

## A new species of the loricariid catfish genus *Hemipsilichthys* from southern Rio de Janeiro coastal rivers, southeastern Brazil (Teleostei: Siluriformes)

EDSON H. L. PEREIRA \*, ROBERTO E. REIS\*, PABLO F. M. SOUZA\*\* & HENRIQUE LAZZAROTTO\*\*\*

\* Laboratory of Ichthyology, Pontifícia Universidade Católica do Rio Grande do Sul, P. O. Box 1429, 90619-900, Porto Alegre, RS, Brazil. edsonhlp@puers.br and reis@puers.br

\*\* Laboratório de Avaliação e Promoção da Saúde Ambiental - LAPSA, Departamento de Biologia, IOC, FIOCRUZ, Av. Brasil 4365, 21045-900 Rio de Janeiro, RJ, Brazil. pablof@rio.com.br

\*\*\* Laboratório de Ecologia de Peixes, Instituto de Ecologia, Universidade Federal do Rio de Janeiro – UFRJ, Rua Pau Brasil s/n. CCS, Bloco A sala A 010, Ilha do Fundão, 21941-569 Rio de Janeiro, RJ, Brazil. kiko\_almeida@hotmail.com

### Abstract

*Hemipsilichthys nimius*, new species, is described from the upper Perequê-Açu River in Parati, in the southern coast of Rio de Janeiro State, southeastern Brazil. The new species is distinguished from the remaining 18 *Hemipsilichthys* species by modally having eight branched rays in the dorsal fin (vs. seven branched rays), by possessing a posteriorly expanded dorsal-fin membrane connecting the last dorsal-fin ray to the dorsum and, except from *H. gobio* and *H. papillatus*, by having teeth cusps equal in size (vs. small lateral cusp or unicuspid teeth in both dentary and premaxilla). From *H. gobio* and *H. papillatus* it is further distinguished by the larger orbital diameter and by its V-shaped dorsal-fin spinelet. *Hemipsilichthys nimius* shares with *H. gobio* and *H. papillatus* several characters that might be indicative of close relationships. These putative phylogenetic relationships are discussed.

**Keywords:** Fish, Siluriformes, Loricariidae, *Hemipsilichthys*, Neotropical, Atlantic Forest, systematics, taxonomy, new species

### Resumo

*Hemipsilichthys nimius*, espécie nova, é descrita do rio Perequê-Açu superior, na costa sul do Rio de Janeiro, Brasil. A nova espécie se distingue das 18 outras espécies de *Hemipsilichthys* por possuir modalmente oito raios ramificados na nadadeira dorsal (vs. sete raios ramificados), por possuir a membrana da nadadeira dorsal expandida posteriormente e conectando o último raio ao dorso e,

exceto de *H. gobio* e *H. papillatus*, por ter as cúspides dentárias de mesmo tamanho (vs. cúspide lateral pequena ou dente unicúspide no dentário e no premaxilar). A nova espécie se distingue também de *H. gobio* e *H. papillatus* pelo maior diâmetro da órbita e por possuir o primeiro elemento da nadadeira dorsal em forma de "V". *Hemipsilichthys nimius* compartilha com *H. gobio* e *H. papillatus* vários caracteres que podem ser indicativos de proximidade filogenética. Essas possíveis relações de parentesco são discutidas.

