

DESCRIPTION OF *MASTIGLANIS ASOPOS*, A NEW
PIMELODID CATFISH FROM NORTHERN BRAZIL,
WITH COMMENTS ON PHYLOGENETIC
RELATIONSHIPS INSIDE THE SUBFAMILY
RHAMDIINAE (SILURIFORMES: PIMELODIDAE)

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Abstract.—*Mastiglanis asopos*, a new genus and species of the neotropical catfish family Pimelodidae, is described from the Amazon basin, and rio Capim and its adjacencies, in northern Brazil. Its monophyly is supported by various autapomorphies in external and internal morphology, such as the first dorsal- and pectoral-fin elements filamentous distally, and the presence of a remarkable osseous process at the anterior portion of the premaxilla. *Mastiglanis* shares unambiguously all diagnostic features proposed for the subfamily Rhamdiinae, and also those that delimit a subset called the *Nemuroglanis* sub-clade. Eleven new synapomorphies are proposed to corroborate the monophyly of the latter group. Additional character evidence supports a hypothesis placing *Mastiglanis* as the sister group of the remainder of the *Nemuroglanis* sub-clade.

Resumo.—*Mastiglanis asopos*, um novo gênero e espécie da família Pimelodidae é descrito para a região norte brasileira (bacia Amazônica e rio Capim e arredores). Seu monofiletismo é indicado por vários caracteres apomórficos observáveis na morfologia externa e interna, dentre os quais destacam-se: os primeiros elementos (“espinhos”) das nadadeiras dorsal e peitoral extremamente alongados e a presença de um notável processo ósseo na região anterior da premaxila. *Mastiglanis* compartilha todos os caracteres diagnósticos da subfamília Rhamdiinae, assim como, todos aqueles que definem um subgrupo mais restrito chamado “*Nemuroglanis* sub-clade.” O monofiletismo deste último é corroborado por onze novas sinapomorfias. *Mastiglanis* é provisoriamente posicionado como grupo-irmão de todos os outros componentes do “*Nemuroglanis* sub-clade.”

The most recent account on the situation of the systematics of South American freshwater fishes is that of Böhlke et al. (1978), who estimated that a large portion of that fish fauna, especially that from the Amazon basin, remains undescribed and even unknown. In spite of the considerable progress made since the publication of Böhlke et al.'s paper, only recently have catfishes from the Amazon basin been dealt within a phylogenetic context (e.g., Stewart 1986a, 1986b; Ferraris & Mago-Leccia 1989; Pinna 1989).

The fish herein studied is an illustrative

example of the above-mentioned situation, for it remained unknown until now in spite of its distinctive external features and wide distribution throughout the Amazonian basin. This paper describes this pimelodid catfish as a new genus and species, and discusses its relationships within a recently provided synapomorphy scheme of the Rhamdiinae (Lundberg et al. 1991a). Additional new corroboration is given to a formerly suggested rhamdiine subset (Ferraris 1988) as well as a discussion about the arrangement of the genera therein included.

Material and Methods

Morphometric values were taken with calipers and expressed to the nearest 0.1 mm. All measurements are made point-to-point on the specimens' left side whenever possible. Morphometric data are expressed as proportions of standard length (SL), or head length (HL; all subunits of the cephalic region, excepting the barbels which were expressed in proportions of SL). Each proportion is provided with its arithmetic mean, followed by the range and standard deviation. The number of specimens tallied in counts is presented enclosed in parentheses. When meristics vary, the count for the holotype is indicated by an asterisk (*). Methodology and terminology for measurements followed Lundberg & McDade (1986), with the following measurements added: prepelvic length, preadipose length, dorsal-fin base length (taken as the gap between the insertion point of the first and the last elements), maxillary-barbel length, outer- and inner-mental barbel length, head depth (taken at the vertical through the posterior margin of the fleshy opercular flap), head width (taken at its maximum width), fleshy interorbital distance (the space between the fleshy upper orbital rims), preorbital length (measured from snout tip to anterior orbital rim), anterior internarial space, and length of first and second branched rays of the dorsal and pectoral fins.

Some paratypes of *Mastiglanis asopos* and additional comparative material of Pimelodidae were cleared and counterstained employing the Taylor & Van Dyke (1985) technique, which provides a differential staining of the skeletal system elements. Vertebral counts included the first five vertebrae transformed in the Weberian apparatus, and the compound caudal centrum (PU1+U1) was counted as one. Principal caudal-fin ray counts included all branched rays plus one unbranched ray in each lobe, following Hubbs & Lagler (1958). Counts for each lobe, upper first, are separated by

a plus sign. Pterygiophores, vertebrae, gill rakers, ribs, and branchiostegal rays were counted on cleared and stained specimens only. Anatomical illustrations were sketched using a Zeiss stereomicroscope with a camera lucida attachment. In the drawings, bone is represented by stipple and cartilage by open circles.

Institutional abbreviations are: California Academy of Sciences, San Francisco (CAS); Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP); Museu Nacional do Rio de Janeiro, Rio de Janeiro (MNRJ); Universidade Federal do Rio de Janeiro, Rio de Janeiro (UFRJ); Departamento de Biologia Animal e Vegetal da Universidade do Estado de Rio de Janeiro, Rio de Janeiro (DBAV-UERJ), National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM).

Comparative material examined (CS-cleared and stained preparations).—*Acentronichthys leptos*, UFRJ 289 (1 ex., CS), UFRJ 505 (1 ex., CS); *Brachyglanis* sp., MZUSP 45895 (1 ex., CS); *Brachyplatystoma filamentosa*, MZUSP 45896 (1 ex., CS); *Brachyrhamdia meesi*, UFRJ 397 (2 ex., CS); *Calophysus macropterus*, MZUSP 26415 (1 ex., CS), MZUSP 45904 (1 ex., CS); *Cetopsorhamdia iheringi*, UFRJ 689 (2 ex., CS); *Cetopsorhamdia picklei*, USNM 121218 (2 ex., paratypes, CS); *Chasmocranus longior*, MZUSP 45909 (2 ex., CS); *Chasmocranus truncatorostris*, UFRJ 322 (1 ex., CS), UFRJ 504 (1 ex., CS); *Cheirocerus goeldi*, MZUSP 45905 (2 ex., CS); *Gladioglanis conquistador*, MZUSP 45906 (2 ex., CS); *Goeldiella leques*, MZUSP 45907 (1 ex., CS); *Heptapterus mustelinus*, UFRJ 291 (1 ex., CS); *Hypophthalmus edentatus*, MZUSP 43304 (1 ex., CS); *Iheringichthys labrosus*, UFRJ 690 (1 ex., CS), DBAV-UERJ 146 (1 ex.); *Imparales mariaei*, USNM 121251 (1 ex., holotype); *Imparales panamensis*, USNM 293454 (1 ex., CS); *Imparfinis minutus*, MZUSP 39990 (1 ex., CS), UFRJ 320 (4 ex.); *I. mirini*, MZUSP 45899 (1 ex., CS); *I. nemacheir*, USNM 121163 (2 ex., CS); *I.*

piperatus, CAS 63636 (1 ex., holotype); *I. schubarti*, MZUSP 45897 (1 ex., CS); *Imparfinis* sp. 1, MZUSP 45900 (1 ex., CS); *Imparfinis* sp. 2, MZUSP 45898 (1 ex., CS); *Imparfinis* sp. 3, UFRJ 393 (1 ex., CS); *Lophiosilurus alexandri*, UFRJ 042 (1 ex., CS); *Megalonema platanus*, MZUSP 45902 (1 ex., CS); *Megalonema* sp., DBAV-UERJ 122 (1 ex., CS); *Microglanis parahybae*, UFRJ 693 (2 ex., CS); *Nannoglanis bifasciatus*, MZUSP 45903 (2 ex., CS); *Nannorhamdia stictonotus*, UFRJ 292 (3 ex., CS); *Nemuroglanis* sp., MZUSP 45908 (1 ex., CS); *Parapimelodus valenciennis*, DBAV-UERJ 230 (1 ex., CS); *Phenacorhamdia boliviana*, MZUSP 42296 (2 ex., CS); *Phenacorhamdia* sp., MZUSP 45901 (1 ex., CS); *Pimelodella lateristriga*, UFRJ 503 (2 ex., CS); *Pimelodella* sp., UFRJ 502 (2 ex., CS); *Pimelodus maculatus*, UFRJ 691 (2 ex., CS); *P. ornatus*, DBAV-UERJ 934 (1 ex., CS); *Pseudopimelodus* sp., DBAV-UERJ 118 (1 ex., CS); *Rhamdia* sp., UFRJ 321 (3 ex., CS); *Rhamdiopsis* sp., UFRJ 708 (1 ex., CS).

