

## A new species of *Parotocinclus* (Siluriformes: Loricariidae) from the rio São Francisco basin, southeastern Brazil

Alexandre Cunha Ribeiro\*, Alex Luiz de Andrade Melo\* and Edson H. L. Pereira\*\*

*Parotocinclus prata*, new species, is described from the headwaters of the rio da Prata, Minas Gerais State, southeastern Brazil. It is distinguished from all known *Parotocinclus* species by the unique combination of an entirely naked abdomen in adults, rostral plates that are reduced in extent with anterior margins that fall short anteriorly of the rostral margin of the snout, lacking a ventral curvature, 25-29 median plates, and a pectoral girdle that is only exposed laterally. The phylogenetic relationships of the new species are discussed.

*Parotocinclus prata*, espécie nova, é descrita com base em espécimes obtidos das cabeceiras do rio da Prata, Estado de Minas Gerais, sudeste do Brasil. A nova espécie é distinguível das demais conhecidas de *Parotocinclus* devido a combinação única do abdômen inteiramente nu nos adultos, placas rostrais de comprimento reduzido, de forma que suas margens anteriores não ultrapassam anteriormente a margem rostral do focinho, não curvando-se ventralmente, 25-29 placas medianas e cintura peitoral exposta apenas nas regiões laterais. As relações filogenéticas da nova espécie são discutidas.

### Introduction

The genus *Parotocinclus* Eigenmann & Eigenmann, 1889 consists of 19 described species (Garavello, 1977; Schmidt & Ferraris, 1985; Garavello, 1988; Schaefer, 1988; Schaefer & Provenzano, 1993), with a disjunct distribution from the Guyana Shield, through the Amazon basin to the coastal drainages of eastern and southeastern Brazil (Schaefer, 1988; Schaefer & Provenzano, 1993). *Parotocinclus* species are not recorded from various South American drainages, including some of the larger river systems in the Amazon basin, the rios Paraná-

Paraguay, Jequitinhonha, Mucuri, and prior to this publication the São Francisco basin (Garavello, 1977; Garavello, 1988). The revision of *Parotocinclus* by Garavello (1977) was followed by the description of species by various authors (e.g. Schmidt & Ferraris, 1985; Garavello, 1988; Schaefer, 1988; Schaefer & Provenzano, 1993). That trend and the continued collecting of undescribed species of the genus (Heraldo Britiski and Roberto E. dos Reis, pers. com.) suggests that *Parotocinclus* may be much more diverse than previously documented.

Despite the increased attention to phyloge-

\* Laboratório de Ictiologia de Ribeirão Preto, Departamento de Biologia, FFCLRP- USP, Av. Bandeirantes 3900, 14040-901 Ribeirão Preto, São Paulo, Brazil.

\*\* Laboratório de Ictiologia, Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, P. O. Box 1429, 90619-900 Porto Alegre, RS, Brazil.

netic level problems in *Parotocinclus*, questions persist on the systematics of the genus. In the most recent phylogenetic study on the Hypoptopomatinae (Schaefer, 1998), *Parotocinclus* could not be defined in terms of unique derived characters (i.e. autapomorphies), and the diagnosis for the genus presented by Reis & Schaefer (1998) consists of combinations of characters that are not necessarily derived.

Recent collecting efforts in the headwaters of the rio da Prata, a tributary of the rio São Francisco in Minas Gerais State, southeastern Brazil, yielded an undescribed species of *Parotocinclus* which is described herein.

### Methods

Measurements were made to the nearest 0.1 mm with digital calipers according to Boeseman (1968: fig. 5) with the addition of modifications suggested by Armbruster & Page (1996). Plate counts and nomenclature follow schemes of serial homology proposed by Schaefer (1997). Other counts include: predorsal plates (number of plates from the tip of the supraoccipital process up to and including the nuchal plate); dorsal plates between the posterior ray of the dorsal fin and the adipose spine (excluding any plate in contact with the adipose spine); dorsal plates within the membrane of the adipose fin; dorsal plates between the adipose-fin and the caudal-fin membrane; ventral plates within the anal-fin interradial membrane; ventral plates from the end of the anal fin to the caudal-fin membrane; number of dorsal, pectoral, pelvic, anal, and caudal-fin branched rays; and number of premaxillary and dentary teeth. All morphometric and meristic data, including premaxillary and dentary teeth, were taken from the left side of the specimen.