## Introduction

*Hemipsilichthys* Eigenmann and Eigenmann, 1889 currently includes 18 species distributed chiefly in the coastal basins of southern and southeastern Brazil. One species is known from the Amazon. Coastal rivers of southern Brazil, namely the rivers of Santa Catarina State, represent the richest area of *Hemipsilichthys* species. The upper Uruguay River in Rio Grande do Sul and Santa Catarina States is inhabited by three species, *H. vestigipinnis* Pereira and Reis, 1992, *H. eurycephalus* Pereira and Reis, 2002, and *H. hystrix* Pereira and Reis, 2002. In addition, a small area of endemism composed of the coastal rivers Maquiné, Três Forquilhas, Mampituba and Araranguá (Reis and Schaefer 1998; Reis and Cardoso 2001), is inhabited by three other species, *H. nudulus* Reis and Pereira, 1999, *H. hypselurus* Pereira and Reis, 2002, and *H. stomias* Pereira and Reis, 2002. Finally, remaining coastal rivers of Santa Catarina State north of the Araranguá River basin are occupied by four additional species, *H. calmoni* (Steindachner, 1907), *H. steindachneri* Miranda Ribeiro, 1918, *H. splendens* Bizerril, 1995, and *H. azygolechis* Pereira and Reis, 2002. North of the above area is a geographic gap for *Hemipsilichthys*, and the Paraíba do Sul River is the next area where species belonging to this genus are found: *H. gobio* (Lütken, 1874) and *H. papillatus* Pereira *et al.*, 2000. Coastal rivers in Rio de Janeiro State, the Macaé and Macacu Rivers, are inhabited by *H. garbei* Ihering, 1911. Still further north, three species of *Hemipsilichthys* are found in the upper São Francisco River and nearby coastal rivers of Bahia: *H. bahianus* (Gosline, 1947), *H. stephanus* Oliveira and Oyakawa, 1999, and *H. mutuca* Oliveira and Oyakawa, 1999, and in the tributaries of the upper Negro River in the Amazon, *H. regani* Giltay, 1936. Type locality and distribution of *H. cerosus* Miranda Ribeiro, 1951 are not known.

Pereira and Reis (2002) recently produced a revision of *Hemipsilichthys* and *Isbrueckerichthys* Derijst, 1996, describing five new species of the former and redescribing all previously known species. Of the 18 known species, 11 were described during the last ten years and additional undescribed species await formal description. During a survey of coastal rivers on southeastern Brazil one of these undescribed species was detected in the upper Perequê-Açu River by the two first authors. Independently, the two last authors also found the same new species during ecological studies in coastal rivers of southeastern Rio de Janeiro State. The aim of the present paper is to describe this new species, diagnosing it from the remaining *Hemipsilichthys* species.

## Material and methods

Specimens examined belong to the Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre (MCP), and to the Museu Nacional, Rio de Janeiro (MNRJ). Measurements and counts of bilaterally symmetrical features were taken from the left side of the body when possible; if a feature was missing or broken on the left side, it was examined on the right side. Body plates counts and nomenclature follow Schaefer (1997). Measurements follow Boeseman (1968). Additional measurements and counts include: (1) postdorsal length, measured from end of dorsal-fin base to posterior hypural margin; (2) adipose-fin spine length, measured dorsally from its origin to distal tip; (3) anal-fin spine length, measured from its origin to its distal tip; (4) body depth at dorsal origin; (5) body width at dorsal-fin origin; (6) body width at anal-fin origin; (7) caudal peduncle length, measured from origin of anal fin to posterior hypural margin; (8) caudal peduncle width, taken at point of least depth; (9) length of mandibular ramus, measured by pressing the calipers on the long axis of the dentary bone (presented as the average of left and right dentaries); (10) middle plate series (number of plates with the lateral line, counted from the posterior process of pterotic-supracleitrum to posterior hypural margin); (11) plates lateral to dorsal-fin base (number of lateral dorsal plates along the dorsal-fin base); (12) plates between dorsal and adipose fins (number of plates in dorsal series between last dorsal-fin branched ray insertion and origin of adipose-fin spine); (13) plates between adipose and caudal fins (number of plates in dorsal series between the adipose membrane and posterior hypural margin); (14) plates lateral to anal-fin base (number of plates in ventral series along the anal-fin base); (15) plates between anal and caudal fins (number of plates in ventral series between the last anal-fin branched ray insertion and posterior hypural margin); (16) azygous plates (number of azygous plates preceding the adipose-fin spine); (17) premaxillary and dentary teeth (counted separately on both sides).

In the list of paratypes the museum acronym and catalogue number comes first, followed by the number of specimens in that lot and the range of standard length. The number of specimens measured in that lot for the morphometric comparisons in Table 1, if any, follows the total number of specimens in parenthesis. All measurements were taken point to point with digital calipers to the nearest 0.1 mm. Standard length is expressed in mm. All other measurements are expressed as percents of standard length, except subunits of the head, which are expressed as percents of head length. Abbreviations used are SL (standard length), HL (head length), and c&s (cleared and stained for inspection of bone and cartilages).

