

Systematics of the  
Neotropical Characiform Genus  
*Curimatella* Eigenmann and  
Eigenmann (Pisces: Ostariophysi),  
with Summary Comments on the  
Curimatidae

RICHARD P. VARI

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Systematics of the  
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## ABSTRACT

Vari, Richard P. Systematics of the Neotropical Characiform Genus *Curimatella* Eigenmann and Eigenmann (Pisces: Ostariophysi), with Summary Comments on the Curimatidae. *Smithsonian Contributions to Zoology*, number 533, 48 pages, 37 figures, 6 tables, 1992.—The genus *Curimatella* Eigenmann and Eigenmann (1889) is hypothesized to be a monophyletic unit of the characiform family Curimatidae. *Curimatella* is defined by the apomorphic possession of a field of small scales extending over at least the basal two-thirds of the middle rays of each lobe of the caudal fin in adults.

*Curimatella* is redefined and three genera (*Apolinarella*, *Walbaunina*, and *Lepipinna*) described by Fernández-Yépez (1948) are synonymized under *Curimatella*. Five species are recognized in *Curimatella*: *C. alburna* (Müller and Troschel, 1844), distributed widely through the Rio Amazonas system and perhaps present in the upper Rupununi River basin; *C. dorsalis* (Eigenmann and Eigenmann, 1889b), a species distributed through the Río Orinoco, Rio Amazonas, and portions of the Río de La Plata basin; *C. immaculata* (Fernández-Yépez, 1948), widespread through the Río Orinoco and Rio Amazonas; *C. lepidura* (Eigenmann and Eigenmann, 1889a) endemic to the Rio São Francisco; and *C. meyeri* (Steindachner, 1882) of the central and western portions of the Rio Amazonas basin. A key to the species of *Curimatella* is provided.

Seven nominal species or subspecies are placed into synonymy. *Curimatella alburnus australe* Eigenmann and Kennedy (1903) based on specimens from Asunción, Paraguay, *Curimatus elegans paraguayensis* Eigenmann and Kennedy (1903) with a type locality in the Río Paraguay in Paraguay, *Curimatus (Curimatella) alburnus* var. *caudimaculata* Pellegrin (1909) described from specimens collected in the central Amazon, and *Curimatus bolivarensis* Steindachner (1910) with a type series originating in the lower Río Orinoco are placed into the synonymy of *Curimatella dorsalis*. *Curimatella meyeri* has two synonyms, *Curimatus serpae* Eigenmann and Eigenmann (1889a) described from specimens collected at Serpa (= Itacoatiara) along the Rio Amazonas, and *Curimata reticulata* Allen in Eigenmann and Allen (1942) based on specimens collected in the Río Ucayali drainage of Peru. *Curimatus alburnus lineatus* Eigenmann and Eigenmann (1889b) based on a specimen from the western Amazon is a synonym of *Curimatella alburna*.

Lectotypes are designated for *Curimatus lepidurus* Eigenmann and Eigenmann, *Curimatus (Curimatella) alburnus* var. *caudimaculatus* Pellegrin, *Curimatus bolivarensis* Steindachner, and *Anodus alburnus* Müller and Troschel.

A key is provided to the genera of the Curimatidae and a revised key is presented for the genus *Curimatopsis* Steindachner. Major range extensions are reported for *Curimatopsis microlepis* Eigenmann and Eigenmann and *C. myersi* Vari, and the presence of *Curimata vittata* Kner in the Río Orinoco basin is confirmed.

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# Systematics of the Neotropical Characiform Genus *Curimatella* Eigenmann and Eigenmann (Pisces: Ostariophysi), with Summary Comments on the Curimatidae

*Richard P. Vari*

## Introduction

Species of the curimatid genus *Curimatella* Eigenmann and Eigenmann (1889b) inhabit many of the major drainage basins of South America east and south of the Andean Cordilleras. One of the five recognized species of *Curimatella* is endemic to the Rio São Francisco basin of eastern Brazil. The other four species are sympatric to varying degrees across the vast expanses of the Amazon basin and associated Rio Tocantins. Two of the four *Curimatella* species occurring in the Amazon basin also range beyond that drainage system. They are sympatric in the Río Orinoco, with one also widespread through the Río de La Plata basin with the evident exception of the Río Uruguay and upper Río Paraná.

*Curimatella alburna* (Müller and Troschel, 1844) was among the first half dozen nominal curimatid species to be described by European researchers. Following the description of that species was a hiatus of nearly four decades until Steindachner (1882) proposed *C. meyeri*, the second recognized member of the lineage. This action was followed by the episodic description of the other species herein assigned to *Curimatella*, terminating with the study by Fernández-Yépez (1948). This century of species descriptions resulted in 12 nominal species with a sheath of scales over the larger portion

of the caudal fin, the distinctive feature of the genus *Curimatella*. During the 13 decades since the description of *C. alburnus*, the nominal species of *Curimatella* have been repeatedly cited in faunal accounts (e.g., Géry et al., 1987), checklists (e.g., Britski et al., 1984), and systematic studies. This extensive literature demonstrates, however, numerous inconsistencies as to the nominal species recognized, their distinguishing features, and purported distributional ranges.

This uncertainty was a consequence of numerous factors, most of which are pervasive in the early taxonomy of Neotropical freshwater fishes (see also discussion by Böhlke et al., 1978). The limited population samples of *Curimatella* from many regions in the vast range of the genus made it difficult to estimate the degree of variability in and between the proposed species of *Curimatella* and thus evaluate the validity of nominal forms. The problems posed by limited comparative samples are compounded by the restriction of many earlier systematic studies of the Curimatidae and its subunits to within political boundaries or other subcontinental regions. Earlier researchers were additionally hampered by the absence of critical information in many original species descriptions and by lack of access to type series. In the case of *Curimatus elegans paraguayensis* Eigenmann and Kennedy (= *Curimatella dorsalis*), the limitations imposed by the brief original description were compounded by the composite nature of the type series.

Fernández-Yépez (1948) was the last author to treat most of the species united by Vari (1989a) in *Curimatella*. The classification proposed by Fernández-Yépez distributed nine of the 12 nominal species assigned to *Curimatella* in this paper to

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TABLE 1.—Nominal species, subspecies, and varieties of curimatids assigned herein to *Curimatella*, and the recognized equivalent species of *Curimatella* according to the results of this study. Nominal forms are cited as in original description and are arranged alphabetically by specific, subspecific, or varietal epithet.

Nominal species	<i>Curimatella</i>
<i>Anodus alburnus</i> Müller and Troschel, 1844	<i>alburna</i>
<i>Curimatella alburnus australe</i> Eigenmann and Kennedy, 1903	<i>dorsalis</i>
<i>Curimatus bolivarensis</i> Steindachner, 1910	<i>dorsalis</i>
<i>Curimatus (Curimatella) alburnus</i> var. <i>caudimaculata</i> Pellegrin, 1909	<i>dorsalis</i>
<i>Curimatus dorsalis</i> Eigenmann and Eigenmann, 1889b	<i>dorsalis</i>
<i>Lepipinna immaculata</i> Fernández-Yépez, 1948	<i>immaculata</i>
<i>Curimatus lepidurus</i> Eigenmann and Eigenmann, 1889a	<i>lepidura</i>
<i>Curimatus alburnus lineatus</i> Eigenmann and Eigenmann, 1889b	<i>alburna</i>
<i>Curimatus Meyeri</i> Steindachner, 1882	<i>meyeri</i>
<i>Curimatus elegans paraguayensis</i> Eigenmann and Kennedy, 1903	<i>dorsalis</i>
<i>Curimata reticulata</i> Allen in Eigenmann and Allen, 1942	<i>meyeri</i>
<i>Curimatus serpa</i> Eigenmann and Eigenmann, 1889a	<i>meyeri</i>

five genera (*Apolinarella* Fernández-Yépez, *Curimatella*, *Lepipinna* Fernández-Yépez, *Rivasella* Fernández-Yépez, and *Walbaunina* Fernández-Yépez (emended to *Walbaumina* by Géry et al., 1987). Those genera were assigned, in turn, to the tribes Curimatellini, Apolinarellini, and Curimatini within Fernández-Yépez's "phylogenetic tree" (1948, fig. 2). Such a fine taxonomic subdivision is not a priori problematical; however, each of his tribes included species that lacked the derived feature of *Curimatella* and that in some cases are more closely related to other lineages in the Curimatidae (Vari, 1989a).

The inconsistencies between the classifications of Fernández-Yépez (1948) and Vari (1989a) reflect the differing methodologies of those authors. Fernández-Yépez (1948) recognized a number of genera and suprageneric taxa, either explicitly or by default, on degree of overall similarity or difference. Such criteria fail to critically examine the correlation, or lack thereof, between recognized supraspecific taxa and hypothesized evolutionary lineages. Phylogenetic systematics, the methodology used in Vari (1989a) and the present study, in contrast, requires that taxa reflect the hypothesized evolutionary history of their included species—in other words, that they be natural or monophyletic in the strict sense of those terms. The application of this more rigorous criterion in phylogenetic studies of fishes postdates Fernández-Yépez's effort by some two decades.

Three nominal species of *Curimatella* were not included in Fernández-Yépez's classification of the Curimatidae (his Curimatinae). In the case of two of these (*Curimatus (Curimatella) alburnus* var. *caudimaculata* Pellegrin and *Curimatus bolivarensis* Steindachner) he was unable to place them within his taxonomic scheme due to lack of available material. It is not clear why he did not consider the third nominal subspecies, *Curimatus elegans paraguayensis* Eigenmann and Kennedy in his monograph. These three forms share the distinguishing feature for *Curimatella* and were placed by Vari (1989a) in the genus.

The present study has three major aims: first, to determine the recognizable species in the group and their distinguishing characters; second, to advance a hypothesis of the monophyly of the genus and its components; and third, to delimit the known geographic distributions of the recognized forms. A key to the genera of the Curimatidae, together with an expanded key for the species of *Curimatopsis* Steindachner and a discussion of the distributions of some species in that genus and *Curimata* Bosc, follows the revisionary study of *Curimatella*.

#### SYSTEMATIC PROCEDURES

This paper completes a series of publications dealing with aspects of the phylogeny, taxonomy, and historical biogeography of curimatid characiforms (Vari, 1982a,b, 1983, 1984a,b, 1987, 1988, 1989a,b,c,d, 1991, in press; Vari and Barriga, 1990; Vari and Castro, 1988; Vari and Géry, 1985; Vari and Nijssen, 1986; Vari and Vari, 1989; and Vari and Weitzman, 1990). Vari (1989a) advanced a hypothesis of generic-level relationships in the Curimatidae. That study and the phylogenetically more encompassing scheme of relationships for the Curimatidae, Prochilodontidae, Anostomidae, and Chilodontidae put forward by Vari (1983) are herein used as the phyletic framework for the outgroup analyses in this study. The phylogenetic methodologies outlined in previous studies of the Curimatidae, its components, and proximate relatives of the family (see Vari, 1983, 1989a) are used in this study.

#### METHODS AND MATERIALS

Measurements were made with dial calipers and recorded to the nearest 0.1 millimeter (mm). Counts and measurements were made on the left side of specimens whenever possible. Lateral-line scales were counted from the supracleithrum to the hypural joint. Counts of total vertebrae were taken from radiographs, and cleared and stained specimens, with the fused



$PU_1+U_1$  considered a single bone, and the vertebrae incorporated into the Weberian Apparatus counted as four elements. The numbers in parentheses that follow a particular vertebral count are the numbers of radiographed specimens with that count.

Subunits of the head are presented as proportions of head length (HL). Head length itself and measurements of body parts are given as proportions of standard length (SL). Greatest depth of the body was taken at the origin of the dorsal fin. In the counts of median and pelvic fins unbranched-fin rays are indicated by lower case roman numerals, and branched-fin rays are indicated by arabic numerals. The observed range in the values of each count and measurement is presented first, followed by the value of the holotype or lectotype for a particular count or measurement, when available, in brackets. When recognized species of *Curimatella* have junior synonyms, the available morphometric and meristic data for the type series of all involved nominal species is presented in tabular form. In such cases the data in brackets in the species descriptions are those for the holotype or lectotype of the senior synonym.

The "Material Examined" section of each species account is arranged in the following sequence: total number of specimens examined (with the number of specimens used for the meristic and morphometric data and their range of standard lengths (in mm) in parentheses), 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 SL range (in mm) of those individuals). Geographic descriptors are first country (capitalized), then state, province, department, or district (in italics), followed by more specific locality data.

Eigenmann and Eigenmann's (1889a,b) revisionary studies of the Curimatidae were based largely on collections of the Thayer Expedition to Brazil in 1865 and 1866. The Eigenmanns and many subsequent authors have incorrectly or incompletely cited localities for Thayer Expedition specimens as a consequence of the limited data directly associated with the specimens. Higuchi's (ms) expanded and modernized equivalents for the Thayer Expeditions localities are cited in parentheses both in synonymies and lists of materials examined.