Mastiglanis, new genus

Diagnosis.—A small pimelodid catfish displaying the suite of apomorphic characters ascribed to the subfamily Rhamdiinae (Lundberg, 1991a). It also exhibits all attributes that characterize a more restricted monophyletic unit called “*Nemuroglanis* sub-clade” (Ferraris 1988; see also Phylogenetic Relationships section below). *Mastiglanis* is distinguishable from all other rhamdiines by the following putatively autapomorphic traits: 1—integument pigmentation very reduced; 2—anterior-most element of the dorsal fin (homologous to dorsal-fin spine) prolonged as a long filament; 3—first pectoral-fin element (homologous to pectoral-fin spine) prolonged as a long filament; 4—anterior internarial width greater than the posterior one; 5—frontals narrow at supraorbital portion; 6—an anterodorsal oriented shelf-like process at the symphyseal region of premaxilla; 7—anterior cornua of

mesethmoid abruptly assuming a reversed direction at their mid-length; 8—an elongated metapterygoid; 9—a lamina at the anterodorsal margin of the opercle; 10—rear portion of opercular bone tapered and curved ventrally. Other characters considered plesiomorphic or of unknown polarity but still useful for identification include: eyes large; long maxillary barbels extending beyond adipose-fin origin; mouth ventral; bones of cranial roof thin, lacking ornamentation and connected via lap junctions (dentate sutures absent); well-developed supraoccipital process; and triangular pectoral fins.

Type species.—*Mastiglanis asopos*, new species.

Etymology.—From the Greek *mastix* (*mastigo*, in latinized form) meaning whip, in allusion to the filamentous elements of pectoral and dorsal fins; and *glanis*, the name of the Greek catfish of Aristotle, a common denomination for fishes of the order Siluriformes. The last two letters of the word *mastigo* were suppressed for the sake of euphony. Gender masculine.

Mastiglanis asopos, new species

Figs. 1, 2, Table 1

Diagnosis.—As for the genus.

Holotype.—MNRJ 12227, SL 65.9 mm, Brazil, Pará, Igarapé Saracazinho, tributary of rio Trombetas, near Porto Trombetas, coll. É. P. Caramaschi & D. F. Moraes Jr., 14 Dec 1990.

Paratypes.—MNRJ 12228, 10 ex., SL 42.5–53.1 mm, taken with holotype; MNRJ 12229, 1 ex. cleared and stained, SL 48.8 mm, taken with holotype; MZUSP 7446, 2 ex., SL 44.8–51.5 mm, Brazil, Amazonas, município de Silves, rio Sanabani, coll. EPA, 7–8 Dec 1967; MZUSP 23299, 2 ex., SL 37.0–39.1 mm, Brazil, Amazonas, rio Jauaperi, beach 30 km upstream from the river mouth, coll. T. Roberts, 19 Nov 1968; MZUSP 23533, 1 ex., SL 39.6 mm, Brazil, Amazonas, left margin of the rio Içá, Cuiuaú,

Igarapé da Cachoeira, coll. EPA, 18 Oct 1968; MZUSP 23541, 10 ex., SL 30.8–58.2 mm, Brazil, Amazonas, left margin of the rio Içá, upstream from Cuiauá, Igarapé Boa Vista, coll. EPA, 19 Oct 1968; MZUSP 23549, 1 ex., SL 43.0 mm, Brazil, Amazonas, left margin of the rio Solimões, 7 km downstream from the Santo Antonio do Içá, Igarapé Içá, coll. EPA, 20 Oct 1968; MZUSP 23875, 1 ex., SL 35.8 mm, Brazil, Pará, rio Capim, Caranandéua beach, coll. EPA, 17 Aug 1970; MZUSP 24282, 2 ex., SL 28.3–34.7 mm, Brazil, Pará, município de São Luis, rio Tapajós, coll. EPA, 5 Nov 1970; MZUSP 25635, 1 ex., SL 27.4 mm, Brazil, Pará, pov. Pimental, right margin of the rio Tapajós, mouth of the Igarapé Pimental, coll. J. C. de Oliveira, 15–31 Jul 1979; MZUSP 30617, 84 ex., SL 16.5–40.0 mm, Brazil, Amazonas, rio Negro, 2 hours upstream from Barcelos, Urumari beach, coll. M. Goulding, 6 Oct 1979, 0000 h; MZUSP 30618, 11 ex., SL 19.6–41.8 mm, Brazil, Amazonas, beach at the Tamaquaré island, coll. M. Goulding, 10 Oct 1979, 2100 h; MZUSP 30633, 2 ex., SL 32.9–33.8 mm, Brazil, Amazonas, Massarabi, rio Negro, coll. M. Goulding, 18 Oct 1979; 2000 h; MZUSP 30635, 1 ex., SL 35.5 mm, Brazil, Amazonas, beach at Paraná do Jacaré, coll. M. Goulding, 7 Oct 1979, 2100 h; MZUSP 30636, 2 ex., SL 30.7–34.7 mm, Brazil, Amazonas, beach near mouth of rio Arirará (tributary of rio Negro), coll. M. Goulding, 6 Oct 1979, 2100 h; MZUSP 34953, 6 ex., SL 39.0–49.4 mm, Brazil, Amazonas, rio Daraá (tributary of rio Negro), Cachoeira do Aracu, coll. M. Goulding, 10 Feb 1980; MZUSP 34954, 17 ex., SL 26.4–38.1 mm, Brazil, Amazonas, near mouth of rio Marauíá (tributary of rio Negro), coll. M. Goulding, 13 Oct 1979; MZUSP 34955, 6 ex., SL 29.6–33.2 mm, Brazil, Amazonas, confluence of rio Arirará with rio Negro, coll. M. Goulding, Oct 1979; MZUSP 44215, 1 ex. cleared and stained, SL 52.0 mm, taken with MZUSP 34953; UFRJ 381, 2 ex., SL 35.7–38.6 mm, Brazil, Pará, muni-

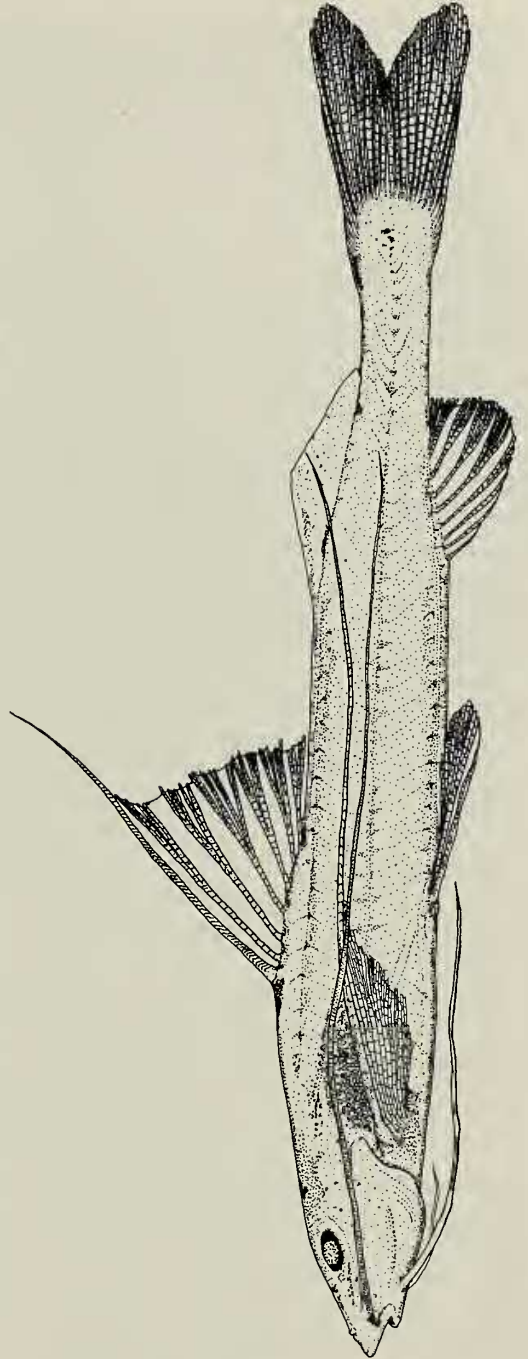


Fig. 1. *Mastiglanis asopos*, n. gen. and sp. Lateral view of holotype, MNRJ 12227, 65.9 mm SL. Scale bar: 10 mm.

Table 1.—Morphometric data of *Mastiglanis asopos* taken from holotype (MNRJ 12227) and 10 paratypes (MNRJ 12228). Morphometric data 1–23 are expressed as percentage of standard length and 24–33 as percentage of head length. H: holotype; SD: standard deviation.