**TABLE 1.** Descriptive morphometrics and meristics of *Hemipsilichthys nimius*.

Character	Holotype	N	low	high	mean	SD
Standard length	105.1	12	55.6	105.1	80.4	17.0
<b>Percents of standard length</b>						
Head length	31.0	12	30.4	33.6	31.8	1.0
Predorsal length	43.3	12	42.3	45.4	43.7	0.8
Postdorsal length	34.3	12	33.1	37.2	34.8	1.2
Dorsal-fin spine length	20.4	12	17.8	21.4	19.4	1.1
Anal-fin spine length	9.8	12	6.5	11.4	9.1	1.5
Pectoral-fin spine length	17.1	12	13.3	17.1	15.1	1.2
Pelvic-fin spine length	18.9	12	15.4	19.4	18.3	1.1
Uppermost caudal-fin ray	17.5	11	14.7	19.6	16.5	1.5
Lowermost caudal-fin ray	19.9	12	16.7	20.9	18.8	1.1
Adipose-fin spine length	9.2	12	6.9	9.4	8.8	0.7
Thoracic length	18.0	12	17.6	18.9	18.2	0.3
Abdominal length	21.0	12	21.0	27.2	22.9	1.5
Cleithral width	31.2	12	30.9	33.2	31.7	0.6
Body depth at dorsal-fin origin	20.4	12	19.1	22.0	20.6	0.8
Body width at dorsal-fin origin	21.6	12	20.7	23.2	21.7	0.7
Body width at anal-fin origin	14.2	12	12.7	15.0	14.2	0.6
Length of caudal peduncle	37.0	12	34.7	38.2	36.8	1.2
Depth of caudal peduncle	10.8	12	9.3	11.3	10.5	0.4
Width of caudal peduncle	5.5	12	4.3	5.7	5.1	0.4
<b>Percents of head length</b>						
Snout length	66.9	12	62.4	70.1	65.3	2.1
Orbital diameter	15.3	12	15.3	16.9	16.1	0.5
Interorbital width	27.6	12	25.4	28.2	27.1	0.9
Head depth	59.5	12	56.1	62.5	59.2	2.2
Mandibular ramus	26.4	11	20.3	27.9	25.4	2.1
<b>Counts</b>						
Lateral plates in middle series	26/26	12	24	27	25.6	0.7
Teeth on premaxilla	86/89	9	47	93	74.0	12.1
Teeth on dentary	89/95	11	57	110	81.2	13.7
Plates by dorsal fin	11	12	8	12	9.1	1.3
Plates between dorsal and adipose	6	12	6	7	6.6	0.5
Plates between adipose and caudal	2	12	2	4	2.6	0.6
Plates by anal fin	4	12	3	4	3.9	0.2
Plates between anal and caudal	10	12	10	11	10.1	0.2
Azygous preadipose plates	7	12	5	7	6.0	0.6

*Hemipsilichthys nimius* new species

(Fig. 1)

**Holotype.** MCP 33049, male, 105.1 mm SL; Brazil: Rio de Janeiro: Parati: rio Carrasquinho below the Cachoeira do Tobogã, upper Perequê-Açu basin, Penha, ca. 7.5 km West of highway BR101, on road from Parati to Cunha (23°12'51"S 44°47'28"W), 1 Feb 2003, E. H. L. Pereira, R. E. Reis & F. Fernandes.



**FIGURE 1.** *Hemipsilichthys nimius*, holotype, MCP 33049, 105.1 mm SL, male; Brazil: Rio de Janeiro: Parati: rio Carrasquinho below Cachoeira do Tobogã, upper rio Perequê-Açu.

