

Systematics of the Neotropical  
Characiform Genus *Potamorhina*  
(Pisces: Characiformes)

RICHARD P. VARI

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## ABSTRACT

Vari, Richard P. Systematics of the Neotropical Characiform Genus *Potamorhina* (Pisces: Characiformes). *Smithsonian Contributions to Zoology*, number 400, 36 pages, 17 figures, 1984.—The previously monotypic curimatid characiform genus *Potamorhina* is redefined as a multispecific, monophyletic subunit of the Curimatidae. Five species are recognized. *Potamorhina pristigaster* (Steindachner, 1876) and the following new combinations: *P. laticeps* (Valenciennes, 1849), *P. altamazonica* (Cope, 1878), *P. latior* (Spix, 1829), and *P. squamoralevis* (Bragg and Azpelicueta, 1983).

A variety of synapomorphies in the gill arches, sixth infraorbital, and other morphological systems define the genus *Potamorhina* as a monophyletic subunit of the family. Derived modifications of the gasbladder, vertebral column, and the third unbranched ray of the lower lobe of the caudal fin unite groups within the genus.

*Potamorhina altamazonica*, considered a synonym of *P. laticeps* by Eigenmann and Eigenmann (1889) and subsequent authors, is shown to be a distinct species that inhabits the Rio Amazonas and Rio Orinoco systems. *Potamorhina laticeps* is endemic to the Lago Maracaibo drainage basin of

Venezuela. The numerous literature citations of *P. laticeps* from other river systems of South America were based on misidentifications, primarily of *P. altamazonica* and to a lesser extent of *P. latior* and *P. squamoralevis*. Records of *P. latior* and *P. laticeps* from the La Plata drainage system and Eigenmann and Ogle's report (1907) of *Psectrogaster curviventris* from that river basin were found to be based on misidentifications of *Potamorhina squamoralevis*.

*Semitapicis*, which previously included the majority of the species incorporated into *Potamorhina* in the present study, was found to be unavailable for the species of that assemblage. The type-species of *Semitapicis* (*Charax planirostris* of Gray, 1854) is evidently a synonym of *Curimata cyprinoides* or a closely related species. The *C. cyprinoides* assemblage and *Potamorhina* (sensu lato) do not constitute a monophyletic lineage. *Gasterotomus* Eigenmann (1910) and *Suprasinelepicthys* Fernandez-Yepey (1948) are placed into the synonymy of *Potamorhina*, and *Gasterostomus* Fernandez Yepey (1948) is considered to be an incorrect spelling of *Gasterotomus* Eigenmann.

## RESUMO

O gênero *Potamorhina* da família Curimatidae, anteriormente considerado monotípico, é redefinido e expandido. Cinco espécies são reconhecidas: *Potamorhina latior* (Spix, 1829), *P. laticeps* (Valenciennes, 1849), *P. pristigaster* (Steindachner, 1876), *P. altamazonica* (Cope, 1878), *P. squamoralevis* (Braga e Azpelicueta, 1983). Uma variedade de caracteres derivados em comum relativos a arcos branquiais, sistema látero-sensorial do sexto infra-orbital e dados merísticos, define o gênero como uma sub-unidade monofilética de Curimatidae e une as sub-unidades do gênero.

*Potamorhina altamazonica* foi considerada um sinônimo de *P. laticeps* por Eigenmann e Eigenmann (1889) e esta atitude foi seguida por todos os autores subsequentes. Pesquisas posteriores revelaram que *P. altamazonica* é uma espécie distinta, amplamente distribuída nas bacias do Rio Amazonas e do Rio Orinoco. *Potamorhina laticeps* é, na verdade, endêmica à bacia do Lago Maracaibo. As numerosas citações da literatura referentes a *P. laticeps* das bacias do Rio Amazonas

e do Rio Paraguai basearam-se em identificações errôneas de *P. altamazonica*, *P. latior* e *P. squamoralevis*. *Potamorhina latior* e *P. pristigaster* têm distribuições geográficas amplas na bacia Amazônica. *Potamorhina squamoralevis* é endêmica ao sistema Paraguai-Paraná. Registros de *P. latior* e *P. laticeps* para a bacia do Prata são devidos a identificações errôneas de *P. squamoralevis*.

*Semitapicis*, anteriormente utilizado para a maioria das espécies de *Potamorhina* (sensu lato) não é um nome adequado para o grupo em discussão no presente trabalho. A espécie-tipo de *Semitapicis* (*Charax planirostris* de Gray, 1854) é mais intimamente relacionada às espécies do complexo *Curimata cyprinoides*. Este complexo e *Potamorhina* não formam um grupo natural. *Gasterotomus* Eigenmann (1910), *Suprasinelepicthys* Fernandez-Yepey (1948) e *Gasterostomus* Fernandez-Yepey (1948) são colocados na sinonímia de *Potamorhina* Cope (1878).

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# Systematics of the Neotropical Characiform Genus *Potamorhina* (Pisces: Characiformes)

*Richard P. Vari*

## Introduction

The genus *Potamorhina* Cope is a distinctive assemblage of curimatid characiforms that inhabit a variety of aquatic ecosystems in the drainage basins of Lake Maracaibo and the Amazon, Orinoco, Paraguay, and Parana rivers. The members of the genus occur in extensive populations and achieve some of the largest adult body sizes within the Curimatidae. These factors result in the exploitation of *Potamorhina* species in the commercial and subsistence fisheries of the Amazon River basin and Lake Maracaibo (Lowe-McConnell, 1975:74; Smith, 1981:90, 141–142; A. Machado-Allison, pers. comm.). Mass seasonal migrations presumably associated with reproduction and feeding (Smith, 1981:22) and characterized by pronounced vocalizations (Dorn and Schaller, 1972:169; Schaller, 1974:249) have been reported for *Potamorhina* species in the Amazon basin.

Given the large populations, the relatively large adult body sizes, and the broad geographic distributions of most *Potamorhina* species, it is not surprising that some members of the group have been known to science for over one hundred and

fifty years (e.g., Spix, 1829). Taxonomic treatments of the nominal species were, nonetheless, pervaded by incorrect identifications and synonymizations. To a considerable degree, the problems were a consequence of the brief original descriptions of a number of nominal species. Such sometimes uninformative early treatments led to erroneous conclusions by subsequent researchers, who were typically handicapped by the limited availability of comparative material. These factors in combination resulted in uncertainty as to the number of recognizable species in *Potamorhina* (sensu lato), the attributes that characterize each species, and the known geographic distribution of each form.

Previous systematic treatments of the unit herein termed *Potamorhina* were also characterized by taxonomic inconsistency at the supra-specific level. Classification of the species of *Potamorhina* (sensu lato) and suggested closely related species as advanced by previous authors are listed below (species excluded from *Potamorhina* in this study are indicated by an asterisk (\*); *Curimatus altamazonicus* of Cope (1878) was not recognized as distinct by the listed authors).

Eigenmann and Eigenmann, 1889

*Potamorhina pristigaster*

*Curimatus (Semitapicis) laticeps*

*Curimatus (Semitapicis) latior*

\* *Curimatus (Semitapicis) planirostris*

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Eigenmann, 1910

*Potamorhina pristigaster*

*Potamorhina laticeps*

*Gasterotomus latior*

\* *Semitapicis planirostris*

Fernandez-Yepez, 1948

*Potamorhina pristigaster*

*Suprasinelepicthys laticeps*

*Gasterostomus* (= *Gasterotomus*) *latior*

\* *Semitapicis planirostris*

Braga and Azpelicueta, 1983

*Potamorhina pristigaster*

*Semitapiscis laticeps*

*Semitapiscis latior*

*Semitapiscis squamoraievis*

\* *Semitapiscis planirostris*

Cope (1878:675) created the monotypic genus *Potamorhina* for *Curimatus* (*Anodus*) *pristigaster* Steindachner (1876:73). The remaining, then-known *Potamorhina* species were retained by Cope in *Curimatus*, along with the majority of other curimatid species. Eigenmann and Eigenmann (1889) subsequently united *Charax planirostris* Gray (1854) and the other species of the *Potamorhina* lineage described to that time (*Potamorhina latior* (Spix) and *P. laticeps* (Valenciennes) of this study) in the subgenus *Semitapicis* Eigenmann and Eigenmann of *Curimata*. *Semitapicis* was thereafter utilized by different authors as either a genus or subgenus that included the majority of species that form *Potamorhina* of this study (e.g., Eigenmann and Eigenmann, 1889; Braga and Azpelicueta, 1983). A reevaluation of the situation (see "Comments on *Semitapicis* Eigenmann and Eigenmann") shows, however, that *Semitapicis* is actually properly associated phylogenetically with a different lineage of curimatids and is, therefore, unavailable for use with the species that constitute *Potamorhina* in this study.

Among the alternative taxonomic schemes advanced for curimatids, only that of Fernandez-Yepez (1948) included an explicit statement on the hypothesized relationships among the species of *Potamorhina*. Within Fernandez-Yepez's "phylogenetic tree" of curimatids (1948:19), *Potamorhina* (containing only *P. pristigaster*) was aligned with the various *Psectrogaster* species of the tribe Potamorhini. *Suprasinelepicthys* Fernandez-Ye-

pez (for *Curimatus laticeps* Valenciennes, with *Curimatus altamazonicus* Cope as a synonym), *Gasterotomus* Eigenmann (for *Anodus latior* Spix, incorrectly spelled *Gasterostomus* by Fernandez-Yepez), and *Semitapicis* (for *Charax planirostris* Gray) were components of another lineage of curimatids recognized by Fernandez-Yepez as the tribe Curimatini. The most recent treatment of the group (Braga and Azpelicueta, 1983) did not delve into the question of phylogenetic relationships between the species but did propose several shifts in taxonomy. Those authors retained *Potamorhina* as monotypic, synonymized *Gasterotomus* and *Suprasinelepicthys* into *Semitapicis*, which in their sense included all the other species in that study, and left *Curimatus altamazonicus* Cope in the synonymy of *Curimatus laticeps* Valenciennes (their *Semitapiscis laticeps*).

Neither Fernandez-Yepez nor any of the other authors who published extensively on curimatids analyzed the phylogenetic relationships among the above species. Genera were characterized by external attributes, which were neither evaluated in terms of their polarity nor relative to their utility in advancing phylogenetic hypotheses. Such practices and a dependence on poorly defined and uncritical morphological gap criteria for the recognition of genera are reflected in the absence of corroborated hypotheses of the relationships of the nominal species to each other.

This paper is the fifth of a series that deals with aspects of the phylogeny and taxonomy of curimatid characiforms (Vari, 1982a,b, 1983, in press). This study aims to advance a corroborated hypothesis of the monophyly of *Potamorhina* and of the phylogenetic relationships within the genus, to determine the recognizable species in the group and to delimit the geographic distribution of each form.

The hypotheses of evolutionary relationships of, and within, *Potamorhina* are derived following the principles of "Phylogenetic Systematics" first proposed in English by Hennig (1906) and since discussed and refined by a variety of authors (see Wiley, 1981, for a summary). In that system (alternatively termed "Cladism" or "Cladistics"), recognized taxa must be monophyletic in that

they include all descendants of a hypothesized common ancestor and only descendants of that ancestor. Monophyletic groups are defined on the basis of the most parsimonious hypothesis of relationships derivable from the distribution of shared derived (synapomorphic) characters. Hypotheses of relationship derived from the common possession of primitive characters (symplesiomorphies) and phylogenetic speculations based on concepts of overall phenetic similarity or degrees of difference are useless as criteria to evaluate alternative phylogenetic hypotheses or are incongruent with the aims of this study: the advancement of a hypothesis of the phylogenetic history of the taxa under consideration. Detailed discussions of these methodologies and their application can be found in Wiley (1981).

The polarities of characters relevant to the hypotheses of the monophyly of *Potamorhina* and less-inclusive species assemblages were determined by comparisons to other curimatids and the Prochilodontidae, the hypothesized sister group to the Curimatidae (Vari, 1983:47). The vast majority of the derived modifications were unique to the genus or its subunits within curimatids, and often characiforms, and as such could be polarized without the necessity of specific sister-group comparisons. Further results to be published will deal with the question of the relationships of the major groups within the Curimatidae and will examine the zoogeographic implications of curimatid phylogeny and species distribution.

**METHODS AND MATERIALS.**—Measurements were made with dial calipers and data recorded to tenths of a millimeter. Counts and measurements were made on the left side of specimens when possible. Counts of total vertebrae were taken from radiographs, with the fused  $PU_1+U_1$  considered a single bone and the vertebrae incorporated into the Weberian Apparatus counted as four elements. The numbers in parentheses that follow a particular vertebral count are the numbers of radiographed specimens with that count. In the species descriptions, subunits of the head are presented as a proportion of head length (HL). Head length itself and measure-

ments of body parts are given as proportions of standard length (SL). In the counts of median and pelvic fins, unbranched fin rays are indicated by lower case roman numerals, and branched fin rays are indicated by arabic numerals. The observed range in the values of each count and measurement is presented first, followed by the value of the holotype or lectotype for a particular count or measurement, when available, in square brackets.

The "Material Examined" section of each species account is arranged in the following sequence: number of specimens of the species examined (in parentheses the number of specimens forming the basis for the presented meristic and morphometric data and the range of standard lengths (in mm) for these specimens), collection locality of specimens, institutional abbreviation, catalog number, number of specimens in the lot (in parentheses the number of specimens in the lot from which counts and measurements were taken, if less than the total number of specimens, and the standard lengths (in mm) of those individuals). Geographic descriptors are first country (capitalized), then state, province, department, or district (in italics), followed by more specific locality data. The names of localities from which at least some of the examined specimens were previously cited in the literature are given as originally presented, followed by the current or correct name, in parentheses, if that differs.

The common names presented are those found in the literature, although such terminology is not necessarily standardized across the entire range of the species. In the synonymies for each species, localities are presented as in the original citation, followed by the presently recognized or correct name, in parentheses, if that differs. Osteological preparations were cleared and counterstained for cartilage and bone following a modification of the procedure of Dingerkus and Uhler (1977).

**ABBREVIATIONS.**—The following abbreviations for institutions and collections are used.

AMNH American Museum of Natural History, New York  
ANSP Academy of Natural Sciences of Philadelphia  
BMNH British Museum (Natural History), London

CAS	California Academy of Sciences, San Francisco
CAS-IU	Indiana University (collections now at CAS)
CAS-SU	Stanford University (collections now at CAS)
GC	Jacques Géry, personal collection (no register numbers)
LACM	Los Angeles County Museum, Los Angeles
MBUCV	Museo de Biología, Universidad Central de Venezuela, Caracas
MCZ	Museum of Comparative Zoology, Cambridge
MNHN	Muséum National d'Histoire Naturelle, Paris
MHNG	Muséum d'Histoire Naturelle, Geneva
MZUSP	Museo de Zoologia da Universidade de São Paulo
NRM	Naturhistoriska Riksmuseet, Stockholm
NMW	Naturhistorisches Museum, Vienna
USNM	Former United States National Museum collections deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.
ZUEC	Zoologia, Universidade Estadual de Campinas, Campinas

The following abbreviations are used in the figures.

AC	anterior chamber of gasbladder
B	branch of anterior diverticuli of anterior chamber of gasbladder (1 to 4)
BB	basibranchial (2 to 4)
BL	baudelot's ligament
C	ceratobranchial (1 to 5)
CA	cartilage body
DCE	distal cartilage of epibranchial (3 or 4)
E	epibranchial (2 to 5)
FR	frontal
H	hypobranchial (1 to 3)
HS	hemal spine
HY	hypural (1 or 2)
IO	infraorbital (5 or 6)
LC	lagenar capsule
MP	medial process of penultimate procurrent ray of lower lobe of caudal fin
PA	parietal
PB	infrapharyngobranchial (1 to 4)
PH	parhypural
PC	posterior chamber of gasbladder
PR	procurrent fin rays
PT	pteric
S	sphenotic
SPO	suprapreopercle
UP	upper pharyngeal tooth plate (4 or 5)
VDT	ventrally divergent tip of penultimate procurrent ray of lower lobe of caudal fin
VPR	ventralmost principal ray of caudal fin

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mission to reproduce the photograph of the original Gronovius drawing of *Charax planirostris* (Figure 7). I am indebted to the following individuals and institutions for the loan and exchange of specimens, information, and other assistance: D.E. Rosen and M.N. Feinberg (AMNH); W. Smith-Vaniz and W. Saul (ANSP); P.H. Greenwood and G.J. Howes (BMNH); W. Eschmeyer and P. Sonoda (CAS); J. and G. Géry (GC); C. Swift (LACM); F. Mago-Leccia and A. Machado-Allison (MBUCV); K. Liem and K. Hartel (MCZ); M.L. Bauchot (MNHN); V. Mahnert (MHNG); N. Menezes, H. Britski and J. Figueiredo (MZUSP); S. Kullander (NRM); R. Hacker and H. Ahnelt (NMW); I. Sazima (ZUEC); M. Goulding, Instituto Nacional de Pesquisas da Amazonia; P. Bayley, Illinois Natural History Survey; H. Ortega, Universidad Nacional Mayor de San Marcos; and L. Braga and M. Azpelicueta, Universidad Nacional de La Plata. S.L. Jewett (USNM), A. Machado-Allison and L. Aguana (MBUCV), and O. Castillo of the Estacion de Investigaciones Pesqueras, San Fernando de Apure, Venezuela, provided valuable assistance in field investigations associated with this study. Naercio Menezes generously translated the Resumo. S.L. Jewett, J.R. Gomon, E.N. Gramblin, and K. Bruwelheide provided technical assistance at the National Museum of Natural History. Photographs other than Figure 7 were prepared by J.T. Williams. L.A. Lo Presti assisted with the anatomical illustrations. Numerous specimens reported in this paper were collected by the Expediçao Permanente de Amazônia under the direction of P. Vanzolini (MZUSP). Research associated with this study was partially supported by the Neotropical Lowland Research Program and the Venezuela Project of the Smithsonian Institution. This paper benefitted from the valuable comments and criticisms of S.H. Weitzman, J.G. Lundberg, and E.O. Wiley.

### Phylogenetic Analysis

The components of the assemblage recognized as *Potamorhina* in this study were previously apportioned among a variety of generic-level taxa



of differing degrees of inclusiveness and of usually unstated phyletic associations. The only explicit tree of relationships that treated the then-known components of *Potamorhina* (sensu lato) (Fernandez-Yepez, 1948, fig. 2) placed the species as subunits of the tribes Curimatini and Potamorhini. In contrast, a number of skeletal, soft anatomical, and meristic synapomorphies uncovered during this study support a hypothesis of the monophyly of *Potamorhina* and serve to define subunits of the genus as a natural assemblage.