Osteological examination was performed on specimens cleared and double-stained (c&s) according to the procedures of Taylor & Van Dyke (1985). Institutional abbreviations follow Leviton et al. (1985) with the addition of LIRP (Laboratório de Ictiologia de Ribeirão Preto).

### *Parotocinclus prata*, new species (Fig. 1)

**Holotype.** MZUSP 68359, 38.2 mm SL; Brazil: Minas Gerais: rio São Francisco basin, município de Presidente Olegário, headwaters of rio da Prata, stream tributary of ribeirão Quiricó, fazenda São Zeferino, near Galena; approximately 18°22'S 46°14.3'W; A. C. Ribeiro & A. L. A. Melo, 19 March 2000.

**Paratypes.** MZUSP 68360, 4, 17.8–28.0 mm SL; MCP 27381, 5, 29.1–40.8 mm SL, 1c&s; collected with holotype. – LIRP 1136, 38, 19.8–41.9 mm SL, 1 c&s; Brazil: Minas Gerais: rio São Francisco basin, município de Presidente Olegário, headwaters of rio da Prata, ribeirão Quiricó, near Galena; approximately 18°19'S 46°03'W; A. C. Ribeiro, 13 Oct 2000. – LIRP 1137, 6, 25.9–33.7 mm SL; Brazil: Minas Gerais: rio São Francisco basin, município de Presidente Olegário, upper rio da Prata, fazenda Devaneio; approximately 18°23.5'S 46°14.3'W; A. C. Ribeiro, 14 Oct 2000. – LIRP 1138, 3, 32.4–38.1 mm SL; Brazil: Minas Gerais: rio São Francisco basin, município de Presidente Olegário, headwaters of rio da Prata, córrego São João, fazenda Devaneio; approximately 18°23.5'S 46°16'W; A. C. Ribeiro, 14 Oct 2000.

**Diagnosis.** *Parotocinclus prata* is distinguished from all other *Parotocinclus* species by the combination of the following characters: total absence of platelets on the abdomen in specimens of all sizes (the absence of platelets on the abdomen has been recorded in other *Parotocinclus* species only in juveniles) and by having rostral plates reduced in extent with anterior margins that fall short of the anterior of the rostral margin of the snout, lacking a ventral curvature. It is further distinguished from other *Parotocinclus* species with naked areas on the abdomen in the number of median plates (25–29 vs. 21–23 in *P. spilosoma*, 23–24 in *P. cearensis*, 23 in *P. cesarpinto*, and 22–24 in *P. haroldoi*) and by having the pectoral girdle exposed only on small areas on each side (vs. almost totally exposed in other species except for *P. cearensis*).

**Description.** Morphometrics and meristics are given in Table 1. Dorsal profile of body gently arched from snout tip to dorsal-fin origin; straight from near of dorsal-fin base to adipose-fin origin; slightly concave from near adipose-fin base to