	H	\bar{X}	Range	SD
Standard length (mm)	65.9		42.5–65.9	
1. Predorsal length	35.4	34.9	33.6–35.8	0.75
2. Preanal length	69.2	69.6	68.0–71.2	1.06
3. Prepelvic length	43.7	42.6	40.1–43.7	1.09
4. Preadipose length	64.5	64.2	61.7–66.9	1.45
5. Caudal-peduncle length	20.0	20.8	18.8–22.5	1.28
6. Caudal-peduncle depth	5.9	5.9	5.6–6.3	0.24
7. Adipose-fin length	22.2	23.0	20.5–26.0	1.66
8. Dorsal fin to adipose fin	17.3	17.7	16.2–19.5	0.84
9. Anal-fin base	10.3	11.2	10.3–12.0	0.65
10. Dorsal-fin spine length	44.3	38.4	35.0–44.3	3.17
11. Length of first branched dorsal-fin ray	23.2	24.6	23.1–26.7	1.19
12. Length of second branched dorsal-fin ray	19.6	21.0	19.1–22.9	1.14
13. Dorsal-fin base	12.7	13.2	12.6–13.8	0.36
14. Pelvic-fin length	17.5	17.8	17.4–18.5	0.37
15. Pectoral-fin spine length	64.0	55.7	49.7–64.0	4.54
16. Length of first branched pectoral-fin ray	21.9	20.9	19.7–21.9	0.75
17. Length of second branched pectoral-fin ray	17.0	16.8	16.2–17.2	0.39
18. Body depth	14.6	13.6	12.2–14.6	0.90
19. Body width	17.3	16.2	15.1–17.3	0.72
20. Maxillary-barbel length	75.1	69.8	63.0–77.7	4.49
21. Outer mental-barbel length	40.7	35.2	26.1–42.7	5.03
22. Inner mental-barbel length	17.9	16.7	14.7–20.3	1.89
23. Head length	23.4	24.3	23.4–25.7	0.66
24. Head depth	50.6	47.7	44.4–53.0	2.58
25. Head width	72.1	69.9	67.2–72.7	1.90
26. Bony interorbital	10.3	10.0	8.7–11.3	0.82
27. Fleshy interorbital	22.1	22.7	21.7–24.6	0.94
28. Eye diameter	20.1	20.1	18.9–21.8	0.77
29. Preorbital length	42.9	41.6	39.2–43.5	1.74
30. Snout length	27.9	29.5	23.4–33.6	2.94
31. Internarial length	16.2	17.8	16.2–19.2	0.98
32. Anterior internarial width	13.6	14.1	13.3–15.0	0.57
33. Posterior internarial width	9.7	9.1	8.2–9.7	0.54

cípio de Castanhal, coll. H. Cunha, Oct 1990; UFRJ 382, 1 ex. cleared and stained, SL 38.0 mm, taken with UFRJ 381.

Description.—Morphometric data are given in Table 1. Refer to Fig. 1 for general appearance. A small rhamdiine catfish (largest specimen 65.9 mm SL). Dorsal profile slightly ascendent toward dorsal-fin origin, nearly straight to adipose-fin origin and from there slightly concave caudally. Ventral profile straight to anal-fin origin, gently concave to caudal peduncle. Body relatively

elongated, elliptical in cross-section at dorsal-fin origin, gradually more compressed toward caudal peduncle. A conspicuous axillary organ present on each side of trunk, immediately above pectoral fins, composed of globular corpuscles covered by translucent skin. Lateral line complete. In preserved specimens, myomeres conspicuous along body, totaling around 32.

Head depressed, dorsally covered by a thin skin, cheek filled with muscular mass of adductor mandibulae. Snout long and pointed,

conical in dorsal view. Posterior nostrils surrounded anterolaterally by skin flaps, well separated from anterior tubular nostrils (internarial length about twice the distance between posterior nostrils). Eyes large, lying close together, with orbital rim subtly invaginated anterodorsally. Mouth ventral, with crescentic aspect, with fleshy rictal fold at corner. Upper jaw markedly longer than lower. Premaxilla bearing approximately 30 tiny viliform teeth arranged in 4 irregular rows, its posterior corner gently curved posteriorly. Lower jaw with similar dentition disposed in 3 rows. Palatine and vomer edentulous. Barbels nearly ovoid in cross section. Maxillary barbels long, extending posteriorly beyond origin of anal fin. Outer and inner mental barbels long, extending posteriorly beyond pelvic- and pectoral-fin origins, respectively. Mental barbels supported by large and morphologically complex cartilaginous plates not fused mesially. Branchiostegal membranes medially overlapping, joined to isthmus region only at its anteriormost portion. Seven branchiostegal rays (5 on anterior ceratohyal, 1 on posterior ceratohyal, 1 on cartilage in between). Ten long gill rakers on first ceratobranchial plus 1 on the angle formed with first epibranchial. Fontanel reaching base of supraoccipital process, interrupted by epiphyseal bridge just behind eyes. Anterior portion of cranial fontanel narrow. Supraoccipital process well developed, wide, with lateral edges parallel and distal tip concave. Bones of cranial roof thin, with smooth texture (devoid of ornamentation). Frontals, sphenotics, pterotics, and supraoccipital joined via overlapping joints. Nasal bones elongate. Infraorbital series poorly ossified and comprised of five elements: lacrimal, a tiny canal transversely fused to lacrimal, and three tubular ossicles.

Dorsal fin well developed, triangular in overall shape with posterior margin gently concave, with $i+6$ rays. First dorsal-fin element (homologous to dorsal-fin spine) segmented, rigid at its proximal portion (a re-

gion as long as the first branched element), and with distal portion produced into a long and flexible filament reaching beyond adipose-fin origin when fin is adpressed to trunk. First and second branched dorsal-fin elements also rather developed. Locking element (spinelet) absent. Seven dorsal-fin pterygiophores articulating with bifid neural spines of vertebrae 6 through 12–13. First proximal radial enlarged. Two anteriormost proximal radials closely approximated for their entire lengths, and suturally connected at their proximal thirds, almost forming a single structure.

Pectoral fin scythe-shaped with $i+8$ (3), $i+9$ (10*). First element unfused, segmented, unserrated posteriorly, with basal portion (equivalent to length of first branched element) rigid and distal portion filamentous (Figs. 1, 2), the tip of which extends beyond anal-fin origin when pectoral fin is adpressed to trunk. Postcleithral process reduced, slightly curved dorsally.

Pelvic fin large, with $i+5$ rays, its origin vertically below fifth branched ray of dorsal fin.

Anal-fin rays $ii+7$ (7), $iii+6$ (4), $iii+7$ (2*) (plus 1 rudimentary anterior ray); anal fin with rounded margin in lateral profile, and originating at myomere 20–21. Nine blade-like pterygiophores between hemal spines of vertebrae 22 through 27–28.

Adipose fin long, barely triangular in shape, moderately high, its origin slightly in advance of origin of anal fin, nearly above the centra of vertebrae 16 or 17.

Caudal fin deeply forked, its lobes equal in length. Principal caudal rays $i+7-i+8$, procurrent caudal rays xiv (1), xv (2), xvi (7*), $xvii$ (3) above; xiv (3), xv (7), xvi (2*), $xvii$ (1) below. Hypural 1, hypural 1 and 2, and 3, 4, and 5 fused. Parahypural separate.

Six or seven pairs of ribs associated with parapophyses of vertebrae 6 to 11–12. First complete haemal spine on vertebrae 13 or 14. Distal extremities of pleural ribs strongly flattened dorsoventrally, presenting a scythe-like aspect. Total vertebrae 38. Swim



Fig. 2. Dorsal view of *Mastiglanis asopos*, paratype, MNRJ 12228, 42.5 mm SL.

bladder reduced, bilobed, transversely aligned, restricted to anterior body cavity.

Pigmentation in alcohol.—Overall body color pale yellowish (transparent when alive and white immediately after fixation). Dorsal half of trunk with almost indistinct disperse punctuation, ventral half devoid of pigment. Dorsal portion of body with seven conspicuous areas of concentrated dark chromatophores: one between head and dorsal fin (just behind nape), one in front of dorsal-fin origin, one at the level of last three branched dorsal-fin rays, one between dorsal and adipose fin, one just behind the adipose-fin origin, one on the posterior point of adipose-fin base, and one on caudal peduncle. Laterally, there are chromatophores concentrated along the horizontal septum,

posteriorly to caudal-fin base, forming a poorly defined stripe. Some scattered melanophores present on top of head region, along path of infraorbital canals and over cheek. Dispersed melanophores at the humeral region, just above pectoral fins. Dorsal part of maxillary barbels darkly pigmented. Adipose fin with few irregularly distributed melanophores. Dorsal-, pectoral-, and caudal-fin rays lightly pigmented. Interradial membranes hyaline. Pigmentation intensity increases with size.