The gill arches of curimatids and their near relatives are characterized by numerous phylogenetically informative modifications (Vari, 1983). Several such derived restructurings are unique to the *Potamorhina* assemblage within curimatids or, indeed, in some cases among characiforms examined. Vari (1983:20) noted that a reorientation of the primitively vertically aligned process of the fourth epibranchial ( $E_4$ ) to a more anterodorsal orientation is synapomorphic for the Curimatidae and Prochilodontidae. Such a moderately realigned dorsal process of  $E_4$  typifies all prochilodontids examined (Vari, 1983, fig. 15c), whereas a more pronounced shift in the primary axis of the process distinguishes many curimatids. The trend within the Curimatidae culminates in the marked reorientation of the  $E_4$  complex that uniquely characterizes *Potamorhina* species among characiforms examined. In *Potamorhina* species the primary axis of the primitively dorsal process of  $E_4$  extends parallel to the longitudinal axis of the dorsal portion of the gill arches. That portion of the fourth epibranchial is, furthermore, significantly lengthened into a horizontally elongate vertical wall (Figure 1) that parallels the lateral surface of the anterior section of the muscular epibranchial organ. The transversely flattened cartilage that caps the primitively dorsal, now anterior, region of the bone has undergone a comparable longitudinal expansion. This elongation results in the contact anteriorly of the  $E_4$  cartilage and the posterodorsal margin of the cartilage body, which caps the uncinatous process of the third epibranchial ( $E_3$ ) (Figure 1). The  $E_3$  uncinatous process cartilage is,

in turn, specialized in being flared out distally rather than having the rounded form typical for characiforms. Outgroup comparisons in the Curimatidae have failed to discover other members of the family with such a reorientation and longitudinal elongation of  $E_4$  and its associated distal cartilage. Neither was there found any taxon with a direct contact of the terminal cartilage of the uncinatous process of the third epibranchial with the dorsal cartilage of the fourth epibranchial. The above alterations of  $E_3$  and  $E_4$  are consequently considered synapomorphies for the species of *Potamorhina*.

The branchial basket in the genus also has a number of other elements that demonstrate a longitudinal elongation relative to the condition found in curimatid and characiform outgroups. The cartilaginous fourth basibranchial ( $BB_4$ ) is greatly lengthened (Figure 2) and occupies nearly two-thirds of the longitudinal length of the gill arches. This is a pronounced elongation relative to the condition in other curimatids in which the cartilage extends over approximately 50% of the gill arches (e.g., *Curimata vittata*, Vari, 1983, figs. 5, 6). The anterior portion of the fourth ceratobranchial ( $C_4$ ) (Figure 2) is also greatly lengthened and extends as a narrow process along the lateral surface of the cartilaginous fourth basibranchial ( $BB_4$ ). Finally, the complex formed by the fourth infrapharyngobranchial ( $PB_4$ ) and fourth upper pharyngeal tooth plate ( $UP_4$ ) (Figure 1) is lengthened anteroposteriorly relative to the remaining gill-arch elements. The absence of similar elongations of the above elements in prochilodontids and other subunits of the Curimatidae leads to a hypothesis of the derived nature of the alterations. These latter characters are conservatively considered to represent one rather than three synapomorphies for the members of the genus, in light of the functional associations of  $BB_4$ ,  $C_4$ , and the  $PB_4$ - $UP_4$  complex.

The hypothesis of the monophyly of *Potamorhina* is further corroborated by the form of the laterosensory canal segment in the sixth infraorbital ( $IO_6$ , dermosphenotic). A tripartite canal segment in this element is widespread in diverse

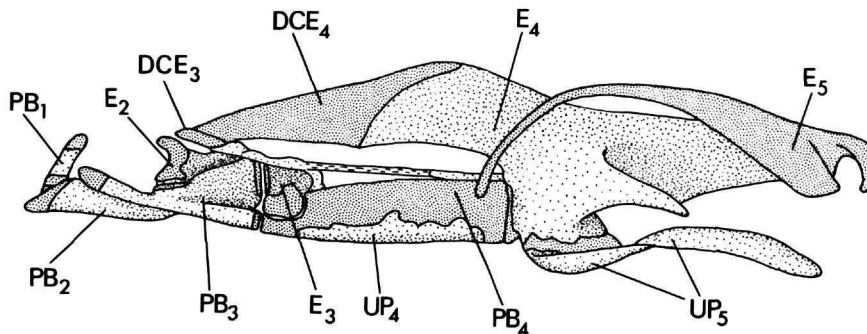


FIGURE 1.—*Potamorhina laticeps*, USNM 121325, dorsal portion of gill arches, right side, medial view (denser stippling represents cartilage).

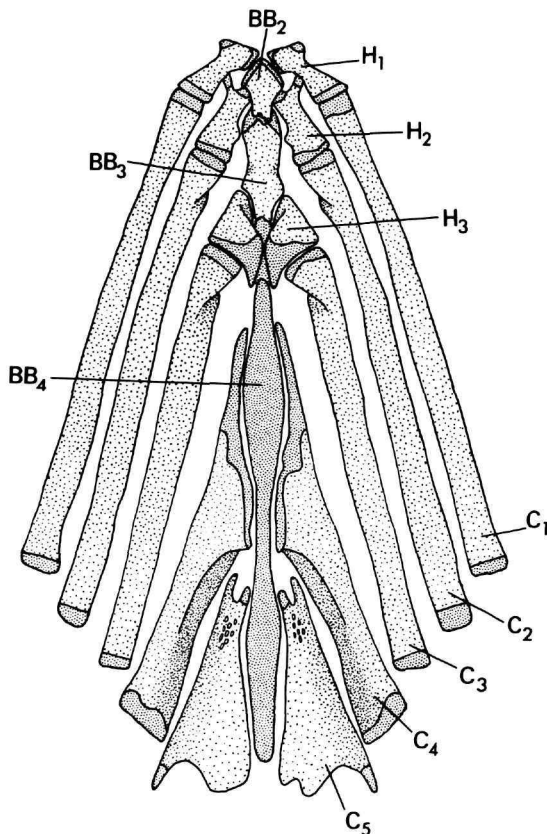


FIGURE 2.—*Potamorhina squamoralevis*, USNM 243228, ventral portion of gill arches, dorsal view (denser stippling represents cartilage).

groups of characiform fishes, including characids (*Brycon*, Weitzman, 1962, fig. 8), some distichodontids (*Xenocharax*, Vari, 1979, fig. 20), prochilodontids (*Ichthyoelephas*, Roberts, 1973, fig. 17), and many curimatids (e.g., *Curimata aspera*, Figure 3A). In these groups the ventral branch of the IO<sub>6</sub> laterosensory canal system communicates with that of the fifth infraorbital, the anterodorsal portion with the sensory canal of the frontal, and the posterodorsal section with the laterosensory canal segment in the pterotic (Figure 3A). Although such a tripartite canal is generalized for, and evidently plesiomorphic for, characiforms, a variety of alterations of that pattern, both elaborations and reductions, occurs in subunits of the order. Among curimatids *Potamorhina* is unique in having an elaboration of the canal system in IO<sub>6</sub>. All *Potamorhina* species have the three primary branches of the IO<sub>6</sub> laterosensory canal system described above and an additional segment that runs posteroventrally (Figure 3B). An additional anteriorly or anteroventrally aligned branch is also frequently present. Other curimatids examined have alternatively a maximum of three branches of the laterosensory canal system of the sixth infraorbital. The broad distribution of such a tripartite system in the family and characiform outgroups leads to a hypothesis of the derived nature of the more elaborate laterosensory canal system in *Potamorhina* species.

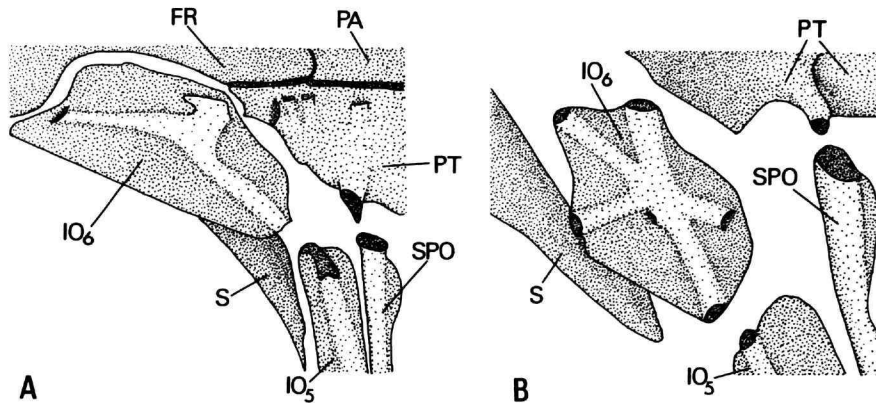


FIGURE 3.—Sixth infraorbital and proximate portions of associated bones: A, *Curimata aspera*, USNM 243242; B, *Potamorhina altamazonica*, USNM 257367.

Two meristic characters also lend credence to a hypothesis of the monophyly of *Potamorhina*. The species of the genus have a relatively long anal fin with 2 or 3 unbranched rays and 11 to 16 branched rays. This contrasts with a maximum of 2 or 3 unbranched and 7 to 12 branched rays in other groups in the family. Indeed the only other curimatids having an anal-ray count as high as that of *Potamorhina* species are a subgroup of the species phylogenetically associated with *Curimata cyprinoides*. Prochilodontids, the hypothesized sister group to the Curimatidae, typically have a maximum of 10 or 11 rays, combined branched and unbranched, in the anal fin (Mago-Leccia, 1972:43). Anostomids and chilodontids that, in turn, form the sister group to the clade consisting of prochilodontids and curimatids are similarly characterized by relatively short anal fins. The presence of a low number of anal-fin rays in outgroups of increasing inclusiveness indicates that a low anal-fin ray count is probably primitive for the Curimatidae. This supports the conclusion that the high number of rays in *Potamorhina* is derived.

A second meristic character of interest relative to the question of the monophyly of *Potamorhina* is the number of pored lateral line scales in a longitudinal series from the supracleithrum to the hypural joint. The number of such scales in

*Potamorhina* ranges from 85 to 110. Other curimatids, with the exception of *Curimata abramoides* Kner (1859), have a range of 26 to 76 scales. That species, however, has 77 to 95 pored lateral line scales. The relatively high number of scales in that taxon was evidently a major factor in Eigenmann and Eigenmann's alignment of *C. abramoides* Kner (as *C. planirostris* Gray, which it is not; see also discussion under "Comments on *Semitapicis* Eigenmann and Eigenmann") with the species of their subgenus *Semitapicis* (1889:417), which they defined in part on the basis of an increased number of pored scales in the lateral line. The number of pored lateral line scales to the hypural joint in prochilodontids ranges from 35 to 65 (Dahl, 1971; Géry, 1977; Mago-Leccia, 1972). *Curimatopsis*, the sister group to all other curimatids (Vari, 1982a), is characterized by 24 to 63 scales in a longitudinal series to the hypural joint. The hypothesis that a high number of pored lateral line scales is derived within curimatids is thus the most parsimonious on the basis of outgroup comparisons. The possession of 85 to 110 lateral line scales serves as a synapomorphy for the members of *Potamorhina*.

In both of the meristic characters considered derived for the members of *Potamorhina*, there is some overlap with non-*Potamorhina* curimatids—*Curimata abramoides* (squamation) and some spe-



cies associated with *C. cyprinoides* (anal fin ray count). The similarities between *Potamorhina* and those taxa are hypothesized to be homoplasious on the basis of other derived characters that indicate that those taxa are more closely related to curimatids other than *Potamorhina*. Hypothesized derived characters found in *C. cyprinoides*, its close relatives, and *C. abramoides*, but absent in *Potamorhina*, include the presence of a cartilage mass (sometimes ossified) in the ligamentum primordiale complex, a reduction in the ossification of the fourth and fifth infraorbitals, and a shift in the position and form of the laterosensory canal segments in infraorbitals 4 and 5. The taxonomic distribution of these and a variety of other characters is congruent with the hypothesis that *C. abramoides* and the *C. cyprinoides* complex are not sister groups to *Potamorhina* or any of its subunits but are rather more closely related to some other curimatid groups. Future phylogenetic and revisionary studies will more explicitly detail the evidence supporting that hypothesis.

Within the five-species assemblage defined by the synapomorphies for the members of *Potamorhina*, it is possible to define a series of less-inclusive groups on the basis of derived characters of more restricted phyletic distribution. The number of vertebrae in *Potamorhina* species ranges from 31 to 37 (*P. laticeps*, 31; *P. pristigaster*, 33 or 34; *P. squamoralevis*, 35; *P. altamazonica*, 35; *P. latior*, 36 or 37). The genus *Curimatopsis*, the hypothesized sister group to all other curimatids (Vari, 1982a), has 28 to 30 vertebrae, and a low vertebral count also occurs in many other members of the family. Thus the increasing number of vertebrae within *Potamorhina* is considered to represent a transition series of nested derived states. In other words the possession of 33 or more vertebrae is a synapomorphy for a four-species subunit of the genus (*P. pristigaster*, *P. squamoralevis*, *P. altamazonica*, and *P. latior*), the occurrence of 35 or more vertebrae unites three species (*P. squamoralevis*, *P. altamazonica*, and *P. latior*), and the presence of 36 or 37 vertebrae in *P. latior* is autapomorphic for that species.

The form of the third unbranched ray (penul-

timate procurent ray) of the ventral caudal-fin lobe is modified in a mode unique to *Potamorhina squamoralevis*, *P. altamazonica*, and *P. latior* within curimatids. The proximal portion of that fin ray in other characiforms examined and in curimatids is comparable to that of neighboring elements, straight and tapering anteriorly (e.g., *Brycon meeki*, Weitzman, 1962, fig. 15). In the three noted species, however, the proximal portion of the ray diverges ventrally with a resultant lateral overlap of the proximal portion of the fourth unbranched ray by the third unbranched ray (Figure 4). The functional significance of this modification is unknown, although the realigned portion of the ray does serve as an attachment area for a portion of the flexor ventralis muscle. The third unbranched caudal-fin ray is also distinctive in having a well-developed anteromedial process proximally, which approximates or contacts the comparable process on the contralateral half of the fin ray. Although a slight expansion of the fin ray in that region occurs in *P. laticeps* and *P. pristigaster*, the ray in those species is not developed to the degree found in *P. squamoralevis*, *P. altamazonica*, and *P. latior*.

The gasbladder in characiform fishes typically consists of two portions, a relatively rotund anterior chamber and a more elongate, posteriorly tapering posterior chamber (e.g., Rowntree, 1903:57–58, figs. 1, 2). The two subunits of the gasbladder are interconnected by a relatively short narrow tube. The posterior chamber, typically much the larger, communicates with the alimentary tract via a relatively elongate tube termed the "ductus pneumaticus." The preceding gasbladder plan is typical for the Prochilodontidae, the hypothesized sister group of the Curimatidae (Vari, 1983:47), and all curimatids other than *Potamorhina altamazonica* and *P. latior*. Adults of those two species, rather, have a pair of complex lateral diverticula of the anterior chamber of the gasbladder and associated alterations of the main portion of that and the posterior chamber. These diverticula show an ontogenetic progression in relative size and overall complexity.

The gasbladder of *Potamorhina altamazonica*

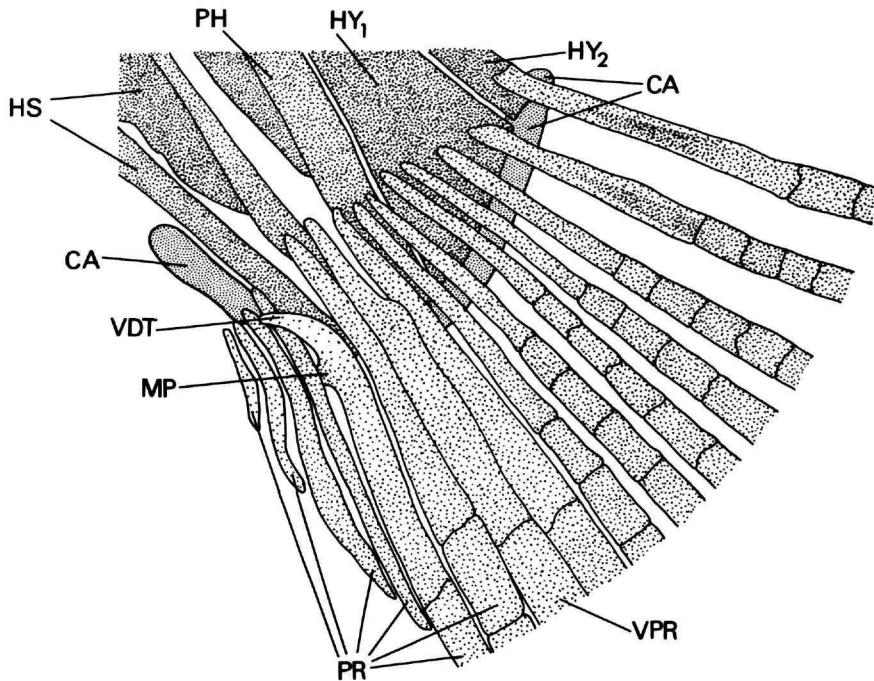


FIGURE 4.—*Potamorhina squamoralevis*, USNM 243228, proximal portion of rays of lower lobe of caudal fin and associated elements of vertebral column.

and *P. latior* at 30 mm SL (standard length) has the generalized unelaborated form of the anterior chamber of most characiforms. By 60 mm SL a distinct tubular diverticulum extends anteriorly from each of the anterodorsal corners of the anterior chamber of the gasbladder. At this stage of development, the form of the main portion of the chamber is, otherwise, that typical for characiforms. The simple tubular anterior extensions of the chamber become progressively more complex ontogenetically. In 90 mm SL specimens of *P. altamazonica* and *P. latior*, each anteriorly directed process of the gasbladder is longer, more attenuate, and extends along the ventral surface of the musculature that attaches onto the posteroventral surface of the neurocranium. At this developmental stage, each gasbladder diverticulum has lateral and medial, transversely aligned sidebranches proximal to the main portion of the gasbladder chamber. The medial branch passes along the anterior surface

of the gasbladder nearly to the coeliac artery. The lateral outpocketing is embedded in the medial portion of the epaxial muscle mass. At the same developmental stage, the anterior chamber of the gasbladder has distinct indentations on its lateral surface. This contrasts with the straight or convex margin of the chamber generalized for other curimatids and characiforms and thus hypothesized as plesiomorphous for curimatids.

