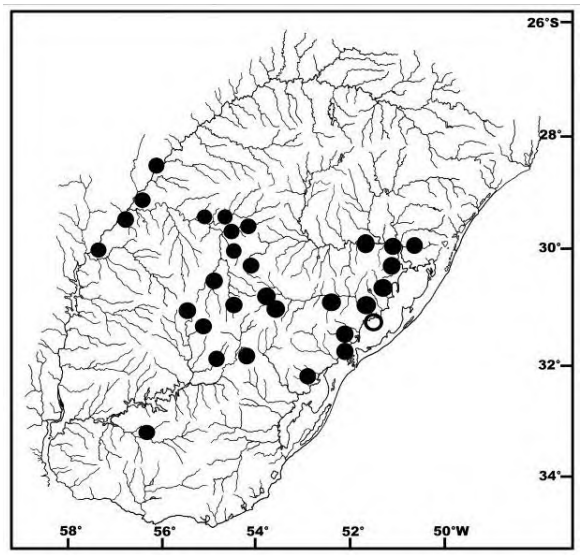


Figure 11. Drainage map of laguna dos Patos system and rio Uruguai basin showing distribution of *Hisonotus nigricauda*. Open symbol designate the probably type locality□some symbols represent more than one collecting locality.

Figure 12. Arroio Banhado Grande, slow flowing stream collecting site of *Hisonotus nigricauda*.

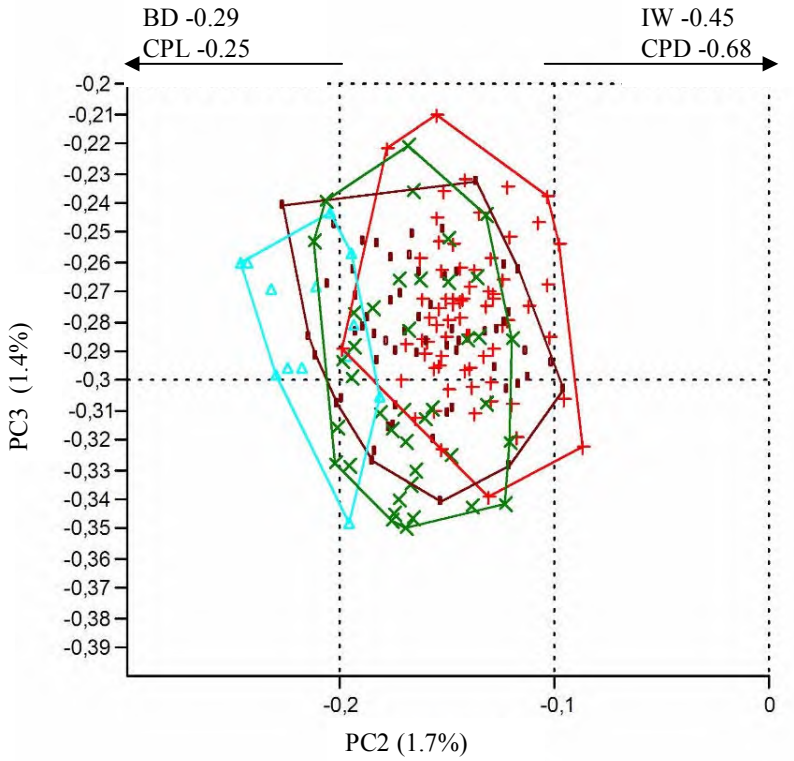


Figure 13. Principal component analysis of 14 morphometric data of *H. nigricauda/H. maculipinnis* complex. Stronger loadings on the second principal component. Red crosses = *H. nigricauda*

1911 including syntypes (laguna dos Patos system)□Brown squares = *H. nigricauda* (rio Uruguay basin)□

1912 Green X = *H. maculipinnis* including syntypes (lower Río Paraná and La Plata)□Blue triangles = *H.*

1913 *maculipinnis* (lower Río Paraguay).

1914

1915

1916 Figure 14. Syntype of *Otocinclus maculipinnis*, BMNH 1909.4.2.19-22, female, 26.0 mm SL, from

1917 "La Plata".

Figure 15. Holotype of *Hisonotus laevior*, ANSP 21253, female, 39.2 mm SL. Rio Jacuí, Brazil.

Figure 16. *Hisonotus laevior*, MCN 12682, female, 46.0 mm SL, arroio Inhuquipá, São Lourenço do Sul, Brazil.

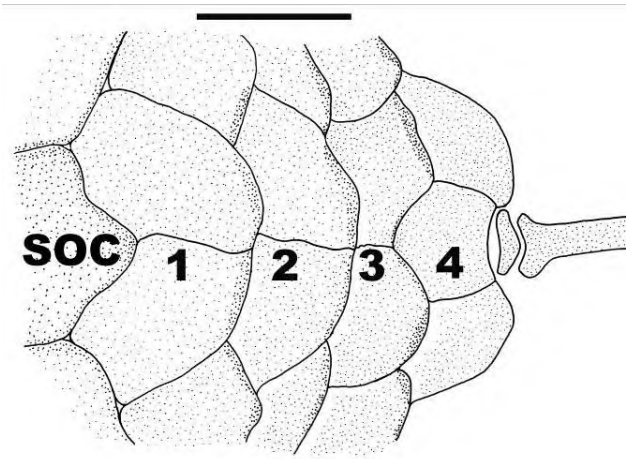


Figure 17. Predorsal region in dorsal view of *Hisonotus laevior* showing arrangement of predorsal plates, MCP 23854 38.7 mm SL. 1-3 – paired predorsal plates, 4 – nuchal plate, SOC – parieto-supraoccipital. Anterior portion toward left. Scale bar 2 mm.

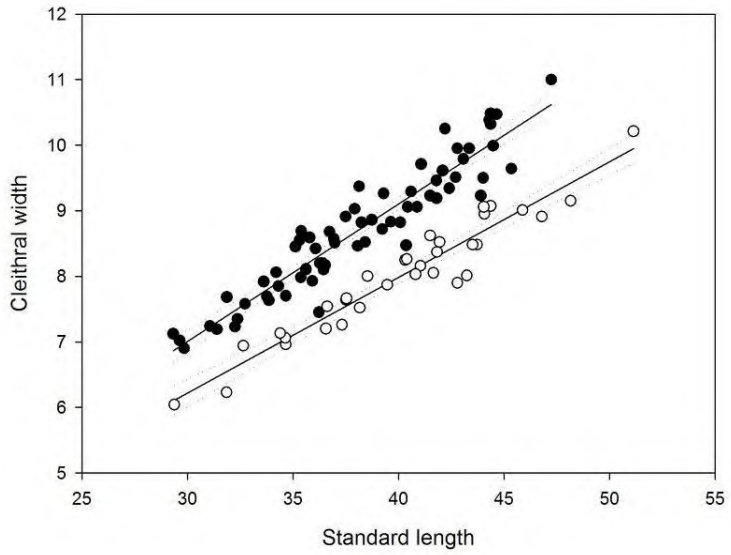
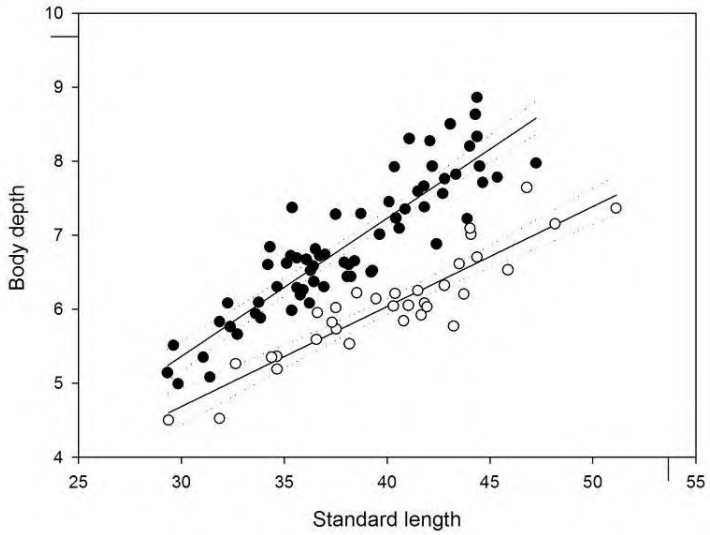


Figure 18. Cleithral width as a function of standard length for *Hisonotus laevior* (black circles) against *Hisonotus taimensis* (open circles). Dotted lines represent confidence intervals of 95%.

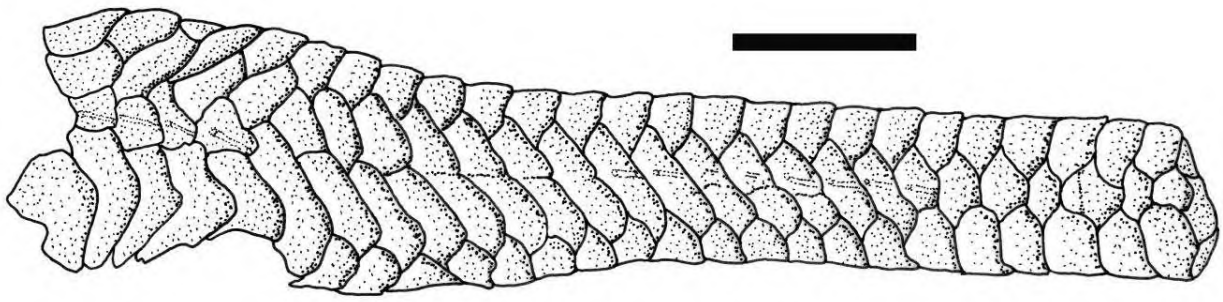


1930

1931 Figure 19. Body depth at dorsal-fin origin as a function of standard length for *Hisonotus laevior*

1932 (black circles) against *Hisonotus taimensis* (open circles). Dotted lines represent 95% confidence

1933 limits.



1934

1935 Figure 20. Trunk lateral plates of *Hisonotus laevior*, lateral view of left side, MCP 23854 41.8 mm

1936 SL. Scale bar 4 mm.

1937

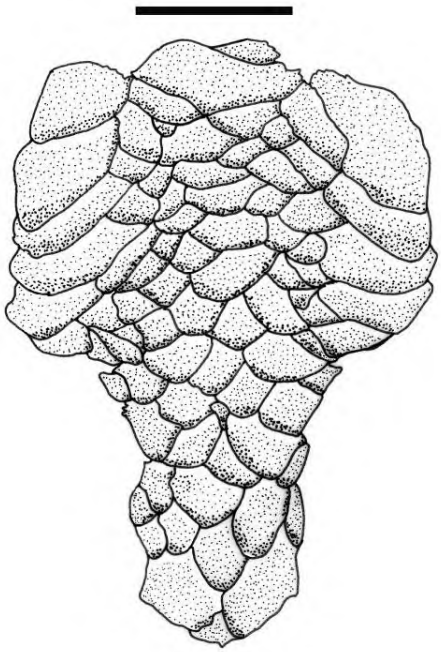


Figure 21. Arrangement of abdominal plates, *Hisonotus laevior*, MAPA 1755, 35.3 mm SL. Anterior portion toward top. Scale bar 2 mm.

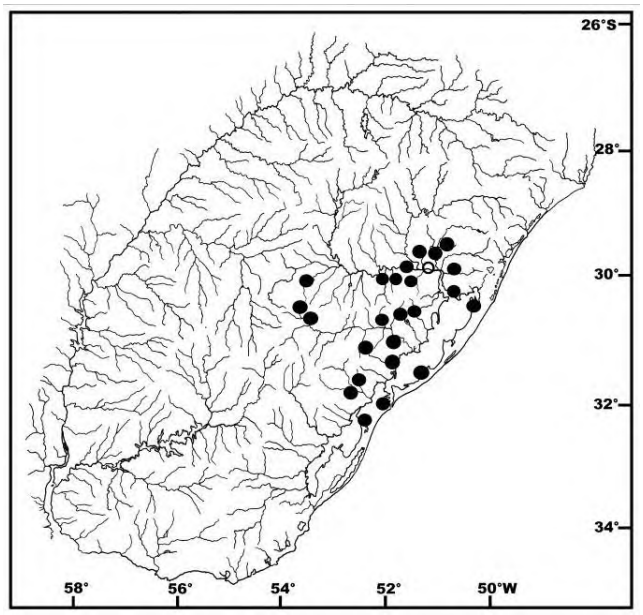


Figure 22. Drainage map of laguna dos Patos system and rio Uruguai basin showing distribution of *Hisonotus laevior*. Open symbol designate approximately the type locality□some symbols represent more than one collecting locality.

Figure 23. Holotype of *Hisonotus leptochilus*, ANSP 21564, female, 40.9 mm SL. Rio Jacuí, Brazil.

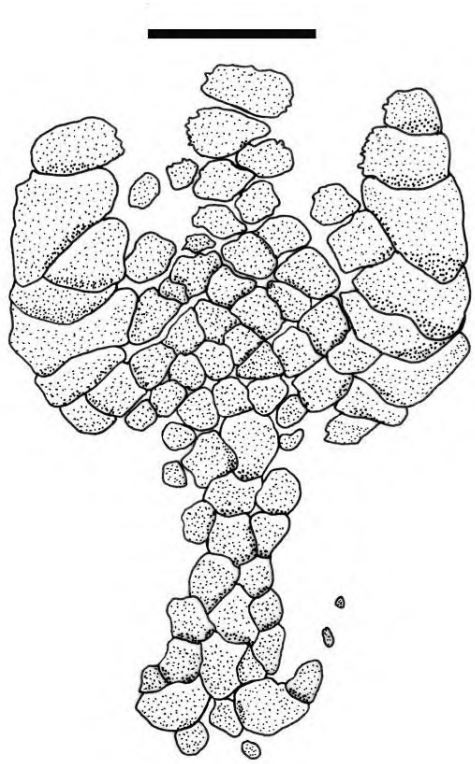


Figure 24. Arrangement of abdominal plates in *Hisonotus laevior*, showing variation in the plating pattern, MCP 23854, 41.8 mm SL. Anterior portion toward top. Scale bar 2 mm.

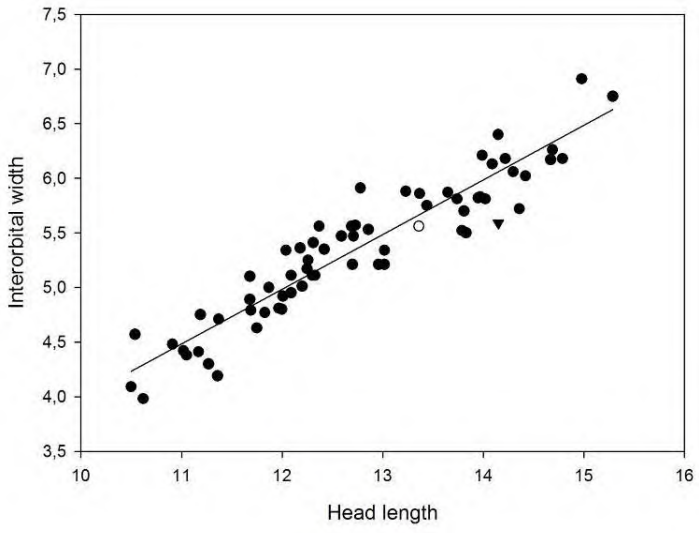


Figure 25. Interorbital width as a function of head length of *Hisonotus laevior*. Open circle is holotype of *H.laevior* and triangle is holotype of *H. leptochilus*.

Figure 26. Paratype of *Hisonotus taimensis*, MAPA 1068, female, 46.5 mm SL. New channel of arroio Taim, Estação Ecológica do Taim, Rio Grande, Brazil.

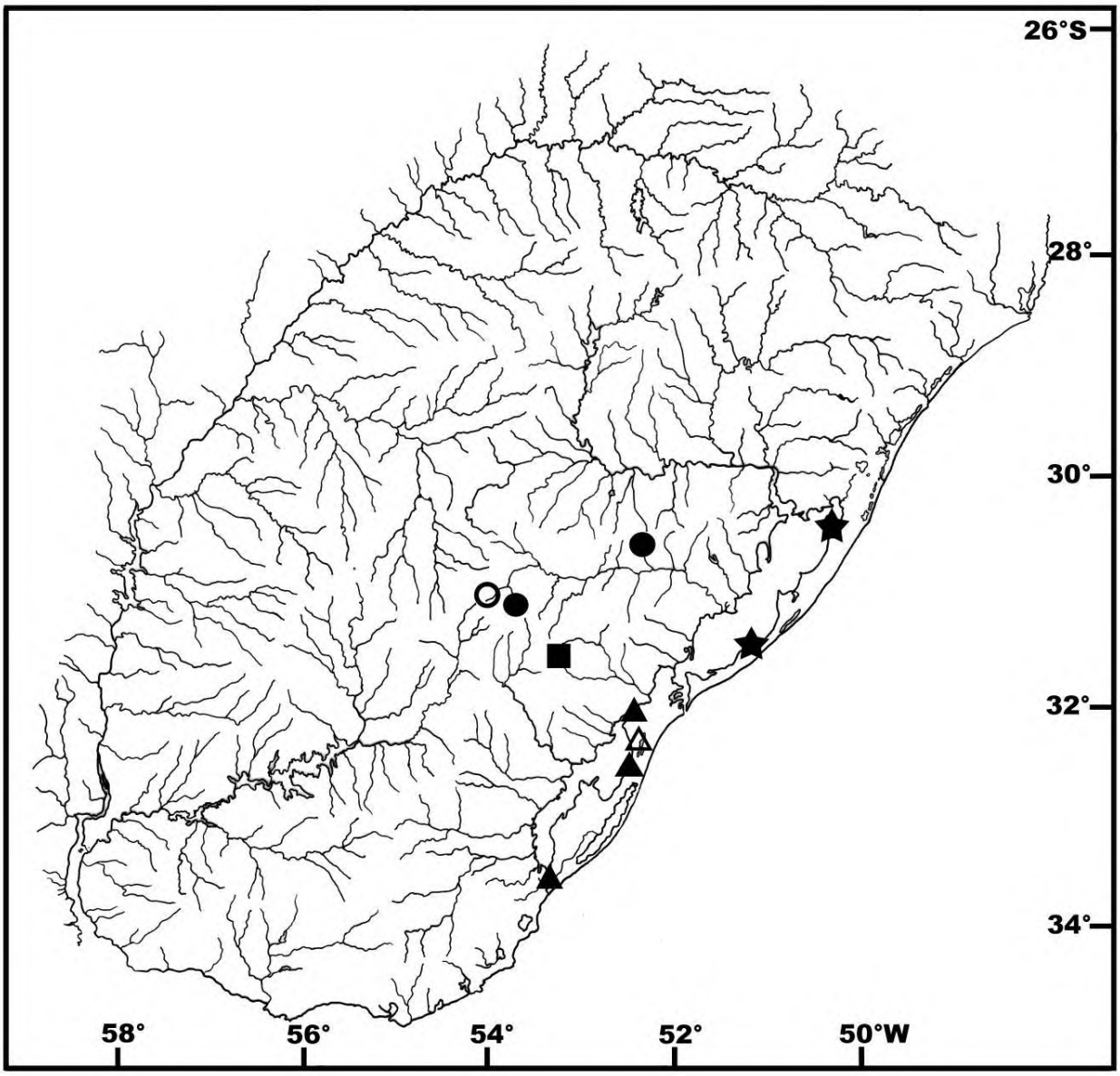


Figure 27. Drainage map of laguna dos Patos system and rio Uruguai basin showing distribution of *Hisonotus* species in the former. Some symbols represent more than one collecting locality. Open symbols represent type localities. *Hisonotus taimensis* (triangles) *Hisonotus* sp. "camaquã" (circles) *Hisonotus* aff. *leucofrenatus* (star) and *Hisonotus charrua* (square).

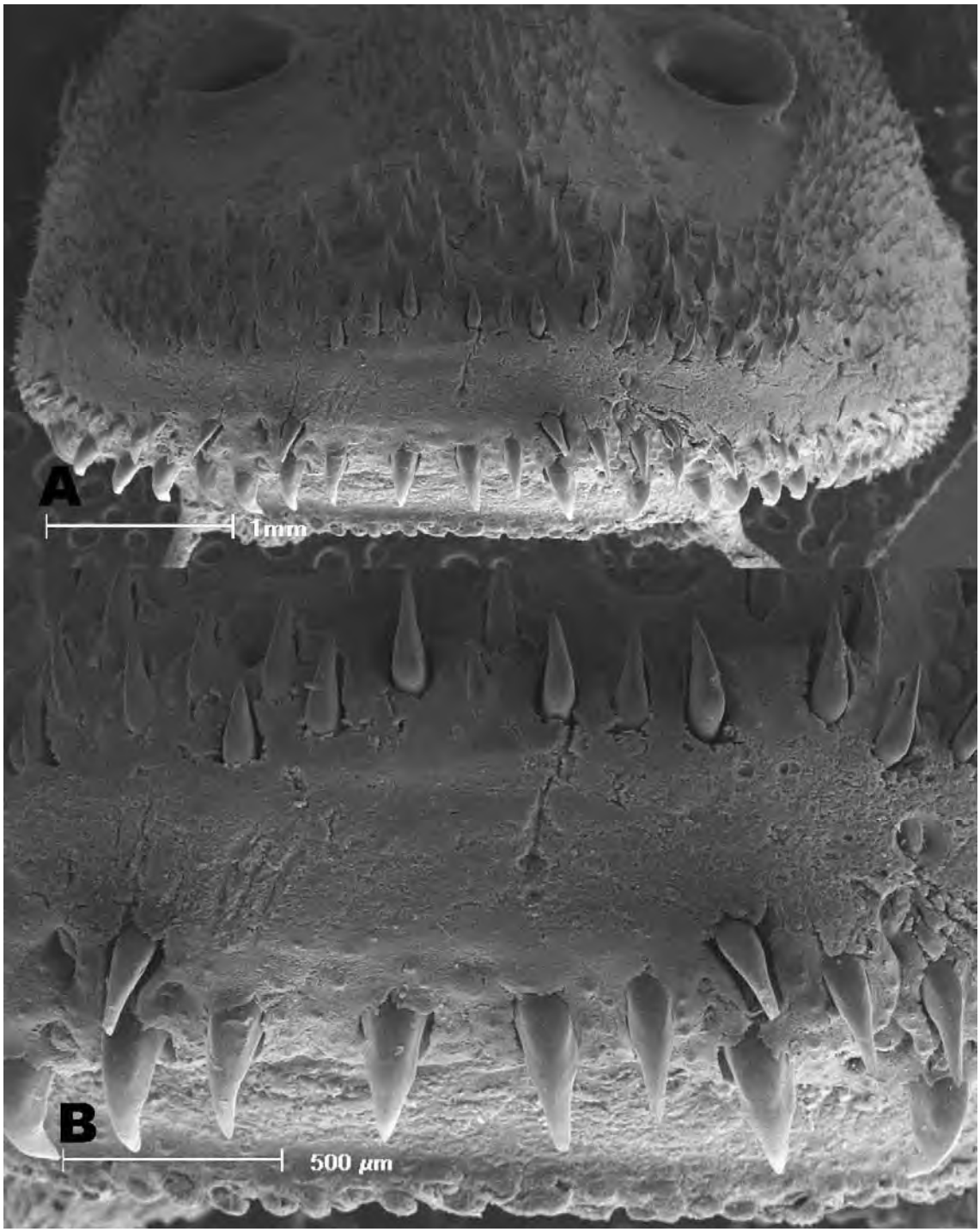


Figure 28. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus taimensis*, MCP 17417, 20,8 mm SL. A-anterior view of rostrum B-magnification of medial portion.

Figure 29. Holotype of *Hisonotus armatus*, MCP 41323, female, 44.4 mm SL. Arroio Arambaré, about 5 km south of Vila Basílio, on road to Pedro Osório, Pedro Osório, Brazil.

Figure 30. Live specimen of *Hisonotus armatus*, Uncataloged. rio Piratini, Rio Grande do Sul, Brazil. Photo: J. Pezzi.

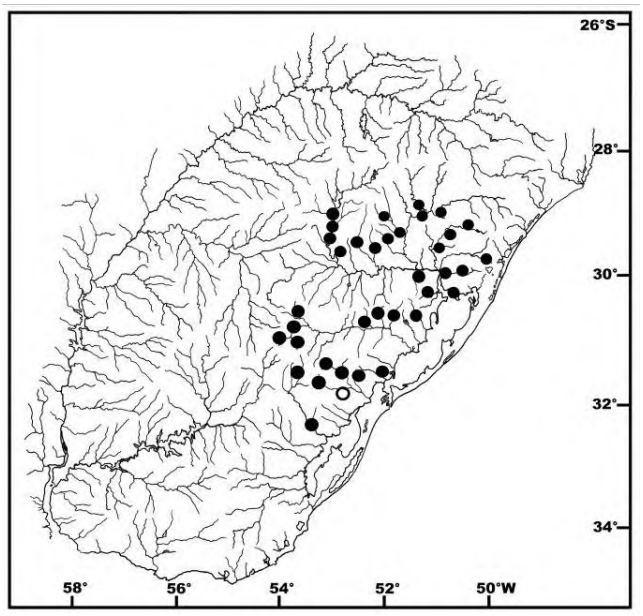
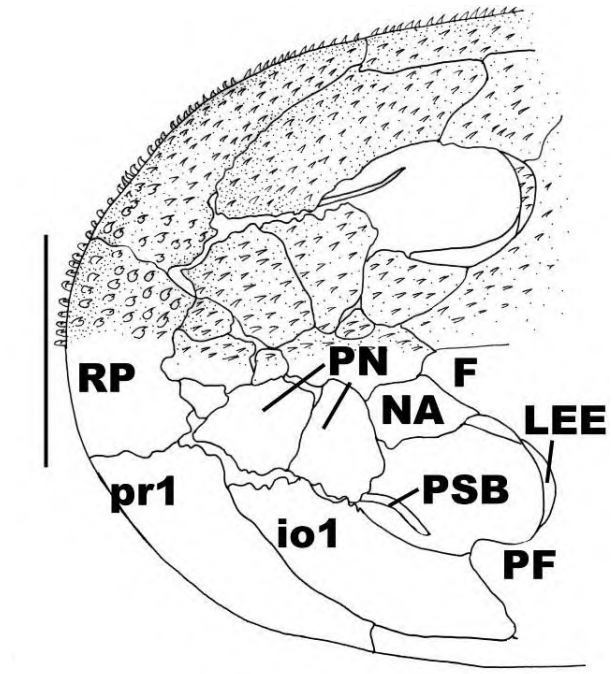


Figure 31. Drainage Map of laguna dos Patos system and rio Uruguai basin showing distribution of *Hisonotus armatus*. Open symbol designates the type locality□some symbols represent more than one collecting locality.

Figure 32. Holotype of *Hisonotus* sp. "Camaquã", MCP uncatalog, female, 45.0 mm SL. Small creek tributary of arroio das Lavras on road from Lavras do Sul to Bagé, Lavras do Sul, Brazil,

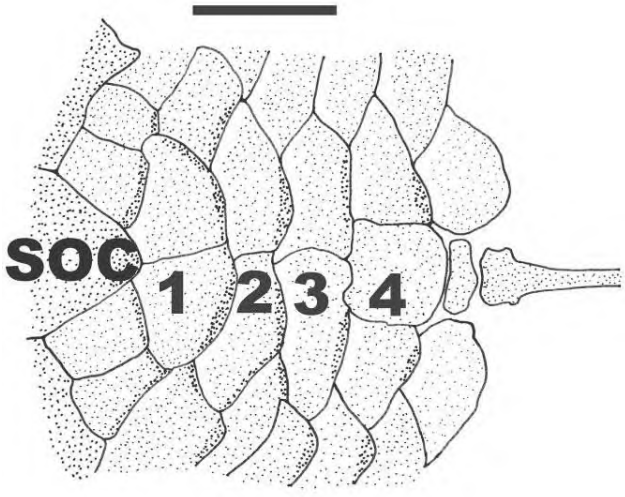
Figure 33. *Hisonotus* sp. “Camaquã”, UFRGS 8966, female, 38.6 mm SL. Small creek in Encruzilhada do Sul tributary to rio Camaquã drainage, Encruzilhada do Sul, Brazil.



1980

1981 Figure 34. Snout in dorsal view of *Hisonotus* sp. “Camaquã” showing prenasal region completely

1982 covered by plates, MCP 22294 35,4 mm SL. Scale bar 2 mm.



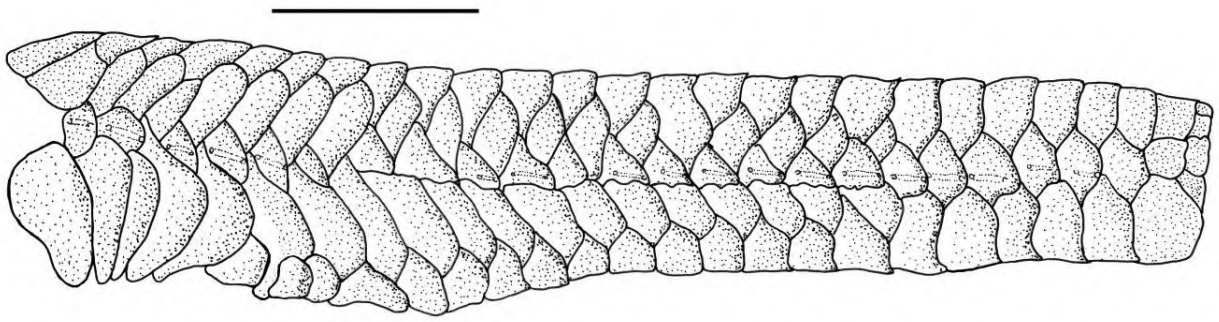
1983

1984 Figure 35. Predorsal region in dorsal view of *Hisonotus* sp. “Camaquã” showing arrangement of

1985 predorsal plates, UFRGS 8966, 35.8 mm SL. 1-3 – paired predorsal plates, 4 – nuchal plate, SOC –

1986 parieto-supraoccipital. Anterior portion toward left. Scale bar 2 mm.

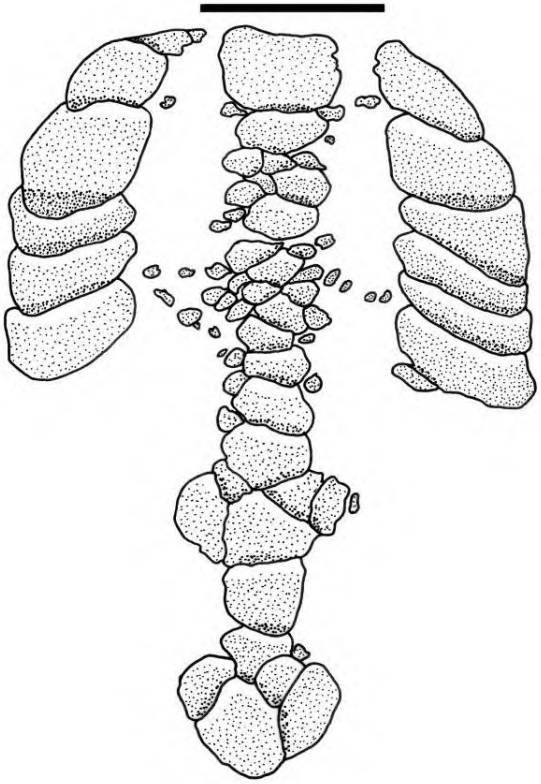
1987



1988

1989 Figure 36. Trunk lateral plates of *Hisonotus* sp. “Camaquã”, lateral view of left side, MCP 25924,

1990 44.4 mm SL. Scale bar 4 mm.



1991

1992 Figure 37. Arrangement of abdominal plates, *Hisonotus* sp. “Camaquã”, MCP 25924, 44.4 mm SL.

1993 Anterior portion toward top. Scale bar 2 mm.

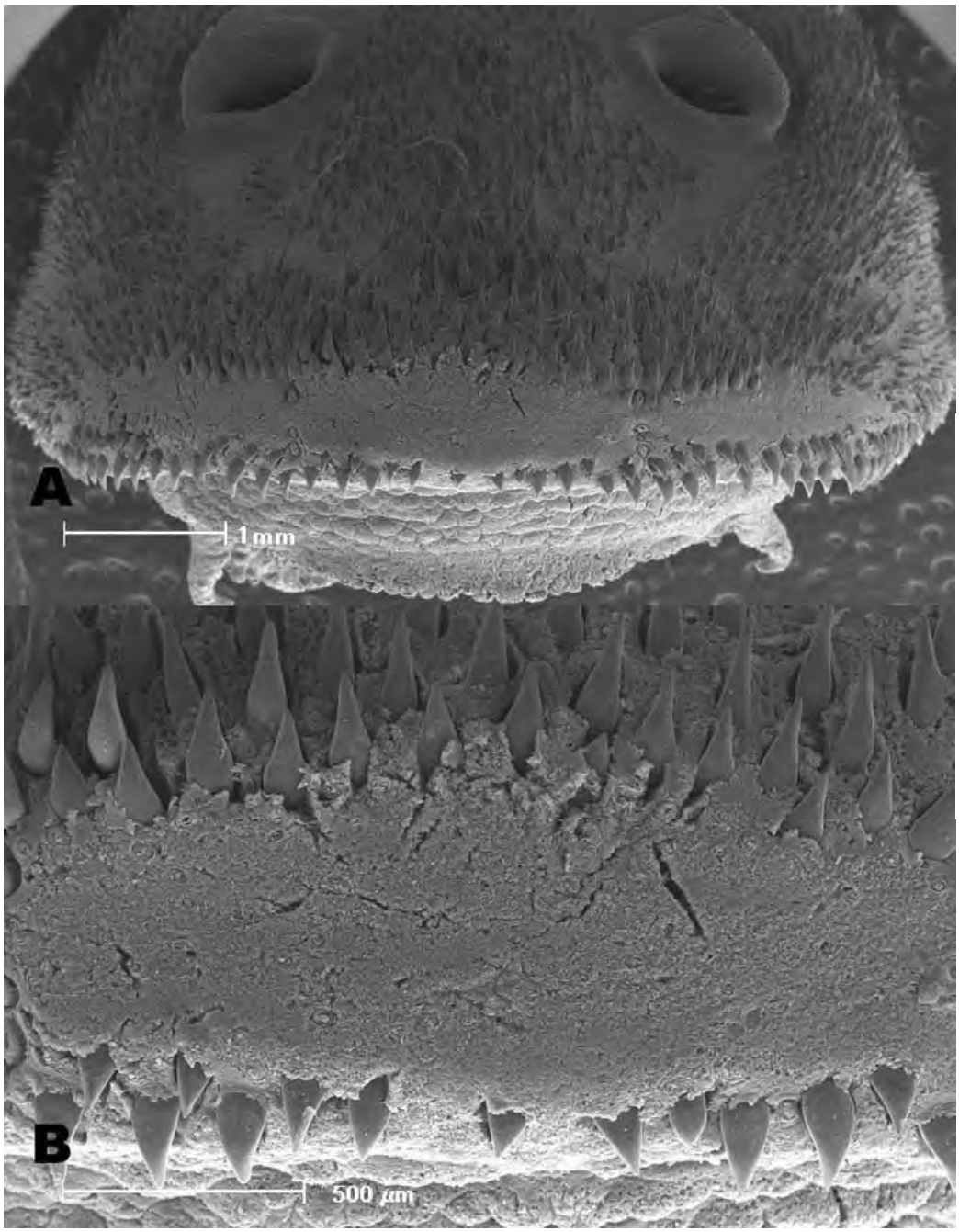


Figure 38. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus* sp. "Camaquã", MCP 25924, 40.2 mm SL. A-anterior view of rostrum B-magnification of medial portion.

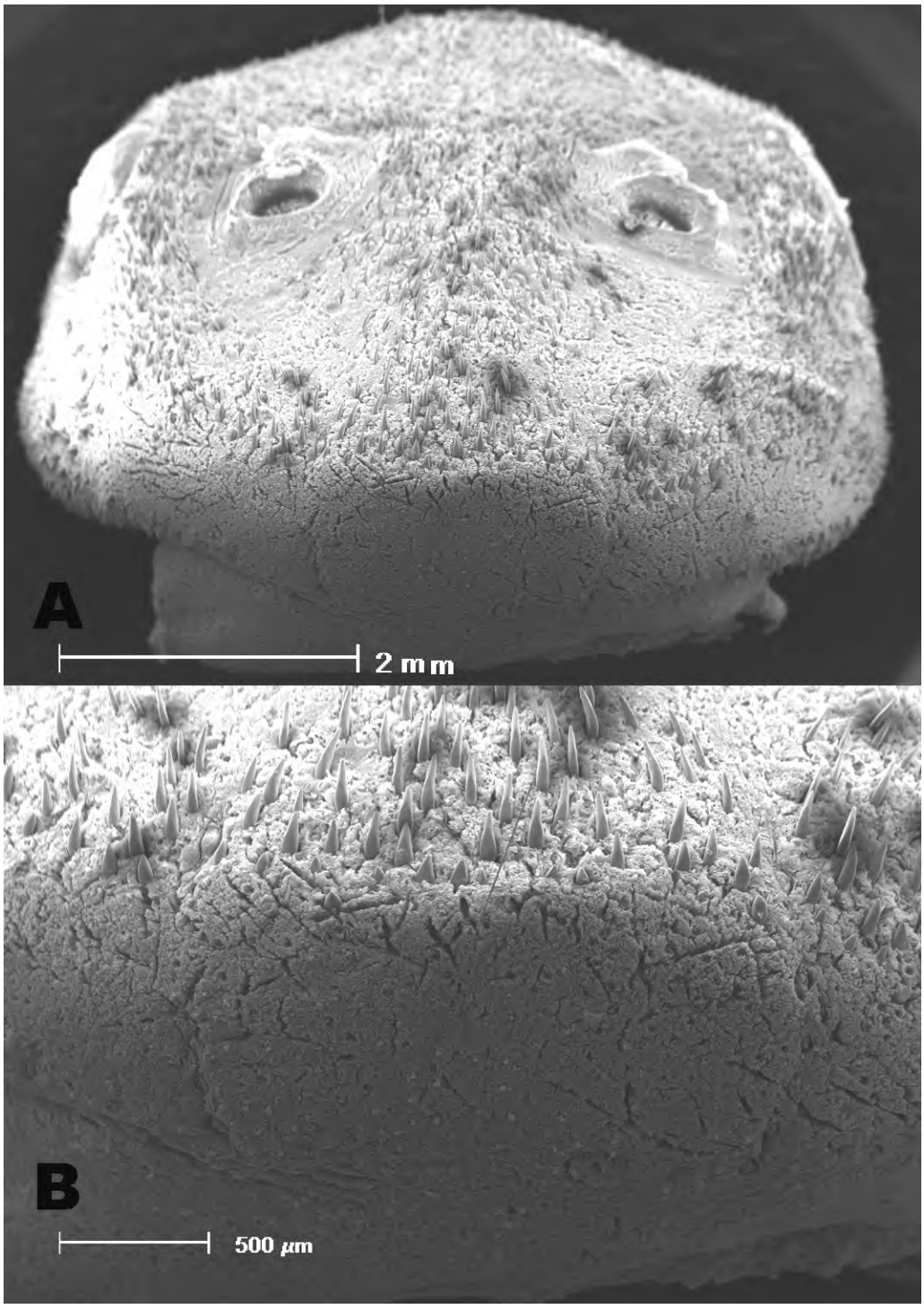


Figure 39. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus* sp. "Camaquã" showing the absence of the rostral ventrad series of odontodes, UFRGS 8966, 34.7 mm SL. A-anterior view of rostrum B-magnification of medial portion.