Etymology.—The specific name is derived from the Greek river-God Asopos, given in reference to the widespread distribution of this fish throughout Amazonian drainages.

Distribution.—Known to occur in the



Fig. 3. Distribution of *Mastiglanis asopos*. Asterisk indicates the locality where holotype was collected.

Amazon basin and the rio Capim, northern Brazil (Fig. 3).

Autapomorphies of *Mastiglanis*

Mees (1974) attempted to rediagnose the pimelodid genus *Imparfinis* on the basis of presence of free orbital rim and dorsal- and pectoral-fin spines, and as a consequence considered *Nannorhamdia* as its junior synonym. More recently, Mees & Cala (1989) tentatively gave a new definition to *Imparfinis* (also including *Nannorhamdia*). However, no derived character supporting the monophyly of *Imparfinis* was presented, making the genus a taxonomic waste-basket that encompasses medium- and small-sized

rhamdiines not ascribed to other known genera. Because *Mastiglanis* does not have any evident derived characters shared with any other single rhamdiine genus, it would certainly fall into *Imparfinis* by traditional generic diagnoses. However, ongoing studies indicate that *Imparfinis piperatus*, the type species of its genus, plus some species, but not all, currently assigned to *Imparfinis* and *Nannorhamdia* compose a monophyletic group. This group is herein called *Imparfinis sensu stricto*. This group includes, at least, the following nominal species: *Chasmocranus peruanus*, *Imparfinis mirini*, *Imparfinis hasemani*, *Imparfinis piperatus*, *Nannorhamdia benedettii*, *Nannorhamdia guttatus*, *Nannorhamdia lineata*, *Nanno-*

rhamdia nemacheir, *Nannorhamdia schubarti*, *Pimelodella cochabambae*, *Pimelodus longicauda*, and *Rhamdia minuta*. At the moment, it is not possible to unambiguously assess the monophyly of *Nannorhamdia*, mainly because of uncertainties regarding *Nannorhamdia spurrellii*, the type species of the genus. Therefore, the synonymy between *Imparfinis* and *Nannorhamdia* is still doubtful. In any case, the specific composition of *Imparfinis* proposed by Mees & Cala (1989) makes the genus a non-monophyletic unit because the characters herein presented (see below) indicate that *Imparfinis* sensu stricto appears to be more closely related to a restricted group including the majority of the *Nemuroglanis* subclade (e.g., *Acentronichthys*, *Cetopsorhamdia*, *Chasmocranus*, and *Heptapterus*, none synonymized into *Imparfinis*), than to *Mastiglanis*, *Nemuroglanis*, *Rhamdiopsis*, and at least one species currently in *Nannorhamdia*, *Nannorhamdia stictonotus* Fowler (and probably *Imparfinis pseudonemacheir* Mees & Cala, a closely related species). Given the situation depicted above, *Mastiglanis* cannot be placed in *Imparfinis*. Also, *Mastiglanis* does not share any exclusive character with *Nemuroglanis*, *Rhamdiopsis* or *Nannorhamdia stictonotus*, justifying its generic rank. These attributes plus autapomorphies for the new genus are described and discussed below.

The integument pigmentation of *Mastiglanis* is limited to faint maculae on the dorsal region of trunk and head, a faint band of melanophores along the lateral line, and scattered melanophores on fin rays and maxillary barbels. Similar reductive pigmentation is encountered among cave dwelling pimelodids such as the monotypic genera *Caecorhamdella* Borodin, *Caecorhamdia* Norman, and *Typhlobagrus* Ribeiro, often accompanied by eye degeneration. However, *Mastiglanis* does not inhabit caves (it has diurnal activity, swimming in rock pools with sandy bottom cov-

ered with leaf litter deposition; É. P. Caramaschi, pers. comm.) and has very well-developed eyes. Irrespective of their habitats, the troglobitic pimelodids are related to relatively plesiomorphous unresolved rhamdiine assemblages (Ferraris, 1988; Lundberg et al., 1991a). Due to the large phylogenetic distance between them, the reduction in pigment is interpreted as an independent event, thus an autapomorphy for *Mastiglanis*.

The first elements of the pectoral and dorsal fins in *Mastiglanis* are prolonged into long and flexible filaments. The pectoral-fin filament is about 2.5 times as long as the first branched pectoral-fin element, and the dorsal filament is 1.5 times as long as the first branched dorsal-fin element, rare situations within Pimelodidae (Figs. 1, 2). Some species of *Pimelodella*, such as *P. figueroai* Dall, *P. griffini* Eigenmann, *P. insignis* Schubart, *P. martinezi* Fernández-Yépez, and *P. taenioptera* Ribeiro, show very similar filamentous conditions in the dorsal spine, but no other character is congruent with a hypothesis of close relationships between them and *Mastiglanis*, hence this trait is considered homoplastic. The most similar condition is present in the pectoral spine of *Nannorhamdia nemacheir* Eigenmann & Fisher, but various differences maintain it isolated from *Mastiglanis* [e.g., different body appearance, dark coloration, number of vertebrae (39–40 vs. 38 in *Mastiglanis*)]. Regardless of its distinctive traits, *Nannorhamdia nemacheir* certainly pertains to the genus *Imparfinis* sensu stricto, which is sufficient reason to consider the filamentous condition of the pectoral spine as not-homologous in this species and *Mastiglanis* (see Phylogenetic Relationships section below).

Usually in rhamdiines, the distance between the posterior nostrils is approximately equal to the distance between the anterior ones. A different situation occurs in *Mastiglanis*, where the anterior nostrils are near-

ly 1.5 times further apart than the posterior ones. Therefore, this situation is interpreted as an autapomorphy of *Mastiglanis*.

The eyes of *Mastiglanis* are set relatively close to one another (Bony Interorbital Distance about 10.0% of HL), while in other rhamdiines the eyes are separated by a considerably larger gap (Bony Interorbital Distance at least to 18.0% of HL). Therefore, the close placement of eyes of *Mastiglanis* is considered derived. This feature is seen osteologically by the narrowness of the orbitosphenoid and the frontals in the supra-orbital region (Figs. 4, 5).

Perhaps the most striking autapomorphy of *Mastiglanis* is a prominent plate-like process at the anteroproximal portion of the premaxilla (Figs. 4, 5). This process, unique within rhamdiines, is edentulous and gently directed dorsally, and is related to the pointed snout of this fish.

Another autapomorphy identified at the anterior cranial region is the modified anterior mesethmoid cornua. Plesiomorphically, the catfish mesethmoid cornua have arms that diverge anterolaterally gradually. In *Mastiglanis*, the arms reverse abruptly at mid length, assuming a posterolateral orientation—a situation unique within Rhamdiinae (Fig. 5).

Among rhamdiine catfishes the common metapterygoid configuration is that illustrated by Lundberg & McDade (1986) for *Brachyrhamdia*, where the bone is roughly quadrangular and approximately as long as deep. The metapterygoid in *Mastiglanis*, contrastingly, is longitudinally elongate, rectangular in shape (Fig. 6).

Finally, two other uniquely derived characters of *Mastiglanis* may be observed in its opercle. A sloping osseous flange is present on the dorsal border of the opercle, lying in the same plane of the bone. This lamina is raised just posterior to the site of articulation of the preopercle and decreases gradually towards the posterior extremity of the bone, reaching to its mid length (Fig. 6). A

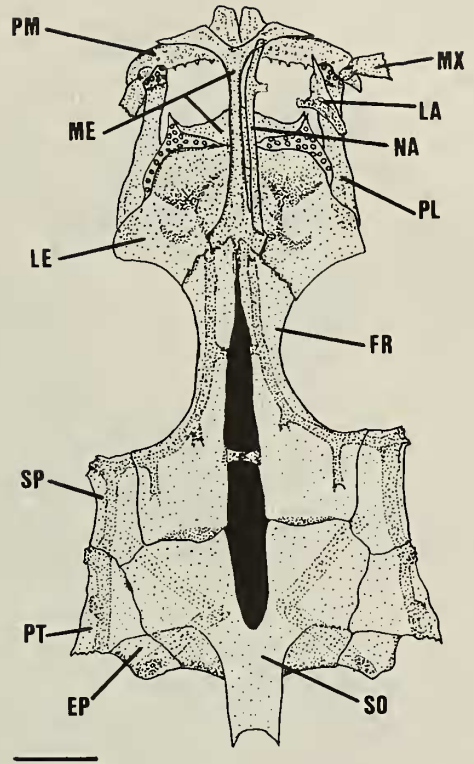


Fig. 4. Dorsal view of cranial skeleton of *Mastiglanis asopos*, paratype, UFRJ 382, 38.0 mm SL. Scale bar: 1 mm. Abbreviations: EP—Epioccipital; FR—Frontal; LA—Lacrimal; LE—Lateral ethmoid; ME—Mesethmoid; MX—Maxilla; NA—Nasal; PL—Palatine; PM—Premaxilla; PT—Pterotic; SO—Supraoccipital; SP—Sphenotic. Extrascapula and infraorbitals not represented.

dorsal lamina is also present in the opercle of other rhamdiines, but it is medially reflected, originated at its mid length, and increases towards the posterior extremity of the bone. Although both structures can still be considered homologous, the state in *Mastiglanis* is hypothesized as derived since it is a condition unknown within rhamdiines. Also, the distal extremity of the opercle of *Mastiglanis* is exclusively tapered and directed ventrally (Fig. 6), a difference which can be taken as additional evidence for its monophyly.