The above modifications of the main chamber of the gasbladder and its diverticula are preludes to further ontogenetic elaborations. Figure 5 presents a ventral view of the anterior chamber of the gasbladder and anterior portion of the posterior chamber in a 190 mm SL specimen of *Potamorhina latior*. In specimens of that species and *P. altamazonica* of comparable sizes, each diverticulum of the anterolateral corner of the gasbladder's anterior chamber is subdivided into 4 main branches. The medial branch ( $B_1$ ) extends

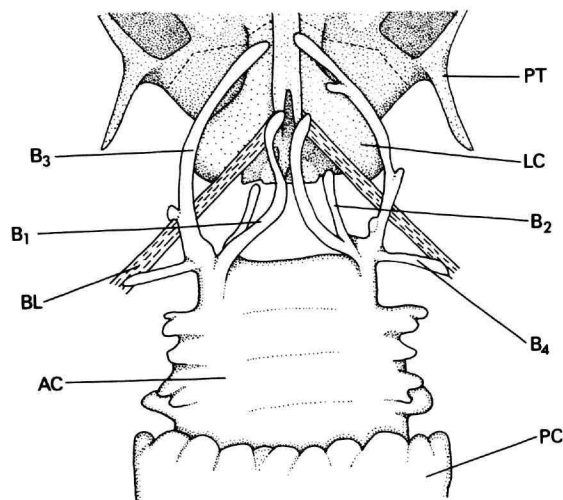


FIGURE 5.—*Potamorhina latior*, posterior portion of neurocranium, anterior chamber and anterior portion of posterior chamber of gasbladder, ventral view.

towards the midline and contacts the sheath for the coeliac artery. It then continues anteriorly along the ventral surface of the connective tissue that surrounds that blood vessel and the dorsal aorta, to terminate anteriorly ventral of either the articular facet of the basioccipital or the posterior portion of the parasphenoid. This results in an approximation or, in some cases, contact of the corresponding contralateral branches. The second branch ( $B_2$ ) of the diverticulum arise from the dorsal surfaces of the diverticulum complex in the region proximate to the main gasbladder chamber. It passes dorsally to the inner surface of the abdominal cavity, matching the anteroventrally sloping curvature of that chamber as it continues anteriorly to approximate the posteroventral margin of the neurocranium. In lateral view this diverticulum of the gasbladder is concavely curved with its distal tip lying slightly dorsal of the horizontal plane through the point where it diverges from the main portion of the chamber. Branch 3, the most highly developed portion of the diverticulum system, extends anteriorly along the ventral surface of Baudelot's ligament and the musculature that extends be-

tween the pectoral girdle and neurocranium. Ventral to the neurocranium the anterior portion of this diverticulum then extends along the ventrolateral surface of the exoccipital portion of the lagenar capsule into the region of the opercular cavity from which it is separated only by a relatively thin layer of connective tissue and epithelium. The final, and least developed, portion of the complex, branch 4, extends from the basal portion of the diverticulum complex laterally into a pocket in the epaxial musculature just anterior to the first full pleural rib.

These two species also demonstrate a series of changes in the main portion of the anterior chamber of the gasbladder that are congruent, both ontogenetically and phylogenetically, with the progressive elaboration of the diverticula of the gasbladder's anterior chamber. As noted above a shift from the rotund chamber typical for characiform fishes to an indented chamber occurs during development. This trend continues ontogenetically, leading to the lateral surface of the chamber in adults being developed into a series of outpocketings of varying degrees of complexity (Figure 5). The anteriormost of these outpocketings is closely associated with the first full pleural rib and may serve a resonatory function in the sound production reported for at least one of these species (*P. altamazonica*, reported as *Anodus laticeps*, Dorn and Schaller, 1972:169; Schaller, 1974:249). The anterior margin of the posterior chamber of the gasbladder has a series of bulbous diverticula, which extend forward to overlap the posterior portion of the anterior chamber, another modification not found in other curimatids.

Comparable modifications of the gasbladder have not been found elsewhere in the Curimatidae nor have they been reported elsewhere in characiforms. The gasbladder diverticula noted by Nelson (1949:499, figs. 3, 4) in the characid *Rhaphiodon vulpinis* are outpocketings of the posterior, rather than anterior, chamber of the gasbladder. The only characiforms examined that have elaborations of the anterior chamber of the swimbladder reminiscent of those described for



*Potamorhina* are the hemiodontids *Anodus elongatus* and *A. melanopogon*. Those species have paired diverticula of the gasbladder that arise immediately lateral of the area of contact of the coeliac sheath with the gasbladder. These diverticula then extend forward as relatively thick, straight tubular structures that fall short of the neurocranium. This situation differs significantly from the morphology of the outpocketings in *Potamorhina*, in which the diverticula arise more laterally on the chamber, are not thick walled, are ramified, and are more elongate. These differences raise questions as to the homology of the outpocketings in *Anodus* and a subunit of *Potamorhina*. Such a hypothesis of the non-homology of the diverticula in the two assemblages is in agreement with our present knowledge of characiform phylogeny, under which curimatids are not hypothesized to be most closely related to hemiodontids but rather to prochilodontids (Vari, 1983:46–47). This data also indicates that *Anodus* is properly aligned with the Hemiodontidae (Roberts, 1974). In summary, available evidence indicates that the gasbladder modifications are synapomorphies unique for *Potamorhina altamazonica* and *P. latior*.

A transversely concave prepelvic region bordered by longitudinal ridges margined by relatively small scales (see Steindachner, 1876, pl. 6b) is unique to *Potamorhina pristigaster* among curimatids. The possession of this form of prepelvic region is thus considered an autapomorphy for the species. The postpelvic region of *P. pristigaster* has a distinct median keel, a modification characteristic of the genus and many curimatids. The keel in the species is noteworthy, however, in its distinctly serrate margin. The possession of a serrate postpelvic keel was used by Fernandez-Yepe (1948, key after page 16) as a defining character for his tribe Potamorphini, which consisted of *Potamorhina pristigaster* and a group of species centered around *Psectrogaster rhomboides*, all of which had serrate postpelvic keels. A more detailed analysis of the serrae in these two groups reveals various differences in the mode of formation of the serrate keel mar-

gins. In *Potamorhina pristigaster* the scales are bent over the midline with the serrate midventral border being formed by a distinct posteroventral elaboration of the median ridge on the scale. In the *Psectrogaster* complex the serrations are a consequence of the elaboration of the posterior margin of the scale, typically somewhat dorsal of the ventral midline, and with only a limited number of scales overlapping the keel margin. *Psectrogaster* species also lack the synapomorphies characteristic of the members of *Potamorhina*, a further indication that the serrate postventral keels in the two taxa are homoplasious.

Two species in the complex (*Potamorhina laticeps* and *P. pristigaster*) have pigmented spots on the midlateral surface of the caudal peduncle in the region of the hypural joint. These markings are pronounced in juveniles but less obvious in adults. A pigmentation patch in the same region characterizes *Curimatopsis* (e.g., *C. macrolepsis*; Vari, 1982a, figs. 10, 11), the genus hypothesized to be the sister group of the remaining species in the family. Such a spot also occurs in a variety of other curimatids and is possibly primitive for the family. Its absence in the trispecific grouping of *P. squamoralevis*, *P. altamazonica*, and *P. latior* is tentatively considered derived, a hypothesis congruent with the overall phylogeny.

### Genus *Potamorhina* Cope, 1878

- Potamorhina* Cope, 1878:675 [type-species: *Curimatus (Anodus) pristigaster* Steindachner, 1876, by monotypy].  
*Gasterotomus* Eigenmann, 1910:422 [type-species: *Anodus latior* Spix, 1829, by original designation].  
*Gasterostomus*.—Fernandez-Yepe, 1948:34 [incorrect spelling of *Gasterotomus*].  
*Suprasinelepicthys* Fernandez-Yepe, 1948:35 [type-species: *Curimafus laticeps* Valenciennes, 1849, by original designation].  
*Potamorrhina* Braga and Azpelicueta, 1983:144 [unjustified emendation of *Potamorhina*].

**DIAGNOSIS.**—*Potamorhina* is a distinctive group of curimatids, which attain the largest adult body sizes in the family (up to 270 mm SL). The genus is characterized by a high anal-fin ray count, high pored lateral line scale count, an elongation of

the postorbital portion of the head, and a variety of other derived features (see "Phylogenetic Analysis").

Rayed dorsal-fin rays ii,8–10 or iii,9; anal fin rays ii,11–16 or iii,12–15; pectoral-fin rays 15 to 18; pelvic-fin rays i,8 or i,9; adipose dorsal fin always present. Pored lateral line scales from supracleithrum to hypural joint 85 to 110; sensory canals in lateral line scales diverge somewhat dorsally and ventrally in adults. Scale margins slightly to markedly ctenoid, more so on ventral portions of body. Number of scales in a transverse series from origin of rayed dorsal fin to lateral line 18 to 31; number of scales in a transverse series from origin of anal fin to lateral line 16 to 31. Dorsal midline anterior of rayed dorsal fin not scaled. Total number of vertebrae 31 to 37.

**REMARKS.**—The placement of all species in this assemblage within *Potamorhina* differs from previous taxonomic practice in which that genus was monotypic. All the nominal *Potamorhina* species of this study were first described in *Curimatus* or *Anodus* (the latter genus not available in curimatids) with the exception of *P. squamoralevis*, originally placed in *Semitapicis*. The subdivision of *Curimatus* (sensu lato) was initiated by Cope (1878:675). He suggested that the morphological distinctiveness of *Curimatus* (*Anodus*) *pristigaster* of Steindachner (1876:73) necessitated its removal to a new genus, *Potamorhina*. Soon thereafter Eigenmann and Eigenmann (1889) segregated *Charax planirostris* of Gray (1854), *Curimatus laticeps* of Valenciennes (1849) (with *C. altamazonicus* of Cope, 1878, as a synonym), and *Anodus latior* of Spix (1829) in the subgenus *Semitapicis* of *Curimatus*. *Semitapicis* was subsequently recognized as a genus by Eigenmann (1910), Fowler (1906, 1945), and Braga and Azpelicueta (1983). The lattermost researchers' concept of the genus encompassed four species, excluding *Curimatus altamazonicus* of Cope, which they did not recognize as distinct. Other authors have, in contrast, restricted *Semitapicis* by the removal of *Anodus latior* of Spix to *Gasterotomus* (Eigenmann, 1910:422) and *Curimatus laticeps* of

Valenciennes to *Suprasinelepicichthys* (Fernandez-Yepe, 1948:35). Utilization of all those nominal genera for the then-recognized species resulted in a monotypic *Semitapicis*.

The use of a more broadly defined *Potamorhina* in this study—contrary to the continued recognition of that genus as monotypic, along with the use of *Semitapicis*, *Gasterotomus*, and *Suprasinelepicichthys*—is based on two factors. The first involves the availability of *Semitapicis* in this assemblage of curimatids. The second is the question of which taxonomic scheme most appropriately communicates the hypothesis of relationships arrived at in the preceding phylogenetic reconstruction. The discussion in the following sections shows that *Semitapicis*, used previously to encompass the majority of the species, is not available for use in this lineage of curimatids. Three generic names remain available for the five species recognized in the clade. First proposed was *Potamorhina* (for *Curimatus pristigaster* of Steindachner), followed chronologically by *Gasterotomus* (for *Anodus latior* of Spix) and *Suprasinelepicichthys* (for *Curimatus laticeps* of Valenciennes).

Reference to the hypothesized phylogeny (Figure 6) shows that several alternative generic classifications would fulfill the primary criterion of the present study: all recognized taxa must be monophyletic. Two new genera could be described for *Curimatus altamazonicus* of Cope and *Semitapicis squamoralevis* of Braga and Azpelicueta. Those two taxa in conjunction with the pre-existing *Potamorhina*, *Suprasinelepicichthys*, and *Gasterotomus* would result in five evidently monotypic, therefore monophyletic, taxa. Alternatively *Gasterotomus* could be applied to the unit that consists of the three terminal species (*squamoralevis*, *altamazonica* and *latior*), obviating the need for new genera. *Potamorhina* might also be redefined to include all species other than *Curimatus laticeps* of Valenciennes, which would remain in *Suprasinelepicichthys*. Finally, *Potamorhina* could serve as an all-encompassing genus for the entire five species complex. A selection between these alternatives is, of course, somewhat arbi-

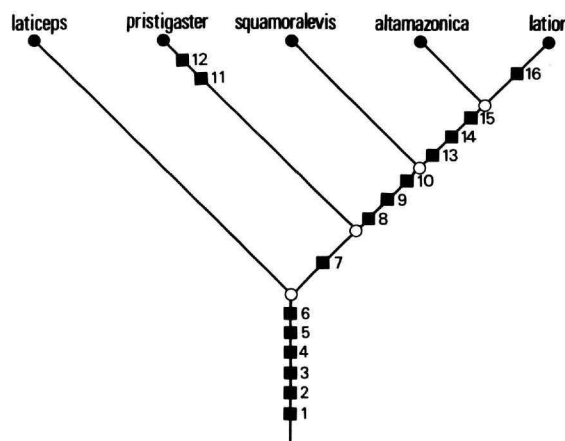


FIGURE 6.—Distribution of synapomorphies (boxes) for and within the genus *Potamorhina*: (1) horizontal realignment and elongation of dorsal process and distal cartilage of fourth epibranchial, (2) contact of distal cartilage of fourth epibranchial with distal cartilage of uncinat process and third epibranchial, (3) horizontal elongation of fourth basibranchial, fourth ceratobranchial, and complex formed by fourth infrapharyngobranchial and fourth upper pharyngeal tooth plate, (4) elaboration of laterosensory canal system of sixth infraorbital, (5) anal fin with 2 or 3 unbranched rays and 11 to 16 branched rays, (6) 85 to 110 pored lateral line scales from supracleithrum to hypural joint, (7) 33 or more vertebrae, (8) 35 or more vertebrae, (9) proximal portion of third unbranched (penultimate procurrent) ray of lower lobe of caudal fin diverges ventrally and laterally overlaps fourth unbranched ray; third ray with medial proximal process, (10) absence of pigmented spot on midlateral surface of caudal peduncle, (11) prepelvic region of body transversely concave, (12) postpelvic midventral keel with a serrate margin, (13) anterior chamber of gasbladder with elaborate anterior diverticula, (14) main portion of anterior chamber of gasbladder with numerous lateral outpocketings, (15) posterior chamber of gasbladder with anterior outpocketings overlapping posterior margin of anterior chamber, (16) 36 or 37 vertebrae.

trary. The scheme in the present study, the utilization of an all-inclusive *Potamorhina*, is the outgrowth of several factors. *Potamorhina* has a long taxonomic history and is the only available generic name that has been consistently used by all authors since it was first proposed. The broader concept of *Potamorhina* does not require the description of one or more new genera. It also does not involve the resurrection of two

poorly defined and irregularly used genera (*Gasterotomus* and *Suprasinelepicthys*) for species with only slight morphological differences. Equally important, under this scheme the all-inclusive *Potamorhina* conveys the concept of the hypothesized monophyly of the group. Such a concept would be absent in a more highly subdivided taxonomic system.

#### COMMENTS ON *Semitapicis* EIGENMANN AND EIGENMANN

In their original description of the subgenus *Semitapicis*, Eigenmann and Eigenmann (1889:417) failed to designate a type-species, although *Curimatus (Semitapicis) planirostris* has line priority. Eigenmann (1910:422) rectified this omission by designating that species as the type for the genus. As will be detailed below, however, the supposedly diagnostic characters for the genus are not present on the type-species, *Curimatus (Semitapicis) planirostris*. Furthermore, the association of the designated type-species with the other nominal forms placed in *Semitapicis* by Eigenmann results in a phylogenetically unnatural grouping. These taxonomic problems are an outgrowth of confusion concerning the identity of two nominal species, *Charax planirostris*, the type-species of the genus, and *Curimatus abramoides* of Kner (1859:142), considered as a synonym of *C. planirostris* for more than a century.

Gronovius (1763:123) in his *Zoophylacii* provided a reasonably detailed description of an unillustrated curimatid he termed *Charax* 378. Linnaeus, soon thereafter (1766:514), suggested that *Charax* 378 was equivalent to his *Salmo* (= *Curimata*) *cyprinoides*, a member of a curimatid lineage different from that forming *Potamorhina* in this paper. Gray (1854:154), who worked from a long-lost, unpublished Gronovius manuscript, nonetheless described *Charax* 378 as *Charax planirostris* (see Wheeler, 1958, for a discussion of the Gronovius manuscript and collection). No reasons were put forward by Gray for his resurrection of *Charax* 378 from the synonymy of *Salmo cyprinoides* as proposed by Linnaeus. Gray's de-

scription of *Charax planirostris*, "Charax maxilla superiore longiore obtusa, capite antice plagio-plateo: dorso summo acuminato elevato. Zoophyl. n 378," was copied verbatim from the Gronovius manuscript (see also below). That brief passage is too sparse to allow an identification to family let alone species. Only the earlier, more detailed *Zoophylacii* description (Gronovius, 1763) to which Gray (1854) provided a cross-reference provides clues as to the identity of the species.

*Curimatus* (= *Curimata*) *abramoides*, the second species involved in this question, is a distinctive species described by Kner (1859:142). The species is particularly noteworthy for its great body depth and Kner's comment that "immediately prior to it [the dorsal fin] is a short, diagonal, spur-like ray, which is bifurcated at the tip" (my translation).

The association of *Charax planirostris* and the other species that Eigenmann and Eigenmann (1889) and more recent authors have placed in *Semitapicis* was not based on information in the very sparse original description of that species. That practice was, rather, an outgrowth of a series of assumptions made by Günther (1864:290, 293) and subsequent researchers. Günther stated that Linnaeus (1766) was incorrect in placing *Charax* 378 (*Charax planirostris* of Gray) as a synonym of *Salmo* (= *Curimata*) *cyprinoides*, a suggestion that was in line with the actions of Gray (1854:154), who recognized the two nominal species as distinct. This action by Günther was apparently based primarily on Gronovius' statement (1763) that the scales of *Charax* 378 were "minutissimae." Günther felt that description was not appropriately applied to *Curimata cyprinoides*, which he reported as having 56 scales. Although he was not explicit in his reasoning, he evidently considered the comment to be a more appropriate description of the squamation in *Curimata abramoides*, reported by Kner (1859) as having 85 to 90 lateral line scales. As an outgrowth of this presumed similarity, Günther placed *Curimatus* (= *Curimata*) *planirostris* of Gray (1854) as the senior synonym of

Kner's *Curimata abramoides* (Kner, 1859). Günther's brief description of *C. planirostris* gives no indication that he had any specimens of the nominal species at hand. Nonetheless, his description was more extensive than the original of Gray or the earlier character listing of Gronovius (1763). Günther's information, particularly the morphometrics and meristics, is identical to, and evidently taken from, Kner's description of *C. abramoides*, the putative junior synonym.