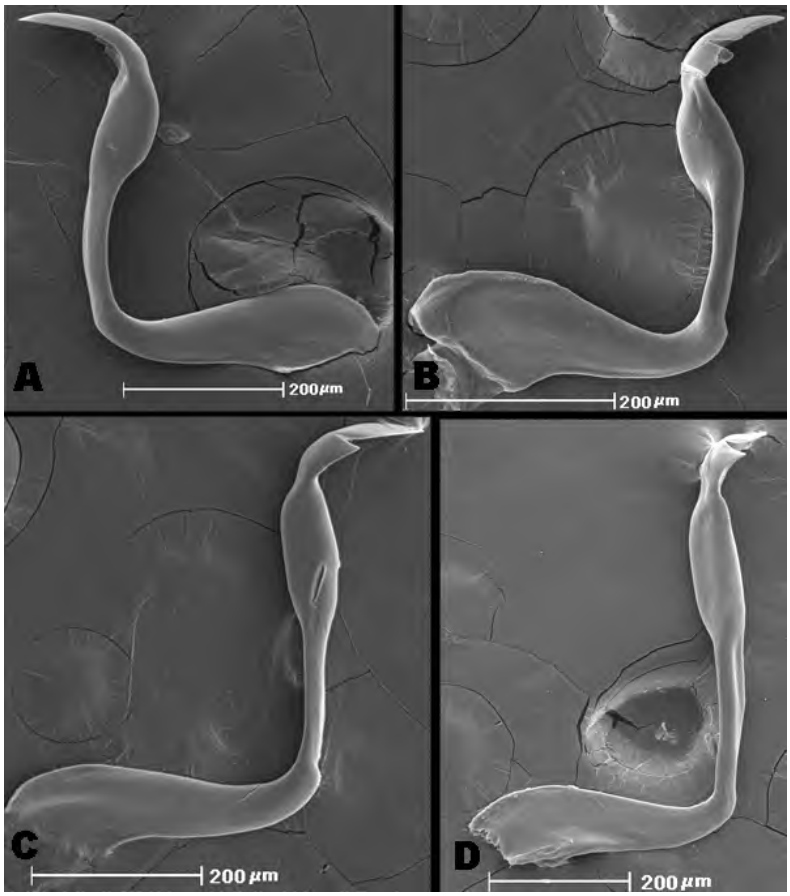


Figure 40. Dentary teeth of *Hisonotus* species of laguna dos Patos system. A- *Hisonotus* sp. "Sinos", MCP 14619, 41.9mm SL. B- *Hisonotus* sp. "Prata", MCP 22204, 28.9 mm SL. C- *Hisonotus* sp. "Camaquã", MCP 25924, 44. 4 mm SL. D- *Hisonotus armatus*, MCP 37682, 40.4 mm SL.

Figure 41. Type locality of *Hisonotus* sp. “Camaquã”. Small creek tributary to arroio das Lavras, Lavras do Sul, Brazil.

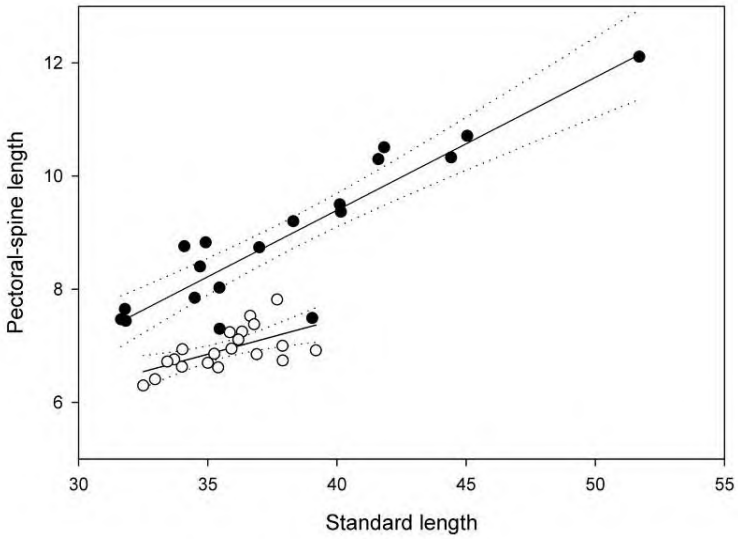


Figure 42. Pectoral-fin spine length as a function of standard length in *Hisonotus* sp. “Camaquã”, showing variation within the species. Open circles designate the population of Encruzilhada do Sul, black circle designate the population near Lavras do Sul.

Figure 43. Holotype of *Hisonotus* sp. “Carreiro”, MCP uncataloged, female, 35.4 mm SL. Rio Carreiro downstream Carreiro bathing spot, Serafina Corrêa, Brazil.

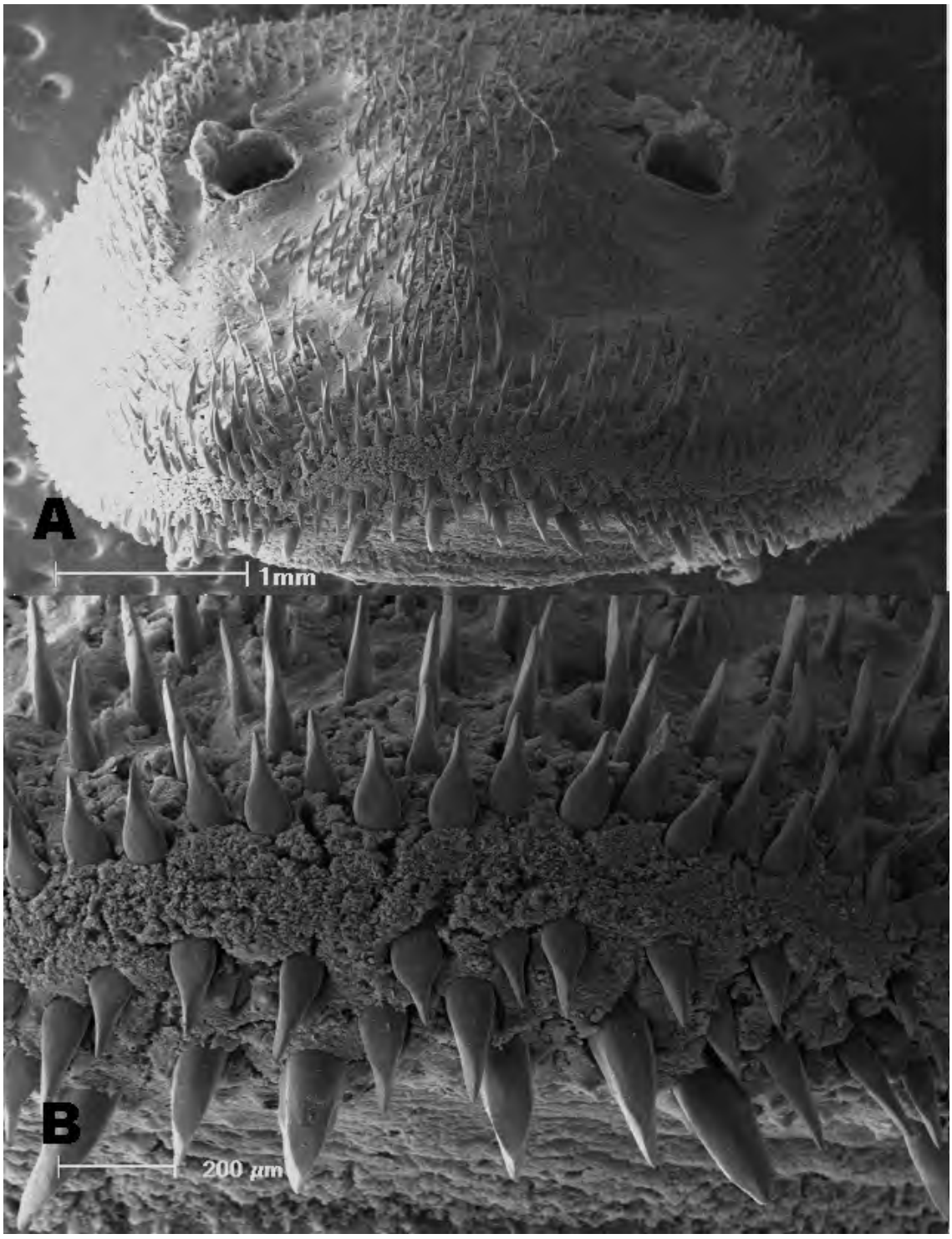


Figure 44. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus* sp. "Carreiro", MCP 40945, 30.0 mm SL. A-anterior view of rostrum B-magnification of medial portion.

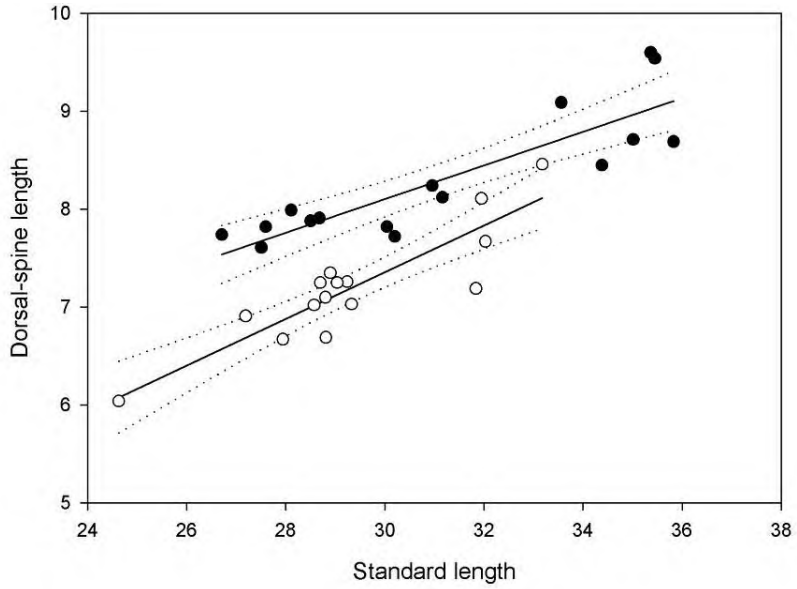


Figure 45. Dorsal-fin spine length as a function of standard length for *Hisonotus* sp. "Carreiro" (black circles) against *Hisonotus* sp. "Prata" (open circles). Dotted lines represent 95% confidence limits.

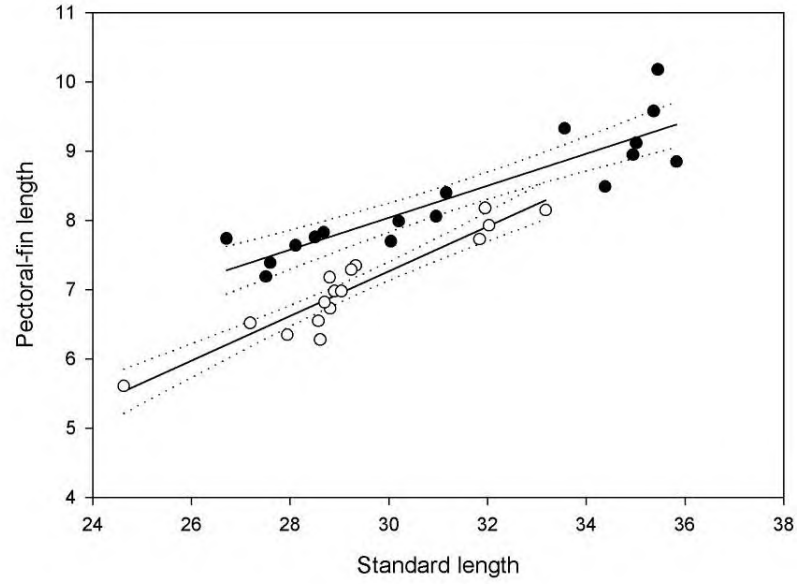


Figure 46. Pectoral-fin spine length as a function of standard length for *Hisonotus* sp. "Carreiro" (black circles) against *Hisonotus* sp. "Prata" (open circles). Dotted lines represent 95% confidence limits.

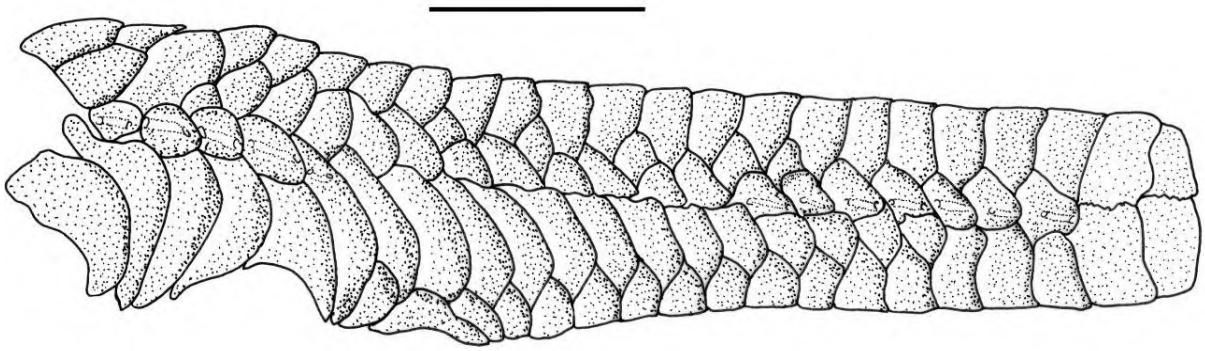


Figure 47. Trunk lateral plates of *Hisonotus* sp. “Carreiro”, lateral view of left side, MCP 40945, 31.2 mm SL. Scale bar 4 mm.

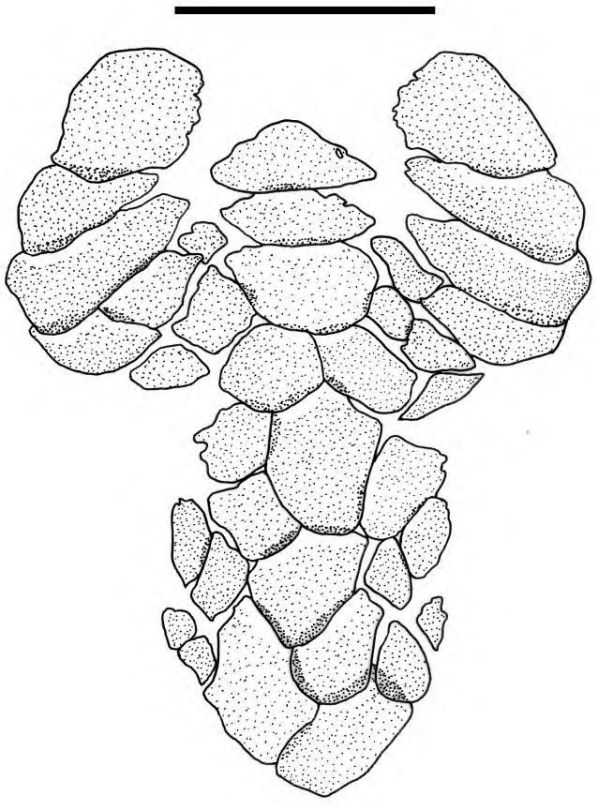


Figure 48. Arrangement of abdominal plates, *Hisonotus* sp. “Carreiro”, MCP 40954, 31.2 mm SL. Anterior portion toward top. Scale bar 2 mm.

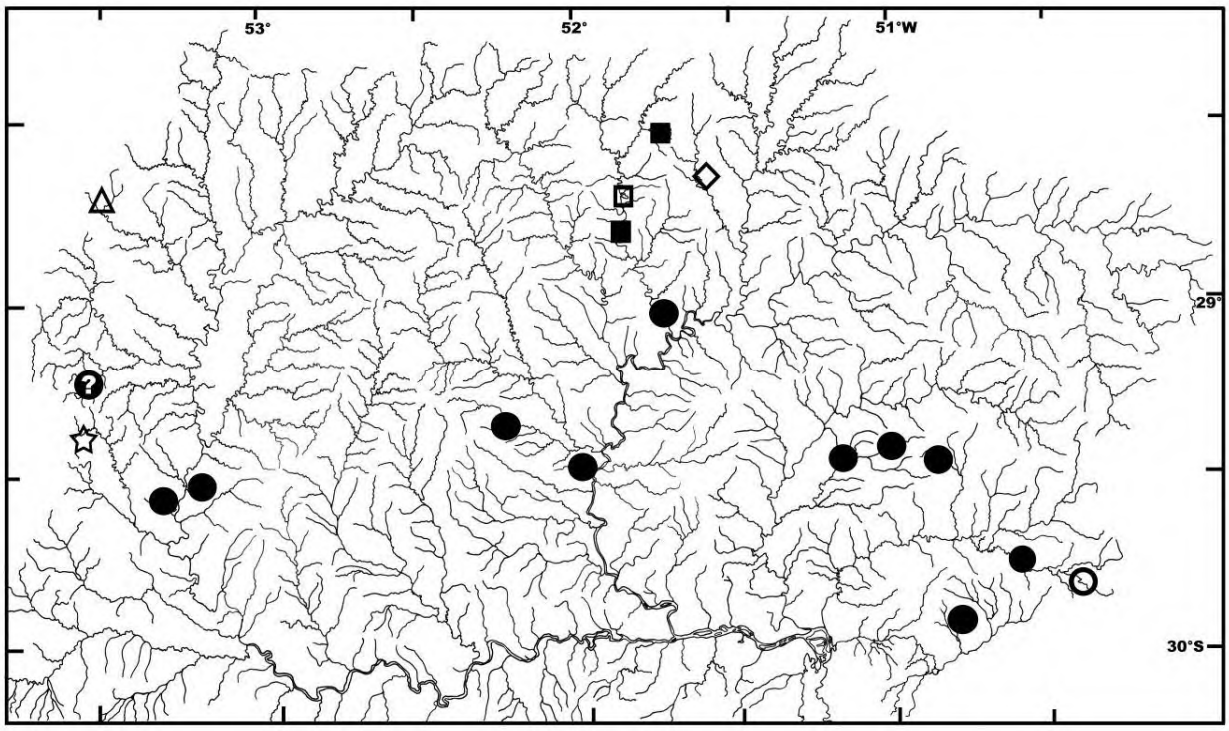


Figure 49. Drainage map of rio Jacuí basin showing distribution of *Hisonotus* species. Some symbols represent more than one collecting locality. Open symbols represent type locality. *Hisonotus* sp. “Carreiro” (squares) *Hisonotus* sp. “Prata” (diamond) *Hisonotus* sp. “Passo Novo” (Triangle) *Hisonotus* sp. “Felicio” (star) *Hisonotus* sp. “Sinos” (circles), questionable record represents arroio Tipiáia locality.

Figure 50. Type locality of *Hisonotus* sp. “Carreiro”. Rio Carreiro downstream of Carreiro bathing pool, Serafina Corrêa, Brazil.

Figure 51. Holotype of *Hisonotus* sp. “Prata”, MCP uncataloged, female, 31.8 mm SL. Rio da Prata on Passo do Despraiado, Nova Prata, Brazil.

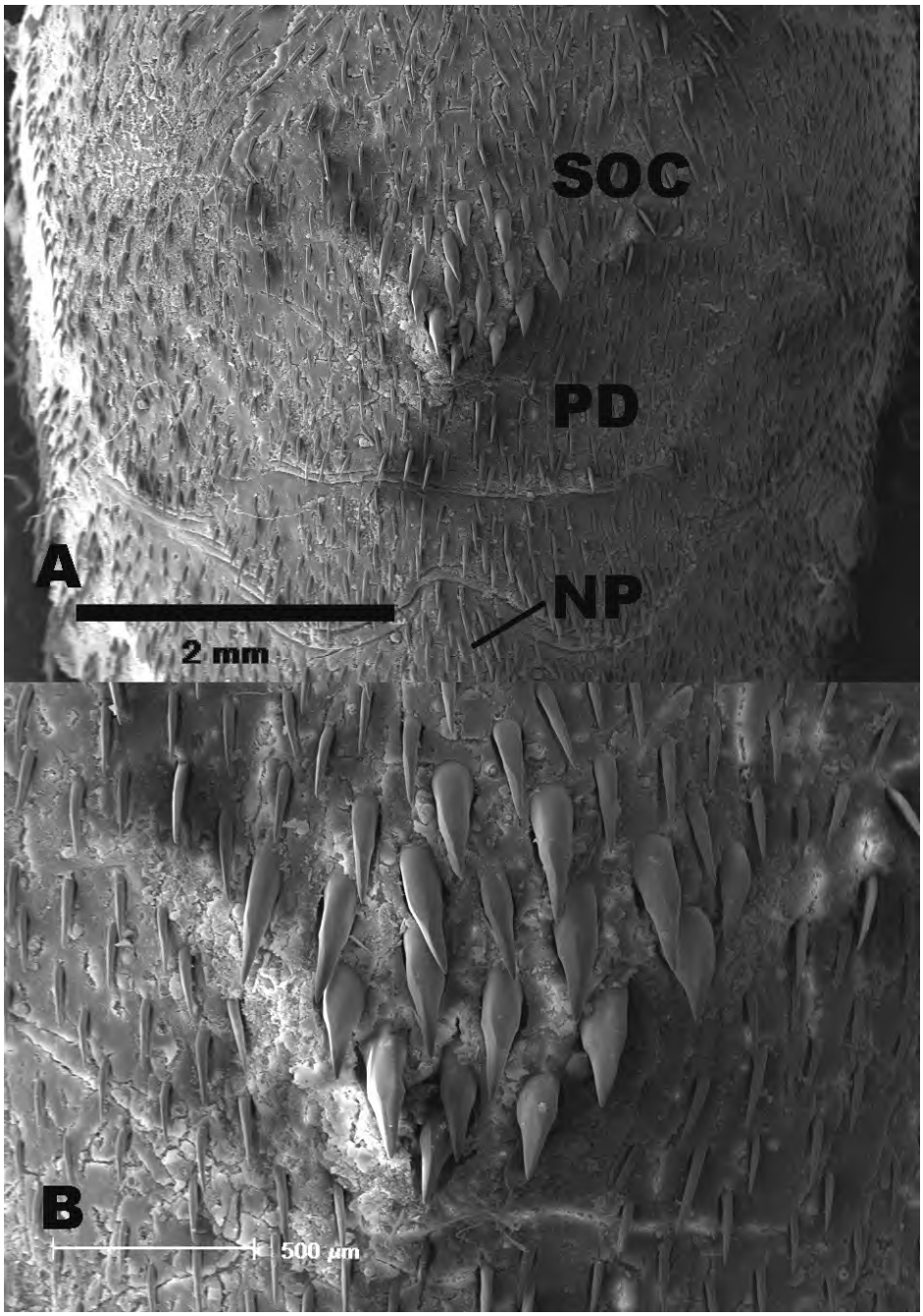


Figure 52. Scanning electron micrograph of predorsal region of *Hisonotus* sp. "Prata", showing the raised tuft of odontodes in the posterior tip of parieto-supraoccipital. MCP 22204, 29.2 mm SL. A- dorsal view of predorsal region. B-magnification of raised odontodes. SOC – parieto-supraoccipital PD - paired predorsal plates NP - nuchal plate.

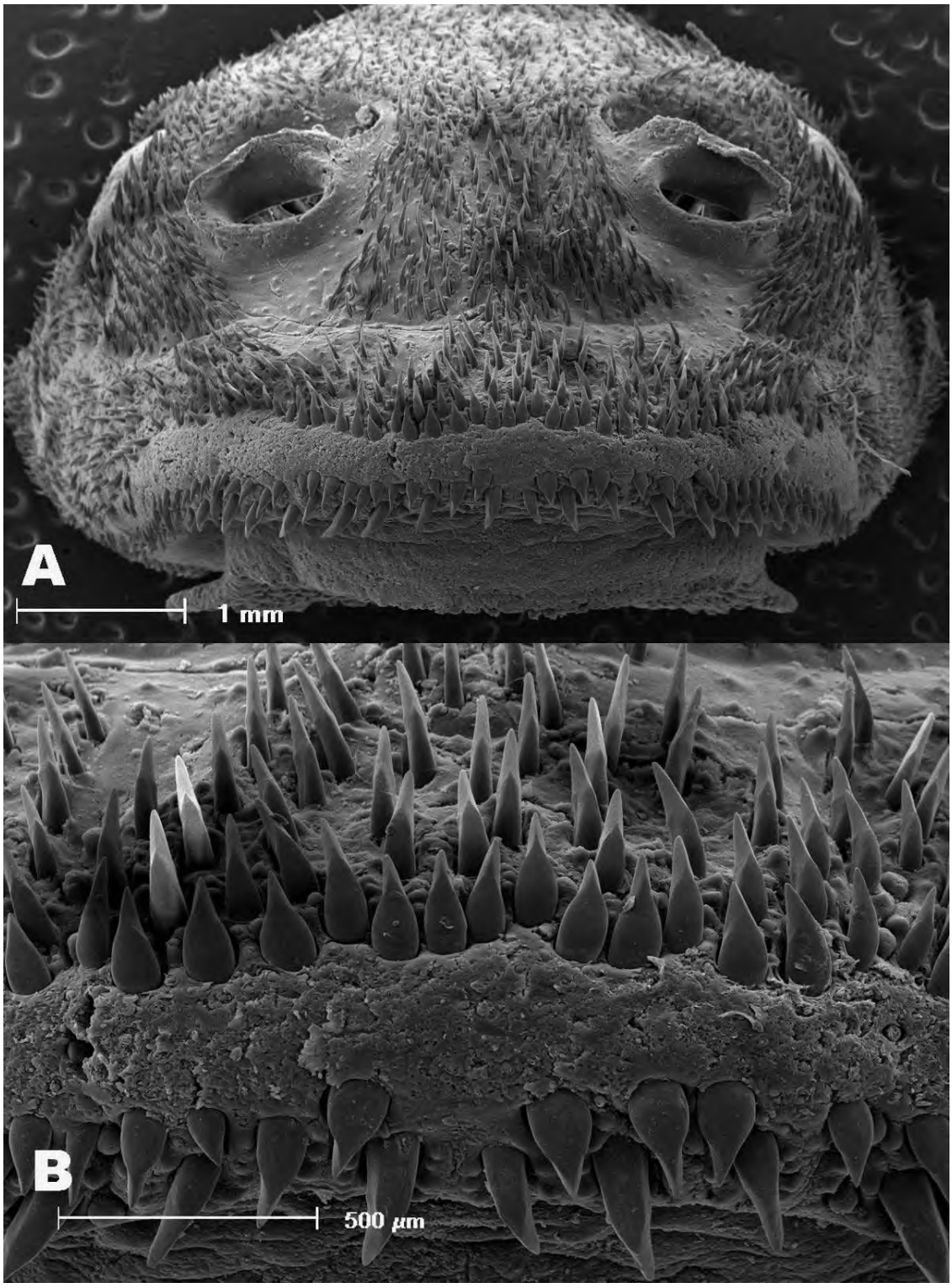


Figure 53. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus* sp. "Prata", MCP 22204, 29.2 mm SL. A-anterior view of rostrum B-magnification of medial portion.

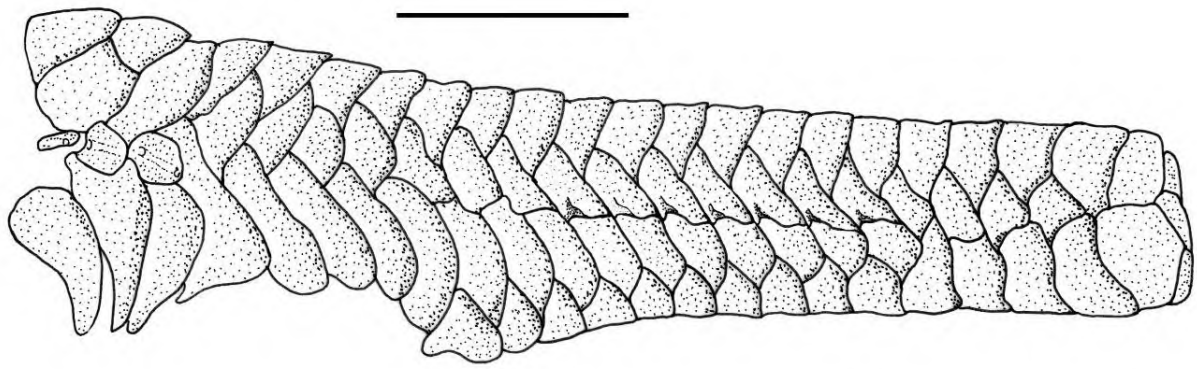


Figure 54. Trunk lateral plates of *Hisonotus* sp. “Prata”, lateral view of left side, MCP 22204, 28.9 mm SL. Scale bar 4 mm.

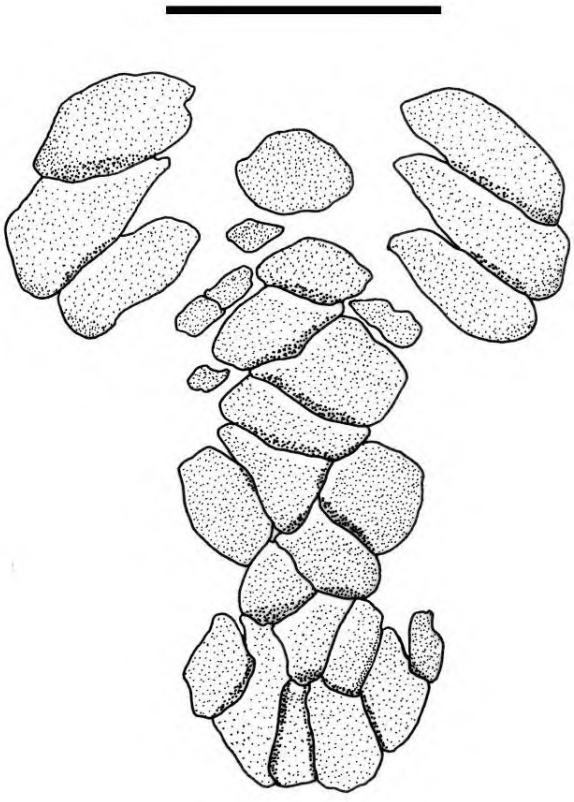


Figure 55. Arrangement of abdominal plates, *Hisonotus* sp. “Prata”, MCP 22204, 28.9 mm SL. Anterior portion toward top. Scale bar 2 mm.

Figure 56. Type locality of *Hisonotus* sp. “Prata”. Rio da Prata at Passo do Despraiado, Nova Prata, Brazil.

Figure 57. Holotype of *Hisonotus* sp. “Sinos”, MCP uncataloged, female, 38.2 mm SL. Rio dos Sinos, bridge 7 km north from Caraá, road to Fundo Quente, Caraá, Brazil.

Figure 58. Live specimen of *Hisonotus* sp. “Sinos”, UFRGS 8812, female, SL unrecorded. Mouth of arroio pinheirinho with rio Forqueta, Lageado, Brazil. Photo: L. Malabarba.

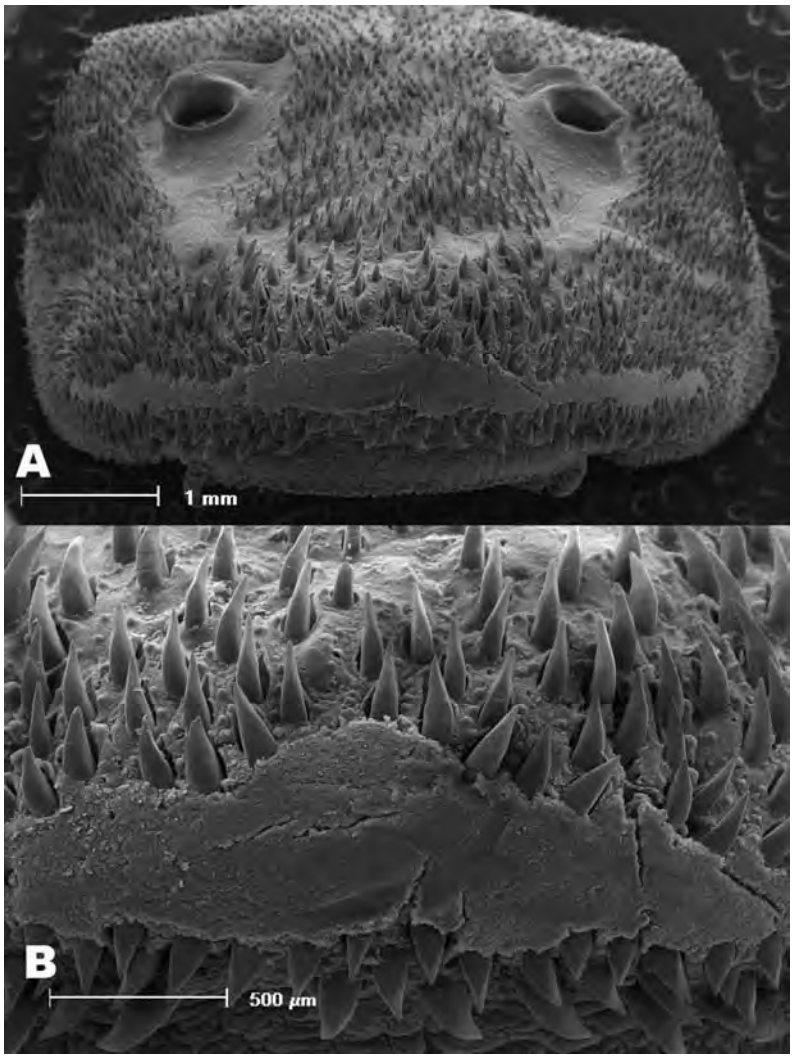


Figure 59. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus* sp. “Sinos”, MCP 17643, 38.5 mm SL. A-anterior view of rostrum B-magnification of medial portion.

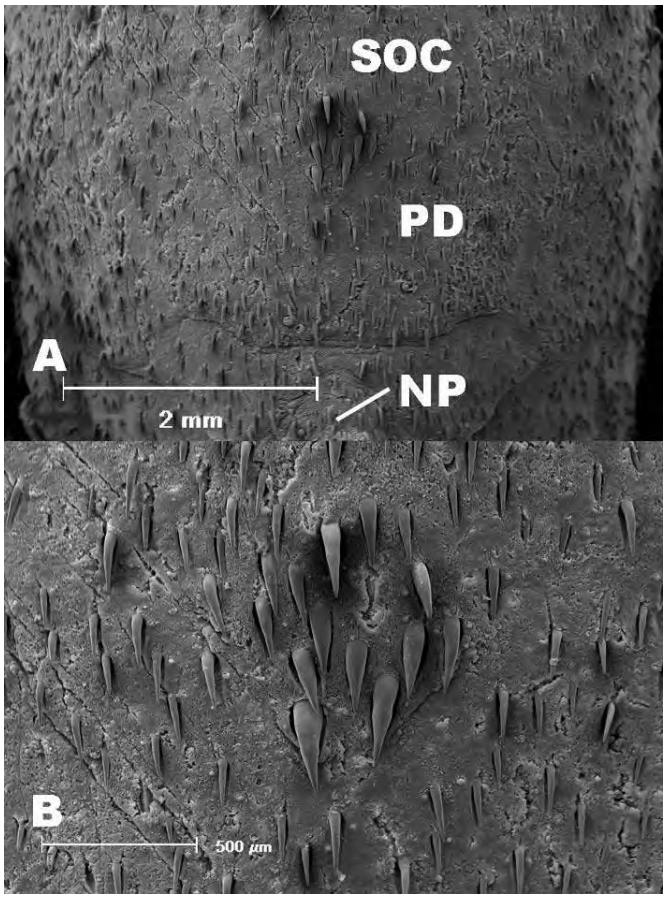


Figure 60. Scanning electron micrograph of predorsal region of *Hisonotus* sp. “Sinos”, showing the enlarged odontodes in the posterior tip of parieto-supraoccipital of a juvenile. MCP 26568, 30.4 mm SL. A-dorsal view of predorsal region. B-magnification of raised odontodes. SOC – parieto-supraoccipital□PD - paired predorsal plates□NP - nuchal plate.

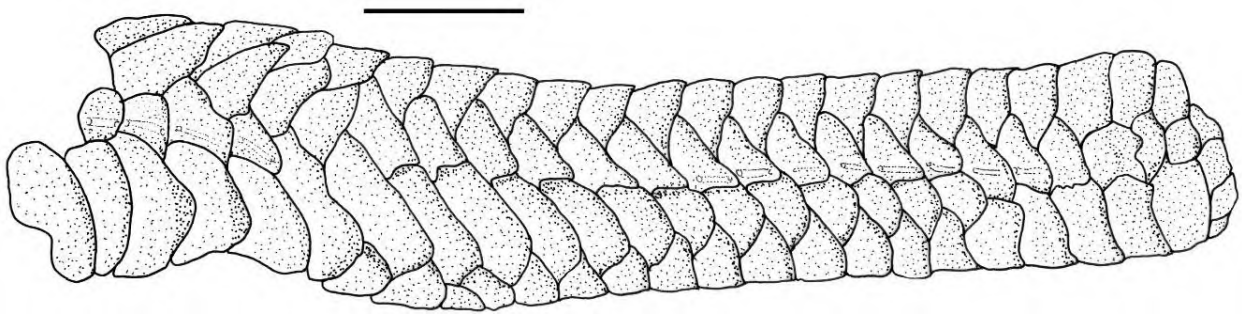


Figure 61. Trunk lateral plates of *Hisonotus* sp. “Sinos”, lateral view of left side, MCP 14619, 41.3 mm SL. Scale bar 4 mm.

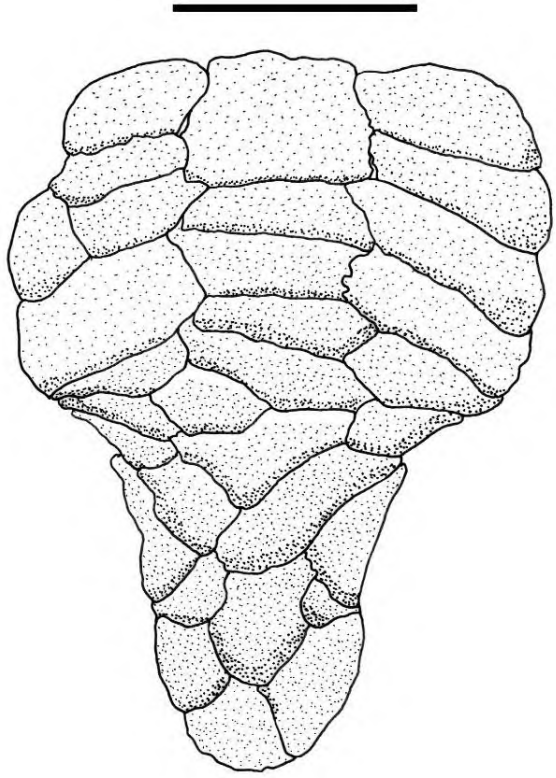


Figure 62. Arrangement of abdominal plates, *Hisonotus* sp. “Sinos”, MCP 14619, 41.3 mm SL. Anterior portion toward top. Scale bar 2 mm.

Figure 63. *Hisonotus* cf. “Sinos”, showing variation on caudal-fin pigmentation, MCP 41074, female, 41.6 mm SL. Arroio Passo dos Buracos (Tipiáia) on road from Júlio de Castilhos to Cruz Alta, Cruz Alta, Brazil.

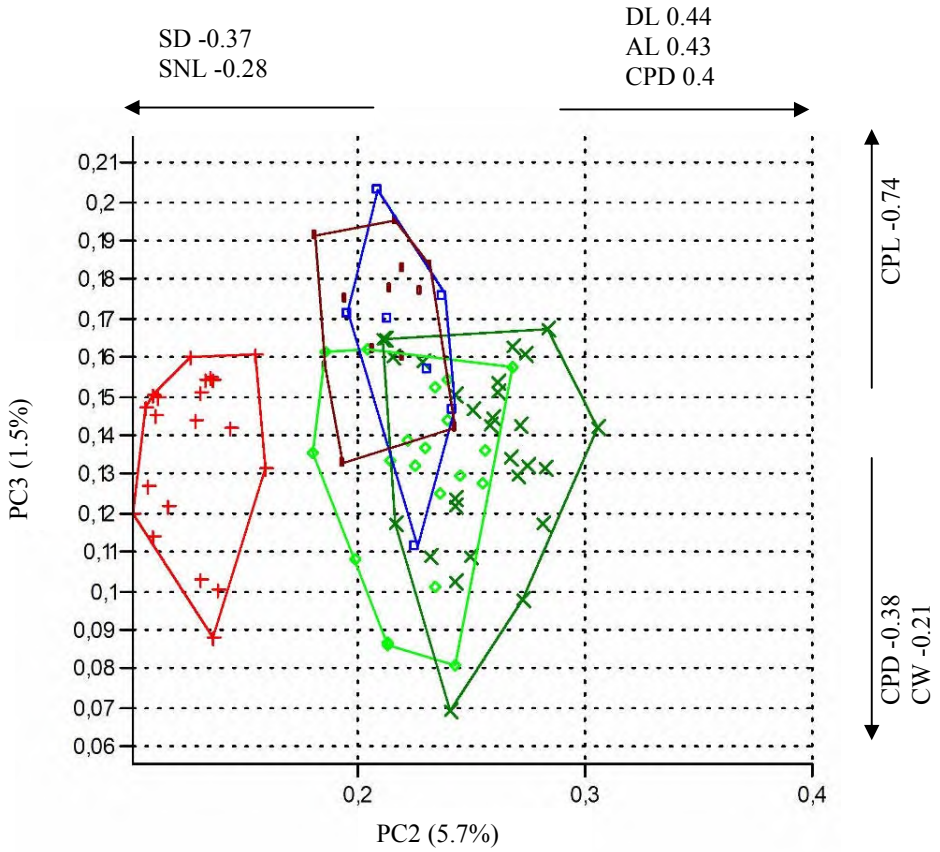


Figure 64. Principal component analysis of 17 morphometric data of *Hisonotus* species from rio Jacuí basin. Stronger loadings on the second and third principal components. Red crosses = *Hisonotus* sp. "Passo Novo" brown dots = *Hisonotus* sp. "Felício" dark green exes = *Hisonotus* sp. "Sinos" (type specimens/rio dos Sinos) light green diamonds = *Hisonotus* sp. "Sinos" (non types rio Taquari/rio Jacuí) blue squares = *Hisonotus* cf. "Sinos".