**Paratypes.** Brazil: Rio de Janeiro: Parati: MCP 31990, 11 (6) 45.7–98.1 mm SL; collected with the holotype. MCP 30671, 9 + 1 c&s (5) 35.9–102.2 mm SL; same locality as holotype, 18 Oct 2002, V. A. Bertaco, J. F. P. Silva & P. Lehmann. MCP 31573, 1, 48.7 mm SL; rio Taquari at Taquari Village, ca. 2.2 km West of highway BR101 (23°02'29"S 44°41'34"W), 18 Oct 2002, V. A. Bertaco, J. F. P. Silva & P. Lehmann. MNRJ 24909, 2, 32.5–89.1 mm SL; rio Carrasquinho 800 m above "Poço do Tarzan", upper Perequê-Açu basin, 17 Feb 2003, P.M.Souza, H.L.Almeida, U.Fidélis. MNRJ 24910, 1, 58.1 mm SL; same locality as MNRJ 24909, 11 Jan 2002, H. Lazzarotto, U. Fidelis, M. L. Rheigantz & A. M. Castro. MNRJ 24911, 2, 38.8–67.0 mm SL; same locality as MNRJ 24909, 24 Mar 2003, P. F. M. Souza & U. Fidelis. MNRJ 24913, 6, 22.4–41.8 mm SL; same locality as MNRJ 24909, 18 Apr 2002, P. F. M. Souza, M. L. Rheingantz & T. A. P. Vianna. MNRJ 24912, 1, 34.4 mm SL, rio Perequê-Açu, Penha, 20 Oct 2002, H.L.Almeida, M.L.Rheingantz, M.C.Matos.

**Diagnosis:** The new species can be easily distinguished from all remaining congeners by the presence of eight (rarely seven or nine) branched rays in dorsal-fin (vs. seven in all other species), and by possessing the dorsal-fin membrane expanded posteriorly, connecting the proximal half of the last dorsal-fin ray to the dorsum. It is also distinguished from most species, except *H. gobio* and *H. papillatus*, by having both teeth cusps equal in size (vs. small lateral cusp or unicuspid teeth in both dentary and premaxilla). From *H. gobio* and *H. papillatus* it is further distinguished by the larger orbital diameter 15.3–16.9 % HL (vs. 8.6–11.8 % in *H. papillatus* and 12.0–14.7 % in *H. gobio*), and by having a V-shaped dorsal-fin spinelet (vs. oval in *H. gobio* and absent in *H. papillatus*).

**Description:** Standard length of measured specimens 55.6 to 105.1 mm. Counts and proportional measurements presented in Table 1. Body short and depressed. Greatest width at cleithrum and progressively narrowing from that point to end of caudal peduncle. Dorsal profile of body gently convex, elevating from snout tip to origin of dorsal fin and then descending to last plate of caudal peduncle. Trunk and caudal peduncle rounded dorsally in cross-section, flattened ventrally and more compressed caudally. Greatest body depth at dorsal-fin origin. Dorsal surface of body completely covered by dermal plates, except for a naked area around dorsal fin base. Ventral surface of head, region from pectoral-fin insertion to anal-fin origin totally naked.

Head broad and moderately depressed. Anterior profile of head rounded in dorsal view. Interorbital space slightly concave, nearly flattened. Three small ridges on dorsal surface of head, one median from snout tip to area between nostrils, and one pair from nostril to posterior margin of orbit. Lateral margin of head covered with minute odontodes, straight or curved posteriorly. Snout in lateral profile gently convex. Eye moderately small (15.3 to 16.9 % HL), dorsolaterally placed. Iris without dorsal flap covering pupil, or some with very small flap. Lips roundish and well developed, occupying most of ventral surface of head. Lower lip almost reaching pectoral girdle and covered with minute papillae anteriorly; papillae larger and more spaced towards margin. Papillate surface of lower lip pro-

jecting between dentary and premaxillary rami laterally. Posterior edge of lower lip slightly fringed. Maxillary barbel short and free, not coalesced with lower lip. Upper lip with 1–3 rows of transversally elongate papillae. Teeth long, slender, and bicuspid, both cusps approximately equal in size.

