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**LEPORINUS TRIMACULATUS, A NEW SPECIES FROM AMAZONIA, BRAZIL,
AND REDESCRIPTION OF THE SYMPATRIC *LEPORINUS ARIPUANAENSIS*
(Pisces, Characiformes, Anostomidae)**

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ABSTRACT

Leporinus trimaculatus n.sp. is described, and *Leporinus aripuanaensis* Garavello & Santos, 1981 is redescribed, both from the Aripuanã river basin, Mato Grosso state, Amazonia, Brazil. A colour pattern of two, three or more dark brown blotches on the lateral sides of the body in both species concerned, is considered a derived character for anostomid fishes of the genus *Leporinus*. The geographical distribution of blotched *Leporinus* species is discussed.

INTRODUCTION

During 1975 and 1976, the National Research Institute of Amazonia, the Zoological Museum of the University of São Paulo, and the Federal University of São Carlos carried out a series of ichthyological collecting expeditions at the Aripuanã river basin, Mato Grosso state, Brazil. This collection of fishes was studied by Garavello in 1979, who encountered several undescribed species of the genus *Leporinus* in this river basin.

Additional specimens provided by Dr. Geraldo Mendes dos Santos from collections of the National Research Institute of Amazonia initiated the publication of this paper.

It is apparent from other publications on fishes from the Aripuanã river basin (Britski, 1976; Garavello & Santos, 1981; Vari & Géry, 1985, and Nijssen &

Isbrücker, 1985) that this river basin is still a poorly explored area.

Supplementary to the description of the new species, we redescribe the sympatric *Leporinus aripuanaensis* Garavello & Santos, 1981, which original description was too poor. Both species are figured and compared. Comments are made on *Leporinus bimaculatus* Castelnau, 1855 from Vermelho river basin in Goiás, Brazil, and on other blotched *Leporinus* species from Brazil.

Material and Methods

The specimens studied were collected in the Aripuanã and Canumã rivers; they are deposited at the Zoological Museum of the University of São Paulo (MZUSP), Zoological Museum of Amsterdam (ZMA), and National Research Institute of Amazonia (INPA).