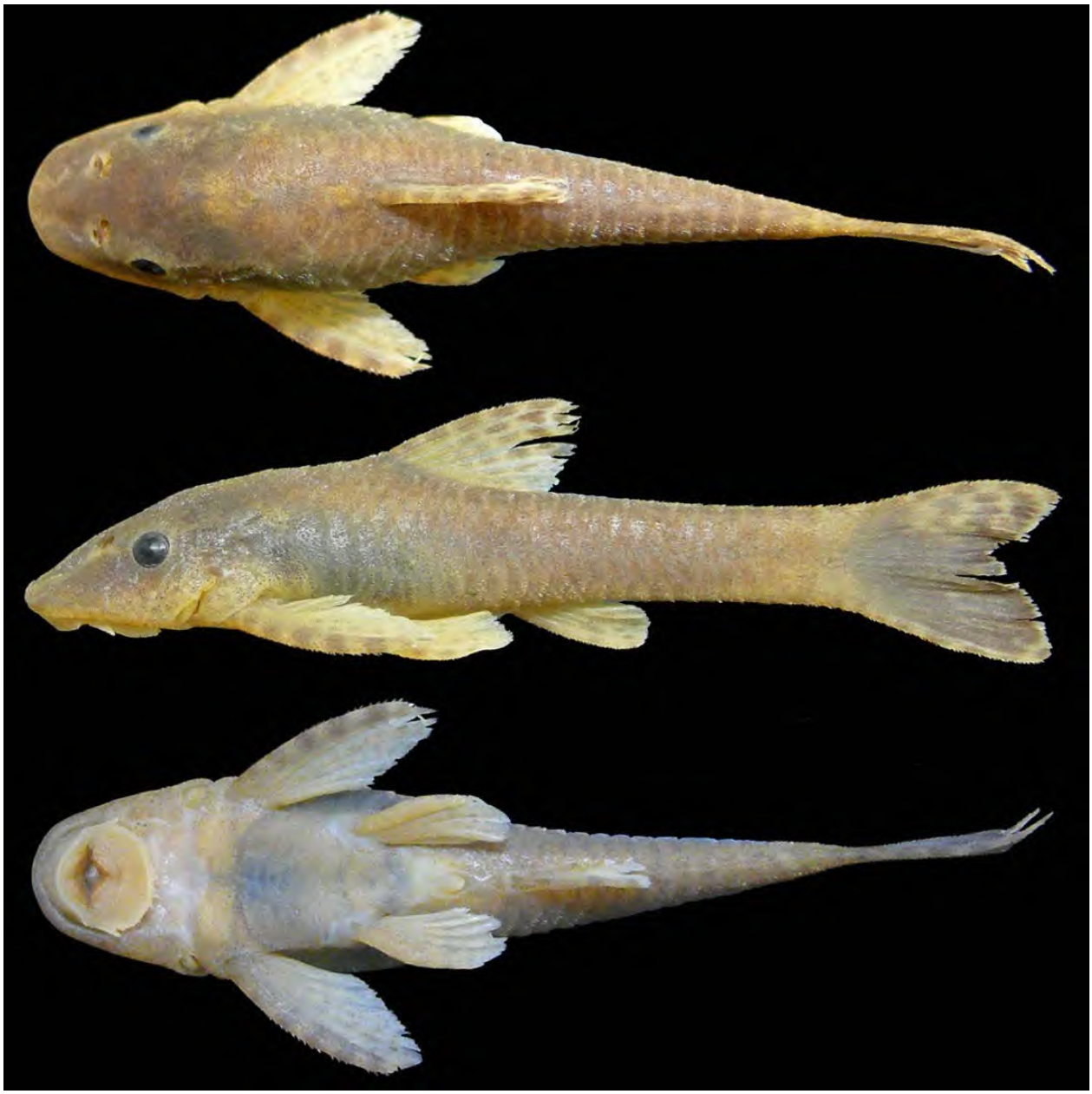


Figure 65. Holotype of *Hisonotus* sp. “Passo Novo”, MCP uncatalog, female, 41.5 mm SL. Rio Passo Novo on road from Cruz Alta to Ibirubá, Cruz Alta, Brazil.

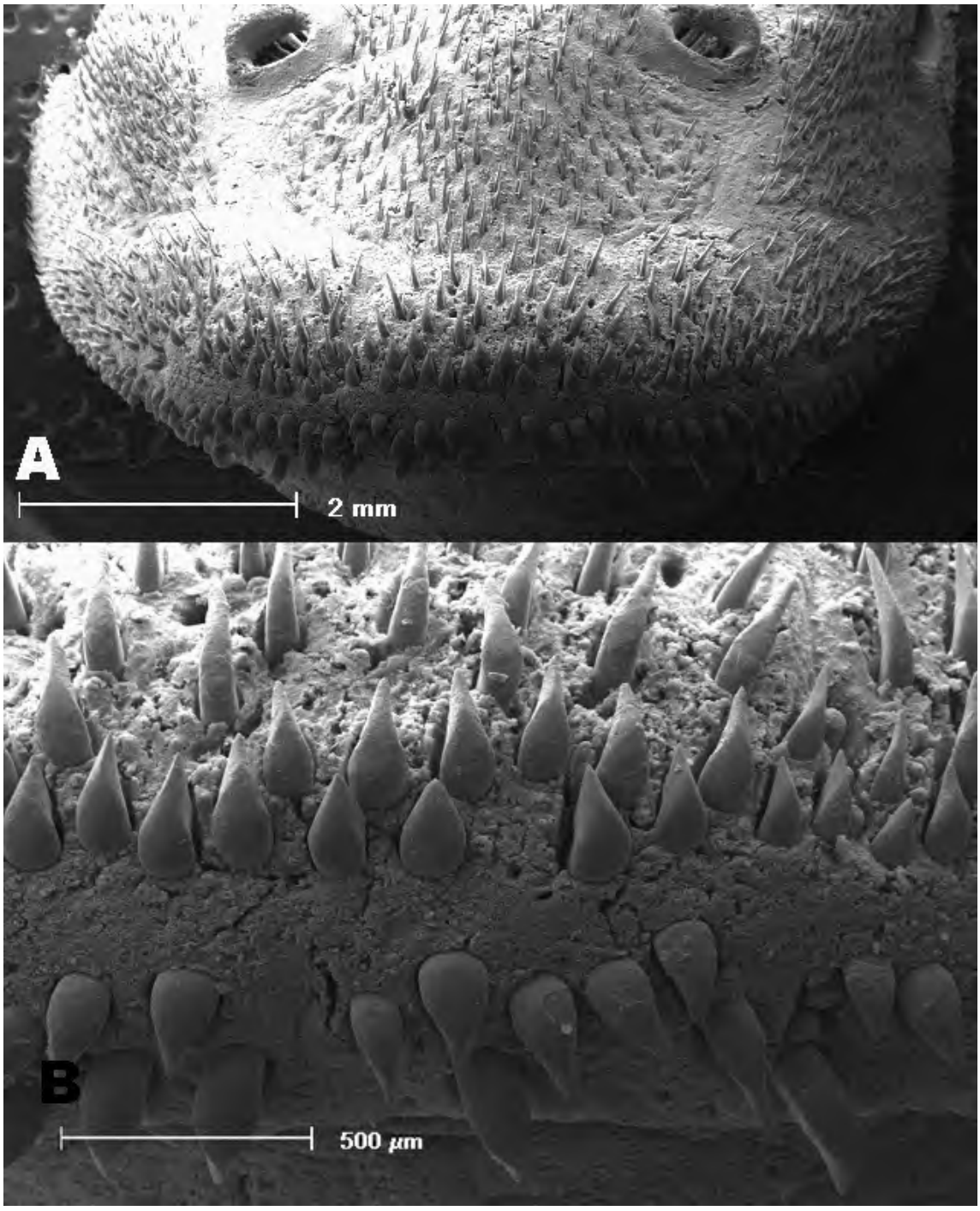


Figure 66. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus* sp. "Passo Novo", MCP 22701, 41.1 mm SL. A-anterior view of rostrum B-magnification of medial portion.

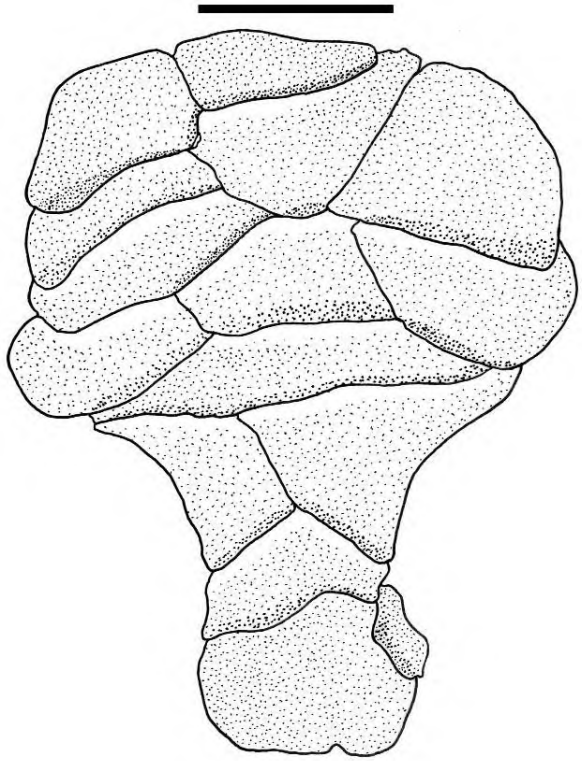


Figure 67. Arrangement of abdominal plates, *Hisonotus* sp. “Passo Novo”, MCP 22701, 40.1 mm SL. Anterior portion toward top. Scale bar 2 mm.

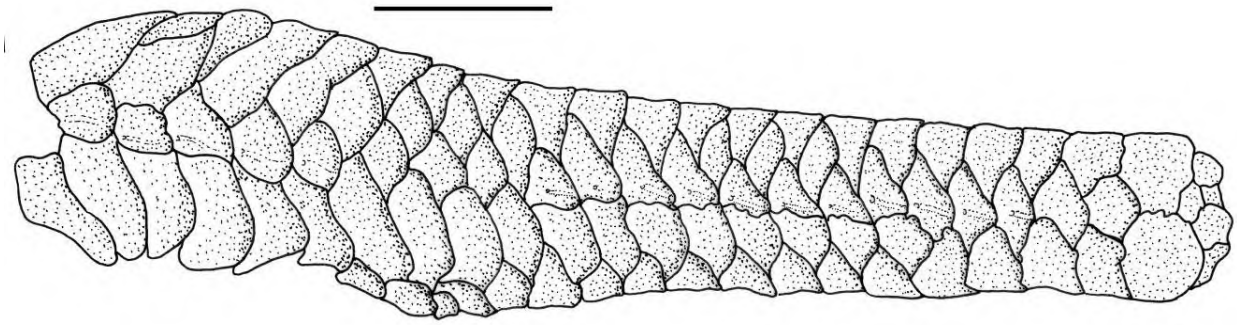


Figure 68. Trunk lateral plates of *Hisonotus* sp. “Passo Novo”, lateral view of left side, MCP 22701, 40.1 mm SL. Scale bar 4 mm.

Figure 69. Live specimen of *Hisonotus* sp. “Passo Novo”, MCP 41072, female, SL unrecorded. Rio Passo Novo on road from Cruz Alta to Ibirubá, Cruz Alta, Brazil.

Figure 70. Type locality of *Hisonotus* sp. “Passo Novo”. Rio Passo Novo on road from Cruz Alta to Ibirubá, Cruz Alta, Brazil.

Figure 71. Holotype of *Hisonotus* sp. “Felício”, MCP uncataloged, female, 43.0 mm SL. Arroio Felício on road from Nova Palma to Júlio de Castilhos, Júlio de Castilhos, Brazil.

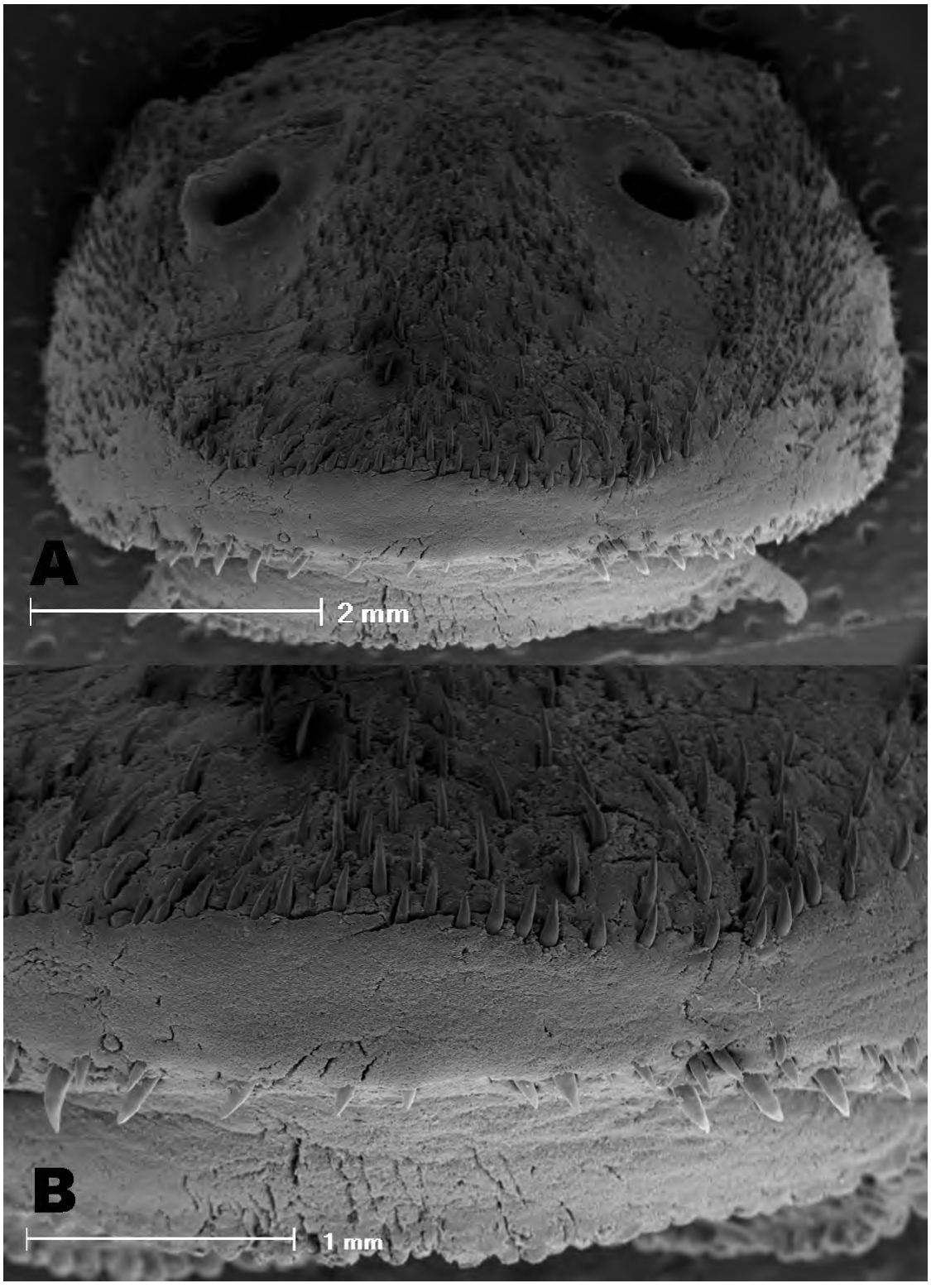


Figure 72. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus* sp. “Felício”, MCP 41073, 39.3 mm SL. A-anterior view of rostrum B-magnification of medial portion.

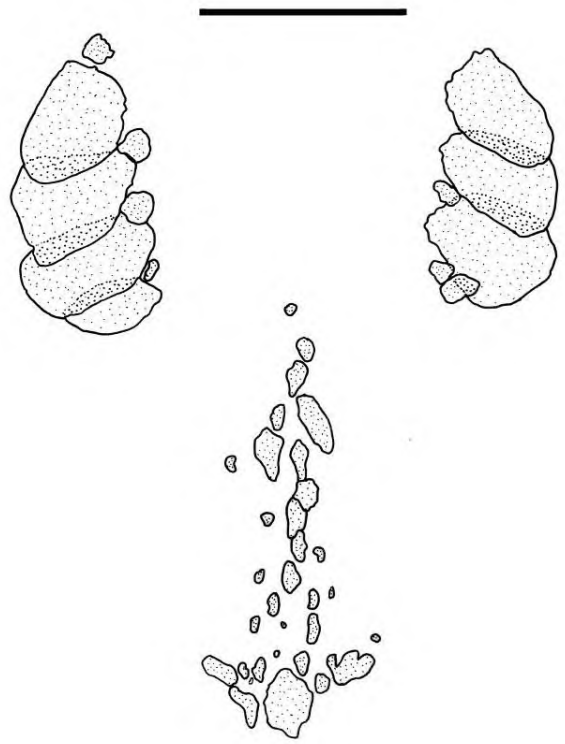


Figure 73. Arrangement of abdominal plates, *Hisonotus* sp. “Felício”, MCP 41073, 39.8 mm SL. Anterior portion toward top. Scale bar 2 mm.

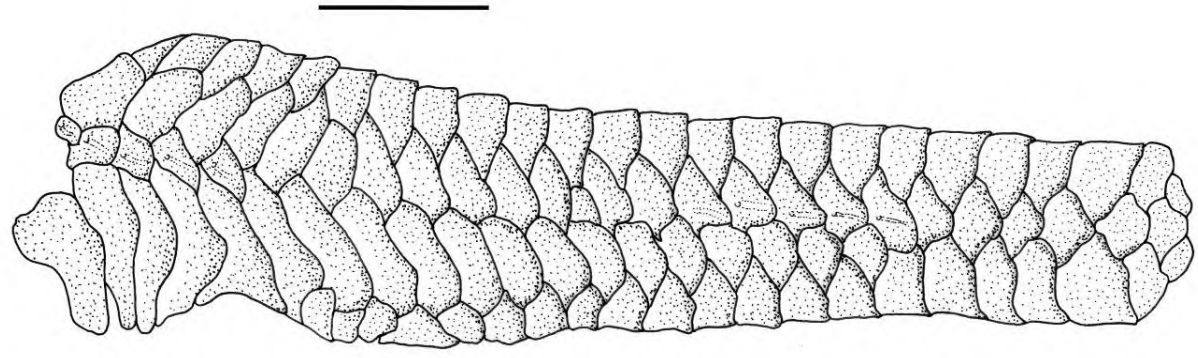


Figure 74. Trunk lateral plates of *Hisonotus* sp. “Felício”, lateral view of left side, MCP 41073, 39.8 mm SL. Scale bar 4 mm.

Figure 75. Type locality of *Hisonotus* sp. “Felício”. Arroio Felício on road from Nova Palma to Júlio de Castilhos, Júlio de Castilhos, Brazil.

Figure 76. *Hisonotus* aff. *leucofrenatus*, MCN 17790, male, 36.3 mm SL. Lagoa do Casamento at southeast coast of Ilha Grande, Palmares do Sul, Brazil.

Figure 77. *Hisonotus charrua*, MCP 25139, female, 46.4 mm SL. Arroio dos Pires on the bridge of railroad at Passo dos Pires, Pinheiro Machado, Brazil.

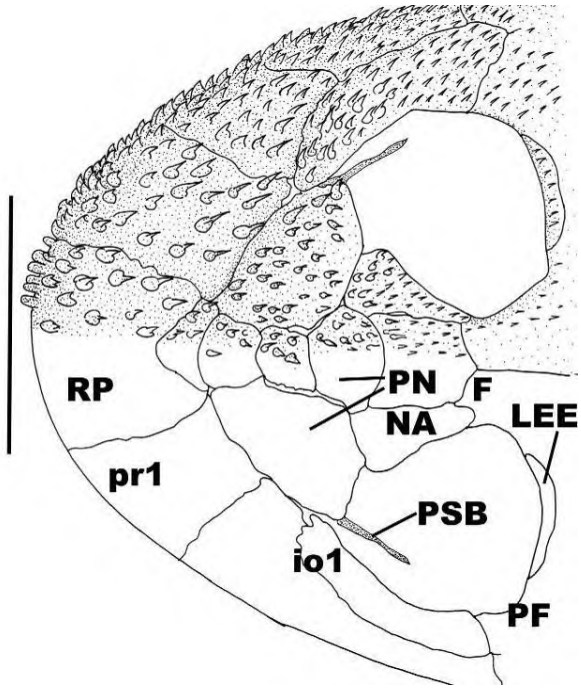


Figure 78. Snout in dorsal view of *Hisonotus notatus*, showing prenasal region completely covered by plates, MCP 18089 30.4 mm SL. Scale bar 2 mm.

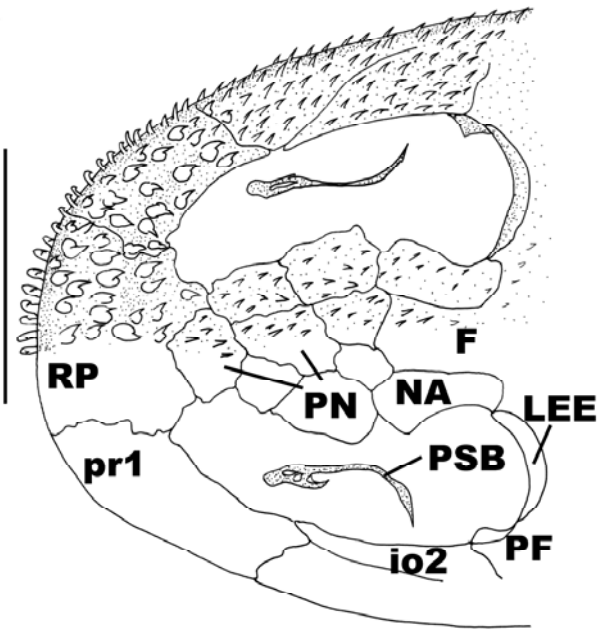


Figure 79. Snout in dorsal view of *Hisonotus taimensis*, showing unplated prenasal region, MCP 17417, 35.3 mm SL. Scale bar 2 mm.

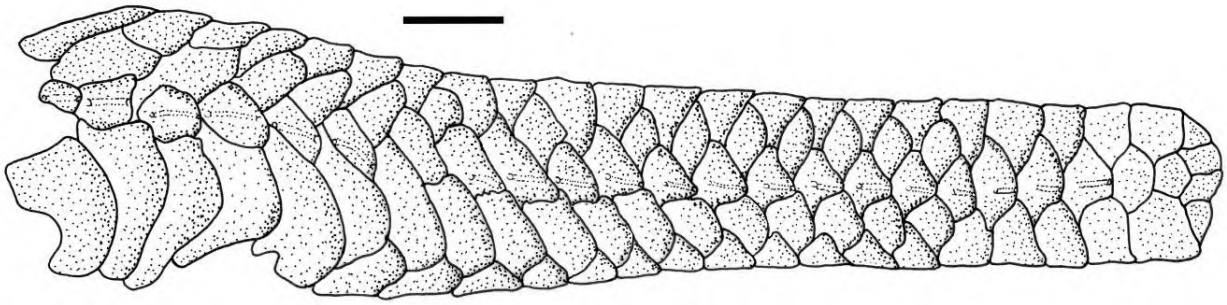


Figure 80. Trunk lateral plates of *Hisonotus notatus*, lateral view of left side, showing a complete median series. MCP 18098, 41.3 mm SL. Scale bar 4 mm.

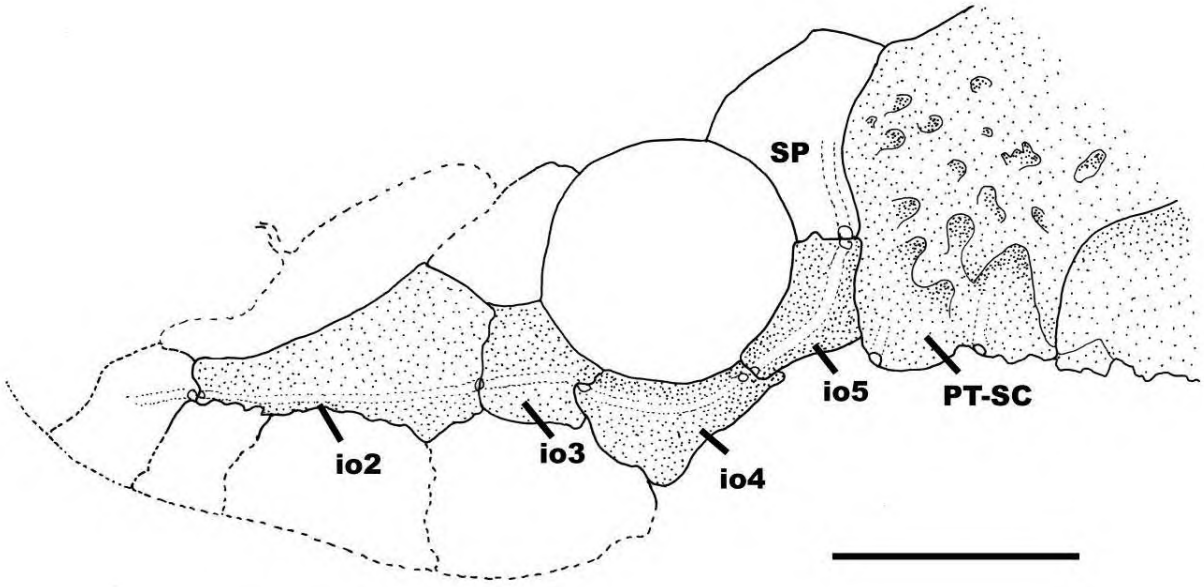


Figure 81. Skull in dorsolateral view of *Hisonotus ringueleti*, MCP 11215 37,1 mm SL, showing ventrally expanded infraorbital four.

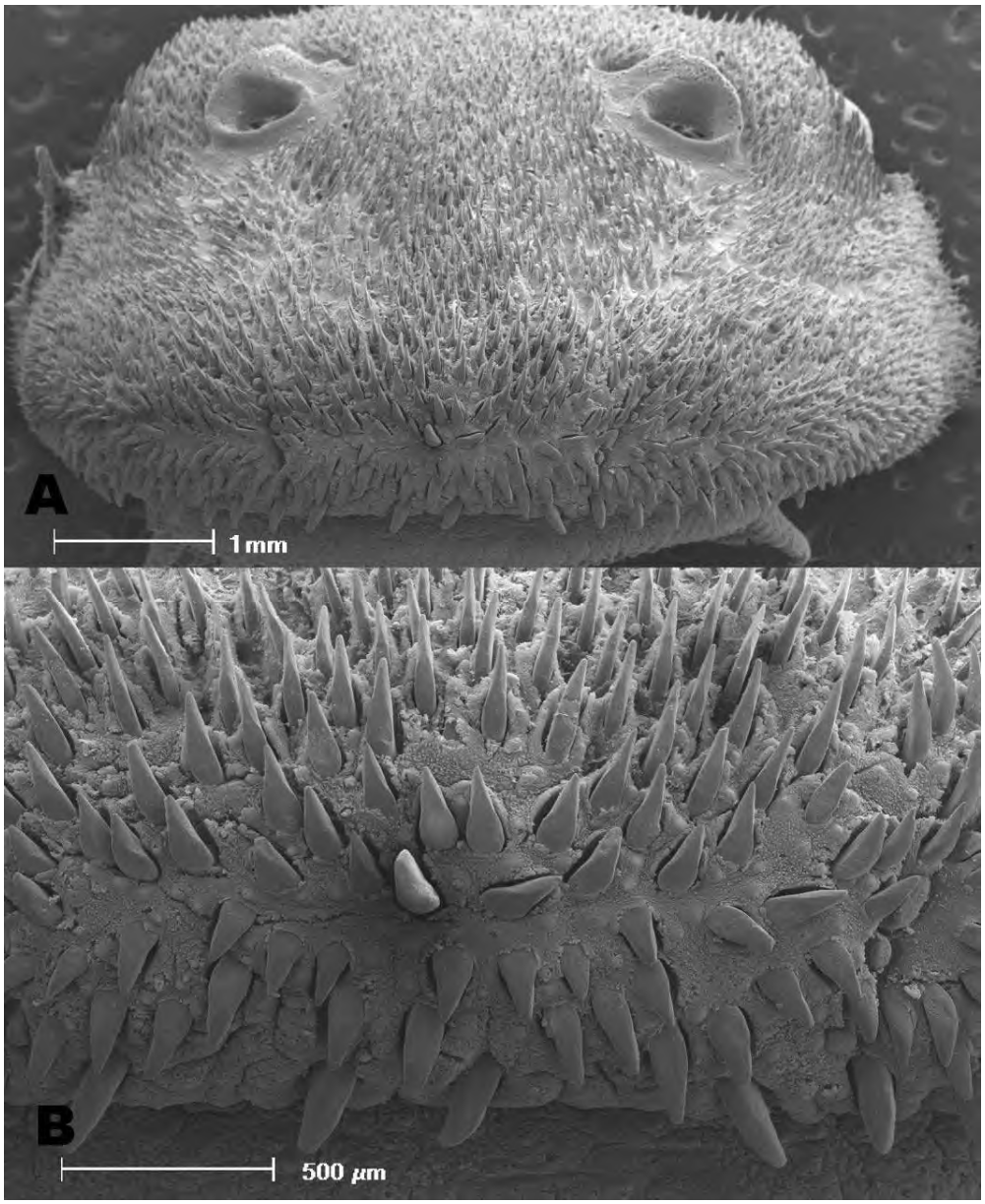


Figure 82. Scanning electron micrograph of snout anterior rostral margin of *Epactionotus bilineatus*, MCP 29293, 38.0 mm SL. A-anterior view of rostrum B-magnification of medial portion.

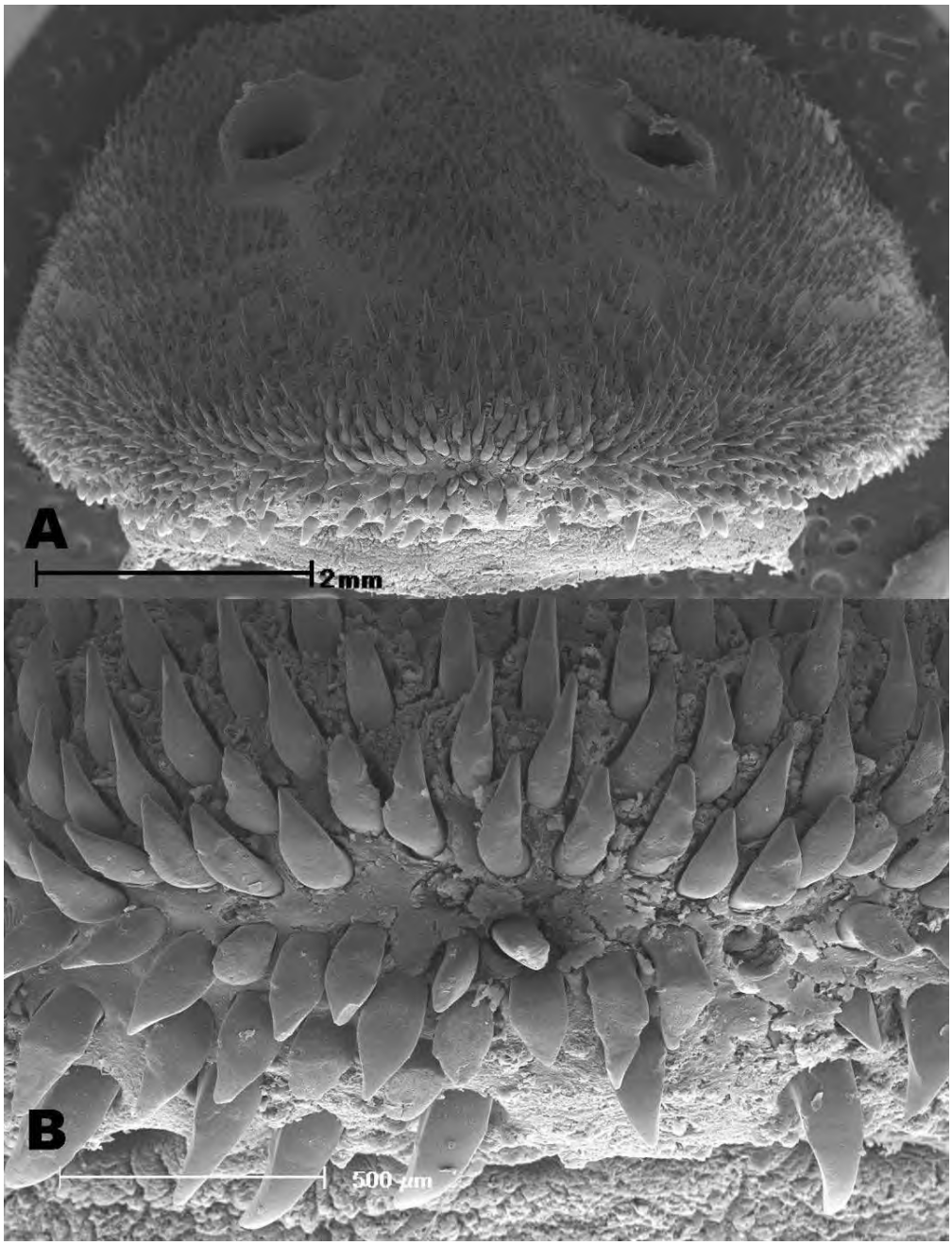


Figure 83. Scanning electron micrograph of snout anterior rostral margin of *Parotocinclus maculicauda*, MCP 20087, 40.4 mm SL. A-anterior view of rostrum B-magnification of medial portion.

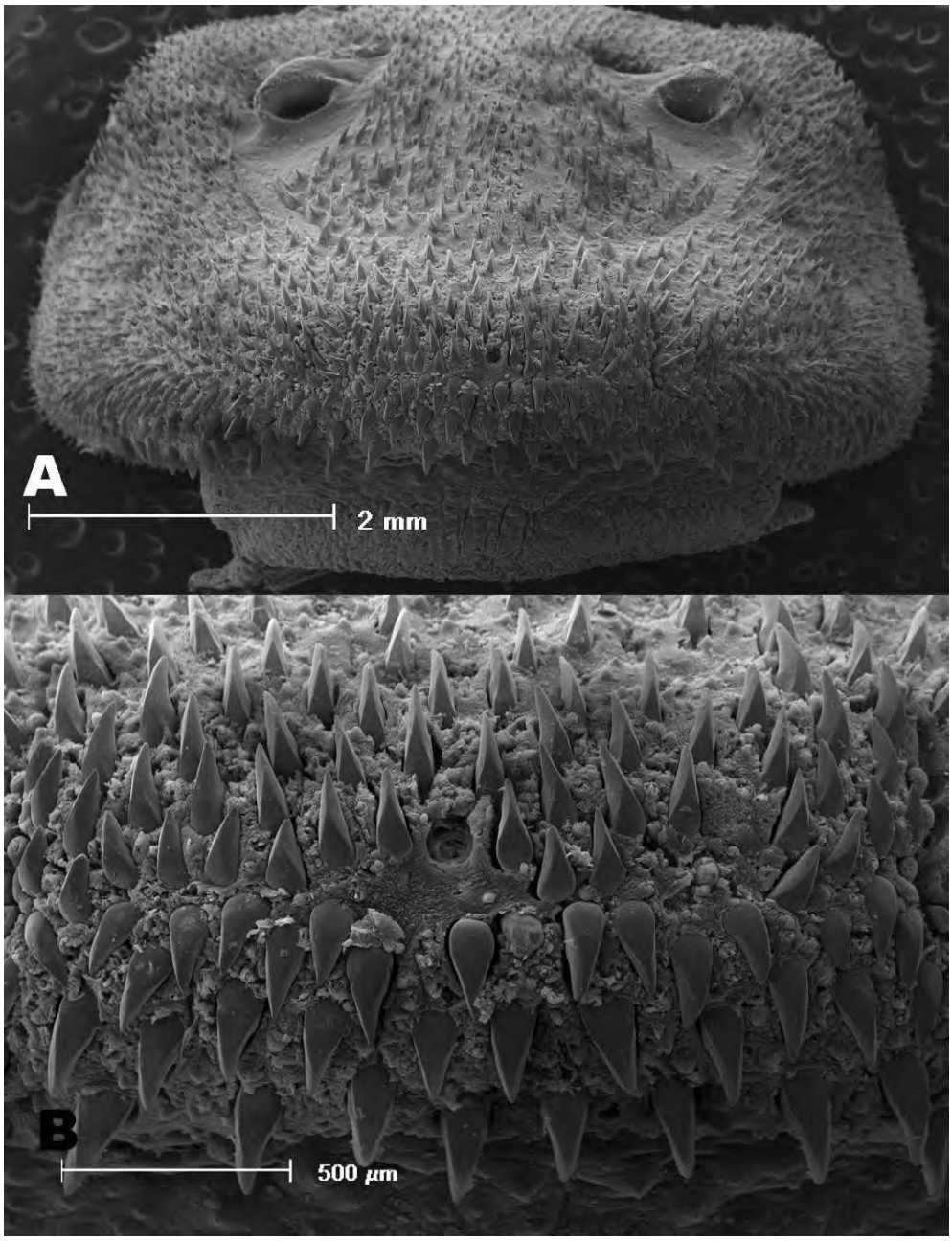


Figure 84. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus notatus*, MCP 18098, 40.4 mm SL. A-anterior view of rostrum B-magnification of medial portion.

2158 **Table 1.** Morphometrics and meristics of *Hisonotus nigricauda*. SD = Standard deviation. n = number of specimens.

	Syntypes					Laguna dos Patos					Rio Uruguai				
	n	Low	High	Mean	SD	n	Low	High	Mean	SD	n	Low	High	Mean	SD
Standard length (mm)	9	24.8	31.8	27.6		60	25.06	39.24	32.37	-	60	24.1	38.5	30.1	-
Percents of Standard Length															
Head length	9	33.2	39.1	36.6	1.77	60	34.1	40.8	36.0	1.16	60	34.0	38.9	36.4	1.10
Predorsal length	9	44.5	49.6	47.6	1.57	60	44.9	48.8	46.8	0.86	60	44.6	51.0	47.5	1.24
Dorsal-fin spine length	8	22.6	26.5	24.4	1.21	59	23.7	28.7	26.3	1.25	59	22.7	28.7	25.4	1.12
Anal-fin unbranched ray length	8	16.3	19.0	17.9	1.00	58	16.3	21.4	18.7	1.10	60	15.9	20.4	17.8	0.90
Pectoral-fin spine length	9	23.2	27.7	25.6	1.33	60	22.4	31.2	26.7	1.62	60	23.8	30.4	27.1	1.22
Pelvic-fin unbranched ray length	9	14.6	18.7	16.3	1.23	60	14.3	22.1	16.8	1.95	59	12.9	19.7	15.9	1.60
Cleithral width	9	23.7	25.8	24.8	0.74	60	23.4	27.3	25.2	0.77	60	23.4	27.7	25.1	0.94
Thoracic length	9	16.2	19.7	18.3	1.11	60	15.8	19.4	17.7	0.88	60	15.8	19.3	17.7	0.82
Abdominal length	9	18.0	20.6	19.2	1.00	60	18.3	21.6	19.7	0.71	60	18.1	21.5	19.7	0.87
Body depth at dorsal fin origin	9	18.2	20.3	18.8	0.66	60	17.7	21.6	19.2	0.89	60	17.3	21.9	19.1	0.99
Caudal-peduncle length	9	28.6	33.1	31.2	1.56	60	29.9	34.6	31.9	1.10	60	28.0	35.1	31.0	1.55
Caudal-peduncle length	9	9.8	10.6	10.2	0.23	60	10.0	12.2	11.0	0.43	60	9.4	11.3	10.3	0.51
Percents of Head Length															
Snout Length	9	44.6	47.2	45.8	0.79	60	40.0	49.8	47.2	1.44	60	44.7	50.6	47.4	1.30
Orbital diameter	9	18.3	20.7	19.6	0.76	60	16.1	20.2	18.2	0.99	60	15.3	20.1	17.7	0.95
Interorbital width	9	35.9	41.9	39.2	1.75	60	38.3	47.6	43.4	1.79	60	37.4	48.5	42.2	2.29
Head depth	9	43.8	51.2	47.5	2.73	60	41.0	56.6	49.4	2.93	60	44.5	53.4	48.6	2.07
Suborbital depth	9	13.5	16.4	15.0	0.98	60	14.4	20.4	17.4	1.34	60	14.3	19.3	16.3	1.08
Mandibular ramus	9	6.1	9.3	7.5	0.97	59	6.6	9.5	8.1	0.78	60	5.8	9.7	7.5	0.85
Meristics															
Left premaxillary teeth	7	10	14	12.1	1.35	56	11	19	14.4	1.61	55	10	17	13.6	1.59
Right premaxillary teeth	7	11	15	12.7	1.50	52	11	19	14.4	1.66	59	10	17	13.3	1.54
Left dentary teeth	9	10	12	11.4	0.88	56	10	16	12.8	1.50	60	10	15	11.9	1.45
Right dentary teeth	6	10	11	10.7	0.52	54	11	16	12.6	1.40	56	10	15	11.9	1.36
Left lateral scutes	9	23	24	23.3	0.50	60	22	24	23.0	0.64	60	22	24	23.3	0.65
Right lateral scutes	9	23	24	23.3	0.50	60	22	24	23.1	0.57	60	22	24	23.3	0.63

2159 **Table 2.** Frequency distribution for left and right lateral plate counts of species of *Hisonotus* in the

2160 laguna dos Patos system. n = number of specimens.