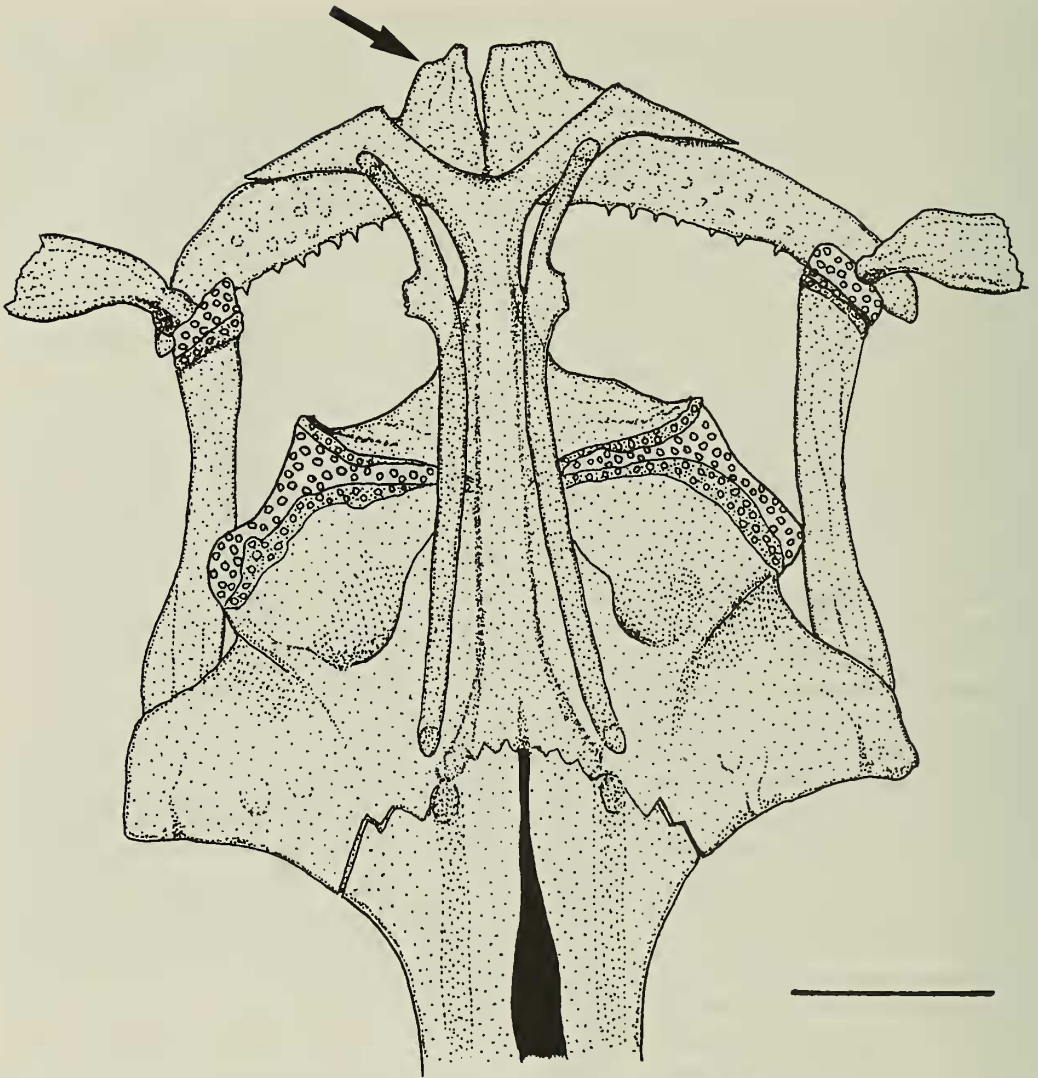


Fig. 5. Anterior portion of the cranial skeleton of *Mastiglanis asopos*, paratype, MZUSP 44215, 52.0 mm SL. Arrow points to the anterior process of premaxilla. Scale bar: 1 mm.

Phylogenetic Relationships of *Mastiglanis*

The family Pimelodidae has recently received a cladistic treatment, and large monophyletic subsets have been identified, a first step towards the elucidation of phylogenetic relationships in this still much confused assemblage (Lundberg & McDade 1986; Stewart 1986a, Ferraris 1988, Lundberg et al. 1988, Lundberg et al. 1991a,

1991b). Lundberg & McDade (1986) and Lundberg et al. (1991a) provided evidence for a monophyletic group within Pimelodidae composed of the following genera: *Acentronichthys*, *Brachyglanis*, *Brachyrhamdia*, *Caecorhamdella*, *Caecorhamdia*, *Cetopsorhamdia*, *Chasmocranus*, *Gladioglanis*, *Goeldiella*, *Heptapterus*, *Horiomyzon*, *Imparales*, *Imparfinis*, *Leptorhamdia*, *Medemichthys*, *Myoglanis*, *Nannorhamdia*,

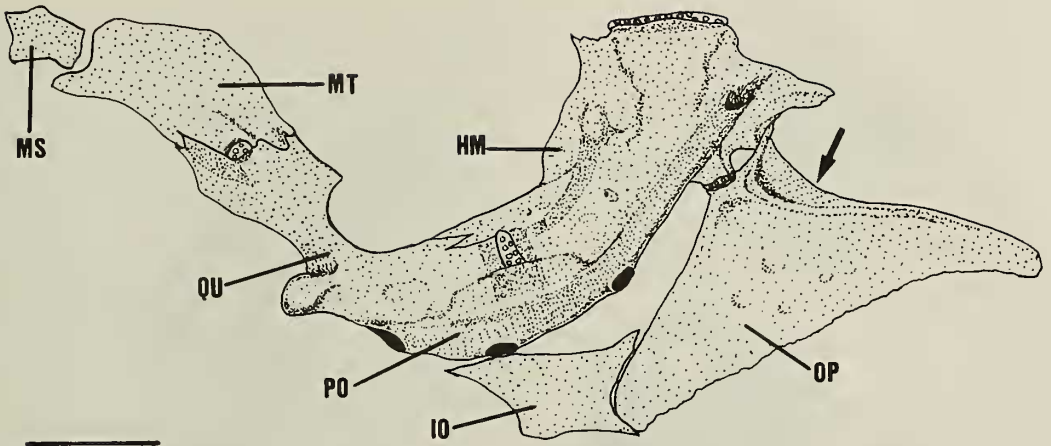


Fig. 6. Lateral view of the left suspensorium and opercular series of *Mastiglanis asopos*, paratype, MZUSP 44215, 52.0 mm SL. Arrow shows the osseous lamina running on dorsal edge of opercle. Scale bar: 1 mm. Abbreviations: HM—Hyomandibula; IO—Interopercle; MS—Mesopterygoid; MT—Metapterygoid; OP—Opercle; PO—Preopercle; QU—Quadrate.