Dorsal fin originating slightly posterior to vertical line passing through pelvic-fin origin; nuchal plate covered by skin, dorsal spinelet V-shaped, and dorsal-fin locking mechanism functional. Tips of posterior dorsal-fin rays extending beyond end of pelvic fin. Dorsal-fin spine somewhat flexible, followed by 8 branched rays (in 31 specimens, 7 in two specimens and 9 in two specimen). Dorsal-fin membrane expanded posteriorly, connecting proximal half of last dorsal-fin ray to dorsum. Adipose-fin present, preceded by 4–7 median, azygous pre-adipose plates, forming tall ridge between dorsal and adipose fins. Pectoral fin small; with curved and flattened spine, and 6 branched rays. Spine of mature males covered with short and delicate hypertrophied odontodes on anterodorsal margin. Posterior margin of pectoral-fin straight; overlapping pelvic-fin origin when adpressed.

Pelvic-fin moderate in size, with one spine and 5 branched rays, not reaching insertion of anal fin when adpressed. Pelvic-fin spine depressed, covered with minute odontodes ventrally and laterally; dermal flap on its dorsal surface absent. Anal-fin small and rounded with one unbranched and 5 branched rays, originating between end of pelvic fin and end of dorsal-fin rays. First anal-fin unbranched ray without odontodes. Caudal fin margin slightly concave, almost truncate, lower rays slightly longer than upper ones, 14 branched rays.

**Color in alcohol:** Ground color of dorsal surface of head and body light brown to dark yellowish; pale yellow ventrally. Head, dorsum and flanks covered with many dark brown or grayish brown blotches irregularly sized and shaped, in such a way that irregular paler markings appear all over dorsal surface. Head usually slightly darker than body; with consistent lighter markings on ridges anterior to eyes, on middle ridge anterior to nostrils, and on two small bands bordering naked area on tip of snout. Lateral margin of head, from snout to opercle, also pale yellow. Dorsal and caudal fins plain grayish or sometimes with two or three series of inconspicuous dots aligned to form darker, irregular lines. Pectoral and pelvic fins with dark brown or grayish pigmentation on rays and sometimes on fin membrane, sometimes arranged in two or three inconspicuous lines. Anal fin light, sometimes with dark pigmentation on middle portion of rays; fin membrane always hyaline. Ventral surface of head and body mostly unpigmented, except for some brown, scattered pigmentation on lateral margins of body posterior to pelvic fins, and on upper lip, pigmented as dorsal surface of head.

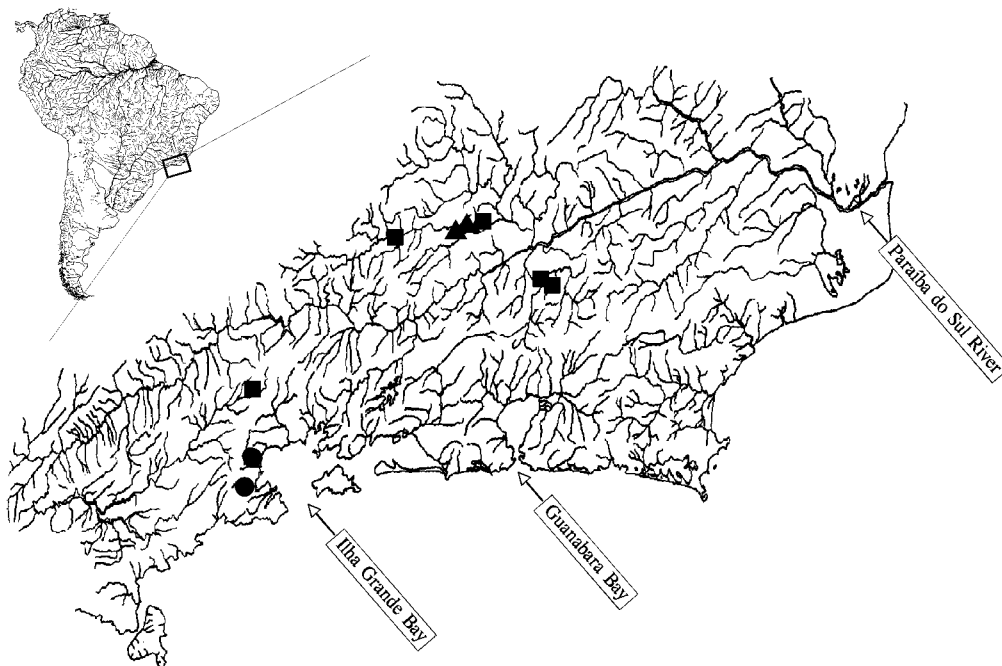
**Color in life:** Same pattern as above, with dorsal surface of head and body dark to light brown or even reddish brown.