	Left Lateral Plates									
Species	22	23	24	25	26	27	28	29	n	Mean
laevior				29	32	6			67	25.7
taimensis					3	15	13	2	33	27.4
"Camaquã"				5	12	2			19	25.8
armatus			41	22					63	24.3
"Sinos"	4	30	21						55	23.3
"Passo Novo"	4	14	2						20	22.9
"Felício"		1	11						12	23.9
"Prata"	3	11	2						16	22.9
"Carreiro"	6	8	3						17	22.9
nigricauda	11	36	13						60	23.0

2161

	Right Lateral Plates									
Species	22	23	24	25	26	27	28	29	n	Mean
laevior				28	34	5			67	25.7
taimensis					8	13	10	2	33	27.2
"Camaquã"				7	10	2			19	25.7
armatus		3	40	20					63	24.3
"Sinos"	4	34	17						55	23.2
"Passo Novo"	7	13							20	22.7
"Felício"		2	10						12	23.8
"Prata"	4	9	3						16	22.9
"Carreiro"	3	12	2						17	22.8
nigricauda	6	40	14						60	23.1

2162 **Table 3.** Morphometrics and meristics of *Hisonotus laevior*. SD = Standard deviation. n = number

2163 of specimens. H = holotype of *H. laevior*. h = holotype of *H. leptochilus*.

	Types			Non-types			
	H	h	n	Low	High	Mean	SD
Standard length (mm)	39.2	40.9	65	29.3	47.2	38.0	-
Percents of Standard Length							
Head length	34.1	34.6	65	30.6	36.9	33.6	1.39
Predorsal length	45.1	48.2	65	43.2	49.8	46.4	1.34
Dorsal-fin spine length	-	19.6	65	20.6	26.6	23.4	1.33
Anal-fin unbranched ray length	14.3	-	64	14.1	20.0	17.2	1.27
Pectoral-fin spine length	23.5	22.4	65	20.5	26.2	23.5	1.34
Pelvic-fin unbranched ray length	15.2	0.0	65	13.1	20.1	16.5	1.84
Cleithral width	22.2	22.2	65	20.6	24.6	22.9	0.85
Thoracic length	15.2	15.7	65	15.1	20.3	17.3	0.95
Abdominal length	19.9	19.4	65	18.0	21.9	19.9	0.79
Body depth at dorsal-fin origin	16.6	18.0	65	16.2	20.8	18.1	1.03
Caudal-peduncle length	33.2	33.8	65	31.0	37.0	33.7	1.31
Caudal-peduncle depth	11.1	11.1	65	9.2	12.5	10.8	0.68
Percents of Head Length							
Snout Length	50.0	47.8	65	44.7	52.5	48.6	1.32
Orbital diameter	14.2	16.2	65	14.8	19.0	16.6	0.89
Interorbital width	41.6	39.5	65	36.9	46.2	41.9	1.95
Head depth	44.9	48.1	65	42.8	53.4	48.1	2.20
Suborbital depth	18.3	17.7	65	15.9	21.8	18.6	1.05
Mandibular ramus	7.6	8.2	65	7.0	11.1	8.8	0.86
Meristics							
Left premaxillary teeth	19	-	63	14	23	18.1	2.27
Right premaxillary teeth	17	17	62	14	23	18.1	2.12
Left dentary teeth	-	-	64	12	21	16.0	1.80
Right dentary teeth	15	15	64	11	20	16.1	2.07
Left lateral scutes	26	26	65	25	27	25.6	0.65
Right lateral scutes	26	26	65	25	27	25.6	0.62

2164 **Table 4.** Morphometrics and meristics of *Hisonotus taimensis*, including 23 types and 10 non-type

2165 specimens. SD = Standard deviation, n = number of specimens.

	Types + non-types				
	n	Low	High	Mean	SD
Standard length (mm)	33	29.4	51.1	40.2	-
Percents of Standard Length					
Head length	33	29.2	35.3	31.6	1.54
Predorsal length	33	40.8	46.4	43.4	1.42
Dorsal-fin spine length	30	19.9	24.5	22.0	1.26
Anal-fin unbranched ray length	32	13.0	17.8	15.8	1.13
Pectoral-fin spine length	33	19.7	24.1	21.9	1.10
Pelvic-fin unbranched ray length	33	13.1	19.8	15.3	1.48
Cleithral width	33	18.5	21.3	20.0	0.67
Thoracic length	33	15.0	18.3	16.1	0.79
Abdominal length	33	17.4	20.5	18.7	0.69
Body depth at dorsal fin origin	33	13.3	16.3	15.1	0.83
Caudal-peduncle length	33	33.4	38.7	35.8	1.34
Caudal-peduncle length	33	8.8	11.0	9.8	0.50
Percents of Head Length					
Snout length	33	42.8	51.6	49.3	1.69
Orbital diameter	33	14.6	18.1	16.2	0.87
Interorbital width	33	35.9	45.1	40.0	2.04
Head depth	33	38.1	47.7	43.2	2.16
Suborbital depth	33	13.5	18.6	16.7	1.05
Mandibular ramus	33	6.6	9.8	8.1	0.63
Meristics					
Left premaxillary teeth	33	14	20	16.7	1.26
Right premaxillary teeth	33	13	20	16.5	1.73
Left dentary teeth	33	11	19	14.1	1.62
Rigth dentary teeth	32	11	17	14.4	1.46
Left lateral scutes	33	26	29	27.4	0.75
Rigth lateral scutes	33	26	29	27.2	0.88

TABLE 5. Morphometrics and meristics of *Hisonotus armatus* including 40 types plus 20 non-types specimens. SD = Standard deviation, n = number of specimens, and H = holotype.

	Types + non-types					
	H	n	Low	High	Mean	SD
Standard length (mm)		63	27	45.9	38.2	-
Percent of Standard Length						
Head length	34.4	63	31.7	38.2	34.3	1.22
Predorsal Length	47.4	63	44.0	51.3	46.7	1.27
Dorsal-fin unbranched ray length	26.8	63	22.5	27.7	25.2	1.36
Anal-fin spine length	16.9	63	13.7	17.9	16.2	0.98
Pectoral-fin unbranched ray length	27.2	63	20.9	28.1	25.8	1.46
Pelvic-fin spine length	17.0	63	15.1	21.4	18.1	1.68
Cleithral width	25.0	63	21.9	25.4	23.7	0.81
Thoracic length	16.9	63	14.8	18.5	16.6	0.79
Abdominal length	21.9	63	16.4	22.4	20.6	1.13
Body depth at dorsal-fin origin	19.8	63	16.2	20.9	18.5	1.01
Caudal-peduncle length	31.9	63	30.3	35.0	32.8	1.16
Caudal-peduncle length	12.0	63	9.9	12.7	11.2	0.56
Percent of Head Length						
Snout Length	50.2	63	47.1	53.3	50.2	1.32
Orbital diameter	16.7	63	14.8	18.5	16.7	0.86
Interorbital width	40.5	63	37.8	46.5	42.5	1.90
Head depth	49.9	63	43.4	53.8	49.1	2.30
Suborbital depth	18.6	63	15.7	21.6	19.1	1.10
Mandibular ramus	8.6	63	6.9	10.5	8.5	0.75
Meristics						
Left premaxillary teeth	15	61	14	21	17.7	1.69
Right premaxillary teeth	17	62	15	23	17.7	1.66
Left dentary teeth	16	63	11	19	15.0	1.39
Rigth dentary teeth	15	63	12	20	15.0	1.65
Left lateral scutes	24	63	24	25	24.3	0.48
Rigth lateral scutes	24	63	23	25	24.3	0.54

2168 **Table 6.** Morphometrics and meristics of *Hisonotus* sp. “Camaquã”. SD = Standard deviation, n =

2169 number of specimens, H = holotype.

	types						non-types				
	H	n	Low	High	Mean	SD	n	Low	High	Mean	SD
Standard length (mm)	45.0	19	31.6	51.7	38.08		20	32.5	39.2	35.7	
Percents of Standard Length											
Head length	31.0	19	30.4	36.3	33.5	1.94	20	31.7	34.8	33.4	0.77
Predorsal length	44.4	19	42.7	47.9	45.4	1.63	20	44.4	48.1	46.3	1.08
Dorsal-fin spine length	22.2	19	20.8	24.2	23.1	0.84	20	19.8	23.9	22.3	1.22
Anal-fin unbranched ray length	17.4	19	16.1	18.8	17.6	0.85	20	16.2	24.4	17.9	1.61
Pectoral-fin spine length	23.8	19	19.2	25.7	23.5	1.53	20	17.7	20.7	19.5	0.86
Pelvic-fin unbranched ray length	14.8	19	13.9	21.3	17.2	2.17	20	14.1	20.3	16.2	2.01
Cleithral width	21.1	19	21.0	23.3	22.1	0.68	20	20.9	23.1	22.1	0.64
Thoracic length	16.4	19	14.6	17.7	16.0	0.70	20	14.9	18.0	16.3	0.89
Abdominal length	20.0	19	18.3	20.3	19.1	0.61	20	19.4	22.1	20.7	0,71
Body depth at dorsal-fin origin	17.8	19	17.0	18.9	18.0	0.59	20	17.9	21.5	19.3	1.04
Caudal-peduncle length	34.6	19	33.6	37.2	35.3	1.15	20	32.1	36.1	34.3	0.89
Caudal-peduncle length	11.1	19	10.5	12.8	11.9	0.60	20	10.3	12.1	11.5	0.48
Percents of Head Length											
Snout Length	50.2	19	47.3	52.7	50.3	1.29	20	46.7	50.4	48.2	0.95
Orbital diameter	15.5	19	12.1	18.1	16.0	1.24	20	15.1	17.5	16.1	0.64
Interorbital width	45.2	19	38.5	46.7	42.6	2.46	20	40.6	44.7	42.4	1.26
Head depth	50.7	19	44.8	53.3	48.9	2.51	20	47.6	54.0	50.9	1.78
Suborbital depth	20.6	19	16.7	23.5	20.0	1.64	20	18.1	22.9	20.4	1.25
Mandibular ramus	8.5	19	7.0	9.3	7.9	0.65	20	7.5	9.8	8.6	0.62
Meristics											
Left premaxillary teeth	16	19	11	17	14,1	1,89	19	11	16	14.3	1.25
Right premaxillary teeth	15	19	12	16	14,3	1,75	20	12	17	14.6	1.19
Left dentary teeth	15	19	11	16	12,9	1,96	20	9	13	11.7	1.18
Right dentary teeth	13	18	11	15	12,6	1,51	20	10	13	12.1	0.85
Left lateral scutes	25	19	22	23	22.9	0.35	20	25	26	25.5	0.51
Right lateral scutes	25	19	22	24	23.1	0.64	20	25	26	25.4	0.49

Table 7. Morphometrics and meristics of *Hisonotus* sp. "Carreiro". SD = Standard deviation, n = number of specimens, H = holotype.

	types					
	H	n	Low	High	Mean	SD
Standard length (mm)	35.4	17	26.7	35.8	31.4	
Percents of Standard Length						
Head length	36.0	17	34.8	37.7	36.1	0.83
Predorsal length	47.6	17	43.9	50.0	46.8	1.49
Dorsal-fin spine length	26.9	17	24.3	29.0	26.6	1.47
Anal-fin unbranched ray length	18.9	16	17.7	21.7	19.3	1.06
Pectoral-fin spine length	28.7	17	24.7	29.0	26.7	1.20
Pelvic-fin unbranched ray length	17.3	17	16.6	21.5	18.4	1.47
Cleithral width	26.4	17	23.5	26.5	24.9	0.86
Thoracic length	18.7	17	16.6	19.7	18.0	0.89
Abdominal length	19.9	17	18.1	20.8	19.7	0.75
Body depth at dorsal-fin origin	22.9	17	19.7	22.9	20.7	0.91
Caudal-peduncle length	31.4	17	30.9	34.6	32.6	1.17
Caudal-peduncle length	12.7	17	11.4	13.2	12.5	0.51
Percents of Head Length						
Snout length	49.9	17	45.6	51.0	48.1	1.82
Orbital diameter	16.7	17	15.6	18.7	17.3	0.87
Interorbital width	41.1	17	37.2	42.5	40.0	1.65
Head depth	57.1	17	49.3	57.1	52.5	2.59
Suborbital depth	21.5	17	18.7	22.2	20.4	1.17
Mandibular ramus	8.3	17	7.1	9.6	8.6	0.77
Meristics						
Left premaxillary teeth	14	16	11	16	13.3	1.29
Right premaxillary teeth	-	16	11	15	12.8	1.34
Left dentary teeth	12	17	10	16	12.4	1.46
Rigth dentary teeth	13	17	10	14	11.9	1.20
Left lateral scutes	24	17	22	24	22.8	0.73
Rigth lateral scutes	24	17	22	24	22.9	0.56

Table 8. Morphometrics and meristics of *Hisonotus* "Prata". SD = Standard deviation, n = number of specimens, H = holotype.

	types					
	H	n	Low	High	Mean	SD
Standard length (mm)	31.8	16	24.6	33.2	29.3	
Percents of Standard Length						
Head length	37.2	16	36.4	38.6	37.3	0.72
Predorsal length	48.2	16	45.1	49.1	46.9	1.21
Dorsal-fin spine length	22.6	15	22.6	25.5	24.5	0.87
Anal-fin unbranched ray length	18.0	16	17.1	19.4	18.3	0.65
Pectoral-fin spine length	24.3	16	22.0	25.6	24.0	1.01
Pelvic-fin unbranched ray length	16.3	16	15.7	21.3	18.5	1.78
Cleithral width	25.9	16	24.3	27.9	25.9	0.91
Thoracic length	19.2	16	16.2	19.4	17.9	0.91
Abdominal length	20.3	16	18.5	23.8	20.1	1.36
Body depth at dorsal-fin origin	22.7	16	20.4	23.0	21.5	0.81
Caudal-peduncle length	32.3	16	30.2	34.5	32.4	1.33
Caudal-peduncle depth	12.5	16	11.8	13.4	12.4	0.39
Percents of Head Length						
Snout length	46.6	16	45.1	49.5	47.4	1.37
Orbital diameter	15.1	16	15.1	17.9	16.6	0.88
Interorbital width	36.8	16	36.8	40.6	38.7	1.28
Head depth	56.4	16	51.5	57.7	54.5	1.74
Suborbital depth	23.4	16	20.3	23.6	22.2	1.11
Mandibular ramus	8.9	16	8.2	10.3	9.2	0.72
Meristics						
Left premaxillary teeth	13	16	12	16	14.0	1.03
Right premaxillary teeth	12	16	12	15	13.6	0.89
Left dentary teeth	13	16	11	14	12.9	0.81
Rigth dentary teeth	13	16	12	15	13.1	0.89
Left lateral scutes	23	16	22	24	22.9	0.57
Rigth lateral scutes	23	16	22	24	22.9	0.68

2174 **Table 9.** Morphometrics and meristics of *Hisonotus* sp. “Sinos”. SD = standard deviation, n =

2175 number of specimens, and H = holotype.

	types						non-types				
	H	n	Low	High	Mean	SD	n	Low	High	Mean	SD
Standard length (mm)	38.2	28	29.0	42.0	34.5	-	39	27.1	44.3	37.0	-
Percents of Standard Length											
Head length	33.8	28	32.2	35.7	33.9	0.91	39	32.1	38.4	34.5	1.49
Predorsal Length	45.8	28	42.7	47.7	45.0	1.18	39	43.0	48.9	45.9	1.25
Dorsal-fin spine length	28.3	27	23.6	29.8	27.5	1.35	39	21.8	28.4	25.3	1.63
Anal-fin unbranched ray length	18.4	28	15.5	20.9	18.7	1.19	39	16.4	20.4	18.1	0.87
Pectoral-fin spine length	28.5	28	25.4	29.3	27.2	1.06	39	23.4	29.3	26.4	1.42
Pelvic-fin unbranched ray length	16.6	28	13.8	21.3	17.7	1.97	39	13.9	22.3	17.0	1.85
Cleithral width	23.8	28	21.8	25.4	23.5	0.73	39	22.2	25.8	24.0	0.95
Thoracic length	17.4	28	15.8	18.7	17.4	0.63	39	15.6	19.8	17.6	0.74
Abdominal length	18.8	28	17.7	20.6	19.1	0.64	39	17.1	20.8	19.2	0.86
Body depth at dorsal-fin origin	21.9	28	18.0	22.0	20.6	0.82	39	18.9	22.9	20.6	0.82
Caudal-peduncle length	32.5	28	30.5	35.2	33.5	1.22	39	30.6	37.6	33.7	1.51
Caudal-peduncle depth	14.0	28	12.8	14.5	13.7	0.48	39	11.8	15.2	13.1	0.81
Percents of Head Length											
Snout Length	49.6	28	47.7	52.3	49.4	1.18	39	45.9	50.2	48.3	1.16
Orbital diameter	17.0	28	15.8	19.7	17.6	0.96	39	15.7	20.0	17.3	0.99
Interorbital width	42.5	28	38.8	45.7	42.6	1.51	39	38.3	47.1	42.0	2.27
Head depth	57.2	28	51.8	58.9	54.9	2.16	39	49.4	59.0	54.0	2.12
Suborbital depth	20.9	28	17.6	21.3	19.7	0.99	39	17.4	22.7	20.0	1.30
Mandibular ramus	8.6	28	7.0	10.5	8.8	0.87	39	7.3	10.1	8.8	0.67
Meristics											
Left premaxillary teeth	18	28	13	20	16.0	1.88	38	11	20	15.7	2.20
Right premaxillary teeth	18	28	13	19	15.9	1.81	37	11	20	15.5	2.29
Left dentary teeth	18	28	13	19	15.1	1.82	38	11	18	14.1	2.12
Rigth dentary teeth	16	28	12	19	14.8	1.85	37	10	18	14.2	2.07
Left lateral scutes	23	28	23	24	23.4	0.50	39	22	24	23.4	0.68
Rigth lateral scutes	23	28	22	24	23.3	0.66	39	22	24	23.4	0.54

Table 10. Morphometrics and meristics of *Hisonotus* sp. "Passo Novo". SD = Standard deviation, n = number of specimens, H = holotype.

	Types					
	H	n	Low	High	Mean	SD
Standard length (mm)	41.5	20	31.8	41.5	35.9	
Percent of Standard Length						
Head length	35.3	20	32.9	37.9	35.6	1.22
Predorsal length	48.5	20	45.2	49.3	47.4	1.22
Dorsal-fin spine length	23.8	20	22.6	25.4	23.8	0.79
Anal-fin spine length	17.2	20	14.9	17.2	16.3	0.72
Pectoral-fin spine length	25.8	20	24.4	26.8	25.4	0.62
Pelvic-fin spine length	15.8	20	15.2	19.0	17.1	1.07
Cleithral width	25.5	20	23.4	26.2	24.8	0.69
Thoracic length	16.4	20	15.9	18.4	17.4	0.61
Abdominal length	20.1	20	18.2	20.4	19.6	0.67
Body depth at dorsal-fin origin	20.9	20	19.4	21.6	20.4	0.60
Caudal-peduncle length	32.9	20	30.3	34.9	33.0	1.37
Caudal-peduncle length	11.8	20	11.0	13.4	12.0	0.58
Percent of Head Length						
Snout Length	47.9	20	47.8	54.8	50.3	1.62
Orbital diameter	15.0	20	14.1	16.9	15.5	0.66
Interorbital width	42.4	20	40.1	45.8	42.8	1.48
Head depth	53.4	20	48.9	54.9	51.6	1.46
Suborbital depth	20.3	20	19.1	24.0	21.0	1.07
Mandibular ramus	9.1	20	7.2	9.5	8.5	0.65
Meristics						
Left premaxillary teeth	19	20	15	21	17.9	1.35
Right premaxillary teeth	18	20	16	20	17.8	1.36
Left dentary teeth	17	20	14	19	16.0	1.56
Rigth dentary teeth	15	20	13	20	16.0	1.59
Left lateral scutes	23	20	22	24	22.9	0.55
Rigth lateral scutes	23	20	22	23	22.7	0.49

Table 11. Morphometrics and meristics of *Hisonotus* sp. "Felício". SD = Standard deviation, n = number of specimens, H = holotype.

	Types					
	H	n	Low	High	Mean	SD
Standard length (mm)	43.0	12	37.5	44.3	40.2	-
Percent of Standard Length						
Head length	33.0	12	32.1	35.7	33.6	1.01
Predorsal length	44.6	12	43.0	47.1	45.3	1.19
Dorsal-fin spine length	24.0	12	21.8	24.9	23.5	0.92
Anal-fin spine length	17.6	12	16.5	19.2	17.7	0.66
Pectoral-fin spine length	25.1	12	23.4	26.4	24.8	0.84
Pelvic-fin spine length	16.0	12	14.4	22.3	17.2	2.02
Cleithral width	23.3	12	22.2	24.7	23.2	0.76
Thoracic length	17.0	12	17.0	18.5	17.6	0.52
Abdominal length	19.2	12	17.9	20.6	19.3	0.80
Body depth at dorsal-fin origin	20.7	12	18.9	21.6	20.5	0.67
Caudal-peduncle length	35.7	12	32.3	36.2	34.5	1.12
Caudal-peduncle depth	12.0	12	11.8	13.5	12.6	0.60
Percent of Head Length						
Snout Length	48.6	12	46.1	49.5	48.1	1.05
Orbital diameter	16.2	12	16.2	18.9	17.2	0.86
Interorbital width	42.8	12	39.9	47.1	43.8	2.22
Head depth	55.1	12	51.9	55.8	53.5	1.39
Suborbital depth	19.4	12	18.4	22.2	20.2	1.17
Mandibular ramus	8.9	12	8.1	9.7	8.8	0.51
Meristics						
Left premaxillary teeth	17	12	16	20	17.6	1.16
Right premaxillary teeth	17	12	15	20	17.6	1.31
Left dentary teeth	15	12	13	18	15.8	1.48
Rigth dentary teeth	17	12	14	18	15.9	1.08
Left lateral scutes	24	12	23	24	23.9	0.29
Rigth lateral scutes	24	12	23	24	23.8	0.39

Capítulo III

The species of *Hisonotus* (Siluriformes: Loricariidae: Hypoptopomatinae) of the rio Uruguai basin, southeastern South America

The species of *Hisonotus* (Siluriformes: Loricariidae: Hypoptopomatinae) of the rio Uruguai basin, southeastern South America

Abstract

The species of *Hisonotus* from the rio Uruguai basin are reviewed. Four new species are described from the upper course of rio Uruguai basin in Brazil: *Hisonotus* sp. "Canoas" from the rio Canoas drainage; *Hisonotus* sp. "Ariranhas" from rios Rancho Grande and Ariranhas; *Hisonotus* sp. "Passo Fundo", from rio Passo Fundo drainage; and *Hisonotus* sp. "Chapecó" from rio Chapecó. The species *Epactionotus aky*, described from arroyo Yabotí-Guazú drainage in Argentina, is transferred to the genus *Hisonotus* and rediagnosed. *Hisonotus candombe* is considered a junior synonym of *H. ringueleti.* The new taxa, together with *H. nigricauda*, *H. ringueleti*, and *H. charrua* constitute the genus in the rio Uruguai basin. The species are illustrated, and a taxonomic key for *Hisonotus* in the rio Uruguay basin and laguna dos Patos system is provided. Their distributions are mapped and discussed under biogeographic patterns previously proposed for the rio Uruguai basin.

Resumo

As espécies de *Hisonotus* da bacia do rio Uruguai são revisadas. Quatro novas espécies são descritas do alto curso do rio Uruguai no Brasil: *Hisonotus* sp. "Canoas" da drenagem do rio Canoas; *Hisonotus* sp. "Ariranhas" dos rios Rancho Grande e Ariranhas; *Hisonotus* sp. "Passo Fundo" da drenagem do rio "Passo Fundo"; e *Hisonotus* sp. "Chapecó" do rio Chapecó. A espécie *Epactionotus* aky, descrita para a drenagem do arroyo Yabotí-Guazú na Argentina, é trasferida para o gênero *Hisonotus*. *Hisonotus candombe* é considerado sinônimo junior de *H. ringueleti*. Os novos taxóns, junto com *H. nigricauda*, *H. ringueleti* e *H. charrua* constituem o gênero *Hisonotus* na

bacia do rio Uruguai. As espécies são ilustradas, e uma chave de indentificação para as espécies da bacia do rio Uruguai e do sistema da laguna dos Patos é fornecida. As distribuições dos *Hisonotus* são mapeadas e discutidas dentro dos padrões biogeográficos previamente propostos para a bacia do rio Uruguai.

Introduction

The rio Uruguai (called Río Uruguay in Argentina and Uruguay) is the smallest of the three major Río de la Plata tributaries. The river extends over 1838 km, with a drainage area of about 365,000 km² (Di Persia & Neiff, 1986), rising in the Serra Geral formation of southern Brazil, and flowing into the Río de la Plata estuary between Uruguay and Argentina. Its main tributaries are the Río Negro in Uruguay, rio Quaraí (Río Cuareim) in the border between Brazil and Uruguay and the rios Ibicuí and Ijuí in Brazil. The distributional patterns of the ichtyofauna in the rio Uruguai basin were previously discussed by Lucena & Kullander, 1992, Winberger et al., 1998, Aquino et al., 2001, Miquelarena & Lopez, 2004, and Rican & Kullander, 2006. These studies agreed that the rio Uruguai presents endemic ichthyofaunal components, mostly in its upper portions. Lucena & Kullander, (1992: 157), suggested five general distributional patterns of fishes in the rio Uruguai basin based on the distribution of several taxa, in which almost all species from that basin could be included. According to Miquelarena & López (2004), the basin can be divided in three portions by its geographical and ichthyofaunal attributes. The upper rio Uruguai presents a high degree of endemism of its species. Contrasting, the middle and lower courses have a low degree of endemism.

Hisonotus together with *Otocinclus flexilis* Cope, 1894 *Eurycheilichthys pantherinus* Reis & Schaefer, 1992 and *Epactionotus aky* Azpelicueta, Casciotta, Almirón & Körber, 2004 are the known representatives of Hypoptopomatinae from the rio Uruguai basin. Until recently, studies on

the genus *Hisonotus* were almost absent for that region, and the first species of *Hisonotus* from the rio Uruguai basin was described in 2001, *Hisonotus ringueleti* Aquino, Schaefer & Miquelarena, 2001. Previous to the description of *H. ringueleti* the study of *Hisonotus* in the rio Uruguai basin was limited to the distributional data of *H. maculipinnis* provided by Aquino (1997), in the redescription of that species. Despite its brief history, the number of papers on Hypoptopomatinae from the rio Uruguay basin have greatly increased, and several species have been described since then (Azpelicueta et al., 2004, Almiron et al., 2006, and Casciotta et al., 2006).

In this work I review the taxonomic composition of *Hisonotus* from the rio Uruguai basin, and describe four new species. Besides that, the generic allocation of *Epactionotus aky* is questioned, and therefore included in the genus *Hisonotus*. At last, the implications of the species distribution in the biogeographic context of the rio Uruguai basin are discussed. This work is part of my Master in Sciences thesis at the Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS), entitled taxonomic review of the species of *Hisonotus* (Siluriformes: Loricariidae) from the rio Uruguay basin and the laguna dos Patos system.

Material and Methods

Geography. In this review, the rio Uruguai basin (Fig. 1) is divide in three portions (upper, middle and lower). The upper course is situated upstream to the remarkable Saltos de Yucumã (saltos del Moconá) a 10-meters high, longitudinal waterfall situate above the mouth of arroyo Yaboty-Guazú. The middle and lower courses are situated downstream to Saltos de Yucumã and separated from each other by Salto Grande, site of the homonymous hydroeletric dam. The portion downstream from Salto Grande to the mouth at Río de La Plata estuary is named lower rio Uruguai basin. Names of geographic localities, except country, are given in the language of the country of

origin to avoid transferal of English style onto South American place names, following Schaefer (1997). English names are used for countries. In making reference to rivers spanning or bordering more than one geopolitical (and language) unit, I use the Portuguese spelling (e.g. rio Uruguai, rio Negro, rio Quaraí).

Collections. The specimens examined are deposited in the following institutions (abbreviations in parentheses), listed in alphabetic order of the abbreviations: Asociación Ictiológica, La Plata (AI) Academy of Natural Sciences, Philadelphia (ANSP) Natural History Museum, London (BMNH) Coleção Ictiológica Morevy Cheffe, Pelotas (CIMF) Instituto de Limnología "Dr. Raúl A. Ringuelet", La Plata (ILPLA) Museo Argentino de Ciências Naturales Bernadino Rivadavia, Buenos Aires, (MACN-ict) Museu Anchieta, Porto Alegre (MAPA) Fundação Zoobotânica do Rio Grande do Sul/Museu de Ciências Naturais, Porto Alegre (MCN) Museu de Ciências e tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre (MCP) Muséum d'Histoire Naturelle, Geneve (MHNG) Museo de La Plata, La Plata (MLP) Museu Nacional, Rio de Janeiro (MNRJ) Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP) Natuhistorisches Museum, Wien (NMW) Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicültura, Maringá (NUP) Universidade Federal do Rio Grande do Sul, Porto Alegre (UFRGS) Zoologisches Sammlung des Bayerischen Staates, Munique (ZSM) Faculdade de Ciências Universidad de La República, Montevideo (ZVC-P).

Morphology. Measurements were made to the nearest 0.1 mm with digital calipers under a stereomicroscope on the left side of specimens. The measurements and its abbreviations follow those presented in chapter II. 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). Plate counts and nomenclature follow the schemes of serial homology proposed by Schaefer (1997). Vertebral counts included all vertebrae (including the first five vertebrae incorporated into the Weberian

apparatus), with the compound caudal centrum (PU1+U1) counted as one element. Cleared and stained specimens (c&s) were prepared according to the method of Taylor & Van Dyke (1985). Whenever available, juvenile specimens were cleared and stained. Juvenile designation was used for specimens not totally covered by plates with an anterior paired crest of odontodes on the parieto-supraoccipital and for males without a fleshy flap on the first thickened pelvic-fin ray, adults presenting the opposite states. Scanning electron microscope pictures were taken from dissected alcohol preserved specimens. Drawings were prepared using a Zeiss SV8 stereomicroscope with camera lucida.

Results

Hisonotus nigricauda (Boulenger, 1891).

(Figure 2, Table 1)

Otocinclus nigricauda Boulenger, 1891: 234 [original description, type locality: Rio Grande do Sul, Brazil].-Regan, 1904:268-269 [redescription, senior synonym of *Hisonotus laevior* and *Hisonotus leptochilus*].-Isbruecker, 1980:84 [listed].-Schaefer, 1991:23 [Phylogenetic relantionships of Hypoptopomatinae]

Hisonotus nigricauda.-Cope, 1894:97 [compared with *Hisonotus laevior* and *Hisonotus leptochilus* and new generic combination].-Schaefer, 1998:383 [transferred to *Hisonotus*].-Schaefer, 2003:232 [listed].-Reis & Carvalho, 2007:84 [listed].-Ferraris, 2007:248 [listed].

Microlepidogaster nigricauda.-Eigenmann, 1910:413 [listed].-Gosline, 1945: 101 [listed].-Fowler, 1959:166-167 [listed and illustrated].-Schaefer, 1997:8 [listed].-Malabarba, 1989:150 [type-locality restricted to laguna dos Patos system, probably rio Camaquã].

Material examined. From laguna dos Patos system, Rio Grande do Sul, Brazil: BMNH 91.3.16.53-62, syntypes of *Otocinclus nigricauda*, 9, 24.8-31.8 mm SL, Rio Grande do Sul, Brazil. **Rio Jacuí drainage:** ANSP 21565, 2, 21.3-22.4, rio Jacuí. MCN 16246, 10, 23.7-34.1 mm SL, Porto Alegre, Parque Estadual Delta do Jacuí, Saco da Pólvora, 30°01'S 51°14'W. MCP 19834, 12, 25.6-40.2 mm SL, Amarópolis, creek tributary of rio Jacuí in sylviculture Santo Amaro, 29°55'S 51°55'W. MCP 20543, 1, 31.1 mm SL, Porto Alegre, rio Jacuí on Saco da Alemoa, 30°00'00"S 51°14'51"W. **Rio Vacacaí drainage:** MCP 19584, 33 + 3 c&s, 22.7-39.1 mm SL, São Gabriel, bridge on road between São Gabriel and Tiaraju, 30°17'29"S 54°20'18"W. MCP 26756, 5, 24.2-29.5 mm SL, São Gabriel, marsh of arroio Piraí, 30°17'07"S 54°20'33"W. **Lago Guaíba drainage:** MAPA 1737, 1, 26.7, Gravataí, arroio Passo dos Ferreiros tributary of rio Gravataí, 29°56'S 50°58'W. MCN 17416, 10, 22.0-32.3 mm SL, Tapes, arroio Guará tributary of arroio Araçá on road between Barra do Ribeiro and Tapes, 30°29'14"S 51°23'39"W. MCN 18048, 12, 17.8-34.8 mm SL, Tapes, arroio Guará tributary of arroio Araçá on road between Barra do Ribeiro and Tapes, 30°29'14"S 51°23'39"W. MCP 13781, 1, 28.4 mm SL, Eldorado do Sul, creek at highway BR-290, about 2 km from highway BR-116, 30°03'S 51°23'W. MCP 13949, 10, 22.3-31.8 mm SL, Eldorado do Sul, creek at highway BR-290, about 2 km from highway BR-116, 30°03'S 51°23'W. MCP 15059, 3, 29.4-30.6 mm SL, Gravataí, marsh at highway RS-118, about 500 meters from highway BR-290, 29°58'S 50°56'W. MCP 15766, 3, 27.1-30.1 mm SL, Eldorado do Sul, creek at highway BR-290, about 2 km from highway BR-116, 30°03'W 51°21'S. MCP 21165, 4, 26.8-29.5 mm SL, Eldorado do Sul, creek at margins of highway BR-290, 30°02'36"S 51°20'56"W. MCP 28589, 8, 23.1-32.3 mm SL, Eldorado do Sul, creek at highway BR-290, about 2 km from highway BR-116, 30°03'W 51°21'S. MCP 28986, 11, 24.7-34.3 mm SL, Eldorado do Sul, arroio Passo dos Carros, 30°05'S 51°23'W. UFRGS 2361, 25, 21.1-32.4 mm SL, Eldorado do Sul, arroio Passo dos Carros, 30°05'S 51°23'W. **Laguna dos Patos:** MCP 17677, 6, 19.8-24.7 mm SL, Pelotas, old drainage

channel near to Passo do Tabajara, marsh of Pontal da Barra in Laranjal, 31°47'S 52°14'W. MCP 23855, 33, 23.1-34.1 mm SL, Sentinela do Sul, arroio Velhaco on road between Cerro Grande do Sul and Camaquã, 30°41'22"S 51°41'51"W. MCP 23858, 4, 27.2-28.9 mm SL, Sentinela do Sul, arroio do Tigre tributary of arroio Velhaco on road from Cerro Grande do Sul to Camaquã, 30°44'30"S 51°46'26"W. **Rio Camaquã drainage**: MCP 17416, 20 + 3 c&s 25.5-39.1 mm SL, Camaquã, marsh at rio Camaquã in Pacheca, 31°08'S 51°47'W. MCP 19701, 1, 27.2 mm SL, Encruzilhada do Sul, arroio Passo da Miséria on road between Encruzilhada do Sul and Canguçu, 30°57'S 52°26'. MCP 25881, 51, 15.8-36.7 mm SL, Caçapava do Sul, creek tributary of arroio Seival on road between Lavras do Sul and Capaçava do Sul, 30°44'00"S 53°42'04"W. MCP 25875, 1, 34.2 mm SL, Caçapava do Sul, small creek tributary to arroio Hilário on road between Caçapava do Sul and Lavras do Sul, 30°44'24"S 53°44'51"W. MCP 40761, 10 + 3 c&s, 31.0-38.2 mm SL, Bagé, arroio Banhado Grande on highway BR-153 between Bagé and Caçapava do Sul, 31°14'34"S 053°52'50"W. **São Gonçalo drainage**: MCP 17415, 32, 27.7-34.9 mm SL, Pelotas, dead channel of rio Pelotas, marginal of highway BR-116 in Retiro, 31°37'S 52°20'W. MCP 17577, 4, 25.1-31.6 mm SL, Pelotas, arroio Totó on road to colonia Z-3, 31°46'S 52°20'W. **Laguna Mirim drainage:** MCP 11134, 2, 28.2-35.0 mm SL, Arroio Grande, arroio Xasqueiro on highway BR-116 between Pelotas and Arroio Grande, 32°09' S 53°02 W. From rio Uruguai basin: **rio Ibicuí drainage:** MCP 9270, 17.0-29.7 mm SL, Brazil, Mata, Creek on road Between Santa Maria and Mata, 29°33'S 54°27'W. MCP 9386, 10, 14.5-24.3 mm SL, Brazil, Cacequi, rio Ibicuí on the bridge between São Rafael and Cacequi, 29°50'S 54°47'W. MCP 9473, 9, 20.3-32.5 mm SL, Brazil, São Vicente do Sul, arroio do Salso, road from São Vicente do Sul to Santiago, 29°34'S 54°42'W. MCP 9643, 33, 22.1-34.1 mm SL, Brazil, Dom Pedrito, rio Santa Maria at km 246 of highway BR-293 between Dom Pedrito and Santana do Livramento, 30°59'S 54°42'W. MCP 14145, 1, 24.5 mm SL, Brazil, Rosário do Sul, creek on road between Rosário do Sul and Santana do Livramento, 30°18'45"S

54°59’49”W. MCP 14166, 1, 34.1 mm SL, Brazil, Rosário do Sul, arroio Santo Antonio on road between Rosário do Sul and Santana do Livramento, 29°50’S 54°47’W. MCP 14214, 1, 33.2 mm SL, Brazil, Santana do Livramento, pools at side of rio Santa Maria on road between Dom Pedrito and Santana do Livramento, 30°59’S 54°42’W. MCP 15831, 1, 25.6 mm SL, Brazil, Dom Pedrito, rio Santa Maria at km 246 of highway BR-293, between Dom Pedrito and Santana do Livramento, 30°59’S 54°42’W. MCP 16161, 2, 15.5-28.9 mm SL, Brazil, Santana do Livramento, lateral pools on road to Campo Seco, 15 km east from highway BR-158, 30°42’S 55°04’W. MCP 19593, 22.3-33.5 mm SL, Brazil, São Gabriel, bridge over banhado do Inhatium, highway BR-290, 30°15’43”S 54°31’33”W. MCP 23149, 11, 26.0-31.4 mm SL, Brazil, São Francisco de Assis, rio Inhacunda at São Francisco de Assis on road to Manuel Viana, 29°32’51”S 55°08’11”W. MCP 25249, 1, 33.6 mm SL, Brazil, São Francisco de Assis, rio Inhacunda at São Francisco de Assis about 500 meters from pottery, 29°32’27”S 55°07’45”W. MCP 25250, 4, 27.4-32.3 mm SL, Brazil, São Francisco de Assis, rio Inhacunda at São Francisco de Assis on road to Manuel Viana, 29°32’51”S 55°08’11”W. MCP 25251, 15, 29.1-34.9 mm SL, Brazil, São Francisco de Assis, creek affluent to rio Inhacunda at São Francisco de Assis about 300 meters from pottery, 29°32’27”S 55°07’45”W. MCP 26865, 88 + 3 c&s, 22.7-38.5 mm SL, Brazil, Rosário do Sul, arroio do Salso on the highway BR-158, affluent of rio Ibicuí da Armada, 30°22’27”S 55°02’07”W. MCP 27608, 14, 16.2-35.9 mm SL, Brazil, São Francisco de Assis, arroio Caraí-Passo on road from São Francisco de Assis to Manuel Viana, 29°31’03”S 55°10’49”W. UFRGS 8241, 23, 23.7-34.5 mm SL, Brazil, Rosário do Sul, creek at the margin of highway BR-290, 10 km from Rosário do Sul, 30°12’S 55°03’W. **Río Negro drainage:** MCP 10000, 34, 15.4-30.1 mm SL, Uruguay, Cerro Largo, lagoon 10 m from Río Negro at Arreria, 31°50’S 54°28’W. UFRGS 7183, 17, 29.2-32.5 mm SL, Uruguay, Durazno, arroyo Maestre de Campo on road to Polanco de Yi, tributary of Río Yí, 33°24’55”S 56°12’06”W. UFRGS 9243, 7, 29.3-35.5, Uruguay, Rivera, arroyo Batovi on ruta 27 at km 24, tributary to Río Tacuarembó.