Nemuroglanis, *Pariolius*, *Phenacorhamdia*, *Phreatobius*, *Pimelodella*, *Rhamdella*, *Rhamdia*, *Rhamdiopsis*, and *Typhlobagrus*. Two other nominal genera, *Nannoglanis* and *Rhamdioglanis*, can be added to this list. Lundberg et al. (1991a) ranked the above monophyletic group as the subfamily Rhamdiinae. The following synapomorphies for the Rhamdiinae are compiled from Lundberg et al. (1991a): 1) posterior limb of fourth transverse process laterally expanded above swim bladder and notched once to several times; 2) neural spines of Weberian complex centrum joined by a straight-edged, horizontal or sometimes sloping bony lamina; 3) process for insertion of levator operculi muscle on postero-dorsal corner of hyomandibula greatly expanded; 4) quadrate with a free dorsal margin and bifid shape, its posterior and anterior limbs articulate separately with hyomandibula and metapterygoid; 5) presence of an anteriorly recurved process drawn out from ventrolateral corner of mesethmoid. *Mastiglanis* presents all of the above characters, supporting its inclusion in Rhamdiinae. Further, it has the following

derived traits shared exclusively by a rhamdiine subgroup called *Nemuroglanis* sub-clade (Ferraris 1988): the laminar portion of complex centrum transverse process, posterior to branched segment, is triangular and extends nearly to the lateral tip of the fifth vertebral transverse process; the first dorsal-fin basal pterygiophore is inserted behind the Weberian complex, usually above vertebrae 7 to 10; the “dorsal-fin spine” is thin and flexible and the dorsal-fin lock is absent; the “pectoral-fin spine” is thin and flexible for its distal half. This subset is composed of the following genera: *Acentronichthys*, *Cetopsorhamdia*, *Chasmocranus*, *Heptapterus*, *Horiomyzon*, *Imparales*, *Imparfinis*, *Medemichthys*, *Nannoglanis*, *Nannorhamdia*, *Nemuroglanis*, *Pariolius*, *Phenacorhamdia*, *Phreatobius*, *Rhamdioglanis*, *Rhamdiopsis*, and now also *Mastiglanis*. In addition to those characters, new traits supporting an hypothesis of monophyly of the *Nemuroglanis* sub-clade are proposed below.

Various modifications of the pectoral girdle and associated parts are related to the reduction of the pectoral-fin spine men-

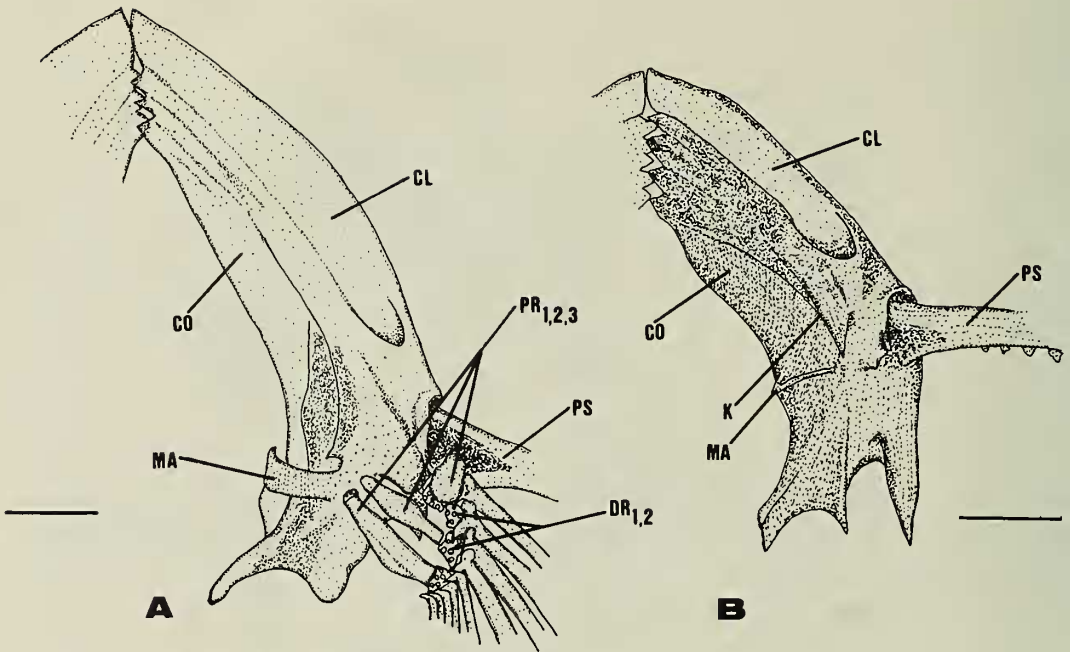


Fig. 7. Ventral view of the pectoral girdle of: A. *Mastiglanis asopos*, paratype, MZUSP 44215, 52.0 mm SL, Scale bar: 1 mm; B. *Brachyrhamdia meesi*, UFRJ 397, 42.8 mm SL, Scale bar: 2 mm SL. Abbreviations: CL—Cleithrum; CO—Coracoid; DR 1, 2—Distal radials 1 and 2; K—Coracoid keel; MA—Mesacoracoid arch; PR 1, 2, 3—Proximal radials 1, 2, and 3; PS—Pectoral spine.

tioned above. Plesiomorphically, the mesacoracoid arch is a slender and delicate ring (Fig. 7B, Arratia 1987, Grande 1989, Grande & Lundberg 1988). Within Rhamdiinae, this structure differs markedly in the *Nemuroglanis* sub-clade, where it is modified into a wide band (Fig. 7A). Also, the two posterior proximal radials are apomorphically enlarged and flattened in the *Nemuroglanis* sub-clade (Fig. 7A). In most pimelodids, in contrast, the pectoral radials are plesiomorphically thin.

Two other characters of the pectoral-fin girdle offer further support for the monophyly of the *Nemuroglanis* sub-clade, including *Mastiglanis*. Usually the ventral portion of the catfish pectoral girdle is formed by a horizontal bridge composed of the two cleithra ligamentously united to each other and by the scapulo-coracoid (hypocoracoid of Regan 1911) tightly joined to

its bilateral counterpart via an interdigitating suture (Regan 1911). The interlocking symphysis of the scapulo-coracoid is absent in Diplomystidae (Regan 1911, Arratia 1987), but widely distributed among almost all other siluriforms, including the basal genus *Hypsidoris*, being probably the plesiomorphic condition at the level of non-diplomystid catfishes. *Hypsidoris* has the scapulo-coracoids interdigitated with six sutural dentations (Grande 1987). Seven dentations are present in the fossil ictalurid *Astephus* (Grande & Lundberg 1988). The same situation occurs among the majority of Pimelodidae, Pseudopimelodidae, and Rhamdiinae exclusive of the *Nemuroglanis* sub-clade, where all have at least four scapulo-coracoid dentations (Fig. 7B). In contrast, the *Nemuroglanis* sub-clade have a delicate pectoral girdle with a short mesial contact line comprising only three weakly

joined scapulo-coracoid dentations. The contact surface between the cleithra is also reduced (Fig. 7A). Therefore, the extreme reduction of the sutural extension between the scapulo-coracoids is interpreted as apomorphic. Within pimelodids, a similar condition is developed homoplastically in the *Calophysus* group (Stewart 1986a) and *Megalonema*.

Another feature postulated as autapomorphic for the *Nemuroglanis* sub-clade is the absence of a pointed process projected posteroventrally from the coracoid keel. Although such a process has not been noted in Diplomystidae or Hypsidoridae, the hypothesized consecutive sister-groups of all other extant siluriforms (Fink & Fink 1981, Arratia 1987, Grande 1987), it is present in the majority of pimelodids, including all rhamdiines outside of the *Nemuroglanis* sub-clade (Fig. 7B), and in various other catfish families (e.g., Ariidae, Bagridae, Auchenipteridae, Mochockidae). Consequently, its absence is interpreted as a synapomorphy for the genera in the *Nemuroglanis* sub-clade (Fig. 7A).

The gas bladder composed of one anterior and two posterior chambers is the hypothesized generalized display for siluriforms (Regan 1911; Chardon 1968). The posterior chambers in members of the *Nemuroglanis* sub-clade are atrophied. The gas bladder in these catfishes is represented only by a bilobed transversely aligned structure, covered anterodorsally by the anterior limbs of the transverse process of the complex vertebra.

Among the members of the *Nemuroglanis* sub-clade, the nasal bone is comparatively longer and less ossified than in remaining rhamdiines (Figs. 4, 5). The morphology of this bone in basal rhamdiines is similar to that in other catfishes (e.g., *Hypsidoris*), i.e., a short and robust structure. Hence, the elongation and reduced ossification of the nasal is interpreted as a synapomorphy for the *Nemuroglanis* sub-clade.