The common names are those found in the literature, although such terminology is not standardized. In the synonymies for each species, localities are presented as in the original citation, followed by the modern equivalent, in parentheses, if that differs. Generic genders are as cited in Eschmeyer (1990).

**OSTEOLOGICAL MATERIAL EXAMINED.**—Osteological preparations were cleared and counterstained for cartilage and bone using a modification of the Taylor and Van Dyke (1985) method. Previously cleared specimens stained solely with alizarin Red-S were supplemental sources of data. Osteological terminology follows Vari (1989a:5). Drawings were made with

a Zeiss microscopic camera lucida.

The observations on osteological characters in outgroups to *Curimatella*, both in the Curimatidae and other taxa in the Characiformes, are based on the specimens cited in Vari (1989a:10–11; 1991:3–4).

The following cleared and stained specimens of *Curimatella* are the basis for osteological text illustrations and/or specific observations noted in the following phylogenetic analysis.

- Curimatella alburna* (Müller and Troschel), MZUSP 6309, 1 specimen, 92.0 mm SL; Brazil, Amazonas, Lago Castro, mouth of Rio Purus. USNM 278580, 1 specimen, 93.8 mm SL; Bolivia, Beni, Río Blanco.
- Curimatella dorsalis* (Eigenmann and Eigenmann), USNM 260159, 2 specimens, 72.5–75.0 mm SL; Venezuela, Apure, Río Apure, San Fernando de Apure. USNM 258284, 2 specimens, 62.5–67.8 mm SL; Venezuela, Apure, Río Apure, San Fernando de Apure. USNM 243235, 2 specimens, 51.5–53.7 mm SL; Brazil, Amazonas, Rio Solimões, near Coari. USNM 181642, 1 specimen, 79.2 mm SL; Paraguay, Central, Río Paraguay, Asunción Bay. USNM 243234, 2 specimens, 60.2–62.9 mm SL; Brazil, Mato Grosso, Rio Cuiabá, Santo Antonio de Leverger.
- Curimatella immaculata* (Fernández-Yépez), USNM 257565, 2 specimens, 61.0–63.8 mm SL; Venezuela, Guarico, Río Guariquito, E-SE of Calabozo. USNM 235524, 2 specimens 50.2–53.0 mm SL; Venezuela, Monagas, Río Orinoco, Isla Cocos, opposite Los Castillos.
- Curimatella lepidura* (Eigenmann and Eigenmann), USNM 302934, 1 specimen, 72.5 mm SL; Brazil, Bahia, Rio São Francisco basin.
- Curimatella meyeri* (Steindachner), USNM 261508, 1 specimen, 98.8 mm SL; Peru, Loreto, Río Ucayali, Masisea.

#### INSTITUTIONAL 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	formerly, British Museum (Natural History), London, now, Natural History Museum, London
CAS	California Academy of Sciences, San Francisco
FMNH	Field Museum of Natural History, Chicago
GC	personal collection of Jacques Géry; most specimens subsequently transferred to MHNG
IU	Indiana University, Bloomington; collections now dispersed to various repositories
MBUCV	Museo de Biología de la Universidad Central de Venezuela, Caracas
MCZ	Museum of Comparative Zoology, Cambridge
MNHN	Muséum National d'Histoire Naturelle, Paris
MHNG	Muséum d'Histoire Naturelle, Geneva
MNRJ	Museu Nacional, Rio de Janeiro
MUSM	Museo de Historia Natural de la Universidad Nacional de San Marcos, Lima
MZUSP	Museu de Zoologia, Universidade de São Paulo, São Paulo

NMNH	National Museum of Natural History, Smithsonian Institution, Washington, D.C.
NMW	Naturhistorisches Museum Wien, Vienna
NRM	Naturhistoriska Riksmuseet, Stockholm
SU	Stanford University, collections now at CAS
UMMZ	University of Michigan, Museum of Zoology, Ann Arbor
USNM	former collections of the United States National Museum, now deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.
USP-RP	Universidade de São Paulo, Ribeirão Preto, Brazil
ZMB	Zoologisches Museum, Humboldt-Universität, Berlin

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undertaken as a collaborative effort with the Museo de Biología de la Universidad Central de Venezuela. The specimens of *Curimata vittata* from the upper Río Orinoco were collected by R. Royero and forwarded by A. Machado-Allison (MBUCV).

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#### Character Description and Analysis

The synapomorphy diagnosing *Curimatella*, derived features for subunits of the genus, and autapomorphies for various species are discussed in this section. The discussion of these derived features is followed by a "Character Summary."

#### CAUDAL-FIN SQUAMATION

In their key to the then-known members of the Curimatidae, Eigenmann and Eigenmann (1889b:415) proposed the subgenus *Curimatella* for those species of *Curimatus* (sensu lato) with the "caudal lobes thickly scaled to their tips." Their concept of the subgenus included three of the species recognized in this study (*lepidurus*, *meyeri*, and *alburnus*) along with two nominal forms (*serpae* and *alburnus lineatus*) considered synonyms herein. In the same paper Eigenmann and Eigenmann (1889b:420) noted that *Curimatus dorsalis* had the "basal half of the caudal rays scaled," but nonetheless did not include it in the subgenus *Curimatella*. These six taxa together with four other nominal curimatid species (*Curimatella alburnus australe*, *Curimatus elegans paraguayensis*, *Curimatus (Curimatella) alburnus* var. *caudimaculata*, *Curimata reticulata*, and *Lepipinna immaculata*) have a sheet of small scales extending across at least the proximal two-thirds of the central rays of each caudal-fin lobe in adults. Contrary to Eigenmann and Eigenmann's comment (1889b:415), in none of the nominal species or subspecies do the scales on the lobes of the caudal fin "extend to their tips." Instead these taxa have an ontogenetic expansion of the field of scales onto the caudal-fin rays. Specimens of *Curimatella* species under 20 to 30 mm SL have few, if any, scales on the caudal-fin rays beyond those typical for juveniles and adults of other curimatid genera. Adults of *Curimatella*, in contrast, have a sheet of scales smaller than those on the caudal peduncle extending to varying degrees onto the caudal fin. The degree to which individual fin rays are covered varies within each fin lobe (Figure 1). The field is most extensive on the central rays of

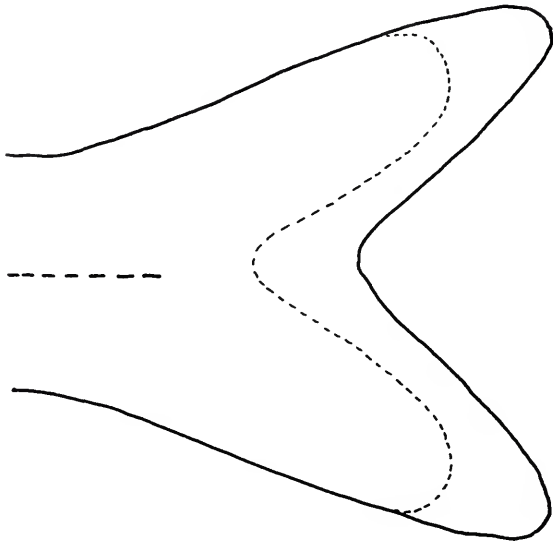


FIGURE 1.—Schematic illustration showing extent of squamation on caudal fin of *Curimatella meyeri*, USNM 278577, 129.0 mm SL; left side, lateral view (dotted line indicates posterior limit of scale field overlying caudal-fin rays; dashed horizontal line indicates position of lateral line).

each caudal-fin lobe where it extends two-thirds or more of the distance to the tips of the fin rays. The actual extent of the scale field varies ontogenetically within species and also interspecifically. The scales overlying the dorsal and ventral rays of the fin extend about one-half to two-thirds of the distance to the tips of the rays, but not as far distally as do the scales on the central rays of each lobe. The field of scales is least developed posteriorly in the region where the upper and lower lobes come together. The less extensive squamation on those rays presumably permits motion of the lobes of the caudal fin relative to each other.

Although the exact degree of development of the field of caudal-fin scales on individual fin rays varies in *Curimatella*, such extensive fields are absent in other curimatids. In outgroups to *Curimatella* within the Curimatidae the caudal-fin squamation terminates only slightly posterior of the base of the caudal fin or maximally extends a relatively short distance onto the middle rays of each caudal-fin lobe (see also discussion below). An extensive field of scales over the caudal-fin lobes does not occur in the Prochilodontidae, the sister group to the Curimatidae (Vari, 1983, 1989a). Within the Chilodontidae and Anostomidae, the sister lineage to the clade formed by the Curimatidae and Prochilodontidae (Vari, 1983), extensive caudal-fin squamation occurs only in *Leporellus* Lütken, one of the least speciose lineages in the Anostomidae. In light of conditions in the sequential outgroups, the possession of broad fields of scales on the caudal fin in *Curimatella* is hypothesized to be synapomorphic for the members of the genus, as previously put forward by Vari (1989a:49).

Larger individuals of several *Cyphocharax* species (*leucostictus* (Eigenmann and Eigenmann), *microcephalus* (Eigenmann and Eigenmann), *magdalenae* (Steindachner), and *aspilos* Vari) have a small field of scales basally on the middle rays of each caudal-fin lobe. These limited-scale fields differ notably in degree of development from the broad sheet of scales on the caudal fin in *Curimatella*. Furthermore the caudal fin scales of the noted *Cyphocharax* species more closely approximate the size of the scales on the adjoining portions of the caudal peduncle than do the caudal-fin scales in *Curimatella*. For these reasons the conditions in the species of *Curimatella* and the cited members of *Cyphocharax* are considered non-homologous.

#### FOURTH EPIBRANCHIAL

The fourth epibranchial demonstrates the largest number of modifications of any component of the gill-arches in the Curimatidae. One of the most distinctive features is the development of a bony spur (Vari, 1989a:15) that extends medially from the main body of the bone in all curimatids other than the species of *Curimatopsis*. All species of *Curimatella*, other than *C. lepidura*, retain the form of the medial bony spur generalized for the other members of the terminal polytomy within the Curimatidae defined by Vari (1989a:50). *Curimatella lepidura*, in contrast, has the distal portion of the process expanded ventrally into a broad, bowl-like process (Figure 2) that contacts the ventral surface of the epibranchial

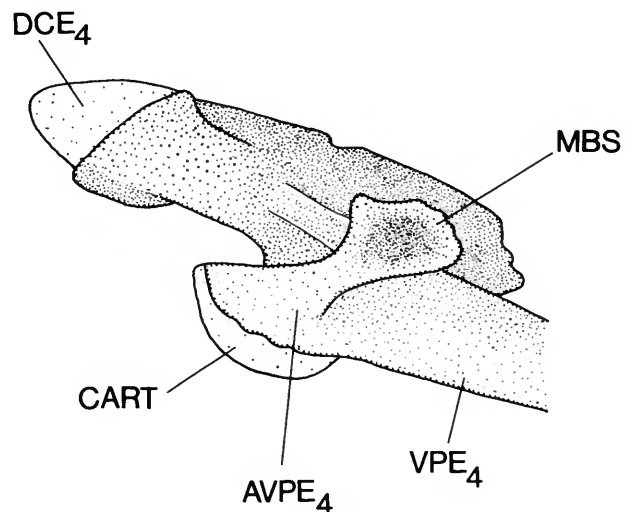


FIGURE 2.—*Curimatella lepidura*, USNM 302934, 72.5 mm SL; anterior and central portions of fourth epibranchial, right side, anteromedial view, anterior to left; showing expanded distal portion of medial bony spur (AVPE4 = anteroventral portion of fourth epibranchial; CART = cartilage; DCE4 = distal cartilage of fourth epibranchial; MBS = medial bony spur of fourth epibranchial; VPE4 = ventral portion of fourth epibranchial).

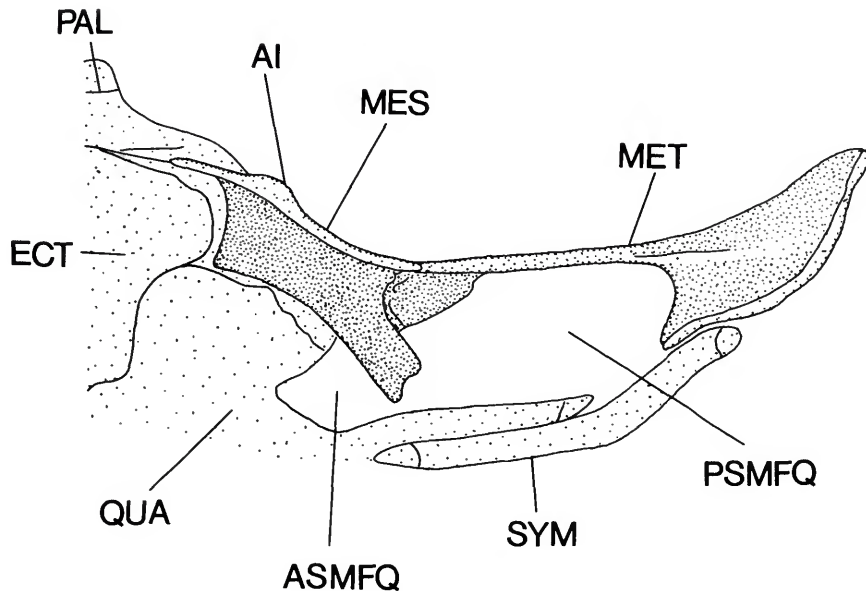


FIGURE 3.—*Curimatella lepidura*, USNM 302934, 72.5 mm SL; mesopterygoid and metapterygoid, right side, medial view, anterior to left; showing reduced process for attachment of ligament extending between vomer and mesopterygoid, and narrow central shaft of metapterygoid; proximate portions of neighboring bones lightly stippled (AI = area of attachment for ligament extending between vomer and mesopterygoid; ASMFAQ = anterior section of metapterygoid-quadrate fenestra; ECT = ectopterygoid; MES = mesopterygoid; MET = metapterygoid; PAL = palatine; PSMFAQ = posterior section of metapterygoid-quadrate fenestra; QUA = quadrate; SYM = symplectic).

organ. Such an expansion of the distal portion of the medial bony spur is neither encountered in the other species of *Curimatella*, nor in other examined curimatids. It is thus hypothesized autapomorphic for *C. lepidura*.