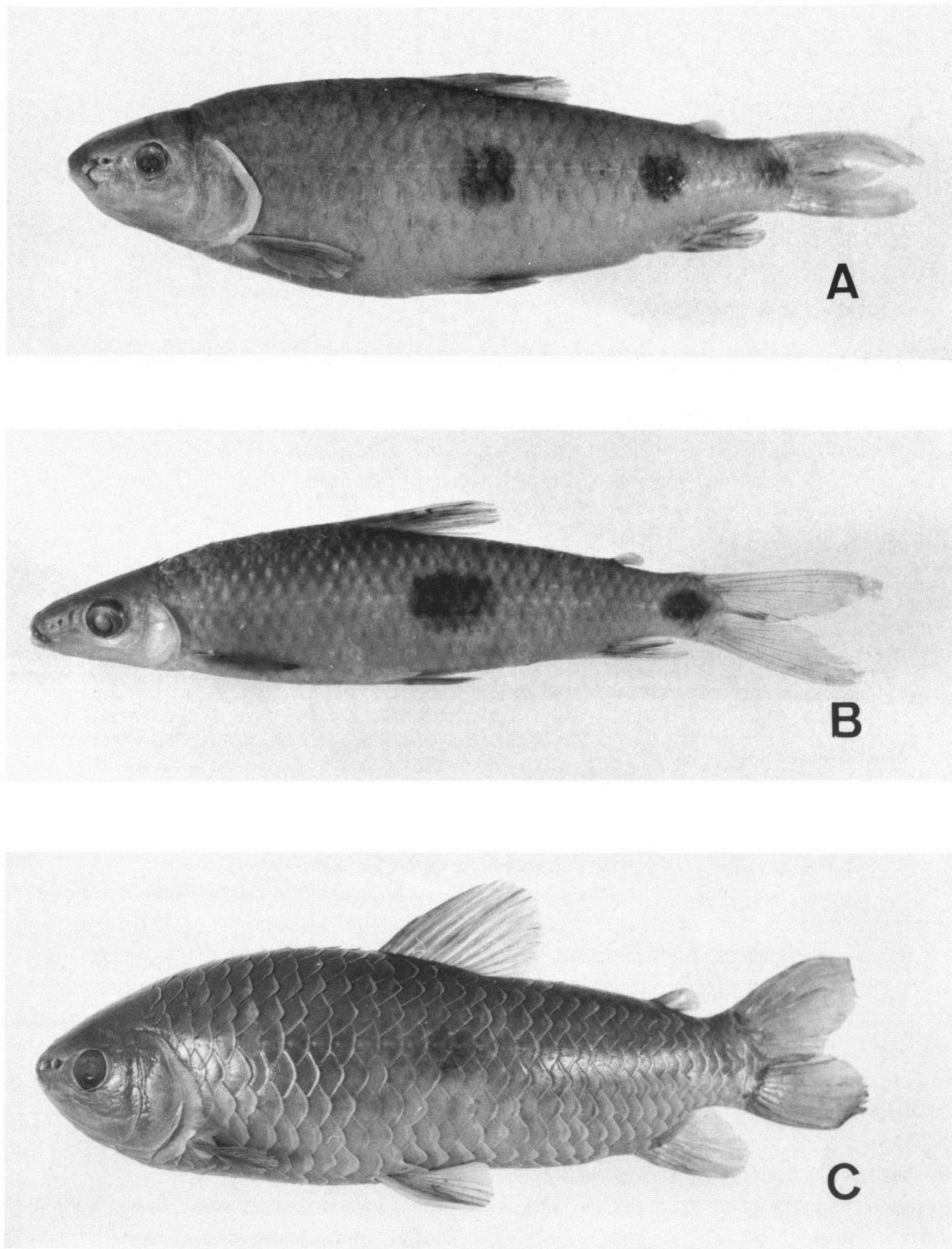


Fig. 1. A. *Leporinus trimaculatus* n. sp. holotype, MZUSP 14459: 195 mm SL. B. *Leporinus aripuanaensis* Garavello & Santos, paratype, INPA 1.532: 100 mm SL. C. *Leporinus lacustris* Campos, MZUSP 14.464: 175 mm SL.

Additional material used

Leporinus lacustris Campos, 1945: MZUSP 14464, Itaqueri river, tributary of the Piracicaba basin in Tietê system, Águas de São Pedro, São Paulo (=SP), 14.XI.1983 (8); MZUSP 14465, Cassange river, Transpantaneira road, Poconé, Mato Grosso (=MT) 29.VII.1978 (2); MZUSP 14466, Mogi-Guaçu river, Emas falls, Pirassununga, SP, 8.V.1978 (5); UFSCar (unregistered) creek tributary of the Tietê river, Pereira Barreto, SP, 29.VII.1977 (1); UFSCar (unregistered) Tietê river, Barra Bonita, SP, X.1979 (20).

Leporinus paranensis Garavello & Britski, 1987: MZUSP 14456, Córrego fundo creek, Murutinga do Sul, SP, 26.XII.1975 (16); MZUSP 37410, Jacaré-Guaçu river, falls above the Gavião Peixoto dam, Araraquara, SP, 18.X.1984 (1); MZUSP 37411, Jacaré-Guaçu river Alabama farm, above the Gavião Peixoto dam, Araraquara, SP, 30.IV.1985 (1).

Leporinus piau Fowler, 1941: MZUSP 14470, São Francisco river, under the Sobradinho dam, Bahia (=BA), 3.X.1976 (1); MZUSP 14471, São Francisco river, Três Marias, Minas Gerais (=MG), 1964 (1); MZUSP 14472, Três Marias dam, São Francisco river, MG, 14-18.II.1965 (1); UFSCar (unregistered), Três Marias dam, São Francisco river, Morada Nova, MG, 5-7.XI.1986 (21).