Neither Eigenmann and Eigenmann (1889) in their original description of *Semitapicis*, Eigenmann (1910) in his designation of *Curimata planirostris* as the type-species of the genus, nor more recent authors who have published on curmatids have commented on Günther's removal of *Charax planirostris* from the synonymy of *Curimata cyprinoides*. Neither was there any discussion of that author's placement of *Charax planirostris* as the senior synonym of *Curimata abramoides* and his redescription of *C. planirostris* on the basis of the data in the original description of *C. abramoides*, the putative junior synonym.

The type specimen of *Charax planirostris* is not known to be extant, nor is there any indication of its presence in the portion of the Gronovius collection acquired by the British Museum in 1854. Günther's failure to list the type in his 1864 catalogue of the fishes in that museum's holdings is consistent with the apparent absence of the specimen from that purchase. The original Gronovius notebook now in the Zoology Library of the British Museum (Natural History), nonetheless contains information relevant to an analysis of the appropriateness of Gray's actions in describing *Charax planirostris* as a distinct species. The data in the notebook also permit a more in-depth evaluation of Günther's suggestion that *C. planirostris* and *Curimatus abramoides* are conspecific.

Gray's original description and binomial (quoted above) were taken verbatim from the manuscript in the British Museum (Natural History). That brief passage is followed in the notebook by "t13f2." The code evidently refers to the plate and figure numbers (tafel 13, figure 2)

Gronovius planned to assign to the associated illustration in the publication that he had in preparation but never completed. Within the notebook a drawing of a curimatid labeled "*Charax planirostris*" bears the same plate and figure code. The illustration (reproduced in Figure 7), in conjunction with the original 1763 description of *Charax* 378, makes it apparent that *Charax planirostris* of Gray and *Curimatus abramoides* of Kner (1859) are not conspecific. Indeed the available information indicates that they are apparently members of different lineages of curimatids.

The most obvious difference between the two nominal species is in body depth. The body is relatively shallow in the specimen of *Charax* 378 (= *C. planirostris*) illustrated by Gronovius (approximately 43% of standard length), whereas the smallest, shallowest bodied specimen of *Curimata abramoides* examined (43 mm SL) has a

body depth 48% of standard length. The body depth in *C. abramoides* is positively allometric ontogenetically and reaches approximately 60% of standard length in larger adults (see Kner, 1859, pl. 2: fig. 3). Gronovius (1763) describes the prepelvic region in *Charax* 378 as flat and the lower jaw as being shorter than the upper (the mouth therefore being inferior). Those attributes characterize *Curimata cyprinoides* and its near relatives, whereas *C. abramoides* has a transversely rounded prepelvic region and terminal mouth. It is also noteworthy that in his description of *Charax* 378, Gronovius failed to mention the obvious scaleless predorsal line and prominent predorsal spine, which characterize *C. abramoides* but are absent in the *C. cyprinoides* species complex. A final but equivocal character is the number of scales in the lateral line. Gronovius imprecisely described the scales in *Charax* 378 (= *C. planirostris*) as "minutissimae," although about

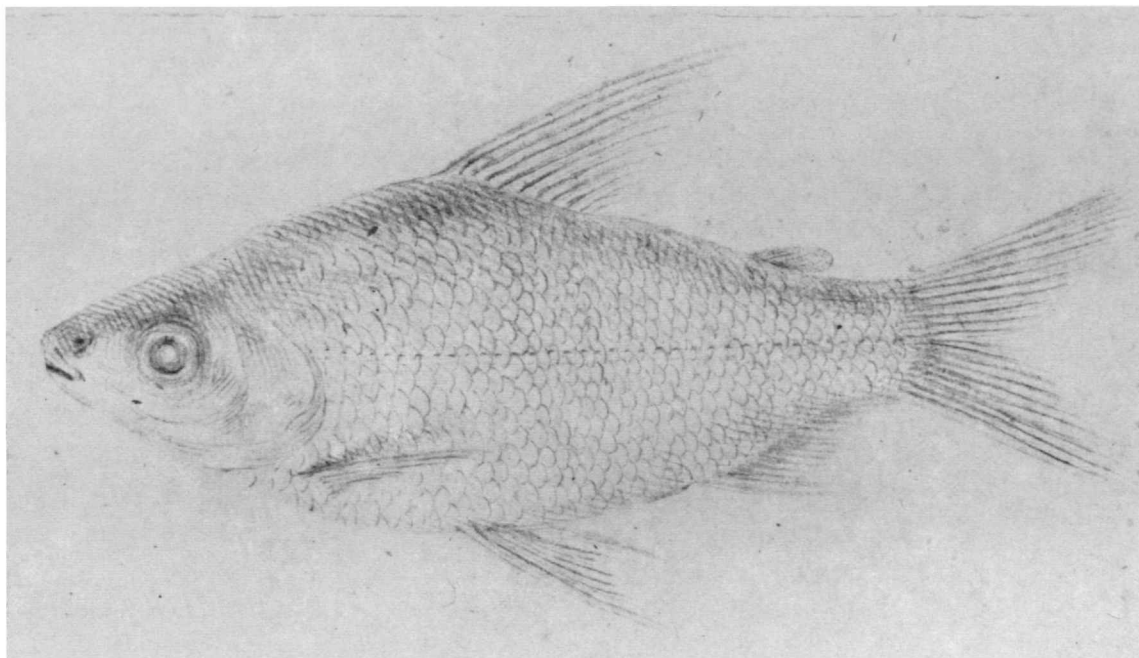


FIGURE 7.—Pencil drawing of *Charax* 378 (t13f2) from Gronovius notebook in Zoology Library, British Museum (Natural History); enlargement. Reproduced with permission of Trustees of British Museum (Natural History).



only 39 transverse series of scales are shown in his illustration of the species (Figure 7). Neither *Curimata abramoides* of Kner nor any known species of *Potamorhina* (sensu lato) and *Curimata* have such large scales. The scale number in the illustration is closer to the range for the species in the *Curimata cyprinoides* complex (most commonly 44 to 60) than to that of *Potamorhina* species (85 to 110) or *Curimata abramoides* (77 to 97). In summary, the evidence is consistent with, or more in line with, the concept that *Curimata abramoides* and *Charax planirostris* (= *C.* 378) are distinct species.

This conclusion has significant implications with respect to the question of the availability of *Semitapicis*. On the basis of the information derived from the illustration in the Gronovius notebook and the original Gronovius description of

*Charax* 378, together with available data on intrafamilial relationships within the Curimatidae, it appears that *Charax planirostris* is not a species most closely related to the forms traditionally in *Semitapicis* but is rather a member of the *Curimata cyprinoides* species complex. That concept was originally put forward by Linnaeus (1766), who went so far as to place *Charax* 378 as a synonym of *Curimata cyprinoides*. This conclusion is reaffirmed by the available data on the recognizable species in the Curimatidae and their interrelationships. *Curimata cyprinoides* and its close relatives are not closely related to the species that form *Potamorhina*, in the sense of this study (see also p. 8). Thus *Semitapicis*, based on *Curimata cyprinoides* or a very similar form, is not available for use as a generic-level taxon in the group of species recognized as *Potamorhina* in this study.

#### Key to the Species of *Potamorhina* Cope

1. Prepelvic region transversely flattened or concave, with distinct, longitudinally aligned lateral keels; postpelvic region compressed, with serrate ventral margin (Rio Amazonas) . . . . . *P. pristigaster*  
 Prepelvic region transversely rounded or with a longitudinally aligned median keel, no longitudinally aligned prepelvic lateral keels; postpelvic region compressed but not with serrate ventral margin . . . . . 2
2. Prepelvic region transversely rounded, without a distinct median prepelvic keel (Rio Amazonas and Río Orinoco) . . . . .  
 . . . . . *P. altamazonica*, new combination  
 Prepelvic region with a distinct medial keel . . . . . 3
3. Small, round spot located midlaterally on posterior portion of caudal peduncle; 31 vertebrae; median keel on ventral surface of body interrupted at insertion of pelvic fins; insertion of pelvic fin continuous with ventral profile of body (Lago Maracaibo drainage basin) . . . . .  
 . . . . . *P. laticeps*, new combination  
 No spot midlaterally on posterior portion of caudal peduncle; 35 to 37 vertebrae; median keel of ventral body surface not interrupted under insertion of pelvic fin; insertion of pelvic fin distinctly dorsal of ventral profile of body . . . . . 4
4. Twenty-six to 32 scales in a transverse series from origin of rayed dorsal fin to lateral line; 22 to 30 scales in a transverse series from origin of anal fin to lateral line; greatest body depth 0.38–0.45 of standard length; 35 vertebrae; gasbladder diverticula absent (Río Paraguay and Río Parana) . . . . . *P. squamoralevis*, new combination

Eighteen to 22 scales in a transverse series from origin of rayed dorsal fin to lateral line; 16 to 20 scales in a transverse series from origin of anal fin to lateral line; greatest body depth 0.32–0.40 of standard length; 36 or 37 vertebrae; gasbladder diverticula present, highly ramified (Rio Amazonas) . . . . . *P. latior*, new combination

***Potamorhina pristigaster* (Steindachner)**

FIGURES 8, 9

*Curimatus (Anodus) pristigaster* Steindachner, 1876:73, pl. 68 [type-locality: Brazil: mouth of Rio Negro, Tefé].

*Potamorhina pristigaster*.—Cope, 1878:685 [Peruvian Amazon].—Eigenmann and Eigenmann, 1889:411 [Brazil: Tefé (= Tefé), Lake Hyanuary (= Januari)]; 1891:46 [reference].—Fowler, 1906:306 [Peruvian Amazon]; 1942:210 [reference]; 1945:119 [compilation]; 1950:299, fig. 377 [bibliography]; 1975:377 [reference].—Eigenmann, 1910:420 [reference].—Eigenmann and Allen, 1942:289 [Peru: Iquitos].—Fernandez-Yepe, 1948:32, fig. 12 [reference].—Marlier, 1968:25, 38 [Brazil: Lac Redondo; diet].—Smith, 1981:140 [Brazil: Itacoatiara; market fish].

*Curimata (Potamorhina) pristigaster*.—Géry, 1977:230 [Amazon, Rio Negro].

*Potamorrhina pristigaster*.—Braga and Azpelicueta, 1983: 148 [in key].

**DIAGNOSIS.**—A moderate-sized *Potamorhina* species reaching 214 mm SL. *Potamorhina pristigaster* is easily distinguished from the other members of the genus by its apomorphously transversely flattened or slightly concave prepelvic region, which is delimited laterally by distinct longitudinally aligned keels, and by its highly

serrate postpelvic median keel. Neither character occurs in any other *Potamorhina* species.

**DESCRIPTION.**—Body moderately elongate, compressed. Dorsal profile of head concave, more so in juveniles. Dorsal profile of body distinctly convex to origin of rayed dorsal fin; straight and distinctly posterodorsally slanted at base of rayed dorsal fin, straight or slightly convex from insertion of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with a median keel anterior to rayed dorsal fin, rounded posterior to fin. Ventral profile of body smoothly curved from tip of lower jaw to lower margin of caudal peduncle. Prepelvic region transversely flattened or slightly concave, with distinct longitudinal lateral keels that extend from behind vertical through insertion of pectoral fin to point of insertion of lateralmost pelvic-fin ray (see Steindachner, 1876, pl. 68). A prominent median keel between pelvic fin insertion and anus; keel margined by a series of distinctly serrate scales.

Greatest body depth at origin of rayed dorsal fin, depth 0.40–0.50 [0.45]; snout tip to origin of rayed dorsal fin 0.45–0.54 [0.53]; snout tip to

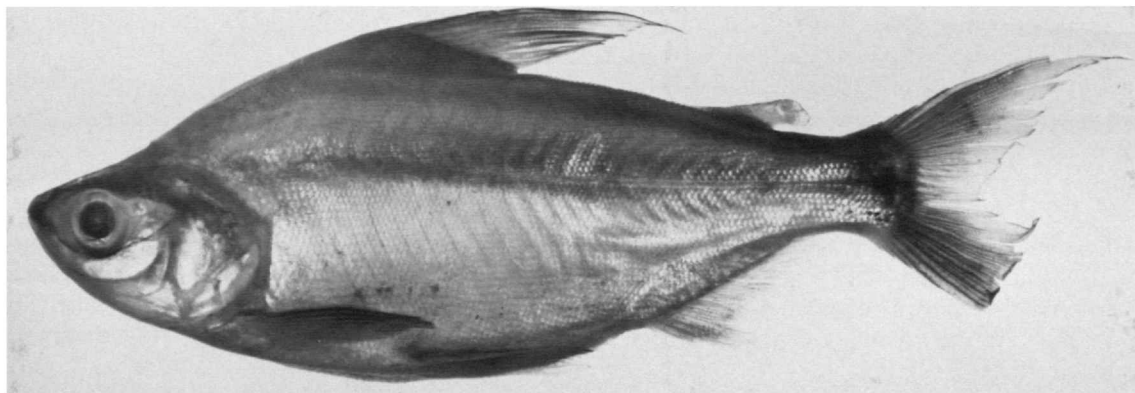


FIGURE 8.—*Potamorhina pristigaster*, USNM 242146, 202.7 mm SL.

origin of anal fin 0.76–0.81 [0.78]; snout tip to insertion of pelvic fin 0.50–0.58 [0.51]; snout tip to anus 0.72–0.80 [0.75]; origin of rayed dorsal fin to hypural joint 0.56–0.61 [0.60]. Rayed dorsal fin pointed, posterior margin concave, particularly in larger individuals; second unbranched and anterior branched rays filamentous, length of first branched ray 3.5–4.0 times length of ultimate dorsal-fin ray, reaches to adipose dorsal fin in some specimens. Pectoral fin pointed, length of pectoral fin 0.19–0.26 [0.20]; fin reaches distinctly beyond vertical through pectoral fin insertion in all but largest specimens examined, in which it extends only to vertical through fin insertion. Pelvic fin pointed, length of pelvic fin 0.18–0.24 [0.21]; fin reaches three-fifths to three-quarters distance to origin of anal fin in adults, slightly more posteriorly in smaller specimens. Anal fin emarginate, anteriormost rays twice length of ultimate ray. Adipose dorsal fin well developed. Caudal peduncle depth 0.11–0.12 [0.12].

Head distinctly pointed in profile, head length 0.31–0.38 [0.32]; jaws equal, mouth terminal; snout length 0.25–0.30 [0.27], nostrils of each side close together, anterior opening circular, posterior crescent-shaped; orbital diameter 0.22–0.28 [0.26]; adipose eyelid present, most highly developed anteriorly, particularly in larger specimens, with a vertically ovoid opening over middle of eye; postorbital portion of head elongate, length 0.49–0.54 [0.50]; gape width 0.28–0.34 [0.30]; interorbital width 0.40–0.47 [0.42].

Pored lateral line scales from supracleithrum to hypural joint 86 to 106 [102]; lateral line canals straight or diverge slightly dorsally and ventrally. Seven to 12 series of scales extend beyond hypural joint onto caudal fin base; 26 to 32 [29] scales in a transverse series from origin of rayed dorsal fin to lateral line, 22 to 28 [24] scales in a transverse series from lateral line to origin of anal fin. All scales distinctly ctenoid, those that form border of postpelvic median ridge flexed over ridge and with strongly developed, posterovertrally oriented ctenii.

Rayed dorsal-fin rays ii,9–10 [ii,9]; anal-fin

rays ii,11–13 or iii,11–13 [iii,12]; pectoral-fin rays 14 to 17 [16]; pelvic-fin rays i,8–9 [i,8].

Total vertebrae 33 (15), 34 (4).

*Color in Alcohol:* Overall coloration silvery-yellow to silvery-brown, head and body with pigmentation more intense dorsally. Dark coloration of dorsal portion of head extends posterovertrally onto dorsal half of opercle. A distinct, small, round spot located midlaterally on posterior portion of caudal peduncle. All fins with scattered small chromatophores that outline fin rays.

**DISTRIBUTION.**—Rio Amazonas drainage basin (Figure 9).

**REMARKS.**—In his original description of *Curimatus* (= *Potamorhina*) *pristigaster*, Steindachner mentions four specimens, one captured by Natterer in the mouth of the Rio Negro and three individuals obtained by Wesel at Tefé. A single specimen from the mouth of the Rio Negro, captured by Natterer and labeled as a type, is located in the Naturhistorisches Museum, Vienna (NMW 67046). The length of the specimen (161.3 mm, or approximately 6.5 inches) is distinctly shorter than that reported by Steindachner (10.5 inches). Three other specimens, listed as types and collected at Tefé (NMW 58205, 66920 and 66921), were also located in the holdings of that institution. One of these, a 210 mm SL individual (NMW 66920), is designated as the lectotype of the species. The remaining syntypic specimens (NMW 58205, 66921, 67046) thus become paralectotypes of the species.

**MATERIAL EXAMINED.**—80 specimens (53, 37.0–219.7).

**BRAZIL.** *Pará:* No specific locality, AMNH 12708, 1 (137.8). Rio Maycuru, NRM LAK 7129, 1 (148.2). Rio Tapajós at Santarem, MZUSP 3714, 1 (165.4). *Amazonas:* Tefé, NMW 66920, 1 (210.0; lectotype of *Curimatus* (*Anodus*) *pristigaster*); NMW 66921, 1 (202.0; paralectotype of *Curimatus* (*Anodus*) *pristigaster*); NMW 58205, 1 (206.0; paralectotype of *Curimatus* (*Anodus*) *pristigaster*); MCZ 20255, 4 (170.0–214.4); MNHN 09-122, 1. Rio Tefé, Supiã-pucu, USNM 242146, 2. Rio Tefé, Mucura, USNM 242145,



FIGURE 9.—Geographic distribution of *Potamorhina pristigaster* (star = lectotype-locality; some symbols represent more than one collecting locality or lot of specimens).

