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

RICHARD P. VARI
ABSTRACT

Vari, Richard P. Systematics of the Neotropical Characiform Genus Curimata Bosc (Pisces: Characiformes). Smithsonian Contributions to Zoology, number 474, 63 pages, 42 figures, 5 tables, 1989.—The genus Curimata Bosc (1817) is recognized as a monophyletic subunit of the family Curimatidae on the basis of a variety of synapomorphies in the gill arches, buccopharyngeal complex, and palatine arch. Derived modifications of the gill arches, hyoid apparatus, opercular apparatus, maxilla, hyomandibula, palatine arch, supraneurals, first proximal pterygiophore of the dorsal fin, pigmentation, body form, squamation, degree of development of dorsal- and caudal-fin rays, number of vertebrae, and morphometrics unite groups of species within the genus.

Curimata is redefined and twelve species are recognized in the genus. These are Curimata cyprinoides Linnaeus (1766), distributed in the lower Rio Orinoco, Atlantic drainages of the Guianas, lower Rio Amazonas and Rio Tocantins; C. vittata Kner (1859) of the Rio Amazonas system; C. aspera Günther (1868a) of the upper Rio Amazonas; C. kneri Steindachner (1877) of the middle and upper Rio Amazonas; C. mivarti Steindachner (1878) endemic to the Rio Magdalena and associated rivers; C. ocellata Eigenmann and Eigenmann (1889) distributed in the Rio Amazonas basin; C. macrops Eigenmann and Eigenmann (1889) known only from the Rio Paranaiba drainage basin of northeastern Brazil; C. cisandina (Allen, in Eigenmann and Allen, 1942) found in the Rio Amazonas system; C. cerasina Vari (1984b), a Rio Orinoco endemic; C. incompta Vari (1984b) of the Rio Orinoco basin; C. inornata, a new species from the Rio Amazonas system; and C. roseni, a new species from the Rio Negro drainage basin.

Curimatus semitaeniatus of Steindachner (1917) was found to be based on a juvenile of Curimata ocellata Eigenmann and Eigenmann (1889) and is placed as a synonym of the latter species. Curimata murieli described by Allen (in Eigenmann and Allen, 1942) has as its holotype a juvenile of Curimata viitata Kner (1859) and the two species are considered conspecific. Lambeipedia allenii Fernández-Yépez (1948) is placed as a synonym of Curimata cisandina Allen (in Eigenmann and Allen, 1942). Curimatus simulatus proposed by Eigenmann and Eigenmann (1889) is considered to be a synonym of Curimata aspera Günther (1868a). Salmo edentulus Bloch (1794), Charax planirostris Gray (1854), Curimatus schomburgkii Günther (1864), and Curimatus copei Fowler (1906) are placed as synonyms of Curimata cyprinoides Linnaeus (1766). Salmo immaculatus Linnaeus (1758), the oldest name for the species herein termed Curimata cyprinoides, is not available (International Commission for Zoological Nomenclature, 1966).

Contrary to the conclusions of many earlier studies, Semitapicis of Eigenmann and Eigenmann (1889) is placed as a synonym of Curimata Bosc (1817) rather than being retained as a distinct genus. The genera Acuticurimata Fowler (1941), Allenina Fernández-Yépez (1948), Bistrnicurimata Fernández-Yépez (1948), Bondichthys Whitley (1953), Lambeipedia Fernández-Yépez (1948), Peltapleura Fowler (1906), and Stupens Whitley (1954) are also placed as synonyms of Curimata.

The historical zoogeography of the species of Curimata is discussed. The genus is hypothesized to have undergone most of its species-level divergence prior to the final uplift of the Andes. The degree of sympatry between sister clades within Curimata indicates that there has been a significant degree of post-vicariance dispersal within the genus.

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Systematics of the Neotropical Characiform Genus Curimata Bosc (Pisces: Characiformes)

Richard P. Vari

Introduction

Curimata Bosc is a genus of the characiform family Curimatidae whose species inhabit streams, rivers, and still waters over a major portion of lowland South America. The greatest species diversity of species of Curimata occurs to the east of the Andes where members of the genus are components of the fish faunas of the Río Orinoco and Río Amazonas drainages, and also occur in the Río Parnaiba of northeastern Brazil. One of the species of Curimata also inhabits the series of rivers that drain the Atlantic slopes of the Guianas in the region between the mouths of the Orinoco and Amazon Rivers. In trans-Andean South America the genus is represented by a single species in the Río Magdalena, Río Cauca, Río San Jorge and Río Sinú. Curimata species are unknown in the remaining Atlantic coastal drainages south of the Río Parnaiba of northeastern Brazil, or in the midcontinental rivers to the south of the Río Amazonas basin. In trans-Andean South America, Curimata is absent in the Lago Maracaibo basin, the Río Atrato of Colombia, and the series of Pacific slope rivers in Colombia, Ecuador and northern Peru that are inhabited by other genera in the Curimatidae. Where they occur, the various Curimata species are important components of the fish biomass in many aquatic ecosystems, and are exploited in commerical and subsistence fisheries in the cis- and trans-Andean portions of South America (Dahl, 1971:105; Goulding, 1981:39, 45, 60, 105; Santos et al., 1985:28-29).

The first curimatids referred to in the scientific literature were species of the genus Curimata that were described based on material probably originating in the Guianas, most likely Surinam. The intervening centuries have seen the description of a number of nominal species of Curimata (sensu stricto), and frequent citations of members of the genus from geographically widely scattered Neotropical localities. Nonetheless, the somewhat subtle differences between many of the nominal forms, the relative scarcity of specimens of some species in systematic collections, and the brief original descriptions and diagnoses of various taxa resulted in considerable taxonomic confusion at both the specific and supraspecific levels. Indicative of the degree of alpha-level taxonomic problems are the proportionally large number of nominal species placed into synonymy in this study, and the numerous incorrect literature citations of those species that are recognized as valid. In retrospect such difficulties are understandable since the discrimination of many nominal species can be best accomplished by the use of previously unutilized counts and measurements, or is greatly facilitated by accurate counts of vertebral elements; data and methods not readily available to earlier researchers.

The generic and suprageneric taxonomy of what is termed Curimata in this paper has been similarly unstable. The originally broadly inclusive genus Curimus was drastically subdivided by Fernández-Yépez (1948) who distributed the then-known members of Curimata, in the sense of this paper, among his nominal genera Allenina, Biiricarínata, Bondia (preoccupied and replaced by Bondichthys [Whitley, 1953]), Camposella (preoccupied and replaced by Supens [Whitley, 1954]), Lambepiedra, and Pseudocurimata. Other authors have also used Semitapicis Eigenmann and Eigenmann (Eigenmann, 1910), Acuticurimata Fowler (Fowler, 1941), Psectrogaster Eigenmann and Eigenmann (Allen, in Eigenmann and Allen, 1942), Rivasella Fernández-Yépez (Fowler, 1975) and Cruxentina Fernández-Yépez (Fowler, 1975) as vehicles for some mem-
bers of this lineage. This progressive generic level subdivision reached its apogee in a taxonomic scheme (Fernández-Yépez, 1948) incongruent with the hypothesis of the phylogenetic history of the genus and its subunits arrived at in this study. Vari (1989:57) noted a series of hypothesized derived characters that united the dozen species of Curimata, in the sense of the present study, into a natural subunit of the Curimatidae. Reference to the phylogenetic scheme proposed by Fernández-Yépez reveals that his system associated species of Curimata with numerous other species within the Curimatidae that do not share the defining characters of the genus, and which are rather more closely related to members of other lineages within the family (Vari, 1989:56-57). Fernández-Yépez also proposed numerous nominal genera, whose limits were often based on imprecise characters that were difficult, if not impossible, to interpret non-arbitrarily. The degree to which the problem of non-monophyletic taxa and imprecise generic limits pervaded Fernández-Yépez’s classificatory scheme is reflected in the fact that several nominal species considered conspecific in the present study were allocated to different genera under Fernández-Yépez’s classification. The various difficulties noted above, and others which will be discussed in the following sections of this paper, in association with the problems in the discrimination of many of the genera proposed by many authors, particularly Fernández-Yépez, served to emphasize the limited usefulness of many previous classificatory schemes as vehicles for conveying hypotheses of the evolutionary history of the group. Attempts to resolve those problems within the context of the previous classifications clearly demonstrated the need for a phylogenetic analysis based on shared derived characters. Such an analysis would both permit the advancement of an explicit hypotheses of phylogenetic relationships within Curimata and serve as a framework to evaluate the usefulness of previous hypotheses of the evolutionary relationships of the components of that genus.

This paper is the fifteenth of a series that deals with aspects of the phylogeny and taxonomy of curimatid characiforms (see Vari, 1982a,b, 1983, 1984a,b, 1987, 1988, 1989, in press a,b; Vari and Castro, 1988; Vari and Géry, 1985; Vari and Nijssen, 1986; Vari and Vari, 1989). A series of synapomorphies defining Curimata as a monophyletic unit were described and analyzed previously (Vari, 1989). In that same publication Vari advanced a hypothesis of generic level relationships within the Curimatidae. That study and the phylogenetically more encompassing scheme of relationships put forward by Vari (1983) provide the framework for the outgroup analyses and polarity determinations of those characters that demonstrate discrete variability within Curimata. The present study has three primary objectives: first to analyze the morphological variation within the genus and propose a hypothesis of the phylogenetic relationships within Curimata; second, to determine the recognizable species in the genus and their distinguishing characters; and third, to delimit the geographic distribution of the recognizable species and advance a hypothesis of the zoogeographic history of the genus.

The hypothesis of evolutionary relationships within Curimata is derived following the principles of Phylogenetic Systematics first proposed in English by Hennig (1966) 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. Monophyletic groups are defined on the basis of the most parsimonious hypothesis of relationships derivable from the distribution of shared derived (synapomorphic) characters. In keeping with the general scientific principle of parsimony, the hypothesis of the phylogenetic history of a group that necessitates the fewest ad hoc assumptions about character transformations is preferred. This does not assume that evolutionary mechanisms are necessarily always parsimonious, but only that parsimony (simplicity) is the best available working principle (Beatty and Fink, 1979; Wiley, 1981). 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), Watrous and Wheeler (1981), and Maddison et al. (1984).

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 whenever possible. Counts of total vertebrae were taken from radiographs, with the fused PU1+U1 considered a single bone, and the vertebrae incorporated into the Weberian apparatus counted as four separate 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 measurements 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. Counts of enlarged median prepelvic scales are inclusive of all median scales from the insertion of the pelvic fins to the anterior enlarged element. That scale is flanked by smaller scales that are diagonally continuous with the scale series that extends posterodorsally to the anterior margin of the pectoral fin. 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. In those cases where recognized species have junior synonyms, morphometric and meristic data are presented for the type series of all nominal species when it is available.
ACKNOWLEDGMENTS.—I am indebted to the following individuals and institutions for the loan and exchange of specimens, information, hospitality during visits to their institutions, and other assistance: the late Donn E. Rosen, Gareth Nelson, and M. Norma Feinberg (AMNH); William Smith-Vaniz and William Saul (ANSP); P. Humphrey Greenwood, Gordon J. Howes, and Alwynn Wheeler (BMNH); William Eschmeyer and Pearl Sonoda (CAS); Robert K. Johnson and Donald Stewart (FMNH); Jacques Géry (GC); Michel Jégu (INPA); Camm Swift (LACM); Karl F. Liem, Melanie L.J. Stiassny, William L. Fink, and Karsten Hartel (MCZ); Antonio Machado-Allison and Francisco Mago-Leccia (MBUCV); Marie-Louise Bauchot (MNHN); Gustavo W. Nunan (MNRJ); Naércio A. Menezes, Heraldo A. Britski, and Jose Lima de Figueiredo (MZUSP); Barbara Herzig and Harald Ahnelt (NMW); Robert R. Miller and Reeve M. Bailey (UMMZ); Han Nijssen and Isaac Isbrucker (ZMA); Jorgen C. Ahlert (ZMUQ; Michael Goulding, Museu Paraense "Emilio Goeldi"; Peter Bayley, Illinois Natural History Survey; and Frank McKinney, Grice Marine Biological Laboratory. Hernán Ortega, Universidad Nacional Mayor de San Marcos, collaborated in field studies in Peru and made available a number of specimens from diverse Peruvian localities. Antonio Machado-Allison and Leonides Aguana (MBUCV), Otto Castillo and his associates of the Estacion de Investigaciones Pesqueras, San Fernando de Apure, Justa Fernandez (MBUCV), and Carl Ferraris, Jr. (AMNH), provided valuable assistance in various

The “Material Examined” section of each species account is arranged in the following sequence: number of specimens examined (in parentheses, the number of specimens forming the basis for the 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 in the sequence of country (capitalized), then state, province, department or district (italicized), 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 standardized across the entire range of the species. In the synonymies for each species, place names are first given as presented in the citation, followed by the presently recognized equivalent, in parentheses, if that differs. Drawings were made with a Zeiss microscopic camera lucida. Osteological preparations were cleared and counterstained for cartilage and bone.

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-SU Stanford University (now deposited at CAS)
FMNH Field Museum of Natural History, Chicago
GC Jacques Géry, personal collection (no register numbers)
INPA Instituto Nacional de Pesquisas da Amazonia, Manaus
IU Indiana University (collections dispersed to various depositories)
LACM Los Angeles County Museum, Los Angeles
MBUCV Museo de Biología, Universidad Central de Venezuela, Caracas
MCZ Museum of Comparative Zoology, Cambridge
MNHN Museum National d'histoire Naturelle, Paris
MNRJ Museu Nacional, Rio de Janeiro
MZUSP Museu de Zoologia da Universidade de Sao Paulo
NMNH National Museum of Natural History, Smithsonian Institution, Washington, D.C.
NMW Naturhistorisches Museum Wien, Vienna
NRM Naturhistoriska Riksmuseet, Stockholm
UMMZ University of Michigan, Museum of Zoology, Ann Arbor
ZMA Institute for Taxonomic Zoology (Zoologisch Museum), Amsterdam
ZMUC Københavns Universitet, Zoologisk Museum, Copenhagen

The following abbreviations are used in the figures and text.

**Abbreviations**

- C ceratobranchial (1–3)
- CBS ceratobranchial spine (1–3)
- DAS dorsal articulating surface of hyomandibula
- DCE<sub>4</sub> distal cartilage of fourth epibranchial (E<sub>4</sub>)
- DP<sub>E1</sub> dorsal process of first epibranchial (E<sub>1</sub>)
- DP-UP<sub>2</sub> dorsal process of fifth upper pharyngobranchial tooth plate (UP<sub>2</sub>)
- E epibranchial (1–5)
- ECT ectopterygoid
- H hypobranchial (1–3)
- HIL head length
- LF lateral fold of buccopharyngeal complex
- LPU lateral process of urohyal
- MBS mesobranchial spine
- MES mesopterygoid
- MET metapterygoid
- MF medial fold of buccopharyngeal complex
- MPL mucus producing layer of the buccopharyngeal complex
- OC opercular condyle of hyomandibula
- PAL palatine
- PB infrapharyngobranchial (1–4)
- PDAS posterior dorsal articulating surface of palatine
- PP posterior process of second infrapharyngobranchial (PB<sub>2</sub>)
- PU<sub>1</sub> first preural centrum
- QU quadrate
- SF secondary fold of buccopharyngeal complex
- SL standard length
- U<sub>1</sub> first ural centrum
- UGL urohyal to gill arch ligament
- UN uncinate process
- UP upper pharyngeal tooth plate (4 or 5)
- UR urohyal
- UVL urohyal to ventral hypophyal ligament
- VP-UP<sub>5</sub> ventral process of fifth infrapharyngobranchial (UP<sub>5</sub>)

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collecting efforts in Venezuela. Susan L. Jewett (NMNH) very ably collaborated in field studies in Venezuela and Peru, and in museum research at MBUCV. Jerry A. Louton (NMNH), and Andrew G. Gerberich (NMNH) assisted in field studies in Peru. Gerberich and Ann W. Vari provided diverse assistance at NMNH. Photographs were prepared by Theophilus Brit Griswold. Ricardo M.C. Castro (Universidade de Sao Paulo, Ribeirão Preto) kindly provided the Portuguese translation of the “Resumo”. Numerous specimens reported on in this paper were collected by the Expedicção Permanente da Amazônia under the direction of Paulo E. Vanzolini (MZUSP). Collecting activities in Peru were carried out as a collaborative project with the Instituto Veterinario de Investigaciones Tropicais y de Altura. The Consejo Nacional de Ciencia y Tecnologia of Peru, and in particular its director M. Vegas Velez greatly facilitated studies in that country.

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Character Description and Analysis

The genus Curimata Bosc as defined in this study has eight junior synonyms (Semitapicus Eigenmann and Eigenmann, Pelteleura Fowler, Acuticurimata Fowler, Allenina Fernández-Young, Lambepeidra Fernández-Yepez, Bitricarinata Fernández-Yepez, Bondichthys Whitley, and Stupens Whitley). In addition to those taxa, four other genera (Cruxentina Fernández-Yepez, Psectrogastric Eigenmann and Eigenmann, Pseudocurimata Fernández-Yepez, and Rivasella Fernández-Yepez) have also been used in association with some of the recognized species or their junior synonyms. Such multiplicity of utilized genera is noteworthy since it involved only eight of the twelve nominal species recognized as distinct in this study. The factors that lead to such a proliferation of generic level taxa within Curimata of the present study are difficult to fathom retrospectively since most of the species of Curimata can only be distinguished on the basis of differences in meristics and morphometrics, rather than via any grossly obvious external morphological modifications or distinctive external pigmentation patterns. Interestingly, Curimata ocellata Eigenmann and Eigenmann, the phenetically most distinctive species in the genus, was never proposed as the type species for a nominal genus, probably as a consequence of its relative scarcity in systematic collections.

Until 1876 Curimata (as Curimatus) was used as an all encompassing genus for all members of the Curimatidae. The generic subdivision of Curimata as defined in the present study was begun by Eigenmann and Eigenmann (1889) in their description of Semitapicus. Following the practice of previous researchers, those authors assumed that Charax planirostris Gray (= Curimata cyprinoides (Linnaeus)) was conspecific with Curimata abramoides Kner. As a consequence, the type species of Semitapicus (Charax planirostris) was mistakenly described as having the diagnostic characters of Curimata abramoides rather than those of Curimata cyprinoides of which it is actually a junior synonym (see Vari, 1984a:16 and remarks following synonymy of Curimata in this paper for a more detailed discussion). The description of nominal genera herein considered synonyms of Curimata was continued by Fowler who advanced Peltapeleura (1906:300) and Acuticurimata (1941:166), and was dramatically accelerated by Fernández-Yepez (1948) who proposed five additional genera (Allenina, Bitricarinata, Bondia, Campisella, and Lambepeidra; two of which were preoccupied and replaced, see synonymy) for species herein placed in Curimata. Those five taxa were interspersed with other genera within his tribe Curimatini, which constituted one of the major branches in his “phylogenetic tree” of curimatids (Fernández-Yepez, 1948, fig. 2).

The other species of Curimata known at that time were dispersed through other genera of the Curimatinini of Fernández-Yepez. Vari (1989), in contrast, detailed a number of shared derived characters of the skeleton and soft anatomical systems that support the hypothesis of the monophyly of Curimata. A series of synapomorphies of those same body systems discovered during this study serve to define subunits of the genus as natural assemblages.

Shared derived characters that define Curimata as a monophyletic lineage were discussed by Vari (1989). In a few instances that study also detailed synapomorphies that characterize sublineages of the genus. Characters discussed in depth in that publication will only be briefly redescribed herein, and the reader is referred to that previous paper for additional information on the characters, the condition of homologs in outgroups, and polarity hypotheses. The discussion of morphological systems and synapomorphies for and within Curimata follows the arrangement in Vari (1989) in order to simplify comparisons and cross-references to that publication.

GILL ARCHES

The branchial baskets of the Curimatidae, its sister family the Prochilodontidae, and the Chilodontidae and Anostomidae (which together are, in turn, the sister clade to that bifamilial clade) all demonstrate numerous synapomorphies at familial and superfamilial levels. Similar phylogenetically significant variation is, not surprisingly, also common within Curimata.

Fourth Epibranchial (E4).—The fourth epibranchial demonstrates two modifications that are common to all species of Curimata and which are uniquely derived for that clade. The first of these features is the ontogenetic ventral expansion of the bony spur of the medial surface of the fourth epibranchial (MBS). In adults of Curimata that process has a vertically expanded area of attachment basally with the main body of E4 (Figure 1), and the ventral margin of the spur contacts the medial margin of the fifth upper pharyngeal tooth plate (UP5). The described elaboration of the bony spur is unique to
**Curimata** among curimatids having that process, with the mode of contact of that element with the fifth upper pharyngeal tooth plate also being limited to that genus. The overall restructuring of the medial spur and its contact with UP5 are thus considered a synapomorphy for the members of the genus (SYNAPOMORPHY 1). The form of the medial spur in all species of *Curimata* is also unique in the family in having a distinct medial ridge along its dorsal margin, and in its pronounced overall fenestration, attributes hypothesized synapomorphous for the species of the genus (SYNAPOMORPHY 2) (see Vari, 1989, for a more detailed discussion of the spur and its derived characteristics).

The ventral portion of the main body of the fourth epibranchial, the associated ventrally expanded median bony spur described above, and the fifth upper pharyngeal tooth plate which attaches to these two processes are located distinctly medial of the vertical plane through the main body of E4 in *Curimata* (Vari, 1989, fig. 17). That medial realignment is a derived shift from the typical placement of those structures along the vertical plane through the main body of the fourth epibranchial, and as such is hypothesized to be a synapomorphy for the genus (SYNAPOMORPHY 3) (see Vari, 1989, for a more detailed discussion of the modification).

**FIFTH UPPER PHARYNGEAL TOOTHPLATE (UP5).—**Within *Curimata* the fifth upper pharyngeal tooth plate demonstrates several unique alterations that serve to define subunits of the genus. Three *Curimata* species (*mivartii, aspera,* and *cerasina*) have the fifth upper pharyngeal toothplate expanded transversely into a broad curved plate (Figure 2). The form of the widened UP5 of these three species matches the surface of the opposing surface of the proximate portions of the fifth ceratobranchial of the lower portion of the gill arches (SYNAPOMORPHY 32). This widened form of the fifth upper pharyngeal tooth plate in this subunit of *Curimata* contrasts with the narrower form of the element in the remaining members of the genus and in most other curimatids. The single exception to that generalization involves a subunit of the genus *Steindachnerina* Fowler which also has a transversely expanded UP5. The common occurrence of a transversely expanded fifth upper pharyngeal tooth plate in clades within both *Curimata* and *Steindachnerina* is considered to be the result of independent acquisitions of such a structure in the two lineages in light of the most parsimonious hypothesis of phylogenetic relationships at the generic level put forward by Vari (1989). The hypothesis of convergence in this feature is also congruent with the proposed phylogenetic scheme within *Curimata* supported by the derived characters reported in this study (see "Synapomorphy List and Phylogenetic Reconstruction").

The sister clade within *Curimata* to the lineage characterized by a transversely widened UP5 just described shows a totally different modification of that ossification. The fifth upper pharyngeal tooth plate in *Curimata cisandina, C. roseni,* and *C. inornata* is only moderately wide, the hypothesized primitive condition for the genus. The UP5 in those species, however, has a well-developed process along the ventral portion of the bone. This process has the form of a curved vertical sheet extending along the lateral margin of the bone (VP-UP5, Figures 3 and 4). When the dorsal and ventral portions of the gill arches are brought into proximity this ventral extension of UP5 lies along the posterior margin of the fourth ceratobranchial, and corresponds in form to the associated portions of that ossification. Such an elaboration of UP5 is neither encountered elsewhere in *Curimata* nor among the remaining groups in the Curimatidae, and is thus hypothesized to be a synapomorphy for *C. cisandina, C. roseni,* and *C. inornata* (SYNAPOMORPHY 46).

The modification of the fifth upper pharyngeal tooth plate characteristic of those three species is carried further within that clade in *C. roseni* and *C. inornata.* In all other curimatids the lateral margin of UP5 is separated by a distinct gap from the ventral flange that forms the ventrolateral margin of the fourth epibranchial. In *Curimata roseni* and *C. inornata,* in contrast, there is an additional dorsal process on the lateral margin of UP5 (DP-UP5, Figure 4) which extends dorsally from the main body of the fifth upper pharyngeal tooth plate to contact the proximate portion of the fourth epibranchial (E5) (SYNAPOMORPHY 55).
continuous vertically with the ventral process (VP-UP$_5$) on that element characteristic of these two species and *C. cisandina*.

**THIRD EPIBRANCHIAL (E$_3$).—**The dorsal portion of the third gill arch is unmodified within *Curimata* with the exception of *C. aspera* and *C. cerasina*. These species have a prominent longitudinal ridge along the ventral surface of the third epibranchial. The possession of such a ridge is apomorphous relative to the transversely rounded surface of the element common to the other members of *Curimata* and most other lineages within the Curimatidae (SYNAPOMORPHY 39). As noted by Vari (1989:23) a comparable ridge on the third epibranchial also occurs in all species of *Psectrogaster* Eigenmann and Eigenmann. The common occurrence of these structures in the two lineages within the Curimatidae is hypothesized to be convergent in the context of the most parsimonious hypothesis of intrafamilial relationships (see Vari, 1989, for additional details).

**SECOND EPIBRANCHIAL (E$_2$).—**The ventral surface of the second epibranchial in characiforms typically is transversely rounded in cross-section. In *Curimata mivartii*, *C. aspera*, *C. cerasina*, *C. cisandina*, *C. inornata*, and *C. roseni* that element has an additional longitudinal ridge extending along its ventral surface, an apomorphous modification (SYNAPOMORPHY 25) relative to that in outgroups. Modifications of the second epibranchial comparable to those in *Curimata* species also occur in all species of *Psectrogaster*. The longitudinal ridges in *Psectrogaster* and within *Curimata* are considered homoplasicous in the overall most parsimonious hypothesis of intrafamilial relationships (see Vari, 1989, for further details). Two of these species of *Curimata* (*aspera* and *cerasina*) with a longitudinal ridge on the ventral surface of the second epibranchial have a further derived form of the process. In those species the margin of the ridge is further developed laterally compared to that process in other species of *Curimata* bearing such a ridge. The second epibranchial ridge in *C. aspera* and *C. cerasina* is in addition uniquely folded over into a narrow horizontal shelf. The pronounced development of the ridge and the folding over of its margin are together considered a synapomorphy for these two species (SYNAPOMORPHY 40).

**SECOND INFRAHARYNGOBRANCHIAL (PB$_2$).—**Characiforms typically have a moderately well developed cartilage-capped uncinate process on the anterolateral portion of the dorsal surface of the second infrapharyngobranchial. That process (UN, Figure 5A) contacts a corresponding cartilage-capped uncinate process on the first epibranchial. In *C. cisandina* the uncinate process of PB$_2$ is significantly reduced in overall size, having the form of a small residual knob. This reductive trend is carried further in *C. roseni* and *C. inornata* in which the uncinate process on the second infrapharyngobranchial is totally lacking (Figure 5B). Associated with the absence of a PB$_2$ uncinate process in *C. roseni* and *C. inornata* is the restructuring of the anterolateral wall of PB$_2$ from which the uncinate process arises in all other curimatids. That portion of PB$_2$ in those two species now overlaps the dorsal surface of that element (Figure 5B) rather than retaining its primitive vertical orientation.

The reduction and subsequent loss of the uncinate process of the second infrapharyngobranchial is considered a synapomorphy for the unit consisting of *C. cisandina*, *C. inornata* and *C. roseni* (SYNAPOMORPHY 47). The complete loss of the uncinate process on that element in the latter two species and the restructuring of the anterolateral portion of the bone in those taxa is, in turn, hypothesized to be a shared derived character for *C. inornata* and *C. roseni* (SYNAPOMORPHY 56).