#### MESOPTERYGOID

In all curimatids with the exception of the species of *Curimatopsis*, the mesopterygoid is linked to the ventral surface of the neurocranium by a discrete band of connective tissue (Vari, 1989a:44–45). The dorsomedial region of the mesopterygoid onto which this ligament attaches is typically expanded into dorsomedial process. Four of the species of *Curimatella* (*alburna*, *dorsalis*, *immaculata*, and *meyeri*) retain this generalized condition of the mesopterygoid. *Curimatella lepidura*, although having a fully developed ligament, has the dorsomedial process on the mesopterygoid notably much less developed (Figure 3), a hypothesized autapomorphy for the species.

#### METAPTERYGOID

The overall form of the metapterygoid within the Curimatidae shows a pronounced degree of variability in the family (see

Vari, 1989a:45–47). The ossified portion forming the dorsal border of the metapterygoid-quadrate fenestra is typically moderately to distinctly broad (see Vari, 1989a, fig. 42). The metapterygoid in all members of *Curimatella* with the exception of *C. lepidura* is relatively wide in the region dorsal to the metapterygoid-quadrate fenestra. *Curimatella lepidura* differs from the generalized condition in the genus in having the central portion of the metapterygoid reduced to a narrow bar-like structure (Figure 3). This feature is unique among the species in *Curimatella* and the proximate outgroups to that genus, and is thus considered autapomorphic for *C. lepidura*.

#### PIGMENTATION

The only feature of the pigmentation of note within *Curimatella* is the patch of dark pigment on the posterior portion of the midlateral surface of the caudal peduncle in *C. dorsalis* (Figures 7–12). Such markings have a relatively limited distribution within the Curimatidae and are absent in the Prochilodontidae, the sister group to the Curimatidae. On the basis of that evidence the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle would be hypothesized derived in the Curimatidae and presumably autapomorphic for *C. dorsalis*. I should note,

however, that similar, possibly homologous pigmentation patterns also occur in the species of *Pseudocurimata* (Vari, 1989b) and various species of *Cyphocharax* (Vari, in press), two of the three other lineages in the terminal polytomy within the Curimatidae (Vari, 1989a:50). The distribution of the feature in conjunction with the undetermined phylogenetic relationships within the polytomy (Vari, 1989a), *Cyphocharax* (in press), and *Curimatella* (see below) interjects some uncertainty into the hypothesized polarity and the level of generality at which the character should be considered derived.

#### VERTEBRAL COUNTS

The number of vertebrae in the species of *Curimatella* fall into two barely overlapping groupings. All radiographed specimens of *C. dorsalis* and *C. lepidura* have 31 or 32 vertebrae as do all but two (= 1.3%) of the 153 radiographed specimens of *C. immaculata* which have 33 vertebrae (Table 2). In contrast, radiographed specimens of *C. alburna* have 33 to 35 vertebrae with a strong mode of 34 elements, and individuals of *C. meyeri* have 35 to 37 vertebrae with a pronounced mode at 36 (Table 2). The polytomy between *Curimatella*, *Steindachnerina*, *Cyphocharax*, and *Pseudocurimata* (Vari, 1989a) complicates the determination of the plesiomorphic number of vertebrae within *Curimatella*. The lower number of vertebrae of *C. dorsalis*, *C. immaculata*, and *C. lepidura* is, however, comparable to the counts in the genera *Psectrogaster* (29–31 vertebrae; Vari, 1989c) and *Curimata* (31–34 vertebrae; Vari, 1989b), the proximate outgroups to the clade formed by the polytomy. Furthermore the most parsimonious hypothesis of relationships within *Curimata* based on a series of non-vertebral features indicates that the 33 or 34 vertebrae in *Curimata kneri* is derived in that genus (Vari, 1989b, fig. 14) and that 30 to 32 vertebrae are primitive for *Curimata*. Examination of the three other genera in the terminal polytomy in the Curimatidae suggests a similar polarity. High numbers of vertebrae in a component of *Steindachnerina* are derived under the phylogenetic scheme proposed for the genus on the basis of characters from multiple body systems (Vari, 1991:22, and fig. 11). Similarly, the distribution of non-vertebral characters in *Pseudocurimata* indicates that the 31 to 34 vertebrae found in the majority of species is the plesiomorphic condition (Vari, 1989d). The unresolved phylogeny within *Cyphocharax* (Vari, in press) prevents an evaluation of the polarity of the range in vertebral number in that genus. Although the character is homoplastic within the family, the information from *Steindachnerina*, *Pseudocurimata*, and the sequential outgroups to the multitomy (*Curimata* and *Psectrogaster*) argues that a lower number of vertebrae is probably plesiomorphic within *Curimatella*. The higher number of vertebrae (33 to 37) in *C. alburna* and *C. meyeri* is consequently hypothesized synapomorphic for the species pair, with the particularly high counts in *C. meyeri* autapomorphic for the species.

TABLE 2.—Number of specimens of the species of *Curimatella* with cited number of vertebrae. Vertebrae incorporated into fused  $PU_1+U_1$  counted as a single element and vertebrae in the Weberian apparatus counted as four elements. Species arranged alphabetically.

Species	Vertebrae						
	31	32	33	34	35	36	37
<i>alburna</i>			11	58	5		
<i>dorsalis</i>	1	87					
<i>immaculata</i>	13	138	2				
<i>lepidura</i>	29	3					
<i>meyeri</i>					9	98	3

#### CHARACTER SUMMARY

Of the derived characters detailed above, only two involve more than one species, the caudal-fin squamation that is synapomorphic for the members of *Curimatella* and the increased number of vertebrae in *C. alburna* and *C. meyeri*, which supports a sister-species hypothesis. Autapomorphies for the species of *Curimatella* are more common, as follows:

*Curimatella meyeri*: a high number of vertebrae.

*Curimatella dorsalis*: the spot of dark pigmentation on the posterior portion of the midlateral surface of the caudal peduncle.

*Curimatella lepidura*: the expanded distal portion of the medial bony spur of the fourth epibranchial; the reduced medial process on the mesopterygoid that serves as the point of attachment for the ligament extending to the ventral surface of the neurocranium; the reduction of the central portion of the metapterygoid into a slender bar forming the dorsal border of the metapterygoid-quadrangle fenestra.

No autapomorphic features for either *Curimatella immaculata* or *C. alburna* were discovered.

#### Biogeography

The lack of a well-resolved intrageneric phylogeny reduces the biogeographically useful information that can be derived from *Curimatella*. The hypothesis of a sister-species relationship between *C. alburna* and *C. meyeri*, which are broadly sympatric in the Amazon basin, is indicative of large-scale historical dispersal under an allopatric speciation model. Even in the absence of a resolved intrageneric phylogeny, the sympatry of *C. alburna*, *C. dorsalis*, *C. immaculata*, and *C. meyeri* through the Amazon basin is similarly congruent with a hypothesis of large scale secondary dispersal under an allopatric speciation model (see also comments in Vari, 1988). Such a pattern of repeated, large-scale dispersal is widespread among curimatids, being universal at the intergeneric level (Vari, 1988), and also typical at the generic level (e.g., *Curimata*, Vari, 1989b; *Psectrogaster*, Vari, 1989c; and *Steindachnerina*, Vari, 1991).

### Genus *Curimatella* Eigenmann and Eigenmann, 1889b

*Curimatella* Eigenmann and Eigenmann, 1889b:415 [type species *Curimatus lepidurus* Eigenmann and Eigenmann, 1889a, by subsequent designation of Eigenmann, 1910:420, proposed as a subgenus; gender feminine].—Fowler, 1906:296 [recognized as a genus rather than a subgenus].

*Apolinarella* Fernández-Yépez, 1948:22 [type species *Curimatus meyeri* Steindachner, 1882, by original designation; gender feminine].—Vari, 1989a, tables 2, 3. [Placed as a synonym of *Curimatella*.]

*Walbaunina* Fernández-Yépez, 1948:24 [type species *Curimatus dorsalis* Eigenmann and Eigenmann, 1889b, by original designation; gender feminine].—Vari, 1989a, tables 2, 3. [Placed as a synonym of *Curimatella*.]

*Lepipinna* Fernández-Yépez, 1948:26 [type species *Anodus alburna* Müller and Troschel, 1844, by original designation; gender feminine].—Vari, 1989a, tables 2, 3. [Placed as a synonym of *Curimatella*.]

*Walbaumina*.—Géry et al., 1987:433 [emendation of *Walbaunina* Fernández-Yépez, 1948].

**DIAGNOSIS.**—*Curimatella* is distinguished from other genera in the Curimatidae by the derived presence of a sheet of small scales over much of the lobes of the caudal fin.

Dorsal-fin rays ii,9 or 10 (ii,10 rare), or iii,9 (rare); anal-fin rays ii,7 or 8, or iii,7; pectoral-fin rays 12 to 17; pelvic-fin rays usually i,8, sometimes i,7 or i,9; adipose fin always present, moderately developed. Pored lateral-line scales from supracleithrum to hypural joint range from 29 to 40; sensory canals in lateral-line scales straight. Number of scales in transverse series from origin of dorsal fin to lateral line 5 to 10<sup>1</sup>/<sub>2</sub>; number of scales in transverse series from origin of anal fin to lateral line 4<sup>1</sup>/<sub>2</sub> to 7<sup>1</sup>/<sub>2</sub>. Body size small to moderate (maximum known standard lengths for the species ranging from 93.0 to 179.9 mm). Total vertebrae 31 to 37.

**DISTRIBUTION.**—Río Orinoco, Río Amazonas, Río Tocantins, Río São Francisco, Río Paraguay, lower Río Paraná basins, and upper Essequibo River.

**REMARKS.**—Twelve nominal species are assigned to *Curimatella* herein (Table 1). Vari (1989a, tables 2, 3) included two additional nominal species (*Curimatus leucostictus* Eigenmann and Eigenmann (1889b) and *Curimatus (Curimatella) xinguensis* Steindachner (1908)) in *Curimatella*. Both of these species have some scales at the base of middle rays of each caudal-fin lobe in the type series. *Curimatus (Curimatella) xinguensis* was also originally erroneously described as having the lobes of the caudal fin scaled, the distinguishing feature of *Curimatella*.

Vari (in press) recognized *leucostictus* with *xinguensis* as a synonym. Examination of recently collected specimens of *leucostictus* has shown that the degree of development of the field of scales and their relative sizes differs from the conditions in the species of *Curimatella*. *Curimatus leucostictus* and *Curimatus (Curimatella) xinguensis* were consequently transferred by Vari (in press) to *Cyphocharax* Fowler (see also discussion under "Phylogenetic Reconstruction" above).

Fernández-Yépez (1948) dramatically modified the taxonomy of the Curimatidae in his overview of the family (his subfamily). Particularly striking was his recognition of numerous genera, most of which were proposed in that paper. This generic proliferation is exemplified by the classification of the species assigned herein to *Curimatella*. Curimatid species with scales covering much of the caudal fin were typically assigned to *Curimatella* by the majority of authors dealing with the family subsequent to Eigenmann (1910). The major exception was Steindachner, who continued to recognize *Curimatella* as a subgenus of *Curimatus* (e.g., Steindachner, 1917). Fernández-Yépez (1948), in contrast, assigned curimatids with scaled caudal fins to five genera, *Rivasella* Fowler, *Curimatella*, *Apolinarella*, *Walbaunina*, and *Lepipinna*, describing the three latter taxa in that publication. As noted by Géry et al. (1987:433), *Walbaunina* was incorrectly derived from Walbaum, an 18th century researcher, and those authors emended the name to *Walbaumina*.