2. Tabatinga (Sapurara), MNHN 09-168, 1. Vicinity of Manaus, USNM 228693, 3 (66.5–108.5; 1 cleared and counterstained for cartilage and bone). Mouth of Rio Negro, NMW 67046, 1 (161.3, paralectotype of *Curimatus (Anodus) pristigaster*). Manacapuru, BMNH 1925.10.28.60, 1 (196.0). Lake Hyanuary (= Januari), MCZ 19033, 12 (8, 135.0–201.5); MZUSP 6863, 5 (3, 107.1–126.8). Lago do Miguel, 20 km below Itacoatiara, MZUSP 13487–88, 2 (182.7–219.7). Igarape Jaraqui, MZUSP 6182, 2 (185.9–215.2). Lago Janauacá, MZUSP 21560, 7 (193.4–216.4). Mouth of Rio Purus, MZUSP 5948, 6 (5, 83.0–207.1). Lago Jacare, MZUSP 6454, 10. Maués, Igarape of Rio Marau, MZUSP 7322, 2. *Roraima*: Rio Branco, Xeriuini, USNM 242147, 1. Rio Branco, Marara, USNM 2573661, 1.

PERU. Peruvian Amazon, ANSP 21520–22, 3 (120.5–178.0). *Loreto*: Río Ampiyacu, USNM 228683, 1 (36.8); SU 64310, 1. Pevas, CAS-SU 36609, 1 (93.5). Iquitos, USNM 228700, 1 (148.0). Iquitos, Cocha Zegarra off Río Itaya,

MZUSP 15234, 1 (178.3). Iquitos, Cocha Aguajal, MZUSP 15233, 1 (158.3). *Ucayali*: Pucallpa, Cashibococha, MZUSP uncat., 2 (106.0–119.5).

#### *Potamorhina altamazonica* (Cope), new combination

FIGURES 10, 11

*Curimatus altamazonicus* Cope, 1878:684 [type-locality: Peruvian Amazon].—Eigenmann and Eigenmann, 1889:432 [placed as a synonym of *Curimatus laticeps* Valenciennes].

*Curimatus laticeps*.—Steindachner, 1882:137 [Brazil: Rio Guapore, Villa Bella, Cujaba, Lake Saraca, Silva].—Eigenmann and Eigenmann, 1889:432 [reference in part, Brazil: Coary (= Coari), Fonteboa (= Fonte Boa), Villa Bella, Serpa (= Itacoatiara); not listed specimens from Venezuela]; 1891:48 [reference in part].—LaMonte, 1935:7 [Brazil: Rio Purus].

*Semitapicis laticeps*.—Fowler, 1906:305 [on type of *Curimatus altamazonicus* Cope].—Eigenmann, 1910:422 [reference in part, not Lake Maracaibo or Río Paraguay].—Fowler, 1939:256, fig. 56 [Peru: Contamana]; 1945:256 [in part; Peru: Río Ucayali].

*Curimatus (Semitapicis) laticeps*.—Pellegrin, 1909:148 [Brazil: Pará].—Géry, 1964:37 [Peruvian Amazon].

*Anodus laticeps*.—Eigenmann and Allen, 1942:300 [Peru: Lago Sanango, Río Nanay, Río Ucayali, Lago Cashiboya].—Fowler, 1950:275, fig. 332 [compilation].—Marlier, 1968:25, 40 [Brazil: Lac Redondo; diet].—Dorn and Schaller, 1972:169 [vocalizations].—Schaller, 1974:249 [vocalization mechanism].

*Sematapicis laticeps*.—Fowler, 1945:119 [incorrect spelling; compilation].

*Curimata (Semiatapicis) laticeps*.—Géry, 1977:230 [reference in part, not Venezuela].

*Curimata altamazonica*.—Goulding, 1981:39, 66, 105, fig. 37 [common name; migration; fisheries and importance in fisheries].

*Curimata laticeps*.—Junk et al., 1983:406 [Brazil: Ilha de Marchantaria; seasonal occurrence].

*Sematapicis laticeps*.—Braga and Azpelicueta, 1983:148 [in part, Amazonian citations; not Lago Maracaibo reference].

**DIAGNOSIS.**—A large *Potamorhina* species that reaches 270 mm SL. *Potamorhina altamazonica* is readily distinguished from its congeners by its transversely rounded preventral area and a non-serrate postventral keel. *Potamorhina pristigaster*, in contrast, has a transversely flattened or slightly concave, laterally keeled preventral region and a serrate median postventral keel. In *P. laticeps*, *P. latior*, and *P. squamoralevis*, the prepelvic region has a distinct median keel. The 35 vertebrae in *P. altamazonica* also separate it from all other members of the genus except *P. squamoralevis*. That species, however, has a distinct median prepelvic keel.

**DESCRIPTION.**—Body moderately elongate,

compressed, more so in specimens over 140 mm SL. Dorsal profile of head very slightly concave in some juveniles, straight or slightly convex in larger specimens. Dorsal profile of body smoothly curved from rear of head to origin of rayed dorsal fin; straight and posteroventrally slanted at base of rayed dorsal fin, straight or gently convex from base of last dorsal-fin ray to caudal peduncle; convexity more pronounced in larger specimens. Dorsal surface of body with an indistinct medial keel anterior to rayed dorsal fin, smoothly rounded transversely posterior to fin. Ventral body profile gently curved from tip of lower jaw to caudal peduncle. Prepelvic region smoothly rounded transversely with no indication of median keel, very slight lateral flexures barely discernable in largest specimens examined. A well-developed, nonserrate, median keel extends from barely posterior of pelvic fin insertion to anus.

Greatest body depth at origin of rayed dorsal fin, depth 0.34–0.43 [0.37]; snout tip to origin of rayed dorsal fin 0.44–0.52 [0.49]; snout tip to origin of anal fin 0.71–0.82 [0.79]; snout tip to insertion of pelvic fin 0.48–0.57 [0.51]; snout tip to anus 0.70–0.79 [0.74]; origin of rayed dorsal fin to hypural joint 0.51–0.60 [0.58]. Rayed dorsal fin pointed, less so with increasing age; anteriormost rays somewhat filamentous, length 3.1–4.1 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.16–0.22 [0.17];

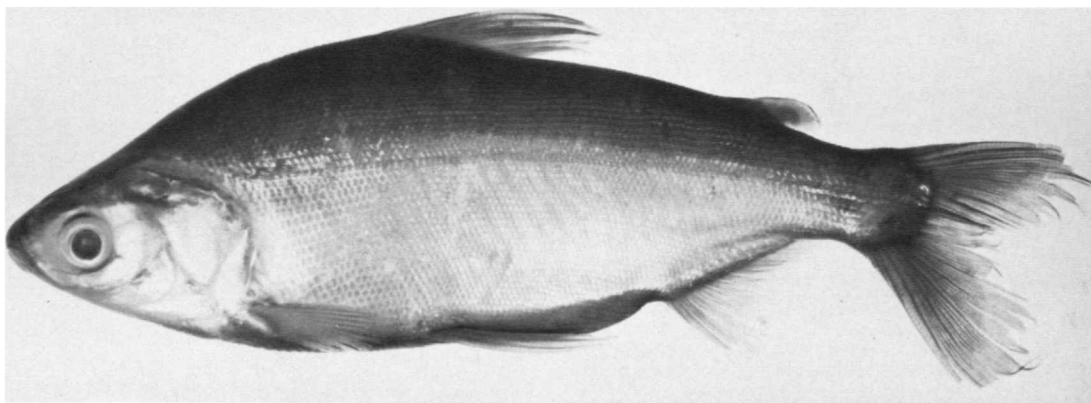


FIGURE 10.—*Potamorhina altamazonica*, USNM 228684, 164.5 mm SL.



fin extends to vertical through insertion of pelvic fin in smaller adults, distinctly shorter in largest specimens examined. Pelvic fin pointed, length of pelvic fin 0.17–0.25 [0.19]; fin reaches two-thirds distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin distinctly emarginate, anteriormost branched rays three times length of ultimate ray. Caudal peduncle depth 0.10–0.12 [0.11].

Head obtusely pointed in profile, head length 0.27–0.37 [0.31]; jaws equal, mouth terminal; snout length 0.25–0.32 [0.30]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin that separates nares; orbital diameter 0.20–0.29 [0.24]; a distinct adipose eyelid, particularly well developed longitudinally posterior to orbit in larger specimens; postorbital portion of head elongate, length 0.50–0.57 [0.53]; gape width 0.28–0.35 [0.29]; interorbital width 0.44–0.51 [0.42].

Pored lateral line scales from supracleithrum to hypural joint 85 to 104 [95]; all scales of lateral line pored, canals in scales diverge dorsally and ventrally; 5 to 11 series of scales extend beyond hypural joint onto caudal fin base; 21 to 27 scales in a transverse series from origin of rayed dorsal fin to lateral line, 17 to 23 scales in a transverse series from the lateral line to origin of anal fin. Scales of anteroventral region of body of adults with somewhat serrate edges.

Rayed dorsal-fin rays ii,8–10 [ii,9]; anal-fin rays ii,11–13 or iii,12–14 [ii,12]; pectoral-fin rays 15 to 18 [15]; pelvic-fin rays i,8–9 [i,8].

Total vertebrae 35 (18).

*Color in Alcohol:* Silvery-yellow to golden in specimens that retain guanine. Yellow to brown in specimens that lack guanine. In all individuals dorsal portions of head and body with more intense pigmentation. Some populations with series of small chromatophores arranged in irregular series aligned with scale edges. Fins with scattered, small chromatophores, particularly on distal portions of pectoral, pelvic, anal, rayed and adipose dorsal fins; some individuals with fin rays, particularly in the caudal and dorsal fins, outlined by series of small chromatophores.

**DISTRIBUTION.**—Rio Amazonas and Río Orinoco basins (Figure 11, see also below).

**COMMON NAME.**—Brazil: Branquinha cabeça lisa (Goulding, 1981).

**REMARKS.**—The erroneous synonymization of *Potamorhina altamazonica* into *P. laticeps* (Eigenmann and Eigenmann, 1889:432) resulted in numerous incorrect citations of the latter species from the Rio Amazonas basin (see “Remarks” section under *Potamorhina laticeps*). The vast majority of those Amazonian records of *P. laticeps* were based on specimens of *P. altamazonica*. Fowler’s (1945:256) citation of *P. laticeps* from the Río Ucayali was based on a complex series (ANSP 73166) that was a combination of *P. altamazonica* and *P. latior*.

The Venezuelan specimens of this species cited under “Material Examined” are the first records of a *Potamorhina* species from the Río Orinoco drainage system. Previous citations of members of the assemblage in Venezuela were based on *P. laticeps*, a Lago Maracaibo endemic, with the exception of the *Anodus latior* record of Roberts (1974), which is an erroneous citation for *Anodus* (= *Potamorhina*) *laticeps*.

Five of the examined specimens of *P. altamazonica* (USNM 196710) were collected in a reservoir in the Rio Moxoto drainage system of Pernambuco, Brazil. Other than for those individuals, no specimens of *P. altamazonica* are known for localities outside of the Rio Amazonas and Río Orinoco basins. Neither has any other member of the genus been reported to occur in the northeast of Brazil. It appears unlikely that such a large-sized species, extensively utilized as a food fish through much of its range, would escape detection in the Rio San Francisco drainage system, if it occurred there naturally. Given the artificial setting from which the specimens were captured, and the lack of other records of the species from the region, it is likely that those individuals represent an introduced population.

**MATERIAL EXAMINED.**—349 specimens (103, 50.2–265.5).

**BRAZIL.** *Pará:* No specific locality, MNHN A.8795, 1; MNHN 09-41, 1. Villa Bella, MCZ 20259, 11; NMW 68832, 1. Monte Alegre,

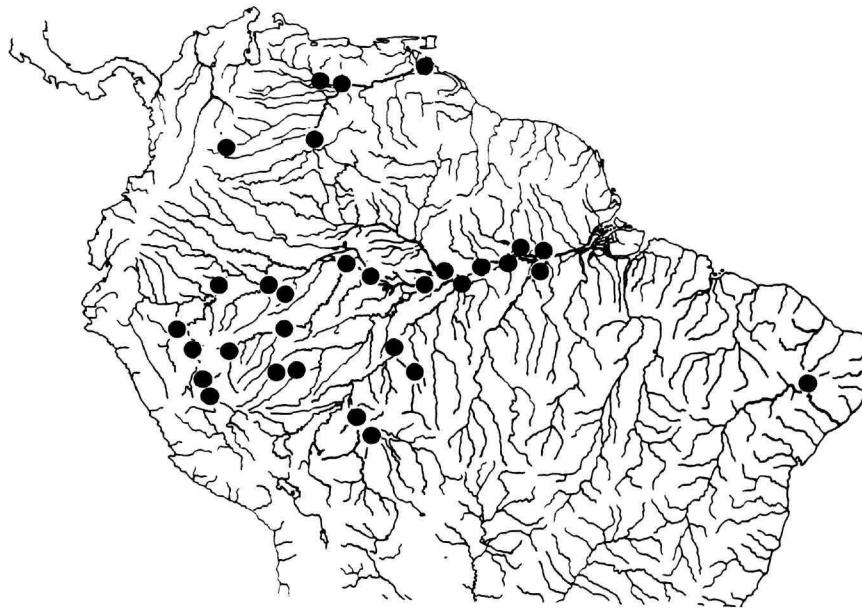


FIGURE 11.—Geographic distribution of *Potamorhina altamazonica* (some symbols represent more than one collecting locality or lot of specimens).

NMW 68828, 1; BMNH 1926.10.27.177, 1. Santarem, MCZ 20228, 3; MCZ 20229, 1. Mouth of Rio Nhamundá, MZUSP 9533, 3 (1, 137.8). Rio Paru, Oriximiná, MZUSP 5996, 15 (5, 184.7–191.3). Rio Trombetas, Oriximiná, MZUSP 20944, 1 (142.3). *Amazonas*: Rio Iaco, USNM 94666, 3 (92.0–137.5); AMNH 43049, 2 (88.1–140.3); AMNH 12566, 2 (82.0–87.1). Lago Castro at mouth of Rio Purus, MZUSP 6307, 3 (2, 157.8–181.3). Mouth of Rio Purus, MZUSP 20902, 1. Rio Purus, MCZ 33531, 1; NMW 68830, 1; MCZ 33548, 2. Fonte Boa, MCZ 20264, 1 (136.0). Igarape Manduaçu, NW of Fonte Boa, MZUSP 20961, 17. Serpa (= Ita-coatiara), MCZ 20317, 1 (75.6); MCZ 20318, 24. Igarape Xicango 5 km E of Humaita, USNM 220003, 1 (57.5); USNM 232364, 1 (cleared and counterstained for cartilage and bone); GC, 6. Rio Jurua, USNM 94644, 1 (202.0). Vicinity of Manaus, USNM 228684, 1 (163.4); USNM 228688, 1; USNM 228686, 1. Lago Januari, MZUSP 6855, 1 (179.0). Tabatinga (= Sapurara), NMW 68829, 1. Rio Madeira, GC, 2. Lago

off Rio Madeira, ~25 km from Nova Olinda, MZUSP 7032, 1. Hyavary (= Rio Javari), MCZ 20239, 1; MCZ 20240, 1. Paraná de Urucará, MZUSP 7511, 1 (149.3); MZUSP 5782, 2. Lago Supiá near Codajás, MZUSP 9665, 6. Lago Janauacá, MZUSP 21556, 8 (4, 199.1–232.4). *Acre*: Rio Jurua, Cruzeiro do Sul, ZUEC 412–413, 2; ZUEC 410, 1. *Rondônia*: Rio Machado, USNM 220195, 5 (201.5–211.0). Rio Machado, Paraiso, MZUSP 14044, 1 (207.2). *Pernambuco*: Rio Moxoto, USNM 196710, 5 (225.0–265.5).

PERU. Peruvian Amazon, ANSP 2118, 1 (157.5; holotype of *Curimatus altamazonicus*); ANSP 21119–21120, 2 (122.3–145.0; paratypes of *Curimatus altamazonicus*). Loreto: Contamana, ANSP 73166, 10 (4, 55.7–128.0); CAS-IU 17861, 12 (9, 63.0–132.5). Iquitos, USNM 163849, 1 (140.0). Iquitos, Caño Lupuna, MZUSP 15232, 1. Rio Amazonas near Iquitos, USNM 257367, 3 (1 cleared and counterstained for cartilage and bone). Rio Samiria, Atum Cocha, MZUSP 15246, 1. Lago Sanago near Yurimaguas, USNM 16776, 2 (155.4–172.8); CAS-

IU 15663, 3 (161.5–185.9). Río Nanay, CAS-IU 15836, 3 (110.3–154.9). Orellana, CAS-IU 17860, 1 (190.0). *Ucayali*: Pucallpa, Cashibococha, MZUSP uncat., 6. Pucallpa, AMNH 48670, 3 (52.0–74.7 [specimen cleared and counterstained for cartilage and bone]); AMNH 48672, 4 (50.2–63.5); AMNH 48671, 1 (64.1); ANSP 119871, 1 (135.8). Río Ucayali, Bagazan, MZUSP uncat., 2. Lago Cashiboya, CAS-IU 17862, 29 (9, 64.5–129.0). *Amazonas*: Ayambas, LACM 36343-8, 1. *Huanuco*: Lower Río Pachitea, BMNH 1969.7.15.48, 1 (153.0).

**BOLIVIA.** *Beni*: Río Guaporé, AMNH 37714, 1 (123.5). Río Mamoré 5 km SE of Limoquije, AMNH 48669, 1 (108.9).

**COLOMBIA.** *Amazonas*: Leticia, ANSP 119888, 1 (154.0). Río Amazonas near Leticia, MCZ 51639, 1 (41.1). *Meta*: Puerto Lopez, USNM 228685, 3 (154.0–191.0).

**VENEZUELA.** *Territorio Federal Delta Amacuro*: lower Río Orinoco, USNM 228698, 1 (154.0); USNM 228694, 2 (73.0–87.3); USNM 228695, 3 (64.8–86.2); USNM 228689, 1; USNM 228696, 1; MBUCV V-13097, 3. Caño El Chano, Tucupita, MBUCV V-10358, 4 (92.9–98.8). *Guarico*: Esteros de Camaguan, near Camaguan, MBUCV V-11811, 2; MBUCV V-11801, 1. Río Manapire, Santa Rita, MBUCV V-5759, 46; MBUCV V-5747, 17. Río Portuguesa, Camaguan, MBUCV V-8802, 1. *Apure*: Río Apure Viejo, San Fernando de Apure, MBUCV V-11165, 9. Caño El Pavoncito, Río Apure, MBUCV V-2786, 2. Lagoon near San Fernando de Apure, MBUCV V-5525, 9. Río Apure, San Fernando de Apure, USNM 257902, 2; USNM 258199, 1. *Territorio Federal de Amazonas*: Raudales de Ature, MBUCV V-12823, 2.