*Curimata inornata* also demonstrates an autapomorphic modification of the anterior surface of PB$_2$. That species has a distinct posterolaterally directed, triangular projection (PP, Figure 5B) that extends to the anterolateral margin of PB$_2$. Such an elaboration of the second infrapharyngobranchial is not encountered elsewhere among species of the Curimatidae or examined characiforms, and is considered an autapomorphy for the species (SYNAPOMORPHY 68).

**FIRST INFRAHARYNGOBRANCHIAL (PB$_1$).—**All species of *Curimata* either have a first infrapharyngobranchial reduced to some degree or lack the bone entirely. That transition series, the reduction and loss of the first infrapharyngobranchial, is considered derived given the well developed PB$_1$ generalized for other species of the Curimatidae and examined characiform outgroups, and a synapomorphy for the genus (SYNAPOMOR-
Although the first infrapharyngobranchial of *Curimata* *ocellata* is reduced relative to the condition in other curimatids it is nonetheless proportionally larger than the condition of the bone in other species of *Curimata* retaining the process. The more pronounced reduction or the complete loss of the first infrapharyngobranchial in the species of *Curimata* other than *C. ocellata* is hypothesized to be a synapomorphy for that clade (SYNAPOMORPHY 12). The terminal stage in the reductive series of the first infrapharyngobranchial, the complete loss of the element, is characteristic of *C. cisandina*, *C. roseni*, and *C. inornata*, another synapomorphy for that less inclusive clade (SYNAPOMORPHY 48).

**First Epibranchial (E₁).**—The form of the uncinate process of the first epibranchial is variable within *Curimata*. A relatively wide but continuous cartilage cap on the E₁ uncinate process (UN) characterizes *C. ocellata*, *C. macrops*, and *C. vittata* (Figure 6A). Although wider than the condition in the outgroups examined, such a single cartilage cap on the uncinate process corresponds to the generalized condition of that structure for characiforms. The primitively single cartilage on the uncinate process of the first epibranchial is subdivided into two cartilage masses separated by a distinct ossified notch in *C. cyprinoides*, *C. knerii*, *C. inornata*, *C. mivartii*, *C. aspera*, *C. cerasina*, *C. cisandina*, *C. roseni*, and *C. inornata* (Figure 6B). This subdivision of the E₁ uncinate process in these species is considered derived in light of the single cartilage present in examined outgroups (SYNAPOMORPHY 20) (see also Vari, 1989, for a further discussion of this character in Curimatidae).

In *Curimata vittata*, which retains only a reduced PB₁, there is a distinct, flattened, elongate triangular process arising from the dorsal surface of the anterior margin of the first epibranchial (DP-E₁, Figure 6A). That dorsally directed process on E₁ is unique to *Curimata vittata* among examined characiforms, and thus hypothesized autapomorphous for the species (SYNAPOMORPHY 16).

**First Hypobranchial (H₁).**—The typical form of the first hypobranchial in the Curimatidae has a broad cartilaginous articular surface along its anterior margin (Figure 7A). The overall form of the bone among curimatids is usually relatively short longitudinally. As a consequence the transverse plane through the articulation between the first hypobranchial (H₁) and first ceratobranchial (C₁) lies distinctly anterior of the transverse axis that passes through the forward limit of the ossified portion of the third basibranchial (BB₃), and anterior of the posterior margin of the anterolateral articular cartilage on the second hypobranchial (H₂) (Figure 7A). *Curimata mivartii*, *C. aspera*, *C. cerasina*, *C. cisandina*, *C. inornata*, and *C. roseni* demonstrate both a restructuring of the anterior articular surface of H₁, and changes in the overall form of the bone. These six species have the articular surfaces between the contralateral first hypobranchials proportionally reduced to relatively narrow cross-sections (Figures 7B and C) (SYNAPOMORPHY 26) relative both to the condition in other species of *Curimata* (Figure 7A) and among outgroups in the Curimatidae. The overall form of the first hypobranchial in these species shows a parallel lengthening in comparison to the
condition in other curimatids, including species of Potamorhina in which the gill-arch elements are proportionally lengthened overall. As a consequence of this relative lengthening of the first hypobranchial the articulation between the first hypobranchial (H1) and first ceratobranchial (C1) in Curimata mivartii, C. aspera, C. cerasina, C. cisandina, C. inornata, and C. roseni is shifted posteriorly and falls slightly short of (Figure 7B) or reaches (Figure 7C) the level of the transverse line through the anterior limit of the ossified portion of the third basibranchial (BB3). These modifications of the anterior portion of the first hypobranchial and of the overall form of that element are together considered a synapomorphy for these six species (SYNAPOMORPHY 27). The elongation of the first hypobranchial and the reduction in the relative transverse dimension of its anterior articular portion are particularly notable in the clade consisting of C. inornata and C. roseni. These terminal stages in the transition series involving the form of the first hypobranchial are considered to represent a further derived condition synapomorphic for these two species (Figure 7C) (SYNAPOMORPHY 57).

**FIRST CERATOBRANCHIAL (C1).**—When viewed in lateral view, the first ceratobranchial of most curimatids is a relatively straight bone either lacking a longitudinal ridge on its dorsal surface, or having only a relatively feeble dorsal ridge. Within Curimata there is a transition in the form of C1 and in the form of its dorsal margin. Curimata mivartii, C. aspera, C. cerasina, C. cisandina, C. inornata, and C. roseni have the shaft of C1 curved ventrally in lateral view, with a moderate to well developed ridge along the anterior two-thirds of the surface of the element; hypothesized derived modifications which are together considered to be a synapomorphy for those taxa (SYNAPOMORPHY 28). Curimata mivartii, C. aspera, C. cerasina, and C. cisandina have a moderate curvature of the first ceratobranchial, with a distinct, although not greatly developed, dorsal ridge on the bone. In C. inornata and C. roseni the ventral flexure of C1 is yet more pronounced, and the ridge along the dorsal surface of the bone is more highly developed, further derived conditions considered synapomorphic for these species (SYNAPOMORPHY 58).

**SECOND HYPOBRANCHIAL (H2).**—The second hypobranchial is typically unelaborated along its ventral surface in curimatids. Four species of Curimata, in contrast, have a distinct process on the ventral surface of the anterolateral corner of the element. The process in C. ocellata has the form of a posteriorly directed elongate spine aligned with, and serving as the point of attachment for, the ligament extending from the second hypobranchial to the anterior portion of the vertical process on the third hypobranchial. The ventral process in Curimata cisandina, C. inornata, and C. roseni although located on this same region of the second hypobranchial, and also serving as an area of attachment for the H2-H3 ligament has rather the form of a triangular flange. This difference in the form of the processes raises questions about the homology of the structures in the two cited lineages. A hypothesis of the homoplasy of the processes in C. ocellata and in the complex formed by C. cisandina, C. inornata, and C. roseni is also congruent with
the most parsimonious hypothesis of relationships within Curimata. The structures are thus assumed to represent independent elaborations of the second hypobranchial, and the presence of a process on the ventral surface of the anterolateral corner of the second hypobranchial is respectively considered an autapomorphy for C. ocellata (SYNAPOMORPHY 7), and a synapomorphy for the clade consisting of C. cisandina, C. inornata, and C. roseni (SYNAPOMORPHY 49).

SECOND CERATOBRANCHIAL (C2).—The plesiomorphously smooth dorsal surface of the second ceratobranchial (C2) demonstrates apomorphous elaborations of differing levels of universality within Curimata. All members of the genus other than C. ocellata have a distinct longitudinal ridge developed to some degree along the dorsal surface of the bone. This is hypothesized to be a synapomorphy for that assemblage relative to the transversely rounded dorsal profile of the element that is typical for proximate sister groups to Curimata and outgroups to the Curimatidae (SYNAPOMORPHY 13). Half of the species of Curimata (mivartii, aspera, cerasina, cisandina, inornata, and roseni) have that dorsal ridge on the second hypobranchial developed to a greater degree than in the remainder of the genus, a further derived state uniting that assemblage (SYNAPOMORPHY 29). The degree of development of the ridge is autopomorphously notably pronounced in C. mivartii in which it forms a distinct vertical flange (SYNAPOMORPHY 36).

THIRD HYPOBRANCHIAL (H3).—The third hypobranchial of all members of the Curimatidae has a well developed ventral process with anterior and posterior extensions that lie within the wall of connective tissue that extends parallel to the ventral aorta (see Vari, 1989, figs. 23 and 24). The anterior portion of that ventral process of H3 serves as the point of attachment for a ligament that extends forward to the posteromedial margin of the second hypobranchial. In both Curimata roseni and C. inornata there is developed a discrete anterolateral spur on this portion of H3 at the point of attachment for the ligament, a unique modification for those species in the Curimata, and an evident synapomorphy for that species pair (SYNAPOMORPHY 59). A moderately developed longitudinal ridge on the dorsal surface of the third hypobranchial is typical for curimatids. Curimata mivartii, C. aspera, and C. cerasina have the ridge on that element developed into a distinct vertically aligned plate-like process, a unique alteration that is considered a synapomorphy for that lineage (SYNAPOMORPHY 33).

THIRD CERATOBRANCHIAL (C3).—Characiform outgroups to Curimata, including the Prochilodontidae and most members of the Curimatidae, have a transversely rounded dorsal margin or a very slight middorsal ridge on the third ceratobranchial. All members of Curimata have at least a discrete longitudinal ridge along the dorsal surface of the bone. A pronounced, distinctly convex ridge extending about two-thirds of the length of the bone characterizes the assemblage consisting of C. mivartii, C. aspera, C. cerasina, C. cisandina, C. roseni, and C. inornata. The convexity of the ridge is even more pronounced in C. cisandina, C. roseni, and C. inornata. These modifications are considered to represent synapomorphies at two levels of universality. The presence of a well developed convex ridge on the dorsal surface of the third ceratobranchial is hypothesized as synapomorphy for the lineage consisting of C. mivartii, C. aspera, C. cerasina, C. cisandina, C. roseni, and C. inornata (SYNAPOMORPHY 30). The greatly pronounced further development of the third ceratobranchial ridge, in turn, is considered a synapomorphy for C. cisandina, C. roseni, and C. inornata (SYNAPOMORPHY 50).

BUCCOPHARYNGEAL COMPLEX

All members of the Curimatidae, other than the species of Curimatopsis and Potamorhina, have the soft tissue layers of the dorsal portions of the oral cavity elaborated to some degree beyond the condition in those two genera and proximate outgroups to the family. This elaboration, the buccopharyngeal complex, most commonly has the form of three primary longitudinally aligned folds, a medial flap extending along the midline of the roof of the mouth, flanked on each side by a fold located on the lateral portion of that region of the oral cavity. As noted by Vari (1989:31–32), all species of Curimata have the three primary mouth folds expanded into large dangling flaps that extend distinctly ventrally from the roof of the oral cavity (MF and LF, Figure 8). Furthermore the buccopharyngeal complex in species of Curimata is also distinctive in having a number of secondary folds (SF) not found in other curimatids. Those additional folds either arise from the margins of the three primary folds, or if independent of those major flaps, are aligned parallel to them. Associated with this elaboration of the soft tissues of the roof of the mouth is a distinct layer of mucus-producing tissue (MPL, Figure 9) that presumably assists in bolus formation. The hypertrophy of the buccopharyngeal complex in the described mode is unique to the species of Curimata among examined Characiforms, and is considered a synapomorphy for the members of the genus (SYNAPOMORPHY 5) (see Vari, 1989:31–33, for further details on the system in the Curimatidae).

HYOID APPARATUS

UROHYAL (UR).—The urohyal within the genus Curimata demonstrates a number of phylogenetically informative modifications. The ossification in Curimatopsis and Potamorhina, the proximate outgroups to Curimata within the Curimatidae, is relatively elongate and extends distinctly posterior of the point where the medial branchiostegal rays diverge laterally. The anteroventral surface of the element in those taxa is unelaborated and the ligamentous band attaching the urohyal to the ventral portion of the gill arches inserts directly onto the ventrolateral flange of the urohyal or onto a very slightly developed process at the point of attachment. The anterior portion of the urohyal, in turn, is moderately expanded
riorly, with two separate concave surfaces that serve as the point of attachment for the thick ligaments that connect the urohyal to the posterior surface of the ventral hypohyal.

In *Curimata mivarrii*, *C. aspera*, *C. cerasina*, *C. cisandina*, *C. inornata*, and *C. roseni* the overall length of the urohyal is relatively short. An elongate urohyal is hypothesized derived within the Curimatidae given the less horizontally developed forms of that ossification in proximate outgroups to the family. The shortened condition of the urohyal in the species of *Curimata* just cited is thus considered a derived secondary reduction (SYNAPOMORphy 31) within the context of the overall most parsimonious hypothesis of intrafamilial relationships advanced by Vari (1989) and the intrageneric phylogeny proposed herein. Within the clade consisting of these six species the urohyal is particularly reduced in *C. inornata* and *C. roseni* in which it barely extends beyond the point where the medial branchiostegal rays diverge laterally. This further shortened form of the urohyal is considered a less inclusive apomorphy uniting those two species (SYNAPOMORphy 60).

Three species of *Curimata* (*cisandina*, *inornata*, and *roseni*) have a definite well-developed ventral process arising from the lateral margin of the ventrolateral flange of the urohyal (LPU, Figure 10). This process serves as the point of attachment for the ligament joining the urohyal and gill arches (UGL). Such a lateral elaboration of the urohyal represents a modification not found in examined outgroups within and outside of the Curimatidae, and its possession is consequently considered a synapomorphy for the three species clade (SYNAPOMORphy 51). Two of the species characterized by the possession of the lateral process on the urohyal (*inornata* and *roseni*) have the anterior portion of that ossification apomorphously expanded. The anterior portion of the urohyal in those species has the form of two large obliquely flattened processes (Figure 8). These processes, which serve as the attachment for the enlarged urohyal-ventral hypohyal ligament (UVL), are unique to and considered synapomorphous for that clade (SYNAPOMORphy 61).

**BASIHYAL TOOTH-PLATE.**—As noted by Vari (1989:36), the presence of a basihyal tooth-plate has a phyletically mosaic distribution in the Curimatidae; a situation exemplified by *Curimata*. The ossification is found in five species of the genus (*ocellata*, *macrops*, *cyprinoides*, *knerrii*, and *inornata*) but absent in the examined specimens of the other seven species. Given the absence of the ossification in *Curimatopsis*, *Potamorhina*, and *Psectrogaster* which are the proximate outgroups to *Curimata*, the possession of a basihyal tooth plate is presumed to represent the derived condition within *Curimata*. Two alternative, equally parasmonious, hypotheses exist as explanations for the distribution of the ossification within *Curimata* in the context of the most parasmonious hypothesis of intrageneric relationships. The first of these assumes the independent acquisition of the bone in each of *C. ocellata*, *C. macrops*, *C. inornata*, and in the hypothetical ancestor of *C. knerrii* and *C. cyprinoides*. The second hypothesis

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**FIGURE 8.**—Roof of the buccopharyngeal chamber and anterior portion of gill arches of *Curimata cyprinoides*, USNM 267963; ventral view showing buccopharyngeal complex (hyoid apparatus, ventral portion of gill arches, eyes and associated tissues removed).

**FIGURE 9.**—Histological section through folds of buccopharyngeal complex of *Curimata cyprinoides*, USNM 267963, showing mucus producing surface layers.
FIGURE 10.—Curimata inornata, MZUSP 21392, anterior section of urohyal, ventral view, anterior at top.

presumes the presence of the ossification in the ancestor of all Curimata species, its loss in the ancestor of the clade consisting of all Curimata species other than C. ocellata and C. macrops, and the secondary reacquisition of the bone in C. inornata and the ancestor of C. knerii and C. cyprinoides. These equally parsimonious alternatives are congruent in assuming that the presence of the ossification in C. inornata and in the C. knerii-C. cyprinoides clade is derived, albeit homoplasiously. In light of the congruence between these hypotheses the presence of a basihyal tooth-plate in those two lineages is thus considered an autapomorphy for C. inornata (SYNAPOMORPHY 69), and a synapomorphy for the clade formed by C. knerii and C. cyprinoides (SYNAPOMORPHY 21), respectively.

OPEROCULAR APPARATUS

SUPRAPEROPERCLE.—The typical condition of the suprapreopercle in most curimatids and that found in the majority of species of Curimata is an elongate tube with an anteriorly concave section proximate to the anterior margin of the flange on the lateral surface of the opercle. This curvature of the suprapreopercle carries that portion of the bone around the anterior margin of the laterally developed opercular flange. The degree of anterior convexity of that portion of the suprapreopercle is reduced in C. cisandina. In that species there is rather an increased lateral flexure of the suprapreopercle resulting from its partial shift posteriorly over the anterior portion of the opercular flange. In C. inornata and C. roseni the plesiomorphous anterior curvature of the suprapreopercle proximate to the margin of the opercular flange is completely absent. The suprapreopercle instead extends directly over the anterior portion of the lateral flange of the opercle, but is much more distinctly bowed laterally than in other species of Curimata. These modifications of the suprapreopercle are considered to represent synapomorphies at two levels of universality. The partial reduction or complete elimination of the anterior concavity of the suprapreopercle, and the migration of that portion of the bone to some degree over the anterior portion of the lateral flange on the opercle is hypothesized to be a synapomorphy for C. cisandina, C. inornata, and C. roseni (SYNAPOMORPHY 52). The more pronounced shift posteriorly and lateral flexure of the section of the suprapreopercle proximate to the lateral flange of the opercle, together with the elimination of the region of anterior curvature in that bone are, in turn, considered a synapomorphy for C. roseni and C. inornata (SYNAPOMORPHY 62).

MAXILLA

The form of the maxilla nearly universal in Curimata species and indeed in the majority of curimatid species has a relatively truncate ventral margin. That flattened border distinctly separates the anterior and posterior margins of the bone. In C. inornata and C. roseni, in contrast, the ventral portion of the maxilla is distinctly pointed with the anterior and posterior margins of the ossification in direct contact. The unique form of maxilla in those two species is consequently hypothesized to be derived (SYNAPOMORPHY 63) relative to the cited condition in outgroups. Those two species similarly have the overall profile of the main body of the maxilla vertically lengthened relative to the condition in other species of Curimata and outgroups in the Curimatidae, another modification hypothesized synapomorphous for the species pair (SYNAPOMORPHY 64).

HYOMANDIBULAR

The hyomandibular in species of Curimata is typically an angled, moderately broad element with a short, distinctly anterodorsally angled dorsal portion that articulates with the hyomandibular fossa of the cranium (Figure 11A). The longer lower portion of the hyomandibula extends along the margin of the preopercle to terminate at the level of the horizontal through the dorsal margin of the metapterygoid-quadrate foramen. Two species of Curimata have this phyletically widespread hyomandibular form distinctly modified. Curimata roseni and C. inornata both have hyomandibulars which are much narrower, with a less pronounced flexure at the level of the opercular condyle (OC, Figure 11B) than those found in other curimatids (Figure 11A). Correlated with the overall more slender body of the ossification in C. roseni and C.
FIGURE 11.—Hyomandibular of (A) *Curimata ocellata*, MCZ 20329, and (b) *Curimata roseni*, USNM 268596; right side, medial view, anterior to left (dense patterned stippling represents cartilage).

*inornata* is a reduction in the relative size of the dorsal articular surface of the bone (DAS) which fits the hyomandibula fossa of the neurocranium. The overall restructuring of the hyomandibular in these two species is hypothesized as derived (SYNAPOMORPHY 65).

PALATINE ARCH

ECTOPTERYGOID (ECT).—The ectopterygoid in *Curimata* is notably modified in three different subunits of the genus.

Based on the form of the ectopterygoid in curimatid outgroups the plesiomorphic condition of the bone for species of *Curimata* is hypothesized to be an anteriorly arching element with a distinctly concave anterior margin. The plesiomorphic state of the medial surface of the element is hypothesized to have a concave medial surface with a moderately developed anterodorsally aligned ridge (see Varí, 1983:fig. 27). This form of the ectopterygoid is modified in divergent fashions within *Curimata*. *Curimata ocellata* has the ectopterygoid anteriorly expanded into an overall triangular bone with a nearly straight anterior margin. The posterodorsal portion of the ossification in that species is also elaborated into a discrete process that fits into a corresponding concavity on the anterior margin of the mesopterygoid (MES, Figure 12A). This marked overall reconfiguration of the anterior and posterior portions of the ectopterygoid is autapomorphic for *C. ocellata* (SYNAPOMORPHY 8).

The clade consisting of *Curimata aspera* and *C. cerasina* also has a distinctly modified ectopterygoid (Figure 12B). In those species the anterodorsal portion of the bone is expanded anteriorly into a rounded process that is separate dorsally from the ventral surface of the palatine (PAL), a derived form of the ectopterygoid not found elsewhere in the family (SYNAPOMORPHY 41). The third derived condition of the ectopterygoid among *Curimata* species characterizes *C. roseni* and *C. inornata* (Figure 12C). The overall profile of the bone from a medial view is similar to that found in outgroups in the Curimatidae. The ridge on the medial surface of the ossification is, however, developed into a very strong strut that abuts dorsally against the the ventral surface of the palatine (PAL). No such strong ridge is found in other lineages within the

FIGURE 12.—Ectopterygoid of (A) *Curimata ocellata*, MCZ 20329, (B) *Curimata aspera*, USNM 243242, and (c) *Curimata inornata*, MZUSP 21392; right side, medial view, anterior to left, proximate portions of neighboring elements of suspensorium outlined and lightly stippled.
Curimatidae, and the possession of that feature is considered derived for *C. roseni* and *C. inornata* (SYNAPOMORPHY 66).

**MESOPTERYGOID (MES).—**The mesopterygoid in all species of the Curimatidae has a distinct horizontal ridge extending along the entire dorsomedial margin of the ossification. Those species of the family with a mesopterygoid-vomer ligament among curimatid outgroups have the region for the attachment of that connective tissue band well developed, but not enlarged to any significant degree or reinforced by struts (Figure 13A). Modifications of diverse components of the mesopterygoid distinguish various clades within *Curimata*.

In *Curimata mivartii*, *C. cerasina*, and *C. aspera* the posterior portion of the mesopterygoid proximal to the border with the metapterygoid is considerably thickened relative to the condition in other *Curimata* species and examined outgroups. The elaboration of that portion of the bone is hypothesized as apomorphic for these three species (SYNAPOMORPHY 34). The lineage consisting of *C. roseni* and *C. inornata* also has the mesopterygoid strengthened, but in a considerably different mode. In those two species the horizontal ridge along the dorsomedial margin of the bone is distinctly thickened, most notably anteriorly. Furthermore, in those species there is also a strong medial, vertical strut extending from the base of the process for the attachment of the mesopterygoid-vomer ligament (AI) to the ventral margin of the mesopterygoid in the region where the latter abuts the ectopterygoid (ECT) and quadrate (QU) (Figure 13B). Although this process is analogous to the thickening of the mesopterygoid noted above in the lineage consisting of *C. mivartii*, *C. cerasina*, and *C. aspera*, the structure in *C. roseni* and *C. inornata* is more anteriorly located, and has a different overall morphology. The modifications of the horizontal ridge on the mesopterygoid and the development of the vertical strut on the medial surface of that bone in *C. roseni* and *C. inornata* are thus considered unique to that clade and synapomorphous for those species (SYNAPOMORPHY 67).

**METAieder CGOFORMATION (MET).—**Vari (1989:46) noted that the members of the genus *Curimata* have the ridge on the medial surface of the metapterygoid thickened anteriorly relative to the condition in the other curimatids characterized by the presence of that process. This expansion of that portion of the bone, unique to the genus, is considered a synapomorphy for the species of *Curimata* (SYNAPOMORPHY 6) (see Vari, 1989, for further details).

 Within *Curimata*, three species, *C. mivartii*, *C. aspera*, and *C. cerasina*, have the anterior portion of the metapterygoid thickened to a degree beyond the condition in the other species in the genus. This thickened region of the metapterygoid abuts against a similarly expanded region on the posterior portion of the mesopterygoid that serves as the area of attachment for the ligament between that element and the vomer (see above). This further thickening of the metapterygoid ridge is considered a synapomorphy for *C. mivartii*, *C. aspera*, and *C. cerasina* (SYNAPOMORPHY 35). That derived condition, in turn, is further developed in *C. cerasina* in which the anterior portion of the metapterygoid is notably thickenend, a unique modification autapomorphous for the species (SYNAPOMORPHY 44). Finally, the clade formed by *C. cisandina*, *C. roseni*, and *C. inornata* is distinguished by the presence of a distinct dorsal ridge on the anterior portion of the metapterygoid (SYNAPOMORPHY 53).

**SUPRANEURALS**

Vari (1989) noted that the majority of species within the Curimatidae have five supraneurals, two anterior of the neural spine on the first vertebra posterior of the Weberian Apparatus, and three supraneurals interdigitating sequentially between the first and fourth neural spines. The first proximal pterygiophore of the dorsal fin, in turn, interdigitates between the fourth and fifth neural spines (see Vari, 1989, fig. 43A). That hypothesized plesiomorphous condition, common to ten of the species of *Curimata*, is modified in divergent fashions in *C. ocellata* and *C. vittata*. *Curimata ocellata* has the first proximal pterygiophore of the dorsal fin inserting between the fifth and sixth neural spines, a posterior shift in the position of that bone that is reflected in the absence of a supraneural or proximal

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**Figure 13.**—Mesopterygoid of (a) *Curimata cyprinoides*, USNM 267964, and (b) *Curimata inornata*, MZUSP 21392, right side, medial view, anterior to left, proximate portions of neighboring elements of suspensorium outlined and lightly stippled.
pterygiophore between the fourth and fifth neural spines. This apomorphic shift posteriorly (SYNAPOMORPHY 9) is similar to that characteristic of species of the trans-Andean curimatid genus *Pseudocurimata* (see Vari, 1989, figs. 43b and c). The posterior shift in the position of the supraneurals in *C. ocellata* and the species of *Pseudocurimata* is hypothesized to have been independently achieved in light of the overall most parsimonious hypothesis of intrafamilial relationships (Vari, 1989).

*Curimata vittata* has an opposite shift in the position of the system of supraneurals and the first proximal pterygiophore of the dorsal fin. That species has four rather than five supraneurals, two anterior to the first neural spine and one element between each of the first and second, and second and third neural spines. The first proximal pterygiophore of the dorsal fin, in turn, inserts between the third and fourth neural spines. Both the reduction in the number of supraneurals and the forward shift in the position of the first proximal pterygiophore relative to the neural spines are unique to *Curimata vittata* among examined curimatids, and are considered autapomorphies for the species (SYNAPOMORPHIES 17 and 18).

**PIGMENTATION**

The members of the Curimatidae do not as a whole demonstrate a notable range in pigmentation patterns of the head and body. Within *Curimata* there are, however, several distinct derived pigmentation patterns which define subunits of the genus. *Curimata ocellata* has a distinct dark middorsal body stripe on the posterior portion of the body, along with a dark middorsal spot on the body in larger individuals (see Figure 15). Such a pigmentation pattern does not occur in other species of the Curimatidae, or in any members of the Prochilodontidae, and is consequently considered an autapomorphy for the species (SYNAPOMORPHY 10) (see "Color in Alcohol" under *Curimata ocellata* for a more detailed description of the pigmentation pattern).

*Curimata vittata* typically has a pattern of ten vertical or near vertical bars on the dorsal portion of the body in the adults (see Figure 19). Although there is some ontogenetic and geographic variation in the form and number of body bars within the species, such a pattern of pigmentation is unique to *C. vittata* both within the Curimatidae and in the sister clade to the family, the Prochilodontidae. The pattern of vertical bars is thus hypothesized to be an autapomorphy for the species (SYNAPOMORPHY 19) (see "Color in Alcohol" under *C. vittata* for a more detailed description of the pigmentation pattern).