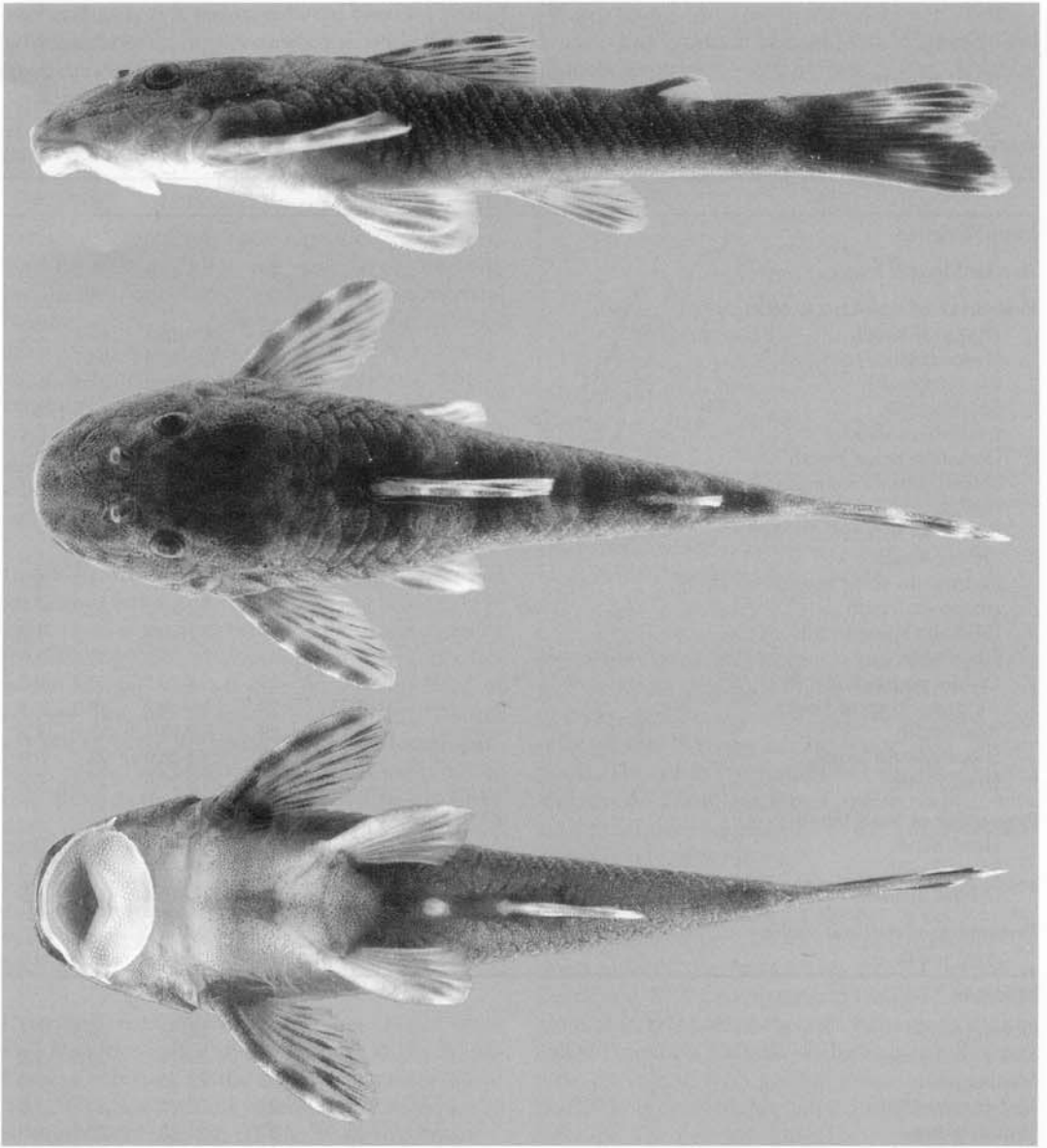


Fig. 1. *Parotocinclus prata*, holotype, MZUSP 68359, 38.2 mm SL; Brazil: rio São Francisco basin.

caudal-fin base. Ventral profile of body straight to slightly concave from snout tip to base of pectoral fins; straight from that point to anal-fin origin and then slightly concave to caudal-fin base. Greatest body depth at dorsal-fin origin. Least body depth at caudal peduncle. Greatest body width at opercular region. Trunk mostly straight and gradually tapering to caudal-fin base. Trunk and caudal peduncle rounded in cross sec-

tion, trunk slightly flattened at base of dorsal and pectoral fins and laterally compressed caudally. Body progressively narrowing caudally from cleithrum. Head wide and rounded anteriorly. Interorbital region flat to slightly convex, with latter margins slightly elevated. Snout straight to slightly convex anterior to nares. Eyes small and dorsolaterally placed.