UFRGS 9241, Uruguay, Rivera, 1, 37.3 mm SL, arroyo Cunãpiru on km 12 of ruta 27, tributary to Río Tacuarémbo, 31°02'21"W 55°29'31"S. UFRGS 9243, 5 + 1 c&s, 30.2-36.5 mm SL, Uruguay, Rivera, lateral pools and arroyo Corrales on ruta 27, tributary of río Tacuarembó, 31°23'26"S 55°15'14"W. **Other drainages and rio Uruguai:** ILPLA, 9, 238, 18.5-25.8 mm SL, Argentina, Corrientes, arroyo Cuay Grande, 28°41'S 56°14'W. MAPA 2493, 15, 23.6-33.6 mm SL, Brazil, Barra do Quaraí, arroio Quaraí-Chico, 30°12'S 57°31'W. MCP 11568, 4, 23.2-29.1 mm SL, Brazil, Uruguaiana, rio Touro Passo, 29°38'S 56°56'W. MCP 16190, 2, 24.4-26.2 mm SL, Brazil, São Marcos, marginal lagoon of rio Uruguai at praia da Formosa, 29°30'S 56°49'W. MCN 16592, 6, 18.7-33.7 mm SL, Brazil, Itaqui, pool at side of highway BR-472, Reserva Biológica Estadual de São Donato, 29°00'S 56°10'W. MCN 16639, 1, 28.9 mm SL, Brazil, Maçambará, marsh drainage canal at Reserva Biológica Estadual de São Donato, 29°00'S 56°10'W. MCN 16759, 7, 18.7-33.7 mm SL, Brazil, Itaqui, creek on highway BR-472 between Itaqui and São Borja, Reserva Biológica Estadual de São Donato, 29°00'S 56°10'W. MCN 16887, 5, 17.4-23.4 mm SL, MCN 16951, 29, 15.0-31.3 mm SL, Brazil, Itaqui, creek on highway BR-472 bteween Itaqui and São Borja, Reserva Biológica Estadual de São Donato, 29°00'S 56°10'W. MCP 16964, 5, 16.1-33.9 mm SL, Brazil, Itaqui, Reserva Biológica Estadual de São Donato, 29°00'S 56°10'W.

Diagnosis. *Hisonotus nigricauda* differs from its congeners, except *Hisonotus maculipinnis*, *Hisonotus* sp. "Chapecó", and *Hisonotus* sp. "Prata", by lacking the posterior portion of the lateral line vs. posterior portion of lateral line present. Differs from *H. maculipinnis*, *H.* sp. "Chapecó", and *H.* sp. "Prata" by having an almost completely dark caudal fin, without hyaline areas in the middle portion, vs. caudal fin presenting hyaline areas in the middle portion.

Description. This species was redescribed in chapter II and will not be repetead here.

Distribution and habitat. *Hisonotus nigricauda* is widely distributed in the laguna dos Patos system and in the rio Uruguai basin. In the laguna dos Patos system the species is found

mostly in the lower portions of the drainages near the laguna do Patos, being absent in the upper portions of rio Jacuí basin. In the same manner, *H. nigricauda* is most commonly collected in the lower portions of the rio Uruguai basin, but is found in the headwaters of rio Negro, rio Quaraí, and rio Ibicuí drainages (Fig. 3). *Hisonotus nigricauda* is absent in the rio Ijuí drainage, and apparently not found upstream the mouth of rio Ijuí in the middle rio Uruguai basin. This species inhabits slow flowing watercourses, of brown waters running over dark organic matter and sandy bottom. The individuals were found in between marginal and aquatic vegetation.

***Hisonotus ringueleti* Aquino, Schaefer & Miquelarena, 2001**

(Figures 4-6, Table 2)

Hisonotus ringueleti Aquino, Schaefer & Miquelarena, 2001:1-12, (type locality: Uruguay, Rivera, creek at km 18 of route joining Santana do Livramento, Brazil, and Rivera, Uruguay, tributary to rio Quaraí drainage.

Hisonotus candombe Casciotta, Azpelicueta, Almirón & Litz, 2006:147-152, (type locality: Uruguay, Departamento Salto, río Uruguay basin, arroyo Palomas – New synonym).

Material examined. All from rio Uruguai basin: **Rio Quaraí drainage:** ILPLA 886, holotype, 35.4 mm SL, Uruguay, Rivera, creek at km 18 of route joining Santana do Livramento, Brazil, and Riveira, Uruguay, close to border, tributary to rio Quaraí drainage (ca. 31°00' S 55°30'W). ILPLA 883, paratypes, 95, 24.2-35.4 mm SL□ANSP 177878, paratypes, 3 + 1 c&s, 22.8-31.3 mm SL□MCP 26154, paratypes, 3 + 1 c&s, 22.6-32.1 mm SL□and MLP 9536, 4, 27.2-34.1 mm SL□collected with the holotype. AI 187, paratypes of *H. candombe*, 3, 23.6-29.2 mm SL, Uruguay, Artigas, arroyo Catalán Grande, 30°50'35"S 56°14'30"W. MCP 11215, 128 + 4 c&s 13.5-38.4 mm SL, Brazil, Quaraí, arroio Quaraí-Mirim on road between Quaraí and Alegrete,

30°18’S 56°19’W. MCP 35239, 1, 39.4 mm SL, Brazil, Quaraí, arroio Quaraí-Mirim on road from Quaraí to Baltazar Brum train station about 20 km northeast from Quaraí, 30°14’38”S 56°18’23”W. UFRGS 4208, 1, 31.9 mm SL, Brazil, Uruguaiana, sanga Mergulhão tributary of arroio Garupá on highway BR-290. UFRGS 7763, 3, 19.7-38.3 mm SL, Uruguay, Artigas, arroyo Cuaró Grande on ruta 4, 30°46’57”S 56°46’47”W. **Rio Ibicuí drainage:** MCN 11383, 2, 35.5-37.7 mm SL, Brazil, Alegrete, sanga do Lagoão about 20 km south of Alegrete, tributary of arroio Pai-Passo, tributary of rio Ibirapuitã, MCP 11373, 3, 13.6-18.8 mm SL, Brazil, Quaraí, arroio Pai-Passo on highway RS-185 between Alegrete and Santana do Livramento, 30°13’S 56°02’W. MCP 27659, 1, 36.8 mm SL, Brazil, Tupaciretã, rio Santana near to locality of Jari, tributary to rio Jaguari, 29°14’33”S 54°16’47”W. **Río Arapey Grande drainage:** ZVC-P 5595, holotype of *Hisonotus candombe*, 28.7 mm SL, Uruguay, Salto, Arroyo Palomas, 31°04’43S 57°37’26”W. ZSM 32062, paratype of *H. candombe*, 1, 25.9 mm SL AI 164, paratype of *H. candombe*, 25.5 mm SL and MHNG 2662.86, paratype of *H. candombe*, 1, 26.3 mm SL, collected with the holotype. UFRGS 8029, 1, 26.3 mm SL, Uruguay, Salto, creek tributary to Río Arapey Grande on ruta 4. **Other drainages of Río Uruguay:** UFRGS 7976, 3, 32.3-40.8 mm SL, Uruguay, Artigas, arroyo Guaviyú on ruta 3, 30°38’S 57°41’W. UFRGS 8064, 3, 29.9-43.4 mm SL, Uruguay, Artigas, arroyo Mandiyú on ruta 3, 30°51’S 57°39’W. UFRGS 8573, 3, 33.5-40.6 mm SL, Uruguay, Salto, arroyo del Tala on ruta 31 between Artigas and Salto, 31°23’S 57°33’W.

Diagnosis. *Hisonotus ringueleti* differs from its congeners, except *Hisonotus* sp.“Camaquã”, by the presence of serrae along the posterior margin of the pectoral-fin spine (serrae feeble or absent in larger specimens Fig. 7) vs. serrae absent, posterior margin smooth (juveniles of some species presenting serrae along the distal half of posterior margin of pectoral-fin spine). *Hisonotus ringueleti* differs from *Hisonotus* sp. “Camaquã” by having lower lateral plate count 22-24 (Tab. 3)

vs. 25-27 lateral plates by having three predorsal plates vs. four predorsal plates and by having round caudal peduncle in cross section vs. slightly square caudal peduncle in cross section.

Description. This species was recently described by Aquino et al. (2001) and will not be redescribed here.

Distribution and habitat. *Hisonotus ringueleti* is distributed in tributaries of the left margin of the middle rio Uruguai basin, from the southern Río Arapey Grande in Uruguay, to the northern rio Ibicuí drainage in Brazil (Fig. 8). This species inhabits small creeks of median to rapid flow watercourses. Collected in clear to brown waters of sandy and rocky bottom. Captured associated with marginal or aquatic submersed vegetation. *Hisonotus ringueleti* is collected together with *Hisonotus charrua* along its distribution.

Remarks on type-locality. *Hisonotus ringueleti* was described from a single locality on the Río Uruguay basin (Aquino et al., 2001). The type-locality is a creek tributary to the rio Quaraí at km 18 of route joining Santana do Livramento, Brazil and Rivera, Uruguay (ca. 31°00'S 55°30'W). However, the cities of Rivera and Santana do Livramento are separated by an avenue, without a route of 18 km between each other. These cities are surrounded by the headwaters of three large drainages, rio Negro, rio Quaraí, and rio Ibicuí, all tributaries to the rio Uruguai basin. The approximate coordinates (ca. 31°00' S 55°30'W) as well as all localities about 18 km from Rivera in Uruguay are situated in the río Negro drainage. However, *Hisonotus ringueleti* was not found in that drainage. The headwaters of rio Quaraí drainage, nearby Santana do Livramento/Rivera were located at the Brazilian territory or more distant, in the Departmento of Artigas in Uruguay, which seems the most probable type-locality of *Hisonotus ringueleti*.

Comments on synonym. Examination of the type-series of *Hisonotus candombe* (Fig. 7B) did not reaveal any consistent differences between the later and *Hisonotus ringueleti*. According to Casciotta et al. (2006, p.150) *H. candombe* differs from *H. ringueleti* in having larger pectoral spine

serrae distributed all along the posterior margin of the pectoral spine vs. serrae smaller and placed on distal two thirds of the spine. Besides that, *H. candombe* could be distinguished from *H. ringueleti* by having five branched anal-fin rays and males with a smaller flap on first pelvic-fin unbranched ray, whereas *H. ringueleti* presents four anal-fin rays and a well developed flap. A disapeareance of the pectoral-fin spine serrae in the ontogeny of specimens of *H. ringueleti* was observed. Smaller individuals of that species present strong serrations on the posterior portion of pectoral spine, decreasing in size with the development, being totally absent at about 35 mm SL (Fig. 7). A similar disapearence of serrae in adults occurs in *Hisonotus* sp. "Camaquã", and in several other congeners. Since specimens used in the description of *H. candombe* are relatively small (range size 22.8-30.0 mm in SL), compared to the range of the species (up to 43 mm) that difference seems to be due to degree of ontogenetic development. In the same manner, a smaller pelvic flap in males of *H. candombe* is related with the maturity of the individuals, and not useful to diagnose the species. Lastly, the anal-fin ray count is identical in both nominal species. The description of Aquino et al. (2001, tab.1) of four branched anal-fin rays for *H. ringueleti* seems to be an error, since from 30 paratypes examined only one specimen presented four branched anal-fin rays. Fin-ray counts do not vary considerably within or among species of *Hisonotus*, and are not useful to distinguish species. Therefore *H. candombe* is considered a junior synonym of *H. ringueleti*.

Hisonotus aky **(Azpelicueta, Casciotta, Almirón & Körber, 2004).**

(Figures 9-10, Table 4)

Epactionotus aky Azpelicueta, Casciotta, Almirón & Körber, 2004: 81-90, [original description, type locality: Arroyo Garibaldi, rio Uruguay basin at Missiones, Argentina].-Liotta, 2005:354 [listed].

311 *Hisonotus* sp. “Argentinien”. - Evers & Seidel, 2002 [listed and illustrated].

312 *Hisonotus aky*. -Reis & Carvalho, 2007 [misidentified with *H.* sp. “Chapecó” new species].

313 **Material examined**. All from rio Uruguay basin: AI 124, holotype of *Epactionotus aky*, 29.2
314 mm SL, Argentina, Missiones, arroyo Garibaldi, tributary of arroyo Yabotí-Guazú, 26°38’46”S
315 053°59’55”W. AI 125, paratypes of *E. aky*, 7, 25.0-34.5 mm SL, same collecting data as holotype.
316 MCP 41474, 36 + 3 c&s 18.2-39.7 mm SL, Brazil, Rio Grande do Sul, Paim Filho, rio Forquilha at
317 Espraiado bathing spot on secundary road from Maximiliano de Almeida to Paim Filho, 27°40’37”S
318 51°44’11”W.

319 **Diagnosis.** *Hisonotus aky* differs from its congeners, except from *Hisonotus ringueleti*,
320 *Hisonotus* sp. “Sinos”, *Hisonotus* sp. “Prata”, *Hisonotus* sp. “Canoas”, *Hisonotus* sp. “Passo
321 Fundo”, and *Hisonotus* sp. “Passo Novo” by the presence of a narrow odontode-free band in the
322 anterior portion of snout (Fig. 11) and by its general color pattern in life, which is greenish (Fig. 12)
323 vs. presence of a snout completely covered with odontodes, without an anterior odontode-free band,
324 and general color pattern in life yellowish to light brown, or light gray. *Hisonotus aky* differs from
325 species mentioned above by its relatively narrow odontode-free band in the anterior portion of the
326 snout contrasting with a wider odontode-free area. Further, *H. aky* differs from *H. ringueleti* by
327 having the posterior portion of the pectoral fin smooth, vs. posterior portion serrated. Differs from
328 *Hisonotus* sp. “Sinos”, *Hisonotus* sp. “Prata”, *Hisonotus* sp. “Passo Novo”, and *Hisonotus* sp.
329 “Passo Fundo” by the color pattern of the caudal fin, which is composed by dark vertical bars vs
330 color pattern composed by two hyaline blotches in upper and lower lobes or caudal fin almost
331 completely dark except for light areas on posterior portion of most dorsal and ventral rays.
332 *Hisonotus aky* differs from *Hisonotus* sp. “Canoas" by having narrow longitudinal light stripes on
333 the head vs. wider longitudinal light stripes markings in the head.

334 **Description.** This species was recently described by Azpelicueta et al. (2004) and will not be
335 redescribed here.

336 **Distribution and habitat**. *Hisonotus aky* is known only from two tributaries of the rio
337 Uruguai widely separated from each other: small affluents to arroyo Yabotí-Guazú a tributary to
338 middle Río Uruguay basin in Argentina (type-locality), and from rio Forquilha a tributary to upper
339 rio Uruguai basin in Brazil (Fig. 13). There is a large distributional hiatus between these populations
340 located in different tributaries. However, these populations are similar in morphometric data (Tab.
341 4) and no additional morphological difference was found between them, except for a more densely
342 pigmented caudal fin in specimens from rio Forquilha (Fig.13). Hence, these populations are
343 considered conspecific. The population in rio Forquilha inhabits a rapid flowing watercourse, with
344 clear to brown waters and rocky bottom. The individuals were found between aquatic vegetation of
345 the genus *Echinodorus*, which form green islands between the rocky substrate (Fig. 14).

346 **Remarks**. *Hisonotus aky* (Azpelicueta, Casciotta, Almirón & Körber, 2004) was originally
347 described in *Epactionotus* Reis & Schaefer, 1998 because of its supposed possession of three
348 synapomorphies proposed for that genus: neural spine of seventh vertebra not contacting nuchal
349 plate dorsally (contacting unpaired predorsal plates), first dorsal proximal radial contacting the
350 eighth vertebral centrum, and absence of an expanded fleshy flap on the dorsal surface of the first
351 pelvic-fin ray in males. Also, *Hisonotus aky* possesses one of the additional diagnostic characters of
352 *Epactionotus*: longitudinal light stripes on dorsal surface of head. However, the examination of type
353 specimens of *Epactionotus aky* indicates the absence of most diagnostic features for the genus. The
354 first pelvic fin without dorsal skin flap in males is a derived feature, evolving three times
355 independently in Hypoptopomatinae (*Schizolecis*, *Epactionotus*, and the clade formed by
356 *Acestridium*, *Oxyropsis, Hypoptopoma*, and *Nannoptopoma*) according to the topology proposed by
357 Schaefer (1998:382) and Gauger & Buckup (2005:511). The presence of a fleshy flap on the dorsal

surface of the first pelvic-fin ray of mature males is pleosimorphic and shared by all species of *Hisonotus*, most hypoptopomatines, and *Epactionotus aky* (Fig 15). Another two synapomorphies proposed by Reis & Schaefer (1998) for *Epactionotus* are, neural spine of seventh vertebra not contacting the nuchal plate dorsally and first proximal radial of dorsal fin contacting the eighth vertebra (Fig. 16A). These character-states are not present in *H. aky*, which shares with remaining *Hisonotus* species and other hypoptopomatines (except *Microlepidogaster*) the neural spine of the seventh vertebra contacting the nuchal plate, at least posteriorly and the first proximal radial of dorsal fin contacting the seventh vertebra (Fig. 16B). Another character, discussed by Azpelicueta *et al*. (2004), suggesting the inclusion of *H. aky* in *Epactionotus* is the presence of light longitudinal stripes on head and trunk. Because the presence of light stripes is more widespread among hypoptopomatines and appears in several species of *Hisonotus*, that feature does not diagnose *H. aky* as belonging to the genus *Epactionotus*. Moreover, *Epactionotus aky* share with two species of *Hisonotus* (*H.* sp. "Canoas" and *H.* sp. "Chapecó") the presence of an infraorbital canal entering the infraorbital series via the compound pterotic, which is a derived feature and suggests a close relationship between these species. For these reasons, *Epactionotus aky* is treated here as belonging to the genus *Hisonotus*.

Hisonotus charrua **Almirón, Azpelicueta, Casciotta & Litz, 2006**

(Figures 17-18, Table 5)

Hisonotus charrua Almirón, Azpelicueta, Casciotta & Litz, 2006: 87-94 [original description, type locality: Uruguay, Departamento Tacuarembó, Río Uruguay basin, Canãda de Los Penã].- Reis & Carvalho, 2007:83 [listed].

Material examined. from rio Uruguai basin. **Río Negro drainage:** ZVC-P 5639, holotype, 49.2 mm SL, Uruguay, Tacuarembó, Cañada de Los Peña, 31°39'05"S 56°12'19'W. AI 165,

paratypes, 5, 37.1-48.7 mm SL, collected with the holotype. MCP 9648, 1, 34.2 mm SL, Brazil, Bagé, rio Negro on bridge of highway BR-293 between Bagé and Aceguá, 31°21'S 54°03'W. MCP 16177, 3, 27.1-36.1 mm SL, Brazil, Bagé, rio Piraizinho on road from Bagé to Dom Pedrito, 31°17'S 54°09'W. MCP 40256, 4 + 1 c&s, 32.8-50.3 mm SL, same collecting site of holotype. UFRGS 9242, 15, 26.6-38.3 mm SL, Uruguay, Durazno, arroyo Maestre de Campo on road to Polanco de Yí, tributary of Río Yí, 33°24'55"S 56°12'06"W. UFRGS 7184, 9 + 2 c&s, 18.0-46.2 mm SL, Uruguay, Rivera, lateral pools and arroyo Corrales on ruta 27, tributary of Río Tacuarembó, 31°23'26"S 55°15'14"W. UFRGS 7185, 12, 15.9-39.8 mm SL, Uruguay, Rivera, arroyo Batovi at km 24 of ruta 27, tributary of Río Tacuarémbo drainage. UFRGS 7186, 3, 15.8-20.6 mm SL, Uruguay, Tacuarémbo, arroyo Batovi on km 365 of ruta 5, about 20 km from Tacuarembó tributary of Río Tacuarembó drainage, 31°43'S 55°46'W. UFRGS 7187, 3, 16.1-28.3 mm SL, Uruguay, Rivera, arroyo Cunãpiru on km 12 of ruta 27 Río Tacuarémbo drainage, 31°02'21"W 55°29'31"S. **Other drainages of rio Uruguai:** MACN 7593, 1, 40.5 mm SL, Argentina, Entre Rios, Parque Nacional El Palmar. UFRGS 7977, 2, 32.7-38.5 mm SL, Artigas, Uruguay, arroyo Guaviyú on ruta 3, 30°38'00"S 57°41'16"W. UFRGS 9195, 8, 25.1-40.9 mm SL, Uruguay, Artigas, arroyo Mandiyú on ruta 3, 30°51'55"S 57°39'57"W. AI 176, paratype, 1, 35.9 mm SL, Uruguay, Salto, arroyo Aspinillar in Constitución. **Uruguay coastal drainages:** MAPA 1969, 15, 14.7-47.2 mm SL, Uruguay, Maldonado, San Carlos, arroyo Maldonado. MAPA 2282, 57, 41.2 mm SL, Uruguay, Canellones, arroyo Tropa Vieja (bridge of Tambó) Pinamar. MCP 40257, 3, 37.3-40.3 mm SL, Uruguay, Canelones, arroyo Tropa Vieja, 34°44'59"S 55°50'46"W. MCP 40258, 1, 45.7 mm, Uruguay, Canelones, SL arroyo Tropa Vieja on Interbalnearia, 34°46'45"S 55°52'12°W. MCP 40255, 1, 38.8 mm SL, Uruguay, Canelones, arroyo Sauce on km 38 of Ruta 7, 34°38'48"S 55°58'27"W. **Rio Quaraí drainage:** AI 186, paratype, 1, 40.5 mm SL, Uruguay, Artigas, arroyo Catalán Grande, 30°50'40"S 56°12'19"W. MCP 11351, 3, 12.8-18.4 mm

SL, Brazil, Quaraí, small creek affluent of arroio Garupá, 30°09’S 56°13’W. MCP 19573, 41, 20.7-41.5 mm SL, rio Quaraí-Mirim on road between Uruguaiana and Quaraí, Quaraí, Brazil, 30°15’29”S 56°30’37”W. MCP 21644, 32, 30.6-46.0 mm SL, Brazil, Quaraí, rio Quaraí-Mirim on road between Uruguaiana and Quaraí, 30°15’21”S 56°30’23”W. MCP 35303, 3, 33.8-41.5 mm SL, Brazil, Quaraí, arroio Garupá on road from Quaraí to Harmonia, about 33 km northeast of Quaraí, 30°09’45”S 56°14’08”W. MCP 40904, 23 + 4 c&s, 17.6-45.6 mm SL, Brazil, Quaraí, arroio Quaraí-Mirim on road between Uruguaiana and Quaraí, 30°18’S 56°19’W. UFRGS 7926, 1, 21.1 mm SL, Uruguay, Artigas, arroyo Yucutujá on ruta 3. **Rio Ibicuí drainage:** MCP 9630, 2, 23.4-33.4 mm SL, Brazil, Dom Pedrito, rio Santa Maria at km 246 of highway BR-293, between Dom Pedrito and Santana do Livramento, 30°59’S 54°42’W. MCP 23090, 1, 44.4 mm SL, Brazil, São Francisco de Assis, arroio Sanga Funda about 15 km southeast from São Francisco de Assis, 29°39’02”S 55°00’06”W. MCP 27539, 4 + 2 c&s, 28.8-46.6 mm SL, Brazil, Jaguari, arroio do Tigre on highway BR-453/Ijucapirama, about 2.5 km northeast from BR-453, 29°28’18”S 54°40’19”W. MCP 27545, 1, 42.6 mm SL, creek affluent of rio Santana, near Jari, tributary to rio Jaguari, Tupanciretã, Brazil, 29°13’56”S 54°21’23”W. MCP 27567, 1, 28.6 mm SL, Brazil, Jaguari, creek affluent of rio Tunas on highway BR-453/Ijucapirama, tributary to rio Jaguari, 29°26’27”S 54°35’35”W. MCP 27604, 7, 15.2-35.3 mm SL, Brazil, Jaguari, arroio Capivari on highway BR-453/Jari, tributary to rio Jaguari, 29°21’10”S 54°28’32”W. MCP 27611, 15, 16.5-40.7 mm SL, Brazil, São Francisco de Assis, arroio Caraí-Passo on road from São Francisco de Assis to Manoel Viana, 29°31’03”S 55°10’49”W. MCP 27625, 3, 29.8-37.0 mm SL, Brazil, Tupanciretã, rio Santana near Jari, tributary to rio Jaguari, 29°14’33”S 54°16’47”W. MCP 41631, 5, 34.4-39.74 mm SL, Brazil, São Francisco de Assis, rio Inhacunda at São Francisco de Assis going to Manoel Viana, 29°32’51”S 55°08’11”W. MCP 41632, 1, 32.7 mm SL, Brazil, São Francisco de Assis, rio Inhacunda at São Francisco de Assis about 500 meters above potery, 29°32’27”S 55°07’45”W.

MCP 41633, 5, 26.8-32.6 mm SL, Brazil, São Francisco de Assis, rio Inhacunda at São Francisco de Assis on road to Manoel Viana, 29°32’51”S 55°08’11”W. MCP 41634, 6, 19.1-37.2 mm SL, Brazil, São Francisco de Assis, creek affluent to rio Inhacunda at São Francisco de Assis about 300 meters from potery, 29°32’39”S 55°07’50”W. UFRGS 2576, 1, 34.5 mm SL, Brazil, Santa Maria, arroio Taquara at km 10 on highway RS-453 between Santa Maria and Santiago. UFRGS 8332, 3, 36.8-39.7 mm SL, Brazil, Bagé, rio Santa Maria on highway BR-293 between Bagé and Dom Pedrito, 31°08’S 54°22’W. UFRGS 8333, 1, 40.4 mm SL, Brazil, Bagé, arroio Santa Maria Chico affluent of rio Santa Maria on highway BR-293, 31°04’S 54°29’W. **Rio Ijuí drainage:** MCP 9616, 1, 32.5 mm SL, Brazil, Panambi, riacho Raiz Mana at Condor on road from Palmeira das Missões to Panambi, 28°13’S 53°29’W. MCP 16751, 1, 34.5 mm SL, Brazil, Jóia, creek affluent of rio Ijuizinho near Jóia, on road from Eugênio de Castro to Jóia, 28°39’S 54°07’W. MCP 16770, 1, 28.7 mm SL, Brazil, Eugenio de Castro, creek affluent of rio Ijuizinho, 2 km from Eugenio de Castro on road to Jóia, 28°33’S 54°07’W. MCP 34876, 1, 37.4 mm SL, Brazil, São Pedro do Butiá, arroio Albino, 28°08’10”S 54°55’28”W. MCP 34968, 2 c&s, 19.3-34.9 mm SL, Brazil, Roque Gonzales, arroio Portão, 28°06’21”S 54°58’33”W. MCP 35337, 4, 34.8-42.3 mm SL, Brazil, São Pedro do Butiá, arroio Albino, 28°08’10”S 54°55’28”W. MCP 37035, 4, 37.2-39.0 mm SL, Brazil, São Pedro do Butiá, arroio Albino, 28°08’10”S 54°55’28”W. MCP 37064, 3, 34.0-40.4 mm SL, Brazil, Roque Gonzales, arroio Portão, 28°06’21”S 54°58’33”W. MCP 37232, 2 + 2 c&s 36.1-38.4 mm SL, Brazil, São Pedro do Butiá, arroio Albino, 28°08’10”S 54°55’28”W. MCP 37270, 4, 23.1-33.6 mm SL, Brazil, Dezesseis de Novembro, lageado Araçá, 28°12’23”S 54°56’58”W. UFRGS 4329, 3, 37.8-45.6 mm SL, Brazil, Panambi, rio Caxambu, at km 275 of highway BR-285, 28°19’S 53°39’W. From laguna dos Patos system. **São Gonçalo drainage:** MCP 25139, 15 + 2 c&s, 32.4-46.4 mm SL, Brazil, Pinheiro Machado, arroio dos Pires on bridge of railroad at Passo dos Pires, 31°38’S 53°27’W.

454 **Diagnosis.** *Hisonotus charrua* differs from its congeners, except from *Hisonotus armatus,*
455 *Hisonotus* sp. "Ariranhas", *Hisonotus laevior, Hisonotus* sp. "Camaquã", and *Hisonotus taimensis*
456 by the color pattern of the caudal fin, which has a hyaline transverse band composed of clear spots
457 (a second posterior band in larger individuals) in a dark background vs. a different pattern from the
458 above described hyaline areas not forming clearly defined transversal stripe in the middle portion
459 of caudal fin. *Hisonotus charrua* is distinguished from *Hisonotus armatus* and *Hisonotus* sp.
460 "Ariranhas" by having a narrow naked band, without odontodes on the anterior margin of snout vs.
461 snout completely covered by odontodes. *Hisonotus charrua* is distinguished from *Hisonotus*
462 *laevior, Hisonotus* sp. "Camaquã", and *Hisonotus taimensis* by the number of median plates 23-25
463 vs. 25-28 plates, and by vertebral count 28-29 vs. 30-32 vertebrae.

464 **Description.** This species was recently described by Almirón et al. (2006) and will not be
465 redescribed here.

466 **Distribution and habitat**. *Hisonotus charrua* is widely distributed in the middle and lower
467 portions of the rio Uruguai basin from the northern rio Ijuí drainage in the Rio Grande do Sul state,
468 Brazil to the southern Río Negro drainage in the Uruguay. Besides the limits of the rio Uruguai
469 basin, this species is known from the coastal streams of Uruguay, and from a single locality in the
470 headwaters of São Gonçalo drainage in the laguna dos Patos system (Fig. 19). The new species is
471 synpatric with *H. ringueleti* along its distribution. In several streams tributaries to rio Ibicuí and Río
472 Negro drainage *H. charrua* is usually collected together with *H. nigricauda*. This species inhabits a
473 variety of habitats, usually small to medium size creeks with loose stones, and gravel bottom, with
474 medium to rapid-flowing water. Collected associated to marginal vegetion composed by grasses or
475 *Echinodorus* sp.

476 **Variation.** There are morphological differences between the specimens collected in the rio
477 Ijuí drainage (the northern distribution limit of the species) and the other drainages tributaries to the

478 rio Uruguai basin and Río de La Plata. The specimens from the rio Ijuí drainage posses a narrow
479 stripe devoid of odontodes in the anterior portion of the snout (Fig. 20), vs. a wider naked odontode-
480 free band in the specimens from the other tributaries (including the type-locality in the Río Negro
481 drainage Fig. 21). However, that population is diagnosed by the same features as other *H. charrua*
482 populations, and no additional differences were found.
483
484 ***Hisonotus* sp. "Chapecó", new species**
485 Figure 22, Table 6
486 *Hisonotus aky* non (Azpelicueta, Casciotta, Almirón, Körber, 2004).-Reis & Carvalho (2007:
487 84) listed misidentified].
488
489 **Holotype.** MCP uncataloged, 33.4 mm SL, female, Brazil, Santa Catarina, Coronel de
490 Freitas, rio Chapecó at vila São Miguel on road from Coronel de Freitas to Quilombo, rio Uruguai
491 basin, 26°51'26"S 052°44'29"W, 23 Jan 2006, C. A. S. Lucena, V. Bertaco, E. Pereira J. P. Pereira.
492 **Paratypes.** MCP 40029, 22 + 3 c&s, 21.6-29.7 mm SL, collected with the holotype.
493 **Diagnosis.** *Hisonotus* sp. "Chapecó" differs from its congeners by the lower lateral plate
494 count 20-22 vs. 23-29 lateral plates (Tab. 3), and by the lower vertebral count 25-26, vs. 27-32
495 vertebrae. Additionally, it can be distinguished from all other congeners, except *Hisonotus aky* and
496 *Hisonotus* sp. "Canoas", by having an infraorbital canal entering the infraorbital series via the
497 compound pterotic (Fig. 23A) vs. infraorbital canal entering the infraorbital series via the sphenotic
498 (Fig. 23B).
499 **Description.** Morphometrics and meristics in Table 6. Adult size small for members of this
500 genus (maximum size 33.4 mm in SL). Body stocky, without conspicuous keels. Caudal peduncle
501 round in cross section. Dorsal profile almost straight from snout to supraoccipital tip, convex bump

on internareal region. Almost straight from posterior parieto-supraoccipital tip to dorsal-fin origin, except for posterodorsally inclined profile of nuchal region. Dorsal-fin base straight and posteroventrally sloped, straight from posterior end of dorsal-fin base to posterior end of caudal penduncle. Ventral profile straight from snout tip to anal-fin origin, concave at anal-fin base, and straight from posterior end of anal-fin base to caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth at caudal peduncle. Posterior profile of caudal fin concave. Head and snout broad, snout rounded in dorsal view, body progressively narrowing posterior to pectoral-fin insertion. Snout region anterior of nares depressed, interorbital region slightly convex. Upper margin of orbit not elevate. Eye dorsolaterally positioned. Iris operculum present.

Pectoral fin I,6. Pectoral-fin posterior margin gently curved when depressed tip extending anterior to middle of pelvic fin. Posterior margin of pectoral-fin spine smooth in adults, juveniles with feeble serrae along distal third of pectoral-fin spine. Pectoral-fin axillary slit present, slit posteroventrally sloped below posterior margin of cleithral process. Pelvic fin i,5, tip of depressed fin just reaching anal-fin origin in females, but extending far beyond that point in males. Dorsal fin II,7. Dorsal-fin origin located posterior to vertical through pelvic-fin origin. Dorsal-fin spinelet somewhat rounded in shape. Anal fin i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent. Caudal fin i,14,i.

Body almost entirely covered by plates except for region overlying opening of swim bladder capsule, area between pectoral girdle and lower lip, region around anus, and area around base of paired fins. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened, completely covered by odontodes without anterior odontode-free band (Fig. 24). Region anterior to nares completely covered by plates, prenasal plates anterior to nares not reduced in size. Three rows of predorsal plates. Median series formed by 20–22 plates (Tab. 3). Lateral line incomplete, with gap without pores along middle length of body, posterior portion of lateral line sometimes absent.

Median-plate series truncated, not reaching posterior end of caudal peduncle (Fig. 25). Lateral abdominal plates large and forming regular series of three to five plates on each side. Median abdominal series formed by one to three irregularly arranged series. Plates of pre-anal shield region large (Fig. 26). Coracoid and cleithrum exposed and covered by odontodes, except for median region of cleithrum between arrector fossae openings and medial region of coracoids.

Head without conspicuous crests, except for enlarged odontodes on parieto-supraoccipital tip, forming raised tuft (Fig. 27). Head, fin-spines, and body plates covered with odontodes, these larger on anterior surface of all fin spines, and on ventral margin of rostrum. Anteroventral margin of compound pterotic with median-to-large size perforations. Infraorbital canal entering infraorbital series via compound pterotic. Lips roundish and papillose, posterior margin of lower lip gently fimbriate to smooth. Maxillary barbel present.

Premaxillary and dentary teeth slender proximally and flattened distally□bifid, major (medial) cusp large and rounded, minor (lateral) cusp minute and pointed. Accessory patch of teeth absent on dentary and premaxilla.

Hypurals 1-2 and 3-5 completely fused, without median notch on posterior margin of caudal-fin. Total vertebrae 25-26 (2 c&s).

Color in alcohol. Ground color of dorsal and lateral surfaces carbon black. Dorsolateral region of head with paired longitudinal stripes, begining at tip of snout, passing through nares and reaching anterior orbit margin. Parieto-supraoccipital tip lighter than surrounding areas. Ventrolateral and ventral surfaces yellowish, with scattered chromatophores, most concentrated on cheek, bases of paired fins, and caudal peduncle. Fins mostly unpigmented, except for dark transverse bars, forming striped pattern. Middle portion of caudal fin with wide hyaline bar. Ground color in life dark green.

549 **Sexual dimorphism.** Characterized by the urogenital papilla, positioned just behind anal
550 opening in males. Adult males also possess a developed fleshy flap along dorsal margin of first
551 thickened pelvic-fin ray, that is absent in females. Flap slightly wider basally and progressively
552 narrowing distally. Middle portion of first and second branched rays with a slightly developed
553 fleshy flap. Flaps absent in juvenile males and females. Males have a longer pelvic-fin unbranched
554 ray that extends beyond anal-fin origin, with pelvic-fin just reaching origin of anal fin in females.
555 **Distribution and habitat.** *Hisonotus* sp. "Chapecó" is known only for the type locality in rio
556 Chapecó, a tributary of the upper rio Uruguai basin (Fig. 13). Rio Chapecó, at the collection site of
557 the new species, is a wide and shallow river with a median to fast flow watercourse. The stream has
558 clear waters running over a rocky bottom. The species is collected in the aquatic submersed
559 vegetation.
560
561 ***Hisonotus* sp. "Ariranhas", new species**
562 Figures 28-29, Table 7
563 *Hisonotus* sp. 8 in Reis & Carvalho (2007: 84) [listed].
564
565 **Holotype.** MCP uncataloged, 42.2 mm SL, female, Brazil, Santa Catarina, Xavantina, rio
566 Ariranhas on bridge of highway SC-466, rio Uruguai basin 27°04'17"S 052°20'34"W, 30 Apr
567 2007, T. P. Carvalho, A. R. Cardoso & C. A. Cramer.
568 **Paratypes.** All from Brazil, Santa Catarina, rio Uruguai basin: MCP 41354, 5 + 2 c&s 18.3-
569 40.8 mm SL, collected with the holotype. MCN 12741, 2, 37.4-37.6 mm SL, same type locality, 8
570 Jul 1996, W. R. Koch, M. Rosenau & K. M. Grosser. MCP 41351, 1, 19.8 mm SL, Xavantina, rio
571 Ariranhas about 800 meters northeast from urban area of Xavantina, 27°03'55"S 052°20'10"W, 30
572 Apr 2007, T. P. Carvalho, A. R. Cardoso & C. A. Cramer. MCN 12024, 1, 40.2 mm SL, Concórdia,

573 rio Rancho Grande on the highway SC-461, 27°20’22”S 051°57’50”W, 27 Jul 1995, R. C. Vieira,
574 R. R. Estevão & K. M. Grosser. MCN 12553, 1, 37.4 mm SL, Concórdia, rio Rancho Grande on
575 highway SC-461, 27°20’22”S 051°57’50”W, 25 Apr 1996, W. R. Koch, M. Rosenau & K. M.
576 Grosser.

577 **Diagnosis.** *Hisonotus* sp. “Ariranhas” differs from its congeners, except *Hisonotus* sp.
578 “Canoas” by having wider light stripes on dorsolateral surface of head, from snout tip to posterior
579 end of compound pterotic, vs. narrow light stripes on dorsal surface of head extended from snout tip
580 to posterior end of compound pterotic, or no longitudinal stripes in that region. *Hisonotus* sp.
581 “Ariranhas” differs from *Hisonotus* sp. “Canoas” by having the snout completely covered with
582 odontodes, without an odontode-free band vs. anterior portion of snout with an odontode-free band
583 by the life color pattern pale yellow to brown (Fig. 29), vs. light greenish and by the coloration of
584 the caudal fin which is composed by a dark ground crossed by vertical hyaline bar, vs. caudal fin
585 with several dark bars in a hyaline ground.

586 **Description.** Morphometrics and meristics in Table 7. Adult size moderate for members of
587 this genus (large adult reaching 42 mm in SL). Body somewhat robust, moderately elongate,
588 without conspicuous keels. Caudal peduncle round in cross section. Dorsal body profile convex
589 from snout tip to nuchal plate, straight and posterodorsally inclined over nuchal plate to dorsal-fin
590 origin. Straight and posteroventrally sloped at dorsal-fin base, straight from that point to caudal fin.
591 Ventral profile of body almost straight from snout tip to anal-fin origin, except for somewhat
592 concave margin from snout to posterior border of opercle. Straight and posterodorsally inclined at
593 anal-fin base, straight from that point to caudal-fin origin. Greatest body depth at dorsal-fin origin.
594 Least body depth at posterior end of caudal peduncle. Profile of posterior caudal fin margin
595 pronounced concave. Head and snout somewhat broad, snout rounded to slightly pointed in dorsal
596 view, body progressively narrowing caudally from pectoral-fin insertions. Snout region anterior to

nares depressed, interorbital region convex. Upper margin of orbit somewhat elevate. Eye dorsolaterally positioned. Iris operculum present.