The middorsal region of the body is typically darker than are the proximate areas in members of the Curimatidae, with the chromatophore pigmentation of the region gradually intensifying to the dorsal midline rather than demonstrating an abrupt change in intensity. Such a progressive increase in the degree of dark pigmentation characterizes all *Curimata* species with the exception of *C. cisandina, C. roseni,* and *C. inornata.* Those three species rather than having a diffuse dark middorsal region have a distinct, relatively narrow, very dark strip extending along the middorsal line from the rear of the rayed dorsal fin to the caudal peduncle. This condition is hypothesized derived given its unique nature in the family (SYNAPOMORPHY 54).

A final pigmentation character involves the life coloration in the hypothesized sister pair *C. cerasina* and *C. aspera.* These two species have a patch of bright red pigmentation on the ventral and lateral surface of the body in the region centered on the origin of the pelvic fin. Such a bright red life pigmentation in that region has not been observed or reported elsewhere in the family, and is thus hypothesized to be a synapomorphy for these two species (SYNAPOMORPHY 42).

**BODY FORM AND SQUAMATION**

Within the Curimatidae there is a considerable range in the degree of development of median and lateral angles in the predorsal, prepelvic and postpelvic regions of the body. Indeed Fernández-Yépez (1948) used the variation in those features as the primary diagnostic characters for a number of generic and suprageneric lineages in his classification of the Curimatidae. *Curimata* demonstrates two distinct conditions of one of these areas, the prepelvic region. *Curimata ocellata* and *C. mivartii* have transversely rounded prepelvic regions of the body whereas the remainder of the genus has a flattened prepelvic region with distinct, nearly right, lateral angles in the body wall. Such lateral angles in the body wall are not known in the Prochilodontidae, which is the sister group to the Curimatidae, and thus are judged to represent a derived character within the Curimatidae. Among curimatids such a flattened prepelvic region and the associated angles in the ventrolateral body wall occur within *Curimata, Psectrogaster,* and *Curimatella,* with the transversely concave prepelvic region of *Potamorhina pristigaster* possibly homologous with the conditions in those genera. Nonetheless overall hypotheses of relationships within the Curimatidae (Vari, 1989), within *Potamorhina* (Vari, 1984a) and that proposed for *Curimata* in this study indicate that the flattened form of prepelvic region arose independently in each of the genera. The flattened preventral region, with distinct lateral angles in the body wall is consequently considered derived within *Curimata* (SYNAPOMORPHY 14).

The distribution of the flattened prepelvic region within *Curimata* does not, however, delimit a monophyletic assemblage in the genus under the final most parsimonious hypothesis of intrageneric relationships. *Curimata mivartii,* a species with a rounded prepelvic region, is in a clade including ten other species with flattened prepelvic regions (see Figure 14). The occurrence of the transversely rounded prepelvic region in *C. mivartii* is consequently considered a derived secondary reversal in light of the overall most parsimonious hypothesis of phylogenetic relationships within *Curimata* (SYNAPOMORPHY 37).
Associated with the presence of a flattened preventral region in the majority of species of Curimata is an increase in the relative size of the scales on that portion of the body. The species of Curimata with a flattened preventral region have a single midventral series of enlarged scales flanked on each side by a series of similar sized scales with a distinct vertical angle that corresponds to the underlying form of the body wall. The relative enlargement of the scales in these three longitudinal series and the reconfiguration of the lateral series of scales are considered derived relative to the condition in outgroups in which the scales on the prevpelvic region are neither enlarged nor angled (SYNAPOMORPHY 15). Enlarged prevpelvic scales with angled lateral series on each side of the body also occur within the Curimatidae in a subunit of Psectrogaster and in Curimataella. Once again it is most parsimonious within the scheme of intrafamilial relationships proposed by Vari (1989) to hypothesize that the presence of these adaptations in those non-Curimata curimatids represent homoplasies. The absence of enlarged prevpelvic scales with angled lateral series in C. mivartii is considered a derived secondary loss (SYNAPOMORPHY 38) within the overall most parsimonious hypothesis of intrageneric relationships.

Curimata ocellata is an elongate fusiform species which is phenetically very similar to and evidently mimics Hemiodopsis semiaenatus (Géry, 1977b), a member of the characiform family Hemiodontidae. Such a fusiform body form is unique to C. ocellata within the Curimatidae, and is furthermore not approximated within the Prochilodontidae, the sister group to that family. The overall body form in C. ocellata is consequently hypothesized as autapomorphous (SYNAPOMORPHY 11).

MISCELLANEOUS

Several other derived characters found in body systems not yet discussed are detailed in this section.

FIN EXTENSIONS.—The anterior rays of the dorsal fin, and the dorsal and ventral rays of the caudal fin are either approximately the same length as the neighboring rays or only slightly longer than those elements in most members of the Curimatidae. The only known exceptions are Curimata knerii and C. cyprinoides in which the last unbranched and first branched dorsal-fin rays are produced into an elongate filamentous extension that extends posteriorly to, or beyond the caudal peduncle. Similarly the dorsal and ventral rays of the caudal fin are developed into elongate trailing filaments in those species. The more extensive development of these dorsal and caudal rays are considered synapomorphies for the two species given their unique nature within the family (SYNAPOMORPHIES 22 and 23).

VERTEBRAE.—The number of vertebrae among Curimata species inclusive of those in the Weberian complex ranges from 30 to 34, with the majority of species having 30 to 32 vertebrae. Curimata cyprinoides typically has 32 vertebrae, with 33 occurring in less than three percent of the specimens radiographed. A similar percentage of the examined specimens of C. cerasina and C. aspera, species usually having 32 vertebrae, were found to have 33 elements. All remaining species in the genus have 32 or fewer vertebrae with the exception of Curimata knerii. That species typically has 33 vertebrae, with approximately five percent of the radiographed specimens having 34 vertebrae. The higher number of vertebrae in C. knerii (33 or 34) is considered derived relative to the lower number of elements (30 to 32, rarely 33) typical for the other members of the genus (SYNAPOMORPHY 24).

HEAD WIDTH.—A single morphometric feature involving the width of the interorbital region serves to define a subunit of Curimata. The width of the interorbital region of the head is 0.46 to 0.52 of head length (HL) in Curimata aspera and 0.53 to 0.57 of HL in C. cerasina. This contrasts with an intraorbital width of 0.45 of HL or less in the vast majority of curimatids. The increased width of the head in C. cerasina and C. aspera together is considered a synapomorphy for that species pair (SYNAPOMORPHY 43). The very wide interorbital space of C. cerasina is, in turn, hypothesized as autapomorphous for that species (SYNAPOMORPHY 45).

Synapomorphy List and Phylogenetic Reconstruction

The preceding section of the discussion detailed the series of shared derived characters in a variety of body systems common to the members of Curimata or to subunits of that genus. Vari (1989) has discussed the relationships of Curimata within the Curimatidae and the reader is referred to that study for further details on, and analysis of, the various character systems that contained information useful for the phylogenetic delimitation of Curimata, and in the phyletic placement of the genus within the Curimatidae.

In the following discussion the shared derived characters congruent with a hypothesis of the monophyly of the genus Curimata will only be listed in brief since those synapomorphies were discussed in greater detail in an earlier publication (Vari, 1989). The enumeration of the shared derived characters defining Curimata is followed by a listing of the less universal apomorphies that characterize the clades and species within the genus. Various authors have proposed diverse schemes as vehicles for conveying information on phylogenetic hypotheses within a classification. A subset of these methodologies involve the proposal of a name for each clade defined by shared derived characters. Formal nomenclatural recognition in this study is rather given only to the genus and the contained species. That nomenclatural system is used since the formal recognition of supraspecific taxa for all the clades in Curimata consisting of two or more species would necessitate the proposal and utilization of a series of at least eight additional taxa within the genus, a number that would increase if the two trichotomies in the present hypothesis of relationships were resolved to dichotomies by future studies. The resultant proliferation of subgeneric taxa in Curimata would, at best, only marginally clarify the following discussion, and indeed
FIGURE 14.—Cladogram of the most parsimonious hypothesis of relationships for the species of the genus *Curimata*. The numbered synapomorphies of the figure correspond to those of the text (see "Synapomorphy List and Phylogenetic Reconstruction").

would more likely obfuscate the presentation. Such subgeneric taxa are thus not utilized. Although the proposed scheme of relationships within *Curimata* cannot as a consequence be directly retrieved from the classification, that phylogenetic hypothesis is discussed in detail in the following section, and is presently visually in Figure 14.

Characters pertinent to questions of suprageneric relationships within the Curimatidae are not discussed unless they represent homoplasies within the family that are common to *Curimata* or one of its subunits, and an outgroup in the Curimatidae. Such characters are typically discussed in greater detail in Vari (1989:59–62).

Subsequent to the reconstruction of the most parsimonious hypothesis of phylogenetic relationships within *Curimata* there is a discussion of the homoplasious characters within the genus, that is those derived attributes that have a phylogenetic distribution incongruent with the arrived at most parsimonious hypothesis of relationships. These characters are typically homoplasies between a subunit of *Curimata* on the one hand and another species or a supraspecific clad within the Curimatidae on the other. Less commonly the homoplasies involve two subgroups within *Curimata*. The discussion of the homoplasies in conjunction with the phylogenetic reconstruction provides the basis for the evaluation of the efficacy of previous classificatory schemes as indicators of the phylogenetic history of the genus, its suprageneric groupings and contained species.

The most parsimonious phylogenetic hypothesis for species relationships within *Curimata* incorporating the synapomorphies described above is presented in Figure 14. That hypothesis was first derived by a manual construction of the phylogenetic scheme. The parsimony of that scheme was confirmed by the use of David L. Swofford’s numeric algorithm PAUP (Phylogenetic Analysis Using Parsimony, version 2.4, 1985). Derived characters unique to a single species (autapomorphies) were not included in the analysis. The data on 39 polarized characters with two to four character states was analyzed using the branch and bound option of PAUP which is guaranteed to find the most parsimonious trees. The analysis resulted in nine equally parsimonious trees with consistency indices of 0.900. These trees have identical topologies, with the differences between them being in the sequence of presentation of the clades at the two trichotomies in the final phylogeny. These trees are thus identical in terms
of the phylogenetic hypothesis they represent and equivalent to the scheme of relationships in Figure 14.

The apomorphous characters defining the genus *Curimata*, the supraspecific clades, and species within the genus are numbered sequentially. The numbering of characters in the following text and the immediately preceding section on "Character Description and Analysis" corresponds to the numbered synapomorphies of Figure 14. That numbering procedure is utilized to simplify the visualization of the distribution of characters at all phylogenetic levels. It furthermore readily permits cross-reference of the preceding character descriptions and analyses with the phylogenetic reconstruction in this section.

Vari (1989:57) listed six characters as synapomorphies for the members of *Curimata*. Those characters are listed below and were discussed briefly under "Character Description and Analysis". The reader is referred to the earlier publication for further information on the characters, the condition(s) in the examined outgroups and the phylogenetic distribution of the different characters.

The discovered synapomorphies described by Vari (1989) for the members of the genus *Curimata*:

1. The ontogenetic reconfiguration of the medial spur on the fourth epibranchial (E4) into a ventrally expanded, fenestrated process contacting the fifth upper pharyngeal tooth plate (UP5).
2. The development of a median shelf on the dorsal margin of the medial spur on the fourth epibranchial (E4), and the associated pronounced fenestration of that spur.
3. The medial shift of the medial spur and ventral articular process of the fourth epibranchial (E4), and of the associated fifth upper pharyngeal tooth plate (UP5).
4. The reduction to some degree to complete loss of the first infrapharyngobranchial (PB1).
5. The elaboration of the three primary folds of the buccopharyngeal complex into large vertical flaps, and the development of numerous parallel secondary folds on the roof of the buccal cavity.
6. The thickened anteromedial portion of the metapterygoid.

Within the hypothesized monophyletic assemblage defined by characters 1 to 6, two lineages are, in turn, defined by less universal apomorphies. The first lineage consists of a single species, *Curimata ocellata*, and the second clade contains eleven species (*vitata, macrops, knerii, cyprinoides, incompta, mivartii, aspera, cerasina, cisandina, roseni, and inornata*). The less speciose lineage containing *C. ocellata* is defined by the following derived characters:

7. The posteriorly directed elongate spine on the ventral surface of the anterodorsal corner of the second hypobranchial (H2).
8. The expansion of the ectopterygoid into a large overall triangular element, with a posterodorsally expanded process fitting into a corresponding notch on the anterior margin of the mesopterygoid.
9. The posterior shift of the region of interdigitation of the first proximal pterygiophore of the dorsal fin relative to the neural spines of the anterior vertebrae.
10. The distinct pigmentation pattern of a midlateral stripe on the posterior portion of the body, with a dark midlateral body spot present in adults.
11. The elongate fusiform shape of the body.

The elongate body form and distinctive pigmentation pattern of *Curimata ocellata* are evidently mimetic with those features in some hemiodontids, in particular various species of *Hemiodopsis* with which it schools (see Géry, 1977a).

The more inclusive clade consisting of the other eleven species of *Curimata* is delimited by the following synapomorphies:

12. The pronounced reduction or total loss of the first infrapharyngobranchial (PB1).
13. A slightly developed to pronounced longitudinal ridge on the dorsal surface of the second ceratobranchial (C2).
14. The distinct flattened prepelvic region of the body with discrete, nearly right, lateral angles in the body wall (secondarily absent in *C. mivartii*).
15. The enlarged series of midventral scales in the prepelvic region and the flanking series of enlarged scales that have a discrete angle corresponding to the angle in the underlying body wall (secondarily absent in *C. mivartii*).

At this point in the phylogeny there exists a trichotomy that has not been resolved with the evidence from the examined characters. Those three clades are as follows: first, *Curimata vitata*; second, *C. macrops*; and third, the lineage consisting of *C. knerii, C. cyprinoides, C. incompta, C. mivartii, C. aspera, C. cerasina, C. cisandina, C. roseni, and C. inornata*. These clades are discussed sequentially, with the order of presentation not indicative of any hypothesis of relationships.

*Curimata vitata*, a distinctively pigmented species widely distributed through the Rio Amazonas basin, has the following autapomorphies:

16. The flattened, elongate triangular process on the dorsal surface of the anterior margin of the first epibranchial (E1).
17. The reduction to four supraneurals from the five in other *Curimata* species.
18. The anterior shift of the point of interdigitation of the first proximal pterygiophore of the dorsal fin to between the fourth and fifth neural spines, and the reduction to four supraneurals.
19. The distinctive pigmentation pattern in the adults of a series of vertical bars on the dorsal portion of the body.

*Curimata macrops*, the second component of the trichotomy, is unique in the genus in being endemic to the rivers of northeastern Brazil. No autapomorphies to characterize the species were discovered during this study.
The next lineage in *Curimata*, involved in this trichotomy, consists of nine species (*knerii*, *cyprinoides*, *incompta*, *mivartii*, *aspera*, *cerasina*, *cisandina*, *roseni*, and *inornata*). The discovered synapomorphy for the assemblage is as follows:

20. The subdivision of the cartilage cap on the uncinate process of the first epibranchial (E1) into two smaller cartilages.

Once again the intrageneric phylogeny within the assemblage defined by character 20 has been only resolved to the level of a trichotomy. The three components of the trichotomy are *C. incompta*, the clade consisting of *C. knerii* and *C. cyprinoides*, and the lineage formed by *C. mivartii, C. aspera, C. cerasina, C. cisandina, C. roseni*, and *C. inornata*. These three clades are discussed consecutively, with the order of presentation not indicative of any hypothesis of relationships. *Curimata incompta*, the first element of the trichotomy, achieves the smallest known adult body size in the genus, and is a Rio Orinoco basin endemic. It is not known to be characterized by any autapomorphies.

The two species forming the next lineage in this trichotomy, *Curimata knerii* and *C. cyprinoides*, are very similar allopatic forms that share the following synapomorphies:

21. The possession of a basihyal tooth-plate.
22. The filamentous anterior rays of the dorsal fin.
23. The elongate dorsal and ventral rays of the caudal fin.

*Curimata knerii*, a species of the middle and upper portions of the Rio Amazonas system, is characterized by the following autapomorphy:

24. An increase to 33 or 34 vertebrae.

No autapomorphies are known to delimit *Curimata cyprinoides*, an inhabitant of the lower Rio Amazonas and the Atlantic drainages of the Guianas between the Amazon and the Orinoco Rivers.

The six *Curimata* species of the next clade involved in the trichotomy (*mivartii, aspera, cerasina, cisandina, roseni*, and *inornata*) have in common a number of shared derived characters, most notably involving the gill arches and associated body systems. The discovered synapomorphies for the clade are as follows:

25. The longitudinal ridge on the ventral surface of the second epibranchial (E2).
26. The reduction in the relative size of the anterior articular surface of the first hypobranchial (H1).
27. The relative lengthening of the first hypobranchial (H2).
28. The moderate to pronounced curvature of the shaft of the first ceratobranchial (C1).
29. A moderately well-developed longitudinal ridge on the dorsal surface of the second ceratobranchial (C2).
30. The pronounced distinctly convex longitudinal ridge extending along approximately two-thirds of the length of the dorsal surface of the third ceratobranchial (C3).
31. The reduction in the relative length of the urohyal.

Within the clade defined by characters 25 to 30 there occur two less inclusive lineages, each consisting of three species, and both delimited by a series of synapomorphies. These clades are *C. mivartii, C. aspera, and C. cerasina* on the one hand, and *C. cisandina, C. roseni*, and *C. inornata* on the other.

The first of these clades, the lineage consisting of *C. mivartii, C. aspera*, and *C. cerasina*, is defined by the following synapomorphies:

32. The transverse widening of the fifth upper pharyngeal tooth plate (UP5) into a broad plate.
33. The highly convex longitudinal ridge on the dorsal surface of the third hypobranchial (H3).
34. The thickening of the mesopterygoid proximate and posterior to the process for the attachment of the ligament extending between the mesopterygoid and vomer.
35. The pronounced thickening of the anterior portion of the ridge on the medial surface of the metapterygoid.

Within this grouping of species, *C. mivartii* is definable by three autapomorphies, and the clade consisting of *C. aspera* and *C. cerasina* by a larger series of synapomorphies. *Curimata mivartii*, a Rio Magdalena basin endemic, which achieves the largest known body size in the family, is also the only member of the genus found in trans-Andean South America. The autapomorphies for *C. mivartii* are the following:

36. The greatly developed longitudinal ridge on the dorsal surface of the second ceratobranchial (C2).
37. The secondary reacquisition of a transversely rounded prepelvic region of the body, and the secondary loss of the lateral angles in the body wall.
38. The secondary absence of the enlarged scales on the prepelvic region of the body, and the reacquisition of flattened rather than distinctly angled scales along the anterolateral border of that region.

Synapomorphies defining the clade formed by *C. aspera* and *C. cerasina*:

39. The longitudinal ridge along the ventral surface of the third epibranchial (E3).
40. The elaboration of the ventral longitudinal ridge of the second epibranchial (E2), and the folding over of its distal portion into a horizontal shelf.
41. The expansion of the anterodorsal portion of the ectopterygoid into a discrete rounded process separate from the ventral margin of the palatine.
42. The bright red coloration on the ventral surface of the body in life.
43. The widened interorbital region of the head.

*Curimata aspera*, an inhabitant of the upper Rio Amazonas basin, is not known to be characterized by any autapomorphies. *Curimata cerasina*, a Rio Orinoco basin endemic, is
characterized by the following autapomorphies:

44. The very highly developed thickening of the anteromedial portion of the metapterygoid.
45. The extremely wide interorbital region of the head.

The sister clade to the lineage consisting of *C. mivartii*, *C. aspera*, and *C. cerasina* is formed by *C. cisandina*, *C. roseni*, and *C. inornata*. An extensive series of characters define the clade consisting of *C. cisandina*, *C. roseni*, and *C. inornata*:

46. The development of a strong ventral process having the form of a curved vertical sheet on the fifth upper pharyngeal tooth plate (UP$_5$).
47. The reduction or loss of the uncinate process on the second infrapharygobranchial (PB$_2$).
48. The loss of the first infrapharygobranchial (PB$_1$).
49. The triangular, anteriorly directed process on the ventral surface of the anterolateral corner of the second hypobranchial (H$_2$).
50. The very pronounced longitudinal ridge on the dorsal surface of the third ceratobranchial (C$_3$).
51. The distinct process on the ventrolateral margin of the urohyal serving as a point of attachment for the ligament joining the urohyal and gill arches.

The two less inclusive clades within this three species lineage are *C. cisandina* on the one hand and the species pair consisting of *C. roseni* and *C. inornata* on the other.

No autapomorphies for *Curimata cisandina*, a species inhabiting the middle and upper portions of the Rio Amazonas basin, were discovered during this study.

The last species pair in the family, *Curimata roseni* and *C. inornata*, in contrast, shares numerous derived characters:

52. The reduction or elimination of the anterior flexure in the supraperopercle proximate to the anterior of the flange on the lateral surface of the opercle, and the partial or complete migration of the supraperopercle over the anterior portion of the flange.
53. The distinct dorsal ridge on the anterior portion of the metapterygoid.
54. The discrete black middorsal stripe extending from the rear of the rayed dorsal fin to beyond the adipose dorsal fin.
55. The dorsal flange on the dorsolateral margin of the fifth upper pharyngeal tooth plate (UP$_5$) that abuts the corresponding process of the fourth epibranchial (E$_4$).
56. The loss of the uncinate process on the second infrapharygobranchial (PB$_2$) and the restructuring of the anterior portion of that bone resulting in its overlapping the margin of the first epibranchial (E$_1$).
57. The very pronounced relative shortening of the first hypobranchial (H$_1$).
58. The pronounced curvature of the shaft of the first ceratobranchial (C$_1$).
59. The discrete anterolateral spur on the anteroventral process of the third hypobranchial (H$_3$).
60. The pronounced reduction in the relative length of the urohyal which barely extends posterior of the point where the medial branchiostegal rays diverge laterally.
61. The expansion of the anterior portion of the urohyal into two large processes on which the urohyal to ventral hypobranchial ligament attaches.
62. The elimination of the anterior convexity in the suprapereopercle proximate to the lateral flange of the opercle and the complete migration of that section of the bone over the anterior portion of the lateral flange.
63. The ventrally acute margin of the maxilla.
64. The relative elongation of the maxilla.
65. The slender hyomandibular with a reduced dorsal articular surface.
66. The development of a very strong ridge on the medial surface of the ectopterygoid.
67. The pronounced thickening of the horizontal ridge along the posteroomedial margin of the mesopterygoid and the development of a well developed vertical strut extending from the process for the attachment of the mesopterygoid-vomer ligament to the ventral margin of the mesopterygoid.

*Curimata roseni*, an Amazon basin species, is not known to be characterized by any autapomorphies.

The last species of the genus to be discussed, *Curimata inornata*, a form that is widely distributed in the middle and lower Amazon basin, in contrast, possesses the following autapomorphies:

68. The posterolaterally directed triangular projection along the anterior portion of the second infrapharygobranchial (PB$_2$) that extends to the anterolateral margin of the third infrapharygobranchial (PB$_3$).
69. The possession of a basihyal tooth-plate.

**Convergent Characters**

Homoplasy, the common occurrence of shared derived characters in lineages that do not constitute a monophyletic group in the overall most parsimonious phylogeny, is a factor typical of the majority of hypotheses of relationships. Distinctions have been made previously between convergencies and parallelisms on the basis of concepts of degrees of relative phylogenetic relationships between the involved taxa. Although the distinction may be valid genetically, it is, however, not possible to distinguish these classes of homoplasies in practice when examining morphological characters. All such homoplasious features are as a result referred to as convergencies in this discussion.

The overall most parsimonious hypothesis of relationships within *Curimata* and the results reported on by Vari (1989) necessitate a hypotheses of the independent acquisition of a subset of shared derived characters either between components of *Curimata* or between a subunit of *Curimata* and another
lineage within the Curimatidae.

Only one such convergent character, the common occurrence of a basihyal toothplate in Curimata inornata and the clade formed by C. knerii and C. cyprinoides, was found within Curimata. The absence of a flattened prepelvic region of the body with associated enlarged scales in C. mivartii and C. ocellata would at first appear to represent a second intrageneric homoplasy. The morphology of that region in those two species is, however, most parsimoniously considered to represent a secondary reversal to the plesiomorphic condition in C. mivartii within the overall scheme of intrafamilial and intrageneric relationships.

Convergences between a subunit of Curimata and outgroups within the Curimatidae are much more common. Such homoplasies discovered during this study are as follows, listed by synapomorphy number (see also “Character Description and Analysis” and “Synapomorphy List and Phylogenetic Reconstruction”):

5. The elaboration of the buccopharyngeal complex in Curimata and the majority of species within Steindachnerina.
9. The posterior position of the interdigitation of the first proximal pterygiophores of the dorsal fin with the proximate neural spines in C. ocellata and all species of Psectrogaster.
14. The flattened prepelvic region of the body in all Curimata species other than C. mivartii and C. ocellata and subunits of Curimatella and Psectrogaster.
15. The angled lateral series of scales on the prepelvic region of the body in all Curimata species other than C. mivartii and C. ocellata, and subunits of Curimatella and Psectrogaster.
25. The well developed ventral longitudinal ridges on the second epibranchial in C. mivartii, C. inornata, C. roseni, C. cisandina, C. aspera, and C. cerasina, and all species of Psectrogaster.
27. The longitudinal ridge along the dorsal surface of the third ceratobranchial in C. mivartii, C. inornata, C. roseni, C. cisandina, C. aspera, and C. cerasina, and all species of Psectrogaster.
39. The well developed ventral longitudinal ridges on the third epibranchial in C. aspera and C. cerasina, and all species of Psectrogaster.

Convergences 5, 9, and 20 involve unique patterns of homoplasy between subunits of Curimata and curimatid outgroups and obviously must be considered convergent in light of the much more numerous synapomorphies within the Curimatidae noted by Vari (1989:52–59) and given the apomorphous defining features for Curimata noted in the previous section. Furthermore as noted in Vari (1989) the elaborations of the buccopharyngeal complex (5) and the subdivision of the uncinate process on the first epibranchial (20) differ in various details between Curimata and outgroups within the Curimatidae, and may not represent homologous and thus homoplasious characters. Repeated patterns of homoplasy occur between components of Curimata on the one hand and Psectrogaster on the other (25, 33, 39). These features involve different levels of inclusiveness within Curimata and thus provide internally equivocal data on possible relationships between the involved taxa. Furthermore the most parsimonious hypothesis of relationships within the family indicates that these features, although derived, do not define a monophyletic unit among curimatids. The characters common to some species of Curimata and subunits of Curimatella and Psectrogaster (14, 15) are evidently identical, but again are hypothesized as homoplasious for reasons of parsimony.

Comparisons with Previous Classifications

The concept of the genus Curimata applied in previous classifications has varied remarkably, with the genus as defined in the present study inconsistent to differing degrees with all earlier taxonomic schemes. Eigenmann (1910:420–422) used a broadly defined Curimata which incorporated approximately 71% of the 66 nominal species of the Curimatidae that had been described to that date. Fernández-Yépez (1948) in his drastic subdivision of the family restricted Curimata to two species, C. cyprinoides and C. knerii, with the other 87 species that he recognized in that revision divided among 26 other genera. The remainder of the nominal species placed in Curimata in the present study were apportioned by Fernández-Yépez among six other genera, one of which (Semitaipics Eigenmann and Eigenmann) predated his study, and six of which (Allenina, Bitricarinata, Bondia (replaced by Bondichthys (Whitley, 1953)), Camposella (replaced by Supens (Whitley, 1954)), Lambeleida, and Pseudocurimata) were described by Fernández-Yépez (1948) in that publication.