***Potamorhina laticeps* (Valenciennes), new combination**

FIGURES 12, 13

*Curimatus laticeps* Valenciennes, 1849:21, pl. 634 [type-locality: Venezuela, Lake Maracaibo drainage basin].—Günther, 1864:293 [after Valenciennes].—Eigenmann and Eigenmann, 1889:432 [reference in part, Venezuela; not listed specimens from Brazil; *Curimatus altamazonicus*

Cope (1878) incorrectly placed as a synonym]; 1891:48 [reference in part]. [Not Steindachner, 1882:137.]

*Semitapiscis laticeps*.—Eigenmann, 1910:422 [citation in part, Lake Maracaibo]. [Not Bertoni, 1914:10; Fowler, 1906:305, 1939:256, 1945:119.]

*Anodus laticeps*.—Schultz, 1944:251 [Venezuela, Lago Maracaibo basin: Río Negro, Río Palmar, Río San Ignacio, Río Apón].—Mago-Leccia, 1970:75 [Venezuela]. [Not Pearson, 1937:109; Eigenmann and Allen, 1942:300; Fowler, 1950:275; Marlier, 1968:25, 40; Ringuelet, 1975:72; Dorn and Schaller, 1972:169; Schaller, 1974:249.]

*Suprasinelephichthys laticeps*.—Fernandez-Yepe, 1948:35 [assignment to *Suprasinelephichthys*; not illustrated figure].—Fowler, 1975:375 [reference].

*Gasterotomus latior*.—Roberts, 1974:433 [erroneous citation of *Anodus laticeps* (Valenciennes)].

*Curimata* (*Semitapiscis*) *laticeps*.—Géry, 1977:230 [reference in part, not Amazon].

*Semitapiscis laticeps*.—Braga and Azpelicueta, 1983:148 [in part, Lago Maracaibo citation; not Amazonian references].

**DIAGNOSIS.**—A large *Potamorhina* species that reaches 260 mm SL. *Potamorhina laticeps* is readily distinguishable in having 31 vertebrae contrary to the 33 to 37 in its congeners. Externally the moderately developed, longitudinal prepelvic median keel not continuous with the distinct, nonserrate postpelvic keel distinguishes *P. laticeps* within the genus. *Potamorhina pristigaster*, in contrast, has a flattened or transversely concave, laterally keeled prepelvic region and a serrate median postpelvic keel. In *P. latior* and *P. squamoralevis* the midventral keel anterior to the pelvic fin insertion is more highly developed and continuous posteriorly with the comparable postpelvic median ridge. *Potamorhina altamazonica*, in turn, has the ventral body surface anterior to the pelvic fin smoothly rounded transversely.

**DESCRIPTION.**—Body moderately elongate, compressed, more so in specimens over 150 mm SL. Dorsal profile of head straight or very slightly concave. Dorsal profile of body smoothly curved from rear of head to origin of rayed dorsal fin; straight and posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with an indistinct median keel anterior to rayed dorsal fin, smoothly rounded transversely poste-

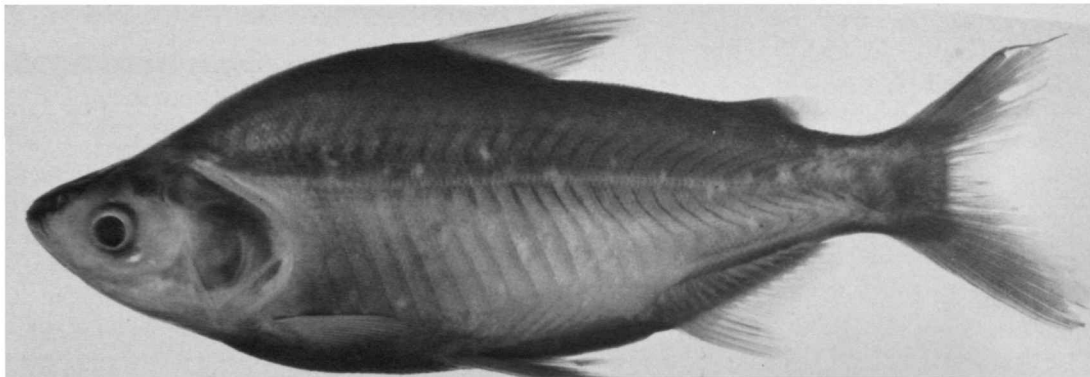


FIGURE 12.—*Potamorhina laticeps*, MBUCV, V-13283, 220.9 mm SL.

rior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Pre-pelvic region with an obtuse median keel that extends from anteroventral margin of pectoral girdle to area between insertion of pelvic fins. A well-developed median keel posterior to pelvic fin insertion. Pre- and post-pelvic median keels not continuous, interrupted in region of pelvic fin insertion.

Greatest body depth at origin of rayed dorsal fin, depth 0.34–0.44 [0.34]; snout tip to origin of rayed dorsal fin 0.47–0.54 [0.47]; snout tip to origin of anal fin 0.71–0.79 [0.74]; snout tip to insertion of pelvic fin 0.47–0.53 [0.49]; snout tip to anus 0.68–0.73 [0.72]; origin of rayed dorsal fin to hypural joint 0.55–0.59 [0.58]. Rayed dorsal fin pointed, less so with increasing age; anteriormost fin rays 2.5–3.0 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.17–0.23 [0.20]; fin extends distinctly beyond vertical through insertion of pelvic fin in smaller adults, barely beyond in largest specimens examined. Pelvic fin pointed, length of pelvic fin 0.20–0.26 [0.20]; fin reaches to origin of anal fin in young adults, only three-quarters of distance in larger specimens. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays twice length of ultimate ray. Caudal peduncle depth 0.11–0.12 [0.11].

Head distinctly pointed in profile, head length 0.29–0.35 [0.32]; jaws equal, mouth terminal;

snout length 0.24–0.31 [0.26]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin that separates nares; orbital diameter 0.20–0.27 [0.21]; adipose eyelid present, most highly developed anteriorly, with a vertically ovoid opening over middle of eye; postorbital portion of head elongate, length 0.53–0.58 [0.55]; gape width 0.27–0.31 [0.27]; interorbital width 0.39–0.45 [0.39].

Pored lateral line scales from supracleithrum to hypural joint 92 to 106 [105]; all scales of lateral line pored, sensory canals in lateral line scales diverge dorsally and ventrally; 5 to 10 series of scales extend beyond hypural joint onto caudal fin base; 24 to 29 [25] scales in a transverse series from origin of rayed dorsal fin to lateral line, 25 to 31 [27] scales in a transverse series from the lateral line to origin of anal fin. Scales weakly ctenoid, ctenii most highly developed on region anterior to insertion of pelvic fin.

Rayed dorsal-fin rays ii, 9–10 [ii, 9]; anal-fin rays ii, 12–15 or iii, 12–14 [ii, 15]; pectoral-fin rays 15 to 17 [16]; pelvic-fin rays i, 8–9 [i, 9].

Total vertebrae 31 (12).

*Color in Alcohol:* Overall coloration silvery-yellow to silvery-brown, head and body pigmentation more intense dorsally. A distinct, dark, round or slightly vertically elongate spot located on midlateral posterior portion of caudal peduncle at base of middle caudal fin rays. All fins with

scattered small chromatophores.

**DISTRIBUTION.**—Lago Maracaibo drainage basin of Venezuela (Figure 13).

**COMMON NAME.**—Venezuela: Manamana (Mago-Leccia, 1970).

**REMARKS.**—*Curimatus* (= *Potamorhina*) *laticeps* was described by Valenciennes based on specimens captured in the Lago Maracaibo drainage system of northwestern Venezuela. The species was subsequently reported from that basin and numerous geographically scattered locations in the Rio Amazonas drainage system. It was also cited as an element of the ichthyofauna of the Río Paraná-Paraguay system (see synonymies of *Potamorhina altamazonica*, *P. latior*, and *P. squamoralevis*). Despite these numerous citations, only one known literature record by Schultz (1944:251), based on Lake Maracaibo drainage basin material, actually represented *Potamorhina laticeps*. The remaining citations were misidentifications, largely of *P. altamazonica* and to a lesser extent of *P. latior* and *P. squamoralevis*.

The incorrect identifications of *P. altamazonica*

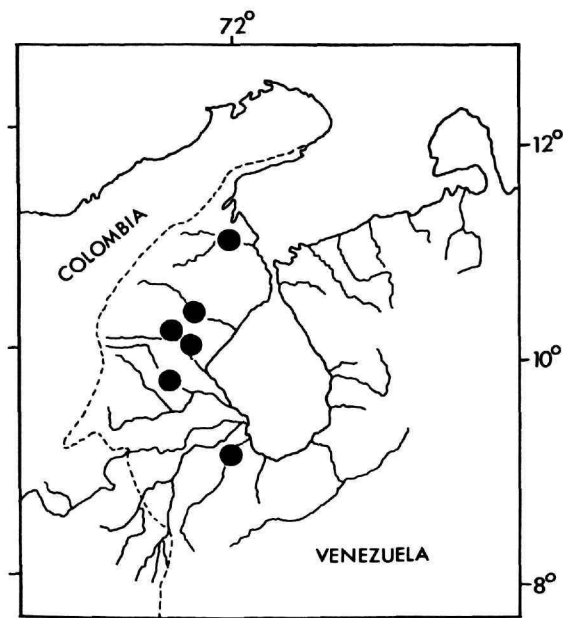


FIGURE 13.—Geographic distribution of *Potamorhina laticeps* (some symbols represent more than one collecting locality or lot of specimens).

as *P. laticeps* began with Eigenmann and Eigenmann (1889:432). Those authors erroneously considered the two species to be conspecific, although *P. laticeps* is characterized by a median prepelvic keel contrary to the transversely rounded prepelvic region in *P. altamazonica*. Eigenmann and Eigenmann evidently did not have any specimens of *P. laticeps* available and may have been misled by the absence, in the original description of *P. laticeps*, of any comment on the distinctive prepelvic keel present in that species. Subsequent researchers followed Eigenmann and Eigenmann's practice in identifying Amazonian *Potamorhina* specimens with a transversely rounded preventral region as *P. laticeps*. Examination of the type series of both nominal species has shown that they are actually distinct in the form of the prepelvic region and in numerous other characters.

The specimens from the Río Ucayali basin of Peru (ANSP 73166) identified as *Semitapecis laticeps* by Fowler (1945:256) represent a mixture of *Potamorhina altamazonica* and *P. latior*. Bertoni (1914:10), followed by Pearson (1937:109) and Ringuélet (1975:72), reported *Potamorhina laticeps* (in *Semitapecis* and *Anodus*) from the Río Paraná-Paraguay system. None of the numerous *Potamorhina* specimens examined from various sections of that drainage basin have proved to be *P. laticeps*. Those reports were most likely based on misidentifications of *P. squamoralevis* (see "Remarks" under that species).

Fernandez-Yepe (1948:35) designated *Curimatus laticeps* of Valenciennes as the type of his genus *Suprasinelepicthys* and followed Eigenmann and Eigenmann (1889:432) in incorrectly equating the Amazonian material of *Potamorhina altamazonica* with *P. laticeps*. The diagnosis of *Suprasinelepicthys* is consequently based on the characters of *P. altamazonica* rather than those of its designated type-species, *P. laticeps*. The drawing that accompanied the original generic diagnosis proposed by Fernandez-Yepe illustrates characters similarly not found in *P. laticeps*. The most misleading characterization, also illustrated in the associated drawing, is that the "prepelvic region . . . is rounded, not compressed . . ." (my



translation). In actuality *P. laticeps* has a distinct median prepelvic keel.

The original description of *Potamorhina laticeps* was based on two specimens. The larger individual (MNHN A.9772) is apparently that illustrated in the original description of the species (Cuvier and Valenciennes, 1829, pl. 634) and is designated as the lectotype. The remaining specimen (MNHN B.2935) therefore becomes the paralectotype of the species.

**MATERIAL EXAMINED.**—24 specimens (23, 125.1–259.0).

**VENEZUELA.** Maracaibo basin, no specific locality, MNHN A.9772, 1 (223.7; lectotype of *Curimatus laticeps*); MNHN B.2935, 1 (192.0; paralectotype of *Curimatus laticeps*); AMNH 1101, 1 (144.0). **Zulia:** Río Negro below mouth of Río Yasa, USNM 121321, 3 (143.5–151.8). Río Palmar 70 km SW of Maracaibo, USNM 121323, 4 (125.7–157.4, 1 specimen cleared and counterstained for cartilage and bone). Río San Ignacio 20 km S of Rosario, USNM 121322, 1 (128.4). Río Apón, 35 km S of Rosario, USNM 121320, 9 (210.1–259.2). Estacion Centro Adiestramiento Don Bosco, Carrasquero, MBUCV V-13282, 3 (191.4–204.8). Río Escalante below Santa Barbera de Zulia, MBUCV V-2139, 1.

***Potamorhina squamoralevis* (Braga and Azpelicueta), new combination**

FIGURES 14, 15

*Curimatus latior*.—Boulenger, 1896:34 [Paraguay].—Marcelli, 1923:557 [Argentina: Río de La Plata, Buenos Aires].

*Curimata latior*.—Berg, 1899:93 [Argentina: Buenos Aires].

*Anodus latior*.—Eigenmann and Kennedy, 1903:511 [Paraguay: Asunción, Fuerte Olimpo].—Pearson, 1937:109 [on Eigenmann and Kennedy, 1903].—Ringuelet and Aramburu, 1961:36 [Argentina].

*Psectrogaster curuiventris*.—Eigenmann and Ogle, 1907:3 [Paraguay].

*Semitapiscis laticeps*.—Bertoni, 1914:10 [Paraguay].

*Anodus laticeps*.—Pearson, 1937:109 [Río Paraguay basin].—Ringuelet, 1975:72 [Río Paraguay].

*Gasterotomus latior*.—Ringuelet et al., 1967:196 [reference].  
*Semitapiscis squamoralevis* Braga and Azpelicueta, 1983:140

[type-locality: Argentina: Río Paraná at Rosario; range: Río Paraguay, Río Paraná, Río de La Plata].

**DIAGNOSIS.**—A moderate-sized *Potamorhina* species that reaches 215 mm SL. *Potamorhina squamoralevis* can be distinguished from its congeners, other than *P. altamazonica*, in having 35 vertebrae contrary to 36 or 37 in *P. latior* and 31 to 34 in *P. laticeps* and *P. pristigaster*. Externally the moderate median keel continuous with the distinct, nonserrate postventral keel distinguishes *P. squamoralevis* within the genus. In contrast, *Potamorhina altamazonica* has the ventral body surface smoothly rounded transversely anterior to the pelvic fin insertion. *Potamorhina pristigaster* has a transversely flattened or slightly concave, laterally keeled preventral region and a serrate median postventral keel. In *P. latior* the ventral keel anterior to the pelvic fin insertion is more highly developed and the pelvic fin insertion is distinctly dorsal of the midventral line. The midventral prepelvic keel of *P. laticeps* is not continuous with that of the postpelvic region.

**DESCRIPTION.**—Body moderately elongate, more so in larger individuals, compressed. Dorsal profile of head straight or very slightly concave. Dorsal profile of body convex from rear of head to origin of rayed dorsal fin, convexity increased in larger specimens; straight and posteroventrally slanted at base of dorsal fin, straight or gently convex from base of last dorsal-fin ray to caudal peduncle, convexity increases with age. Dorsal body surface with a slight median keel anterior to rayed dorsal fin, smoothly rounded transversely posterior to fin. Ventral body profile gently curved from tip of lower jaw to approximately vertical through pelvic fin insertion, straight from that point to region of posterior-most portion of pelvic fin, then distinctly convex to anal fin origin; base of anal fin straight. Prepelvic region with a low median keel that extends from anteroventral margin of pectoral girdle to area between insertion of pelvic fins. A well-developed obtuse median keel extends from posterior of pelvic fin insertion to origin of anal fin. Pre- and post-pelvic keels barely continuous in region of pelvic fin insertion.

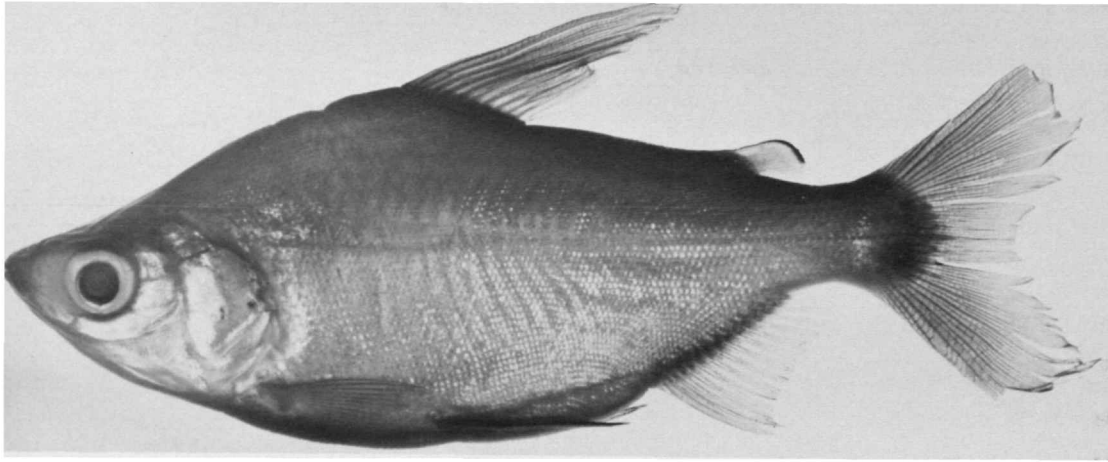


FIGURE 14.—*Potamorhina squamoralevis*, MZUSP 21736, 112.1 mm SL.

Greatest body depth at origin of rayed dorsal fin, depth 0.38–0.45; snout tip to origin of rayed dorsal fin 0.49–0.54; snout tip to origin of anal fin 0.75–0.83; snout tip to insertion of pelvic fin 0.51–0.58; snout tip to anus 0.74–0.80; origin of rayed dorsal fin to hypural joint 0.54–0.60. Rayed dorsal fin pointed, less so with increasing age; anteriormost branched rays somewhat filamentous, length 2.7–3.4 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.18–0.22; fin falls short of vertical through insertion of pelvic fin, particularly in largest specimens examined. Pelvic fin pointed, length of pelvic fin 0.19–0.26; fin reaches three-quarters of distance to origin of anal fin, somewhat less in larger individuals. Caudal fin forked. Adipose dorsal fin well developed. Anal fin margin straight or slightly emarginate, anteriormost branched rays twice length of ultimate ray. Caudal peduncle depth 0.10–0.12.