Leporinus boehlkei Garavello, 1988: MZUSP 28061, Meta river system, small stream flowing to S, hacienda Humacita, presumably entering the general Lago Mocambique complex, (1).

Measurements and counts follow standard methods used for fresh-water fishes, as described in Garavello & Britski (1987). Counts of teeth, scales, and gill rakers were made with a stereomicroscope. Body dimensions were analyzed with the Canonical Variate Analysis, according with the methods of Bookstein et al. (1985). The values of the CVA were processed by the 1.2 version of the STATIGRAPHICS-PC computational program.

Leporinus trimaculatus sp.n.

(Fig. 1, a)

Holotype: MZUSP 14459, Aripuanã river, Humboldt, Aripuanã, Mato Grosso (=MT), 16.X.1976. Paratypes: MZUSP 14460, Igarapé do Aeroporto, Humboldt, Aripuanã, MT,

9.XI.1976 (15); MZUSP 14461, Aripuanã river, above Dardanelos falls, Humboldt, Aripuanã, MT, 26.IX.1978 (10); ZMA 120.760, Aripuanã river, Humboldt, Aripuanã, MT, 16.X.1976 (2); INPA 4857, Bacia da Cachoeira, Aripuanã river, MT, 13.XI.1976 (3); INPA 4858, Igarapé do Aeroporto, Aripuanã, MT, 6.X.1976 (6).

Diagnosis

A medium sized *Leporinus* (250 to 300 mm SL). Mouth large and terminal along horizontal line and through ventral border of orbit. Two large, circular, light brown blotches, along lateral line; at vertical through middle of base of dorsal fin, and at vertical through anal fin origin; a small and less conspicuous, variably present brown blotch, on caudal peduncle. Fin rays: dorsal i,11; pectoral i,14 or i,15; pelvic i,8, anal i,9. 33-35 scales on lateral line; four longitudinal rows of scales above and four below lateral line; twelve circumpeduncular rows of scales. Premaxilla and dentaries with eight teeth each.

DESCRIPTION

Body medium sized, compressed, reaching 250 to 300 mm SL. Head short and high; head length 2.6-2.8 in body length. Snout length 2.0 in head length; standard orbital diameter 2.5-3.0 in interorbital width, and 5.5-6.0 in head length; predorsal distance 2.0 in SL.

Dorsal profile of head almost straight. Snout elongate and distally blunt. Dorsal profile of body slightly convex before dorsal fin insertion; base of dorsal fin almost straight. Ventral profile of body slightly convex from tip of lower jaw to origin of anal fin. Caudal peduncle low, slightly concave in profile in both sides. Base of caudal fin with prominent scales.

Mouth terminal, nearly aligned with horizontal line through ventral margin of orbit; upper lip fleshy, lower lip thin and sulcate. Symphyasal premaxillary teeth large, recurved, spoon-like, more elongate than posterior teeth; teeth of upper jaws with sharp cutting edge and arranged like steps of a stair. Dentary teeth much more elongate than premaxillary teeth, slightly recurved, and arranged like steps of a stair; symphyasal dentary teeth much more elongate and pointed than premaxillary teeth; eight premaxillary teeth and eight dentary teeth.

Gill opening large. 19-21 gill rakers on first gill arch; 33-35 scales along lateral line; four longitudinal

rows of scales above lateral line to dorsal fin and four below lateral line to pelvic fins; caudal peduncle with 12 circumpeduncular series of scales; 10 predorsal scales; 24-25 preanal scales. Base of caudal fin rays with a sheath of scales formed by three vertical series.

Dorsal fin rays i,11; pelvic fin rays i,8, with origin of the pelvic fin along a vertical series of scales posterior to the origin of dorsal fin; pelvic fin slightly convex in profile; longest ray reaching about five or six abdominal scales. Anal fin rays i,9, margin obliquely truncate, tip of fin, when depressed, reaching the first scale anterior to caudal fin; pectoral fin short, rays i,14 or i,15; longest ray when depressed, reaching fifth scale of lateral line. Caudal fin furcate, upper lobe slightly larger than the lower.