Body entirely covered by plates, except for

ventral surface from mouth to anus, region overlying opening of swimbladder capsule, and around pectoral, pelvic, and anal-fin insertions. Rostral plates reduced in extent such that anterior margins fall short of rostral margin of snout, lacking a thickened ventral curvature. Body and head

Table 1. Morphometric and meristic data of *Parotocinclus prata*.

	holotype	n	range	mean	sd
<b>Morphometrics</b>					
Standard length (mm)	38.2	29	17.8-41.9	33.1	5.5
<b>Percentage of standard length</b>					
Predorsal length	44.8	29	34.0-48.3	44.1	2.4
Head length	31.2	29	30.3-44.8	33.1	2.5
Cleithral width	26.9	29	20.8-27.6	24.8	1.4
Snout length	17.0	29	14.4-18.4	16.5	0.9
Interorbital width	12.1	29	11.8-13.3	12.6	0.4
Dorsal-fin spine length	22.1	29	16.6-23.4	21.5	1.5
Folded dorsal-fin length	23.9	29	20.5-25.3	23.2	1.3
Base of dorsal-fin length	12.6	29	10.7-15.6	13.6	1.2
Interdorsal length	19.7	29	16.5-24.4	20.9	1.7
Thorax length	17.0	29	15.2-21.7	18.1	1.6
Pectoral-fin spine length	25.1	29	18.0-25.1	22.9	1.5
Abdomen length	23.6	29	19.2-25.3	22.9	1.7
Pelvic-fin spine length	17.7	29	12.1-19.9	17.0	1.6
Postanal length	28.9	29	27.6-35.2	31.6	2.0
Caudal peduncle depth	10.0	29	8.4-10.5	9.4	0.5
Adipose-fin spine length	8.7	29	4.8- 9.2	8.0	0.9
Anal width	13.7	29	8.9-15.1	12.9	1.2
Snout-opercle length	25.2	29	25.0-28.6	27.2	0.9
Head width	27.0	29	25.8-27.9	27.0	0.6
<b>Percentage of head length</b>					
Head depth	48.3	29	36.7-49.7	45.9	2.4
Snout length	54.6	29	36.5-60.8	50.1	4.3
Orbital diameter	15.7	29	13.5-19.4	17.2	1.6
<b>Percentage of cleithral width</b>					
Anal width	50.9	29	42.7-61.2	51.8	4.2
<b>Meristics</b>					
Dorsal plates	26	23	26-28	26.5	0.6
Mid-dorsal plates	22	22	22-26	24.1	1.0
Median plates	26	23	25-29	25.9	0.9
Mid-ventral plates	25	22	22-25	23.5	1.0
Ventral plates	23	22	21-25	23.3	0.9
Predorsal plates	5	23	5-6	5.7	0.5
Dorsal plates between posterior ray of dorsal fin and adipose spine	8	23	7-8	7.4	0.5
Dorsal plates from end of adipose-fin to caudal-fin membrane	4	23	4-7	5.6	0.8
Dorsal plates within membrane of adipose fin	3	23	2-4	3.0	0.4
Ventral plates within anal-fin interradiial membrane	4	23	3-5	4.2	0.7
Ventral plates from end of anal fin to caudal-fin membrane	13	23	12-14	12.9	0.7
Dorsal-fin branched rays	7	23	7	7.0	0.0
Pectoral-fin branched rays	6	23	6	6.0	0.0
Pelvic-fin branched rays	5	23	5	5.0	0.0
Anal-fin branched rays	5	23	5	5.0	0.0
Caudal-fin branched rays	14	23	14	14.0	0.0
Premaxillary teeth	31	23	22-35	28.1	3.1
Dentary teeth	31	23	22-35	29.4	3.4

without crests. Head and body plates covered with odontodes, uniform in size and distribution, but not arranged in conspicuous rows. Pectoral girdle surface mostly covered by thick layer of skin. Pectoral girdle partially exposed, with small odontodes only near base of pectoral fins.