Pectoral fin I,6. Pectoral-fin posterior margin almost straight, when depressed, its tip reaching middle of pelvic fin. Posterior margin of pectoral-fin spine smooth in adults, juveniles with posterior half of spine serrate. Pectoral-fin axillary slit present, located below ventral margin of cleithral process. Pelvic fin i,5. Tip of depressed fin not reaching anal-fin origin in females, but surpassing that point in males. Dorsal II,7. Dorsal-fin origin located posterior to vertical through pelvic-fin origin. Dorsal-fin spinelet somewhat rounded in shape. Anal fin i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent. Caudal fin i,14,i.

Body almost entirely covered by plates except for region overlying opening of swim bladder capsule, area between pectoral girdle and lower lip, region around anus, and base of paired fins. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened, anterior margin completely covered by odontodes, without odontode-free band. Prenasal plates anterior to nares reduced, a small unplated area positioned laterally between infraorbitals and prenasal plates. Three rows of predorsal plates. Median series formed by 23–24 plates (Tab. 3). Lateral line incomplete, with gap without pores along middle length of body. Median series not truncated, reaching posterior end of caudal peduncle (Fig. 30). Abdominal plates composed by three rows, lateral abdominal plates slightly larger, forming regular series of about four to five plates in each side. Median abdominal series formed by one plate series. Pre-anal shield region formed by plates of small size, irregularly arranged (Fig. 31). Coracoid and cleithrum exposed and covered by odontodes, except for median region of cleithrum between arrector fossae openings and medial region of coracoids.

Head without conspicuous crests. Odontodes on parieto-supraoccipital tip slightly larger than those of surrounding areas, forming a slightly pronounced crest. Head, fin-spines, and body plates

621 covered with odontodes, these larger on anterior surface of all fin spines, and on ventral and dorsal
622 margin of rostrum. Anteroventral margin of compound pterotic with median-to-large size
623 perforations. Infraorbital canal entering infraorbital series via sphenotic. Lips roundish and
624 papillose, posterior margin of lower lip fimbriate. Maxillary barbel present.
625 Premaxillary and dentary teeth slender proximally and flattened distally□bifid, major (medial)
626 cusp round□minor (lateral) cusp minute pointed. Accessory patch of teeth absent on dentary and
627 premaxilla.
628 Hypurals 1-2 and 3-5 not completely fused, slight median notch on posterior portion of caudal
629 skeleton. Total vertebrae 29 (1 c&s).
630 **Color in alcohol**. Ground color of dorsal and lateral surfaces dark gray to light brown. Dorsal
631 and lateral portions of head darker than body. Light rounded spots over dorsal surface of head
632 between nares and orbits. Pair of longitudinal light stripes starting at snout tip and bifurcating
633 posterior to orbit. One branch reaching posterior end of parieto-supraoccipital and another branch,
634 not continuous, reaching posterior parieto-supraoccipital tip. Stripes wider than pupil diameter.
635 Ventrolateral region of head mostly yellowish, except for scattered dark marks, variable in shape.
636 Dorsolateral surface of body with three paired light longitudinal stripes. One pair more dorsally,
637 beginning at predorsal plate just after parieto-supraoccipital tip and reaching posterior end of caudal
638 peduncle. Two paired stripes more laterally located. Stripes beginning at posterior end of compound
639 pterotic, joining bellow dorsal-fin region and from that point, continuous as single stripe, reaching
640 posterior end of caudal peduncle. Sometimes presenting longitudinal stripe, at ventrolateral region,
641 from opercle to vertical trough end of anal-fin base. Ventral surface of body pale yellow with
642 scaterred chromatophores. Grouped chromatophores forming dark blotches on cheeks, on bases of
643 pectoral fin, and on caudal peduncle. Unbranched rays of pectoral, pelvic, dorsal, anal, and caudal
644 fins mostly unpigmented, except for dark transverse bars. Branched rays of pectoral, pelvic, dorsal,

and anal fins mostly hyaline except for transverse dark bars. Caudal-fin branched rays mostly dark pigmented, except for hyaline posterior portion of upper rays, and for transversal hyaline bar, composed by rounded light spots crossing middle portion of caudal fin. Ground color in life yellowish.

Sexual dimorphism. Characterized by the presence of an urogenital papilla, positioned just behind the anal opening in males. Adult males also possess a fleshy flap along the dorsal margin of the first thickened pelvic-fin ray. Flap is absent in juveniles males and females. Males show a longer pelvic-fin unbranched ray that surpasses anal-fin origin, falling short of this point in females.

Distribution and habitat. *Hisonotus* sp. "Ariranhas" is only known from two tributaries of the right margin of the rio Uruguai, rio Ariranhas and rio Rancho Grande, in the upper rio Uruguai basin (Fig. 13). This species inhabits median to fast flowing watercourses of clear water, with stones and sand on the bottom, and are found in aquatic, partially submersed, vegetation islands composed by grasses (Fig. 32). Recent collection efforts in rio Rancho Grande failed to capture additional individuals of this species. After the flooding of the reservoir of the Itá dam (a power plant downstream the mouth of rio Rancho Grande into the rio Uruguai) in the year of 2000, a large portion of the rio Rancho Grande was flooded. The changes in the environment from a rapid running river to a lentic habitat apparently are the cause of the species disappearance.

***Hisonotus* sp. "Passo Fundo", new species**

Figure 33, Table 8

Hisonotus sp. Câmara & Hahn (2002) [listed].

Hisonotus sp. 7. Reis & Carvalho (2007: 84) [listed].

Holotype. MCP uncataloged, 42.8 mm SL, female, Brazil, Rio Grande do Sul, Coxilha, arroio Caraguatá on secundary road to highway BR-153 between Passo Fundo and Ipiranga, 28°07'55"S 052°20'56"W, 29 Apr 2007, T. P. Carvalho, A. R. Cardoso & C. A. Cramer.

Paratypes. All from Brazil, Rio Grande do Sul, rio Uruguai basin, rio Passo Fundo drainage, MCP 41352, 10, 23.7-47.1 mm SL, collected with the holotype. MCP 31765, 2, 18.2-38.6 mm SL, Passo Fundo, rio Passo fundo on highway BR-285, 28°14'55"S 052°18'39"W, 3 Jan 2003, W. Bruschi Jr. & J. P. Silva. MCP 31779, 9 + 3 c&s, 30.7-43.9 mm SL, Passo Fundo, rio Passo Fundo, downstream of Corsam dam, 28°15'15"S 052°18'52"W, 3 Jan 2003 W. Bruschi Jr. & J. P. Silva.

Diagnosis. *Hisonotus* sp. "Passo Fundo" differs from its congeners by the arrangement of abdominal plates, which are composed by greatly enlarged lateral abdominal plates, which contact each other at the belly midline, without a median abdominal series (Fig. 34). All other species of *Hisonotus*, with the exception of *Hisonotus* sp. "Canoas", possess a median series between the lateral abdominal plate or a naked area between them. This feature is polymorphic in *H.* "Canoas", some individuals having enlarged lateral abdominal plates, contacting at the midline. *Hisonotus* sp. "Passo Fundo" is distinguished from *Hisonotus* sp. "Canoas" by the color pattern, having narrow light stripes on head extended from the snout tip to the posterior end of the compound pterotic, vs. wider light stripes on head extended from the snout tip to posterior end of the compound pterotic by the caudal-fin color pattern which is almost completely dark, vs. color pattern composed by vertical dark stripes, and by the infraorbital canal entering infraorbital series via sphenotic, vs. infraorbital canal entering infraorbital series via compound pterotic.

Description. Morphometrics and meristics in Table 8. Adult size moderate to large for members of this genus (larger individual surpassing 47 mm in SL). Body robust, somewhat elongate, without conspicuous keels. Caudal peduncle round in cross section. Dorsal profile slightly concave from tip of snout to nares, convex from that point to parieto-supraoccipital tip. Straight and

posterodorsally inclined from posterior end of parieto-supraoccipital to dorsal-fin origin. Dorsal-fin base straight and posteroventrally sloped, almost straight from posterior end of dorsal-fin base to caudal-fin origin. Ventral profile almost straight from snout tip to anal-fin origin. Concave at anal fin base, straight from that point to origin of caudal fin. Greatest body depth at dorsal-fin origin. Least body depth just posterior to middle of caudal peduncle. Posterior profile of caudal-fin margin concave Head and snout broad, snout rounded in dorsal view, body progressively narrowing posterior of pectoral-fin insertion. Snout region anterior of nares slightly depressed□interorbital region straight to slightly convex. Upper margin of orbit not elevated. Eye dorsolaterally positioned. Iris operculum present.

Pectoral fin I,6. Pectoral-fin posterior margin almost straight, when depressed tip extending beyond middle of pelvic fin. Posterior margin of pectoral-fin spine smooth. Pectoral-fin axillary slit apparently absent. Pelvic fin i,5. Tip of depressed fin not reaching anal-fin origin in females, but extending just to that point in males. Dorsal II,7. Dorsal-fin origin located slightly posterior of vertical through pelvic-fin origin. Dorsal-fin spinelet laterally extended. Anal fin i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent. Caudal fin i,14,i.

Body almost entirely covered by plates except for region overlying opening of swim bladder capsule, area between pectoral girdle and lower lip, region around anus, and base of paired fins. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened, with odontode-free area between dorsad and ventrad series of odontodes. Area devoided of odontodes narrow at medial portion and wider at lateral portions (Fig. 35). Prenasal plates present not reduced. Three rows of predorsal plates. Median series formed by 22–24 plates (Tab. 3). Lateral line incomplete, with gap without pores along middle length of body. Median plate series truncated, not reaching posterior end of caudal peduncle (Fig. 36). Abdominal plates composed by enlarged lateral abdominal plate series, each other at midportion of the belly. Lateral abdominal plates forming

716 regular series of three to five plates, two to four of them contacting at midline. Pre-anal shield
717 region formed by large size plates (Fig. 34). Coracoid and cleithrum exposed and covered by
718 odontodes, except for median region of cleithrum between arrector fossae openings and medial
719 region of coracoids.

720 Head without conspicuous crests. Odontodes on parieto-supraoccipital tip slightly larger than
721 those of surrounding areas, mostly in smaller specimens. Head, fin-spines, and body plates covered
722 with odontodes, these larger on anterior surface of all fin spines, and on ventral margin of rostrum,
723 slightly enlarged in dorsal margin. Anteroventral margin of compound pterotic with median-to-large
724 size perforations. Infraorbital canal entering infraorbital series via sphenotic. Lips roundish and
725 papillose, posterior margin of lower lip fimbriate. Maxillary barbel present.

726 Premaxillary and dentary teeth slender proximally and flattened distally□bifid, major (medial)
727 cusp round□minor (lateral) cusp minute pointed. Accessory patch of teeth absent on dentary and
728 premaxilla.

729 Hypurals 1-2 and 3-5 almost completely fused, with median notch on anterior portion caudal-
730 fin skeleton. Total vertebrae 28 (2 c&s).

731 **Color in alcohol**. Ground color of dorsal and lateral surfaces dark gray to almost black.
732 Dorsal and lateral portions of head darker than body, except for yellowish area in ventrolateral
733 region of head contrasting with dark rounded blotches, and lighter spots on parieto-supraoccipital
734 forming Y shaped mark. Region anterior to nares lighter than surrounding areas, forming narrow
735 paired longitudinal light stripes from snout tip to posterior end of parieto-supraoccipital, bifurcating
736 and becoming inconspicuous from that point, and completely disappearing at vertical bellow dorsal-
737 fin origin. Ventral surface of body pale yellow, with scattered chromatophores grouped on base of
738 pectoral fin, forming dark blotches. Unbranched rays of pectoral, pelvic, dorsal, and anal fins
739 mostly unpigmented, except for dark transverse bars, forming striped pattern. Branched rays of

these fins mostly hyaline except for unconpicous dark transverse bars. Caudal fin mostly dark gray pigmented, except for hyaline tranverse bands on posterior portion of upper rays. Unbranched rays of caudal fin with alternating transverse light and dark bars. In life, ground color of dorsum and flanks dark green (Fig. 37).

Sexual dimorphism. Characterized by the urogenital papilla, positioned just behind the anal opening in males. Adult males also possess a developed fleshy flap along the dorsal margin of first thickened pelvic-fin ray, that is absent in females. Flap slightly wider basally and progressively narrowing distally. Presence of fleshy flap on first and second branched rays of pelvic fin, in the medial portion of these rays. In juvenile males, flaps smaller or absent. Males have a longer pelvic fin that extends up to anal-fin origin, with pelvic fin falling short of that point in females.

Distribution and habitat. *Hisonotus* sp. "Passo Fundo" is known only from the headwaters of the rio Passo Fundo drainage, a tributary to the upper rio Uruguai basin (Fig. 13). Arroio Caraguatá at the type-locality is a small watercourse with slow to median flow of clear to brown waters running over stones, vegetal litter, and sand bottom (Fig. 38). The species inhabits marginal submerged vegetation composed mainly by grasses. See Câmara & Hahn (2002) for detailed description of arroio Caraguatá, and its fish fauna. Recent collection efforts failed to capture this species in the headwaters of rio Passo Fundo, near the city of Passo Fundo. The construction of a dam (Barragem da Fazenda da Brigada) and the pollution caused by sewer rejects from the urban area of Passo Fundo seems to be the cause of the disappearance of this species in that region.

Hisonotus sp. "Canoas", new species

Figure 39, Table 9

Holotype. MCP uncataloged, 43.0 mm SL, female, Brazil, Santa Catarina, Rio Rufino, rio Rufino on highway SC-427 at city of rio Rufino, 27°51'36"S 049°46'55"W, 01 May 2007, T. P. Carvalho, A. R. Cardoso & C. A. Cramer.

Paratypes. All from Brazil, Santa Catarina, rio Uruguai basin, rio Canoas drainage, MCP 41459, 20 + 3 c&s, 16.0-45.1 mm SL, collected with the holotype. MCP 22369, 1, 33,5 mm SL, Bom Retiro, creek tributary to rio João Paulo on road of Fazenda Jair Philippe, 27°45'36"S 049°36'19"W, 21 Dec 1998, R. E. Reis, A. R. Cardoso, P. A. Buckup & F. Melo

Diagnosis. *Hisonotus* sp. "Canoas" differs from its congeners, with the exception of *Hisonotus* sp. "Ariranhas", by the color pattern: wider light stripes on dorsal surface of head extending from snout tip to posterior end of compound pterotic, vs. narrow light stripes extending from snout tip to posterior end of compound pterotic, or absence of longitudinal stripes in that region. *Hisonotus* sp. "Canoas" differs from *Hisonotus* sp. "Ariranhas" by having the anterior portion of the snout with an odontode-free band (Fig. 40) vs. anterior portion of the snout completely covered by odontodes□by the life coloration of the body which is brilliant green (Fig. 41), vs. a pale yellow to brown ground color pattern□and by the color pattern of the caudal fin which is composed by vertical dark bars, vs. caudal fin with a dark background crossed by a vertical light bar composed by hyaline dots. Additionally it can be distinguished from other congeners, except *Hisonotus aky* and *Hisonotus* sp. "Chapecó", by having an infraorbital canal entering the infraorbital series via the compound pterotic, vs. infraorbital canal entering the infraorbital series via the sphenotic.

Description. Morphometrics and meristics in Table 9. Adult size moderate to large for members of this genus (larger specimen surpassing 45 mm in SL). Body robust anteriorly, somewhat slender posteriorly, without conspicuous keels. Caudal peduncle round in cross section. Dorsal profile almost straight from tip of snout to parieto-supraoccipital, except for convex bump

over nares, straight to slightly convex from that point to dorsal-fin origin. Dorsal-fin base straight and posteroventrally sloped, slightly convex from posterior end of dorsal-fin base to caudal-fin origin. Ventral profile almost straight from snout tip to anal-fin origin. Concave at anal fin base and straight from that point to caudal-fin origin. Greatest body depth at dorsal-fin origin. Least body depth just posterior to middle of caudal peduncle. Posterior profile of caudal-fin margin concave. Head and snout broad, snout rounded, somewhat square, in dorsal view, body progressively narrowing posterior of pectoral-fin insertion. Snout region anterior of nares slightly depressed interorbital region straight to slightly convex. Upper margin of orbit not elevated. Eye dorsolaterally positioned. Iris operculum present.

Pectoral fin I,6. Pectoral-fin posterior margin somewhat convex, when depressed tip extending beyond middle of pelvic fin. Posterior margin of pectoral-fin spine smooth in adults, juveniles with half of spine length serrate. Pectoral-fin axillary slit present, located below ventral margin of cleithral process. Pelvic fin i,5. Tip of depressed fin not reaching anal-fin origin in females, but surpassing that point in males. Dorsal fin II,7. Dorsal-fin origin located posterior to vertical through pelvic-fin origin. Dorsal-fin spinelet not laterally extended, somewhat rounded. Anal fin i,5. First anal-fin pterygiophore exposed anterior to anal fin. Adipose fin absent. Caudal fin i,14,i.

Body almost entirely covered by plates except for region overlying opening of swim bladder capsule, area between pectoral girdle and lower lip, region around anus, and bases of paired fins. Rostral plate with posterior notch articulation with mesethmoid. Rostral plate thickened, with narrow odontode-free band between dorsad and ventrad series. Area devoided of odontodes narrower at medial portion, wider laterally (Fig. 40). Prenasal plates present not reduced, without unplated area anterior to nares. Three rows of predorsal plates. Median series formed by 22–23 plates (Tab. 3). Lateral line incomplete, with gap without pores along middle length of body.

Median plate series truncated, not reaching posterior end of caudal peduncle. Arrangement of abdominal plates variable. Composed of three rows, lateral abdominal plates slightly larger and forming regular series of about two or three plates. Median abdominal series formed by a single series (Fig. 42 A), or abdominal region plated only by enlarged abdominal plates of the lateral series which contacts at belly midline portion. Lateral abdominal plates relative larger, forming regular series of two to three plates, contacting each other at midline, (Fig. 42 B). Median abdominal series composed by one, triangular in shape, plate located posteriorly, pre-anal shield region formed by large size plates. Coracoid and cleithrum exposed, covered by odontodes, except for median region of cleithrum between arrector fossae openings and medial region of coracoids.

Head without conspicuous crests. Odontodes on parieto-supraoccipital tip slightly larger than those of surrounding areas, mostly in smaller specimens. Head, fin-spines, and body plates covered with odontodes, these larger on anterior surface of all fin spines, and on ventral margin of rostrum. Anterior and ventral margins of compound pterotic with median-to-large size perforations. Infraorbital canal enters infraorbital series via compound pterotic. Lips roundish and papillose, posterior margin of lower lip fimbriate. Maxillary barbel present.

Premaxillary and dentary teeth slender proximally and flattened distally□bifid, major (medial) cusp round□minor (lateral) cusp minute pointed. Accessory patch of teeth absent on dentary and premaxilla.

Hypurals 1-2 and 3-5 completely fused. Total vertebrae 28 (2 c&s).

Color in alcohol. Ground color of dorsal and lateral surfaces light to dark gray. Dorsal and lateral portions of head darker than body. Light rounded spots over dorsal surface of head between nares and orbits. Pair of longitudinal light stripes starting at snout tip, passing through nares, and bifurcating posterior to orbit. One branch reaching posterior end of parieto-supraoccipital and other branch, not continuous, reaching V-shaped mark at parieto-supraoccipital tip. Stripes wider than

pupil diameter. Ventrolateral region of head yellowish, covered with scattered dark spots. Dorsolateral surface of body with two light longitudinal stripes, from posterior end of compound pterotic to vertical through dorsal-fin base. Dorsum, between posterior end of dorsal fin and caudal fin, with three to four light saddles. Ventral surface of body pale yellow, with scattered chromatophores, these grouped on base of pectoral fin, forming dark blotch. Unbranched rays of pectoral, pelvic, dorsal, anal, and caudal fins mostly unpigmented, except for dark transverse bands, forming a barred pattern. Branched rays of these fins mostly hyaline except for dark transverse bars. Caudal fin mostly unpigmented, except for transverse dark bars, some individuals with square-lined pattern or presenting wide hyaline transverse area in middle of caudal fin. In life, ground color of dorsum and flanks shiny light green (Fig. 41).

Sexual dimorphism. Characterized by the urogenital papilla, positioned just behind anal opening in males. Adult males also possess a developed fleshy flap along the dorsal margin of first thickened pelvic-fin ray, which is absent in females. Flap slightly wider basally and progressively narrowing distally. Presence of a fleshy flap at the medial portion of first and second branched rays of pelvic fin. In juvenile males, flaps smaller or absent. Males have a longer pelvic fin that surpasses anal-fin origin, with pelvic fin falling short of anal-fin origin in females.

Distribution and habitat. *Hisonotus* sp. “Canoas” is known only from two tributaries of rio Canoas drainage in the upper rio Uruguai basin (Fig. 13). This species inhabits median flow watercourses, with clear waters of sand and rocky bottom and is found associated with marginal vegetation composed mainly of grasses (Fig. 43). *Hisonotus* sp. “Canoas” is found at high altitudes, about 850 m above the sea level, and is the species of *Hisonotus* occurring in the most elevated portions of the rio Uruguai basin.

Key to the species of *Hisonotus* from laguna dos Patos system and rio Uruguai basin.

859

860 **1a.** Dorsal and ventral series of odontodes along anterior margin of the snout separated by an

861 odontode-free band……...…….……...2

862 **1b.** Absence of an odontode-free band, anterior margin of snout completely covered by odontodes

863 ……15

864 **2a.** Presence of a tuft of conspicuously enlarged odontodes on the parieto-supraoccipital tip in

865 adults…….3

866 **2b.** Absence of a tuft of enlarged odontodes on the parieto-supraoccipital tip in adults, odontodes on

867 parieto-supraocipital tip with same size of surrounding ones, sometimes larger in juveniles.....4

868 **3a.** Shorter pectoral-fin spine (22.0-25.6% of SL), just reaching the vertical through dorsal-fin

869 origin□general color pattern in life dark green, in alcohol grayish .....……..

870 ……..*Hisonotus* sp. "Prata" (rio da Prata drainage□laguna dos Patos system).

871 **3b.** Longer pectoral-fin spine (24.7 -29.0% in SL), far surpassing the vertical through dorsal-fin

872 origin□general color pattern in life yellowish …….……..

873 ……*Hisonotus* sp. "Carreiro" (rio Carreiro drainage□laguna dos Patos system).

874 **4a.** Three predorsal plate series□22-25 plates in lateral series□and 27-29 vertebrae ……..……5

875 **4b.** Three or four predorsal plate series (modally four)□25-29 plates in lateral series□and 30-32

876 vertebrae .....……..…13

877 **5a.** Posterior portion of pectoral-fin spine serrate in specimens smaller than 35 mm SL …….

878 ……*Hisonotus ringueleti* (middle Uruguai basin)

879 **5b.** Posterior portion of pectoral-fin spine smooth in specimens larger than 25 mm SL ……..…..6

880 **6a.** Caudal-fin pigmentation mostly dark without hyaline areas, except for posterior portion of upper

881 caudal-fin rays ...……..…..…….…....7

882 **6b.** Caudal fin presenting hyaline areas in different patterns in the middle portion …….10

883 **7a.** Median series of abdominal plates present ..……...…..8

884 **7b.** Median series of abdominal plates absent.....……..…….……9

885 **8a.** Median series of abdominal plates composed by several small plates, irregularly arranged

886 ……*Hisonotus nigricauda* (lower and middle rio Uruguai basin, and lower portions of laguna

887 dos Patos system)

888 **8b.** Median series of abdominal plates composed by one or two rows of plates, forming a regular

889 series ……..…*Hisonotus* sp. “Passo Novo” (upper rio Jacuí basin laguna dos Patos system)

890 **9a.** Lateral series of abdominal plates contacting each other at midline

891 ……*Hisonotus* sp. “Passo Fundo” (rio Passo Fundo drainage rio Uruguai basin)

892 **9b.** Lateral series of abdominal plates not contacting at midline, leaving a naked area between them

893 ……...…… *Hisonotus* sp. “Felício” (arroio Felício rio Jacuí basin)

894 **10a.** Trunk median plate series truncated, not reaching the posterior end of caudal peduncle

895 infraorbital canal entering infraorbital series via compound pterotic ……11

896 **10b.** Trunk median plate series not truncated, reaching the posterior end of caudal peduncle,

897 infraorbital canal entering infraorbital series via sphenotic …….....12

898 **11a.** Dorsal surface of head with rounded light marks, a wide light longitudinal stripe ……...

899 ……...…….. *Hisonotus* sp. “Canoas” (rio Canoas drainage, upper rio Uruguai basin)

900 **11b.** Dorsal surface of head without ligth marks, a narrow ligth longitudinal stripe ……

901 …….....*Hisonotus aky* (Yabotí-Guazú and Forquilha drainages rio Uruguai basin)

902 **12a.** Median portion of caudal fin with a vertical hyaline bar composed by round dots ……...

903 …….. ……. *Hisonotus charrua*

904 (lower and middle rio Uruguai basin, and upper rio Piratini drainage in laguna dos Patos system)

905 **12b.** Median portion of caudal fin with somewhat triangular hyaline areas forming an hour-glass
906 like mark ……..……..*Hisonotus* sp. ”Sinos” (rio Jacuí
907 basin)
908 **13a.** Caudal peduncle slightly square in cross section odontode-free band of snout wide rostral
909 plate thin without the posterior notch articulation with the mesethmoid
910 ……...……...……*Hisonotus* sp. “Camaquã” (rio Camaquã drainage)
911 **13b.** Caudal peduncle round in cross section odontode-free band of snout narrow rostral plate thick
912 with a posterior notch articulation with the mesethmoid ……..…….14
913 **14a.** Body relatively slender, low body depth at dorsal-fin origin (13.3-16.3% in SL)
914 ……..……*Hisonotus taimensis* (lower portions of laguna Mirim)
915 **14b.** Body relatively robust, high body depth at dorsal-fin origin (16.2-20.8 % in SL)
916 ……..…..... *Hisonotus laevior* (laguna dos Patos system)
917 **15a.** Lateral plate series 20-21 vertebral count 25-26 …….. *Hisonotus* sp. “Chapecó”
918 (rio Chapecó drainage rio Uruguai basin)
919 **15b.** Lateral plate series 22-25 vertebral count 27-29 …….....16
920 **16a.** Median portion of caudal fin with a vertical hyaline bar composed by round dots……..……17
921 **16b.** Caudal-fin mostly dark, without hyaline bar on median portion……...18
922 **17a.** Dorsolateral surface of head with wide light stripes, dorsal region of head with a light V-
923 shaped mark ……*Hisonotus* sp. “Ariranhas” (rio Rancho Grande and Ariranhas drainages, upper
924 rio Uruguai basin)
925 **17b.** Dorsolateral surface of head without ligth stripes, dorsal region of head with dark marks
926 contrasting with somewhat reticular light areas……...*Hisonotus armatus* (laguna dos Patos system)
927 **18a.** Posterior portion of lateral line present, median abdominal series composed by a single row of
928 plates……..……..*Hisonotus aff. leucofrenatus* (Coastal plan of eastern laguna dos Patos system)

18b. Posterior portion of lateral line absent, median abdominal series composed by several rows of small plates, irregularly arranged ……...*Hisonotus nigricauda* (lower and middle Uruguai basin, and lower portions of laguna dos Patos system)

Discussion

The diversity of *Hisonotus* in the rio Uruguai basin is immense. As a comparison, the upper rio Paraná drainage has five species (Britski & Garavello, 2003), and just two species, apparently are found in southeastern coastal drainages of Brazil. Eight species are herein reported, but many portions of the upper rio Uruguai basin are poorly sampled, and the number of *Hisonotus* species can be understimated.

Lucena & Kullander (1992) described five general distributional patterns of the fish fauna in the rio Uruguai and neighboring drainages. The distribution of species of *Hisonotus* can be included in three of these patterns: *Hisonotus* sp. "Ariranhas", *Hisonotus* sp. "Chapecó", *Hisonotus* sp. "Passo Fundo", and *Hisonotus* sp. "Canoas" fit in the pattern (1) with species endemic from the upper rio Uruguai. *Hisonotus aky* is likely to be part of the pattern (2) of species endemic within the Uruguai. *Hisonotus nigricauda* and *Hisonotus charrua* share the pattern (5), of species restricted to the coast of Uruguay and Rio Grande do Sul plus the Uruguai drainage. The exception is *Hisonotus ringueleti* that do not fit in any pattern proposed by Lucena and Kullander (1992). That species is widespread in the middle rio Uruguai, suggesting it as an endemic component for that portion of basin.

Studying in more detail the diversity of *Hisonotus* in the rio Uruguai, two distributional patterns are observed: (1) species restricted to the upper rio Uruguai basin found in one or two

953 drainages tributaries to rio Uruguai, allopatric in distribution, and occurring in separated
954 headwaters (2) widespread species ocurring in the middle and lower Uruguai, courses inhabiting
955 several drainages, most synpatric to one another. A single species, *Hisonotus aky*, is shared between
956 upper and middle rio Uruguai courses. The distribution of that species is somewhat awkward being
957 only found in the rio Forquilha drainage (upper rio Uruguai/Brazil) and Río Yabotí-Guazu drainage
958 (middle rio Uruguai/Argentina) nowhere between these localities or downstream the latter. Rio
959 Forquilha apparently has a peculiar fish fauna as previously observed by Lucena & Kullander
960 (1992), which reported a different fauna of the cichlid genus *Crenicichla*. According to them, local
961 conditions of that drainage do not offer any clue to the presence of an endemic *Crenicichla* fauna,
962 no fall or other apparent barriers are present in the rio Forquilha. In the same manner, Rican &
963 Kullander (2006) studying the diversity of *Australoheros* cichlids, found a species inhabiting rio
964 Forquilha (*Australoheros* sp. "Forquilha") and a similar but not conspecific (*Australoheros* cf.
965 "Forquilha) inhabiting tributaries of middle portion of the Uruguay basin in Missiones/Argentina.
966 However, no conspicuous differences were found suggesting the split between *Hisonotus aky* from
967 Yabotí-Guazú and the specimens from rio Forquilha into different taxa. Moreover, the ichthyofauna
968 of some portions of upper rio Uruguai basin are still unknown, and perhaps that distributional gap,
969 could be due to the presence of poorly sampled areas.
970 Several authors suggested the upper rio Uruguai as an endemic area (Winberger et al., 1998
971 Aquino et al., 2001 Miquelarena & Lopez, 2004). The presence of a putative clade of *Hisonotus*
972 (see *Hisonotus aky* remarks in this chapter) inhabiting the upper portions of that basin reinforces
973 that endemism. These species share the derived presence of an infraorbital canal entering
974 infraorbital series via compound pterotic. That feature was discussed by myself (Carvalho, in press)
975 and seems to be a convergence between some species of *Corumbataia* and this putative clade of
976 *Hisonotus*, since these genera are not closely related (Gauger & Buckup, 2005).

977 The great diversity in the upper rio Uruguai, compared to the lower portions can be
978 explained by its accidented relief. The upper portions of the rio Uruguai basin differ from the
979 neighbouring Paraná/Paraguay system mainly by its geomorphic immaturity, indicated by the
980 sloped river profile and the prevalence of rocky substrata and strong currents (Di Persia & Neiff,
981 1986). Rapids and waterfalls are dispersal barriers for most of *Hisonotus* species, and is likely the
982 cause for allopatric speciation during the process of drainage evolution. A simililar aspect is found
983 in the headwaters of the rio Jacuí basin (Chapter 2) which possesses several endemic and
984 restrictedly distributed species.

985 The endemism of the lower portions (middle and lower courses) is less apparent. The
986 species *Hisonotus nigricauda* and *Hisonotus charrua* are widely distributed in these lower portions,
987 but are also present in other hydrographic systems. Only *Hisonotus ringueleti* is endemic for that
988 region. Aquino et al. (2001) considered that species pertaining to the upper rio Uruguai basin, which
989 differs from the definition of the rio Uruguai portions used here. Miquelarena & Lopez (2004)
990 erroneously cited *H. ringueleti* from the upper rio Uruguai. Miquelarena & Lopez (2004)
991 delimitation of rio Uruguai courses follow the same used here, which subdivides the upper course
992 (sensu Aquino et al., 2001) into middle and upper rio Uruguai. *Hisonotus ringueleti* and *H.*
993 *nigricauda* distributions are impressively complementary (Fig. 8 and Fig. 3, respectively). These
994 species are never collected together but are synpatric with *H. charrua* throughout.

995 A phylogetic review of *Hisonotus*, and more sampling efforts in the upper rio Uruguai basin
996 should provide refined evidences for discussion of history of the genus in these areas.

997

998 Acknowledgements

999

I would like thank to the following people for their help and support while visiting their institutions and for the loan of specimens: M. Sabaj and J. Lundberg (ANSP), J. Maclaine (BMNH), A. Miquelarena (ILPLA), F. Meyer (MAPA), M. Azevedo (MCN), M. Azpelicueta (MLP), O. Oyakawa (MZUSP), C. Pavanelli (NUP), J. Ferrer and L. Malabarba (UFRGS), P. Buckup (MNRJ), G. Chiaramonti and F. Firpo (MACN). I am grateful to F. Mayer, J. Verba, J. Wingert, and M. Lucena for support at the MCP collection. Thanks also to V. Bertaco, J. Wingert, C. Cramer, and especially to A. Cardoso for help collecting *Hisonotus* in the field trips. Thanks to the Centro de Microscopia e Microanálises – CEMM, PUCRS for the SEM preparations. This paper was financially supported by the "All Catfishes Species Inventory" Project (NSF DEB 0315963) that provided funding to visit museum collections. Thanks are also due to the Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq, for a studentship to TPC (process #132879/2006-9).

Literature Cited

Almirón, A. E., M. M. Azpelicueta, J. R. Casciotta, & T. Litz. 2006. A new species of *Hisonotus* (Siluriformes, Loricariidae, Otothyrini) from the República Oriental del Uruguay. Revue Suisse de Zoologie 113:87-94.

Aquino, A. E. 1997. Las especies de Hypoptopomatinae (Pisces, Siluriformes, Loricariidae) en la Argentina. Revista de Ictiologia 5:5-21.

Aquino, A. E., S. A. Schaefer & A. M. Miquelarena. 2001. A new species of *Hisonotus* (Siluriformes, Loricariidae) of the Upper Río Uruguay Basin. American Museum Novitates 3333: 1-12.

1023 Azpelicueta, M. M., J. Casciotta, A. Almirón, & S. Körber. 2004. A new species of Otothyrini
1024 (Siluriformes: Loricaridae: Hypoptopomatinae) from the Río Uruguay basin, Argentina.
1025 Verhandlungen der Gesellschaft für Ichthyologie, 2004:81-90.
1026 Azpelicueta, M. M., A. E. Almirón, J. R. Casciotta & S. Koerber. 2007. *Hisonotus hungy* sp. n.
1027 (Siluriformes, Loricariidae) a new species from arroyo Tirica, Misiones, Argentina.
1028 Revue suisse de Zoologie 114 (3): 591-598.
1029 Britski, H. A. & J. C. Garavello. 2003. *Hisonotus insperatus*: New species from the Upper Rio
1030 Paraná Basin (Pisces: Ostariophysi: Loricariidae). Copeia 2003:588-593.
1031 Carvalho T. P. in press. A new species of *Corumbataia* (Siluriformes: Loricariidae:
1032 hypoptopomatinae) from Upper Rio Tocantins basin, central Brazil. Copeia 2008.
1033 Câmara L. F. & L. Hahn. 2002. The fish fauna of two tributaries of the Passo Fundo River,
1034 Uruguay River Basin, Rio Grande do Sul, Brazil. Comunicações do Museu de Ciências e
1035 Tecnologia da PUCRS, Serie Zoologia 15:163-174.
1036 Casciotta J. R., M. M. Azpelicuta, A. E. Almirón &T. Litz. 2006. *Hisonotus candombe*, a new
1037 species from the rio Uruguay basin in the República Oriental del Uruguay. Spixiana 29:147-
1038 152.
1039 Di Persia, D. H., & J. J. Neiff. 1986. The Uruguay River system. Pp.599-621 *in*: B. R. Davies & K.
1040 F. Walker (eds). The ecology of river systems. Dr W. Junk Publishers, Dordrecht,
1041 Netherlands.
1042 Evers, H.-G. & I. Seidel. 2002. Wels Atlas. Vol. 1. Mergus, Melle, 860p.
1043 Gauger, M. F. W. & P. A. Buckup. 2005. Two new species of Hypoptopomatinae from rio Paraíba
1044 do Sul basin, with comments on the monophyly of *Parotocinclus* and Otothyrini
1045 (Siluriformes: Loricariidae). Neotropical Ichthyology 3:509-518.

1046 Liotta, J. 2005. Distribución geográfica de los peces de aguas continentales de la República
1047 Argentina. ProBiota, Serie Documentos N°3, 701 p.
1048 Lucena, C. A. S. & S. O. Kullander. 1992. The *Crenicichla* (Teleostei: Cichlidae) species of the
1049 Uruguai River drainage in Brazil. Ichthyological Exploration of Freshwaters 3:97-160.
1050 Miquelarena, A. M. & H. L. López, 2004. Considerations on the Ichthyofauna of the Uruguay River
1051 basin: *Hemiancistrus fuliginosos* Cardoso & Malabarba, 1999 (Loricariidae: Ancistrinae).
1052 Journal of Applied Ichthyology 20:238-240.
1053 Reis, R. E. & S. A. Schaefer. 1998. New cascudinhos from Southern Brazil: Systematics,
1054 Endemism, and Relationships (Siluriformes, Loricaridae, Hypoptopomatinae)
1055 Reis R. E. & T. P. Carvalho. 2007. Hypoptopomatinae. p. 83–84. In: P. A. Buckup, N. A. Menezes
1056 and M. S. Ghazzi. Catálogo das espécies de peixes de água doce do Brasil. Museu Nacional
1057 (Série Livros), Rio de Janeiro, Brazil.
1058 Regan C. T. 1904. A monograph of the fishes of the family Loricariidae. Transactions of the
1059 Zoological Society of London 17:191-350.
1060 Rican O. & S. O. Kullander. 2006. Character- and tree based delimitation of species in the
1061 '*Cichlasoma*' facetum group (Teleostei, Cichlidae) with the description of a new genus.
1062 Journal Compilation 2006:1-17.
1063 Schaefer, S. A. 1997. The Neotropical cascudinhos: Systematics and biogeography of the
1064 *Otocinclus* catfishes (Siluriformes: Loricariidae). Proceedings of the Academy of Natural
1065 Sciences of Philadelphia 148:1–120.
1066 Schaefer, S. A. 1998. Conflict and resolution: Impact of new taxa on phylogenetic studies of the
1067 neotropical cascudinhos (Siluriformes: Loricariidae) p. 375–400. *In*: L. R. Malabarba, R. E.
1068 Reis, R. P. Vari, C. A. S. Lucena, and Z. M. S. Lucena (Eds.). Phylogeny and Classification
1069 of Neotropical Fishes. Edipucrs, Porto Alegre, Brazil.

Schaefer, S. A. 2003. Loricariidae – Hypoptopomatinae (Armored catfishes) p. 321–329. *In*: R. E. Reis, S. O. Kullander & C. J. Ferraris, Jr. (Eds.). Checklist of Freshwater Fishes of the South and Central America. Edipucrs, Porto Alegre, Brazil

Taylor, W. R. & G. C. Van Dyke. 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. Cybium, 9:107–119.

Winberger P. H., R. E. Reis, & K. R. Thornton. 1998. Mitochondrial Phylogenetics, Biogeography, and Evolution of Parental Care and Mating Systems in *Gymnogeophagus* (Perciformes: Cichlidae). *In*: L. R. Malabarba, R. E. Reis, R. P. Vari, C. A. S. Lucena, and Z. M. S. Lucena (Eds.). Phylogeny and Classification of Neotropical Fishes. Edipucrs, Porto Alegre, Brazil.