The type species of *Rivasella*, *Curimata melaniris*, Fowler shares the derived features of *Steindachnerina* Fowler (Vari, 1991) and is not part of the lineage herein recognized as *Curimatella*. Fernández-Yépez (1948, key following p. 16) separated the other genera to which he assigned species with scaled caudal fins (*Curimatella*, *Apolinarella*, *Walbaumina*, and *Lepipinna*) on the basis of subtle differences in body form anterior and posterior to the insertion of the pelvic fins. Contrary to the statements in Fernández-Yépez's key (1948) the species do not exhibit appreciable differences in those portions of the body and thus do not distinguish the nominal taxa. Even in the absence of questions about the utility of those features, there is no advantage in recognizing four genera in a lineage of five species. As a consequence *Apolinarella*, *Walbaumina*, and *Lepipinna* are herein placed as synonyms of *Curimatella*.

### Key to the Species of *Curimatella* Eigenmann and Eigenmann

1. Scales in transverse series between origin of dorsal fin and lateral line 9 to 10<sup>1</sup>/<sub>2</sub>; scales in transverse series between lateral line and origin of anal fin 6<sup>1</sup>/<sub>2</sub> to 7<sup>1</sup>/<sub>2</sub> (Río São Francisco basin of eastern Brazil) . . . . . *C. lepidura*  
Scales in transverse series between origin of dorsal fin and lateral line 5 to 7<sup>1</sup>/<sub>2</sub>; scales in transverse series between lateral line and origin of anal fin 4 to 6 . . . . . 2
2. Caudal peduncle with distinct dark, mid-lateral spot [see Figures 7 to 12] (Río Orinoco, Río Amazonas, Río Tocantins, Río Paraguay, and lower Río Paraná systems) . . . . . *C. dorsalis*

- Caudal peduncle without dark, mid-lateral spot . . . . . 3
3. Lateral-line scales from supracleithrum to hypural joint 35 to 40; scales between origin of dorsal fin and lateral line  $6\frac{1}{2}$  to  $7\frac{1}{2}$ ; least depth of caudal peduncle 0.10–0.12 of SL; vertebrae 35 to 37, 35 and 37 less common [see Table 2] (central and western portions of Rio Amazonas basin) . . . . . *C. meyeri*
- Lateral-line scales from supracleithrum to hypural joint 29 to 35; scales between origin of dorsal fin and lateral line 5 or 6; least depth of caudal peduncle 0.13–0.15 of SL; vertebrae 31 to 35, 35 relatively rare, found only in some specimens of *C. alburna* [see Table 2] . . . . . 4
4. Maximum interorbital width 0.45–0.50 of HL; gape width 0.28–0.33 of HL; length of postorbital portion of head 0.39–0.45 of HL; orbital diameter 0.27–0.32 of HL; vertebrae 33 to 35, usually 34 (Rio Amazonas basin) . . . . . *C. alburna*
- Maximum interorbital width 0.38–0.45 of HL; gape width 0.24–0.29 of HL; length of postorbital portion of head 0.36–0.40 of HL; orbital diameter 0.33–0.39 of HL; vertebrae 31 to 33, usually 32, rarely 33 (Río Orinoco, Rio Amazonas, and Rio Tocantins basins) . . . . . *C. immaculata*

***Curimatella lepidura* (Eigenmann and Eigenmann)**

FIGURES 4–6; TABLE 2

*Curimatus lepidurus* Eigenmann and Eigenmann, 1889a:8 [type locality: Brazil: San Francisco (= Rio São Francisco), below its fall]; 1889b:417 [Brazil: Rio San Francisco (= São Francisco), below the fall]; 1891:46 [reference].

*Curimatella lepidurus*.—Eigenmann, 1910:420 [reference].

*Curimatella lepidura*.—Fernández-Yépez, 1948:25 [reference].—Fowler, 1950:297 [literature compilation].—Travassos, 1960:9 [Rio São Francisco].—Fowler, 1975:364 [reference].—Britski et al., 1984:58, fig. 67 [Brazil: Rio São Francisco, region of Três Marias reservoir; common name].—Oliveira et al., 1988:594 [Brazil: Minas Gerais, Três Marias; karyotypes].

DIAGNOSIS.—*Curimatella lepidura* is readily distinguished from its congeners in the number of scales in a transverse series between the origin of the dorsal fin and the lateral line (9 to  $10\frac{1}{2}$  versus 5 to  $7\frac{1}{2}$  in the other *Curimatella* species), and in

the number of scales in a transverse series between the lateral line and the origin of the anal fin ( $6\frac{1}{2}$  to  $7\frac{1}{2}$  versus 4 to  $6\frac{1}{2}$  in the other members of the genus).

DESCRIPTION.—Body moderately elongate, somewhat more so in larger specimens (compare Figures 4 and 5); somewhat compressed laterally. Dorsal profile of head distinctly convex from tip of snout to vertical line through posterior nostril, straight to slightly convex from that line to tip of supraoccipital spine. Dorsal profile of body smoothly curved from tip of supraoccipital spine to origin of dorsal fin; straight and posteroventrally slanted at base of dorsal fin, gently convex from base of last ray of dorsal fin to caudal peduncle. Dorsal surface of body with median keel anterior to dorsal fin, keel more obvious proximate to origin of fin; surface of body smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region transversely rounded, without enlarged scales.



FIGURE 4.—*Curimatella lepidura*, USNM 302934, 68.9 mm SL; Brazil, Bahia, Rio São Francisco basin.



FIGURE 5.—*Curimatella lepidura*, MZUSP 21454, 103.4 mm SL; Brazil, Minas Gerais, Rio São Francisco, Represa de Três Marias.

Obtuse midventral keel present posterior to pelvic fin insertion. Secondary obtuse keel on each side of postpelvic portion of body about two scales dorsal of ventral midline.

Greatest body depth at origin of dorsal fin, depth 0.36–0.43 [0.40]; snout tip to origin of dorsal fin 0.48–0.54 [0.52]; snout tip to origin of anal fin 0.80–0.85 [0.84]; snout tip to insertion of pelvic fin 0.52–0.58 [0.55]; snout tip to anus 0.76–0.82 [0.80]; origin of dorsal fin to hypural joint 0.55–0.60 [0.59]. Dorsal fin acutely pointed anteriorly in profile, more so in larger individuals, posterior portion of distal border straight or slightly emarginate, last unbranched and first branched rays approximately three times length of ultimate ray. Pectoral fin distinctly pointed in profile; length of pectoral fin 0.18–0.20 [0.20], extending one-half to two-thirds distance to vertical line through insertion of pelvic fin. Pelvic fin pointed in profile, length of pelvic fin 0.19–0.23 [0.22], reaching about two-thirds distance to origin of anal fin in smaller specimens, somewhat less far in larger specimens. Caudal fin forked, lobes rounded, with sheet of small scales developed to varying extent over fin rays of both lobes. Specimens of approximately 35 mm SL with scales extending over basal half of all rays other than those in middle portion of fin; scale series becoming proportionally more extensive in larger specimens. Individuals of over 70 mm SL with broad sheet of scales extending two thirds or more of distance to tip of middle of each lobe of caudal fin. Adipose fin well developed. Anal-fin border straight to emarginate, anteriormost branched rays about two and one-half times length of ultimate ray. Depth of caudal peduncle 0.13–0.15 [0.14].

Head obtusely pointed in profile, head length 0.28–0.33 [0.30]; upper jaw barely longer than lower, mouth terminal to slightly subterminal; snout length 0.24–0.30 [0.28]; nostrils of each side of head close to each other, anterior circular, posterior

crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.28–0.33 [0.33]; adipose eyelid present, more highly developed in larger specimens, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.39–0.45 [0.44]; gape width 0.24–0.27 [0.25]; interorbital width 0.39–0.45 [0.43].

Pored lateral-line scales from supracleithrum to hypural joint 38 to 41 [40]; all scales of lateral line pored, canals in pored scales straight; 3 to 6 series of scales extend beyond hypural joint onto caudal-fin base; 9 to  $10\frac{1}{2}$  [ $9\frac{1}{2}$ ] scales in transverse series from origin of dorsal fin to lateral line;  $6\frac{1}{2}$  to  $7\frac{1}{2}$  [ $7\frac{1}{2}$ ] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 [ii,9]; anal-fin rays ii,7 or 8 [ii,7]; pectoral-fin rays 14 to 17 [15]; pelvic-fin rays i,8 [i,8].

Total vertebrae 31 (29), 32 (3).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery to silvery-golden, darker on dorsal portions of head and body. Specimens lacking guanine on scales tan to brown, distinctly darker on dorsal surface of head and body, more so in larger specimens. No pronounced pigmentation pattern on head or body. Rays of dorsal, anal, and caudal fins in specimens under 25 mm SL outlined by series of small, dark chromatophores; pigmentation along those rays more pronounced in larger specimens. Pectoral and pelvic fins hyaline in smaller specimens, with fin rays outlined by series of small, dark chromatophores in larger individuals.

DISTRIBUTION.—Rio São Francisco basin of eastern Brazil (Figure 6).

KARYOTYPE.—Oliveira et al. (1988:594) reported that *Curimatella lepidura* has  $2n = 54$  chromosomes.

COMMON NAME.—Manjuba (Britski et al., 1984:58).

REMARKS.—Eigenmann and Eigenmann (1889a:8) based



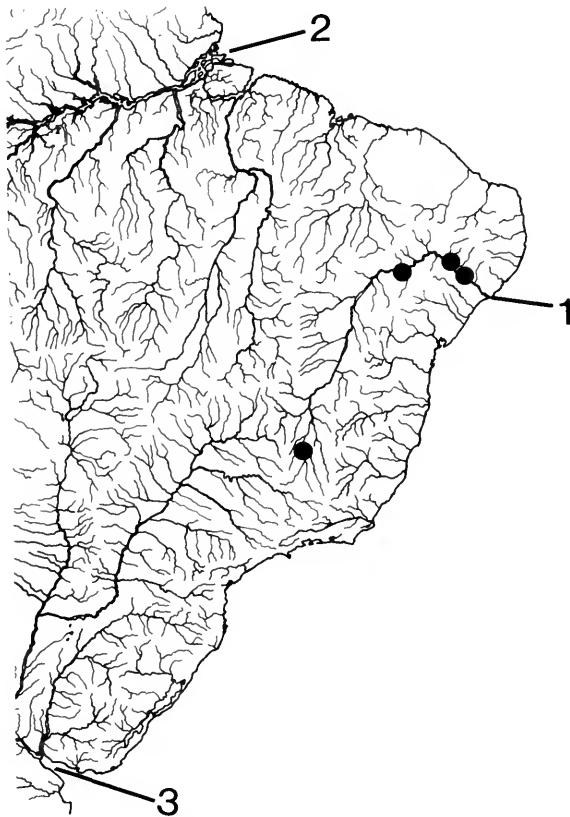


FIGURE 6.—Map of eastern Brazil and adjoining regions showing geographic distribution of *Curimatella lepidura* (filled in circles; type locality “San Francisco (=Rio São Francisco), below its fall” inexact; 1 = mouth of Rio São Francisco, 2 = mouth of Rio Amazonas, 3 = Río de La Plata) (some symbols represent more than one collecting locality or lot of specimens).

their description of *Curimatus lepidurus* on five specimens. The largest of these, a 91.0 mm SL specimen in the best overall condition, is designated as the lectotype (MCZ 20291). The four remaining syntypes (MCZ 20292) become paralectotypes.

MATERIAL EXAMINED.—231 specimens (38, 40.7–112.8).

BRAZIL. Rio San (= São) Francisco “below its fall,” MCZ 20291, 1 (91.0, lectotype of *Curimatus lepidurus*); MCZ 20292, 4 (69.2–85.7, paralectotypes of *Curimatus lepidurus*). Rio São Francisco, NMW 67020, 5; NMW 67022, 9; NMW 67024, 5; NMW 67025, 2; USNM 302357, 10 (9, 40.7–51.0). Rio São Francisco and tributary streams, MZUSP 39738, 5. Baringa near Joazeiro, Rio São Francisco, NMW 67023, 16; NMW 67017, 25; NMW 67022, 9; NMW 67020, 5; NMW 67024, 5. Minas Gerais: Rio São Francisco, Represa de Três Marias, MZUSP 21450, 1 (99.3); MZUSP 37972, 46; MZUSP 20820, 2 (98.0–103.4); MZUSP 21715, 2 (96.7–108.7); MZUSP 21454, 9 (66.0–112.8); MZUSP 38519, 34 (5,

89.6–112.8). Lagoa do Praiano, on left margin of Rio São Francisco, MZUSP 39397, 6. Lagoa do Tacho, on left margin of Rio São Francisco, MZUSP 39418, 6 (3, 53.7–68.2). Rio São Francisco basin, Rio Formosa at Pirapora, USNM 313075, 5. Rio São Francisco basin, Rio Formosa 10 km upstream of Pirapora, USNM 313076, 2. Sergipe: Rio São Francisco, vicinity of Propriá, USNM 302933, 1; MZUSP 21520, 1. Bahia: Rio São Francisco, Paulo Afonso, MNRJ 10905, 1; USNM 302934, 2 (2, 68.9–73.5; 1 specimen cleared and counterstained for cartilage and bone). Pernambuco: Lagoas Coripos, left bank of Rio São Francisco, UMMZ 147399, 12.