Colour of preserved specimens

Ground colour of the dorsal portion of body and superior portion of head in snout, orbital and opercular regions light brown. Ventral region of head and body yellow. Dark inconspicuous brown blotches on opercular region and on base of body scales below lateral line. Two large, dark, circular, brown blotches on sides of body along lateral line, and an inconspicuous spot on caudal peduncle; first blotch about as wide as three or four scales, present between dorsal and pelvic fins; second blotch covering two or three scales, anterior to vertical at adipose-fin origin, extending through vertical at anal-fin insertion; third blotch variably present, about the size of a scale, on caudal peduncle.

Dorsal and anal fin rays dark brown; interradial membranes of anal fin black; adipose fin dark brown; pectoral and pelvic fins yellow.

Caudal fin dark brown with two light areas, one at the base and the second outlining the caudal fin margin.

DISTRIBUTION

Aripuanã river basin, tributary of Madeira River, Amazon system, Mato Grosso state, Brazil.

Leporinus aripuanaensis Garavello & Santos, 1981
(Fig. 1,b)

Leporinus aripuanaensis Garavello & Santos, 1981:188
(Type locality: Rio Aripuanã, Humboldt, Aripuanã, MT, Brazil; short description)

Material examined

Holotype MZUSP 14495, Igarapé do Aeroporto, tributary of rio Aripuanã, Humboldt, Aripuanã, MT, 6.X.1975. PARATYPES: MZUSP 14496, same locality of holotype (2); INPA 1534, same locality of holotype (1); INPA 1533, Igarapé Praia Grande, tributary of Rio Aripuanã, 2 km from Dardanelos falls, MT (4); INPA 1532, Rio Aripuanã, under Dardanelos falls, Humboldt, Aripuanã, MT (8).

Diagnosis

Small sized *Leporinus* (100 to 150 mm SL). Mouth small and subinferior, parallel to the horizontal line and along ventral margin of orbit. Two large oval, dark brown blotches on body, along lateral line; the first large, at the posterior end in the base of dorsal fin; the second on caudal peduncle. Thirteen or fourteen thin dark brown vertical bars on dorsal side of the body. Dorsal-fin rays i,11; pectoral-fin rays i, 14; anal-fin rays i, 9; pelvic-fin rays i,8. 38-39 scales along lateral line; four and one half longitudinal rows of scales between lateral line and dorsal fin; four between lateral line and pelvic fin. Sixteen circumpeduncular rows of scales on caudal peduncle. Premaxilla and dentaries with eight teeth each.

DESCRIPTION

Small sized and compressed body, 100 to 150 mm SL. Body depth 4.0 in standard length. Head short; head length 2.5 - 3.0 in body length; snout length 2.0-3.0 in head length; orbital diameter 1.5 in interorbital width, and 4.0 - 4.5 in head length; predorsal distance 3.5-4.5 in SL.

Mouth small and subinferior, horizontally in line with the ventral part of orbit, under the median line of the fish; lips thin, both slightly sulcate. Teeth small and thin, recurved, internally concave as a spoon; premaxillary symphyseal teeth larger and more pointed than posterior ones, all disposed as the steps of a stair; eight premaxillary teeth. Symphyseal dentary teeth elongate; eight teeth on dentaries. First gill arch with 18-20 gill rakers. 38-39 scales along lateral

line; four and half longitudinal rows of scales above lateral line and four below lateral line until the pelvic fins; 16 circumpeduncular rows of scales; a sheath of three columns of vertical scales at the base of caudal fin.

Dorsal-fin rays i, 11; pelvic-fin origin located in two vertical series of scales posterior to origin of dorsal fin. Anal-fin rays i,9; fin obliquely truncate; tip of fin reaching ventral margin of caudal fin. Pectoral-fin rays i,14 to i,16; fin elongated with its longest ray reaching the sixth lateral line scale; pelvic fin rays i,8, longest ray reaching the seventh abdominal scale. Caudal fin deeply forked with upper lobe slightly larger than lower.