Figure Legends

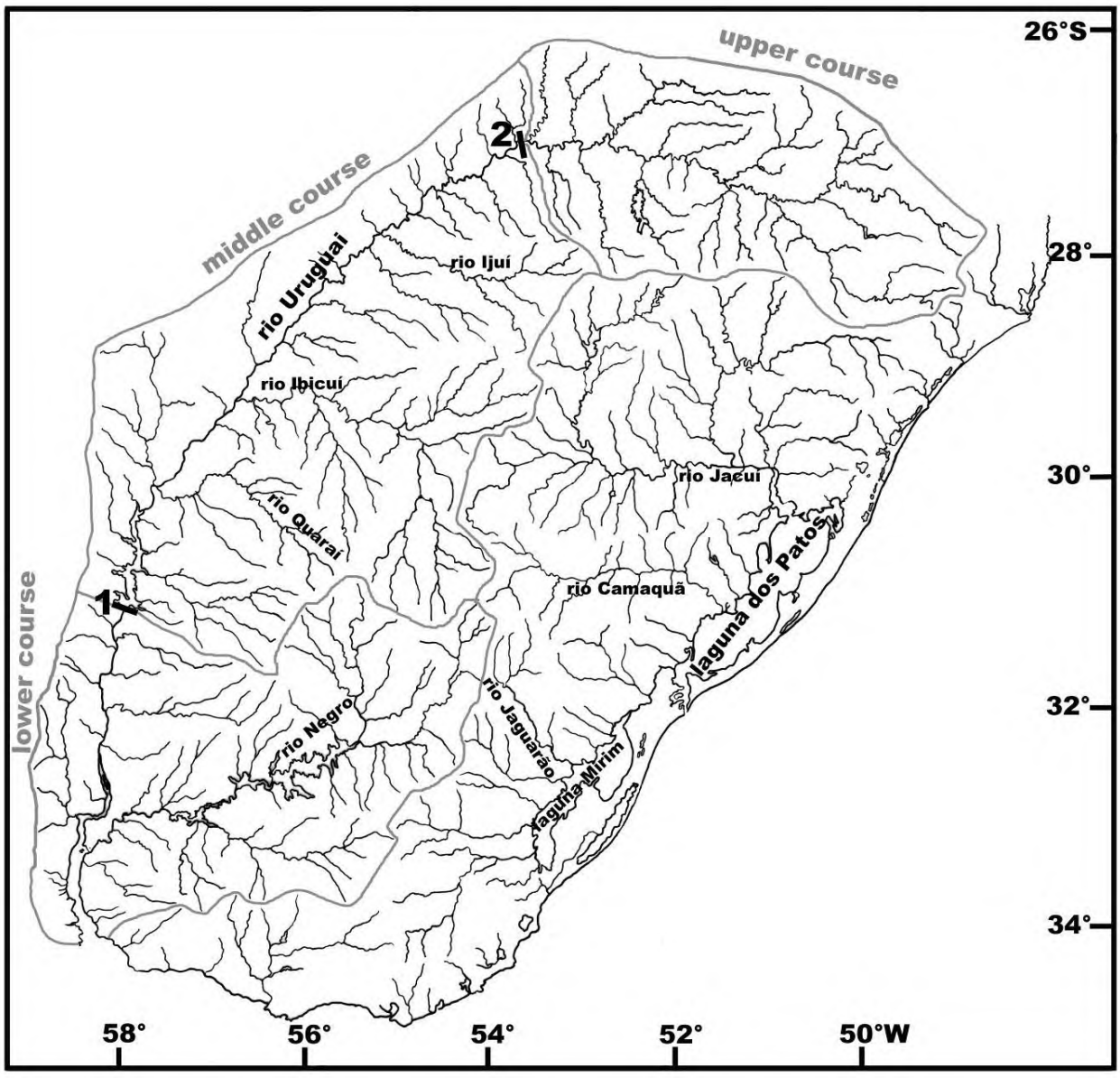


Figure 1. Drainage map of rio Uruguai basin (circulate areas) and the neighboring laguna dos Patos system. Numbers 1-2 represent the divides between lower, middle, and upper courses. 1-Salto Grande 2-Saltos do Yucumã.

Figure 2. *Hisonotus nigricauda*, MCP 26865, female, 37.9 mm SL. Arroio do Salso on highway BR-158, affluent to rio Ibicuí da Armada.

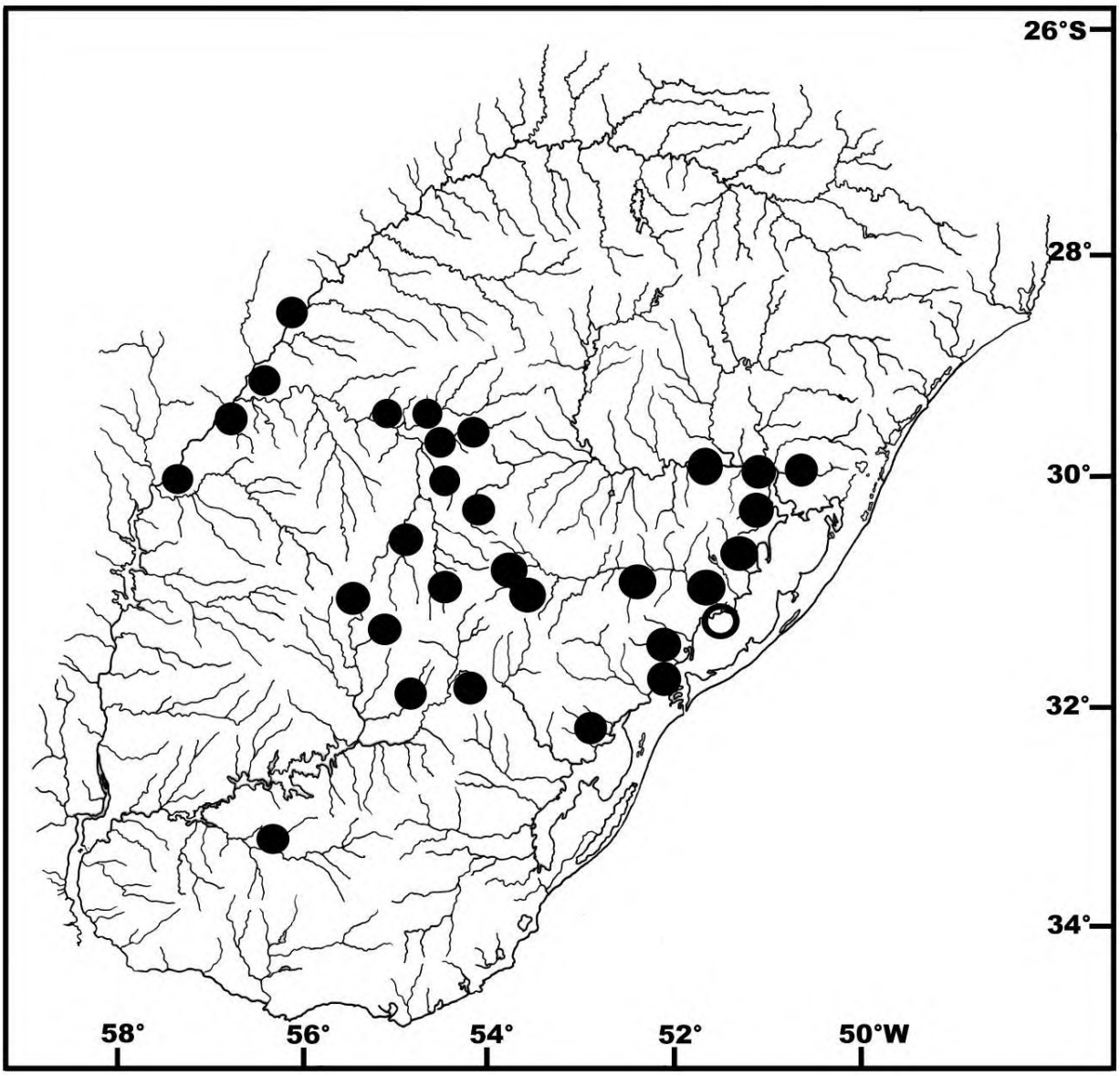


Figure 3. Drainage map of rio Uruguai basin and laguna dos Patos system showing distribution of *Hisonotus nigricauda*. Open symbol designate the probable type locality□some symbols represent more than one collecting locality.

Figure 4. Paratype of *Hisonotus ringueleti*, ILPLA 883, female, 35.5 mm SL. Creek at km 18 of route joining Santana do Livramento, Brazil and Rivera Uruguay, rio Quaraí drainage, Rivera, Uruguay.

Figure 5. *Hisonotus ringueleti*, MCP 11215, female, 37.0 mm SL. Arroio Quaraí-Mirim on road between Quaraí and Alegrete, Quaraí, Brazil.

Figure 6. Young specimens of *Hisonotus ringueleti*. A- ILPLA 883, paratype, 23.9 mm SL. Creek at km 18 of route joining Santana do Livramento, Brazil and Rivera Uruguay, rio Quaraí drainage, Rivera, Uruguay. B - MHNG 2662, paratype of *Hisonotus candombe*, 26.3 mm SL. Arroyo Palomas, Río Arapey Grande drainage, Salto, Uruguay.

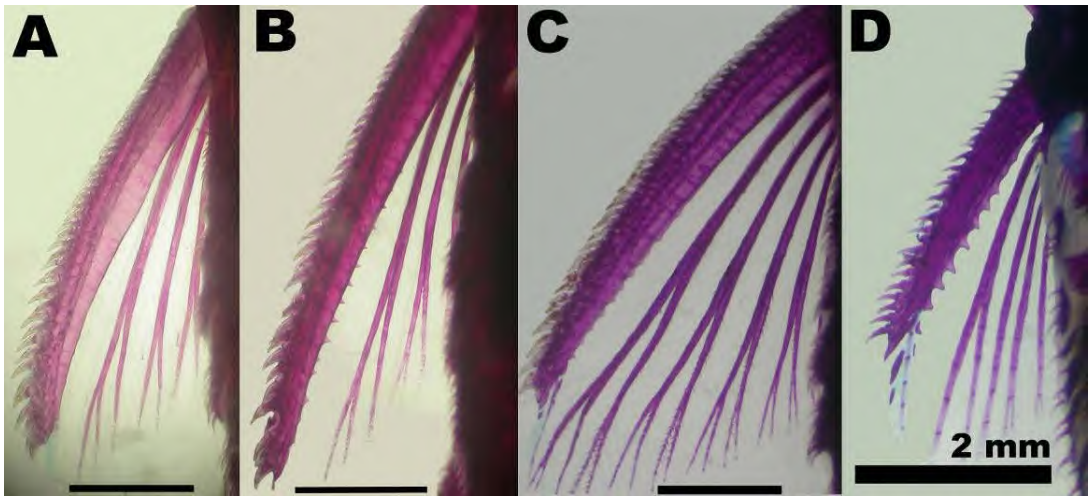


Figure 7. Left pectoral-fin spine in dorsal view. A - *Hisonotus ringueleti*, MCP 11215, 38.1 mm SL. B - *Hisonotus ringueleti*, MCP 11215, 31.2 mm SL. C - *Hisonotus* sp. "Camaquã", UFRGS 8966, 36.6 mm SL. D – *Hisonotus* sp. "Camaquã", UFRGS 8966, 22.5 mm SL. Scale bar 2mm.

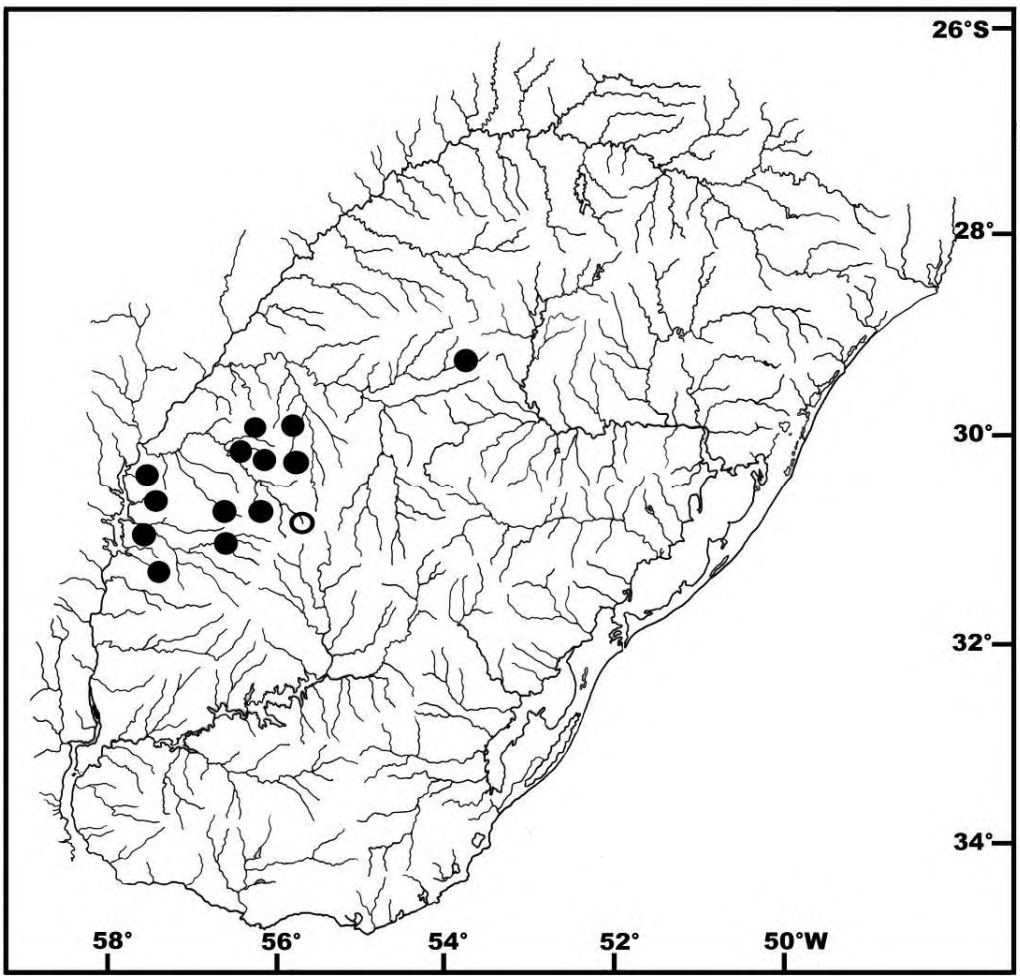


Figure 8. Drainage map of rio Uruguai basin and laguna dos Patos system showing distribution of *Hisonotus ringueleti*. Open symbol designate the type locality□some symbols represent more than one collecting locality.

Figure 9. Holotype of *Epactionotus aky*, AI 124, female, 29.2 mm SL. Arroyo Garibaldi tributary to arroyo Yabotí Guazu, Missiones, Argentina.

Figure 10. *Hisonotus aky*, MCP 41474, female, 33.7 mm SL. Rio Forquilha at Espraiado bathing spot on secondary road from Maximiliano de Almeida to Paim Filho, Paim Filho, Brazil

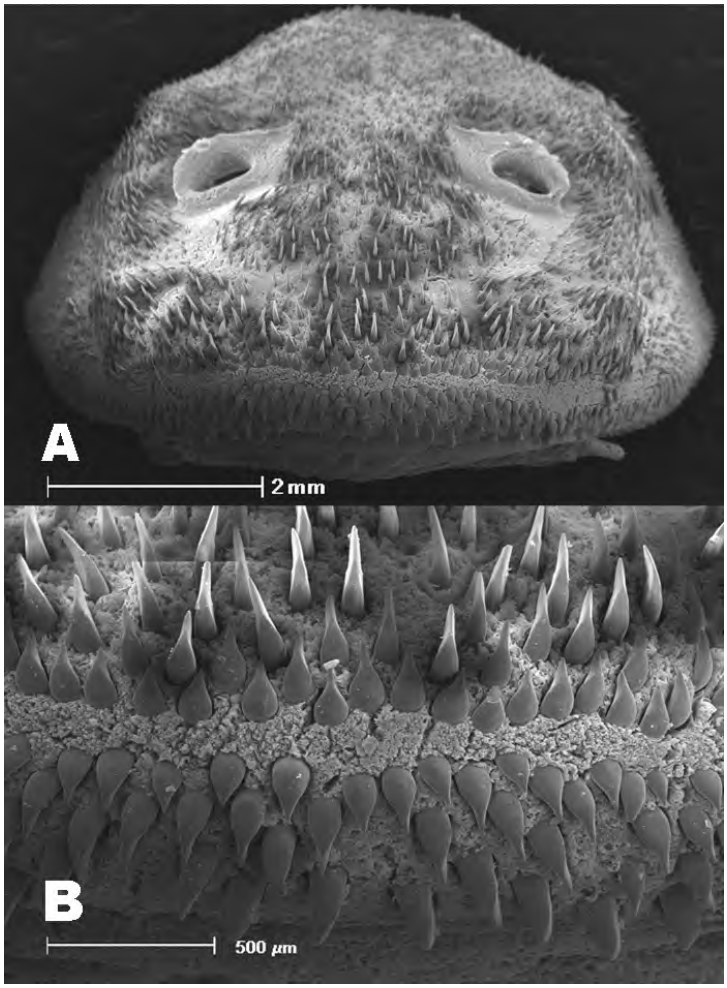


Figure 11. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus aky*, MCP 41474, 34.7 mm SL. A-anterior view of rostrum B-magnification of medial portion.

Figure 12. Live specimen of *Hisonotus aky*, MCP 41474, SL unrecorded. Rio Forquilha at Espraiado bathing spot on secondary road from Maximiliano de Almeida to Paim Filho, Paim Filho, Brazil.

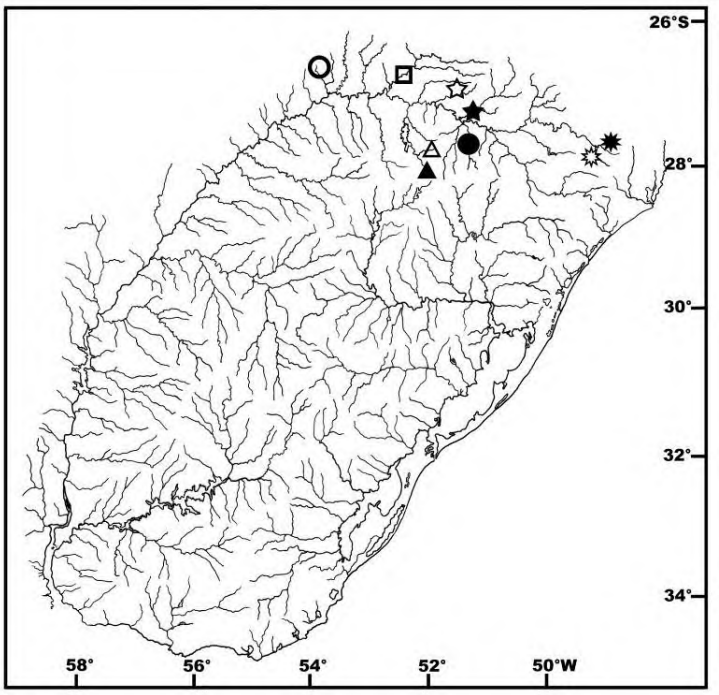


Figure 13. Drainage map showing distribution of *Hisonotus* species in the upper rio Uruguai basin. Some symbols represent more than one collecting locality. Open symbols represent type locality. *Hisonotus aky* (circles) *Hisonotus* sp. “Chapecó” (square) *Hisonotus* sp. “Passo Fundo” (triangles) *Hisonotus* sp. “Ariranhas” (star) and *Hisonotus* sp. “Canoas” (asterisk).

Figure 14. Collecting site of *Hisonotus aky*. Rio Forquilha at Espraiado bathing spot on secondary road from Maximiliano de Almeida to Paim Filho, Paim Filho, Brazil.

Figure 15. Paratype of *Hisonot*

us aky, AI 125, male, 34.5 mm SL. Anterior portion of body in ventrolateral view. Arrow indicates the developed fleshy flap on pelvic-fin spine of adult male.

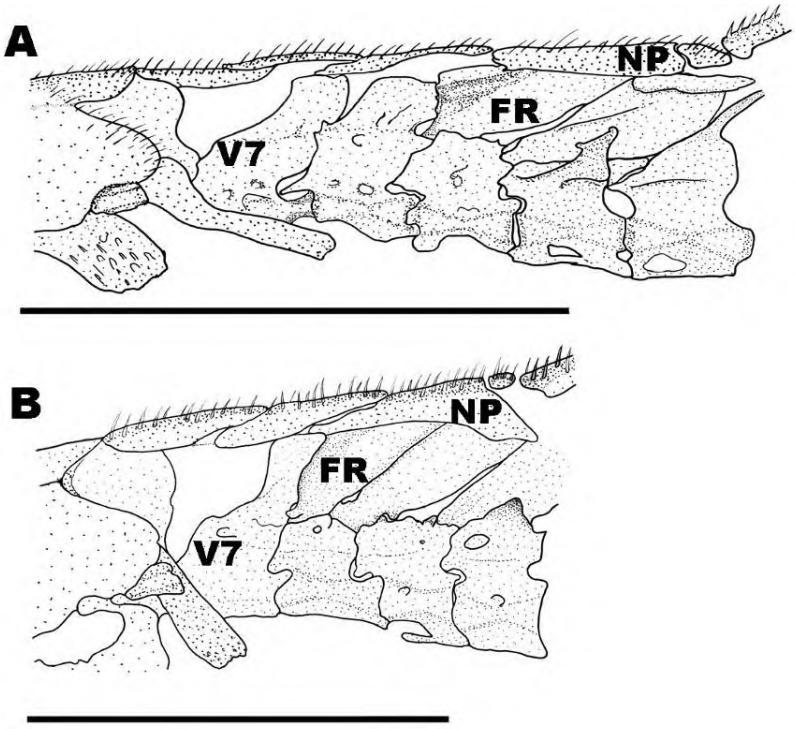


Figure 16. Anterior portion of axial skeleton in lateral view. A- *Epactionotus bilineatus*, MCP 29293, 36.5 mm SL, neural spine of seventh vertebra not contacting nuchal plate dorsally, and first proximal radial of dorsal fin contacting eighth vertebra. B- *Hisonotus aky*, MCP 41474, 37.2 mm SL, neural spine of seventh vertebra contacting nuchal plate, and first proximal radial of dorsal fin

contacting the seventh vertebra. FR = first proximal radial NP = nuchal plate V = vertebra. Scale bar is 5 mm.

Figure 17. Holotype of *Hisonotus charrua*, ZVC-P 5639, 49.2 mm SL. Cañada de los Peña, Tacuarembó, Uruguay.

Figure 18. *Hisonotus charrua* MCP 35303, female 35.8 mm SL. Arroio Garupá on road from Quaraí to Harmonia, about 33 km northeast of Quaraí, Quaraí, Brazil.

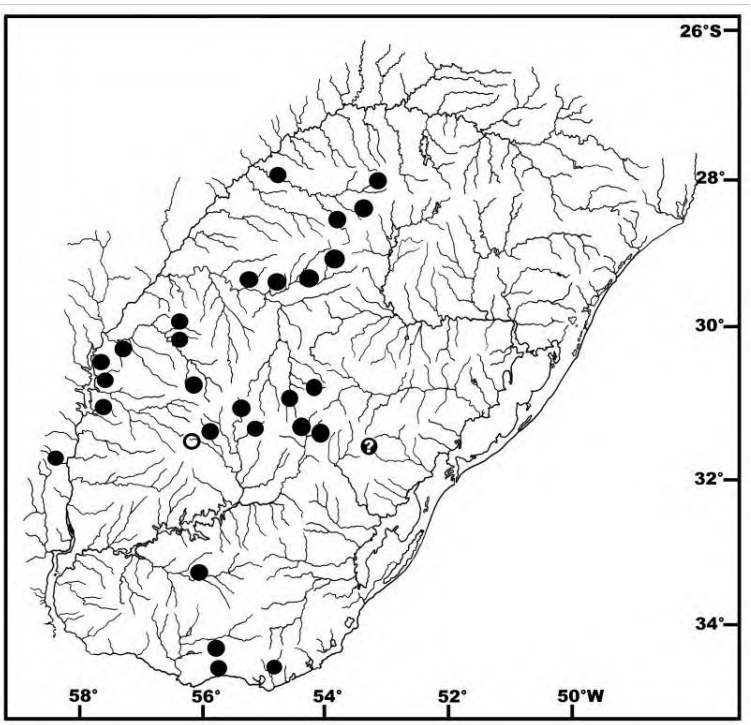


Figure 19. Drainage map showing distribution of *Hisonotus charrua* in the rio Uruguai basin, coastal streams of Uruguay, and laguna dos Patos system. Some symbols represent more than one collecting locality. Open symbol represent type locality.

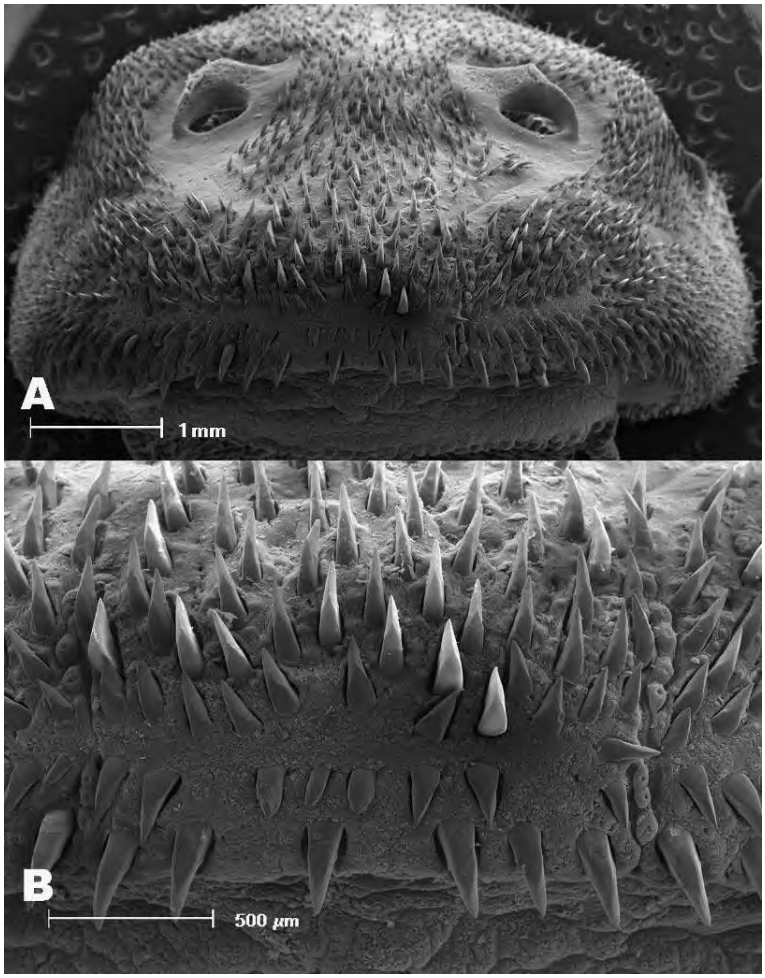


Figure 20. Scanning electron micrograph of the snout anterior rostral margin of *Hisonotus charrua* from rio Ijuí drainage, MCP 35337, 38.2 mm SL. A-anterior view of rostrum B-magnification of medial portion.

Figure 21. Scanning electron micrograph of the snout anterior rostral margin of *Hisonotus charrua*, MCP 40256, 36.0 mm SL. A-anterior view of rostrum B-magnification of medial portion.

Figure 22. Holotype of *Hisonotus* sp. “Chapecó”, MCP uncataloged, female, 33.4 mm SL. Rio Chapecó at vila São Miguel on the road from Coronel de Freitas to Quilombo, Coronel de Freitas, Brazil.

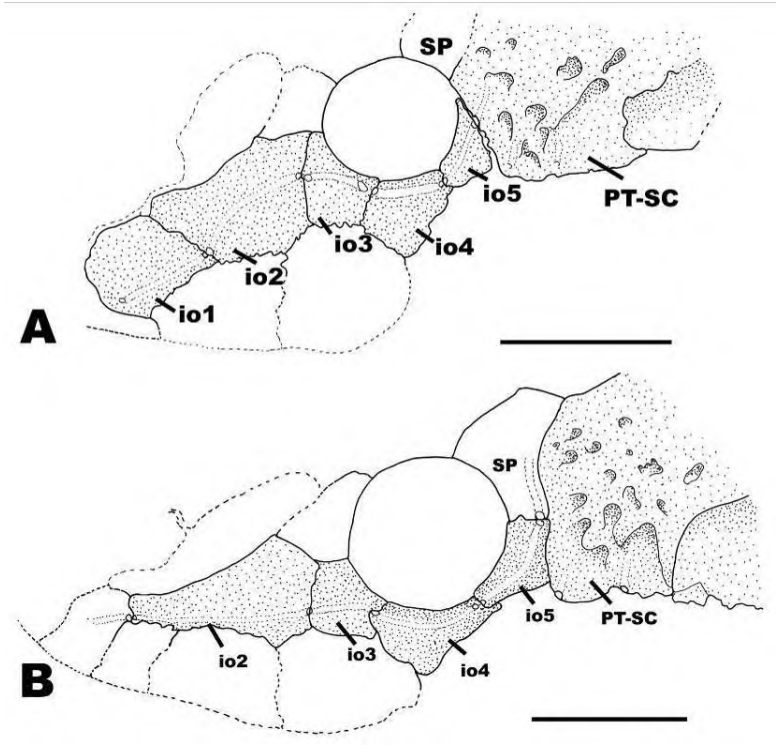


Figure 23. Skull of *Hisonotus* in dorsolateral view showing infraorbital canal. A- *Hisonotus* sp.“Chapecó”, MCP 40029, 28.0 mm SL. B- *Hisonotus ringueleti*, MCP 11215, 37.2 mm SL. Scale bar is 2 mm.

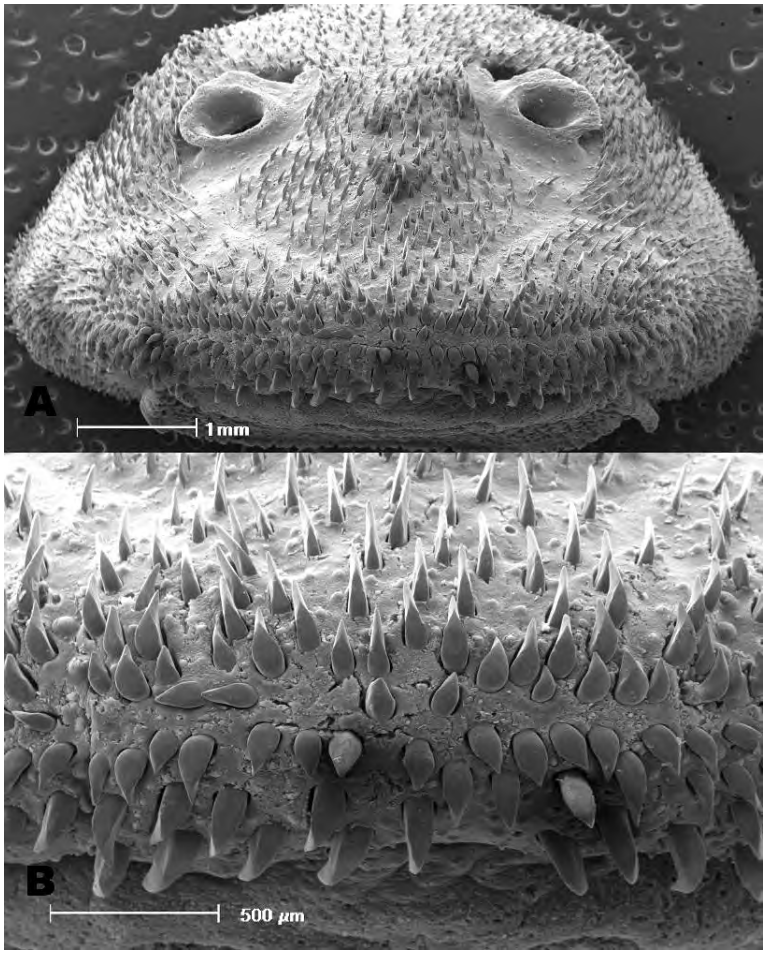


Figure 24. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus* sp. "Chapecó", MCP 40029, 29.7 mm SL. A-anterior view of rostrum B-magnification of medial portion.

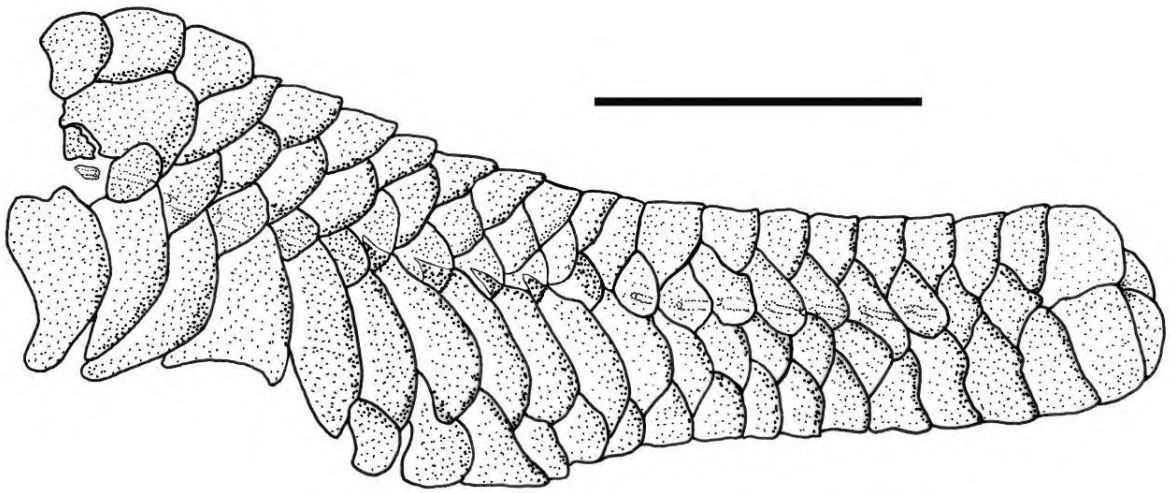


Figure 25. Trunk lateral plates of *Hisonotus* sp. “Chapecó”, lateral view of left side, MCP 40029, female, 23.3 mm SL. Scale bar is 4 mm.

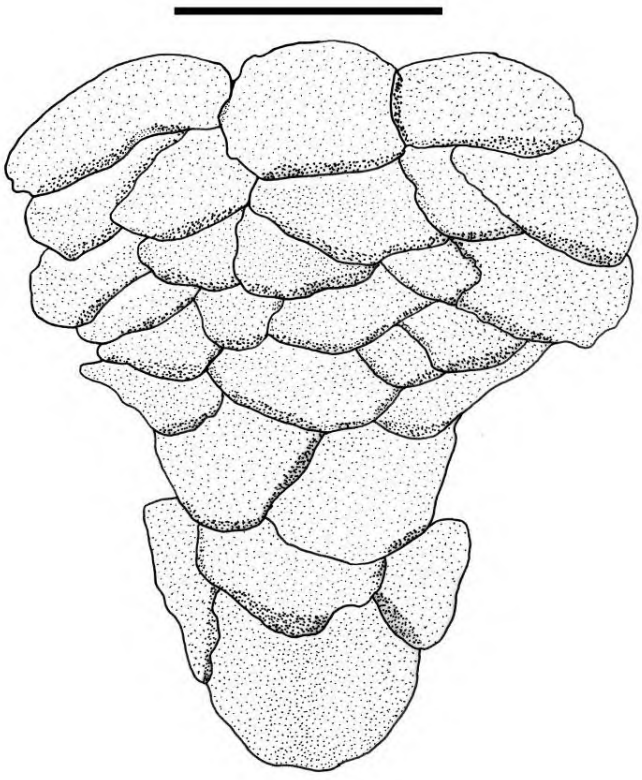


Figure 26. Arrangement of abdominal plates, *Hisonotus* sp. “Chapecó”, MCP 40029, 28.0 mm SL. Anterior portion toward top. Scale bar is 2 mm.

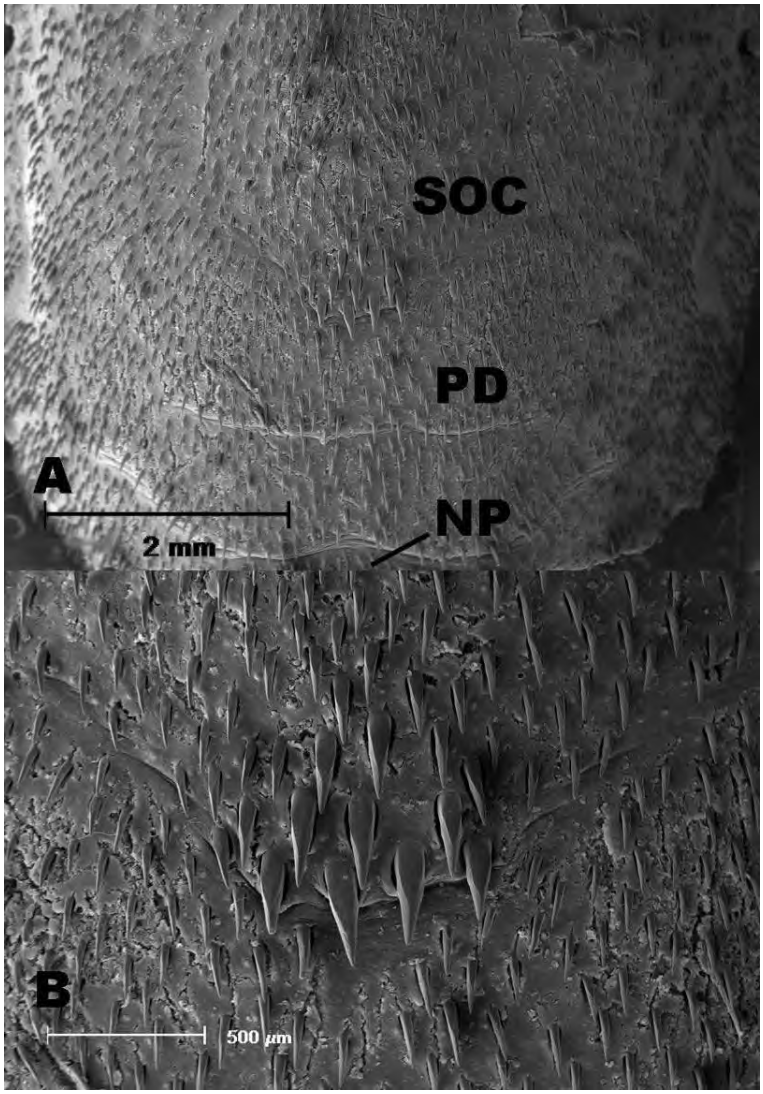


Figure 27. Scanning electron micrograph of predorsal region of *Hisonotus* sp. “Chapecó”, showing raised tuft of odontodes in posterior tip of parieto-supraoccipital. MCP 40029, 29.7 mm SL. A-dorsal view of predorsal region. B-magnification of raised odontodes. SOC – Parieto-supraoccipital PD - paired predorsal plates NP - nuchal plate.

Figure 28. Holotype of *Hisonotus* sp. “Ariranhas”, MCP uncataloged, female, 42.2 mm SL. Rio Ariranhas on bridge of highway SC-466, Xavantina, Brazil.

Figure 29. Live specimen of *Hisonotus* sp. “Ariranhas”, MCP 41354, SL unrecorded. Rio Ariranhas on bridge of highway SC-466, Xavantina, Brazil.

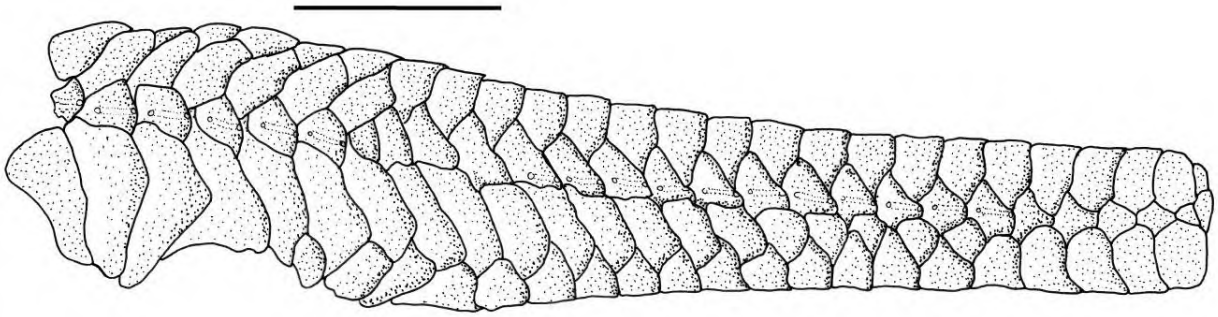


Figure 30. Trunk lateral plates of *Hisonotus* sp. “Ariranhas”, lateral view of left side, MCP 41354, 40.8 mm SL. Scale bar 4 mm.