### *Curimatella dorsalis* (Eigenmann and Eigenmann)

FIGURES 7–13; TABLES 2–4

- Curimatus dorsalis* Eigenmann and Eigenmann, 1889b:420 [type locality: Brazil: Coary (= Lago do Coari), Manacapuru (= Lago Grande de Manacapuru), Hyavary (= Rio Javari at Brazilian-Peruvian border), Óbidos]; 1891:47 [reference].—Eigenmann, 1910:421 [reference].—Vari, 1989a, tables 2, 3 [phylogenetic relationships].
- Curimatus alburnus*.—Boulenger, 1896:34 [Brazil: Mato Grosso, Descalvados]; 1898:426 [Brazil: Rio Jurua].
- Curimatella alburnus australe* Eigenmann and Kennedy, 1903:510 [type locality: Paraguay: Asuncion].—Ringuelet and Aramburu, 1961:36 [Argentina].—Vari, 1989a, tables 2, 3 [phylogenetic relationships]. [New synonymy.]
- Curimatus elegans paraguayensis* Eigenmann and Kennedy, 1903:510 [type locality: Paraguay: Estancia La Armonia, Arroyo Carumbey].—Eigenmann et al., 1907:124 [placed as a synonym of *Curimatus elegans nitens*].—Pozzi, 1945:258, 271 [Argentina, Río Paraguay basin].—Vari, 1989a, tables 2, 3 [phylogenetic relationships]; 1991:101 [complexity of type series of *Curimatus elegans paraguayensis* noted; paratype identified as *Steindachnerina brevipinna* (Eigenmann and Eigenmann, 1889b)].
- Curimatella alburnus*.—Eigenmann et al., 1907:124 [Paraguay: Bahia Negra].
- Curimatus (Curimatella) alburnus* var. *caudimaculata* Pellegrin, 1909:150 [type locality: Brazil: Santarém and Rio Tonantins].—Vari, 1989a, tables 2, 3 [phylogenetic relationships]. [New synonymy.]
- Curimatus bolivarensis* Steindachner, 1910:265 [type locality: Venezuela: Río Orinoco near Ciudad Bolívar].—Femández-Yépez, 1948:73 [reference].—Fowler, 1950:366 [listed as a possible synonym of *Bitricarinata vittata* (Kner, 1859)].—Vari, 1989a, tables 2, 3 [phylogenetic relationships].
- Curimatella alburna caudimaculata*.—Eigenmann, 1910:421 [reference].—Femández-Yépez, 1948:73 [reference].—Fowler, 1950:297 [literature compilation].—Azpelicueta and Braga, 1980:165 [Argentina: Río Paraguay, Formosa].—Lopez et al., 1984:84 [Argentina: Corrientes, Bella Vista and Río Paraná].
- Curimatella alburna australis*.—Eigenmann, 1910:420 [reference].—Bertoni, 1914:9 [Paraguay]; 1939:54 [Paraguay].
- Curimatella alburna*.—Bertoni, 1914:9 [Paraguay]; 1939:54 [Paraguay].
- Curimatella bolivarensis*.—Schultz, 1944:249 [Venezuela; citation based on Steindachner, 1910].—Mago-Leccia, 1967:254 [Venezuela: Llanos of Río Orinoco basin; presumably based on Steindachner, 1910]; 1970:75 [Venezuela].
- Walbaunina dorsalis*.—Femández-Yépez, 1948:24, fig. 6 [designation as type species of *Walbaunina* Femández-Yépez].—Fowler, 1975:365 [reference].—Géry et al., 1987:433 [*Walbaunina* Femández-Yépez emended to *Walbaunina*; *W. dorsalis* compared with *Curimatella* cf. *australis*].
- Rivasella australis*.—Femández-Yépez, 1948:57 [reference].—Ringuelet et al., 1967:202 [reference].—Ringuelet, 1975:72 [Río Paraguay basin].
- Curimata dorsalis*.—Fowler, 1950:282 [literature compilation].
- Curimatella alburna australe*.—Fowler, 1950:297 [literature compilation].

*Rivasella australe*.—Fowler, 1975:374 [reference].

*Bitracarinata aspera caudimaculata*.—Fowler, 1975:366 [*Curimatus* (*Curimatella*) *alburnus* var. *caudimaculata* Pellegrin placed as a synonym of *Curimatus aspera* Günther].

*Bitracarinata vittata*.—Fowler, 1975:366 [in part, incorrect possible synonymy of *Curimatus bolivarcensis* (= *bolivarensis*) in *Curimata vittata* Kner].

*Rivasella alburna*.—Ringuelet, 1975:72 [Río Paraguay system].

*Curimatella* cf. *australis*.—Géry et al., 1987:431, fig. 45 [Paraguay: Río Paraguay system: Arroyo Trementina, Laguna Negra, Río Jejuiguazu, Río Paraguay at Asuncion, Río Pirapo, Lagoon at Pilar. Río Paraná basin: Río Paraná at Campichuela, Río Paraná at mouth of Río Pirayu. Validity of species discussed].

**DIAGNOSIS.**—The distinct dark mid-lateral spot on the caudal peduncle is unique to *Curimatella dorsalis* in the genus. The 31 to 35 scales along the lateral line to the hypural joint and 5 to 6 scales in a transverse series from the lateral line to the origin of the dorsal fin distinguish *C. dorsalis* from *C. lepidura*, which has 38 to 41, and 9 to 10½ scales, respectively, in those series. The 31 or 32 vertebrae and 31 to 35 lateral-line scales of *C. dorsalis* separate it from *C. meyeri*, which has 35 to 37 vertebrae and 35 to 39 lateral-line scales. *Curimatella dorsalis* is differentiated from *C. alburna* in the relative length of the orbit (0.31–0.41 of HL versus 0.27–0.32, respectively) and in the number of vertebrae (31 or 32, typically 32, versus 33 to 35, typically 34; Table 2). *Curimatella dorsalis* differs modally, but with some overlap, from *C. immaculata* in the relative greatest width of the interorbital region of the head (0.43–0.50 versus 0.38–0.45, respectively).

**DESCRIPTION.**—Body robust, somewhat compressed, relatively deeper in larger specimens; body depth somewhat variable geographically, relatively greatest in specimens from western portions of Amazon basin (Figure 8); shallower in population samples from Rio Tocantins basin (see also

discussion under “Geographic Variation” below). Dorsal profile of head convex from tip of snout to vertical line through anterior nostril, straight from that line to tip of supraoccipital spine. Dorsal profile of body smoothly curved from tip of supraoccipital spine to origin of dorsal fin, curvature more pronounced in specimens over 70 mm SL, particularly in specimens from western portions of Amazon basin, less pronounced in specimens from Rio Tocantins system; straight and posteroventrally slanted at base of dorsal fin, straight or sometimes gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with indistinct median keel anterior to 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 flattened, with one median series of scales. Median scale series of prepelvic region flanked on each side by longitudinal series of scales that conform in shape to lateral angles on that portion of body. Scales of prepelvic region approximately of same size as those on adjoining regions of body. Obtuse median keel posterior to insertion of pelvic fins. Secondary obtuse keel on each side of postpelvic portion of body one scale row dorsal of ventral midline.

Greatest body depth at origin of dorsal fin, depth 0.37–0.48 [0.44], depth typically proportionally greater in larger specimens, particularly in population samples from western portions of Amazon basin; snout tip to origin of dorsal fin 0.48–0.52 [0.48]; snout tip to origin of anal fin 0.80–0.87 [0.84]; snout tip to insertion of pelvic fin 0.52–0.57 [0.54]; snout tip to anus 0.76–0.81 [0.79]; origin of dorsal fin to hypural joint 0.55–0.63 [0.59]. Distal margin of dorsal fin obtusely pointed in profile anteriorly; last unbranched and first branched rays approximately three to three and one-half times length of



FIGURE 7.—*Curimatella dorsalis*, lectotype, MCZ 20183, 64.2 mm SL; Brazil, Amazonas, Coary (= Lago do Coari).



FIGURE 8.—*Curimatella dorsalis*, USNM 261457, 77.8 mm SL; Peru, Loreto, Río Yavarí, near Petropolis.

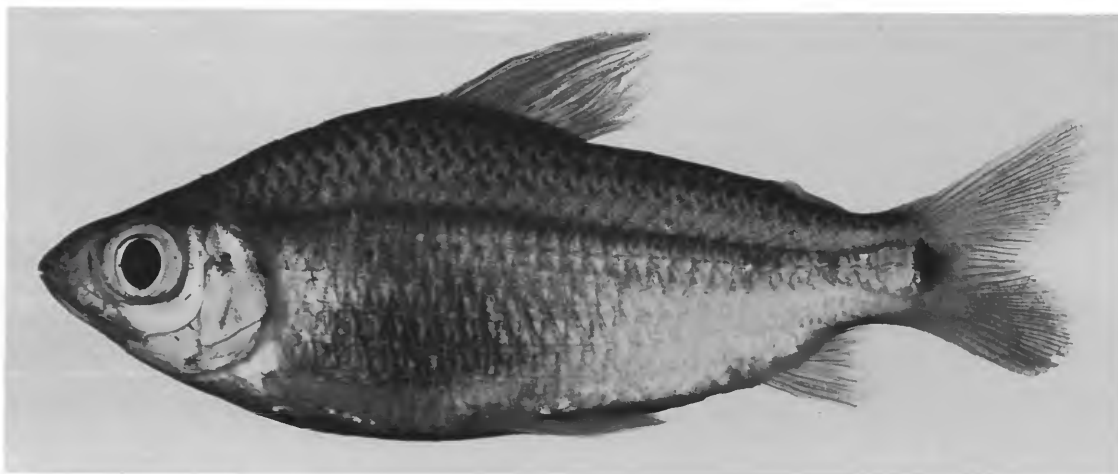


FIGURE 9.—*Curimatella dorsalis*, USNM 258284, 80.9 mm SL; Venezuela, Apure, Río Apure, San Fernando de Apure.

ultimate ray. Margin of pectoral fin pointed in profile distally; length of pectoral fin 0.18–0.24 [0.19], extending about two-thirds to three-quarters distance to vertical line through insertion of pelvic fin. Pelvic fin margin pointed, length of pelvic fin 0.22–0.28 [0.27], reaching about two-thirds to three-quarters of distance to origin of anal fin. Caudal fin forked; specimens of 50 to 80 mm SL with basal two-thirds of all caudal-fin rays other than those in center of fin covered by adherent scales much smaller than those on body, scales over central rays of caudal fin only extending approximately one-third to one-half distance to tips of those fin rays. Greater proportions of all fin rays covered by scales in larger

specimens. Adipose fin well developed. Border of anal fin emarginate, anteriormost branched rays twice length of ultimate ray. Caudal peduncle depth 0.12–0.15 [0.13].

Head obtusely pointed in profile anteriorly, head length 0.28–0.33 [0.29]; upper jaw slightly longer than lower, mouth barely subterminal; snout length 0.27–0.33 [0.28]; nostrils of each side of head close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.31–0.41 [0.39]; adipose eyelid present, more developed in larger individuals, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.33–0.42 [0.36]; gape width

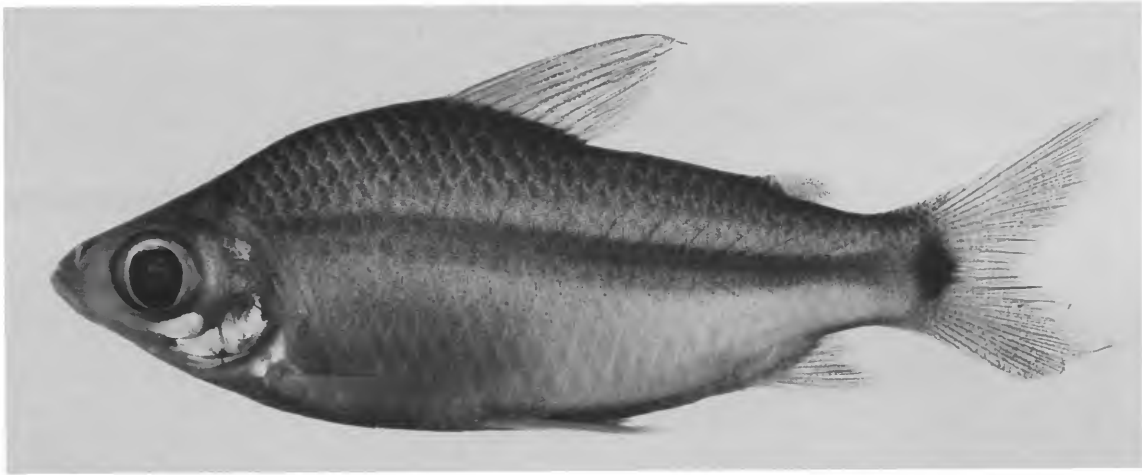


FIGURE 10.—*Curimatella dorsalis*, USNM 235513, 57.3 mm SL; Venezuela, Monagas, caño off Río Orinoco.