Colour of preserved specimens

Ground colour of dorsal surface of body light brown with thirteen to fourteen thin vertical dark brown bars; bars running ventrally to horizontal series of scales dorsal to first blotch on body. Two dark brown circular or oval blotches on the sides of body, the first on the lateral line posterior to the base of dorsal fin; the second, small round spot on caudal peduncle, not extending beyond caudal fin rays. Dorsal surface of head light brown. Surface of upper lip with a thin black line from tip to angle of mouth on each side. Ventral part of head yellow.

Ventral part of body and abdomen yellow. Distal margin of body scales dark brown. Four dorsal rows of scales, slightly silver basally, with silvery lines on the dorsum. Pelvic and anal fins yellow; remaining fins hyaline with unbranched rays light brown.

DISTRIBUTION

Aripuanã river basin, Madeira River, Amazon system, Mato Grosso state, Brazil.

DISCUSSION

Leporinus trimaculatus n. sp. is characterized by the combination of large scales on the body (only 33-35 perforated scales on the lateral line, and twelve rows of circumpeduncular scales), and its colour pattern (only two or three large brown blotches on both sides). *Leporinus piau* Fowler from São Francisco river basin, *L. lacustris* Campos, *L. paranensis* Garavello & Britski from Paraná-Paraguay basin, and *L.*

boehlkei Garavello from Meta system, share this combination of features.

Géry (1977) recognized three colour patterns in the Anostomidae and divided the species of genus *Leporinus* into three groups, following Böhlke (1955), who noted that the Hemiodontidae (*Hemiodus*, *Pterohemiodus* and *Anisitsia*) displayed three basic colour patterns: 1. transverse dark brown bars on the body; 2. longitudinal dark brown stripes; 3. round black or dark brown blotches varying both in number and positions on the lateral surface of the body.

Garavello (1979), Garavello & Britski (1987), and Garavello & Britski (1990) confirmed the presence of these three basic colour patterns in *Leporinus* and *Schizodon* although variations were found in young specimens.

The blotched pattern of genus *Leporinus* exhibits one to four dark brown blotches along the lateral line, which are sometimes inconspicuous in young specimens. Species of smaller size (about 100 to 150 mm SL in adults) show this pattern together with small blotches above and below the lateral line alternating the main blotches. Géry included this pattern in what he called "maculatus group". *Leporinus* species with only two conspicuous dark brown blotches on the body sides are rare as is *Leporinus klausewitzi* Géry, 1960, which has four midlateral brown blotches on the body.

Leporinus aripuanaensis and *L. lacustris* have two dark brown blotches on their sides; the first ventral of the dorsal fin, and the second on the caudal peduncle. The remaining described *Leporinus* species with body blotches, always show three lateral dark brown blotches on their body; the first at the vertical at the insertions of dorsal and pelvic fins, the second at the vertical between anal and adipose fins, and the third on the base of caudal peduncle.

In terms of meristics, *Leporinus trimaculatus* is closest to *L. boehlkei*, *L. lacustris*, *L. paranensis* and *L. piau*. These species have 33-37 lateral line scales, four longitudinal rows above, and four below the lateral line. The new species is similar to *L. boehlkei* in its 12 circumpeduncular rows and scales, but it differs from *L. aripuanaensis*, *L. piau*, *L. lacustris*, and *L. paranensis* which have 16 circumpeduncular scales. It also differs from *L. aripuanaensis* which has 38-39

Table I. Morphometrics of *Leporinus trimaculatus*, *Leporinus aripuanaensis* and *Leporinus lacustris*