As discussed by Vari (1989) neither the nearly totally inclusive concept of Curimata used by Eigenmann nor the highly subdivided classification proposed by Fernández-Yépez represent to any significant degree the natural lineages within the Curimatidae. Eigenmann’s definition of Curimata resulted in a large genus consisting of all curimatid species not assigned to the other externally more distinctive genera within his system. As a consequence his Curimata was diagnosed by the common possession of primitive features, and did not constitute a natural assemblage. Although Fernández-Yépez’s drastically restricted Curimata (kneri and cyprinoides) is a natural lineage according to the findings of the present study (see Figure 14), the genus Curimata, as defined herein, does not form a discrete lineage within the “phylogenetic tree” proposed by Fernández-Yépez (1948, fig. 2). Rather the species
of Curimata of the present study are intermingled with species of other curimatid lineages within the tribe Curimatini of Fernández-Yépez (see Vari, 1989).

To a considerable degree these differences between the results of the present study and Vari (1989) on the one hand and those of Fernández-Yépez on the other are a consequence of the dependence by Fernández-Yépez on a few characters (e.g., the flattened prepelvic region of the body) which have been found to demonstrate a high degree of homoplasy within the family when evaluated within the framework of a phylogenetic hypothesis based on information from multiple body systems. The possible difficulties with the limitation of the phylogenetic hypothesis based on information from multiple characters drawn from numerous body systems are examined.

The problems with the classifications of Eigenmann and Fernández-Yépez are typical of those in most classifications of the Curimatidae—the separation of externally distinctive taxa into their own genera and subgenera. The remaining species in such systems were lumped together in taxa defined solely by the absence of the features characteristic of more externally distinctive species. Such residual assemblages are as a consequence typically defined on primitive features. Although the resultant groupings may form monophyletic lineages, it was not possible to recognize them as such on the basis of then available data. More often such groupings have been subsequently found to represent unnatural conglomerates of species, the situation typical of many genera recognized in previous classifications of the Curimatidae.

**Genus Curimata Bosc, 1817**

*Curimata* Bosc, 1817:9 [type species *Salmo adiantulus* Bloch, 1794 (= *Salmo cyprinoides* Linnaeus, 1766), designated by International Commission on Zoological Nomenclature, Opinion 772, 1966].

*Semitapicis* Eigenmann and Eigenmann, 1889:417 [type species *Charax planirostris* Gray, 1854 (= *Salmo cyprinoides* Linnaeus, 1766), designated by Eigenmann, 1910:422; proposed as a subgenus].

*Pelapia* Fowler, 1906:300 [type species *Salmo cyprinoides* Linnaeus, 1766, by original designation; proposed as a subgenus].

*Aciucurimata* Fowler, 1941:166 [type species *Curimata macrops* Eigenmann and Eigenmann, 1889, by original designation].

*Allenia* Fernández-Yépez, 1948:39 [type species *Curimata murieli* Allen, in Eigenmann and Allen, 1942 (= *Curimatus variatus* Kner, 1859, by original designation].


*Bitricarinata* Fernández-Yépez, 1948:64 [type species *Curimatus schomburgkii* Günther, 1864 (= *Salmo cyprinoides* Linnaeus, 1766, by original designation].


**DIAGNOSIS.**—*Curimata* is a morphologically diverse assemblage of curimatids typically of moderate maximum body size, with the maximum known standard lengths for the species of the genus ranging from 112 to 225 mm. The genus is characterized by a series of shared derived characters most notably of the gill arches and buccopharyngeal complex (see characters 1 to 6 of "Synapomorphy List and Phylogenetic Reconstruction").

Dorsal-fin rays ii,8–10 or iii,7–9, anteriormost dorsal-fin rays elongate in some species, sometimes extending to or beyond tip of upper lobe of caudal fin; anal-fin rays ii,7–12 or iii,7–11; pectoral-fin rays 13 to 18; pelvic-fin rays i,7–9; adipose fin always present. Pored lateral-line scales from supracleithrum to hypural joint range from 43 to 76; sensory canals in lateral-line scales straight or slightly divergent. Scale margins smooth to markedly ctenoid; ctenii more developed on ventral portions of body, particularly anterior of pelvic fin. Number of scales in a transverse series from origin of rayed dorsal fin to lateral line 11 to 19; number of scales in a transverse series from origin of anal fin to lateral line 7 to 15. Total vertebrae 30 to 34.

**REMARKS.**—In a previous paper Vari (1984a:13-16) discussed the identity of *Charax* 378 of Gronovius (1763:123) which Gray (1854:154) made available as *Charax planirostris*. Eigenmann and Eigenmann (1889:417) placed the latter species in the subgenus *Semitapicis*, and Eigenmann (1910:422) subsequently specifically designated *C. planirostris* as the type species of *Semitapicis*. Vari (1984a:13-16) noted that the association of *Charax* 378 of Gronovius, the *Charax planirostris* of Gray, with the other species placed in *Semitapicis* by most authors, was based on a series of assumptions by researchers commencing with Günther (1864:290, 293). Those assumptions lead to a hypothesis of the conspecificity of *Charax planirostris* and *Curimata abramoides* Kner (1859). A reappraisal of the original description of *Charax* 378 and the Gronovius manuscript illustration of the species in the Library of the British Museum (Natural History) indicates that *Charax* 378 (= *planirostris*) is not conspecific with *Curimata abramoides*. That information furthermore supports the hypothesis that *Charax planirostris* is not most closely related to the other nominal species placed in *Semitapicis* by various authors from Eigenmann and Eigenmann (1889) to Braga and Azpelicueta (1983). The available evidence (Vari, 1984a:13–16) rather indicates that *Charax planirostris* is properly assigned to the genus *Curimata* as defined in this study. Within *Curimata*, *C. planirostris* is considered a synonym of *C. cyprinoides* as first proposed by Linnaeus (1766:514) who placed *Charax* 378 into the synonymy of his *Salmo cyprinoides* (see also Vari, 1984a:16, and "Remarks" under *Curimatus cyprinoides*). *Semitapicis*, with a type species of *Charax planirostris*, is as a consequence considered a junior synonym of *Curimata*.

Fowler (1906, 1941) and Fernández-Yépez (1948) proposed a number of additional genera and subgenera for various species or species groups within *Curimata* as defined herein.
Two of the genera advanced by Fernández-Yépez (Bondia, Camposella) were later found by Whitley (1953, 1954) to be preoccupied and were replaced with alternative names (Bondichthys and Stupens respectively). Of the generic names available in this assemblage, nearly half either have Curimata cyprinoides as the designated type species (Bitricarinata) or have type species that are considered to be synonyms of Curimata cyprinoides in the present paper (Curimata, Semitapicis, and Peltapleura). The continued recognition of the remaining available genera (Acuticurimata, Allenina, Stupens, Lambepiedra, and Bondichthys) in this monophyletic lineage would, given the topology of the proposed phylogenetic tree, necessitate the description of several new genera in order to satisfy the criterion that all recognized taxa be monophyletic. Such a further generic subdivision, which would create a number of additional monotypic genera, would only complicate the already involved nomenclature of the clade. Furthermore such an expansion in the number of genera without a simultaneous proposal of a series of nested taxa indicative of relationships of lineages between the generic and specific levels would still fail to identify supraspecific clades at subgeneric levels. The definition of such supraspecific taxa within the clade would require the advancement of a minimum of four additional names. That more complex taxonomy together with the numerous genera in such a system although allowing the hypothesis of relationships to be derived directly from the classification would at the same time be very cumbersome. The taxonomically simpler and distinctly less complicated alternative of a single all encompassing genus, Curimata is judged preferable and is the procedure followed herein.

### Key to the Species of Curimata

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Species</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Body elongate, greatest body depth 0.22–0.27 of standard length (SL); a distinct, dark, midlateral spot extends between the 38th and 45th scales of lateral line; spot in juveniles continuous with midlateral body stripe that extends to base of caudal fin; a band of black pigment on dorsal rays of lower lobe of caudal fin (middle and lower Rio Amazonas basin, upper Rio Orinoco)</td>
<td>C. ocellata</td>
<td></td>
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<tr>
<td></td>
<td>Body moderately to distinctly deep, greatest body depth 0.30–0.45 of SL; no large dark midlateral spot or stripe on posterior of body, or if stripe present, species also has vertical bars or vertical series of spots of dorsal portion of body; caudal fin lacks distinct band of dark pigmentation on dorsal rays of lower lobe</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>Branched anal-fin rays 7 to 9</td>
<td>C. vittata</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Branched anal-fin rays 10 to 12</td>
<td>C. incompta</td>
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<tr>
<td>4</td>
<td>Eight to 11 dark vertical bars on dorsal portion of body, bars in some individuals subdivided into vertically aligned series of spots; a longitudinal dark midside stripe sometimes present (Rio Amazonas basin, upper Rio Orinoco)</td>
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<tr>
<td>5</td>
<td>Greatest body depth 0.34–0.39 of SL</td>
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<tr>
<td>6</td>
<td>Interorbital width less than distance from tip of snout to anterior margin of opening in adipose eyelid; length of postorbital portion of head 0.32–0.37 of head length (HL); snout length 0.31–0.36 of HL; eye width 0.32–0.39 of HL (middle portion of Rio Amazonas basin)</td>
<td>C. inornata, new species</td>
<td></td>
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<tr>
<td>7</td>
<td>Anteriormost rays of dorsal fin distinctly filamentous, tips of elongate dorsal-fin rays often reaching tip of dorsal lobe of caudal fin; typically 32 to 34 vertebrae (very rarely 31); 15 to 17 enlarged median scales along prepelvic region to origin of pelvic fins</td>
<td>C. roseni, new species</td>
<td></td>
</tr>
</tbody>
</table>
7. Lateral line scales to hypural joint 46 to 56; typically 32 vertebrae, very rarely 31 or 33 (Rio Orinoco delta, Atlantic drainages of the Guianas, lower Rio Amazonas and Rio Tocantins) ......................................... C. cyprinoides
Lateral line scales to hypural joint 56 to 63 or 34 vertebrae (middle and upper Rio Amazonas basin) ......................................... C. knerii
8. Lateral line scales to hypural joint 57 to 76; scales above lateral line to origin of rayed dorsal fin 16 to 19 ......................... 9
Lateral line scales to hypural joint 43 to 54; scales above lateral line to origin of rayed dorsal fin 12 to 16 ............................... 10
9. Prepelvic region margined laterally with distinct longitudinal angles in body wall. Midventral scale series of prepelvic region distinct, enlarged; flanked by a distinct series of scales that conform in shape to lateral angles of prepelvic region (Northeastern Brazil: Rio Poti and Rio Parnaiba) ............... C. macrops
Prepelvic region transversely rounded, no distinct lateral angles in body wall; scale series of prepelvic region irregularly arranged, not enlarged (Colombia: Rio Magdalena, Rio Cauca, Rio San Jorge, Rio Sinu) ......................... C. mivartii
10. Width of interorbital region of head 0.40–0.45 of head length (HL); vertebrae usually 31, rarely 32 (Rio Negro, middle and upper Rio Solimões) ......................... C. cisandina
Width of interorbital region of head 0.46–0.57 of HL; vertebrae 32 or 33, rarely 31 ................................. 11
11. Width of interorbital region of head 0.46–0.52 of HL; gape width 0.27–0.36 of HL; lateral surface of body relatively flat (middle and upper Rio Amazonas) ......................... C. aspera
Width of interorbital region of head 0.53–0.57 in HL; gape width 0.35–0.40 of HL; body robust, sides of body curved laterally (Rio Orinoco basin) ......................... C. cerasina

Curimata ocellata Eigenmann and Eigenmann


DIAGNOSIS.—The elongate body form and distinctive coloration pattern of Curimata ocellata, which are similar to those of various hemiodontids (see Figure 15 and Géry, 1977a, figs. 1–3), are unique to this species within the Curimatidae. Curimata ocellata is further distinguishable in the genus by its slender body (greatest body depth 0.22–0.27 of SL, in contrast to 0.30–0.46 of SL for other Curimata species), the possession of a dark midlateral spot on the body, and a broad stripe of pigmentation on the dorsal rays of the ventral lobe of the caudal fin, attributes absent in other species of the genus.

DESCRIPTION.—Body markedly elongate, robust, more so in larger specimens. Dorsal profile of head slightly convex. Dorsal profile of body slightly convex from rear of head to origin of rayed dorsal fin; straight and very slightly posteroventrally slanted at base of rayed dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with an indistinct median keel immediately anterior to rayed dorsal fin, smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region transversely rounded anteriorly, indistinctly flattened in region immediately anterior to origin of pelvic fins; no discrete midventral series of scales or enlargement of scales in ventral prepelvic region. Postpelvic region transversely rounded.

Greatest body depth at origin of rayed dorsal fin, depth 0.22–0.28 [0.27]; snout tip to origin of rayed dorsal fin 0.48–0.51 [0.49]; snout tip to origin of anal fin 0.79–0.85 [0.81]; snout tip to origin of pelvic fin 0.52–0.56 [0.52]; snout tip to anus 0.76–0.79 [0.76]; origin of rayed dorsal fin to hypural joint 0.52–0.55 [0.53]. Rayed dorsal fin pointed, anteriormost rays approximately 3 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.15–0.17 [0.16], extends approximately one-half distance to origin of pelvic fin. Pelvic fin pointed, length of pelvic fin 0.16–0.18 [0.16], reaches one-half distance to origin of anal fin. Caudal fin forked. Adipose fin well developed, relatively elongate.
Anal fin emarginate, anteriormost branched rays 2.0–2.5 times length of ultimate ray. Caudal peduncle depth 0.09–0.10 [0.10].

Head distinctly pointed, head length 0.27–0.31 [0.28]; upper jaw slightly longer, mouth slightly subterminal, lower jaw distinctly triangular anteriorly in ventral view; snout length 0.31–0.36 [0.33]; nostrils of each side of head very close, anterior circular, posterior crescent shaped with aperture closed by thin flap of skin that separates nares; orbital diameter 0.23–0.28 [0.24]; adipose eyelid present, more developed in larger specimens, with a vertically ovoid opening over middle of eye; length of postorbital portion of head 0.40–0.44 [0.40]; gape width 0.19–0.25 [0.20]; interorbital region smoothly rounded, width 0.36–0.43 [0.36].

Pored lateral-line scales from supracleithrum to hypural joint 59 to 70 [66]; all scales of lateral-line pored, canals in some scales diverge slightly dorsally and ventrally in larger specimens, otherwise straight; 5 to 8 series of scales extend beyond hypural joint onto caudal-fin base; 11 to 14 [13] scales in transverse series from origin of rayed dorsal fin to lateral line, 8 to 10 [9] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,8–10 or iii,9 (ii,8, ii,10 and iii,9 rare) [ii,9]; anal-fin rays ii,7–8 or iii,7 [ii,7]; pectoral-fin rays 14 to 18 [16]; pelvic-fin rays i,9–10 [i,10].

Total vertebrae 31 (15).

COLOR IN ALCOHOL.—Overall coloration in specimens that retain guanine on scales is silvery-golden; darker on dorsal portions of head and body, with a discrete middorsal band between rear of head and caudal peduncle. Juveniles with a longitudinal midside stripe that starts at about lateral-line scale 36 to 40. Stripe extends posteriorly along lateral line to base of caudal fin, continues across dorsalmost portion of lower lobe of caudal fin. Anteriormost portion of midside stripe most intensely pigmented, forming a distinct spot 3 to 5 scales in longitudinal extent. Darker anterior section of lateral band becomes increasingly less contiguous with posterior portion of stripe in larger specimens. Larger specimens retain dark midlateral spot but with midlateral stripe of body less heavily pigmented, and masked in specimens that retain guanine on scales. Caudal fin of juveniles and adults with a distinct dusky band across dorsal rays of ventral lobe of caudal fin and a less heavily pigmented band across middle rays of dorsal lobe of fin. Other fins hyaline.

DISTRIBUTION.—Rio Amazonas and possibly upper Río...
Figure 17.—Plot of greatest body depth (GBD) against standard length (SL), both in millimeters, for examined specimens of *Curimata ocellata*: A, holotype of *Curimatus semitaeniatus* Steindachner (based on information in original species description); B, lectotype of *Curimatus ocellatus* Eigenmann and Eigenmann (MCZ 20339); C, paralectotype of *Curimatus ocellatus* (MCZ 60884) (some dots represent more than one data point).

Orinoco drainage systems (see "Remarks") (Figure 16).

**LIFE HISTORY.**—Goulding et al. (1988:139) report that *Curimata ocellata* is a detritus feeder in the central portions of the Rio Negro.

**REMARKS.**—Eigenmann and Eigenmann (1889:427) described *Curimatus ocellatus* based on three specimens collected by "Senhor Vinhas" from an unspecified locality on the Rio Xingu. The collector was a resident of Porto do Moz in the lower Xingu (Dick, 1977) and the specimens probably were collected in that portion of the river basin. A 160.0 mm SL syntype (MCZ 20339) is designated as the lectotype. The two remaining syntypes (MCZ 60884), therefore become paralectotypes.

Steindachner's (1917:18) original description of *Curimatus semitaeniatus* was based on a unspecified number of specimens from "Moura, near the junction of the Rio Branco and Rio Negro" [my translation]. No portion of the syntypic series could be located in the holdings of the Naturhistorisches Museum, Wien (Vienna).

Steindachner (1917:18), in his original description of *Curimatus semitaeniatus*, did not mention Eigenmann and Eigenmann's (1889:427) species *C. ocellatus* despite the notable similarities between the two nominal forms. More recently Géry (1977b:103-106) discussed the apparent mim- icry of both nominal species with various species of hemiodontids, without explicitly discussing the characters that purportedly distinguished *C. ocellata* from *C. semitaeniata*. Although the body depths differ between the type series of *C. ocellata* (0.27 of SL) and the value reported by Steindachner for *C. semitaeniata* (0.23 of SL), this difference is evidently a consequence of allometric increase in body depth combined with the different sizes of the involved type specimens (160–183 mm SL for *C. ocellatus* vs. 53 mm SL for *C. semitaeniatus*). Examination of a larger series of specimens fails to reveal any discontinuity in relative body depths between the nominal forms over that size range (Table 1, Figure 17). Similarly the differing degrees of continuity between the midlateral spot on the body and the midside stripe on the posterior portion of the body between the two type series also represent evidently ontogenetically variable characters (see "Color in Alcohol," above). Some slight differences occur between the proportions cited by Steindachner for his material of *Curimatus semitaeniatus* and examined specimens of *C. ocellata*. These involve the distance from the origin of the rayed dorsal fin to the hypural joint, pelvic fin length, and interorbital width (Table 1). Steindachner's measurements were less exact...
TABLE 1.—Morphometrics and meristics of (A) lectotype of *Curimata ocellata*, MCZ 20339, (B) paralectotype of *C. ocellata*, MCZ 60884, (C) syntypes of *Curimatus semitaeniatus* (data from Steindachner, 1917), and (D) ranges for all specimens of *Curimata ocellata* from which counts and measurements were taken. (Standard length is expressed in mm; measurements 1 to 10 are proportions of standard length; 11 to 14 are proportions of head length; dash indicates missing data.)

<table>
<thead>
<tr>
<th>Character</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MORPHOMETRICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Length</td>
<td>160.0</td>
<td>183.0</td>
<td>53.0</td>
<td>55.9-225.3</td>
</tr>
<tr>
<td>1. Greatest body depth</td>
<td>0.27</td>
<td>0.27</td>
<td>0.23</td>
<td>0.22-0.28</td>
</tr>
<tr>
<td>2. Snout to dorsal-fin origin</td>
<td>0.49</td>
<td>0.51</td>
<td>—</td>
<td>0.48-0.51</td>
</tr>
<tr>
<td>3. Snout to anal-fin origin</td>
<td>0.81</td>
<td>0.83</td>
<td>—</td>
<td>0.79-0.85</td>
</tr>
<tr>
<td>4. Snout to pelvic-fin origin</td>
<td>0.52</td>
<td>0.53</td>
<td>—</td>
<td>0.52-0.56</td>
</tr>
<tr>
<td>5. Snout to anus</td>
<td>0.76</td>
<td>0.79</td>
<td>—</td>
<td>0.76-0.79</td>
</tr>
<tr>
<td>6. Origin of rayed dorsal fin to hypural joint</td>
<td>0.53</td>
<td>0.52</td>
<td>0.50</td>
<td>0.52-0.55</td>
</tr>
<tr>
<td>7. Pectoral fin length</td>
<td>0.16</td>
<td>0.17</td>
<td>—</td>
<td>0.15-0.17</td>
</tr>
<tr>
<td>8. Pelvic fin length</td>
<td>0.16</td>
<td>0.17</td>
<td>0.15</td>
<td>0.16-0.18</td>
</tr>
<tr>
<td>9. Caudal peduncle depth</td>
<td>0.10</td>
<td>0.10</td>
<td>0.09</td>
<td>0.09-0.10</td>
</tr>
<tr>
<td>10. Head length</td>
<td>0.28</td>
<td>0.28</td>
<td>0.30</td>
<td>0.27-0.31</td>
</tr>
<tr>
<td>11. Snout length</td>
<td>0.33</td>
<td>0.33</td>
<td>0.31</td>
<td>0.31-0.36</td>
</tr>
<tr>
<td>12. Orbital diameter</td>
<td>0.24</td>
<td>0.23</td>
<td>0.25</td>
<td>0.23-0.28</td>
</tr>
<tr>
<td>13. Postorbital length</td>
<td>0.40</td>
<td>0.43</td>
<td>-0.50</td>
<td>0.40-0.44</td>
</tr>
<tr>
<td>14. Interorbital width</td>
<td>0.36</td>
<td>0.40</td>
<td>0.32</td>
<td>0.36-0.40</td>
</tr>
<tr>
<td><strong>MERISTICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral line scales</td>
<td>66</td>
<td>70</td>
<td>66</td>
<td>59-70</td>
</tr>
<tr>
<td>Scale rows between dorsal-fin origin and lateral line</td>
<td>13</td>
<td>12</td>
<td>12</td>
<td>11-14</td>
</tr>
<tr>
<td>Scale rows between anal-fin origin and lateral line</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>8-10</td>
</tr>
<tr>
<td>Branched dorsal-fin rays</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>8-10</td>
</tr>
<tr>
<td>Branched anal-fin rays</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7-8</td>
</tr>
<tr>
<td>Total pectoral-fin rays</td>
<td>16</td>
<td>16</td>
<td>—</td>
<td>14-18</td>
</tr>
<tr>
<td>Branched pelvic-fin rays</td>
<td>10</td>
<td>10</td>
<td>—</td>
<td>9-10</td>
</tr>
<tr>
<td>Vertebræ</td>
<td>31</td>
<td>31</td>
<td>—</td>
<td>31</td>
</tr>
</tbody>
</table>

than those used in this study, and it possible that the differences between his specimens and those examined in this study are a consequence of that factor. It is also possible that the differences between the samples are the result of differing methods of taking measurements. The latter seems likely since no specimens with values in the cited features comparable to those given by Steindachner for *Curimatus semitaeniatus* have been discovered among the material from the Rio Negro, the type region of that species. In light of this situation and in the absence of any specimens agreeing with the original description of *Curimatus semitaeniatus*, that species is placed as a synonym of *Curimata ocellata*.

All specimens of *Curimata ocellata* examined during this study originated in the Rio Amazonas basin with the exception of three individuals in the holdings of the Museum National d'Histoire Naturelle, Paris. That lot, collected by Chaffanjon, has an imprecise collection locality of "upper Rio Orinoco". The specimens presumably originated in the Rio Atabapo, a black water stream along the Venezuelan-Colombian border (see Collette, 1966:11). Chaffanjon's collections from that river have been the basis for a number of species descriptions by Pellegrin (1903, 1908, 1909, 1912) and Collette (1966). Although the Rio Atabapo is a portion of the Rio Orinoco basin, the black acidic waters characteristic of that river are typical of those of the Rio Negro in which *C. ocellata* is widespread, rather than the white, sediment laden waters characteristic of the main Rio Orinoco. Examination of large series of curimatids from the main portion of the upper Rio Orinoco have failed to reveal *C. ocellata* in that portion of the river basin.

**MATERIAL EXAMINED.**—52 (46, 55.9-225.3).

**BRAZIL. Párd:** Rio Xingu, MCZ 20339, 1 (160.0, lectotype of *Curimatus ocellatus*); MCZ 60884, 2 (1, 183.0, paralectotypes of *Curimatus ocellatus*; one specimen previously cleared and stained; out of MCZ 20339). Óbidos, MCZ 19815, 1 (55.9). Lago Jacupá, Oriximinã, MZUSP 8198, 1 (81.5). Rio Trombetas, Lago de Cruz Alto, INPA TROMB-07, 7 (138.2-202.0). *Amazonas:* Rio Negro?, GC, 2 (63.7-70.3). Rio Negro, Bucuri, CAS 41731, 2 (79.7-87.1). Lago Tupe off Rio Negro, INPA NEG-34, 1 (187.0). Lago das Papunhas, 7 km

VENEZUELA. \textit{Amazonas}: Rio Orinoco (? Rio Atabapo. see "Remarks," above), MNHN 87-771, 3 (110.1–143.2).

\textbf{Curimata \textit{vittata} Kner}


\textit{Allenina murieli}.—Fernández-Yépez, 1948:39, fig. 18 [designation as type species of \textit{Allenina}].—Fowler, 1975:365 [reference].


\textbf{DIAGNOSIS}.—The distinctive pattern of 8 to 10 vertical or near vertical dark bars on the dorsal portion of the body (Figures 18, 19) is unique to \textit{Curimata \textit{vittata}} within \textit{Curimata} and the Curimatidae. Among \textit{Curimata} species, the combination of a greatest body depth 0.30–0.39 in SL, and 8 or 9 branched anal-fin rays further distinguish \textit{C. \textit{vittata}} from all species other than \textit{C. \textit{incompta}}. \textit{Curimata \textit{incompta}} lacks the distinctive pigmentation pattern of \textit{C. \textit{vittata}}. The two forms are also separable by the 30 or 31 vertebrae of \textit{C. \textit{incompta}} which contrasts with the 32 vertebrae of \textit{Curimata \textit{vittata}}.

\textbf{DESCRIPTION}.—Body moderately elongate, relatively robust, more so in specimens over 90 mm SL. Dorsal profile of head nearly straight, somewhat more convex anterior to vertical through anterior margin of eye. Dorsal profile of body smoothly convex from rear of head to origin of dorsal fin; straight or slightly convex, and posterovertrnally slanted at base of dorsal fin; straight or gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal body surface with an indistinct median keel anterior to rayed dorsal fin, smoothly rounded transversely posterior to fin. Ventral body profile gently curved from tip of lower jaw to origin of pelvic fin, somewhat more convex from that point to caudal peduncle, particularly at base of anal fin. Prepelvic region flattened, margined laterally by distinct, nearly right, longitudinal angles that extend from anterovertrnral margin of pectoral girdle to point of origin of pelvic fins. Flattened prepelvic region with a median series of enlarged scales, flanked on each side by a series of enlarged scales that conform in shape to lateral angle of body wall. A well developed midventral keel posterior to pelvic fin origin. Well developed median keel posterior to pelvic-fin origin with secondary obtuse angle in body wall approximately two scales dorsal of ventral midline on each side of postpelvic region of body.