0.23–0.31 [0.29]; interorbital width 0.43–0.50 [0.46].

Pored lateral-line scales from supracleithrum to hypural joint 31 to 35 [32]; all scales of lateral line pored, canals in scales straight; 3 to 5 series of pored scales extend beyond hypural joint onto caudal-fin base; 5 to 6 [ $5\frac{1}{2}$ ] scales in transverse series from origin of dorsal fin to lateral line; 4 to  $5\frac{1}{2}$  [ $5\frac{1}{2}$ ] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,8 to 10, or iii,9 (when three unbranched rays present, first very small; ii,9 in most specimens, ii,8 and ii,10 rare, iii,9 uncommon) [ii,9]; anal-fin rays ii,7 or 8, or iii,7 (when three unbranched rays present, first very small) [ii,7]; pectoral-fin rays 12 to 15 [14]; pelvic-fin rays i,7 to 9 (usually i,8; i,7 and i,9 rare) [i,8].

Total vertebrae 31 (1), 32 (87).

**COLOR IN ALCOHOL.**—Overall coloration of specimens retaining guanine on scales silvery to silvery-golden, darker on dorsal portions of head and body. Specimens lacking guanine on scales tannish yellow, darker dorsally. Head dusky dorsally, otherwise without pronounced pigmentation pattern or with scattered chromatophores on lateral surface of opercle. Body with dark, narrow, mid-dorsal stripe running from tip of supraoccipital spine to origin of dorsal fin, and between dorsal and adipose fins. Obscure, deep-lying, mid-lateral stripe extending along body from rear of supracleithrum to caudal peduncle. Distinct, darkly pigmented spot on rear of caudal peduncle and base of middle caudal-fin rays. Form of spot ranges from small and vertically ovoid to moderate-sized and slightly horizontally ovoid. Intensity of dark pigmentation in pigmentation patch, and relative size of spot vary both between and within population samples (compare Figure 7 to Figure 12). Spot usually darkest in samples from Río Orinoco basin (Figure 10) but with some individuals from Río de La Plata basin also having well-developed dark spots (Figure 11). Field of small dark chromatophores extending posteriorly from spot

on caudal peduncle onto basal portion of middle caudal-fin rays in some individuals (Figure 11).

**DISTRIBUTION.**—Río Orinoco, Río Amazonas, Río Tocantins, and Río Paraguay-lower Río Paraná systems (Figure 13).

**GEOGRAPHIC VARIATION.**—The population samples herein identified as *Curimatella dorsalis* from the Río Orinoco, Río Amazonas, and Río Paraguay-lower Río Paraná systems either agree in, or show a very large degree of overlap in all meristic and morphometric characters studied (Table 3). Some specimens from the Amazon system achieve relatively greater body depths (0.39–0.48 of SL) than occur in samples from the Río Orinoco basin (0.37–0.44) or Río de La Plata system (0.39–0.44), but with substantial or complete overlap of the range in this proportion among populations. Amazonian populations have a greater range in relative dorsal-fin origin to hypural joint distance (0.55–0.63 of SL) than is found samples from the Río Orinoco (0.55–0.60) and Río Paraguay-lower Río Paraná (0.56–0.61). Available specimens from the Río Orinoco system achieve a smaller maximum size (76.7 mm SL) than those from the Amazon and Río de La Plata systems (107.5 and 113.7 mm SL, respectively), a difference which may be a sampling artifact. Most specimens from the Río Orinoco basin have more intensely pigmented dark spots on the mid-lateral surface of the caudal peduncle than do individuals examined from drainage systems to the south of that basin (compare Figures 9 and 10 with 7, 8, 11, 12). Despite the differences in size and proportions, no qualitative traits are apparent that would allow the unambiguous subdivision of *Curimatella dorsalis* into more than one recognizable species.

The greatest variation in body form within *Curimatella dorsalis* occurs between the population samples from within the Amazon basin. This variability may simply reflect the greater geographic expanse of the Amazon basin, or the hydrographic complexity of the system, or both. Specimens from the Río

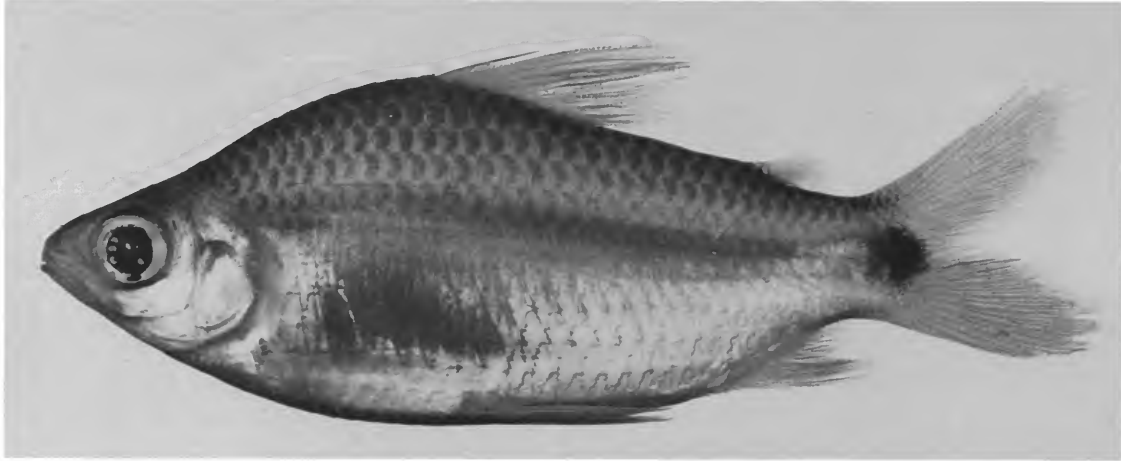


FIGURE 11.—*Curimatella dorsalis*, USNM 243233, 70.3 mm SL; Brazil, Mato Grosso, Rio Miranda, Corumba.

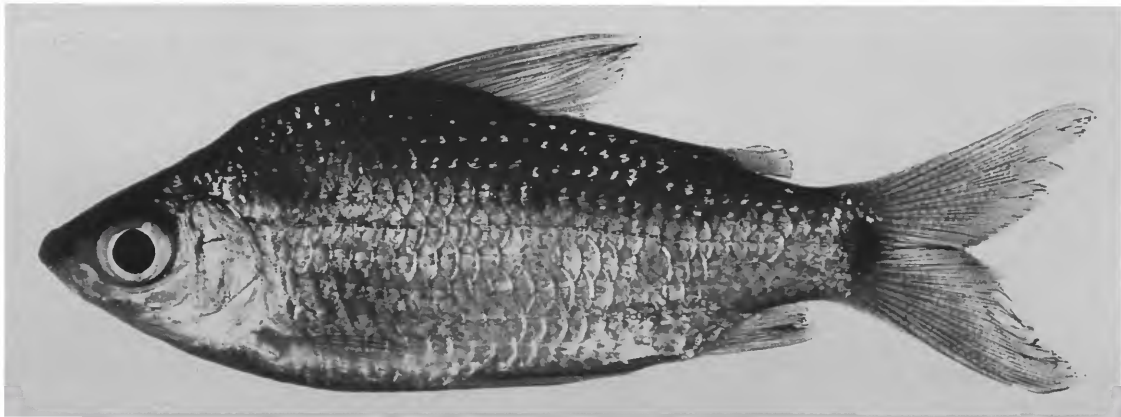


FIGURE 12.—*Curimatella dorsalis*, MZUSP 21733, 66.3 mm SL; Brazil, Mato Grosso do Sul, Rio Paraguai, Ilha de Taima.

Tocantins system of eastern Brazil are on the average more slender than individuals from other portions of the species range (0.39–0.43 of SL versus 0.41–0.48, respectively). Those specimens also have a less-convex dorsal profile of the body than does material from the remainder of the species range. Additional specimens from intervening regions are necessary to determine whether the populations from the Rio Tocantins represent an undescribed species, or one extreme of clinal variation in body form. The other extreme in body depth in *Curimatella dorsalis* occurs in population samples from the western portions of the Amazon basin in northeastern Peru and adjoining sections of western Brazil. Specimens from that region typically have greater relative body depths (0.43–0.48 of SL) with a more convex dorsal profile of the body (compare Figures 7 and 8 with 9 to 12). Nonetheless, these western

Amazonian populations demonstrate substantial overlap with samples from other portions of the Amazon basin in which the body depth is 0.39–0.46 of SL. Thus the various outlier populations are not recognized as a different species.

REMARKS.—Eigenmann and Eigenmann's (1889b:420) original description of *Curimatus dorsalis* was based on four specimens collected in different areas in the Amazon basin. The syntype from Coary (= Lago do Coari) (MCZ 20183, 64.2 mm SL), which is in the best overall condition, is designated as the lectotype (Figure 7). The three remaining syntypes from Manacapuru (= Lago Grande de Manacapuru; MCZ 20210), Hyavary (= Rio Javari along Brazilian-Peruvian border; MCZ 20241), and Óbidos (MCZ 20330) become paralectotypes.

Eigenmann and Eigenmann (1889b:420) noted that in *Curimatus dorsalis* the "Basal half of the caudal [fin] rays [are]



FIGURE 13.—Map of central and northern South America showing geographic distribution of *Curimatella dorsalis* (filled in circles; 1 = type locality of *Curimatus dorsalis*; 2 = type locality of *Curimatus bolivarensis*; 3 = type locality of *Curimatus (Curimatella) alburnus* var. *caudimaculata*; 4 = type locality of *Curimatella alburna australe*; 5 = type locality of *Curimatus elegans paraguayensis*) (some symbols represent more than one collecting locality or lot of specimens).

scaled," a statement at variance with the couplet in their key (1889b:415), which indicates that *dorsalis* has the "Caudal lobes mostly naked." Examination of the damaged caudal fins of the lectotype and paralectotypes shows that scales originally extended over more than one-half the length of the middle rays of each caudal-fin lobe. More recently collected specimens have the caudal fin well scaled over much of its surface, particularly in larger specimens. The incorrect evaluation of the degree of caudal-fin squamation in the type specimens of *dorsalis* led Eigenmann and Eigenmann to retain the species in *Curimatus* rather than assign it to *Curimatella*, the subgenus they proposed in the same publication for species with scaled caudal fins. This error may have caused subsequent researchers to ignore *Curimatus dorsalis* when dealing with curimatids with squamation on the caudal fins. That action, in turn, may

have contributed to the description of several nominal taxa by subsequent authors.

Eigenmann and Kennedy (1903:510) described a subspecies (their variety), *Curimatella alburnus australe*, based on a specimen from Asunción, Paraguay. Soon thereafter Pellegrin (1909:150) proposed *Curimatus (Curimatella) alburnus* var. *caudimaculata* on the basis of specimens from two widely separated Amazonian localities. Steindachner (1910:265), in turn, described *Curimatus bolivarensis* from the lower Río Orinoco. All of these nominal forms have squamation on the caudal-fin lobes and a dark midlateral spot on the caudal peduncle at the base of the middle caudal-fin rays, characters in common with *Curimatus dorsalis* of Eigenmann and Eigenmann. Although *australe* and *caudimaculata* were originally described as a subspecies or variety of *Anodus alburnus* Müller

TABLE 3.—Morphometrics and meristics of populations of *Curimatella dorsalis* in (A) Río Orinoco basin; (B) Río Amazonas basin and Río Tocantins basins; and (C) Río Paraguay and lower Río Paraná basins. (Standard length is expressed in mm; measurements 1 to 10 are proportions of standard length; 11 to 14 are proportions of head length.)

Character	A	B	C
MORPHOMETRICS			
Standard length	37.6–76.7	55.6–107.5	55.8–113.7
1. Greatest body depth	0.37–0.44	0.39–0.48	0.39–0.44
2. Snout to dorsal-fin origin	0.49–0.52	0.48–0.52	0.48–0.52
3. Snout to anal-fin origin	0.82–0.87	0.80–0.87	0.82–0.86
4. Snout to pelvic-fin origin	0.53–0.57	0.52–0.57	0.52–0.57
5. Snout to anus	0.77–0.81	0.76–0.81	0.76–0.81
6. Origin of rayed dorsal fin to hypural joint	0.55–0.60	0.55–0.63	0.56–0.61
7. Pectoral-fin length	0.18–0.23	0.20–0.24	0.18–0.22
8. Pelvic-fin length	0.22–0.27	0.22–0.28	0.22–0.26
9. Caudal-peduncle depth	0.12–0.15	0.12–0.15	0.13–0.15
10. Head length	0.30–0.33	0.28–0.33	0.28–0.32
11. Snout length	0.27–0.33	0.27–0.33	0.28–0.33
12. Orbital diameter	0.34–0.41	0.33–0.41	0.31–0.38
13. Postorbital length	0.33–0.42	0.34–0.41	0.36–0.42
14. Interorbital width	0.43–0.50	0.43–0.50	0.44–0.48
MERISTICS			
Lateral-line scales	31–34	31–34	31–35
Scale rows between dorsal-fin origin and lateral line	5–6	5 <sup>1</sup> / <sub>2</sub> –6	5–6
Scale rows between anal-fin origin and lateral line	4–5	4–5 <sup>1</sup> / <sub>2</sub>	4–5
Branched dorsal-fin rays	9–10	8–10	9
Branched anal-fin rays	7–8	7	7–8
Total pectoral-fin rays	12–15	13–15	12–15
Branched pelvic-fin rays	8	8–9	7–9

and Troschel (*Curimatella alburnus* of this study), both differ from the latter species in a number of characters. Most notable of these is presence of a dark mid-lateral spot on the caudal peduncle. Furthermore, the holotype of *Curimatella alburnus australe* and lectotype of *Curimatus (Curimatella) alburnus* var. *caudimaculata* have 32 vertebrae contrary to the 33 to 35, typically 34, vertebrae in *Curimatella alburna*. The association of the two nominal taxa (*caudimaculata* and *australe*) with *Curimatella alburna* rather than with *Curimatus dorsalis* was presumably an outgrowth of the previously noted misleading description by Eigenmann and Eigenmann of the caudal-fin scales in *C. dorsalis*.