Characters (mm)	<i>L. trimaculatus</i> (10)		<i>L. aripuanaensis</i> (13)		<i>L. lacustris</i> (8)	
	Holotype	Range	Mean	Range	Mean	Range
Standard length	200.0	77.7-250.0	180.3	83.0-148.0	99.6	80.0-145.0
Head Length	52.3	21.0 - 69.0	47.1	19.6- 29.0	23.9	25.5- 39.0
Body length	147.7	56.7-187.0	133.6	62.8-115.0	75.9	54.5-106.0
Greatest body depth	60.0	24.7- 84.5	56.7	19.0-34.5	23.1	31.5- 45.0
Predorsal distance	95.0	38.4-122.0	87.9	37.6- 69.0	46.4	42.6- 70.0
Snout length	22.7	7.9- 32.0	20.1	8.0- 15.0	9.7	10.0- 15.8
Interorbital distance	24.4	8.8- 34.5	22.1	7.0- 14.4	9.1	12.8- 19.5
Orbital diameter	10.0	5.2- 11.0	8.5	5.3- 8.5	6.2	6.3- 8.2
Caudal peduncle depth	21.3	8.6- 25.7	18.7	7.4- 13.7	8.9	12.4- 18.0

Table II. Canonical variate loadings (CV) of the canonical variates analysis of combined samples of *L. trimaculatus*, *L. aripuanaensis* and *L. lacustris*.

Characters	CV I	CV II
Standard length	-3.738	0.920
Head length	0.217	-0.856
Body length	-0.888	-0.481
Greatest body depth	-0.767	-5.004
Predorsal distance	-3.437	-0.198
Snout length	-3.520	-0.225
Interorbital distance	5.658	3.698
Orbital diameter	0.740	1.486
Caudal peduncle depth	5.723	0.094

scales on the lateral line.

The new species is distinguished from *L. lacustris* and from *L. aripuanaensis* by several morphometric traits. The canonical variate analysis of combined samples of *L. trimaculatus*, *L. aripuanaensis* and *L. lacustris*, reveals that the two first canonical variates account for 97.8% of the variation. The first explains 85.3% and the second 14.6% on the variation.

In the graph of individual scores for the three *Leporinus* species studied here, the first canonical variate (CV) discriminates *L. lacustris* from *L. aripuanaensis* and *L. trimaculatus*, whereas the CV II discriminates *aripuanaensis* from *trimaculatus*. The highest canonical coefficients for the caudal peduncle depth and interorbital distance (Table II) indicate these characters as being the best to discriminate *L. lacustris* from the other species along the CV I. In the CV II the greatest body depth discriminates *aripuanaensis* and *trimaculatus*, as shown in table II.

The brief original description of *Leporinus bimaculatus* Castelnau, mentions two inconspicuous black blotches on both sides of the body, the first between the dorsal and pelvic fins, the second on the middle caudal peduncle, as observed in *L. obtusidens* according to Castelnau. His description does not include scales and teeth counts. Dr. Heraldo A. Britski who examined the holotype of *L. bimaculatus*, informed us that *L. bimaculatus* has only six teeth both on the premaxillaries and on the dentaries, 41 lateral line scales, six series of scales above and five below the lateral line series.

In view of this information about *bimaculatus*, it is now possible to determine that *L. bimaculatus* is not alike *L. trimaculatus*, neither in colour pattern, nor in meristic characters.

The discussion on *Leporinus* pigmentation patterns follow Böhlke's theory (1955) for *Hemiodus*, *Pterohemiodus* and *Anisitsia*. Böhlke suggested that the blotched colouration of *Hemiodus quadrimaculatus* should be the remnant previously more extensive banded (transverse) or striped (longitudinal) colour patterns.

There are many more *Leporinus* species with blotched patterns rather than with barred or striped patterns. The blotched pattern might be a derived character within the anostomid genus *Leporinus* following Böhlke within the Hemiodontidae.

Cesar & Galetti Jr. (1990) discovered an unique caryotypic pattern in *L. striatus* Kner, *L. taeniatus* Lütken, and *L. amblyrhynchus* Garavello & Britski, all longitudinally striped species as described by Garavello (1979). It gives an indication of genetic similarities of the striped *Leporinus* species. This could perhaps be true for the blotched species. Only a phylogenetic analysis of the Anostomidae using morphological and caryological data might reveal a more precise evaluation of this character.