Greatest body depth at origin of rayed dorsal fin, depth 0.30–0.39 [0.37]; snout tip to origin of rayed dorsal fin 0.47–0.54 [0.49]; snout tip to origin of anal fin 0.78–0.84 [0.83]; snout tip to origin of pelvic fin 0.51–0.57 [0.54]; snout tip to anus 0.72–0.80 [0.76]; origin of rayed dorsal fin to hypural joint 0.52–0.61 [0.58]. Rayed dorsal fin pointed, less so with increasing age; anteriormost branched rays somewhat filiform, 4.0–6.7 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.18–0.24 [0.18], extends distinctly beyond vertical through origin of pelvic fin in smaller adults, barely to or short of that line in largest specimens examined, particularly in individuals from Rio Guaporé basin. Pelvic fin pointed, length of pelvic fin 0.18–0.26 [0.22], reaches anus in young adults, falls somewhat short of that point in larger specimens. Caudal fin forked; more so in juveniles.
Adipose fin well developed. Anal fin emarginate, anteriormost branched rays 2.3–3.2 times length of ultimate ray. Caudal peduncle depth 0.11–0.13 [0.11].

Head distinctly pointed, head length 0.26–0.36 [0.32]; jaws equal, mouth inferior, upper jaw distinctly longer; snout length 0.27–0.33 [0.30]; nostrils of each side of head very close, anterior circular, posterior crescent shaped, only partially closed by thin flap of skin that separates nares; orbital diameter 0.28–0.35 [0.30]; adipose eyelid present, more developed in adults, with a vertically ovoid opening over middle of eye; length of postorbital portion of head 0.39–0.46 [0.41]; gape wide, width 0.26–0.35 [0.31], lower jaw distinctly triangular anteriorly; interorbital region flat, width 0.42–0.49 [0.44].

Pored lateral-line scales from supracleithrum to hypural joint 48 to 61 [52]; all scales of lateral-line pored, canals in scales irregularly diverge dorsally and ventrally; 4 to 7 series of scales extend beyond hypural joint onto caudal fin base; 12 to 16 [13] scales in transverse series from origin of rayed dorsal fin to lateral line, 8 to 10 [8] scales in transverse series from lateral line to origin of anal fin. Scale margins very weakly ctenoid.

Dorsal-fin rays ii,9 [ii,9]; anal-fin rays ii,7–9 or iii,8 [ii,8]; pectoral-fin rays 14 to 16 [15]; pelvic-fin rays i,9–10 [i,9].

Total vertebrae 32 (20).

COLOR IN LIFE.—Overall coloration bright silvery, darker dorsally. Vertical bars on body apparent in juveniles, somewhat to distinctly masked by guanine on scales in adults.

COLOR IN ALCOHOL.—Specimens that retain guanine on scales silvery, overall coloration darker on dorsal portions of head and body. Specimens that lack guanine on scales yellowish-tan to brown. Adults with ten vertical bars along dorsal half of body, bars of each side in contact along dorsal midline. First bar runs obliquely posteroventrally from posteriorodorsal margin of head to posterdorsal margin of opercle. Second bar extends posteroventrally from midway along nape to reach or fall slightly short of lateral line. Remaining bars vertical or nearly so. Third bar commences at insertion of rayed
dorsal fin and extends to about four scales above lateral line. Fourth bar begins midway along base of rayed dorsal fin, fifth at posterior of base of that fin. Sixth through eighth bars located between rayed and adipose dorsal fins. Ninth bar at posterior of base of adipose fin. Tenth bar on caudal peduncle, sometimes followed posteriorly by another bar on caudal peduncle at base of fin rays of upper lobe of caudal fin. Form of bars somewhat variable. Some populations with bars variably broken into two large spots, or three or four smaller spots arranged in vertical or near vertical patterns. An irregular longitudinal stripe along lateral line; pigmentation of stripe less pronounced than that of bars. Anterior portion of stripe somewhat irregular, anteriormost section sometimes confluent with second vertical bar. Both bars and stripe less apparent in specimens retaining guanine on scales, particularly larger specimens in which bars are nearly totally masked by guanine.

Number of bars in juveniles eight to ten, with ontogenetic subdivision of some bars resulting in ten bars in adults. Each bar in smaller juveniles extends from dorsal midline to somewhat ventral of lateral line. Ventralmost portions of bars become detached from dorsal sections ontogenetically and subsequently expand horizontally to coalesce into dark midside stripe found in adults.

No prominent pigmentation pattern on fins; rays of all fins, particularly caudal and rayed dorsal outlined by series of small chromatophores. Similar pigmentation present, but less pronounced on other fins.

**DISTRIBUTION.**—Rio Amazonas and possibly upper Rio Orinoco drainage basins (see “Remarks”) (Figure 20).

**COMMON NAME.**—Brazil: Roncador (Kner, 1859; Goulding, 1981); Peru: Yahuarachi (Ortega and Vari, 1986:11).

**LIFE HISTORY.**—Goulding et al. (1988:132, 134, 135, 140) report that *Curimatus vitatta* feeds mainly on detritus. The species occurs in a variety of habitats within the Rio Negro basin, most notably beaches, swamps, and lakes on the center of islands in the main river channel.

**REMARKS.**—In his original species description, Kner (1859:139) listed type specimens of *Curimatus vitatus* from the Rio Guaporé and Rio Negro collected by Natterer. No specimens from the latter region could be located in the collections of the Naturhistorisches Museum, Vienna; however, three specimens collected by that collector in the Rio Guaporé (NMW 16363, 68805) were found in the holdings of that institution. A 164.5 mm SL syntype of *Curimatus vitatus* (NMW 68805.1) is evidently the individual illustrated by Kner and is designated as the lectotype. The remaining syntypes of the species (NMW 16363, 68805.2) therefore become paralectotypes.

Allen, in Eigenmann and Allen, 1942:298) in his original description of *Curimata murieli* compared his species to *C. simulata* and *C. asper*, other nominal members of the same species complex. The holotype of *C. murieli* (CAS 57148, formerly IU 17853), however, has proved to be a juvenile of *Curimata vitata* (Table 2). Allen was evidently misled in his comparative studies by his failure to note the presence of *C. vitata* in western Amazonian South America although Kner (1859:139) originally cited the species from the Rio Guaporé of the Rio Madeira system.

Fowler (1975:366) questionably listed *Curimatus bolivarensis* (= *bolivarensis*) of Steindachner (1910:265) as a synonym of *Bitricarinata (= Curimata) vitata*. Examination of the type series of *Curimatus bolivarensis* has shown that the nominal species is distinct from *Curimata vitata*, and is more closely related to species of the lineage recognized by Vari as *Curimatella* (see Vari, 1989, tables 2 and 3).

The examined material of *Curimata vitata* demonstrates a considerable variation in body depth and relative fin lengths across its range. Examined individuals from the Rio Guaporé have relatively shallower bodies and shorter paired fins than those from the central portions of the Amazon basin. These differences are not, however, discrete between populations, but rather appear to vary across the species range. The available material is not sufficient to determine whether the geographic variation demonstrates any definite pattern.

A single specimen of *Curimata vitata* in the Museum National d’Histoire Naturelle, Paris has an indefinite locality of Rio Orinoco and was evidently collected by Chaffanjon. The specimen presumably originated in the Rio Atabapo, a black water stream along the Venezuelan-Colombian border (see Collette, 1966:11, and “Remarks” under *C. ocellata*). Although the Rio Atabapo is a portion of the Rio Orinoco basin, the black acidic waters characteristic of that river are similar to those of the Rio Negro, contrary to the white, sediment laden waters of the main Rio Orinoco. No other specimen of *Curimata vitata* from the main white water portion of the Rio Orinoco basin has been found in the extensive series of curimatids studied from that system.

**MATERIAL EXAMINED.**—194 specimens (61, 33.9–187.0 mm SL).

**BRAZIL.** Prados: Santarem market, CAS uncat., 1 (130.0); CAS uncat., 2 (124.5–149.4); CAS uncat., 1 (127.0); CAS uncat., 1 (164.4). Rio Tapajós, Itaituba, USNM 268019, 8. Tocantins, NMW 68803, 1. Rio Trombetas, Oriximina, MZUSP 5416, 3. Rio Trombetas, Cumina, USNM 268017, 2. Rio Xingu, Belo Monte, USNM 268016, 1. Amazonas: Lago Hyanuary (= Januari), MCZ 27409, 1 (110.0); MZUSP 6859, 2 (108.5–109.1). Rio Solimões, GC, 5 (3, 71.0–89.7). Rio Negro near Manaus, GC, 1 (84.3); MZUSP 6683, 17 (5, 78.5–90.1); MZUSP 6113, 1. Manaus, MNHN 09–87–88, 2; MNHN 09–103, 1; MZUSP 9575, 1. Rio Negro, Cucui at border with Colombia, USNM 267316, 1 (83.3); CAS-SU 64164, 2 (48.7–50.2). Rio Negro, Darara, USNM 267330, 1 (62.0). Rio Negro, Maruia, USNM 267319, 4. Rio Negro, Ilha de Tamaraquei (Tapuruquara), USNM 267340, 10. Mouth of the Rio Maruia, MZUSP uncat., 2. Rio Negro, Arrara, MZUSP uncat., 1. Rio Negro, Paraná de Jacare, USNM 267332, 3; MZUSP uncat., 1. Rio Negro, Anavilhanas, Lago do Prato, USNM 268018, 1. Rio Canumã, MZUSP 7042, 5 (93.5–141.0). Rio Jauaperi, MZUSP 21051, 1; MZUSP 21153, 2; MZUSP 21148, 1. Igarapé do Rio Maruia, município de Maués, MZUSP
TABLE 2.—Morphometrics and meristics of (A) lectotype of *Curimata vittata*, NMW 68805.1, (B) paralectotypes of *C. vittata* (NMW 16363, 68805.2), (C) holotype of *C. murieli* (CAS 57148), and (D) range of all specimens of *C. vittata* from which counts and measurements were taken. (Standard length is expressed in mm; measurements 1 to 10 are proportions of standard length; 11 to 14 are proportions of head length; dash indicates missing data.)

<table>
<thead>
<tr>
<th>Character</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MORPHOMETRICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Length</td>
<td>164.5</td>
<td>180.0-187.0</td>
<td>67.7</td>
<td>33.9-187.8</td>
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<tr>
<td>1. Greatest body depth</td>
<td>0.37</td>
<td>0.34-0.36</td>
<td>0.33</td>
<td>0.30-0.39</td>
</tr>
<tr>
<td>2. Snout to dorsal-fin origin</td>
<td>0.49</td>
<td>0.49-0.49</td>
<td>0.51</td>
<td>0.47-0.54</td>
</tr>
<tr>
<td>3. Snout to anal-fin origin</td>
<td>0.83</td>
<td>0.81-0.84</td>
<td>0.79</td>
<td>0.78-0.84</td>
</tr>
<tr>
<td>4. Snout to pelvic-fin origin</td>
<td>0.54</td>
<td>0.53-0.57</td>
<td>0.54</td>
<td>0.51-0.57</td>
</tr>
<tr>
<td>5. Snout to anus</td>
<td>0.76</td>
<td>0.77-0.79</td>
<td>0.72</td>
<td>0.72-0.80</td>
</tr>
<tr>
<td>6. Origin of rayed dorsal fin to hypural joint</td>
<td>0.58</td>
<td>0.61</td>
<td>0.56</td>
<td>0.52-0.61</td>
</tr>
<tr>
<td>7. Pectoral fin length</td>
<td>0.18</td>
<td>0.18</td>
<td>0.21</td>
<td>0.18-0.24</td>
</tr>
<tr>
<td>8. Pelvic fin length</td>
<td>0.22</td>
<td>0.22-0.24</td>
<td>—</td>
<td>0.18-0.26</td>
</tr>
<tr>
<td>9. Caudal peduncle depth</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11-0.13</td>
</tr>
<tr>
<td>10. Head length</td>
<td>0.32</td>
<td>0.30-0.35</td>
<td>0.26-0.36</td>
<td></td>
</tr>
<tr>
<td>11. Snout length</td>
<td>0.30</td>
<td>0.30-0.33</td>
<td>0.29</td>
<td>0.27-0.33</td>
</tr>
<tr>
<td>12. Orbital diameter</td>
<td>0.30</td>
<td>0.28-0.31</td>
<td>0.32</td>
<td>0.28-0.35</td>
</tr>
<tr>
<td>13. Postorbital length</td>
<td>0.41</td>
<td>0.40-0.41</td>
<td>0.44</td>
<td>0.39-0.45</td>
</tr>
<tr>
<td>14. Interorbital width</td>
<td>0.44</td>
<td>0.48</td>
<td>0.43</td>
<td>0.43-0.49</td>
</tr>
<tr>
<td><strong>MERISTICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral line scales</td>
<td>52</td>
<td>58-60</td>
<td>50</td>
<td>48-61</td>
</tr>
<tr>
<td>Scale rows between dorsal-fin origin and</td>
<td>13</td>
<td>14-16</td>
<td>13</td>
<td>12-16</td>
</tr>
<tr>
<td>lateral line</td>
<td>8</td>
<td>9-10</td>
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<td>Scale rows between anal-fin origin and</td>
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<tr>
<td>lateral line</td>
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<tr>
<td>Branched dorsal-fin rays</td>
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<td>9</td>
<td>9</td>
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<tr>
<td>Branched anal-fin rays</td>
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<td>8</td>
<td>9</td>
<td>7-9</td>
</tr>
<tr>
<td>Total pectoral-fin rays</td>
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<td>15</td>
<td>15</td>
<td>14-16</td>
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<tr>
<td>Branched pelvic-fin rays</td>
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<tr>
<td>Vertebræ</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>


**ECUADOR. Napo Pastaza**: Lago Jatuncocha, BMNH 1970.4.3.82, 1 (173.5).

**COLOMBIA. Amazonas**: Leticia, GC, 1. Rio Amazonas 30 km upstream from Leticia, MCZ uncat., 1 (33.9).


**BOLIVIA. Beni**: Rio Guaporé, NMW 16363, 1 (180.0, paralectotype of *Curimatus vittatus*); NMW 68805.1, 1 (164.5, lectotype of *Curimatus vittatus*); NMW 68805.2, 1 (187.0, paralectotype of *Curimatus vittatus*). Rio Beni, Laguna Paintado, 5 km S Río Itenez, 4 km SW Costa Marques, Brazil, AMNH 37705, 2 (128.3-132.0).
Curimata inornata, new species

**Figures 21, 22, 23**

Curimata A.—Vari, 1984b:34-35 (Amazon River basin); 1988, fig 10 [phylogenetic biogeography]; 1989, tables 2, 3 [phylogenetic relationships].

**Diagnosis.**—The possession of 31 vertebrae, a body depth 0.34–0.38 of SL, 7 to 9 branched anal rays, and the absence of any marked body pigmentation patterns distinguish Curimata inornata from all other members of the genus with the exception of C. incompta. The interorbital distance in C. inornata is less than the distance from the tip of the snout to the anterior margin of the opening in the adipose eyelid. In C. incompta the interorbital distance is greater than that from the snout to the eyelid margin. The species also differ in the relative length of the postorbital portion of the head (0.32–0.37 of HL in C. inornata vs. 0.39–0.46 in C. incompta, Figure 22) orbital diameter (0.32–0.39 of HL vs. 0.29–0.33), and snout length (0.31–0.36 of HL vs. 0.28–0.32). A large series of internal characters also distinguish the species (see “Synapomorphy List and Phylogenetic Reconstruction”).

**Description.**—Body moderately elongate, somewhat compressed. Dorsal profile of head straight or very slightly convex. Dorsal profile of body slightly convex from rear of head to origin of rayed dorsal fin; straight and posteroverventrally 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 posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle, convexity more pronounced posterior to pelvic fin origin. Prepelvic region flattened, margined laterally by distinct, nearly right, angles in body wall. Prepelvic region with a median series of enlarged scales flanked on each side by a series of enlarged scales that conform in shape to lateral angle of body. Well developed median keel posterior to pelvic fin origin, with secondary obtuse angle in body wall about two scales dorsal of ventral midline on each side of postpelvic portion of body.

Greatest body depth at origin of rayed dorsal fin, depth 0.34–0.40 [0.38]; snout tip to origin of rayed dorsal fin 0.49–0.54 [0.50]; snout tip to origin of anal fin 0.80–0.87 [0.80]; snout tip to origin of pelvic fin 0.52–0.59 [0.53]; snout tip to anus 0.76–0.84 [0.77]; origin of rayed dorsal fin to hypural joint 0.53–0.59 [0.58]. Rayed dorsal fin pointed, anteriormost rays somewhat lengthened in some individuals, 3.0–4.5 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.18–0.24 [0.20], extends three-quarters distance to vertical through origin of pelvic fin. Pelvic fin pointed, length of pelvic fin 0.18–0.24 [0.20], reaches one-half to three-quarters distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays approximately three times length of ultimate ray. Caudal peduncle depth 0.10–0.12 [0.11].

Head distinctly pointed, head length 0.30–0.33 [0.31]; upper jaw very much longer, mouth distinctly inferior, snout length 0.31–0.37 [0.35]; nostrils of each side of head very close, anterior circular, posterior crescent shaped with aperture closed by thin flap of skin separating nares; eye large, orbital diameter 0.32–0.39 [0.33]; adipose eyelid well-developed, particularly anteriorly, with vertically ovoid opening over center of eye; length of postorbital portion of head 0.32–0.37 [0.35]; gape width 0.24–0.30 [0.27]; interorbital width 0.39–0.44 [0.42].

Pored lateral-line scales from supracleithrum to hypural joint 47 to 56 [55]; all scales of lateral-line pored, canals in scales straight or slightly divergent; 4 to 7 series of scales extend beyond hypural joint onto caudal fin base; 12 to 15 [13] scales in a transverse series from origin of rayed dorsal fin to lateral line; 7 to 9 [8] scales in a transverse series from the lateral line to origin of anal fin. Median series of enlarged prepelvic scales 14 to 16.

Dorsal-fin rays ii,8–9 or iii,8–9 [ii,9]; anal-fin rays ii,7–9 or iii,7–8 [ii,8]; pectoral-fin rays 13 to 16 [15]; pelvic-fin rays i,8–9 [i,9].

Total vertebrae 31 (56), 32(3).

**Color in alcohol.**—Specimens that retain guanine on scales silvery, darker on dorsal portions of head and body. Specimens that lack guanine on scales tannish-brown to brown.
Darker dorsally. Distinct dark middorsal band extends from posterior of insertion of last dorsal-fin ray to insertion of dorsalmost caudal-fin ray. Rayed and adipose dorsal fins and caudal fins dusky. Rays of those fins outlined by a series of small chromatophores. Other fins hyaline or only slightly dusky.

**DISTRIBUTION.**—Middle and lower portions of the Rio Amazonas basin (Figure 23).

**ETYMOLOGY.**—The specific epithet *inornata* from the Latin for unadorned, in reference to the plain body, head, and fin pigmentation of the species.

**MATERIAL EXAMINED.**—341 specimens (73, 92.1–132.3).
DIAGNOSIS.—The combination of 8 or 9 branched anal-fin rays and a greatest body depth 0.34–0.39 of SL distinguish Curimata incompta from all Curimata species other than C. vittata and C. inornata. The lack of any pronounced vertical pigmentation pattern on the dorsal surface of the body and the possession of 30 or 31 vertebrae readily separates C. incompta from C. vittata which has a characteristic pattern of vertical bars on the dorsal surface of the body and 32 vertebrae. Curimata incompta has an interorbital width that is greater than the distance from the tip of the snout to the anterior margin of the opening in the adipose eyelid. In C. inornata the interorbital width is less than the distance from the snout to the eyelid margin. The species also differ in the length of the postorbital portion of the head (0.39–0.46 of HL in C. incompta vs. 0.32–0.37 in Curimata inornata, Figure 22), horizontal width of the orbit (0.29–0.33 of HL vs. 0.32–0.39), and snout length (0.28–0.32 of HL vs. 0.31–0.36).

DESCRIPTION.—Body moderately elongate, robust, more so in larger specimens. Dorsal profile of head straight or very slightly concave. Dorsal profile of body slightly convex from rear of head to origin of rayed dorsal fin; straight and posterovervantly slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle, particularly in larger specimens. Dorsal surface of body with an indistinct median 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 flattened, marginated laterally by distinct, nearly right, angles in body wall that extend from level of vertical through origin of pectoral fin to origin of pelvic fins. A median series of enlarged scales in prepelvic region flanked on each side by a series of enlarged scales that conform in shape to lateral angle of prepelvic region of body. Well developed median keel posterior to pelvic fin origin with secondary obtuse angle in body wall two scales dorsal of ventral midline on each side of postpelvic portion of body.

Greatest body depth at origin of rayed dorsal fin, depth 0.34–0.39 [0.36]; snout tip to origin of rayed dorsal fin 0.50–0.53 [0.50]; snout tip to origin of anal fin 0.78–0.83 [0.81]; snout tip to origin of pelvic fin 0.52–0.57 [0.54]; snout tip to anus 0.75–0.80 [0.77]; origin of rayed dorsal fin to hypural joint 0.54–0.58 [0.57]. Rayed dorsal fin pointed, anteriormost rays 4.7–5.8 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.18–0.22 [0.21], extends to vertical through origin of pelvic fin in smaller specimens, falls short of that line in largest specimens examined. Pelvic fin pointed, length of pelvic fin 0.20–0.25 [0.22], reaches three-quarters of distance to origin of anal fin in smaller specimens, somewhat less in larger individuals. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays approximately twice length of ultimate ray. Caudal peduncle depth 0.10–0.12 [0.11].

Head distinctly pointed in profile, head length 0.31–0.36 [0.31]; upper jaw longer, mouth inferior; snout length 0.28–0.32 [0.31]; nostrils very close, anterior circular, posterior crescent shaped with aperture closed by thin flap of skin that separates nares; orbital diameter 0.29–0.33 [0.32]; adipose eyelid present, with a vertically ovoid opening over center of eye; length of postorbital portion of head 0.39–0.46 [0.46]; gape width 0.28–0.34 [0.28]; interorbital width 0.40–0.45 [0.45].

Pored lateral-line scales from supracleithrum to hypural joint 52 to 55 [55]; all scales of lateral-line pored, canals in scales straight in smaller specimens, diverging somewhat dorsally or ventrally in adults; 5 to 8 series of scales extend beyond hypural joint onto caudal fin base; 13 to 15 [13] scales in transverse series from origin of rayed dorsal fin to lateral line; 8 to 10 [9] scales in transverse series from the lateral line to origin of anal fin; 13 to 16 [14] enlarged scales in a midventral series anterior to origin of pelvic fins; scale margins weakly
ctenoid, ctenii more developed in larger individuals, particularly on ventral portion of body.

Rayed dorsal-fin rays ii,9 or iii,8 (iii,8 rare) [ii,9]; anal-fin rays ii,8–9 or iii,8–9 (when three unbranched rays present, first very short) [iii,8]; pectoral-fin rays 13 to 15 [14]; pelvic-fin rays i,8–9 [i,9].

Total vertebrae 30 (2), 31 (56).

COLOR IN LIFE.—Overall coloration bright silvery, slightly darker dorsally; median and paired fins without any pronounced pigmentation.

COLOR IN ALCOHOL.—Overall coloration in formalin preserved specimens lacking guanine on scales yellowish to tannish-brown, darker on dorsal portions of head and body. Myomere margins along lateral midline outlined by series of small chromatophores. Distal margin of caudal and rayed dorsal fins dusky.

DISTRIBUTION.—Rio Orinoco drainage basin (Figure 25).

MATERIAL EXAMINED.—59 specimens (57, 43.7–112.0 mm SL).

VENEZUELA. Apure: Rio Meta near Puerto Paez, MBUCV V-5991, 1 (112.8, holotype of *Curimata incompta*); MBUCV V-14026, 3 (103.7–107.9, paratypes of *C. incompta*); USNM 257083, 1 (104.8, paratype of *C. incompta*). Territorio Federal Amazonas. Rio Orinoco, Raudales de Ature upstream of Puerto Ayacucho, USNM 269991, 1. Bolivar: Canó draining into Rio Orinoco slightly north of El Burro, USNM 273308, 2. Laguna between Palua and Ciudad Bolivar, MBUCV V-13213, 1 (56.3, paratype of *C. incompta*). Laguna La Ceiba and discharge channel into Rio Orinoco, Los Castillos de Guyana, MBUCV V-6700, 5 (86.8–103.0). Rio Orinoco just down-
stream of San Felix, USNM 236557, 1 (94.6, paratype of C. incompta). Monagas: Canó Guarguapo system, USNM 236559, 5 (51.5–74.7, paratypes of C. incompta); MBUCV V-13093, 2 (49.8–57.7, paratypes of C. incompta). Río Orinoco, inlet below Barrancas, 1 (64.8, paratype of C. incompta). Cocos Island, Río Orinoco opposite Los Castillos de Guyana, USNM 236551, 1 (43.7, paratype of C. incompta). Isla Tapatapa at Los Castillos, USNM 236558, 1 (51.5, paratype of C. incompta). Canó between Río Orinoco and Laguna Guatero, near Barrancas, USNM 236553, 7 (58.7–72.0, paratypes of C. incompta), 2 specimens cleared and counterstained for bone and cartilage; FMNH 94590, 1 (61.7, paratype of C. incompta); LACM 43350-1, 1 (68.7, paratype of C. incompta). Territorio C. incompta); Los Castillos, USNM 236555, 2, (66.1–72.8, paratypes of C. incompta, 2 specimens cleared and counterstained for bone and cartilage); Isla Tapatapa at Las Castillos de Guyana, USNM 236553, 7 (58.7–72.0, paratypes of C. incompta). Canó Paloma system, USNM 236559, 2 (43.8–57.3, paratypes of C. incompta). Canó from Araguato, USNM 236560, 1 (53.0, paratype of C. incompta); MBUCV V-13125, 2 (55.0–62.6, paratypes of C. incompta). Stream off Río Orinoco, USNM 236556, 4 (43.8–57.3, paratypes of C. incompta). Canó from Araguato, USNM 236560, 1 (53.0, paratype of C. incompta); MBUCV V-13125, 2 (55.0–62.6, paratypes of C. incompta). Stream off Río Orinoco, USNM 236556, 4 (43.8–57.3, paratypes of C. incompta). Canó Paloma system, USNM 236559, 5 (57.9–61.5, paratypes of C. incompta); AMNH 54627, 2 (63.4–64.7, paratypes of C. incompta); BMNH 1983.3.1:5–6, 2 (55.9–59.7, paratypes of C. incompta); ANSP 150914, 2 (55.0–57.5, paratypes of C. incompta); FMNH 94589, 2 (52.0–59.3, paratypes of C. incompta); CAS 52168, 2 (52.2–59.8, paratypes of C. incompta); LACM 43297-1, 2 (52.9–60.0, paratypes of C. incompta).

Curimata roseni, new species

**Figures** 25, 26, 27

*Curimatus knerii.*—Steindachner, 1882:135 [in part, Brazil: Rio Branco].

*Curimata B.—*Vari, 1988, fig. 10 [phylogenetic biogeography]; 1989, table 2 [phylogenetic relationships].

**Diagnosis.**—The combination of 7 to 9 branched anal rays, a body depth 0.40–0.48 of SL, and the absence of any pronounced pigmentation pattern on the body distinguishes *Curimata roseni* from all other *Curimata* species with the exception of *C. cyprinoides* and *C. knerii. Curimata roseni* is distinguishable from those species in having the anteriormost rays of the dorsal fin only moderately developed and in having 31 vertebrae. *Curimata knerii* and *C. cyprinoides* have greatly developed, filiform anteriormost rays of the dorsal fin that reach in some individuals to the tip of the fin rays of the dorsal lobe of the caudal fin, and have 32 to 34 vertebrae. Numerous internal characters also distinguish *C. roseni* from those species (see "Synapomorphy List and Phylogenetic Reconstruction").