Head pointed in profile, head length 0.31–0.37; jaws equal, mouth terminal; snout length 0.29–0.35; nostrils of each side very close, anterior circular, posterior crescent shaped with aperture closed by thin flap of skin that separates nares; orbital diameter 0.21–0.28; adipose eyelid present, more developed anteriorly in smaller specimens, posterior portion of adipose eyelid very well developed both longitudinally and

transversely in larger specimens; with a vertically ovoid opening over center of eye; postorbital portion of head elongate, length 0.44–0.53; gape width 0.31–0.38; interorbital width 0.46–0.54.

Pored lateral line scales from supracleithrum to hypural joint 90 to 110; all scales of lateral line pored, canals in scales diverge dorsally and ventrally; 6 to 12 series of scales extend beyond hypural joint onto caudal fin base; 26 to 32 scales in a transverse series from origin of rayed dorsal fin to lateral line, 22 to 30 scales in a transverse series from the lateral line to origin of anal fin.

Rayed dorsal-fin rays ii or iii, 9; anal-fin rays ii, 13–16 or iii, 13–15; pectoral-fin rays 14 to 17; pelvic fin-rays i, 8.

Total vertebrae 35 (14).

*Color in Alcohol:* Head and body in those specimens that retain guanine silvery to silvery-brown, pigmentation more intense dorsally. Tan to dark brown in specimens that lack guanine. Scattered small chromatophores on body. Series of small chromatophores outline fin rays, particularly distally on pelvic, anal, and rayed dorsal fins. Adipose dorsal fin often with dark dorsal margin.

**DISTRIBUTION.**—Río Paraguay and Paraná drainage basins (Figure 15).

**REMARKS.**—*Potamorhina squamoralevis* has only recently been recognized as a distinct species,

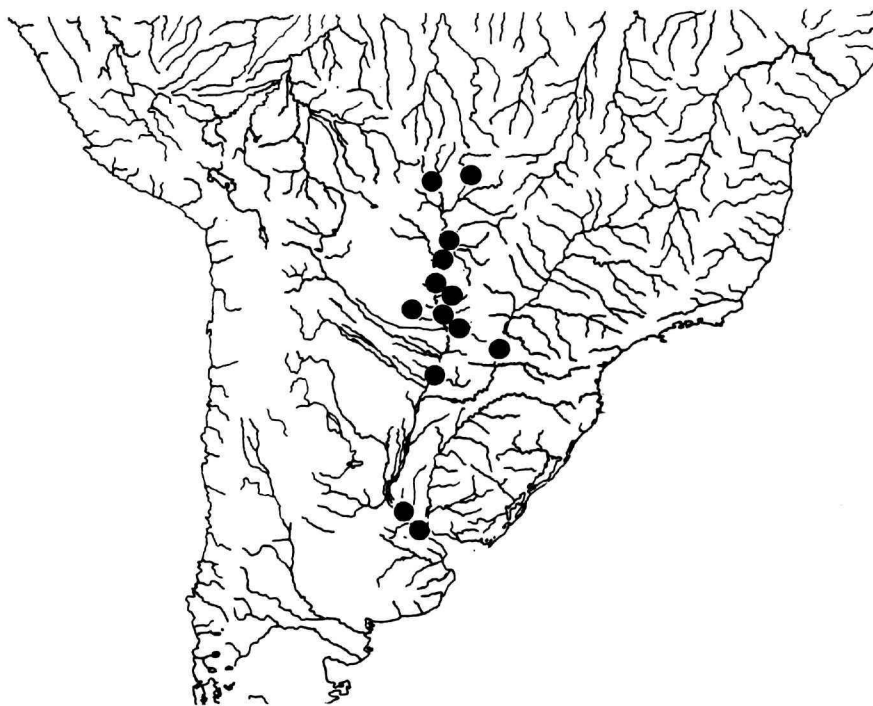


FIGURE 15.—Geographic distribution of *Potamorhina squamoralevis* (some symbols represent more than one collecting locality or lot of specimens).

although material of the species has been reported under several names. Boulenger (1896) reported *Curimatus latior* from Paraguay. Examination of the specimen that served as a basis for that report (BMNH 1895.5.17:140) has shown it to be *Potamorhina squamoralevis*. Similarly, Eigenmann and Kennedy's citation (1903:511) of *Anodus latior* from Paraguay was also based on misidentified specimens of *P. squamoralevis* (CAS 12056). That record was, in turn, apparently the basis for Pearson's (1937:109) citation of *A. latior* as an element of the Río Paraguay ichthyofauna. Braga and Azpelicueta (1983:147) noted that *Potamorhina squamoralevis* was also incorrectly identified as *Curimata latior* by Berg (1899:93). It would appear that other earlier references to nominal *Potamorhina* species from the Río Paraguay and Paraná drainage system (see synonymy) are all based on misidentification of *P. squamoralevis*.

Eigenmann and Ogle (1907:3) identified two specimens from Paraguay (USNM 2106) as *Psectrogaster curviventris*. Examination has shown that these individuals are actually *Potamorhina squamoralevis*.

**MATERIAL EXAMINED.**—91 specimens (60, 70.0–234.1).

**BRAZIL.** *Paraná:* Rio Paraná below Sete Quedras, MZUSP 21092, 6 (4, 205.0–234.1). *Mato Grosso do Sul:* Rodovia between Miranda and Rio Miranda, Corumbá, MZUSP 21683, 2 (103.4–114.3). Port of Corumbá, Rio Paraguai, MZUSP 21684, 2 (192.1–217.5). Rio Paraguai, Cáceres, MZUSP 21532, 2 (139.0–163.4). Baía Bela ou Albuquerque, Rio Paraguai, MZUSP 21533, 4 (2, 142.4–165.3). *Mato Grosso:* Ranchão da logoa, Sto. Antonio do Leverger, MZUSP 21576, 4 (2, 187.5–209.7). Rio Cuiabá, Sto. Antonio de Leverger, MZUSP 4384, 1. Campo do Jofre, Poconé, MZUSP 21585, 3 (143.2–157.0). Rio Pixaim,

Poconé, MZUSP 21587, 1 (145.0). Baiazinha, Rio Pixaim, MZUSP 21544, 2 (1, 183.1). Ilha de Taianã, Rio Paraguai, MZUSP 21736, 8 (4, 111.3–113.4); MZUSP 21737, 1 (179.4). Sangraduoro Grande, Rio Cuiabá, MZUSP 21600, 1 (179.1). Baía Caranda Grande, MZUSP 21546, 2 (165.0–168.5). Baía do Buritizal, MZUSP 21686, 11 (5, 87.5–113.3); USNM 243228, 2 (1 specimen cleared and counterstained for cartilage and bone). Cuiabá, NMW 68834, 2 (175.1–181.9). Descalvado, GC, 1 (164.0).

PARAGUAY. No specific locality, USNM 2106, 2. *Central*: Río Paraguay near Asunción, USNM 181711, 7 (95.0–122.5, 1 specimen cleared and counterstained for cartilage and bone). Asunción Bay, USNM 181715, 1 (115.5); USNM 181707, 1, (146.6); USNM 181708, 1 (109.5); USNM 181705, 3 (104.5–129.2). Asunción, BMNH 1935.6.4.330–333, 3 (70.1–92.0); BMNH 1895.5.17.140, 1 (216.5); CAS 12056 (formerly IU 9934), 1; CAS-IU 9935, 1 (213.0). Río Paraguay, Zeballos Que, USNM 181803, 3. Hatipapunta, NMW 68835, 1; NMW 68836, 1. *Alto Paraná*: Puerto Bertoni, MHNG uncat., 1. *Presidente Hayes*: Km 180 along TransChaco Highway, MHNG uncat., 1.

ARGENTINA. No specific locality, USNM 229610, 1. *Buenos Aires*: Buenos Aires, NMW 68846, 2 (95.4–107.2). La Plata, NMW 68845, 1. *Santa Fe*: Rosario NMW 68831, 3 (1, 184.4).

URUGUAY. No specific locality, NMW 68847, 1.

### *Potamorhina latior* (Spix), new combination

FIGURES 16, 17

*Anodus latior* Spix, 1829:62, pl. 41 [type-locality: rivers of equatorial Brazil].—Müller and Troschel, 1844:83 [Brazil].—Eigenmann and Ogle, 1907:4 [Bolivia].—Eigenmann and Allen, 1942:300 [Peru: Lago Sanango, Río Ucayali, Lago Cashiboya].—Fowler, 1950:276, fig. 333 [compilation]; 1975:362 [reference].—Whitehead and Myers, 1971:495 [proper citation]. [Not Eigenmann and Kennedy, 1903:511; Ringuet and Aramburu, 1961:36.] *Curimatus latior*.—Valenciennes, 1849:19 [Amazon].—Castelnau, 1855:58 [Amazon].—Kner, 1859:145 [Brazil: Río Negro, Río Guaporé, Cujaba].—Günther, 1864:293 [Am-

azon]; 1868:229 [Peru, Zeberos (= Jeberos)].—Steindachner, 1882:136 [Brazil: Tefé (= Tefé), Serpa (= Itacoatiara), Jatuarana].—Eigenmann and Eigenmann, 1889:432 [Brazil: Manacapuru, Hyavary (= Río Javari), Hyanuary (= Lago Januari), Coary (= Coari), Lago Alexo, Tabatinga, Obidos, Río Negro, Sao Paulo (= São Paulo de Olivença), Tefé (= Tefé), Serpa (= Itacoatiara)]; 1891:48 [listing].—LaMonte, 1935:7 [Brazil: Río Purus or Río Jurua].—Knoppel, 1970:276 [stomach contents].—Lowe-McConnell, 1975:74 [Brazil: Manaus; market fish]. [Not Boulenger, 1896:34; Marelli, 1923:557.]

*Curimatus (Semitapicis) latior*.—Pellegrin, 1909:148 [Brazil: Tonantins, Tabatinga].

*Gasterotomus latior*.—Eigenmann, 1910:422 [reference; designation as type-species of *Gasterotomus*].—Starks, 1913:14 [Madeira River].—Fowler, 1939:257 [Peru: Contamana]; 1945:120 [listing].—Smith, 1981:140 [Brazil: Itacoatiara fishery]. [Not Ringuet et al., 1967:196; Roberts 1974:433].

*Semitapicis laticeps*.—Fowler, 1945:256 [in part; Peru: Ucayali River].

*Gasterotomus latior*.—Fernandez-Yepey, 1948:34, fig. 14 [incorrect spelling, listing].—Ovchynnyk, 1968:250 [Ecuador].

*Curimata (Gasterotomus) latior*.—Géry, 1977:234 [reference in part, not La Plata basin].—Junk et al., 1983:406 [Brazil: Ilha de Marchantaria; seasonal occurrence].

*Curimata latior*.—Goulding, 1981:39, 45, 60, 105, fig. 37 [migration, fisheries, common name]. [Not Berg, 1899:93.]

*Semitapicis latior*.—Braga and Azpelicueta, 1983:148 [in part, Amazonian citations; not La Plata Basin records].

DIAGNOSIS.—A moderate-sized *Potamorhina* species reaching 205 mm SL. *Potamorhina latior* is readily distinguished in having 36 to 37 vertebrae contrary to 31 to 35 in its congeners. Externally the highly developed median pre-ventral keel continuous with the distinct, nonserrate postventral keel distinguishes *P. latior* within the genus. *Potamorhina pristigaster*, in contrast, has a transversely flattened or slightly concave, laterally keeled pre-ventral region and a serrate median postventral keel. In *P. laticeps* and *P. squamoralevis* the ventral keel anterior to the pelvic fin insertion is not so highly developed. *Potamorhina altamazonica*, in turn, has the ventral body surface anterior to the pelvic fin insertion smoothly rounded transversely.

DESCRIPTION.—Body elongate, compressed, more so in specimens over 150 mm SL. Dorsal

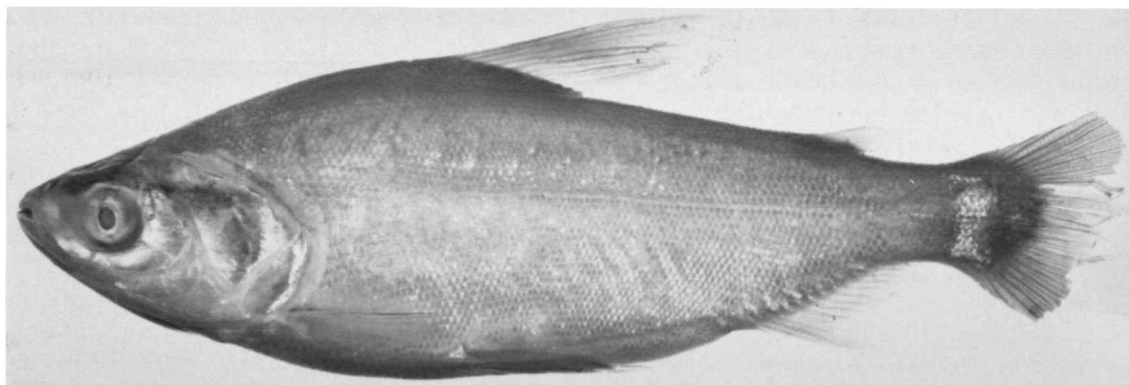


FIGURE 16.—*Potamorhina latior*, USNM 242144, 192.3 mm SL.

profile of head straight. Dorsal profile of body smoothly convex from rear of head to origin of rayed dorsal fin; straight and posteroventrally slanted at base of dorsal fin, straight or very gently convex from base of last dorsal-fin ray to dorsal margin of caudal peduncle. Dorsal body surface with an indistinct median keel anterior to rayed dorsal fin, smoothly rounded transversely posterior to fin. Ventral body profile slightly convex from tip of lower jaw to anteroventral portion of pectoral girdle, distinctly convex from that point to vertical through pelvic fin insertion, slightly convex from pelvic fin insertion to ventral margin of caudal peduncle; pre-pelvic convexity more pronounced in larger specimens. Prepelvic region with a well-developed, acute, median keel that extends from anteroventral margin of pectoral girdle to area between insertion of pelvic fins; keel more pronounced in larger specimens. A well-developed median keel between pelvic fin insertion and origin of anal fin. Pre- and post-pelvic keels continuous, pelvic fin insertion distinctly dorsal of midventral line.

Greatest body depth at origin of rayed dorsal fin, 0.32–0.40; snout tip to origin of rayed dorsal fin 0.45–0.50; snout tip to origin of anal fin 0.73–0.82; snout tip to insertion of pelvic fin 0.48–0.55; snout tip to anus 0.71–0.79; origin of rayed dorsal fin to hypural joint 0.54–0.63. Rayed dorsal fin pointed, less so with increasing age; anteriormost rays 2.6–3.0 times length of

ultimate ray. Pectoral fin pointed; length of pectoral fin 0.15–0.19; fin extends two-thirds to three-quarters distance to vertical through insertion of pelvic fin; relatively longer in juveniles. Pelvic fin pointed, length of pelvic fin 0.17–0.25; fin reaches three-quarters of distance to anal fin origin. Insertion of pelvic fin distinctly dorsal of midventral margin of body. Caudal fin forked. Adipose fin well developed. Anal fin margin straight or slightly concave, anteriormost branched anal rays twice length of ultimate ray. Caudal peduncle depth 0.10–0.11.

Head distinctly pointed in profile, head length 0.28–0.37; jaws equal, mouth terminal; snout length 0.26–0.32; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin that separates nares; orbital diameter 0.20–0.26; adipose eyelid present, highly developed anteriorly, with a vertically ovoid opening over center of eye; postorbital portion of head elongate, length 0.48–0.58; gape width 0.27–0.34; interorbital width 0.42–0.47.

Pored lateral line scales from supracleithrum to hypural joint 83 to 105; all scales of lateral line pored, canals in scales diverge dorsally and ventrally in adults; 5 to 11 series of scales extend beyond hypural joint onto caudal fin base; 18 to 22 scales in a transverse series from origin of rayed dorsal fin to lateral line, 16 to 20 scales in a transverse series from the lateral line to origin



of anal fin. Scales weakly ctenoid, ctenii most developed in prepelvic region.

Rayed dorsal-fin rays ii,9–10; anal-fin rays ii,11–14 or iii,12–13; pectoral-fin rays 14 to 18; pelvic-fin rays i,8.

*Color in Alcohol:* Overall coloration silvery-golden to silvery-brown, head and body pigmentation more intense dorsally. All fins with small chromatophores that outline fin rays; distal portion of middle rays of caudal fin dusky in some individuals.

**DISTRIBUTION.**—Rio Amazonas drainage basin (Figure 17).

**COMMON NAME.**—Brazil: Branquinha chora (Goulding, 1981).

**REMARKS.**—No type specimen for the species appears to be extant; however, the original description (Spix, 1829:62) and the associated illustration leave little doubt as to the identity of the species.

Fowler's citation (1945:256) of *Semitapicis laticeps* in the Río Ucayali system of Peru was based on specimens (ANSP 73166) of *Potamorhina latior* and *P. altamazonica*. Boulenger (1896:34), Berg

(1899:93), Eigenmann and Kennedy (1903:511), Pearson (1937:109), Ringuélet and Aramburu (1961:36), and Ringuélet et al. (1967:196) all list *Potamorhina latior* (in various genera) from the Río Paraguay and Paraná basins. These citations all appear to actually refer to *P. squamoralevis* (see "Remarks" under that species).