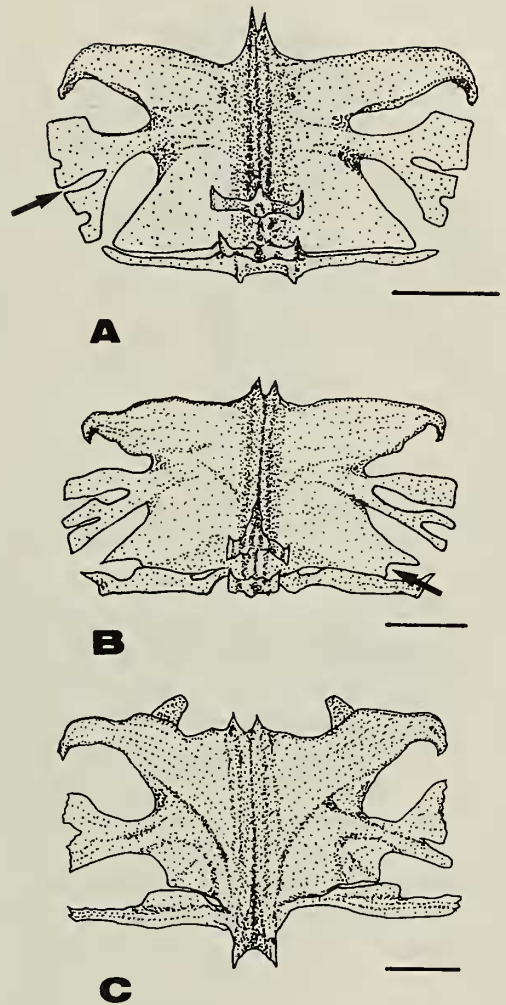


Fig. 8. Dorsal view of the complex vertebrae of: A. *Mastiglanis asopos*, paratype, UFRJ 382, 38.0 mm (arrow indicates the medial notch); B. *Imparfinis minutus*, UFRJ 320, 48.0 mm (arrow indicates the notch at angle of the triangular posterior lamina); C. *Rhamdia* sp., UFRJ 321, 44.0 mm.

Plesiomorphically among catfishes, the neural arch of the fourth vertebra is sloped posteriorly, and gives rise to two divergent ridges that reach the anterior limbs of the transverse process of the fourth vertebra (see fig. 9 in Arratia 1987). This situation is seen in the basal ictalurid *Astephus* (fig. 12A–B in Grande & Lundberg 1988), and also in many Rhamdiinae (Fig. 8C), but not in the

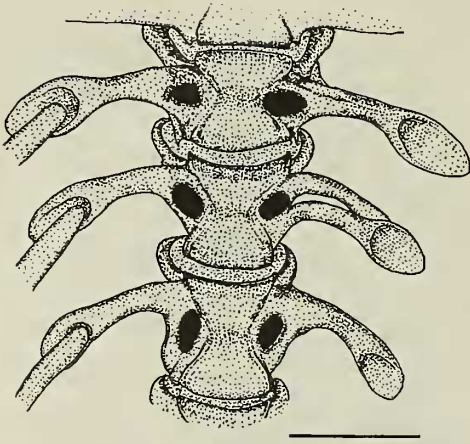


Fig. 9. Ventral view of the unmodified anterior vertebrae of *Cetopsorhamdia iheringi*, UFRJ 689, 53.0 mm SL. Scale bar: 1 mm.

Nemuroglanis sub-clade, where the ridges are apomorphically absent (Fig. 8A–B).

In the *Nemuroglanis* sub-clade, the transverse process of the fourth vertebra branches three times. The anterior division separates the principal anterior and posterior limbs, as in the hypothesized primitive condition (Grande & Lundberg 1988). Additional ramifications of the posterior limb is an apomorphic character of Rhamdiinae (Lundberg & McDade 1986). Uniquely among the members of *Nemuroglanis* sub-clade, however, there is an exclusive deep posterior notch that delimits a posterior triangular lamina (Ferraris 1988). In addition, *Mastiglanis* and all other members of the *Nemuroglanis* sub-clade exclusively possess a distinct deep medial notch that divides the posterior limb of the fourth transverse process into two divergent, approximately symmetrical, long arms (compare Fig. 8A–B and Fig. 8C; for other examples see fig. 4C in Lundberg & McDade 1986 and fig. 3

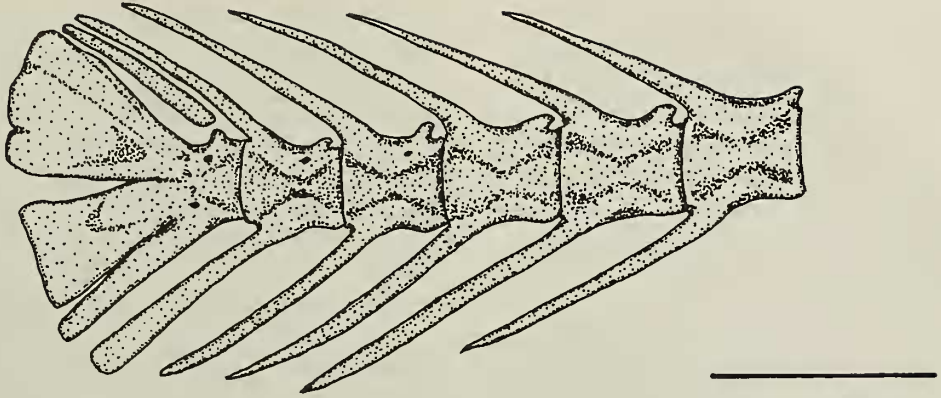
in Ferraris 1988). These arms may secondarily branch and coalesce distally.

Another point of evidence for the monophyly of the *Nemuroglanis* sub-clade is the unmodified anterior free vertebrae. In taxa belonging to that clade, the proximal extremities of the pleural ribs fit under the distally expanded and concave tips of the parapophyses (Fig. 9). In the majority of pimelodids (and other catfishes), contrastingly, the ribs are associated ventrally with the parapophyses without well-defined alveolar sites for articulation. A very similar condition, postulated as independent, is observed in the pimelodines *Calophysus* and *Megalonema*.

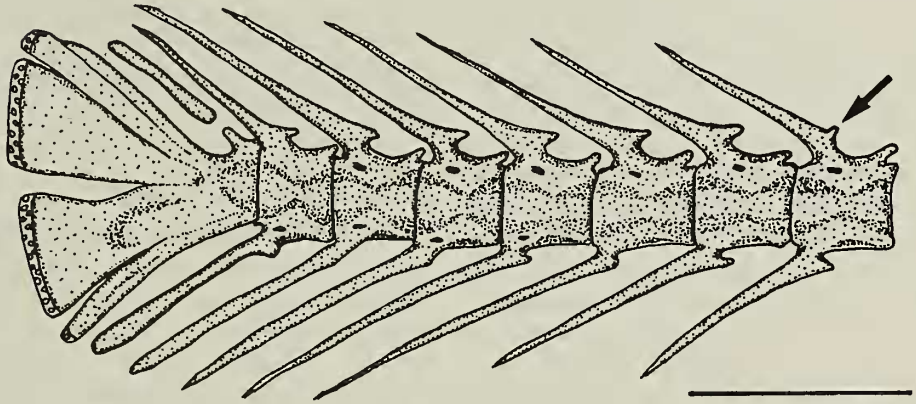
Mastiglanis and all other members of the *Nemuroglanis* sub-clade have the hemal and neural spines of the caudal vertebrae oriented at about 35° to the column axis (Fig. 10A–B). In contrast, a more open angle (greater or equal to 45°, modally 55°) is largely diffused among other pimelodids, including remaining rhamdiines (Fig. 10C). Due to a more restricted distribution, the former situation (an oblique angle) is considered an apomorphic transformation from the latter one (an open angle), corroborating the *Nemuroglanis* sub-clade monophyly. Also, the components of this sub-clade share derived robust hemal and neural spines of the last free precaudal vertebrae, differing from the plesiomorphic state (hemal and neural spines uniformly thin along their lengths) observed in other rhamdiines (compare Fig. 10A–B and Fig. 10C).