**Description.**—Body moderately elongate, somewhat compressed. Dorsal profile of head straight. Dorsal profile of body slightly convex from rear of head to origin of rayed dorsal fin; straight or slightly convex, posterodorsally slanted at base of dorsal fin, 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 median keel anterior to rayed dorsal fin, smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle, convexity more pronounced posteriorly. Prepelvic region flattened, margined laterally by distinct, nearly right, angles in body wall. Prepelvic region with a median series of enlarged scales flanked on each side by series of enlarged scales that conform in shape to lateral angle of body. Distinct median keel posterior to origin of pelvic fin, with secondary obtuse keel about two scales dorsal of ventral midline on each side of postpelvic portion of body.

Greatest body depth at origin of rayed dorsal fin, specimens above 110 mm SL usually with proportionally deeper bodies, depth 0.40–0.48 [0.46]; snout tip to origin of rayed dorsal fin 0.49–0.55 [0.54]; snout tip to origin of anal fin 0.79–0.88 [0.86]; snout tip to origin of pelvic fin 0.53–0.60 [0.59]; snout tip to anus 0.77–0.84 [0.83]; origin of rayed dorsal fin to hypural joint 0.54–0.59 [0.57]. Rayed dorsal fin pointed, anteriormost rays more developed, somewhat filiform in males, posterior margin of fin concave, anteriormost rays 4.5–5.3 times length of ultimate ray; anteriormost dorsal-fin rays less developed in juveniles and females, 4.5–5.3 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.19–0.22 [0.20], extends to or slightly beyond vertical through origin of pelvic fin. Pelvic fin pointed, length of pelvic fin 0.22–0.26 [0.25], reaches approximately three-quarters of distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, more so in males, anteriormost branched rays in males 2.5–3.7 times length of ultimate ray. Caudal peduncle depth 0.12–0.14 [0.13]. Dorsal and ventral rays of caudal fin sometimes somewhat developed, but not elongate.

Head pointed, head length 0.30–0.35 [0.31]; upper jaw longer; mouth inferior, lower jaw margin obtusely triangular from ventral view; snout length 0.29–0.35 [0.33]; nostrils of each side of head very close, anterior circular, posterior crescent shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.31–0.38 [0.33]; adipose eyelid present, with a vertically ovoid opening over center of eye; length of postorbital portion of head 0.34–0.40 [0.36]; gape width 0.26–0.34 [0.32]; interorbital width 0.40–0.46 [0.46].

Pored lateral-line scales from supracleithrum to hypural joint 43 to 55 [54]; all scales of lateral-line pored, canals in scales straight; 4 to 7 series of scales extend beyond hypural joint onto caudal fin base; 12 to 14 [13] scales in a transverse series from origin of rayed dorsal fin to lateral line, 7 to 9 [9] scales in a transverse series from the lateral line to origin of anal fin; scale margins smooth over most of body, ctenii poorly developed ventrally. Median series of enlarged prepelvic scales 12 to 14.

Dorsal-fin rays ii or iii,9 [ii,9]; anal-fin rays ii,7–9 or iii,8–9 [ii,8]; pectoral-fin rays 13 to 16 [15]; pelvic-fin rays i,8–10 [i,9].

**Total vertebrae 31** (63)

**Color in Alcohol.**—Overall coloration silvery or golden, darker on dorsal portions of head and body. Middorsal line
between rear of rayed dorsal fin and upper portion of caudal peduncle very dark. Dorsal margin and distal portion of rayed dorsal fin dusky.

DISTRIBUTION.—Rio Negro and upper Rio Madeira drainage basins (Figure 25).

ETYMOLOGY.—This species is named for Donn E. Rosen, teacher, friend, and colleague, who first introduced me to the fascinations of systematic research and who originally directed my interests to the study of characiform fishes.

REMARKS.—Steindachner (1882:135) reported Curimatus knerii from various Amazonian localities including the Rio Branco. No specimens of that species from that drainage system have been found during the present study, and one specimen which served, at least in part, as the basis for the C. kneri citation from the Rio Branco (NMW 68858) has proved to be C. roseni.

Other than for a single lot of two specimens (USNM 287593), all the cited material of Curimata roseni originated in the Rio Negro basin or portions of the Rio Amazonas system proximate to the mouth of the Rio Negro. The single lot from the upper Rio Madeira system falls within the ranges of meristic and morphometric values for the Rio Negro specimens, although the greatest body depth of the two Bolivian specimens (Figure 27) is not quite as deep as specimens of comparable size from the Rio Negro system. Additional material from intervening portions of the Rio Madeira system is necessary to determine whether that difference is significant or merely represents geographic variation.

MATERIAL EXAMINED.—56 specimens (48, 67.2–144.3).

HOLOTYPE.—BRAZIL. Roraima: Rio Branco, Cachoeira do Bem Querer, cataract pool (approx. 2°50'N, 60°43'W), M. Goulding, 8 Jan 1984, MZUSP 28651, (131.8).

PARATYPES.—BRAZIL. Roraima: Same collection data as holotype, 14 specimens: MZUSP 28652, 4 (114.2–133.7); USNM 267995, 7 (108.0–144.3); ANSP 153669, 1 (119.9); AMNH 55631, 2 (117.8–126.2). Rio Branco, Marara, USNM 267349, 3 (96.8–106.0). Rio Branco, 160 km from its mouth, GC, 3 (94.8–103.7); USNM 268595, 1 (90.3). Rio Branco, Boa Vista (approx. 2°49'N, 61°40'W), USNM 267350, 4 (83.8–92.6); BMNH 1984.8.23:1, 1 (97.9). Rio Xeruini, MZUSP 2, 2 (92.0–93.0). Rio Uraricoera near Ilha Maracá (approx. 3°25'N, 61°40'W), MZUSP 21183, 1 (110.9). Amazonas: Rio Negro, Mandiquié, M. Goulding, 8 Oct 1979, 7 specimens: MZUSP 28653, 3 (91.7–92.4); USNM 268596, 3, (90.7–96.7, 1 specimen cleared and counterstained for cartilage and bone); AMNH 55559, 1 (93.7). Rio Canumã,
NUMBER 474

GUYANA. Rupununi: Manari and Papari Rivers, BMNH 1972.7.27:417-419, 3 (104.3-127.0).

The following specimens were examined but are not part of the type series: BRAZIL. Amazonas: Lago Janaúacá, MZUSP 21697, 1 (107.3). Lower Rio Jauaperi, MZUSP 21149, 1 (86.2); MZUSP 21155, 1 (82.0). Roraima: Rio Branco, NMW 68885, 1 (89.9). Rio Branco, Bem Querer, NMW 66828, 1 (67.2); MZUSP 29542, 3. Rio Branco, Boa Vista, NMW 68822, 1; NMW 67011, 1.

VENEZUELA. Amazonas: Upper Río Orinoco, Tamatama, CAS 56607, 1 (80.8). Bifurcation of the upper Río Orinoco, USNM 267325, 1 (76.3). Río Casiquiare, Curare, CAS-SU 56812, 1.

BOLIVIA. Beni: Iteenez (Londra) and Río Blanco, USNM 287593, 2.

*Curimata cyprinoides* (Linnaeus)

**FIGURES 28, 29, 30**


*Charaxus* 378.—Gronovius, 1763:123 [America].

*Salmo cyprinoides* Linnaeus, 1758:514 [type locality: Surinam].

*Salmo Cyprinoides*—Bonaterre, 1788:169 [America].

*Salmo edentulus* Bloch, 1794, pl. 380 [type locality: Surinam].—Blok and Schneider, 1801:412 [Surinam].—International Commission of Zoological Nomenclature, 1966:41 [designated as type species of *Curimata Bosc*, 1817].

*Characius cyprinoides*—Lacépède, 1803:270-274 [*Salmo edentulus* and *Salmo carpeaus* placed in synonymy].

*Anodos cyprinoides*—Müller and Troschel, 1845:7 [Guiana].


*Charax planirostris* Gray 1854:154 [type locality: Rivers of South America; based on Charax 378, Gronovius, 1763].

*Curimata cyprinoides*—Castelnau, 1855:57 [error in spelling, Amazon].


*Curimata planirostris*—Günther, 1864:293 [in part, not *Curimata abramoides* synonymy or geographic distribution].—Eigenvann and Eigenmann, 1889:431 [references in part, not cited specimens]; 1891:489 [reference in part, not *C. abramoides* synonymy].

*Curimata copei* Fowler, 1906:301, fig. 7 [type locality: Surinam].—Fowler, 1919:130 [Surinam].—Fély, 1977:230 [Surinam].


*Curimata knerii*—Eigenvann and Bean, 1907:661 [Amazon].

*Curimata knerii*—Eigenvann and Ogle, 1907:4 [Brazil: Pará].


*Curimata copei*—Eigenvann, 1910:422 [reference].—Fernández-Yépez, 1948:73 [reference; possible assignment to *Cruzinata*].


*Bitricarinata schomburgkii*—Fernández-Yépez, 1948:64, fig. 34 [designation as type species of *Bitricarinata*].


*Curimata cyprinoides schomburgkii*—Gély, 1977a:230 [placement of *Curimata schomburgkii* Günther as a subspecies of *Salmo cyprinoides Linnaeus*; Guianas].

**DIAGNOSIS.**—The combination of a body depth 0.40-0.47 of SL, 7 to 9 branched anal rays, and the lack of any marked body pigmentation patterns distinguishes *Curimata cyprinoides* from other members of the genus with the exception of *C. knerii* and *C. roseni*. *Curimata cyprinoides* has 46 to 56 lateral line scales from the supracaudalium to the hypural joint, 15 to 17 enlarged median prepelvic scales, and 32 (very rarely 31 or 33) vertebrae. This contrasts with 31 vertebrae and 12 to 14 enlarged median prepelvic scales in *Curimata roseni*, and 33 or 34 vertebrae and 56 to 63 lateral-line scales in *C. knerii*. *Curimata cyprinoides* and *C. roseni* also differ in numerous internal characters (see "Synapomorphy List and Phylogenetic Reconstruction"). *Curimata cyprinoides* and *C. knerii* although having somewhat overlapping lateral-line counts, demonstrate significantly different modal values for that meristic value (Figure 29).

**DESCRIPTION.**—Body moderately elongate, somewhat compressed. Dorsal profile of head straight or slightly convex in small specimens, straight or slightly concave in larger individuals. Dorsal profile of body distinctly curved from rear of head to origin of rayed dorsal fin; straight or slightly posteroventrally slanted at base of dorsal fin; gently convex from base of last dorsal-fin ray to 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 region ventral of middle of pectoral fin, convexity increased from that point to origin of pelvic fin, gently sigmoid from...
Figure 28.—Curimatus cyprinoides, USNM 225214, 149.8 mm SL; Surinam, Nickerie District, Corantijn River at Matapi.

there to caudal peduncle. Prepelvic region flattened, margined laterally by distinct, nearly right, angles in body wall, prepelvic region with median series of enlarged scales flanked on each side by series of enlarged scales that conform in shape to lateral angle of body. Well developed median keel posterior to pelvic fin origin, with secondary obtuse angle in body wall about two scales dorsal of ventral midline on each side of postventral portion of body.

Greatest body depth at origin of rayed dorsal fin, depth 0.40–0.47; snout tip to origin of rayed dorsal fin 0.48–0.55; snout tip to origin of anal fin 0.79–0.85; snout tip to origin of pelvic fin 0.53–0.59; snout tip to anus 0.76–0.82; origin of rayed dorsal fin to hypural joint 0.53–0.60. Rayed dorsal fin pointed, anteriormost rays in some individuals reaching to tip of dorsal lobe of caudal fin. Pectoral fin pointed; length of pectoral fin 0.18–0.24, extends three-quarters distance to vertical through origin of pelvic fin. Pelvic fin pointed, length of pelvic fin 0.20–0.28, reaches three quarters distance to origin of anal fin. Caudal fin forked, dorsalmost and ventralmost principal fin rays moderately filiform in some individuals. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays 3.5–4.6 times length of ultimate fin ray. Caudal peduncle depth 0.11–0.13.

Head distinctly pointed, head length 0.30–0.36; upper jaw longer, mouth inferior; snout length 0.28–0.34; nostrils very close, anterior circular, posterior crescent shaped with aperture closed by thin flap of skin separating nares; eye large, orbital diameter 0.31–0.37; adipose eyelid well-developed, particularly in larger individuals, with vertically ovoid opening over center of eye; length of postorbital portion of head 0.34–0.42; gape width 0.27–0.34; interorbital width 0.35–0.43.

Pored lateral-line scales from supracleithrum to hypural joint 46 to 56; all scales of lateral-line pored, canals in scales straight or somewhat divergent; 4 to 8 series of scales extend beyond hypural joint onto caudal fin base; 13 to 16 scales in transverse series from origin of rayed dorsal fin to lateral line; 7 to 10 scales in transverse series from the lateral line to origin of anal fin. Median series of enlarged prepelvic scales 15 to 17.

Dorsal-fin rays ii,8–10; anal-fin rays ii,8–9 or iii,7–9; pectoral-fin rays 13 to 16; pelvic-fin rays i,8 or 9 (i,8 relatively rare).

Total vertebrae 31 (7), 32 (101), 33 (3).

Color in Alcohol.—Overall coloration in specimens that retain guanine on scales golden or silvery-golden, darker on dorsal portions of head and body. Specimens that lack guanine on scales yellowish-tan to brown, darker on dorsal portions of head and body. No pronounced markings on head or body. Middorsal region from rear of head to upper caudal peduncle with obscure dark band. Rayed dorsal and caudal fins dusky, with series of small chromatophores outlining fin rays. Individuals under 30 mm SL with distinct black blotch on distal half of anterior rays of dorsal fin. Anteriormost anal fin rays and dorsalmost rays of pectoral fin with chromatophores along margins; other portions of fins hyaline. Pelvics hyaline or with some chromatophores along fin-ray margins in larger specimens. Adipose fin dusky.

Distribution.—Lower Rio Orinoco, Atlantic drainages of the Guianas, lower Rio Amazonas (Figure 30).

Common Name.—Brazil: Branquiha-baia (Santos et al., 1985:28).

Life History.—Santos et al. (1985:28–29) report that this species is one of the most common and abundant species along the Rio Tocantins system of eastern Brazil. The species is cited by those authors as eating organic detritus, benthic organisms and periphyton. Sexual maturity occurs at approximately 13 cm (?SL), with breeding taking place in that basin between November and January.

Remarks.—The first use of the specific name cyprinoides (in Salmo cyprinoides Linnaeus, 1766) is predated by that of Salmo immaculatus (Linnaeus, 1758), a form considered conspecific in this work (Table 3). Salmo immaculatus, described in 1758, was not definitely recognized as a curimatid until a recent paper by Fernholm and Wheeler (1983:215), and was not cited in a systematic study in the nearly two centuries that passed between Walbaum’s brief reference (1792) and the paper by Fernholm and Wheeler (1983:215) who equated that species with Curimatus schomburgkii Günther (1864:291). The International Commission on Zoological Nomenclature (1966:41–
45) ruled that *immaculatus* of Linnaeus (1958) is suppressed for the purposes of the Law of Priority. *Curimata cyprinoides* is consequently used in this study.

The specimen or specimens that served as the basis for Linnaeus' description (1766) of *Salmo cyprinoides* are not known to be extant in the holdings of the Swedish Museum of Natural History (Fernholm and Wheeler, 1983), the Linnean Society, London (Wheeler, 1985), or any other repository known to contain types of Linnaeus' species (A. Wheeler, pers. commun.).

Gronovius' *Charax* 378 (1763:123) and *Charax planirostris*, the species based on it that was subsequently made available by Gray (1854:154), are tentatively considered as synonyms of *Curimata cyprinoides*. Neither the original Gronovius description, nor the manuscript illustration of the species by Gronovius now in the British Museum (Natural History) (see Vari, 1984a, fig. 7) permit a definite identification of the species. Nonetheless the overall body form, positions of the fins, and body and head proportions of the specimen in the illustration agree with those of a juvenile of *Curimata cyprinoides*. Furthermore it is likely that the specimens available to Gronovius originated in northeastern South

![Figure 29](image)

**Figure 29.**—Histograms of number of pored lateral-line scales to the hypural joint (II) against number of specimens (n) for *Curimata cyprinoides* (A) and *Curimata kneri* (B).

![Figure 30](image)

**Figure 30.**—Geographic distribution of *Curimata cyprinoides* (some symbols represent more than one collecting locality or lot of specimens).
America, a region of the continent that was one of the first to be sampled for fishes. Such is the case with other Gronovius species such as *Plecostomus* no. 69 (Gronovius, 1754:26–27) which is conspecific with *Loricaria cataphracta* Linnaeus, the distribution of which (Isbrücker, 1981:58–66) is very similar to that of *Curimatus cyprinoides*.

The synonymy of *Charax planirostris* into *Curimata cyprinoides* is congruent with the action of Linnaeus (1766:514) who placed *Charax* 378 as a synonym of his *Salmo* (= *Curimata*) *cyprinoides*. It contrasts with the practice initiated by Günther (1864) that placed *Charax planirostris* as the senior synonym of *Curimatus abramoides* of Kner (1859:142). That synonymy also diverges from previous associations of *Charax planirostris* (as *Semitapicis planirostris*) with elements of the multispecific assemblage defined as *Potamorhina* by Vari (1984a) (see Vari, 1984a:13–16, for a discussion of the basis for these actions).

Günther (1864:291) noted the similarity of his *Curimatus schomburgkii* from Guyana and *C. cyprinoides* (Linnaeus) originally described from Surinam, but did not elaborate on the perceived differences between the nominal forms that lead him to describe a new species. Starks (1913:13) although identifying material from Pará, Brazil as *Curimatus schomburgkii*, nonetheless noted that his material seemed identical to British Guiana (= Guyana) specimens and should be probably referred to as *Curimatus cyprinoides* (Linnaeus). The meristic and morphometric values listed for *C. schomburgkii* fall within the range of *C. cyprinoides* (Table 3) and a re-examination of the majority of the type series of *C. schomburgkii* fails to reveal any basis for a continued recognition of the latter species as distinct. It is consequently placed into the synonymy of *C. cyprinoides*.

*Curimatus schomburgkii* was described by Günther (1864:291) from a series of specimens collected in British Guiana (= Guyana). The single specimen (BMNH 1978.9.12:2) presented by Schomburgk (specimen “a” of Günther [1864:292]) is designated as the lectotype of the species. The remaining specimens thus become paralectotypes. Of these, two speci-

### Table 3

<table>
<thead>
<tr>
<th>Character</th>
<th>Character</th>
<th>Morphometrics</th>
<th>Meristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Length</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Greatest body depth</td>
<td>51.7</td>
<td>62.6–108.5</td>
<td>100.0</td>
</tr>
<tr>
<td>1. Snout to dorsal-fin origin</td>
<td>0.42</td>
<td>0.41–0.46</td>
<td>0.41</td>
</tr>
<tr>
<td>2. Snout to anal-fin origin</td>
<td>0.52</td>
<td>0.48–0.52</td>
<td>0.51</td>
</tr>
<tr>
<td>3. Snout to pelvic-fin origin</td>
<td>0.84</td>
<td>0.82</td>
<td>0.81</td>
</tr>
<tr>
<td>4. Snout to anus</td>
<td>0.56</td>
<td>0.53–0.56</td>
<td>0.53</td>
</tr>
<tr>
<td>5. Origin of rayed dorsal fin to hypural joint</td>
<td>0.79</td>
<td>0.78–0.80</td>
<td>0.77</td>
</tr>
<tr>
<td>6. Head length</td>
<td>0.58</td>
<td>0.57–0.60</td>
<td>0.60</td>
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<tr>
<td>7. Pectoral fin length</td>
<td>–</td>
<td>0.20–0.24</td>
<td>–</td>
</tr>
<tr>
<td>8. Pelvic fin length</td>
<td>–</td>
<td>0.22–0.25</td>
<td>–</td>
</tr>
<tr>
<td>9. Caudal peduncle depth</td>
<td>0.13</td>
<td>0.12–0.13</td>
<td>0.13</td>
</tr>
<tr>
<td>10. Head length</td>
<td>0.35</td>
<td>0.32–0.35</td>
<td>0.34</td>
</tr>
<tr>
<td>11. Snout length</td>
<td>0.30</td>
<td>0.29–0.32</td>
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</tr>
<tr>
<td>12. Orbital diameter</td>
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<td>0.30–0.35</td>
<td>0.34</td>
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<tr>
<td>13. Postorbital length</td>
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<td>0.39–0.41</td>
<td>0.40</td>
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<td>14. Interorbital width</td>
<td>0.42</td>
<td>0.40–0.42</td>
<td>0.41</td>
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<tr>
<td>Lateral line scales</td>
<td>53</td>
<td>53–54</td>
<td>497</td>
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<tr>
<td>Scale rows between dorsal-fin origin and lateral line</td>
<td>16</td>
<td>14</td>
<td>147</td>
</tr>
<tr>
<td>Scale rows between anal-fin origin and lateral line</td>
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<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Branched dorsal-fin rays</td>
<td>9</td>
<td>8–9</td>
<td>9</td>
</tr>
<tr>
<td>Branched anal-fin rays</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Total pectoral-fin rays</td>
<td>13?</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Branched pelvic-fin rays</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Vertebrae</td>
<td>–</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>
mens (the “specimen d” purchased from Scrivener (BMNH 1848.7.1.35) that was cited by Günther (1864:291), and the dried skin referred to by that author (his “specimen c,” BMNH uncatologued) were examined and their conspecificity with the lectotype confirmed. Günther’s specimens “b” and “e” were not located in the holdings of the BMNH. Additional Scrivener specimens from British Guyana (BMNH 1862.12.15:68, 2 specimens), although presumably available to Günther, do not appear to have been referred to by that author in the original description of the species.

More recently Fowler (1906:301) described another nominal species from Surinam, Curimata copei. The holotype of the species (ANSP 8201) is in very poor condition and was already damaged when examined by Fowler as indicated by the incomplete fins in the original illustration and the uncertainty on Fowler’s part as to the number of scales in the lateral line. Fowler noted the similarity of his C. copei to C. schomburgkii (= C. cyprinoides in this study) but distinguished the two species on the basis of the more anteriorly gibbous profile of the body in C. copei. A radiographic plate of the holotype of the latter species has revealed that the marked gibbosity is the function of a postmortem break in the vertebral column and the dorsal displacement of the posterior portion of the body in the very soft specimen. No character has been found to distinguish C. copei from C. cyprinoides (Table 3), and the species are consequently considered conspecific.

Curimata cyprinoides has been cited from a broad geographic range including the middle and upper Rio Amazonas basin and the rivers of eastern Brazil; areas beyond the distribution range recognized in this study. Cope (1872:291) listed Curimatus cyprinoides from the Rio Solimões; an identification subsequently modified by Fowler (1906:305) to Psectrogaster ciliatus (Müller and Troschel). In actuality, the specimen in question (ANSP 8208-9) are Psectrogaster amazonica Eigenmann and Eigenmann reported on by Steindachner (NMW 66885, 66938). A notable degree of variation in overall body form exists in this species across its range, a situation that might be expected in such a geographically wideranging form. Specimens from the southerly portions of the species range typically have more slender bodies with smoother body profiles. No discrete differences subdividing the species have been found, and further research is necessary to determine the significance, if any, of this variation.

Material examined.—2843 specimens (93, 40.5-212.9). “AMERICA.” NRM LP 76, 1 (51.7, holotype of Salmo immaculatus Linnaeus).


Guyana. No specific locality, BMNH 1978.9.12:2, 1 (108.5, lectotype of Curimatus schomburgki); BMNH 1862.12.15:68, 2 (62.6-120.3, paralectotypes of Curimatus schomburgki); BMNH 1959.3.17:95, 1. Essequibo: Manari, BMNH 1972.7.27:417-419, 3 (1, 127.3). Morabelli, Essequibo River, BMNH 1972.10.17:3258-3259, 2 (1, 56.3). Cuyuni River near Kortabo, AMNH 51634, 4; AMNH 51635, 1. Marau River, BMN 1934.9.12:343-347, 5 (2, 90.2-109.3). Georgetown, USNM 267242, 1. Georgetown, Botanic Gardens, BMNH 1974.5.22:503-504, 2 (172.9-175.1). Korenabo Rubber Plantation, AMNH 7089, 3; BMNH 1911.10.31:192-195, 5 (2, 120-90.6); USNM 66144, 3 (57.4-83.9); USNM 267333, 1; MCZ 30045, 1 (86.2). Lama Stop-Off, MCZ 30049, 1 (111.5); USNM 66143, 1 (120.0); USNM 267333, 1; BMNH 1911.10.31:190-191, 2 (1, 132.1). Morowanna, USNM 267343, 2 (52.0-57.9). Hyde Park River, BMNH 1922.3.29:8, 1. Potaro River, AMNH 4469, 3.

Surinam. No specific locality, ANSP 8201, 1 (approx. 100.0, holotype of Curimata copei); MCZ 792, 1 (176.2). Nickerie: Corantijn River, BMNH 1981.6.9:820. Corantijn River, Koekwiek Creek, USNM 267321, 1; USNM 267351, 1.
Corantijn River, Matapi, USNM 225214, 24 (9, 132.2–164.1).
Corantijn River, Maklikabroe, USNM 225619, 4 (79.2–113.9).
Corantijn River, Camp MacClemmen, USNM 226158, 1 (170.2).
Corantijn River, USNM 225403, 2 (116.2–122.5); USNM 225188, 7;
USNM 225616, 1; USNM 225186, 2; USNM 225618, 1;
Dalibana Creek, USNM 225250, 1.
Morawijne: Ferreira Gomes, MZUSP 32282, 1892; USNM 267964, 3
River, In ery Creek, BMNH 1926.3.2:592-594, 3 (40.5-66.5).
BMNH 1926.3.2:586-591, 6 (3, 115.7-200.5). Approuague
Parana Sammuma, MZUSP 21250, 8 (4, 110.2-121.1).
Lagoa near Jatobal, MZUSP 21319, 8. Mouth of Rio Tocantins,
Furo de Panaquera, MZUSP 21244, 1 (131.4). Rio Tocantins,
Mahury River near Cayanne, USNM 220535, 153 (10 of
56.1-75.9).
BRAZIL. Amapá: Cupixi, MZUSP 32254, 3. Rio Araguaui,
Ferreira Gomes, MZUSP 32282, 1892; USNM 267964, 3
(110.5–163.4). Rio Amapá, Cacheira Grande, MZUSP 32253,
512; USNM 267962, 15 (5, 122.0–212.9). Pard: no specific
locality, BMNH 1898.10.11:7, 1; MCZ 794, 2 (77.3–93.4);
AMNH 3769, 5 (66.7–131.3); USNM 34576, 2 (88.5–94.7).
Marajo Island, BMNH 1923.8.11:4, 1 (157.0). Belém, Rio
Guamá, MZUSP 20789, 1 (65.0). Rio Capim, BMNH 1849.11.8:55–56,
2 (138.1–164.5). Rio Capim, Vila Santana, MZUSP 21232,
7 (2, 111.2–112.7); MZUSP 21199, 4 (2, 150.0–167.5); MZUSP 21198,
3 (1, 146.3). Igarapé Sororoca, Furo de Panaquera, MZUSP 21244,
1 (131.4). Rio Tocantins, Lagoa near Jatobal, MZUSP 21319,
8. Mouth of Rio Tocantins, Parana Sammuma, MZUSP 21250,
8 (4, 110.2–121.1). Vicinity of Vila Maiuataí, MZUSP 21235,
7 (3, 65.7–70.7); MZUSP 21237, 1 (64.0); MZUSP 21236,
5. Rio Tocantins near Tucurui, MZUSP 21293, 1; MZUSP 21327,
1. Igarape Coelho, mouth of Rio Tocantins, MZUSP 21245,
6. Rio Itacaiuns, Cacheira do Calderiao, USNM 267961,

Curimata knerii Steindachner

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Curimatus macropterus.—Eigenmann and Eisenm a, 1889:430 [one specimen from San Paolo (= Sao Paulo de Oliveira)].