Tip of adpressed pectoral fin reaching to middle of pelvic fin, with posterior margins slightly rounded. Tip of adpressed pelvic fin reaching anal-fin origin. Pelvic fin with large medially projected odontodes. Dorsal-fin origin at vertical behind end of pelvic-fin base. Dorsal fin spinelet small, with dorsal-fin locking mechanism vestigial, non-functional. Adipose fin present. Lower caudal-fin lobe slightly longer than upper lobe.

Lips roundish, papillose. Maxillary barbel present. Teeth slender, bifid, with larger medial cusp bladeliike and slightly rounded, and smaller lateral cusp minute and pointed.

**Color in alcohol.** Background color of dorsal surface of head and body black to brown. Five light saddles present on dorsal surface of body, located at predorsal area, base of dorsal-fin, between dorsal and adipose fins, along base of adipose fin, and at base of caudal fin. Ventral surface of body unpigmented. First dorsal, pectoral, pelvic, and adipose-fin spines with four to five, three to five, two to three, and one to three dark transversal stripes, respectively. Branched rays of these fins with series of spots aligned in four or five continuous transverse stripes. Caudal fin with irregular color pattern, ranging from vertical stripes to areas with large blotches on both dorsal and ventral lobes.

**Distribution.** *Parotocinclus prata* is known from four localities in the upper reaches of the rio da Prata, a tributary of the rio São Francisco basin (Fig. 2). This is the first species of *Parotocinclus* to be described from the rio São Francisco basin.

**Etymology.** Specific epithet, *prata*, refers to rio da Prata, the river basin from where this new species was collected. It is treated as a noun in apposition.

**Ecological notes.** All specimens were collected on 19 March and 13-14 October 2000 at four localities in headwaters of rio da Prata, rio São Francisco basin, Minas Gerais State, Brazil (Fig. 2). The type locality (a tributary of ribeirão Quiricó) and córrego São João (a direct tributary of rio da

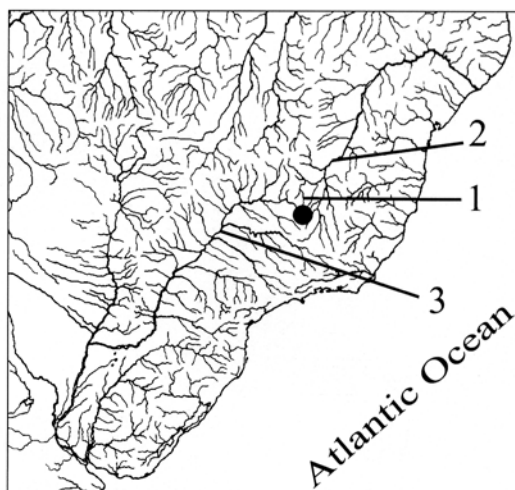


Fig. 2. Eastern Brazil and adjoining areas showing approximate position of type locality and area of occurrence of *Parotocinclus prata* (black dot); 1, rio da Prata; 2, rio São Francisco; 3, rio Paraná.

Prata) are clear water creeks surrounded by dense gallery forest (Fig. 3), with the bottom composed of rocks, pebbles and sand, with submerged litter only at the bottoms of the larger and deeper pools. The other two localities (ribeirão Quiricó and rio da Prata) are larger water bodies, with scarce marginal vegetation and the substrate composed solely of sand.

Geomorphologically, the area of rio da Prata basin is characterized by plateaus of early cretaceous rocks of the Areado group, furrowed by deep valleys (Barbosa et al, 1970; Campos & Dardenne, 1997). According to Rizzini (1992), the general vegetation of the area belongs to the so-called Província Central, with savannah-like cerrado prevalent, with gallery forests along water bodies and open higher altitude fields along the hill tops. The general climate is tropical, with the annual mean temperature varying between 22 and 23 °C and with a mean annual rainfall of about 1200 and 1300 mm (Britski et al., 1984). The elevation is approximately 800 m in the collection areas.