**Ecology and habitat:** Both the Perequê-Açú and the Taquari rivers are coastal basins with approximately 100 km<sup>2</sup> of total area, flowing through a well-preserved area of Tropical Atlantic Forest. Along a longitudinal gradient, members of other loriciid species

were collected up to 900 m above sea level, but *H. nimius* was collected only in localities between 100 and 370 m asl. All individuals were collected on rocky substrate with fast flowing, clear water, direct sunlight, and depths between 10 and 50 cm. Larger specimens were caught by moving rocks as large as possible in stronger water current. Underwater observations indicate that *H. nimius* is most active during the night, grazing on the bottom. During the day almost all individuals were seen under rocky boulders and stones, when these shelters were manually removed.

Other species collected together with *H. nimius* are: *Kronichthys heylandi*, *Pareiorhina* sp., *Neoplecostomus* sp., *Schizolecis guntheri*, *Hisonotus notatus*, *Rhamdioglanis frenatus*, *Trichomycterus zonatus*, *Phalloceros* sp., *Bryconamericus microcephalus*, *Astyanax* sp., *Characidium japyhybensis*, *Rhamdia quelen*, *Pimellodella lateristriga*, *Acentronichthys leptos*, *Gymnotus pantherinus*, *Hollandichthys* sp., *Hyphessobrycon reticulatus*, *Synbranchus marmoratus*, *Centropomus parallelus*, *Geophagus brasiliensis*, *Eleotris pisonis*, *Gobionellus shufeldti* and *Awaous tajasica*. The eleven first species were collected syntopically.

**Distribution:** *Hemipsilichthys nimius* is so far known only from its type-locality in the upper Perequê-Açu River and from the nearby Taquari River, in the southern coast of Rio de Janeiro State (Fig. 2).



**FIGURE 2.** Geographic distribution of *Hemipsilichthys nimius* (dots) and the putatively closely related species *H. gobio* (squares) and *H. papillatus* (triangles) in southeastern coastal Brazil.



**Etymology:** Specific epithet from the Latin *nimius*, meaning nimiety, excessive, in allusion to the supernumerary rays of the dorsal fin, which has seven to nine branched rays; all remaining species of the genus have seven. An adjective.

## Discussion

In a recently published book, Reis *et al.* (2003) recorded 673 loricariid species currently recognized and estimated that an additional 300 species are yet to be described. The discovery of an undescribed *Hemipsilichthys* in the State of Rio de Janeiro, however, is quite surprising since that is one of the best sampled areas in South America.

The new species is easily distinguished from all other *Hemipsilichthys* species by modally having eight branched rays in the dorsal fin, by having the dorsal-fin membrane expanded posteriorly and connecting the proximal half of the last dorsal-fin ray to the dorsum, and by its symmetrical tooth cusps, which are asymmetrical in all other species except *H. gobio* and *H. papillatus*. It is further distinguished from these latter two species by the larger orbit diameter, and by the V-shaped dorsal-fin spinelet, but it shares with them certain features that might be indicative of close relationships. Pereira *et al.* (2000) discussed three putative synapomorphies shared by *H. gobio* and *H. papillatus*, which are also partially shared by *H. nimius*. 1) Anal fin of adult females much longer than that of males (Pereira *et al.* 2000, fig. 2); this was not verified in *H. nimius* and represents a synapomorphy of the two former species only. 2) Upper lip with papillae coalesced to form elongate, transverse skin-folds (Pereira *et al.* 2000, fig. 3); this is present in *H. nimius* but developed to lesser extent and not as elongate as in the former species. 3) More than one azygous preadipose plate forming a tall ridge with the anterior preadipose plates not contacting the dorsal-plate row. This is also present in *H. nimius*. Besides not being articulated with the preadipose plates, plates of the dorsal row on both sides do not contact each other behind the dorsal fin base in any of the three species. Finally, the tooth morphology, consisting of two fine and elongate symmetric cusps, shared by these three species might be an additional derived feature. This character, however, is shared with other basal loricariids like *Delturus* and *Lithogenes*, and also with some astroblepids.