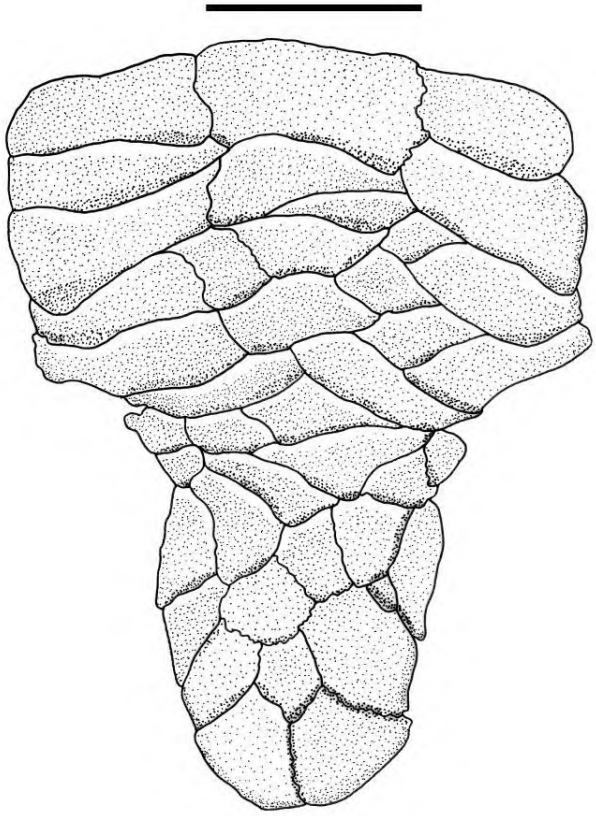


Figure 31. Arrangement of abdominal plates, *Hisonotus* sp. “Ariranhas”, MCP 41354, 40.8 mm SL. Anterior portion toward top. Scale bar 2 mm.

Figure 32. Type locality of *Hisonotus* sp. “Ariranhas”. Rio Ariranhas on bridge of highway SC-466, Xavantina, Brazil.

Figure 33. Holotype of *Hisonotus* sp. “Passo Fundo”, MCP uncatalog, female, 42.8 mm SL. Arroio Caraguatá on secundary road to highway BR-153 between Passo Fundo and Ipiranga, Coxilha, Brazil.

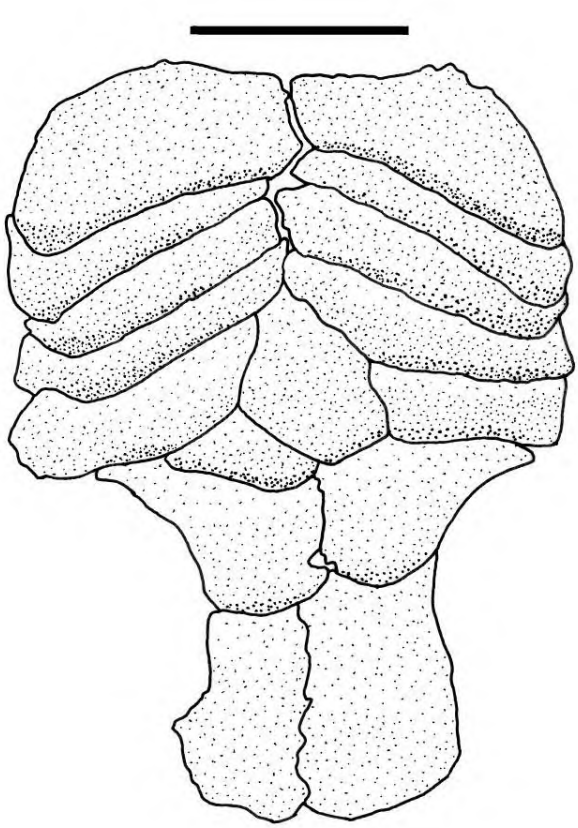


Figure 34. Arrangement of abdominal plates, *Hisonotus* sp. “Passo Fundo”, MCP 31779, 37.8 mm SL. Anterior portion toward top. Scale bar 2 mm.

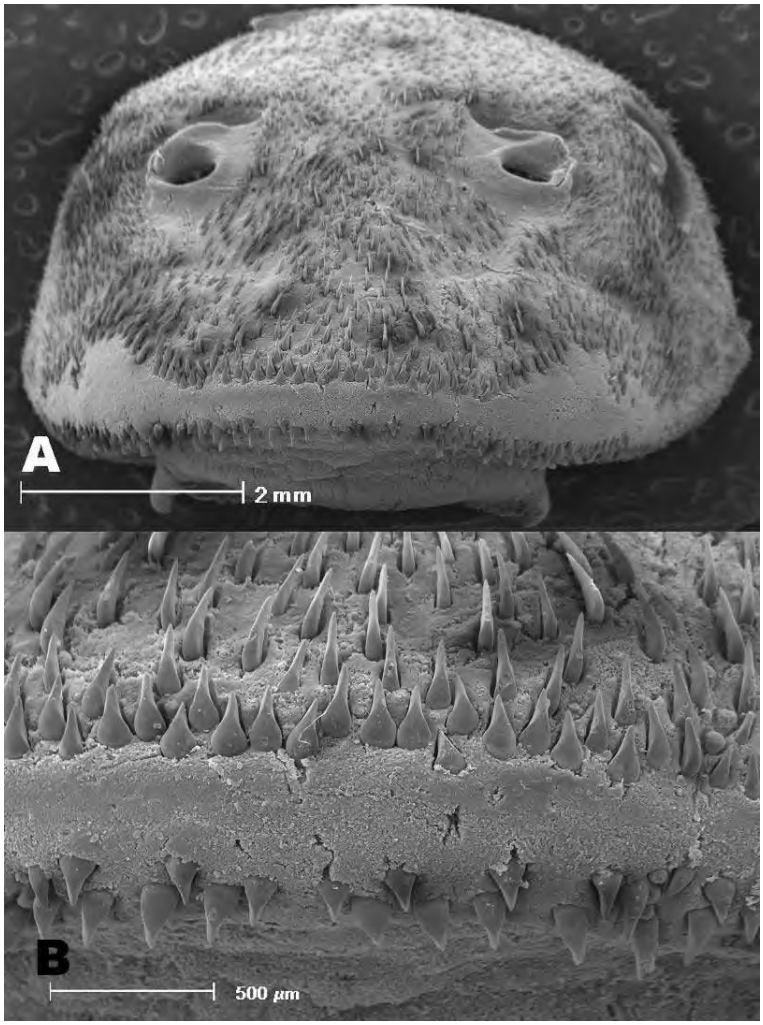


Figure 35. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus* sp. "Passo Fundo", MCP 41352, 40.9 mm SL. A-anterior view of rostrum B-magnification of medial portion.

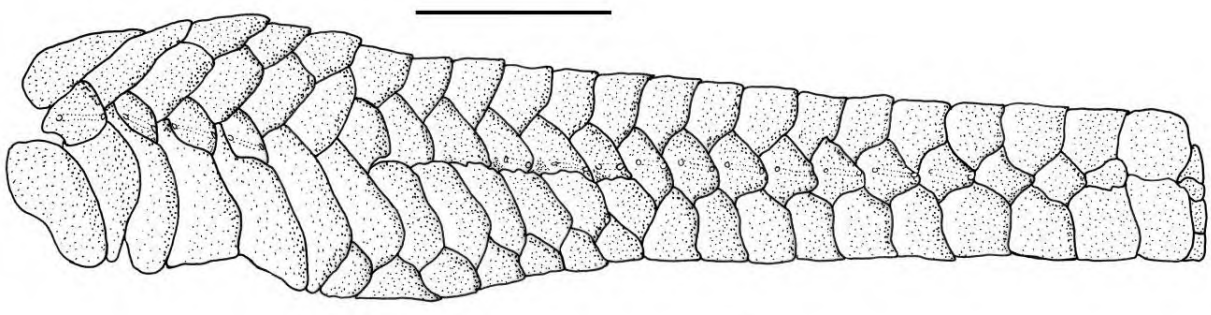


Figure 36. Trunk lateral plates of *Hisonotus* sp. "Passo Fundo", lateral view of left side, MCP 31779, 41.3 mm SL. Scale bar 4 mm.

Figure 37. Live specimen of *Hisonotus* sp. “Passo Fundo”, MCP 41352, SL unrecorded. Arroio Caraguatá on secundary road to highway BR-153 between Passo Fundo and Ipiranga, Coxilha, Brazil.

Figure 38. Type locality of *Hisonotus* sp. “Passo Fundo”, arroio Caraguatá on secundary road to highway BR-153 between Passo Fundo and Ipiranga, Coxilha, Brazil.

Figure 39. Holotype of *Hisonotus* sp. “Canoas”, MCP uncataloged, female, 43.0 mm SL. Rio Rufino on highway SC-427 at city of rio Rufino, Rio Rufino, Brazil.

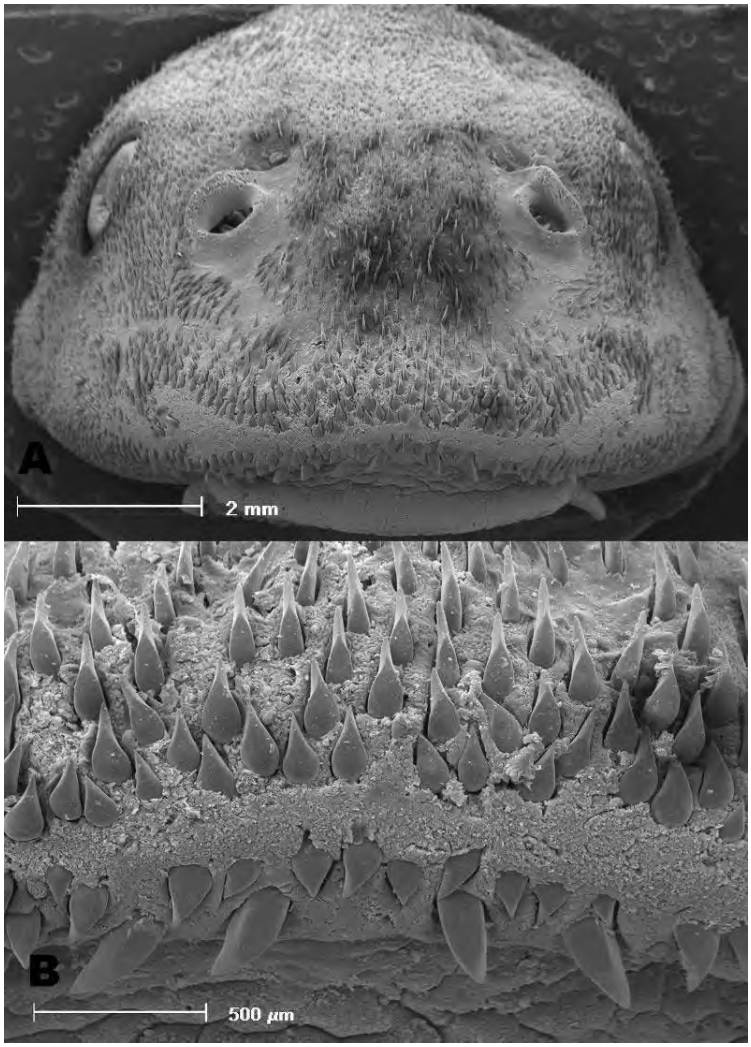


Figure 40. Scanning electron micrograph of snout anterior rostral margin of *Hisonotus* sp. "Canoas", MCP 41459, 41.4 mm SL. A-anterior view of rostrum B-magnification of medial portion.

Figure 41. Live specimen of *Hisonotus* sp. "Canoas", MCP 41459, SL unrecorded. Rio Rufino on highway SC-427 at city of rio Rufino, Rio Rufino, Brazil.

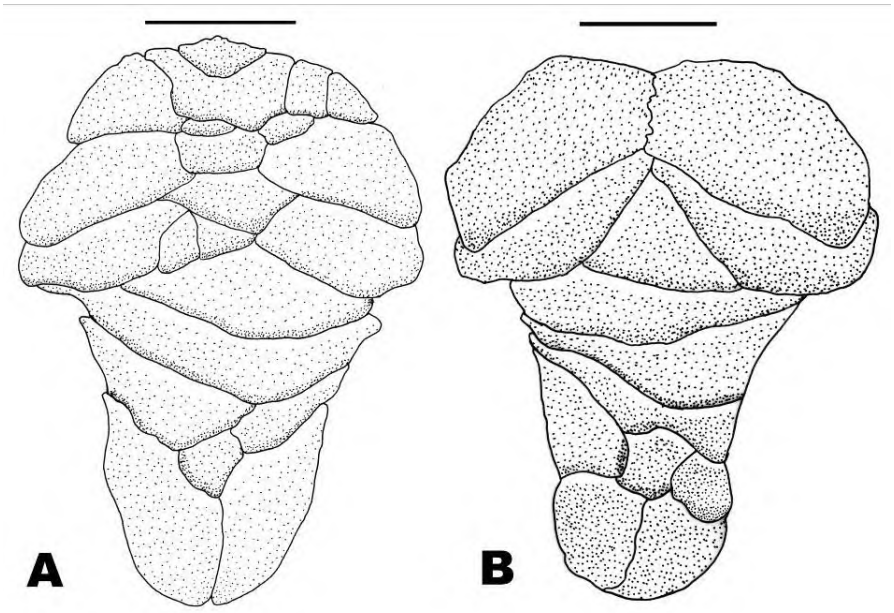


Figure 42. Arrangement of abdominal plates, *Hisonotus* sp. “Canoas”. A- MCP 41459, 37.9 mm SL. B – MCP 41459, 39.4 mm SL. Anterior portion toward top. Scale bar 2 mm.

Figure 43. Type locality of *Hisonotus* sp. “Canoas”. Rio Rufino on highway SC-427 at city of rio Rufino, Rio Rufino, Brazil.

1237 **Table 1.** Morphometrics and meristics of *Hisonotus nigricauda*. SD = Standard deviation. n = number of specimens.

	Syntypes					laguna dos Patos					rio Uruguai				
	n	Low	High	Mean	SD	n	Low	High	Mean	SD	n	Low	High	Mean	SD
Standard length (mm)	9	24.8	31.8	27.6		60	25.06	39.24	32.37	-	60	24.1	38.5	30.1	-
Percents of Standard Length															
Head length	9	33.2	39.1	36.6	1.77	60	34.1	40.8	36.0	1.16	60	34.0	38.9	36.4	1.10
Predorsal length	9	44.5	49.6	47.6	1.57	60	44.9	48.8	46.8	0.86	60	44.6	51.0	47.5	1.24
Dorsal-fin spine length	8	22.6	26.5	24.4	1.21	59	23.7	28.7	26.3	1.25	59	22.7	28.7	25.4	1.12
Anal-fin unbranched ray length	8	16.3	19.0	17.9	1.00	58	16.3	21.4	18.7	1.10	60	15.9	20.4	17.8	0.90
Pectoral-fin spine length	9	23.2	27.7	25.6	1.33	60	22.4	31.2	26.7	1.62	60	23.8	30.4	27.1	1.22
Pelvic-fin unbranched ray length	9	14.6	18.7	16.3	1.23	60	14.3	22.1	16.8	1.95	59	12.9	19.7	15.9	1.60
Cleithral width	9	23.7	25.8	24.8	0.74	60	23.4	27.3	25.2	0.77	60	23.4	27.7	25.1	0.94
Thoracic length	9	16.2	19.7	18.3	1.11	60	15.8	19.4	17.7	0.88	60	15.8	19.3	17.7	0.82
Abdominal length	9	18.0	20.6	19.2	1.00	60	18.3	21.6	19.7	0.71	60	18.1	21.5	19.7	0.87
Body depth at dorsal fin origin	9	18.2	20.3	18.8	0.66	60	17.7	21.6	19.2	0.89	60	17.3	21.9	19.1	0.99
Caudal-peduncle length	9	28.6	33.1	31.2	1.56	60	29.9	34.6	31.9	1.10	60	28.0	35.1	31.0	1.55
Caudal-peduncle depth	9	9.8	10.6	10.2	0.23	60	10.0	12.2	11.0	0.43	60	9.4	11.3	10.3	0.51
Percents of Head Length															
Snout Length	9	44.6	47.2	45.8	0.79	60	40.0	49.8	47.2	1.44	60	44.7	50.6	47.4	1.30
Orbital diameter	9	18.3	20.7	19.6	0.76	60	16.1	20.2	18.2	0.99	60	15.3	20.1	17.7	0.95
Interorbital width	9	35.9	41.9	39.2	1.75	60	38.3	47.6	43.4	1.79	60	37.4	48.5	42.2	2.29
Head depth	9	43.8	51.2	47.5	2.73	60	41.0	56.6	49.4	2.93	60	44.5	53.4	48.6	2.07
Suborbital depth	9	13.5	16.4	15.0	0.98	60	14.4	20.4	17.4	1.34	60	14.3	19.3	16.3	1.08
Mandibular ramus	9	6.1	9.3	7.5	0.97	59	6.6	9.5	8.1	0.78	60	5.8	9.7	7.5	0.85
Meristics															
Left premaxillary teeth	7	10	14	12.1	1.35	56	11	19	14.4	1.61	55	10	17	13.6	1.59
Right premaxillary teeth	7	11	15	12.7	1.50	52	11	19	14.4	1.66	59	10	17	13.3	1.54
Left dentary teeth	9	10	12	11.4	0.88	56	10	16	12.8	1.50	60	10	15	11.9	1.45
Right dentary teeth	6	10	11	10.7	0.52	54	11	16	12.6	1.40	56	10	15	11.9	1.36
Left lateral scutes	9	23	24	23.3	0.50	60	22	24	23.0	0.64	60	22	24	23.3	0.65
Right lateral scutes	9	23	24	23.3	0.50	60	22	24	23.1	0.57	60	22	24	23.3	0.63

1238 **Table 2.** Morphometrics and meristics of *Hisonotus ringueleti*. SD = Standard deviation, n = number of specimens, H = holotype.

	H. ringueleti types						*H. candombe* types						*H. ringueleti* non-types				
	H	n	Low	High	Mean	SD	H	n	Low	High	Mean	SD	n	Low	High	Mean	SD
Standard length (mm)	35.4	30	27.0	35.5	30.4		28.7	7	23.6	29.2	26.4		30	28.4	43.5	34.5	
Percents of Standard Length																	
Head length	34.6	30	34.2	38.9	36.2	1.17	35.6	7	35.6	38.9	37.7	1.23	30	32.7	37.2	35.3	1.31
Predorsal length	46.3	30	43.9	50.7	47.1	1.53	45.2	7	45.2	48.2	47.2	1.12	30	43.5	48.0	45.8	1.13
Dorsal-fin spine length	26.1	30	24.6	30.6	26.6	1.33	25.6	7	24.0	28.5	26.1	1.42	28	23.2	29.0	26.2	1.46
Anal-fin unbranched ray length	18.8	30	17.2	22.0	19.3	1.04	16.4	7	16.4	20.1	18.0	1.30	30	15.9	20.7	18.3	1.12
Pectoral-fin spine length	25.9	30	24.8	28.9	26.7	0.97	24.4	7	24.4	27.0	25.7	1.13	30	23.8	28.7	26.1	1.14
Pelvic-fin unbranched ray length	13.7	30	13.7	20.8	16.9	1.99	15.7	7	14.5	17.8	16.3	1.33	29	12.9	20.1	16.0	2.10
Cleithral width	23.2	30	21.8	24.6	23.2	0.74	22.8	7	22.8	24.3	23.5	0.57	30	22.0	24.5	23.1	0.56
Thoracic length	15.3	30	14.5	17.9	16.0	0.88	16.8	7	16.3	17.1	16.8	0.24	30	16.1	19.0	17.5	0.78
Abdominal length	19.2	30	17.1	20.7	19.1	0.92	18.6	7	18.3	20.9	19.5	0,84	30	17.9	21.3	19.5	0.99
Body depth at dorsal-fin origin	18.9	30	17.2	21.6	19.8	0.92	20.1	7	18.8	21.0	19.9	0.78	30	18.1	22.2	20.0	0.88
Caudal-peduncle length	31.8	30	28.7	35.4	32.0	1.62	34.4	7	28.4	34.4	31.2	2.15	30	29.5	35.0	32.2	1.42
Caudal-peduncle depth	14.0	30	12.5	14.9	13.5	0.68	13.6	7	13.4	14.9	14.1	0.53	30	12.1	15.2	13,6	0.85
Percents of Head Length																	
Snout Length	47.5	30	44.9	49.2	46.9	1.10	48.1	7	46.9	49.8	48.1	1.01	30	45.7	50.5	47.9	1.29
Orbital diameter	18.6	30	17.7	20.7	19.4	0.78	17.0	7	17.0	19.4	18.5	0.91	30	17.3	20.8	18.9	0.88
Interorbital width	40.4	30	35.3	43.7	40.4	1.83	39.4	7	37.3	41.5	38.5	1.47	30	36.5	45.6	40.8	1.91
Head depth	52.5	30	47.0	55.9	51.3	2.12	50.8	7	46.8	50.8	49.7	1.38	30	48.0	56.8	52.5	2.33
Suborbital depth	16.7	30	14.4	18.4	16.6	1.02	18.6	7	15.1	18.6	17.0	1.13	30	15.7	19.4	17.5	0.89
Mandibular ramus	8.7	30	6.1	9.3	8.1	0.70	9.0	7	7.1	9.5	8.6	0.87	30	7.3	9.7	8.4	0.70
Meristics																	
Left premaxillary teeth	14	30	11	15	13.4	1.28	13	6	12	14	13.0	0.89	28	10	18	14.3	1.78
Right premaxillary teeth	14	30	11	17	13.8	1.47	15	6	11	15	13.5	1.64	28	12	20	14.5	1.75
Left dentary teeth	14	30	10	15	12.6	1.30	12	6	10	12	11.2	0.98	29	10	16	12.7	1.37
Right dentary teeth	12	27	10	15	12.4	1.39	-	6	10	13	11.2	1.47	29	10	15	12.7	1.32
Left lateral scutes	24	30	22	24	23.2	0.63	24	7	23	24	23.6	0.53	30	22	24	23.5	0.57
Right lateral scutes	23	30	22	24	23.3	0.66	24	7	23	24	23.4	0.53	30	22	24	23.5	0.63

1239 **Table 3.** Frequency distribution for left and right lateral plate counts of species of *Hisonotus* in the

1240 rio Uruguai basin. N = number of specimens.

	Left Lateral Plates							
Species	20	21	22	23	24	25	N	Mean
Nigricauda			7	31	22		60	23.3
Ringueleti			4	34	29		67	23.4
Aky			7	19	2		28	22.8
Charrua				27	36	40	103	24.1
"Passo Fundo"			5	12	3		20	22.9
"Ariranhas"				4	5		9	23.6
"Canoas"			8	10			18	22.6
"Chapecó"	5	13	2				20	20.9

	Right Lateral Plates							
Species	20	21	22	23	24	25	N	Mean
Nigricauda			6	33	21		60	23.3
Ringueleti			5	30	32		67	23.4
Aky			11	14	3		28	22.7
Charrua				21	42	40	103	24.1
"Passo Fundo"			3	14	3		20	23.0
"Ariranhas"				4	5		9	23.6
"Canoas"			8	10			18	22.6
"Chapecó"	8	11	1				20	20.7

1241 **Table 4.** Morphometrics and meristics of *Hisonotus aky*. SD = Standard deviation, n = number of

1242 specimens, H = holotype.

	types						non-types				
	H	n	Low	High	Mean	SD	n	Low	High	Mean	SD
Standard length (mm)	29.2	8	25.0	34.5	28.6		20	28.8	39.7	32.06	
Percents of Standard Length											
Head length	35.6	8	34.9	38.7	36.7	1.43	20	33.3	36.3	34.8	0.81
Predorsal length	46.4	8	45.6	48.3	47.1	1.36	20	42.8	47.7	46.2	1.06
Dorsal-fin spine length	24.5	7	24.3	26.5	25.5	1.00	20	20.7	26.4	23.6	1.48
Anal-fin unbranched ray length	17.5	8	17.0	20.8	18.1	1.22	19	15.1	18.4	16.4	0.91
Pectoral-fin spine length	24.0	8	23.7	27.9	25.5	1.44	20	21.4	26.7	24.3	1.30
Pelvic-fin unbranched ray length	16.7	8	15.6	21.2	17.9	2.02	20	14.9	21.6	17.5	2.10
Cleithral width	23.5	8	23.5	26.0	24.8	0.90	20	23.6	25.6	24.4	0.62
Thoracic length	17.3	8	16.2	18.0	17.2	0.57	20	13.1	18.2	16.1	1.11
Abdominal length	19.7	8	17.5	21.8	19.3	1.24	20	18.8	22.6	20.7	0,86
Body depth at dorsal-fin origin	20.2	8	19.7	23.8	20.8	1.29	20	18.5	22.0	20.6	0.70
Caudal-peduncle length	33.6	8	32.3	34.5	33.5	0.68	20	31.3	36.0	33.5	1.25
Caudal-peduncle depth	12.3	8	12.3	14.3	13.0	0.65	20	11.3	13.2	11.9	0.48
Percents of Head Length											
Snout Length	48.6	8	48.4	51.2	49.3	0.96	20	48.5	53.8	51.2	1.55
Orbital diameter	17.4	8	16.3	18.4	17.4	0.71	20	15.4	17.9	16.7	0.75
Interorbital width	37.7	8	37.6	43.2	39.6	2.13	20	38.5	43.0	40.5	1.34
Head depth	55.5	8	48.4	58.3	52.4	3.65	20	51.2	56.9	53.4	1.40
Suborbital depth	20.3	8	16.7	22.9	19.9	2.16	20	21.1	24.3	22.4	0.80
Mandibular ramus	7.8	8	6.5	10.1	8.3	1.48	20	7.9	10.7	9.2	0.74
Meristics											
Left premaxillary teeth	17	8	11	17	14,1	1,89	20	10	14	12.4	5.33
Right premaxillary teeth	16	8	12	16	14,3	1,75	20	11	14	12.6	3.85
Left dentary teeth	13	8	11	16	12,9	1,96	20	10	15	11.9	5.04
Right dentary teeth	12	8	11	15	12,6	1,51	20	11	15	12.4	4.95
Left lateral scutes	23	8	22	23	22.9	0.35	20	22	24	22.8	0.62
Right lateral scutes	23	8	22	24	23.1	0.64	20	22	24	22.6	0.60

1243 **Table 5.** Morphometrics and meristics of *Hisonotus charrua*. SD = Standard deviation. n = number of specimens. H = holotype.

	H. charrua types						*H. charrua* Uruguai basin					*H. charrua* Laguna dos Patos				
	H	n	Low	High	Mean	SD	n	Low	High	Mean	SD	n	Low	High	Mean	SD
Standard length (mm)	49.2	6	37.1	49.2	42.8	-	103	22.49	50.53	35.48	-	10	33.8	45.6	37.5	-
Percents of Standard Length																
Head length	33.0	6	33.0	36.4	34.6	1.33	103	32.3	39.4	35.4	1.44	10	32.0	34.8	33.8	1.04
Predorsal length	45.9	6	44.8	48.5	46.7	1.28	103	44.2	49.6	47.3	1.20	10	43.6	47.1	46.1	1.22
Dorsal-fin spine length	23.7	6	21.3	25.7	23.5	1.59	103	20.0	29.1	24.1	1.87	10	22.7	26.3	24.8	0.99
Anal-fin unbranched ray length	16.4	6	14.7	18.7	16.7	1.49	102	13.5	19.6	16.8	1.23	10	16.2	19.3	17.6	0.88
Pectoral-fin spine length	25.5	6	23.9	27.5	25.7	1.35	103	21.4	31.0	25.5	1.75	10	24.2	27.9	25.7	1.29
Pelvic-fin unbranched ray length	14.9	6	14.4	20.1	17.3	2.57	103	12.2	23.9	16.5	2.07	10	15.7	21.0	18.9	1.57
Cleithral width	22.8	6	22.8	24.8	24.0	0.78	103	21.8	25.7	23.9	0.88	10	23.0	25.2	24.1	0.68
Thoracic length	16.0	6	15.8	17.3	16.5	0.58	103	14.8	20.0	16.6	0.89	10	15.8	17.9	17.0	0.76
Abdominal length	19.7	6	19.0	20.9	19.8	0.65	103	16.1	22.1	20.0	1.01	10	18.8	20.6	19.8	0.63
Body depth at dorsal-fin origin	19.2	6	19.2	20.9	20.3	0.59	103	16.0	21.6	19.2	1.13	10	19.6	22.0	20.6	0.77
Caudal-peduncle length	33.3	6	31.9	33.8	33.0	0.79	103	28.7	36.4	32.7	1.40	10	32.1	34.9	33.4	0.89
Caudal-peduncle depth	11.5	6	11.5	12.2	12.0	0.26	103	9.6	13.4	11.8	0.82	10	11.6	13.0	12.2	0.50
Percents of Head Length																
Snout Length	48.2	6	47.4	49.8	48.3	0.83	103	43.4	52.4	49.2	1.34	10	45.7	51.4	48.5	1.76
Orbital diameter	15.5	6	14.8	18.0	16.1	1.12	103	13.4	18.7	16.3	1.09	10	14.9	17.8	16.6	0.75
Interorbital width	44.8	6	42.6	45.2	44.0	1.19	103	35.7	47.6	40.7	2.41	10	40.8	47.1	43.9	1.94
Head depth	53.6	6	53.0	55.0	53.9	0.70	103	42.2	54.6	49.2	3.12	10	51.0	58.9	53.3	2.48
Suborbital depth	17.8	6	16.8	19.4	18.1	0.98	103	14.9	21.9	18.2	1.65	10	17.5	22.1	20.4	1.42
Mandibular ramus	7.8	6	7.2	8.7	8.0	0.53	103	6.5	9.8	8.0	0.71	10	7.5	9.7	8.6	0.75
Meristics																
Left premaxillary teeth	18	5	13	19	17.0	2.35	101	12	20	15.7	1.95	10	14	18	16.5	1.43
Right premaxillary teeth	19	6	14	19	17.3	1.86	101	12	21	15.9	1.87	10	16	20	17.4	1.51
Left dentary teeth	12	6	12	18	15.0	2.19	102	11	19	14.3	1.72	10	14	19	15.7	1.70
Right dentary teeth	15	6	14	17	15.3	1.03	100	11	19	14.4	1.92	10	14	19	16.0	1.56
Left lateral scutes	25	6	24	25	24.2	0.41	103	23	25	24.1	0.76	10	23	25	24.0	0.67
Right lateral scutes	25	6	23	25	24.0	0.63	103	23	25	24.1	0.76	10	23	25	24.0	0.82

TABLE 6. Morphometrics and meristics of *Hisonotus* sp. "Chapecó". SD = Standard deviation, n = number of specimens, H = holotype.

	types					
	H	n	Low	High	Mean	SD
Standard length (mm)	33.4	20	22.6	33.4	26.8	-
Percents of Standard Length						
Head length	37.2	20	36.3	41.1	38.4	1.15
Predorsal Length	50.4	20	47.5	52.6	50.1	1.24
Dorsal-fin spine length	21.9	20	21.9	27.0	24.8	1.20
Anal-fin unbranched ray length	13.1	20	13.1	19.3	16.9	1.29
Pectoral-fin spine length	22.5	20	22.5	29.5	27.4	1.65
Pelvic-fin unbranched ray length	16.6	20	15.9	21.5	18.8	1.67
Cleithral width	28.4	20	27.6	30.5	29.1	0.9
Thoracic length	18.8	20	16.0	19.3	17.8	0.87
Abdominal length	21.4	20	19.2	21.9	20.5	0.78
Body depth at dorsal-fin origin	21.7	20	19.9	23.7	22,3	0.78
Caudal-peduncle length	29.3	20	28.4	32.4	30.6	1.19
Caudal-peduncle depth	13.9	20	12.9	15.8	14.2	0.67
Percents of Head Length						
Snout Length	51.3	20	48.6	53.8	51.3	1.33
Orbital diameter	15.2	20	15.1	17.5	16.1	0.76
Interorbital width	36.8	20	36.4	40.5	37.9	1.01
Head depth	55.7	20	51.1	57.9	54.8	1.97
Suborbital depth	22.0	20	21.4	27.2	22.9	1.29
Mandibular ramus	7.3	20	6.6	9.2	8.2	0.68
Meristics						
Left premaxillary teeth	10	14	9	13	11.1	1.14
Right premaxillary teeth	10	16	9	14	11.3	1.44
Left dentary teeth	11	19	9	13	10.8	1.03
Rigth dentary teeth	-	17	9	12	10.6	1.09
Left lateral scutes	21	20	20	22	20.9	0.59
Rigth lateral scutes	20	20	20	22	20.7	0.59

1246 **TABLE 7.** Morphometrics and meristics of *Hisonotus* sp. "Ariranhas". SD = Standard deviation, n =

1247 number of specimens, H = holotype.

	types					
	H	n	Low	High	Mean	SD
Standard length (mm)	42.2	9	28.3	42.2	36.0	-
Percents of Standard Length						
Head length	35.0	9	32.9	37.5	34.8	1.28
Predorsal length	46.8	9	44.5	48.5	46.0	1.18
Dorsal-fin spine length	21.3	9	21.3	25.1	23.8	1.30
Anal-fin unbranched ray length	16.8	8	14.5	18.0	16.7	1.11
Pectoral-fin spine length	22.6	9	20.8	27.0	23.7	1.67
Pelvic-fin unbranched ray length	17.8	9	14.2	20.4	18.0	1.76
Cleithral width	23.3	9	22.2	24.1	23.1	0.54
Thoracic length	16.7	9	15.1	16.8	16.1	0.60
Abdominal length	20.6	9	19.2	21.2	20.4	0.61
Body depth at dorsal-fin origin	18.9	9	17.6	20.2	18.9	0.87
Caudal-peduncle length	32.9	9	31.9	35.9	33.2	1.51
Caudal-peduncle depth	10.1	9	9.8	11.8	10.6	0.59
Percents of Head Length						
Snout Length	48.6	9	46.8	48.8	47.8	0.67
Orbital diameter	15.1	9	15.1	16.5	15.9	0.38
Interorbital width	38.7	9	36.1	42.7	39.5	2.13
Head depth	50.2	9	46.2	52.8	49.5	2.48
Suborbital depth	18.1	9	17.3	20.0	18.9	0.88
Mandibular ramus	7.2	9	7.1	8.4	7.7	0.51
Meristics						
Left premaxillary teeth	12	9	11	15	12.8	1.79
Right premaxillary teeth	13	9	10	16	12.9	2.09
Left dentary teeth	14	9	10	15	12.7	1.80
Rigth dentary teeth	13	9	10	15	12.7	1.50
Left lateral scutes	23	9	23	24	23.6	0.53
Rigth lateral scutes	23	9	23	24	23.6	0.53

Table 8. Morphometrics and meristics of *Hisonotus* "Passo Fundo". SD = Standard deviation, n = number of specimens, H = holotype.

	types					
	H	n	Low	High	Mean	SD
Standard length (mm)		20	30.7	47.1	38.6	
Percents of Standard Length						
Head length	32.1	20	29.6	35.5	32.3	1.30
Predorsal Length	45.7	20	41.2	46.7	44.2	1.44
Dorsal-fin spine length	21.6	20	19.4	24.4	21.5	1.31
Anal-fin unbranched ray length	15.7	19	13.4	19.1	16.2	1.33
Pectoral-fin spine length	22.6	19	20.4	26.0	22.7	1.47
Pelvic-fin unbranched ray length	12.2	20	12.2	19.9	15.7	2.44
Cleithral width	22.3	20	20.5	23.3	22.0	0.76
Thoracic length	15.4	20	14.6	17.1	16.1	0.83
Abdominal length	18.1	20	17.9	20.6	19.1	0.64
Body depth at dorsal-fin origin	20.0	20	17.8	21.1	19.3	1.01
Caudal-peduncle length	38.8	20	33.3	39.1	36.8	1.50
Caudal-peduncle length	11.2	20	10.3	12.6	11.4	0.67
Percents of Head Length						
Snout Length	53.0	20	46.4	53.0	49.9	1.48
Orbital diameter	15.6	20	13.9	16.8	15.3	0.84
Interorbital width	41.6	20	39.4	44.9	42.1	1.51
Head depth	55.5	20	49.8	56.2	53.0	2.19
Suborbital depth	22.0	20	19.3	23.6	21.8	1.16
Mandibular ramus	7.9	20	6.2	8.5	7.6	0.76
Meristics						
Left premaxillary teeth	20	20	13	21	17.4	2.52
Right premaxillary teeth	20	19	14	22	17.4	2.52
Left dentary teeth	18	20	12	19	16.1	1.86
Rigth dentary teeth	16	20	12	19	15.6	1.70
Left lateral scutes	23	20	22	24	22.9	0.64
Rigth lateral scutes	23	20	22	24	23.0	0.56

Table 9. Morphometrics and meristics of *Hisonotus* sp. "Canoas". SD = Standard deviation, n = number of specimens, H = holotype.

	types					
	H	n	Low	High	Mean	SD
Standard length (mm)		18	27.1	45.1	36.3	
Percents of Standard Length						
Head length	33.3	18	31.8	37.6	33.7	1.67
Predorsal Length	44.9	18	41.9	46.8	44.3	1.32
Dorsal-fin spine length	22.3	18	21.7	25.3	23.6	1.12
Anal-fin unbranched ray length	16.8	18	15.8	19.8	17.8	1.14
Pectoral-fin spine length	23.8	18	21.0	25.1	23.6	1.03
Pelvic-fin unbranched ray length	14.3	18	13.1	20.1	17.1	2.05
Cleithral width	23.7	18	22.9	25.2	23.8	0.70
Thoracic length	16.0	18	14.3	16.3	15.6	0.57
Abdominal length	20.9	18	18.2	21.6	20.2	0.91
Body depth at dorsal-fin origin	20.1	18	19.7	21.9	20.7	0.64
Caudal-peduncle length	35.1	18	33.5	38.7	35.8	1.41
Caudal-peduncle depth	11.0	18	10.4	12.8	11.6	0.56
Percents of Head Length						
Snout Length	48.0	18	46.1	49.5	48.1	1.00
Orbital diameter	15.2	18	14.9	18.0	16.7	0.86
Interorbital width	41.3	18	35.9	44.9	41.2	3.08
Head depth	56.2	18	51.0	59.5	55.7	2.70
Suborbital depth	22.5	18	18.0	24.3	22.3	1.52
Mandibular ramus	8.25	18	7.1	9.2	8.4	0.72
Meristics						
Left premaxillary teeth	14	18	11	14	12.2	1.10
Right premaxillary teeth	14	18	10	14	11.9	1.13
Left dentary teeth	13	18	8	14	10.7	1.87
Rigth dentary teeth	13	18	9	13	11.2	1.44
Left lateral scutes	23	18	22	23	22.6	0.51
Rigth lateral scutes	22	18	22	23	22.6	0.51

Conclusões Gerais

Na bacia do rio Uruguai e no sistema da laguna dos Patos distribuem-se 18 espécies de *Hisonotus*, sendo a região aonde o gênero é mais diverso. Destas, 17 são encontradas apenas nessa região o que indica um alto grau de endemismo para as bacias hidrográficas. Doze espécies estão presentes no sistema da laguna dos Patos: *Hisonotus laevior*, sinônimo sênior de *H. leptochilus*, *H. nigricauda*, *H. taimensis*, H. *armatus*, *H. charrua*, *H. aff. leucofrenatus*, *H.* sp. "Prata", *H.* sp. "Carreiro", *H.* sp."Camaquã", *H.* sp. "Sinos", *H.* sp. "Felício" e *H.* sp. "Passo Novo". As regiões de cabeceira do sistema da laguna dos Patos apresentam um alto grau de endemismo ao passo que as porções mais baixas têm espécies mais amplamente distribuídas. Já a bacia do rio Uruguai apresenta um menor número de espécies, oito ao total. *Hisonotus nigricauda*, *H. ringueleti* sinônimo sênior de *H. candombe*, *H. aky*, *H. charrua*, *H.* sp. "Passo Fundo", *H.* sp. "Chapecó", *H.* sp. "Ariranhas" e *H.* sp. "Canoas" compõem as espécies do gênero na drenagem do rio Uruguai. Assim como ocorre na laguna dos Patos, as porções mais elevadas da bacia apresentam um alto grau de endemismo comparado com as regiões mais baixas. Apenas duas espécies são compartilhas entre estas duas regiões hidrográficas estudadas (*H. nigricauda* e *H. charrua*), ambas espécies habitando regiões de baixas altitudes. Esse estudo permitiu verificar a alta diversidade, anteriormente desconhecida para a região, do gênero bem como os endemismos encontrados nas bacias.