**MATERIAL EXAMINED.**—455 specimens (89, 63.9–205.1)

**BRAZIL.** *Pará:* Rio Tapajós, Santarem, MZUSP 5719, 3 (1, 149.3). Rio Tapajós, CAS uncat., 1 (102.8). Rio Maica, Santarem, MZUSP 9172, 1 (187.5). Santarem, CAS uncat., 1 (116.5); CAS uncat., 1 (114.0); CAS uncat., 1 (92.0). Óbidos, MCZ 20236, 10 (2, 130.3–142.0). Rio Trombetas, Oriximiná, MZUSP 5418, 28 (5, 139.8–171.0). Lago Parú, Oriximiná, MZUSP 5595, 6 (2, 174.5–187.3). *Paraná* Jacare, Faro, MZUSP 7823, 3 (1, 133.0). *Amazonas:* Jatuarana, MCZ 20342, 3 (169.7–173.5); NMW 68842, 1; NMW 68843, 1. Rio Purus, AMNH 12507, 1 (109.0). Lago Beruri, Rio Purus, MZUSP 5998, 12 (3, 122.3–183.6); MZUSP 6372, 8. Mouth of Rio Purus, MZUSP 5947, 17 (3, 125.1–174.5);

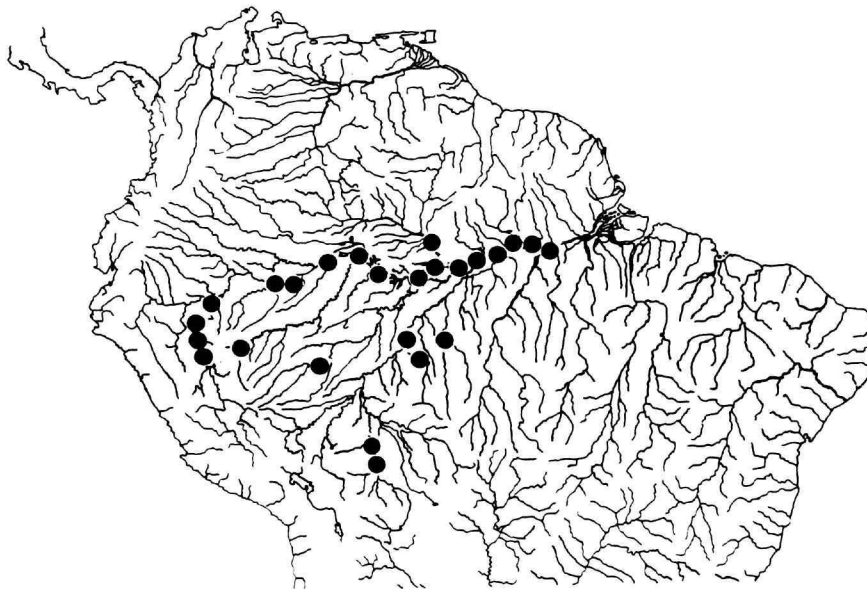


FIGURE 17.—Geographic distribution of *Potamorhina latior* (some symbols represent more than one collecting locality or lot of specimens).

MZUSP 5953, 2; MZUSP 5952, 1. Rio Jurua, AMNH 12552, 1 (195.0). San Paolo (São Paulo de Olivença), MCZ 20223, 3. Manacapuru, MCZ 20207, 2 (158.5–160.0); BMNH 1975.10.28:62, 1. Lago Manacapuru, MZUSP 6521, 1. Lago Jacare above Manacapuru, MZUSP 5904, 5. Rio Madeira, CAS-SU 22068, 1 (165.4). Tabatinga (Sapurana), MCZ 20246, 1 (148.3). Rio Negro, MCZ 797, 2 (130.2–146.6); NMW 68840, 1. Manaus, MZUSP 5834, 4; MZUSP 6130, 3; CAS uncat., 1 (175.0); GC, 2; BMNH 1929.11.18:9, 1; BMNH 1970.4.2:9, 2. Mouth of Rio Negro, NMW 68839, 1. Vicinity of Manaus, USNM 228692, 1; USNM 228691, 3; USNM 228690, 5. Rio Madeira 7 km E of Humaita, GC, 1. Fonte Boa, MCZ 20265, 1. Igarape Manduaçu, Paraná de Iupia, NW of Fonte Boa, MZUSP 20963, 37. Lake Hyanuary (= Lago Januari), MCZ 20269, 2; MZUSP 6866, 26. Tefé, MCZ 20256, 5. Lago Grande, CAS uncat., 1 (159.1). Serpa (= Itacoatiara), MCZ 20319, 19; MZUSP 13483–86, 4 (2, 165.1–188.7); NMW 68844, 5. Urucará, Paraná de Urucará, MZUSP 7513, 4 (2, 130.7–166.5); MZUSP 5761, 2. Lago Janauacá, MZUSP 21559, 18 (5, 190.0–205.1); MZUSP 21696, 3. Lago Supia near Codajás, MZUSP 9664, 8 (3, 150.7–159.3). Rio Solimões near Ilha Baruruá, above mouth of Rio Jutai, MZUSP 20982, 3. Lago Pauraquequara, mouth of Rio Pauraquequara,

MZUSP 6088, 1. Rio Madeira, 25 km from Nova Olinda, MZUSP 6954, 11. Mouth of Rio Pacia, MZUSP 21484, 2. *Acre*: Mouth of Rio Moa, Cruzeiro do Sul, ZUEC 419, 1. *Rondônia*: Rio Machado, USNM 220196, 7 (178.0–226.0). Rio Machado, Lago do Paraiso, USNM 242144, 3.

**BOLIVIA.** No specific locality, USNM 44836, 1 (112.5). *Beni*: Rio Mamoré, 5 km SE of Limonquiye, AMNH 43053, 1 (130.0); AMNH 48868, 7. Rio Mamoré W of San Pedro, AMNH 48676, 11, (64.6–97.5); AMNH 43050, 67. Puerto Siles, AMNH 43051, 1. Boca del Río Ibarre, AMNH 43054, 2; AMNH 43052, 21. Río Mamoré 5 km W of San Javier, AMNH 48677, 3 (1 specimen cleared and counterstained for cartilage and bone).

**PERU.** *Loreto*: Lago Sanango, CAS-IU 15822, 2 (144.0–151.7); CAS-IU 15666, 3 (142.0–156.0). Lago Cashiboya, CAS-IU 17864, 2 (87.5–110.0). Contamana, CAS-IU 17863, 3 (169.0–190.0); ANSP 73166, 1 (103.0); ANSP 73167, 3 (81.0–164.7). Tuye Cocha, USNM 175841, 1 (139.5). Río Samiria, Atum Cocha, MZUSP 15241, 2 (1, 140.0). *Amazonas*: Ayambas, LACM 36342-4, 1. *Ucayali*: Vicinity of Pucallpa, AMNH 35687, 1 (86.8); AMNH 48673, 3. Yarinacocha, AMNH 48674, 1 (81.3).

**COLOMBIA.** *Amazonas*: Near Leticia, ANSP 135974, 12.

## Literature Cited

- Berg, C.  
1899. Comunicaciones ictiológicas, II. *Comunicaciones del Museo Nacional de Buenos Aires*, 1(4):91-97.
- Bertoni, A.  
1914. *Fauna paraguaya, catalogos sistematicos de los vertebrados del Paraguay: Peces, batracios, reptiles, aves y mamiferos conocidos hasta 1913*. 86 pages. Asunción.
- Boulenger, G.A.  
1896. On a Collection of Fishes from the Rio Paraguay. *Transactions of the Zoological Society of London*, 14(2):25-39.
- Braga, L., and M. Azpelicueta  
1983. *Semitapiscis squamoralensis* sp. nov. (Osteichthys: Curimatidae) con consideraciones sobre el género. *Studies on Neotropical Fauna and Environment*, 18:139-150.
- Castelnau, F. de  
1855. *Animaux nouveaux ou rares recueillis pendant l'expédition dans les parties centrales de l'Amérique du Sud, de Rio de Janeiro a Lima, et de Lima au Para, poissons*. xii + 112 pages. Paris.
- Cope, E.D.  
1878. Synopsis of the Fishes of the Peruvian Amazon Obtained by Professor Orton during His Expeditions of 1873 and 1877. *Proceedings of the American Philosophical Society*, 17:673-701.
- Cuvier, G., and A. Valenciennes  
1849. *Histoire naturelle des poissons*. Volume 22, 395 pages, plates 634-650. Paris.
- Dahl, G.  
1971. *Los peces del norte de Colombia*. 391 pages. Bogota: Inderena.
- Dingerkus, G., and L. Uhler  
1977. Enzyme Clearing of Alcian Blue Stained Whole Vertebrates for Demonstration of Cartilage. *Stain Technology*, 52:229-232.
- Dorn, E., and F. Schaller  
1972. Über den lautapparat von Amazonasfischen, 2. *Naturwissenschaften*, 59(4):169-170.
- Eigenmann, C.H.  
1910. Catalogue of the Freshwater Fishes of Tropical and South Temperate America. In *Report of the Princeton University Expedition to Patagonia, 1896-1899*, 3(4):375-511.
- Eigenmann, C.H., and W.R. Allen  
1942. *Fishes of Western South America, I: The Intercordilleran and Amazonian Lowlands of Peru; II: The High Pampas, Bolivia, and Northern Chile; with a revision of the Peruvian Gymnotidae, and of the Genus Orestias*. 494 pages. Lexington: University of Kentucky.
- Eigenmann, C.H., and R.S. Eigenmann  
1889. A Revision of the Edentulous Genera of the Curimatinae. *Annals of the New York Academy of Sciences*, 4:409-440.  
1891. A Catalogue of the Fresh-Water Fishes of South America. *Proceedings of the United States National Museum*, 14:1-81.
- Eigenmann, C.H., and C.H. Kennedy  
1903. On a Collection of Fishes from Paraguay, with a Synopsis of the American Genera of Cichlids. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 55(2):497-537.
- Eigenmann, C.H., and F. Ogle  
1907. An Annotated List of Characin Fishes in the United States National Museum and the Museum of Indiana University with Descriptions of New Species. *Proceedings of the United States National Museum*, 33:1-36.
- Fernandez-Yepez, A.  
1948. Los curimatidos (peces fluviales de Sur America): Catalogo descriptivo con nuevas adiciones genericas y especificas. *Boletin Taxonomico del Laboratorio de Pesqueria de Caquire*, 1:1-86, figures 1-37.
- Fowler, H.W.  
1906. Further Knowledge of Some Heterognathus Fishes, Part I. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 58:293-351.  
1939. A Collection of Fishes Obtained by Mr. William C. Morrow in the Ucayali River Basin, Peru. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 91:219-289.  
1942. Los peces del Perú. *Boletin Museo de Historia Natural "Javier Prado" (Lima)*, 6:206-222, figures 39-44.  
1945. Los peces del Perú. *Boletin Museo de Historia Natural "Javier Prado" (Lima)*, 7:1-298.  
1950. Os peixes de água doce do Brasil. *Arquivos de Zoologia do Estado de São Paulo*, 6:205-401, figures 238-447.  
1975. A Catalogue of World Fishes (XXIII). *Quarterly Journal of the Taiwan Museum*, 28(3):277-402.
- Géry, J.  
1964. Poissons characoides de l'Amazonie péruvienne. *Beitrage sur Neotropischen Fauna*, 4(1):1-44.

1977. *Characoids of the World*. 672 pages. Neptune City: TFH Publications.
- Goulding, M.  
1981. *Man and Fisheries on an Amazon Frontier*. xiii + 137 pages. The Hague: W. Junk Publishers.
- Gray, J.E.  
1854. *Catalogue of Fish Collected and Described by L. T. Gronow, Now in the British Museum*. 196 pages. London.
- Gronovius, L.T.  
1763. *Zoophylacii Gronoviani fasciculus primus exhibens animala quadrupeda, amphibia, atque pisces, etc.* 136 pages. Lugduni Batavorum.
- Günther, A.  
1864. *Catalogue of the Fishes in the Collection of the British Museum*. Volume 5, xii + 455 pages. London.  
1868. Descriptions of Freshwater Fishes from Surinam and Brazil. *Proceedings of the Zoological Society of London*, 1868:229–247.
- Hennig, W.  
1966. *Phylogenetic Systematics*. 263 pages. Urbana: University of Illinois Press.
- Junk, W.J., G.M. Soares, and F.M. Caravelho  
1983. Distribution of Fish Species in a Lake of the Amazon River Floodplain near Manaus (Lago Cama-leão), with Special Reference to Oxygen Conditions. *Amazoniana*, 7:397–431.
- Kner, R.  
1859. Zur Familie der Characinen, III: Folge der ichthyologischen Beiträge. *Denkschriften der Akademie der Wissenschaften, Wien*, 17:137–182, plates 1–9.
- Knöppel, H.  
1970. Food of Amazonian Fishes: Contribution to the Nutrient-Ecology of Amazonian Rain Forest Streams. *Amazoniana*, 2(3):257–352.
- LaMonte, F.R.  
1935. Fishes from Rio Jurua and Rio Purus, Brazilian Amazonas. *American Museum Novitates*, 784:1–8.
- Linnaeus, C.  
1766. *Systema Naturae, editio duodecima*. Volume 1, 532 pages.
- Lowe-McConnell, R.  
1975. *Fish Communities in Tropical Freshwaters*. 337 pages. New York: Longman Publishing.
- Mago-Leccia, F.  
1970. *Lista de los peces de Venezuela*. 241 pages. Caracas: Ministerio de Agricultura y Cria.  
1972. Consideraciones sobre la sistemática de la familia Prochilodontidae (Osteichthys, Cypriniformes), con una sinopsis de las especies de Venezuela. *Acta Biologica Venezuelica*, 8(1):35–96.
- Marelli, C.A.  
1923. Elenco sistemático de la fauna de la Provincia de Buenos Aires. *Memorias del Ministerio Obras Publicas, Buenos Aires*, 1922–1923:536–688.
- Marlier, G.  
1968. Études sur les lacs de l'Amazonie centrale, III: Les poissons du Lac Redondo et leur régime alimentaire; les chaînes tropiques du Lac Redondo; les poissons du Rio Prêto de Eva. *Cadernas da Amazonia*, 11:1–57.
- Müller, J., and F. Troschel  
1844. Synopsis generum et specierum familiae Characiorum (prodromus descriptionis novorum generum et specierum). *Archiv fur Naturgeschichte* (Berlin), 10(1):81–98.
- Nelson, E.M.  
1949. The Swimbladder and Weberian Apparatus of *Rhaphiodon vulpinus*, with Notes on Some Additional Morphological Features. *Journal of Morphology*, 84(3):495–523.
- Ovchynnyk, M.M.  
1968. Annotated List of the Freshwater Fish of Ecuador. *Zoologischer Anzeiger*, 181:237–268.
- Pearson, N.E.  
1937. The Fishes of the Beni-Mamoré and Paraguay Basins, and a Discussion of the Origin of the Paraguayan Fauna. *Proceedings of the California Academy of Sciences*, 23:99–114.
- Pellegrin, J.  
1909. Characines du Bresil rapportes par M. Jobert. *Bulletin du Muséum National d'Histoire Naturelle* (Paris), 15:147–153.
- Ringuélet, R.A.  
1975. Zoogeografía y ecología de los peces de aguas continentales de la Argentina y consideraciones sobre las áreas ictiológicas de América del Sur. *Ecosur*, 2(3):1–122.
- Ringuélet, R.A., and R.H. Aramburu  
1961. Peces argentinos de agua dulce. *Agro*, 3(7):1–98.
- Ringuélet, R.A., R.H. Aramburu, and A. Alonso de Aramburu  
1967. *Los peces argentinos de agua dulce*. 602 pages. La Plata: Comision de Investigacion Cientifica.
- Roberts, T.R.  
1973. Osteology and Relationships of the Prochilodontidae, a South American Family of Characoid Fishes. *Bulletin of the Museum of Comparative Zoology*, 145(4):213–235, figures 1–29.  
1974. Osteology and Classification of the Neotropical Characoid Fishes of the Families Hemiodontidae (including Anodontinae) and Parodontidae. *Bulletin of the Museum of Comparative Zoology*, 146(9):411–472.
- Rowntree, W.S.  
1903. On Some Points in the Visceral Anatomy of the Characinae, with an Enquiry into the Relations of the Ductus Pneumaticus in the Physostomi Generally. *Transactions of the Linnean Society of London*, series 9, 2:47–81, plates 1–2.

- Schaller, F.  
1974. Wie Trommeln Amazonasfische. *Umschau in Wissenschaft und Technik*, 74:249.
- Schultz, L.P.  
1944. The Fishes of the Family Characidae from Venezuela, with Descriptions of Seventeen New Forms. *Proceedings of the United States National Museum*, 95:235-367.
- Smith, N.  
1981. *Man, Fishes and the Amazon*. 180 pages. New York: Colombia University Press.
- Spix, J.B. von  
1829. In J.B. von Spix and L. Agassiz, *Selecta genera et species Piscium quos in itinere per Braziliam annis 1817-20 peregrino collegit J.B. de Spix*, 138 pages, plates 1-101. Munich.
- Starks, E.C.  
1913. The Fishes of the Stanford Expedition to Brazil. *Leland Stanford Junior University Publications, University Series*, 1913:77 pages, 15 plates.
- Steindachner, F.  
1876. Ichthyologische Beiträge (V.), II: Über einige neue Fischarten insbesondere Characinen und Siluroiden aus dem Amazonenstrom. *Sitzungsberichte der Akademie der Wissenschaften, Wien*, 74:49-240.  
1882. Beiträge zur Kenntniss der Flussfische Südamerikas. *Denkschriften der Akademie der Wissenschaften, Wien*, 43:125-141.
- Valenciennes, A.  
1849. In G. Cuvier and A. Valenciennes, *Histoire naturelle des poissons*. Volume 22, 395 pages, plates 634-650. Paris
- Vari, R.P.  
1979. Anatomy, Relationships and Classification of the Families Citharinidae and Distichodontidae (Pisces, Characoidea). *Bulletin of the British Museum (Natural History), Zoology*, 36(5):261-344, figures 1-49.
- 1982a. Systematics of the Neotropical Characoid Genus *Curimatopsis* (Pisces: Characoidei). *Smithsonian Contributions to Zoology*, 373: 28 pages, 21 figures.
- 1982b. *Curimatopsis myersi*, a New Curimatid Characiform Fish (Pisces: Characiformes) from Paraguay. *Proceedings of the Biological Society of Washington*, 95(4):788-792.
1983. Phylogenetic Relationships of the Families Curimatidae, Prochilodontidae, Anostomidae and Chilodontidae (Pisces: Characiformes). *Smithsonian Contributions to Zoology*, 378: 60 pages.
- In press. Two New Fish Species of the Genus *Curimata* (Pisces: Curimatidae) from Venezuela. *Acta Biologica Venezuelica*.
- Weitzman, S.H.  
1962. The Osteology of *Brycon meeki*, a Generalized Characid Fish, with an Osteological Definition of the Family. *Stanford Ichthyological Bulletin*, 8(1):1-77, figures 1-26.
- Wheeler, A.C.  
1958. The Gronovius Fish Collection: A Catalogue and Historical Account. *Bulletin of the British Museum (Natural History), Historical Series*, 1(5):187-249.
- Whitehead, P.J., and G.S. Myers  
1971. Problems of Nomenclature and Dating of Spix and Agassiz's Brazilian Fishes (1829-1831). *Journal for the Society of the Bibliography of Natural History*, 5(6):478-497.
- Wiley, E.O.  
1981. *Phylogenetics: The Theory and Practice of Phylogenetic Systematics*. vi + 439 pages. New York: John Wiley and Sons.



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