As described in the Introduction, there is a gap in the distribution of *Hemipsilichthys* in coastal southeastern Brazil. Ten species occur in the coastal drainages and in the upper Uruguay River between Rio Grande do Sul and northern Santa Catarina States. North from that region, species of *Hemipsilichthys* are found from the coastal rivers of Rio de Janeiro State and Paraíba do Sul River to the north. The possible explanation to this distributional gap is based on two factors: 1) the rather large coastal drainage basin of the Ribeira de Iguape River, located in southern São Paulo State is inhabited by three species of the related genus *Isbrueckerichthys*, *I. duseni* (Miranda Ribeiro, 1907), *I. alipionis* (Gosline, 1947), and a third, new species being described by Edson H. L. Pereira and Osvaldo T. Oyakawa, which occupy the same niche as *Hemipsilichthys* species; and 2) in northern São

Paulo State, between the Ribeira de Iguape and the Paraíba do Sul River basin, the Serra do Mar formation is very close to the ocean, leaving a narrow coastal plain with only very small rivers (see map in Pereira and Reis 2002, fig. 2).

### Acknowledgements

We are grateful to José Pezzi da Silva, Pablo Lehmann, Vinicius Bertaco, Flora Fernandes, Priscila Lange, Gregory Southern, Maria Mattos, Andre Castro and Marcelo Rheingantz for help in collecting specimens. We are also thankful to Ubirajara Fidelis and Thiago Viana for field and laboratorial help, to Arion Aranda for curatorial assistance at MNRJ, to Ricardo Campos da Paz for reviewing an early version of the manuscript and to Dona Angelita for allowing the use of the facilities at Fazenda Murycana. This paper benefited from the critical review of Jon Armbruster and an anonymous reviewer. This paper is part of the projects “Conhecimento, Conservação e Utilização Racional da Diversidade da Fauna de Peixes do Brasil”, supported by FINEP/CNPq, Process PRONEX 661058/1997-2) and “PROAMA – Projeto de Avaliação de Mananciais.” Authors are partially financed by CAPES (EHLF, doctoral fellowship), and CNPq (RER, process # 305344/87-0).

### References

- Boeseman, M. (1968) The genus *Hypostomus* Lacépède, 1803, and its Surinam representatives (Siluriformes, Loricariidae). *Zoologische Verhandlungen*, 99, 1–89.
- Pereira, E.H.L., Oliveira, J.C. & Oyakawa, O.T. (2000) *Hemipsilichthys papillatus*, a new species of loricariid catfish (Teleostei: Siluriformes) from Minas Gerais, Brazil. *Ichthyological Exploration of Freshwaters*, 11, 377–383.
- Pereira, E.H.L. & Reis, R.E. (2002) Revision of the loricariid genera *Hemipsilichthys* and *Isbrueckerichthys* (Teleostei: Siluriformes), with descriptions of five new species of *Hemipsilichthys*. *Ichthyological Exploration of Freshwaters*, 13, 97–146.
- Reis, R.E. & Cardoso, A.R. (2001) Two new species of *Rineloricaria* from southern Santa Catarina and northern Rio Grande do Sul, Brazil (Teleostei: Loricariidae). *Ichthyological Exploration of Freshwaters*, 12, 319–332.
- Reis, R.E., Kullander, S.O. & Ferraris, Jr., C.J. (eds) (2003) *Check List of the Freshwater Fishes of South and Central America*. Edipucrs, Porto Alegre, 729pp.
- Reis R.E. & Schaefer, S.A. (1998) New cascudinhos from southern Brazil: Systematics, endemism, and relationships (Siluriformes, Loricariidae, Hypoptopomatinae). *American Museum Novitates*, 3254, 1–25.
- 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.