DIAGNOSIS.—The combination of a body depth 0.40–0.47 of SL, 7 to 9 branched anal-fin rays, and the lack of any marked body pigmentation pattern distinguishes Curimata knerii from all other members of the genus with the exception of C. cyprinoides and C. roseni. Curimata knerii has 33 or 34 vertebrae, 56 to 63 pored lateral-line scales, and 15 to 17 enlarged median prepelvic scales. This contrasts with 31 vertebrae and 12 to 24 enlarged median prepelvic scales in Curimata roseni and typically 32, rarely 31 or 33, vertebrae and 46 to 56 lateral-line scales in C. cyprinoides. Curimata knerii and C. cyprinoides have overlapping lateral-line counts, but demonstrate significantly different modal values for that meristic value (Figure 29).

DESCRIPTION.—Body moderately elongate, somewhat compressed. Dorsal profile of head straight or very slightly concave in smaller individuals, straight in larger specimens. Dorsal profile of body distinctly curved from rear of head to origin of rayed dorsal fin; straight or slightly convex, posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal body surface with an indistinct median keel anterior to rayed dorsal fin, smoothly rounded transversely posterior to fin. Ventral body profile nearly straight from tip of lower jaw to region of vertical through middle of pectoral fin, more convex from that point to origin of pelvic fin, then somewhat sigmoid to caudal peduncle. Prepelvic region flattened, margined laterally by distinct, nearly right, angles in body wall. Prepelvic region with median series of enlarged scales flanked on each side by series of enlarged scales that conform in shape to lateral angle of body. Well developed median keel posterior to pelvic fin origin with secondary obtuse angle in body about two scales dorsal of ventral midline on each side of postventral portion of body.

Greatest body depth at origin of rayed dorsal fin, depth 0.38–0.44 [0.41]; snout tip to origin of rayed dorsal fin 0.48–0.53 [0.51]; snout tip to origin of anal fin 0.79–0.84 [0.82]; snout tip to origin of pelvis fin 0.52–0.56 [0.52]; snout tip to anus 0.75–0.80 [0.79]; origin of rayed dorsal fin to hypurral joint 0.54–0.60 [0.60]. Rayed dorsal fin pointed, anteriormost rays filiform in some individuals, reaching to tip of dorsal rays of dorsal lobe of caudal fin. Pectoral fin pointed; length of pectoral fin 0.19–0.24 [0.22], extends to or slightly short of vertical through origin of pelvis fin in smaller adults, falls short of that line in largest specimens examined. Pelvis fin pointed, length of pelvic fin 0.19–0.26 [0.23], reaches three-quarters of distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays three to four times length of ultimate ray. Caudal peduncle depth 0.11–0.13 [0.12].

Head distinctly pointed, head length 0.28–0.33 [0.30]; upper jaw longer, mouth inferior; snout length 0.26–0.34 [0.30]; nostrils of each side of head very close, anterior circular, posterior crescent shaped with aperture closed by thin flap of skin that separates nares; eye relatively large, orbital diameter 0.29–0.35 [0.30]; adipose eyelid well-developed, particularly in larger specimens, with vertically ovoid opening over center of eye; length of postorbital portion of head 0.38–0.43 [0.42];
gape width 0.27–0.34 [0.27]; interorbital width 0.42–0.48 [0.44].

Pored lateral-line scales from supracleithrum to hypural joint 56 to 63 [59]; all scales of lateral-line pored, canals in scales straight; 5 to 8 series of scales extend beyond hypural joint onto caudal fin base; 14 to 16 [15] scales in transverse series from origin of rayed dorsal fin to lateral line; 9 to 11 [9] scales in transverse series from the lateral line to origin of anal fin. Median series of enlarged prepelvic scales 15 to 17.

Dorsal-fin rays ii or iii,9 [ii,9]; anal-fin rays ii,7–9 or iii,8–9 [ii,8]; pectoral-fin rays 13 to 17 [15]; pelvic-fin rays i,8 or 9 (i,8 rare) [i,9].

Total vertebrae 33 (59), 34 (3).

COLOR IN ALCOHOL.—Overall coloration in specimens that retain guanine on scales silvery or silvery-golden, darker on dorsal portions of head and body. Specimens that lack guanine on scales tan to tannish-brown, darker dorsally. No pronounced pigmentation pattern on body and head. Middorsal region from rear of head to upper caudal peduncle with obscure dark band. Rayed and adipose dorsal fins, and caudal fin dusky. Small chromatophores outline fin rays, particularly elongate anteriormost dorsal-fin rays. Anteriormost rays of anal fin and dorsalmost rays of pectoral fin somewhat dusky.

DISTRIBUTION.—Middle and upper portions of Rio Amazonas drainage basin (Figure 32).

COMMON NAME.—In Peru: “yahuarachi” (Ortega and Vari, 1986;11).

LIFE HISTORY.—Goulding et al. (1988:132) report that this
species is a detritivore. Bayley (1988:131) provides various data on growth rates and detritivory in the species.

REMARKS.—Steindachner (1882:135) reported Curimatus knerii from the Rio Branco and Surinam. The former citation is based, at least in part, on material of Curimata roseni (NMW 68858), and the latter on specimens of C. cyprinoides.

Eigenmann and Bean (1907:667) and Eigenmann and Ogle (1907:4) reported Curimatus knerii from the lower Amazon River. Examination of the specimens in question (USNM 34697, 52540) has shown that they are actually C. cyprinoides. Eigenmann and Eigenmann (1889:430) tentatively associated specimens from San Paolo (= São Paulo de Olivença) with their species, C. macrops, which is considered to be endemic to northeastern Brazil in the present study. One of the specimens (MCZ 60887) is rather Curimatus knerii.

MATERIAL EXAMINED.—153 specimens (50, 51.4-177.3).


PERU. Loreto: Iquitos, MZUSP 15230, 1 (111.5); MZUSP 15237, 1 (118.3).

Curimata knerii. —Eigenmann and Eigenmann, 1889:430 [type locality: Rio Puy (= Poti), San Gonçalo (= São Gonçalo); not specimens questionably listed from San Paolo (= São Paulo de Olivença).—Eigenmann, 1910:422 [reference].—Fernández-Yépez, 1948:72 [reference].

Curimata knerii. —Fowler, 1941:166, fig. 78 [Ceará: Fortaleza (= Fortaleza); Piaubuy (= Piata): Therezina (= Teresina)]; 1950:276, fig. 335 [citation].


Curimata knerii. —Géry, 1977b:230 [in key, not Sao Paulo citation].—Vare, 1989, tables 2, 3 [phylogenetic relationships].

DIAGNOSIS.—Curimata knerii can be distinguished from all other members of the genus with the exception of C. mivartii by the combination of 10 to 12 branched anal-fin rays, and 57 to 67 pored lateral-line scales to the hypural joint. Curimata knerii is separable from C. mivartii by its deeper body (0.37-0.42 of SL vs. 0.33-0.39), overall body form, and the presence in the prepelvic region of distinct, nearly right, lateral angles in the body wall and a discrete midventral series of enlarged scales. In C. mivartii, in contrast, the prepelvic region is transversely rounded and the scales on that region are neither enlarged nor arranged in discrete longitudinal series.

DESCRIPTION.—Body moderately elongate, somewhat compressed. Dorsal profile of head straight. Dorsal profile of body slightly convex from rear of head to origin of rayed dorsal fin in juveniles, distinctly convex in larger specimens; straight and posterovertrally 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 posterior to fin. Ventral body profile gently curved from tip of lower jaw to caudal peduncle. Prepelvic region distinctly flattened, margined laterally by obtuse longitudinal angles in body wall; prepelvic region with median series of enlarged scales flanked on either side by series of enlarged scales that conform in shape to lateral angles in body wall. Well developed median keel posterior to pelvic fin insertion with secondary, obtuse lateral angles in body wall three scales dorsal of ventral midline on each side of postpelvic portion of body.

Greatest body depth at origin of rayed dorsal fin, depth 0.37-0.42 [0.42]; snout tip to origin of rayed dorsal fin 0.49-0.54 [0.52]; snout tip to origin of anal fin 0.76-0.81 [0.78]; snout tip to origin of pelvic fin 0.52-0.55 [0.52]; snout tip to anus 0.72-0.77 [0.76]; origin of rayed dorsal fin to hypural joint 0.53-0.57 [0.57]. Rayed dorsal fin pointed, less so with increasing age; anterior-most rays 3.2-4.3 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.19-0.24 [0.21], extends to or slightly beyond vertical through origin of pelvic fin. Pelvic fin pointed, length of pelvic fin 0.21-0.23 [0.21], reaches three-quarters of distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anterior-most branched rays twice length of ultimate ray. Caudal peduncle depth 0.11-0.12 [0.12].

Head distinctly pointed, head length 0.31-0.36 [0.33]; upper jaw longer; mouth inferior; lower jaw obtusely triangular anteriorly; snout length 0.26-0.30 [0.29]; nostrils of each side of head very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin that separates nares; orbital diameter 0.29-0.32 [0.30]; adipose eyelid present,
moderately developed, with vertically ovoid opening over middle of eye; length of postorbital portion of head 0.39–0.44 [0.43]; gape width 0.25–0.30 [0.25]; interorbital width 0.37–0.41 [0.39].

Pored lateral-line scales from supracleithrum to hypural joint 57 to 67 [65]; all scales of lateral-line pored, canals in scales straight; 5 to 8 series of scales extend beyond hypural joint onto caudal-fin base; 16 to 19 [17] scales in transverse series from origin of rayed dorsal fin to lateral line, 10 to 12 [12] scales in transverse series from the lateral line to origin of anal fin. Scales somewhat ctenoid along ventral portion of body.

Rayed dorsal-fin rays ii,9–10 [ii,9]; anal-fin rays ii,10–12 or iii,10–11 [ii,10]; pectoral-fin rays 14 to 16 [15]; pelvic-fin rays i,7–9 [i,9].

Total vertebrae 32 (15).

COLOR IN ALCOHOL.—Overall coloration in specimens which retain guanine on scales is silvery-golden; darker on dorsal portions of head and body. Specimens lacking guanine on scales tan to brown with scattered small chromatophores over dorsal portion of body. No distinct pigmentation pattern on head, body or fins. Rays of caudal and rayed dorsal fin outlined by series of small chromatophores.

DISTRIBUTION.—Rio Parnaiba drainage basin (Figure 34).

REMARKS.—Eigenmann and Eigenmann (1889:429) described Curimatus macrops from a series of species collected in the Rio Parnaiba drainage basin. A 109.0 mm SL specimen from the Rio Poti (MCZ 20309) is selected as the lectotype. The remaining specimens (USNM 120249, MCZ 20301, 20302, 20305, 20311) thus become paralectotypes.

In their original description of Curimatus macrops, Eigenmann and Eigenmann (1889:430) questionably equated some specimens from San Paolo (= São Paulo de Olivença) on the Rio Solimões with C. macrops. Examination of the specimens in question (MCZ 20221) has shown that they are not C.
macrops, but rather C. cisandina (MCZ 20221) and C. kneri (MCZ 60887; out of MCZ 20221)

MATERIAL EXAMINED.—120 specimens (41, 55.4–175.6 mm SL).

BRAZIL. Piauí. Rio Puty (= Poti). MCZ 20305, 11 (4, 117.7–128.3, paralecotypes of Curimatus macrops); MCZ 20302, 1 (133.1, lectotype of Curimatus macrops); MCZ 20301, 10 (4, 141.1–141.5, paralecotypes of Curimatus macrops); MCZ 20309, 1 (109.0, lectotype of Curimatus macrops); NMW 68905, 3 (100.3–123.9); NMW 68878, 3; NMW 68879, 4; NMW 68880, 4; NMW 68881, 4; NMW 68882, 3. San Gonçalo (= Sáo Gonçalo), USNM 120249, 3 (124.5–151.0, paralecotypes of Curimatus macrops); NMW 20311, 5 (113.5–175.6, paralecotypes of Curimatus macrops). Teresina, NMW 66901, 4 (115.7–119.3); USNM 258769, 4 (109.6–128.0); NMW 66891, 4; NMW 66899, 4; NMW 66900, 4; NMW 66903, 4; NMW 66904, 4; NMW 66905, 1; MZUSP 5095, 2. Rio Parnaiba near Buriti dos Lopes, MCZ 46801, 11 (3, 66.4–70.4); MCZ 46799, 6 (3, 64.3–73.4). Rio Parnaiba at Floriana, USNM 267313, 3. Maranhão: Rio Parnaiba basin, Engenho de Aqua, NMW 68826, 1 (106.9); NMW 68875, 5; NMW 68877, 5. Rio Parnaiba, USNM 267341, 5 (55.4–77.3).

Curimatus mivartii Steindachner

FIGURES 34, 35

Curimatus Mivartii Steindachner, 1878:48, pl. 13, fig. 1 [type locality: Rio Magdalena]; 1880:67 [Rio Cauca].


Bondichthys mivartii.—Whitley, 1954:134 [assignment to Bondichthys].


Curimatus mivartii.—Vari, 1988:343, fig. 12 [phylogenetic biogeography]; 1989, tables 2, 3 [phylogenetic relationships].

DIAGNOSIS.—Curimatus mivartii is distinguishable from all other members of the genus with the exception of C. macrops in its possession of 10 or 11 branched anal-fin rays, and 63 to 76 pored lateral-line scales to the hypural joint. Curimatus mivartii is separable from C. macrops in overall form of the body, by its greatest body depth (0.33–0.39 of SL vs. 0.37–0.42 of SL), and in having a transversely rounded prepelvic region without distinct longitudinal series of enlarged scales. In C. macrops, in contrast, the prepelvic region is flattened and has a median series of enlarged scales flanked on each side by a comparable sized series of scales that conform in shape to the lateral angles of the prepelvic region of the body.

DESCRIPTION.—Body relatively elongate, somewhat compressed. Dorsal profile of head straight. Dorsal profile of body slightly convex from rear of head to origin of rayed dorsal fin; straight and posteroventrally slanted at base of dorsal fin, straight or very slightly convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with median keel anterior to rayed dorsal fin, smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to vertical through origin of pectoral fin, flattened or slightly convex from that point to anus, somewhat sigmoid from anus to caudal peduncle. Prepelvic region not distinctly flattened, scales irregularly arranged, without distinct median series of scales, prepelvic scales not enlarged. Well developed median keel posterior to pelvic fin origin.

Greatest body depth at origin of rayed dorsal fin, depth 0.33–0.39 [0.36]; snout tip to origin of rayed dorsal fin 0.47–0.52 [0.50]; snout tip to origin of anal fin 0.75–0.81 [0.78]; snout tip to origin of pelvic fin 0.47–0.51 [0.49]; snout tip to anus 0.73–0.78 [0.75]; origin of rayed dorsal fin to hypural joint 0.54–0.66 [0.57]. Rayed dorsal fin pointed, less so with increasing age; anteriormost rays 3.5–4.1 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.17–0.22 [0.22], extends to or slightly beyond vertical through origin of pelvic fin in smaller adults, falls somewhat short of

FIGURE 35.—Curimatus mivartii, USNM 79195, 130.8 mm SL; Colombia, Atlantico, Barranquilla.
that line in largest specimens examined. Pelvic fin pointed, length of pelvic fin 0.19–0.27 [0.27]; reaches to or falls slightly short of anus. Caudal fin forked. Adipose fin well developed. Anal fin margin very emarginate, anteriormost branched rays approximately three times length of ultimate ray. Caudal peduncle depth 0.12–0.13 [0.13].

Head distinctly pointed, head length 0.29–0.34 [0.31]; upper jaw longer; mouth inferior, lower jaw distinctly triangular anteriorly; snout length 0.26–0.32 [0.26]; nostrils of each side of head very close, anterior circular, posterior crescent shaped with aperture closed by thin flap of skin that separates nares; orbital diameter 0.24–0.31 [0.27]; adipose eyelid present, with a vertically ovoid opening over middle of eye; length of postorbital portion of head 0.44–0.50 [0.46]; gape width 0.24–0.30 [0.24]; interorbital width 0.40–0.44 [0.40].

Pored lateral-line scales from supracleithrum to hypural joint 63 to 76 [66]; all scales of lateral-line pored, canals in scales straight, 4 to 7 series of scales extend beyond hypural joint onto caudal fin base; 16 to 18 [18] scales in transverse series from origin of rayed dorsal fin to lateral line, 11 to 15 [14] scales in transverse series from the lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or iii,9 [ii,9]; anal-fin rays ii,10–11 or iii,10 [iii,10]; pectoral-fin rays 14 to 17 [17]; pelvic-fin rays i,9 [i,9].

Total vertebrae 32 (9).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery, darker on dorsal portions of head and body. No pronounced pigmentation pattern on head or body. Membranes of caudal and rayed dorsal fins with numerous small chromatophores, particularly between middle rays of caudal fin.


DISTRIBUTION.—Río Magdalena, Río Cauca, Río San Jorge, Río Sinú (Figure 34).

REMARKS.—Steindachner (1878:48) described Curimatus Mivartii from a syntopic series of unspecified size collected in the Río Magdalena. A 118.1 mm SL specimen (NMW 68759.1) is designated as the lectotype. The remaining known syntopic specimens (NMW 68759.2, NMW 68760, ZMUC 88) thus become paralexotypes.

MATERIAL EXAMINED.—29 specimens (18, 44.7–246.0).

COLOMBIA. Río Magdalena. NMW 68759.1, 1 (118.1, lectotype of Curimatus Mivartii); NMW 68759.2, 1 (132.2, paratype of Curimatus Mivartii); NMW 68760, 3 (126.4–137.1, paratypes of Curimatus Mivartii); ZMUC 88, 1 (104.0, paratype of Curimatus Mivartii); NMW 68758, 2; NRM 7068, 1. Mouth of Río Magdalena, NMW 68757, 4. Río Cauca, NMW 68767, 1. Río Magdalena, Cienega La Biga, perto de San Pablo, MZUSP 36689, 2 (183.2–193.1). Atlanticico: Barranquilla, BMNH 1947.7.1.128–132, 6 (3, 156.3–246.0); BMNH 1900.1.30.38, 1 (157.0). Calamar, USNM 79195, 3 (124.2–129.5); AMNH 7075, 2 (127.9–129.3). Antioquia: Peñas Blancas, USNM 267329, 1 (98.3).
origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays twice length of ultimate ray. Caudal peduncle depth 0.11–0.13 [0.12].

Head distinctly pointed, head length 0.31–0.37 [0.31]; upper jaw longer; mouth inferior; lower jaw triangular in ventral view; snout length 0.30–0.35 [0.34]; nostrils of each side of head very close, anterior circular, posterior crescent shaped with aperture closed by thin flap of skin that separates nares; orbital diameter 0.30–0.35 [0.31]; adipose eyelid present, with vertically ovoid opening over center of eye; length of postorbital portion of head 0.36–0.41 [0.38]; gape width 0.24–0.31 [0.30]; interorbital width 0.40–0.45 [0.42].

Pored lateral-line scales from supracleithrum to hypural joint 44 to 52 [49]; all scales of lateral-line pored, canals in scales straight; 4 to 8 series of scales extend beyond hypural joint onto caudal fin base; 12 to 15 [15] scales in transverse series from origin of rayed dorsal fin to lateral line, 7 to 9 [9] scales in transverse series from lateral line to origin of anal fin; scale margins slightly ctenoid, more so ventrally.

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

Total vertebrae 30 (1), 31 (58), 32 (1).

COLOR IN LIFE.—Overall coloration bright silvery, median and paired fins with slight reddish tint.

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales golden or silvery golden, darker on dorsal portions of head and body. Specimens lacking guanine on scales tannish-brown to brown. Middorsal line quite...
TABLE 4.—Morphometrics and meristics of (A) holotype of Curimata cisandina, USNM 167834, formerly IU 17850, (B) holotype of Lambepiedra alleni, CAS 57144, and (C) range for all specimens of Curimata cisandina from which counts and measurements were taken. (Standard length is expressed in mm; measurements 1 to 10 are proportions of standard length; 11 to 14 are proportions of head length; dash indicates missing data.)

<table>
<thead>
<tr>
<th>Character</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Length</td>
<td>121.5</td>
<td>80.9</td>
<td>55.5-121.5</td>
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<td>1. Greatest Body depth</td>
<td>0.42</td>
<td>0.41</td>
<td>0.38-0.44</td>
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<tr>
<td>2. Snout to dorsal-fin origin</td>
<td>0.51</td>
<td>0.52</td>
<td>0.50-0.54</td>
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<tr>
<td>3. Snout to anal-fin origin</td>
<td>0.79</td>
<td>0.80</td>
<td>0.78-0.83</td>
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<tr>
<td>4. Snout to pelvic-fin origin</td>
<td>0.52</td>
<td>0.55</td>
<td>0.50-0.58</td>
</tr>
<tr>
<td>5. Snout to anus</td>
<td>0.76</td>
<td>0.75</td>
<td>0.75-0.79</td>
</tr>
<tr>
<td>6. Origin of rayed dorsal fin to hypural joint</td>
<td>0.57</td>
<td>0.56</td>
<td>0.55-0.59</td>
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<tr>
<td>7. Pectoral fin length</td>
<td>—</td>
<td>0.22</td>
<td>0.20-0.23</td>
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<tr>
<td>8. Pelvic fin length</td>
<td>—</td>
<td>0.25</td>
<td>0.22-0.27</td>
</tr>
<tr>
<td>9. Caudal peduncle depth</td>
<td>0.12</td>
<td>0.12</td>
<td>0.11-0.13</td>
</tr>
<tr>
<td>10. Head length</td>
<td>0.31</td>
<td>0.34</td>
<td>0.31-0.37</td>
</tr>
<tr>
<td>11. Snout length</td>
<td>0.34</td>
<td>0.34</td>
<td>0.30-0.35</td>
</tr>
<tr>
<td>12. Orbital diameter</td>
<td>0.31</td>
<td>0.33</td>
<td>0.30-0.35</td>
</tr>
<tr>
<td>13. Postorbital length</td>
<td>0.38</td>
<td>0.36</td>
<td>0.36-0.41</td>
</tr>
<tr>
<td>14. Interorbital width</td>
<td>0.42</td>
<td>0.42</td>
<td>0.40-0.45</td>
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<tr>
<td>Lateral line scales</td>
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<td>50</td>
<td>44-52</td>
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<td>Scale rows between dorsal-fin origin and lateral line</td>
<td>15</td>
<td>14</td>
<td>12-15</td>
</tr>
<tr>
<td>Scale rows between anal-fin origin and lateral line</td>
<td>9</td>
<td>8</td>
<td>7-9</td>
</tr>
<tr>
<td>Branched dorsal-fin rays</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Branched anal-fin rays</td>
<td>12</td>
<td>10</td>
<td>10-12</td>
</tr>
<tr>
<td>Total pectoral-fin rays</td>
<td>14</td>
<td>15</td>
<td>14-16</td>
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<tr>
<td>Branched pelvic-fin rays</td>
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<td>8-9</td>
</tr>
<tr>
<td>Vertebrae</td>
<td>31</td>
<td>31</td>
<td>30-32</td>
</tr>
</tbody>
</table>

dark from rear of rayed dorsal fin to upper portion of caudal peduncle. Anterior margin and distal portions of rayed dorsal fin dusky.

DISTRIBUTION.—Rio Branco and Rio Solimões (Figure 37).

COMMON NAME.—Peru: Julilla (Ortega and Van, 1986:11).

REMARKS.—Allen (in Eigenmann and Allen, 1942:290) first described Psectrogaster cisandinus based on eight specimens collected at four localities. It is questionable whether Allen had IU 15842 available when finishing his description of P. cisandinus since the collection data for that material presented in the publication is incomplete and I have been unable to locate the lot in the depositories known to contain the specimens reported on by Eigenmann and Allen. In the text Allen states that of the three specimens in IU 17850 collected at Iquitos, “the largest [is] the type”. In the same work, the caption to plate XIV, figure 3 lists another specimen (IU 15834) from the Rio Paranapura as the “type”. The explicit designation in the text, which furthermore has page priority, is considered the correct type citation.

An examination of the holotype and other available specimens listed by Allen shows that his material of Psectrogaster cisandinus consists of three species. The holotype (IU 15850, now USNM 167384), the two specimens from Lago Cashiboya (IU 17851, originally two specimens, one specimen later made the holotype of Lambepiedra alleni Fernández-Yépez (now CAS 57144), the other now USNM 167805), and one of the two specimens listed from the Rio Nanay, Iquitos (IU 15837, now USNM 167803) are Curimata cisandina. The two other specimens collected with the type (IU 15834, now USNM 167834) at Iquitos are actually an individual of Psectrogaster amazonica (USNM 268199) and a specimen of Curimata aspera (USNM 268200). The single specimen from the Rio Paranapura (IU 15834, now UMMZ 185271) is Curimata aspera.

Fernández-Yépez (1948:62) described Lambepiedra alleni from a single specimen from Lago Cashiboya (IU 17851) previously identified by Allen (in Eigenmann and Allen, 1942:290) as Psectrogaster cisandinus. The purported differences in mouth position cited by Fernández-Yépez (1948: key following p. 16) as distinguishing the two nominal species are not apparent in the types. Neither has any other meristic or morphometric difference been found to distinguish the two nominal species (Table 4). Lambepiedra alleni is consequently placed into synonymy of Curimata cisandina.

In their description of Curimatus simulatus Eigenmann and Eigenmann (1889:430) noted that part of the syntypic series
from Fonteboa (= Fonte Boa) differed from the remaining specimens in that series both in body form and other characters. A re-examination has shown that the three distinctive specimens in the material examined by the Eigenmanns (MCZ 60886) are actually *Curimata cisandina*. In the same publication, those authors questionably associated some specimens from San Paolo (= São Paulo de Olivença) in the Rio Amazonas basin with their species, *C. macrops*, an endemic of the rivers of northeastern Brazil. Three of the specimens (MCZ 20221) are actually *C. cisandina*.

**MATERIAL EXAMINED.**—85 specimens (42, 55.5–121.5)

**BRAZIL.** Roraima: Rio Branco, USNM 267323, 1. Rio Branco at Bem Querrer, USNM 267352, 28 (15, 55.5–71.4); NMW 68862, 1. Rio Uraricoera, opposite Ilha de Maraca, USNM 267956, 4 (112.7–127.9); MZUSP 32256, 10. Rio Branco, Marara, MZUSP 28723, 6. Amazonas: Ilha da Marchantaria, USNM 229171, 2 (84.9–89.2); USNM 267328, 1 (86.2). Fonteboa (= Fonte Boa), MCZ 60886, 3 (103.5–113.8, paralectotypes of *Curimatus simulatus*; out of MCZ 20198); MZUSP 21032, 4 (98.2–107.2). Rio Solimões near mouth of Rio Jutai, MZUSP 20991, 1 (97.8); MZUSP 21015, 2 (98.8–99.0). Vicinity of Manaus, MZUSP 28722, 4 (2, 81.4–98.3). San Paolo (= São Paulo de Olivença), MCZ 20221, 3. Hyavary (= Rio Javari), MZUSP 20233, 1.


**Curimata aspera** Günther

**FIGURES 38, 39, 40**

*Curimata asper* Günther, 1868a:243, fig. 8 [type locality: Rio Huallaga and
**DESCRIPTION.**—Body moderately elongate, somewhat compressed, more so in larger specimens. Dorsal profile of head straight or very slightly concave over orbit. Dorsal profile of body distinctly convex 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, convexity more pronounced in larger specimens. Dorsal surface of body with indistinct median keel anterior to rayed dorsal fin, smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle, more convex posteriorly. Prepelvic region flattened, margined laterally with distinct, nearly right, angles in body wall that extend from level of vertical through origin of pectoral fin to origin of pelvic fins. Prepelvic region with median series of enlarged scales, median scale series flanked on each side by series of enlarged scales that conform in shape to lateral angle of body. Well developed median keel posterior to pelvic fin origin with secondary obtuse angle in body wall about two scales dorsal of ventral midline on each side of postpelvic portion of body.