Specimens of *P. prata* from the type locality and from córrego São João were associated with rocky bottom, in areas of rapids, as shown in Figure 3. In ribeirão Quiricó and rio da Prata, specimens of the species were found in association with marginal vegetation, an apparently plastic behavior that permits its survival in such lo-





Fig. 3. General view of type locality of *Parotocinclus prata*. Brazil: rio São Francisco basin: tributary of ribeirão Quiricó, approximately 18°22'S 46°14.3'W.

calities, since the exclusively sand substrate at those sites is unnatural, being rather a consequence of soil erosion resulting from agriculture practices and deforestation.

Stomach contents of specimens from type locality and ribeirão Quiricó included diatoms, cyanobacteria (*Gloeocapsa*), green algae (*Spirogyra*, *Mesotaenium*, *Chlorella*), organic matter and sand. The most abundant items at both localities were green algae (*Spirogyra* and *Mesotaenium*).

### Discussion

The analysis of the anatomical characters of *P. prata* within the phylogenetic framework of catfishes of the Hypoptopomatinae proposed by Schaefer (1998) permits a partial resolution of the phylogenetic position of the species. The presence of an exposed pectoral girdle (partially exposed in the case of this new species), a nasal capsule opening ventrally, a pterotic bone pierced by numerous enlarged fenestrae, the presence of a metapterygoid channel, a partially closed arrector fossae of the ventral pectoral girdle, the

presence of medially paired snout plates, and the presence of enlarged odontodes on both the dorsal and ventral margins of the snout indicate that *P. prata* is a member of the subfamily Hypoptopomatinae. The inclusion of *P. prata* within the tribe Otothyirini is based on its possession of a metapterygoid channel depth about 50 % of its length, a preopercle reflected medially, and an expanded fourth infraorbital (Schaefer, 1998).

The monophyly of *Parotocinclus* is not supported by autapomorphies and its relationship with other members of the Otothyirini is unclear (Schaefer, 1998). The inclusion of the new species in *Parotocinclus* is based on Reis & Schaefer's (1998) diagnosis of the genus. According to those authors, *Parotocinclus* can be distinguished from other genera of the Otothyirini by the following set of characters: the trunk from the posterior margin of dorsal-fin base to the caudal fin is not rectangular, the caudal peduncle is round to ovoid in cross section, the posterodorsal margin of the pterotic-supracleithrum is short (distance from its posterior tip to posterior margin of the orbit approximately 2.0 times in the orbit diameter), the lateral opening of the swimbladder capsule is

small, six branched pectoral-fin rays are present, a caudal fenestrum is present anterior to the notch between hypurals 2 and 3, and the adipose fin is present. *Parotocinclus prata* possesses all these characters.

Garavello (1977) recognized two species groups within *Parotocinclus* based on morphological and ecological differences among the species. The *P. maculicauda* group includes *P. maculicauda* (Steindachner, 1877), *P. doceanus* Garavello, 1977, *P. jimi* Garavello, 1977, *P. amazonensis* Garavello, 1977, *P. minutus* Garavello, 1977, and *P. britskii* Boeseman, 1974. The *P. spilosoma* group includes *P. spilosoma* (Fowler, 1941), *P. cearensis* Garavello, 1977, and *P. cesarpintoi* Ribeiro, 1939. Garavello did not place *P. cristatus* Garavello, 1977 and *P. bahiensis* (Ribeiro, 1918) in either group (Schaefer, 1988). Subsequently, Garavello (1988) included *P. longirostris* Garavello, 1988 and *P. aripuanensis* Garavello, 1988 in the *P. maculicauda* and *P. haroldoi* Garavello, 1988 in the *P. spilosoma* species group.

*Parotocinclus prata* cannot be unambiguously assigned to either of the two species groups proposed by Garavello (1977) because it has characters of both of them such as: (1) enlarged odontodes on the unbranched fin-rays (*P. maculicauda* group character); (2) a naked abdomen (interpreted as a *P. spilosoma* group feature - despite the fact that in none of species in the group is the abdomen entirely naked, except in juveniles); and (3) the fact that it was collected both on a rocky substrate as well as in submerged vegetation (ecological characters assigned to both *P. spilosoma* and *P. maculicauda* groups, respectively). Furthermore, the classificatory scheme proposed by Garavello (1977) is not applicable to other *Parotocinclus* species (e.g. *P. spilurus* (Fowler, 1949) and *P. collinsae* Schmidt & Ferraris, 1985) that share characters of both species groups (Schaefer, 1988).