*Curimatella alburnus australe* and *Curimatus (Curimatella) alburnus* var. *caudimaculata* along with *Curimatus bolivarensis* of Steindachner do not differ from *Curimatus dorsalis* of Eigenmann and Eigenmann in meristic and morphometric features (Table 4). As noted above the samples of the *Curimatella* species with dark mid-lateral caudal peduncle pigmentation from the Orinoco, Amazon, and La Plata basins, differ somewhat in the ranges of some proportional features. These ratios, however, fail to clearly discriminate those populations (see discussion under "Geographic Variation" above). As a consequence *Curimatella alburnus australe* Eigenmann and Kennedy, *Curimatus (Curimatella) alburnus* var. *caudimaculata* Pellegrin, and *Curimatus bolivarensis* Steindachner are considered synonyms of *Curimatus dorsalis*

Eigenmann and Eigenmann.

Eigenmann and Kennedy (1903:510) described *Curimatus elegans paraguayensis* based on two specimens from the Río Paraguay. Eigenmann et al. (1907:124) placed *C. e. paraguayensis* as a synonym of *Curimatus elegans nitens* Holmberg, an action followed by Eigenmann (1910:421) and Steindachner (1911:331) but not Pozzi (1945:271), who continued to recognize *Curimatus elegans paraguayensis*. An examination of the type series of *Curimatus elegans paraguayensis* reveals it is complex. The holotype of *Curimatus elegans paraguayensis* is an individual of *Curimatella dorsalis* (Table 4) and the paratype (the "cotype" of Eigenmann and Kennedy) is a specimen of *Steindachnerina brevipinna* (Eigenmann and Eigenmann), an endemic to the Río de La Plata system (see Vari, 1991:100–101 for a further discussion of this problem).

Pellegrin (1909:150) based his description of *Curimatus (Curimatella) alburnus* var. *caudimaculata* on a specimen from Santarém and two individuals originating in the Río Tonantins, localities in the Brazilian Amazon. The specimen from Santarém (MNHN 09-57), in the best overall condition, is designated as the lectotype and the two individuals from the Río Tonantins (MNHN 09-227, 09-228) become paralectotypes.

In the original description of *Curimatus bolivarensis*, Steindachner (1910:265) noted that the "Caudal fin is closely covered to the tip with small, tightly fitting scales." He

TABLE 4.—Morphometrics and meristics of (A) lectotype of *Curimatus dorsalis* (MCZ 20183), (B) holotype of *Curimatella alburnus australe* (CAS 60626, formerly IU 9929), (C) holotype of *Curimatus elegans paraguayensis* (CAS 60583, formerly IU 9928), (D) lectotype of *Curimatus (Curimatella) alburnus* var. *caudimaculata* (MNHN 09-57), (E) lectotype of *Curimatus bolivarensis* (NMW 67037.2), and (F) all specimens of *Curimatella dorsalis* 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 values that could not be taken as a consequence of damage to specimen.

Character	A	B	C	D	E	F
MORPHOMETRICS						
Standard length	64.2	88.8	105.0	67.7	66.2	37.6–113.7
1. Greatest body depth	0.44	0.44	0.41	0.44	0.41	0.37–0.48
2. Snout to dorsal-fin origin	0.48	0.52	0.50	0.51	0.50	0.48–0.52
3. Snout to anal-fin origin	0.84	0.87	0.83	0.87	0.82	0.80–0.87
4. Snout to pelvic-fin origin	0.54	0.53	0.52	0.55	0.52	0.52–0.57
5. Snout to anus	0.79	0.81	0.78	0.81	0.78	0.76–0.81
6. Origin of rayed dorsal fin to hypural joint	0.59	0.58	0.60	0.61	0.59	0.55–0.63
7. Pectoral-fin length	0.19	0.20	0.18	0.21	0.20	0.18–0.24
8. Pelvic-fin length	0.27	0.23	–	0.27	0.23	0.22–0.28
9. Caudal-peduncle depth	0.13	0.14	0.14	0.15	0.13	0.12–0.15
10. Head length	0.29	0.30	0.28	0.30	0.31	0.28–0.33
11. Snout length	0.28	0.31	0.30	0.31	0.28	0.27–0.33
12. Orbital diameter	0.39	0.34	0.37	0.41	0.35	0.31–0.41
13. Postorbital length	0.36	0.40	0.40	0.41	0.39	0.33–0.42
14. Interorbital width	0.46	0.47	0.46	0.45	0.45	0.43–0.50
MERISTICS						
Lateral-line scales	32	33	35	33	33	31–35
Scale rows between dorsal-fin origin and lateral line	5 <sup>1</sup> / <sub>2</sub>	6	6	6	5 <sup>1</sup> / <sub>2</sub>	5–6
Scale rows between anal-fin origin and lateral line	5 <sup>1</sup> / <sub>2</sub>	5	5	5	5	4–5 <sup>1</sup> / <sub>2</sub>
Branched dorsal-fin rays	9	9	9	9	9	8–10
Branched anal-fin rays	7	7	7	7	8	7–8
Total pectoral-fin rays	14	14	13	14	14	12–15
Branched pelvic-fin rays	8	8	8	8	8	7–9
Vertebrae	32	32	32	32	32	31–32

nonetheless retained the species in *Curimatus* rather than using *Curimatella*, which Eigenmann and Eigenmann (1889b:415) had proposed for curimatids with extensive series of small scales on the caudal fin. Steindachner (1910:265) used four specimens from the Río Orinoco near Ciudad Bolívar in his description of *Curimatus bolivarensis*. A 66.3 mm SL syntype of NMW 67037.2 is designated as the lectotype of the species, with the three other syntypes (NMW 67037.1, 67037.3–4) becoming paralectotypes.

*Curimatella alburna* (Müller and Troschel, 1845) has been reported from the Río de La Plata under various generic names (see synonymy of *Curimatella dorsalis*), but those records are typically based on *C. dorsalis*. The confusion perhaps arose from the uncertainty concerning the distinguishing characters of the latter species (see comments above). Boulenger (1896:34) cited *Curimatus alburnus* from Descalvados in the Mato Grosso of Brazil, a questionable record because that species is not known to occur south of the Amazon basin. Examination of Boulenger's specimens (BMNH 1895.5.17:136–137) has shown that they are actually *Curimatella dorsalis*. Subsequent reports of *Anodus alburnus* from the Río de La Plata system as *Curimatella alburnus* (Eigenmann et al., 1907:124), *Curimatella alburna alburna* (Bertoni,

1914:9; 1939:54), and *Rivasella alburna* (Ringuélet, 1975:72) are assumed to be misidentifications of *Curimatella dorsalis*, or reiterations of previous erroneous literature records.

Boulenger's citation of *Curimatus alburnus* (1898:426) from the Río Juruá in the Amazon basin was based on a specimen (BMNH 1897.12.1:104) that has on examination proved to be *Curimatella dorsalis*.

Fowler (1975:366) placed Pellegrin's *Curimatus (Curimatella) alburnus* var. *caudimaculata* as a subspecies of *Curimatus asper* Günther (Fowler's *Bitricarinata aspera*). The nominal forms differ in numerous characters (see redescription of *Curimata aspera* (Vari, 1989b)) and are not closely aligned phylogenetically (Vari, 1989a). In the same publication Fowler (1975:366) questionably listed *Curimatus bolivarensis* Steindachner (species misspelled as *bolivarcensis*) as a junior synonym of *Bitricarinata* (= *Curimata*) *vittata*. The two nominal species differ in numerous characters (see redescription of *Curimata vittata* (Vari, 1989b)) and are again members of different phylogenetic lineages (Vari, 1989a), making such an association untenable.

Géry et al. (1987:433) noted that the material they identified as *Curimatella* cf. *australis* differs from the illustration and description of *Walbaunina* (= *Curimatella*) *dorsalis* provided



by Fernández-Yépez (1948:24, fig. 6) in relative greatest body depth, form of the dorsal profile of the body, relative eye size, and details of pigmentation. The specimen illustrated by Fernández-Yépez (SU 36596, now in CAS) is an exceptionally deep-bodied individual of *Curimatella dorsalis* originating in the western Amazonian region where individuals of that species typically are deeper bodied (see discussion under "Geographic Variation" above). The drawing style used by Fernández-Yépez provides a false sense of a larger eye than occurs in the specimen. The spot of dark pigmentation on the mid-lateral surface of the caudal peduncle and the overall body pigmentation are somewhat faded in the illustrated specimen; however, the spot in more recently collected specimens from that region are comparable to that in population samples from the Río de La Plata system. The perceived differences between the material identified by Géry et al. (1987) as *Curimatella* cf. *australis* and *Curimatella dorsalis* are thus judged to be a consequence of the poor illustration provided by Fernández-Yépez and their specimens are considered to be *Curimatella dorsalis*.

MATERIAL EXAMINED.—553 specimens (163, 37.6–113.7 mm).

VENEZUELA. *Territorio Federal Delta Amacuro*: Caño Paloma, USNM 235515, 65 (9, 46.8–54.5). Caño Fiscal, USNM 235521, 4 (45.5–49.3). Río Orinoco near Caño Araguaito, USNM 235514, 2 (55.0–56.2). Caño Guarguapo, MBUCV V-13107, 9. *Monagas*: Isla Tapatapa, Los Castillos de Guayana, USNM 235517, 4 (48.0–61.3). Caño off Río Orinoco, USNM 235513, 34 (9, 43.5–59.7). Isla Chivera, near Barrancas, USNM 235516, 37 (5, 52.0–74.8). Río Orinoco, opposite Los Castillos de Guayana, USNM 235522, 11 (5, 37.6–48.4). *Bolívar*: Río Orocopiche, USNM 235518, 2 (48.7–49.8); USNM 235519, 1 (50.5); USNM 235520, 6 (5, 41.3–45.1). Río Orinoco near Ciudad Bolívar, NMW 67037.2, 1 (66.3, lectotype of *Curimatus bolivarensis*); NMW 67037.1 and 67037.3–4, 3 (69.8–76.7, paralectotypes of *Curimatus bolivarensis*). Laguna Los Francos and Laguna del Medio, Ciudad Bolívar, MBUCV V-1574, 4. *Apure*: Río Apure, San Fernando de Apure, USNM 260159, 12 (5, 68.7–76.3; 2 specimens cleared and counterstained for cartilage and bone); USNM 258284, 50 (6, 61.2–80.9; 2 specimens cleared and counterstained for cartilage and bone); MZUSP 27966, 10. Río Cunaviche, Cunaviche, USNM 257556, 5 (2, 58.4–55.8). Río El Canito, where crossed by road from San Fernando de Apure, USNM 258096, 1 (73.9).