The genus *Leporinus* is widely and irregularly distributed.

Generally, the large sized, blotched *Leporinus* species occur both in isolated tributary basins, and in main channels of the Amazon, whereas median and

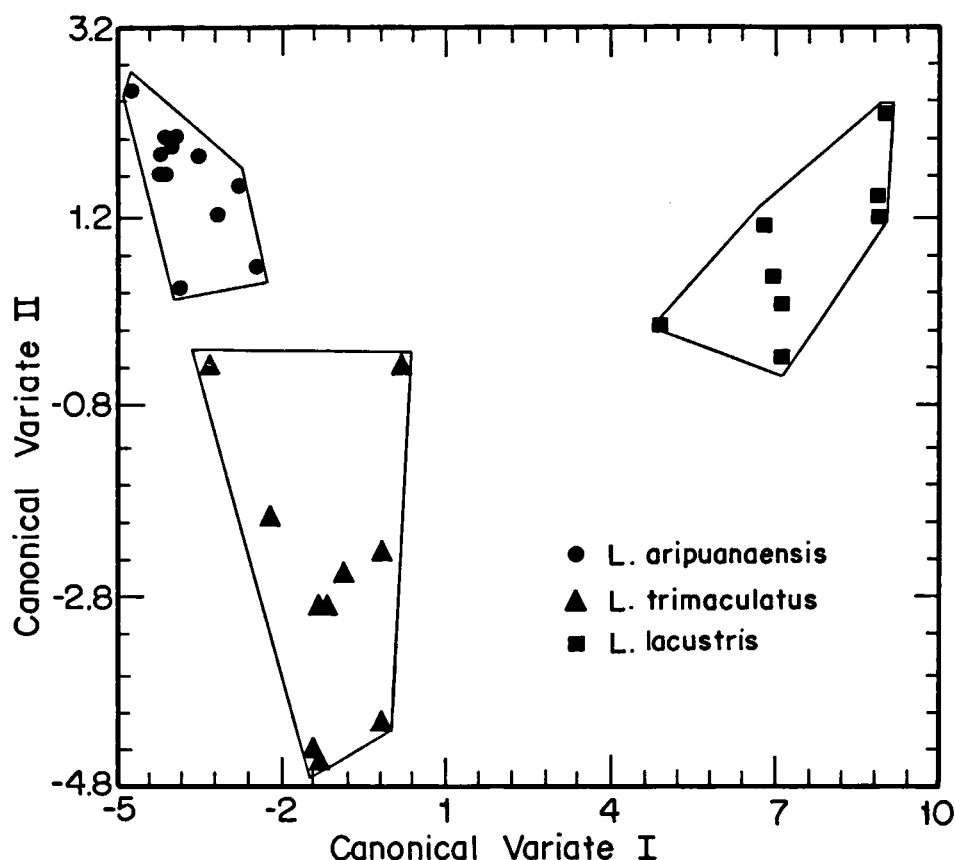


Fig. 2. Canonical variate analysis of combined samples of *Leporinus trimaculatus* n. sp., *Leporinus aripuanaensis* Garavello & Santos and *Leporinus lacustris* Campos. Individual score projections on the first (CVI) and second canonical axis (CVII).

small sized *Leporinus* species are generally endemic to high parts of Amazonian tributaries. Additional specimens studied from the collections of the Zoological Museum of University of São Paulo and from the National Research Institute of Amazonia, indicate that *L. friderici* (Bloch), *L. fasciatus* (Bloch), *L. desmotes* Fowler and *L. pachycheilus* Britski, coexist in the Aripuanã, Tocantins and Amazon basins, whereas *L. gomesi* Garavello & Santos, *L. aripuanaensis* Garavello & Santos and *L. trimaculatus* n. sp. are endemic to the high Aripuanã river basin, which is isolated from the Madeira system by large waterfalls. Therefore, it is reasonable to expect more undescribed *Leporinus* species with dark brown blotches, endemic to large Amazonian tributaries.

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