Greatest body depth at origin of rayed dorsal fin, depth 0.38–0.44 [0.39]; snout tip to origin of rayed dorsal fin 0.50–0.54 [0.52]; snout tip to origin of anal fin 0.76–0.83 [0.80]; snout tip to origin of pelvic fin 0.50–0.54 [0.50]; snout tip to anus 0.70–0.78 [0.76]; origin of rayed dorsal fin to hypural joint 0.54–0.60 [0.58]. Rayed dorsal fin pointed, anteriormost ray 3.5–4.2 times length of ultimate ray. Pectoral fin pointed; length of pectoral fin 0.21–0.26 [0.23], extends to or slightly beyond vertical through origin of pelvic fin in smaller adults. Pelvic fin pointed, length of pelvic fin 0.25–0.31 [0.27], reaches three-quarters of distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays 2.5–3.2 times length of ultimate ray. Caudal peduncle depth 0.12–0.14 [0.13].

Head obtusely pointed, wide, head length 0.31–0.36 [0.31]; upper jaw longer; mouth inferior; lower jaw rounded in ventral view; snout length 0.28–0.36 [0.33]; nostrils of each side of head very close, anterior circular, posterior crescent shaped with aperture nearly closed by flap of skin separating nares; orbital diameter 0.28–0.33 [0.31]; adipose eyelid well-developed, with vertically ovoid opening over center of eye; length of postorbital portion of head 0.36–0.44 [0.42]; gape

**Figure 39.**—*Curimata aspera*, AMNH 35682, 96.7 MM SL; Peru, Ucayali, Río Ucayali.
width 0.27–0.36 [0.28]; interorbital region wide, width 0.46–0.52 [0.49].

Pored lateral-line scales from supracleithrum to hypural joint 43 to 54 [46]; all scales of lateral-line pored, canals in scales straight, 5 to 8 series of scales extend beyond hypural joint onto caudal fin base; 13 to 16 [14] scales in transverse series from origin of rayed dorsal fin to lateral line; 8 to 10 [9] scales in transverse series from lateral line to origin of anal fin; scales slightly ctenoid, particularly ventrally.

Dorsal-fin rays ii,8–10 [ii,9]; anal-fin rays ii,10–11 or iii,10–11 [ii,10]; pectoral-fin rays 13 to 16 [15]; pelvic-fin rays i,9–10 [i,9].

Total vertebrae 31 (2), 32 (37), 33 (2).

COLOR IN LIFE.—Overall body coloration bright silver. Belly and pelvic fins red (H. Ortega, pers. comm.)

COLOR IN ALCOHOL.—Specimens that retain guanine on scales golden or silvery-golden, darker on dorsal portions of head and body. Specimens that lack guanine on scales yellowish to light brown. No pronounced pigmentation pattern on head or body. Dorsal- and caudal-fin rays outlined by series of small chromatophores. Proximal two-thirds of rayed dorsal fin very dusky in some individuals. Comparable pigmentation present, but less developed, on paired fins and anterior portion of anal fin in some specimens.

DISTRIBUTION.—Upper portion of the Rio Amazonas drainage basin (Figure 40).


REMARKS.— Günther (1868a:243) described Curimatus asper from four specimens collected by Bartlett on the Rio Huallaga and at Xeberos. The smallest specimen of the two individuals from the Huallaga is actually a specimen of Psectrogaster rutiloides (Kner) (BMNH 1867.6.13:85). One of the two other syntypes from that locality (124.1 mm SL) is designated the lectotype of Curimatus aspera (BMNH 1867.6.13:83). The remaining specimens from the Huallaga (BMNH 1867.13:84–85) and the specimen from Xeberos (= Xeberos) (BMNH 1867.6.13:48) thus become paralectotypes of that species. The type series of Psectrogaster cisandinus of Allen (in Eigenmann and Allen, 1942:290) contains two species in addition to that nominal species. The single specimen reported on from Rio Paranapura (UMMZ 185271, formerly IU 15834) is actually Curimata aspera, as is one of the specimens from Iquitos (USNM 268200, formerly IU 17850, see also “Remarks” under C. cisandina).

Eigenmann and Eigenmann (1889:415 and 417) in their revision of the then-known species of curimatids separated their nominal species Curimatus simulatus from Günther’s C. aspera at the third major couplet in their key, Curimata aspera was supposedly characterized by a “Postventral region rounded with an obtuse median keel” whereas C. simulata was described as having the “Postventral region trenchent.” An examination of the type series of both species has not revealed any difference between the specimens in the form of the postpelvic region. Neither has any other difference between the nominal species been noted in pigmentation, meristics or morphometrics (Table 5) that justifies the continued recognition of a distinct Curimatus simulatus.

The original description of Curimatus simulatus by Eigenmann and Eigenmann (1889:430) was based on three specimens from Tonantins and five from Fonteboa (= Fonte Boa). Those authors noted that three of the specimens from the
The remaining syntypes from that locality (MCZ 60885; out of MCZ 20198) and the specimens from the latter locality differed from the remaining syntypes in body form and certain other characters. A re-examination of the three cited individuals has shown that they are actually *Curimata aspera* (based on *Curimatus simulatus*; out of MCZ 20198) and the specimens from the Tonantins (MCZ 20194) thus become paratypes of the species.

Fowler (1975:366) recognized four taxa within what he termed *Bitricarinata aspera*. Those were *B. aspera* itself, *B. aspera caudimaculata* (based on *Curimatus alburnus caudimaculatus* Pellegrin [1909:150]), *B. aspera immaculata* (based on *Leptipina immaculata* Fernández-Yépez [1948:27]), and *B. aspera lineatus* (based on *Curimatus alburnus lineatus* Eigenmann and Eigenmann [1889:419]). No explanation was provided for this significant shift in the taxonomy of these taxa. Examination of the types of all of the species has shown that none of the three nominal subspecies incorporated into *Curimata aspera* by Fowler is conspecific with that species, and indeed that all of those proposed subspecies are actually more closely related to species of the lineage recognized by Vari (1989, tables 2, 3) as *Curimatella*.

**TABLE 5.—Morphometrics and meristics of (A) lectotype of *Curimata aspera*, BMNH 1867.6.13:83, (B) paralectotypes of *C. aspera*, BMNH 1867.6.13: 48 and 84, (C) lectotype of *Curimatus simulatus*, MCZ 20198, (D) paralectotypes of *C. simulatus*, MCZ 20194 and 69885, and (E) all specimens of *Curimata aspera* from which counts and measurements were taken. (Standard length is expressed in mm; measurements 1 to 10 are proportions of standard length; 11 to 14 are proportions of head length; dash indicates missing data.)**

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<th>D</th>
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<tr>
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<td>104.3</td>
<td>109.1–115.4</td>
<td>46.2–212.4</td>
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<td>0.38–0.39</td>
<td>0.43</td>
<td>0.40–0.43</td>
<td>0.38–0.44</td>
</tr>
<tr>
<td>2. Snout to dorsal-fin origin</td>
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<td>0.50–0.52</td>
<td>0.52</td>
<td>0.52–0.54</td>
<td>0.50–0.54</td>
</tr>
<tr>
<td>3. Snout to anal-fin origin</td>
<td>0.80</td>
<td>0.76–0.81</td>
<td>0.81</td>
<td>0.76–0.81</td>
<td>0.76–0.83</td>
</tr>
<tr>
<td>4. Snout to pelvic-fin origin</td>
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<td>0.50–0.53</td>
<td>0.52</td>
<td>0.50–0.52</td>
<td>0.50–0.54</td>
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<tr>
<td>5. Snout to anus</td>
<td>0.76</td>
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<td>0.77</td>
<td>0.73–0.78</td>
<td>0.70–0.78</td>
</tr>
<tr>
<td>6. Origin of rayed dorsal fin to hypural joint</td>
<td>0.58</td>
<td>0.57–0.58</td>
<td>0.60</td>
<td>0.58–0.60</td>
<td>0.54–0.60</td>
</tr>
<tr>
<td>7. Pectoral fin length</td>
<td>0.23</td>
<td>—</td>
<td>0.26</td>
<td>0.23–0.24</td>
<td>0.21–0.26</td>
</tr>
<tr>
<td>8. Pelvic fin length</td>
<td>0.27</td>
<td>—</td>
<td>0.30</td>
<td>0.25–0.29</td>
<td>0.25–0.31</td>
</tr>
<tr>
<td>9. Caudal peduncle depth</td>
<td>0.13</td>
<td>0.12–0.13</td>
<td>0.14</td>
<td>0.13</td>
<td>0.12–0.14</td>
</tr>
<tr>
<td>10. Head length</td>
<td>0.31</td>
<td>0.32–0.33</td>
<td>0.33</td>
<td>0.31–0.33</td>
<td>0.31–0.36</td>
</tr>
<tr>
<td>11. Snout length</td>
<td>0.33</td>
<td>0.32</td>
<td>0.32</td>
<td>0.31–0.32</td>
<td>0.28–0.36</td>
</tr>
<tr>
<td>12. Orbital diameter</td>
<td>0.31</td>
<td>0.30–0.31</td>
<td>0.29</td>
<td>0.28–0.29</td>
<td>0.28–0.33</td>
</tr>
<tr>
<td>13. Postorbital length</td>
<td>0.42</td>
<td>0.42–0.44</td>
<td>0.44</td>
<td>0.42–0.43</td>
<td>0.36–0.44</td>
</tr>
<tr>
<td>14. Interorbital width</td>
<td>0.47</td>
<td>0.47–0.48</td>
<td>0.47</td>
<td>0.46–0.47</td>
<td>0.46–0.52</td>
</tr>
<tr>
<td><strong>MERISTICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral line scales</td>
<td>46</td>
<td>45–46</td>
<td>44</td>
<td>44–49</td>
<td>43–54</td>
</tr>
<tr>
<td>Scale rows between dorsal-fin origin and lateral line</td>
<td>14</td>
<td>14–15</td>
<td>14</td>
<td>13–16</td>
<td>13–16</td>
</tr>
<tr>
<td>Scale rows between anal-fin origin and lateral line</td>
<td>9</td>
<td>9–10</td>
<td>10</td>
<td>9–10</td>
<td>8–10</td>
</tr>
<tr>
<td>Branched dorsal-fin rays</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>8–10</td>
</tr>
<tr>
<td>Branched anal-fin rays</td>
<td>10</td>
<td>10–11</td>
<td>10</td>
<td>9–10</td>
<td>10–11</td>
</tr>
<tr>
<td>Total pectoral-fin rays</td>
<td>15</td>
<td>15–16</td>
<td>15</td>
<td>14–16</td>
<td>13–16</td>
</tr>
<tr>
<td>Branched pelvic-fin rays</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9–10</td>
</tr>
<tr>
<td>Vertebrae</td>
<td>32</td>
<td>32–33</td>
<td>32</td>
<td>32</td>
<td>31–3</td>
</tr>
</tbody>
</table>

The remaining syntypes of *C. simulatus* from Fonte Boa (a 104.3 mm SL specimen, MCZ 20198) is designated as the lectotype of the species. The remaining syntypes from that locality (MCZ 60885; out of MCZ 20198) and the specimens from the Tonantins (MCZ 20194) thus become paratypes of the species.

**MATERIAL EXAMINED.—57 specimens (50, 46.2–212.4).**

**BRAZIL. Amazonas:** Tonantins, MCZ 20194, 3 (112.2–115.4, paralectotypes of *Curimatus simulatus*). Fonteboa (= Fonte Boa). MCZ 20198, 1 (104.3, lectotype of *Curimatus simulatus*); MCZ 69885, 1 (109.1, paratype of *Curimatus simulatus*; out of MCZ 20198).

**PERU. Loreto:** Rio Huallaga, BMNH 1867.6.13:83, 1 (124.0, lectotype of *Curimatus asper*); BMNH 1867.6.13:84, 1 (144.5, paratype of *Curimatus asper*). Xebros (= Xeberos), BMNH 1867.6.13:84, 1 (121.5, paratype of *Curimatus asper*). Rio Amazonas, USNM 267345, 1 (103.8). Rio Paranapura, UMMZ 185271 (formerly IU 15834), 1 (116.9, paratype of *Psectrogaster cisandinus*). Rio Gálvez, upstream of Colonia Angamos, NRM SOK/1984312.4057, 2. Iquitos, USNM 268200, 1 (paratype of *Psectrogaster cisandinus*, formerly IU 17850). Rio Marona, USNM 267526, 1 (149.7).
Cochá Agujal, Iquitos, MZUSP 15240, 1 (120.7). Río Corrientes, MZUSP 15239, 1 (160.7); MZUSP 15242, 1 (157.4). Río Ampiyacu near Pebas, USNM 267332, 1 (114.7); SU 36591, 1 (145.0). Lago Sanango, IU 15821, 1 (144.0); USNM 267320 (? formerly IU 15821), 1 (123.4). Río Ampiyacu near Pebas, USNM 267332, 1 (114.7); SU 36591, 1 (145.0). Lago Sanango, IU 15821, 1 (144.0); USNM 267320 (? formerly IU 15821), 1 (123.4). Río Putomayo, El Estrecho, NRM SOK/1986295.5288, 1. Rio Putumayo, El Estrecho, NRM SOK/1986295.5288, 1. Río Putumayo, El Estrecho, NRM SOK/1986295.5288, 1. Río Putumayo, El Estrecho, NRM SOK/1986295.5288, 1. Río Putumayo, El Estrecho, NRM SOK/1986295.5288, 1. Río Putumayo, El Estrecho, NRM SOK/1986295.5288, 1.

ECUADOR. Napo Pastaza: Río Aguarico at Santa Cecilia, ANSP 130464, 1 (212.4). Río Napo at Coca, MCZ 51878, 5 (179.4–221.4). Mouth of Río Pañayacu, ANSP 137615, 6 (5, 113.2–125.6).

Curimata cerasina

**Vari**

**FIGURES 38, 40, 41**

Curimatus schomburgkii.—Mago-Leccia, 1967:254 [Venezuela: Llanos of Río Orinoco basin].

Curimata sp.—Roman, 1983:97 [Venezuela: Río Orinoco basin; common name].


**DIAGNOSIS.**—Curimata cerasina can be distinguished from other species of Curimata, and indeed all other curimatids by the very wide interorbital region which is 0.53–0.58 of HL in contrast to 0.36–0.52 for all other species of Curimata. Only Curimata aspera, a species endemic to the Río Amazonas basin, has an interorbital width (0.46–0.52) approaching, although distinct from, that of C. cerasina (see Figure 38). Differences in gape width (0.27–0.35 in C. aspera vs. 0.35–0.40 for C. cerasina) and the more robust body of C. cerasina further separate these forms.

**DESCRIPTION.**—Body moderately elongate, robust, more so in larger specimens, particularly females in spawning condition. Dorsal profile of head very slightly concave above orbit in smaller specimens, straight in larger individuals. Dorsal profile of body convex from rear of head to origin of rayed dorsal fin; straight and posterovertrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle, convexity more pronounced in larger specimens. Dorsal surface of body with indistinct median keel anterior to rayed dorsal fin, smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle, convexity more pronounced posteriorly. Prepelvic region flattened, margined laterally by distinct, nearly right, angles in body wall that extend from level of vertical through origin of pectoral fin to origin of pelvic fin. Median series of enlarged scales in prepelvic region flanked on each side by series of enlarged scales that conform in shape to lateral angle of prepelvic portion of body. Well developed median keel posterior to pelvic fin insertion with secondary obtuse keel about two scales dorsal of ventral midline on each side of postpelvic portion of body.

Greatest body depth at origin of rayed dorsal fin, depth 0.41–0.48 [0.44]; snout tip to origin of rayed dorsal fin 0.52–0.56 [0.53]; snout tip to origin of anal fin 0.81–0.85 [0.85]; snout tip to origin of pelvic fin 0.52–0.58 [0.54]; snout tip to anus 0.78–0.82 [0.81]; origin of rayed dorsal fin to hypural joint 0.52–0.58 [0.58]. Rayed dorsal fin pointed, anteriormost rays 3.7–5.3 times length of ultimate ray. Pectoral
fin pointed; length of pectoral fin 0.17–0.25 [0.24], extends to or slightly beyond vertical through origin of pelvic fin. Pelvic fin pointed, length of pelvic fin 0.17–0.25 [0.24], reaches three-quarters of distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays 2.5–3.2 times length of ultimate ray. Caudal peduncle depth 0.12–0.15 [0.14].

Head obtusely pointed in profile, very wide; head length 0.30–0.35 [0.32] in specimens over 75 mm SL (0.37–0.38 in specimens of 45.0–55.0 mm SL); upper jaw longer, mouth inferior, teeth present in larvae, but absent in adults (Machado-Allison, 1987:72), snout length 0.32–0.39 [0.36]; nostrils of each side of head very close, anterior circular, inferior, teeth present in larvae, but absent in adults specimens of 45.0–55.0 mm SL); upper jaw longer, mouth forked. Adipose fin well developed. Anal fin emarginate, three-quarters of distance to origin of anal fin. Caudal fin or slightly beyond vertical through origin of pelvic fin. Pelvic fin. Postorbital portion of head 0.39–0.46 [0.44]; gape width vertically ovoid opening over middle of eye; length of posterior crescent shaped with aperture largely closed by flap; length of pectoral fin 0.17–0.25 [0.24], extends to 0.34–0.39 [0.39], specimens under 18.0 mm SL with single 42 to 46 [45] canals in scales straight; all scales of lateral line centers in some specimens; darker pigmentation aligned to on scales pale yellow to brown, darker on dorsal portions of retain guanine on scales silvery or silvery-golden; darker on scales of lateral line incompletely pored, 4 to 6 series of scales extend beyond hyphal joint onto caudal fin base; 13 to 15 [14] scales in transverse series from origin of rayed dorsal fin to lateral line, 8 to 11 [9] scales in transverse series from the lateral line to origin of anal fin; 12 to 15 [14] enlarged scales in midventral series anterior to insertion of pelvic fins; scales somewhat chromatophores. Pelvics somewhat dusky in some individuals.

**DISTRIBUTION.**—Central portions of Río Orinoco drainage basin (Figure 40).

**ECOLOGY.**—Curimata cerasina inhabits rivers, ponds and other highly turbid still waters, typically over muddy bottoms. The species is common in the lower lying regions of the Llanos (savannas) that are most subject to seasonal flooding (Machado-Allison, 1987:68; pers. observ.). Females with ripe ovaries were present in collections made in late March and April, with each female producing over 100,000 eggs (Machado-Allison, 1987:48, 68). The species breeds in the main channels of the watercourses in the Llanos, with juveniles of 17.0–60.0 mm SL captured in floating and emergent vegetation in late July and August. The larvae of the species feed on copepods and cladocerans utilizing oral dentition that is lost ontogenetically (Machado-Allison, 1987:72).


**REMARKS.**—Mago-Leccia (1967:254) reported Curimatus schomburgkii from the Llanos of Venezuela. That report is apparently based on specimens of Curimata cerasina.

**MATERIAL EXAMINED.**—96 specimens (87, 17.0–167.3 mm SL).
V-11845, 1 (105.4, paratype of C. cerasina); MBUCV V-11893, 1 (146.0). Flooded borrow pit along side of road from Calabozo to Camaguan, USNM 257088, 2 (91.7–93.6, paratypes of C. cerasina); BMNH 1983.3.1:8, 1 (86.0, paratype of C. cerasina). Río Portuguesa near La Manga, Camaguan, MBUCV V-8691, 3 (134.9–148.6, paratypes of C. cerasina); BMNH 1983.3.1:7, 1 (131.7, paratype of C. cerasina). Río Portuguesa at Camaguan, USNM 257084, 2 (85.7–97.5). Río Portuguesa, Laguna Boca Ruido, MBUCV V-5807, 3 (17.0–45.6). Río Manapire, deep pool isolated from the main river channel, La Vega near Santa Rita, MBUCV V-5743, 2 (104.3–106.7, paratypes of C. cerasina); MBUCV V-5731, 1 (95.7). Portuguesa: Caño Maraca at bridge on road from Guararito to Guanare MCZ 54344, 1, (88.3, paratype of C. cerasina). Barinas: Río Guanare Viejo, Boca de Tortumal, west of La Union, MBUCV V-3631, 1 (92.9).

**Phylogenetic Biogeography**

The species of the genus *Curimata* inhabit a significant portion of the total range of the family Curimatidae, which in turn occurs through much of South America. Such a broad geographic range in conjunction with a nearly resolved intragenic phylogeny and detailed distributional information should provide insight into the historical biogeography of the genus, and to lesser degrees into those of the family and the lowland South American freshwater fish fauna.

Vari (1988), focusing on questions of areas of endemism of the Neotropical freshwater fish fauna and alternative hypotheses concerning the relative extent of speciation before and after the uplift of the Andes, discussed some aspects of the zoogeography of *Curimata* and the entire Curimatidae. Suprageneric topics will not, as a consequence, be detailed again in this study. Two primary questions can be addressed by the phylogenetic and distributional data at hand for *Curimata*. First, what are the historical associations of the river basins of South America inhabited by the species of *Curimata* as reflected in the hypothesized relationships of those taxa? Second, to what degree has secondary dispersal been a factor in the history of the members of the genus?

Figure 42 is an area cladogram for the species of *Curimata* in which the species names have been replaced by the areas that they inhabit, a system which simplifies the visualization of geographic distributions across the phylogenetic scheme. Although reduced area cladograms are typically used in such historical biogeographic studies I have chosen not to follow that practice since that would decrease the degree of available information relative to the second question—to what extent has dispersal been a factor in the distribution of the known species of *Curimata*?

Reference to Figure 42 shows that the historical biogeography of the genus has apparently been quite complex. The degree of complexity that we recognize is, to a considerable degree, a function of the speciation model that we are operating under. Although it is not possible to ex post facto determine with certainty the methods of speciation that occurred within *Curimata*, we can draw on available information on the ecology and behavior of the genus as a whole to evaluate the likelihood of alternative models. *Curimata* species undertake long distance spawning and feeding migrations, typically in larger schools, often through rapids and across other barriers. Although the species of *Curimata* have modifications specialized for utilizing detritus, the members of the different genera do not apparently specialize within that general food type. Such highly mobile populations and the lack of any apparent species specific specialization in diet or modes of reproduction make it difficult to conceive of *Curimata* species as undergoing either stasipatric or sympatric speciation. The limitation of *Curimata* species, and indeed all curimatids, to relatively low altitude drainage systems do, however, make them prime candidates for allopatric speciation resulting from vicariance between hydrographic systems. These factors in combination lead me to cast the following discussion within an allopatric speciation framework.

Only two species of *Curimata* do not have distributions overlapping to some degree with that of at least one congeneric. These are *C. macrops* (D) of the rivers of northeastern Brazil and *C. mivartii* (G) of the Río Magdalena system; river systems with overall limited curimatid faunas. The more typical condition for species of *Curimata* and one that is obvious in Figure 42 is the notable, often complete, sympathy between sister clades. That pattern is presumably indicative of secondary dispersal following allopatric speciation. Such secondary sympathy obscures the underlying vicariance events that lead to speciation in the genus. Several less inclusive subunits of the genus do, however, demonstrate allopatric distributions, which are congruent with a vicariance biogeography model. These allow insight into both area relationships within the South American ichthyofauna, and into the relative timing of some of the speciation events in the Curimatidae.

The most discrete of the allopatric sister pair distributions within *Curimata* involves the three species of node 8 (G = *mivartii*; H = *aspera*; I = *cerasina*). *Curimata mivartii* of the Río Magdalena system is the sister species to the clade consisting of *C. aspera* of the western Amazon and *C. cerasina* of the Orinoco basin. This pattern of relationships is congruent with a hypothesis of a vicariance event between the Río Magdalena following temporally by a vicariance event between the Amazon and Orinoco basins. As noted by Vari (1988) this pattern of relationships and distributions is also interesting in indicating that the majority of the more encompassing speciation events of the genus (Figure 42, nodes 1–4) occurred prior to the Andean vicariance event, a pattern evidently general for the family. Additional allopatric distributions between sister species involve *C. knerii* (F) of the middle and upper Amazon and *C. cyprinoides* (G) of the Guianas and lower Amazon, and *C. roseni* (K) and *C. inornata* (L) of different subsections of the Amazon (see Figures 23 and 26) cannot, however, be similarly tied to specific geologic events at this time.
Returning to the intrageneric sympathy noted above, we find that there are repeated patterns of large scale sympathy between sequential sister groups (nodes 1–5) until we reach the terminal dichotomies within the genus (nodes 6–9). If the subdivision of the continent by the uplift of the Andes during the Miocene is correlated with the speciation event of node 8, then the speciation at nodes 1, 2, 3, and 4, which also demonstrate the largest degree of sympathy, would have predated the event. It is quite reasonable to assume that the sympathy between sister clades at those phylogenetically higher level nodes is correlated with the dramatic rearrangement of the hydrographic patterns in South America associated with the uplift of the Andes. The reorganization of the drainage patterns of the continent would have brought previously separated species into the same basins. The species could then have dispersed through those now conjoined systems. The lower level of sympathy or lack of distributional overlaps at nodes 6, 7, 8, and 9, in turn, could reflect the more stable hydrographic patterns that have existed following the final uplift of the Andes. Such hydrographic stability would have reduced the possibilities for secondary dispersal between drainage basins following speciation resulting from geological vicariance events.
Resumo

O gênero *Curimata* Bosc (1817) é definido como uma subunidade monofilética da família Curimatidae com base em várias sinapomorfias nos arcos branquiais, complexo buco-faringeano e arco palatino. Modificações de natureza derivada nos arcos branquiais, aparelho ósseo, aparelho opercular, osso maxilar, hiomandibular, arco palatino, supraneurais, primeiro pterigio foro proximal da nadadeira dorsal, pigmentação, forma do corpo, tamanho e forma das escamas, grau de desenvolvimento dos raios das nadadeiras dorsal e caudal, número de vértebras e morfometria reúnem grupos de espécies dentro do gênero.

*Curimata* é redefinido e doze espécies são reconhecidas no gênero. Estas são: *Curimata cyprinoides* Linnaeus (1766), distribuída no baixo rio Orinoco, drenagens atlânticas das Guianas, baixo rio Amazonas e rio Tocantis; *C. vittata* Kner (1859), do sistema do rio Amazonas; *C. aspera* Günther (1868a), do alto rio Amazonas; *C. knerii* Steindachner (1877), do médio e alto rio Amazonas; *C. mivartii* Steindachner (1878), endêmica do rio Magdalen e rios associados; *C. ocellata* Eigenmann & Eigenmann (1889), distribuída na bacia do rio Amazonas; *C. macrops* Eigenmann & Eigenmann (1889), conhecida somente da bacia do rio Paraíba no nordeste do Brasil; *C. cisandina* (Allen, em Eigenmann & Allen, 1942), encontrada no sistema do rio Amazonas; *C. cerasina* Vari (1984b), endêmica do rio Orinoco; *C. incompta* Vari (1984b), da bacia do rio Orinoco; *C. inornata*, uma nova espécie do sistema do rio Amazonas; e *C. roseni*, uma nova espécie da bacia do rio Negro.


A zoogeografia histórica das espécies de *Curimata* é discutida, apresentando-se a hipótese de que a maior parte da divergência evolutiva a nível de espécie no gênero se deu antes do levantamento final dos Andes. O grau de simpatria entre linhagens-irmãs dentro de *Curimata* indica que ocorreu uma significativa quantidade de dispersão pós-vicariância no gênero.
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