However, *Mastiglanis*, *Nannorhamdia stictonotus*, *Nemuroglanis*, and *Rhamdiopsis* present the plesiomorphic state of one character that occurs apomorphically among all other taxa related to the *Nemuroglanis* sub-clade (Fig. 10A–C). *Acentronichthys*,

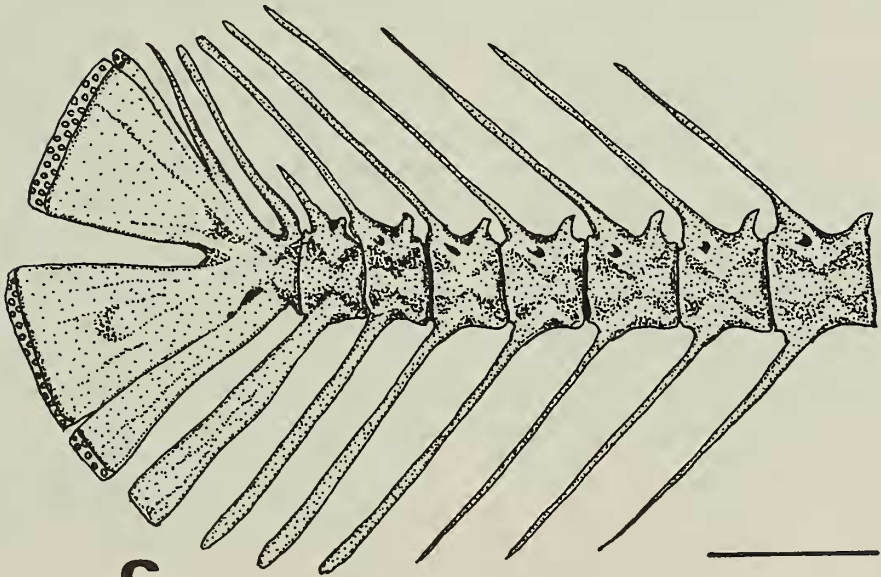
Fig. 10. Posterior caudal vertebrae of: A. *Mastiglanis asopos*, paratype, MZUSP 34953, 52.0 mm SL; B. *Imparfinis minutus*, UFRJ 320, 48.0 mm SL (arrow points to the neural process); C. *Goeldiella eques*, MZUSP 45907, 77.6 mm SL.



A



B



C

Cetopsorhamdia, *Chasmocranus*, *Heptapterus*, *Imparales*, *Imparfinis*, *Phenacorhamdia*, and probably the remaining genera of the *Nemuroglanis* sub-clade, exhibit a median anterior process nearly parallel to the vertebral column axis at the base of spines, at least, of the last five vertebrae (Fig. 10B, see arrow). This derived trait constitutes evidence for the monophyly of a group including these genera.

An additional derived character provides putative evidence for a more inclusive monophyletic group within the *Nemuroglanis* sub-clade. In *Acentronichthys*, *Cetopsorhamdia*, *Chasmocranus*, *Heptapterus*, *Imparales*, *Imparfinis*, *Phenacorhamdia*, and also *Nannorhamdia stictonotus* and *Rhamdiopsis* (and probably *Pariolius*, *Medemichthys*, *Nannoglanis*, and *Rhamdioglanis*), the triangular posterior lamina of the complex centrum transverse process has at its distal angle an additional notch (Fig. 8B, arrow). This configuration is not present in *Nemuroglanis* and *Mastiglanis* (Fig. 8A), where the posterior margin of the triangular posterior lamina is fully straight. The former condition is considered apomorphic and defines a subset including all genera of the *Nemuroglanis* sub-clade except *Nemuroglanis* and *Mastiglanis*. Consequently, *Nemuroglanis* and *Mastiglanis* are candidates for the position of sister group to the other *Nemuroglanis* sub-clade members.

Furthermore, the medial notch separating two symmetrical arms of the posterior limb of complex vertebrae is more attenuated in *Mastiglanis* than in other members of the *Nemuroglanis* sub-clade, including *Nemuroglanis* (compare Fig. 8A and Fig. 8B). This may be an indication that *Mastiglanis* is the sister-group of all other members of the *Nemuroglanis* sub-clade. Although I acknowledge that it is a weak evidence, it is the only one available at present. Two other characters might be used as further evidence for that hypothesis. Almost all members of the *Nemuroglanis* sub-clade share a pectoral fin with a rounded contour, an unquestionable

derived trait, as opposed to triangular (the widespread siluriform configuration) as seen in *Mastiglanis*. Also, *Mastiglanis* presents a seemingly plesiomorphic well-developed supraoccipital process (vs. a reduced condition seen in all other *Nemuroglanis* sub-clade members). However, both derived states are also found at some level in some species of *Brachyglanis*, *Myoglanis*, *Leptorhamdia*, and *Gladioglanis*, that were pointed as potentially related to the *Nemuroglanis* sub-clade by Lundberg et al. (1991a). As the distribution of these features is still poorly known, their value as indicators of relationships is not decisive at present. More conclusive proposals with respect to the position of *Mastiglanis* must await a detailed phylogenetic analysis of Rhamdiinae (Bockmann, in prep.).

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Literature Cited

- Arratia, G. 1987. Description of the primitive family Diplomystidae (Siluriformes, Teleostei, Pisces): morphology, taxonomy and phylogenetic implications.—*Bonner Zoologische Monographien* 24:1–120.
- Böhlke, J. E., S. H. Weitzman, & N. A. Menezes. 1978. Estado atual da sistemática dos peixes de água doce da América do Sul.—*Acta Amazonica* 8:657–677.
- Chardon, M. 1968. Anatomie comparée de l'appareil de Weber et des structures connexes chez les Siluriformes.—*Musee Royal de l'Afrique Centrale*, ser. 8, *Sciences Zoologiques* 169:1–277.
- Ferraris, C. J., Jr. 1988. Relationships of the neotropical catfish genus *Nemuroglanis*, with a description of a new species (Osteichthys: Siluriformes: Pimelodidae).—*Proceedings of the Biological Society of Washington* 10:509–516.
- , & F. Mago-Leccia. 1989. A new genus and species of pimelodid catfish from the Rio Negro and Rio Orinoco drainages of Venezuela (Siluriformes: Pimelodidae).—*Copeia*, 1989:166–171.
- Fink, S. V., & W. L. Fink. 1981. Interrelationships of the ostariophysan fishes (Teleostei).—*Zoological Journal of the Linnean Society* 72:289–296.
- Grande, L. 1987. Redescription of *Hypsidoris farsonensis* (Teleostei: Siluriformes), with a reassessment of its phylogenetic relationships.—*Journal of Vertebrate Paleontology* 7:24–54.
- , & J. G. Lundberg. 1988. Revision and redescription of the genus *Astephus* (Siluriformes: Ictaluridae) with a discussion of its phylogenetic relationships.—*Journal of Vertebrate Paleontology* 8:139–171.
- Hubbs, C. L., & K. F. Lagler. 1958. *Fishes of the Great Lakes region*. Cranbrook Institute of Sciences, Bloomfield Hills, Michigan, 213 pp.
- Lundberg, J. G., & L. A. McDade. 1986. On the South American catfish *Brachyrhamdia imitator* Myers (Siluriformes, Pimelodidae), with evidence for a large intrafamilial lineage.—*Academy of Natural Sciences of Philadelphia, Notula Naturae* 463:1–24.
- , O. J. Linares, M. E. Antonio, & P. Nass. 1988. *Phractocephalus hemiliopterus* (Pimelodidae, Siluriformes) from the Upper Miocene Urumaco Formation, Venezuela: a further case of evolutionary stasis and local extinction among South American fishes.—*Journal of Vertebrate Paleontology* 8:131–138.
- , A. H. Bornbusch, & F. Mago-Leccia. 1991a. *Gladioglanis conquistador* n. sp. from Ecuador with diagnoses of the subfamilies Rhamdiinae Bleeker and Pseudopimelodinae N. Subf. (Siluriformes: Pimelodidae).—*Copeia* 1991:190–209.
- , F. Mago-Leccia, & P. Nass. 1991b. *Exalldontus aguanai*, a new genus and species of Pimelodidae (Pisces: Siluriformes) from deep river channels of South America, and delimitation of the subfamily Pimelodinae.—*Proceedings of the Biological Society of Washington* 101:840–869.
- Mees, G. F. 1974. The Auchenipteridae and Pimelodidae of Suriname.—*Zoologische Verhandlungen* 132:1–256.
- , & P. Cala. 1989. Two new species of *Imparfinis* from northern South America (Pisces, Nematognathi, Pimelodidae).—*Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen* 92: 379–394.
- Pinna, M. C. C. 1989. A new sarcoglanidine catfish, phylogeny of its subfamily, and an appraisal of the phyletic status of the Trichomycterinae (Teleostei, Trichomycteridae).—*American Museum Novitates* 2950:1–39.
- Regan, C. T. 1911. The classification of the teleostean fishes of the order Ostariophysi. 2. Siluroidea.—*The Annals and Magazine of Natural History* 8:553–577.
- Stewart, D. J. 1986a. Revision of *Pimelodina* and description of a new genus and species from the Peruvian Amazon (Pisces, Pimelodidae).—*Copeia* 1986:653–672.
- . 1986b. A new pimelodid catfish from the deep-river channel of the Rio Napo, eastern Ecuador (Pisces: Pimelodidae).—*Proceedings of the Academy of Natural Sciences of Philadelphia* 138:356–367.
- Taylor, W. R. & G. C. Van Dyke. 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study.—*Cybiurn* 9: 107–119.

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