Evidence for monophyletic clades of *Parotocinclus* species from Guyana Shield and Amazon River basins were provided by Schaefer & Provenzano (1993), based on putatively derived morphometric and coloration features. The *P. longirostris* clade, which includes *P. longirostris*, *P. polyochrus*, and *P. eppleyi*, from the upper Río Orinoco and rio Negro basins, is diagnosed by sharing an elongate, pointed snout and a pigmentation pattern consisting of a Y-shaped markings on both the head and snout, and the transverse pre-dorsal path. An additional, more inclusive clade diagnosed on the basis of a derived presence of a triangular dark pigmentation patch at the anterior

or dorsal fin base, includes members of the *longirostris* clade plus three species widely distributed in the Guyana Shield and Amazon basin: *P. amazonensis* from the rio Solimões, *P. aripuanensis*, from the rio Aripuanã of Brazil, and *P. britskii*, from the Guyana Shield of Suriname and Venezuela and the rio Pará of Brazil.

We found no evidence of a close relationships between *P. prata* and the members of the just cited clades, nor is there a basis for its inclusion in any of the known species groups. As noted by de Pinna (1989), there is a general tendency to place highly derived forms in separate high-level groups and to unite generalized form in a taxon of equivalent rank, as a consequence of the acceptance of symplesiomorphies as potential indicators of monophyly. This appears to be the case of *Parotocinclus*. Notwithstanding those problems the evidence indicates that the species should be assigned to *Parotocinclus* as presently delimited and that practice if followed to make the species available for future phylogenetic studies.

**Comparative material.** *Parotocinclus spilosoma*: ANSP 69411, 3 paratypes; Brazil: Paraíba: Campina Grande. *P. haroldoi*: MZUSP 36890, 1 paratype; Brazil: Piauí: Córrego Otaviano, Poço do Sanhará, Riacho Sanhará. *P. cesarpintoi*: MNRJ 1154, 6; Brazil: Alagoas: rio Paraíba, Quebrângulo. *P. jimi*: MZUSP 24531, 7; Brazil: Bahia: rio dos Peixes, afluente do rio das Contas, fazenda Pedra Branca, Itajibá. *P. maculicauda*: MZUSP 35292, 4; Brazil: São Paulo: Ribeirão Grande, bairro Jaraçatá, Miracatú.

### Acknowledgments

Oswaldo Oyakawa provided facilities and access to MZUSP collections, Heraldo Britski kindly allowed examination of type specimens under his care, Katiane Mara Ferreira helped with the identification of stomach contents. This paper was greatly improved by the suggestions and criticisms of Lilian Casatti, Ricardo M. C. Castro, Flávio A. Bockmann, Marcelo R. Britto, Naércio Menezes, Roberto E. Reis, Carl J. Ferraris, Jr., and Richard P. Vari. We sincerely thank all those individuals. This work was partially supported by the State of São Paulo Research Foundation (FAPESP) within the BIOTA/FAPESP - The Biodiversity Virtual Institute Program ([www.biota.org.br](http://www.biota.org.br)) through the Thematic Project "Diversidade de peixes de riachos e cabeceiras da bacia do Alto rio Paraná no Estado de São Paulo, Brasil/Fish diversity of the headwaters and streams of the Upper Paraná River system in State of São Paulo, Brazil" (FAPESP grant No. 98/05072-8) and by PRONEX Project "Conhecimento, Conservação e Utilização Racional da Diversidade da Fauna de Peixes do Brasil" (FINEP/CNPq grant No. 661058/1997-2).

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Received 8 May 2001  
 Revised 30 November 2001  
 Accepted 20 January 2002