BRAZIL. *Pará*: Lagoons along Rio Tocantins, near Tucuruí, MZUSP 21291, 26 (3, 62.1–85.2). Município de Faro, Paraná Jacaré, MZUSP 39789, 1. Óbidos, MCZ 20330, 1 (66.5, paralectotype of *Curimatus dorsalis*). Oriximiná, MZUSP 21189, 3. Santarém, MNHN 09-57, 1 (67.7, lectotype of *Curimatus* (*Curimatella*) *alburnus* var. *caudimaculata*); MZUSP 20790, 2. *Amazonas*: Parintins, mouth of Lago José Açú, MZUSP 7631, 4. Paraná do Mocambo, near Parintins, MZUSP 7586, 2 (67.7–79.8). Manacapuru (= Lago Grande de

Manacapuru), MCZ 20210, 1 (62.6, paralectotype of *Curimatus dorsalis*). Mouth of Rio Negro, NMW 67105, 2 (51.3–53.7); NMW 67093, 2. Lago Janauacá and vicinity, MZUSP 21695, 1. Rio Japurá, Manacabi, approximately 50 km from mouth of river, MZUSP 21038, 3 (55.5–68.4). Rio Solimões, near Coari, USNM 243235, 4 (51.5–57.3; 2 specimens cleared and counterstained for cartilage and bone). Coari (= Lago do Coari), MCZ 20183, 1 (64.2, lectotype of *Curimatus dorsalis*). Rio Solimões, above mouth of Rio Jutai, near Ilha Baruruá, MZUSP 20986, 9 (3, 68.2–72.5). Ilha Xibeco, Rio Solimões above mouth of Rio Jutai, MZUSP 21016, 2 (64.7–75.7). Lago Castro, mouth of Rio Purus, MZUSP 6312, 1 (65.0). Rio Juruá, BMNH 1897.12.1:104, 1 (80.0). Município de Tefé, lower Rio Juruá, Costa Japão, MZUSP 27393, 4 (2, 65.5–73.2). Município de Tefé, lower Rio Juruá, Ressaca do Japão, Costa Japão, MZUSP 27372, 3. Rio Tonantins, MNHN 09-227 and 09-228, 2 (54.7–63.5, paralectotypes of *Curimatus* (*Curimatella*) *alburnus* var. *caudimaculata*). Rio Solimões, Município de Benjamin Constant, Costa do Capacete, MZUSP 27371, 1 (63.7). Hyavary (= Rio Javari along Brazilian-Peruvian border), MCZ 20241, 1 (62.6, paralectotype of *Curimatus dorsalis*). Rio Javari system, opposite Colonia Angamos, Peru, NRM 26467, 2. *Goiás*: Rio Araguaia, Aruanã, MZUSP 4852, 41 (5, 73.7–80.7). Rio Araguaia, Santa Terezinha, MZUSP 20840, 28 (8, 71.7–85.2). *Mato Grosso*: Rio Cuiabá, Santo Antonio de Leverger, USNM 243234, 5 (58.0–67.7; 2 specimens cleared and counterstained for cartilage and bone); MZUSP 4382, 3 (78.2–84.7). Santo Antonio de Leverger, MZUSP 4450, 2 (55.6–74.7). Município de Barão do Melgaço, Rio Cuiabá, mouth of Sangradouro Grande, MZUSP 38169, 4. Descalvados, BMNH 1895.5.17:136-137, 2 (1, 75.5). Rio Itiquira, Município de Itiquira, Fazenda Santo Antonio do Paraíso, Baía Grande, MZUSP 21711, 2 (92.3–107.5). Rio Coxipó, BMNH 1902.2.10:29, 1. Rio Coxipó da Ponte, Coxipó da Ponte, Município de Cuiabá, MZUSP 21509, 24 (5, 63.4–94.7). Rio Coxipó Mirim, Município do Cuiabá, MZUSP 21501, 3. Rio Cuiabá, Município de Rosário d'Oeste, MZUSP 21500, 2. Rio Pixaim, município de Poconé, MZUSP 21588, 1 (97.0). Rio Jaurú, MZUSP 28104, 3 (94.2–113.7). *Mato Grosso do Sul*: Rio Paraguai, Ilha de Taima, MZUSP 21733, 50 (10, 58.7–66.7). Rio Miranda, Corumba, USNM 243233, 1 (70.3). Município de Corumba, Nhecolândia, Corixão, Capão Grande, MZUSP 36358, 2. Município de Quidauna, Fazenda Alegrete, Rio Aquidauana, Baía da Onça ou Jatobá, MZUSP 40066, 4.

PERU. *Loreto*: Río Ampiyacu, Pebas, SU 36596, 2 (66.5–71.2; now deposited in CAS). Río Ampiyacu, USNM 175871, 1 (80.2). Shansho Caño, near Pebas, SU 36594, 1 (68.0; now in CAS). Río Yavari system, Río Galvez near mouth, NRM 26464, 5. Río Yavari, near Petropolis, USNM 261457, 1 (77.8). Río Amazonas, Santa Rosa, opposite Tabatinga, USNM 261507, 2. Río Itaya system, pools near Quebrada Tocón Grande, at km 33 on carratera Iquitos-Nauta,

NRM 26568, 1.

BOLIVIA. *Beni*: Mouth of Río Ibarre, AMNH uncat., 7 (48.7–64.4). Trinidad, MZUSP 27818, 1. Trinidad, Canal San Gregorio, MZUSP 27814, 1.

PARAGUAY. *Central*: Asunción, CAS 60626, 1 (88.8, holotype of *Curimatus alburnus australe*; formerly IU 9929). Río Paraguay, Asunción Bay, USNM 181642, 8 (71.2–95.0; 1 specimen cleared and counterstained for cartilage and bone). Estancia La Armonia, Arroyo Carumby, CAS 60583, 1 (103.1, holotype of *Curimatus elegans paraguayensis*; formerly IU 9928).

ARGENTINA. *Misiones*: Posadas, Río Paraná, mouth of Arroyo Zaimán, BMNH 1972.7.7:361, 1. Posadas, mouth of Arroyo Zaimán into Río Paraná, USNM 311167, 1.

### *Curimatella meyeri* (Steindachner)

FIGURES 14–19; TABLES 2, 5

*Curimatus Meyer* Steindachner, 1882:113, pl. 1: fig. 4 [type locality: Peru: Río Huallaga].—Vari, 1989a, tables 2, 3 [phylogenetic relationships].

*Curimatus serpae* Eigenmann and Eigenmann, 1889a:7 [type locality: Brazil: Serpa (= Río Amazonas at Itacoatiara)]; 1889b:418 [more extensive species description]; 1891:46 [reference].—Vari, 1989a, tables 2, 3 [phylogenetic relationships].

*Curimatus meyeri*.—Eigenmann and Eigenmann, 1889b:418 [Brazil: Óbidos, [reference]].

*Curimatella meyeri*.—Fowler, 1906:296, fig. 3 [Peru].—Eigenmann, 1910:420 [reference].—Fowler, 1940:252 [Peru: Contamana]; 1942:207 [reference].—Eigenmann and Allen, 1942:291 [reference].—Fowler, 1945:115 [reference]; 1950:297, fig. 357 [literature compilation].—Ortega and Vari, 1986:11 [Peru: Amazon drainages; based on Fowler, 1950].

*Curimatus (Curimatella) serpae*.—Pellegrin, 1909:148 [Brazil: Santarém].

*Curimatella serpae*.—Eigenmann, 1910:420 [reference].—Fernández-Yépez, 1948:25, fig. 7 [reference].—Fowler, 1950:297 [literature compilation]; 1975:364 [reference]. [New synonymy.]

*Curimata reticulata* Allen in Eigenmann and Allen, 1942:295, pl. 14: fig. 2 [type locality: Peru: Lago Cashiboya; additional material: Peru: Río Ucayali near Orellana].—Fowler, 1945:116 [Peru, reference]; 1950:290 [literature compilation]; 1975:364 [erroneously placed as a synonym of *Anodus alburnus* Müller and Troschel].—Vari, 1989a, tables 2, 3 [phylogenetic relationships].—Vari and Howe, 1991:19 [location of portion of type series]. [New synonymy.]

*Apolinarella meyeri*.—Fernández-Yépez, 1948:22, fig. 5 [designated as type species of *Apolinarella* Fernández-Yépez].—Fowler, 1975:363 [reference].

*Apolinarella reticulata*.—Fernández-Yépez, 1948:23 [assignment to *Apolinarella*].

*Curimatella alburna serpae*.—Géry, 1964a:36, fig. 37 [Peruvian Amazon].

DIAGNOSIS.—The 35 to 37 vertebrae of *Curimatella meyeri* discriminate the species from *C. lepidura*, *C. dorsalis*, and *C. immaculata*, which have 33 or fewer vertebrae. The 35 to 39 lateral-line scales to the hypural joint in *C. meyeri* and the relative depth of the caudal peduncle (0.11–0.12 of SL) further discriminate that species from *C. immaculata*, which has 33 or fewer lateral-line scales and a relatively deeper caudal peduncle (0.13–0.14 of SL). *Curimatella meyeri* lacks the distinctive mid-lateral spot on the caudal peduncle characteristic of *C. dorsalis*. *Curimatella meyeri* has 6 or 7 scales in a transverse series from the lateral line to the origin of the dorsal fin, in

contrast to 9 to 10½ scales in that series in *C. lepidura*. *Curimatella meyeri* differs from *C. alburna* in greatest body depth (0.30–0.36 of SL versus 0.37–0.41), depth of the caudal peduncle (0.11–0.12 of SL versus 0.13–0.14), and less discretely in the numbers of lateral-line scales to the hypural joint (35 to 39 versus 32 to 35), scales in a transverse series from the lateral line to the origin of the dorsal fin (6 or 7 versus 5 or 5½), and number of vertebrae (35 to 37, most commonly 36, versus 33 to 35, most commonly 34).

DESCRIPTION.—(Available meristic and morphometric values for the holotype (see “Remarks”) are taken from the original species description (Steindachner, 1882) or are estimated from the accompanying illustration of the species (reproduced herein as Figure 14)).

Body elongate, moderately compressed. Dorsal profile of head convex from upper lip to vertical line through posterior nostril, straight or very slightly convex from that line to tip of supraoccipital spine in larger specimens, somewhat more convex overall in smaller individuals. Dorsal profile of body smoothly curved from tip of supraoccipital spine to origin of dorsal fin; straight and posteroventrally slanted at base of dorsal fin, straight from base of last dorsal-fin ray to caudal peduncle; degree of convexity somewhat variable (compare Figure 14 to Figure 18). Dorsal surface of body with indistinct median keel anterior to 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, very obtusely transversely flattened proximate to pelvic fin insertion; with median series of scales near base of pelvic fin. Scales of prepelvic region approximately of same size as those on adjoining regions of body. Obtuse median keel present posterior to pelvic fin insertion. Secondary obtuse keel on each side of postpelvic portion of body about two scale rows dorsal of ventral midline.

Greatest body depth at origin of dorsal fin, depth 0.29–0.36 [0.29], specimens from the western portions of the species range somewhat more slender-bodied than those from central Amazon; snout tip to origin of dorsal fin 0.44–0.50 [0.44]; snout tip to origin of anal fin 0.81–0.88 [0.82]; snout tip to insertion of pelvic fin 0.51–0.56 [0.52]; snout tip to anus 0.75–0.81; origin of dorsal fin to hypural joint 0.56–0.61 [0.59]. Margin of dorsal fin rounded distally, last unbranched and first branched rays approximately two to two and one-half times length of ultimate ray. Margin of pectoral fin pointed distally; length of pectoral fin 0.17–0.21, extends about one-half to two-thirds of distance to vertical line through insertion of pelvic fin. Pelvic fin pointed in profile, length of pelvic fin 0.20–0.24 [0.20], reaches about three-quarters distance to origin of anal fin in smaller individuals, somewhat less than two-thirds of distance in larger specimens. Caudal fin forked; rays of both lobes with exception of middle rays largely covered with dense sheet of small scales in all specimens above 60 mm SL. Scales overlying caudal fin distinctly smaller than

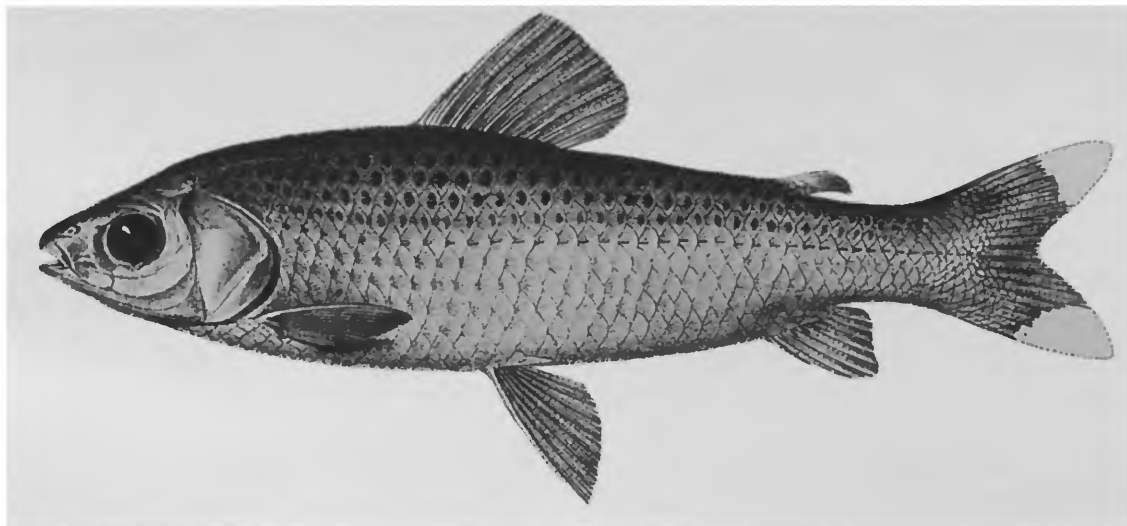


FIGURE 14.—*Curimatella meyeri*, holotype of *Curimatus Meyer*, reproduction of figure in original description of species (Steindachner, 1882, pl. 1: fig. 4); figure reversed into conventional orientation.



FIGURE 15.—*Curimatella meyeri*, lectotype of *Curimatus serpae*, MCZ 20320, 70.4 mm SL; Brazil, Amazonas, Serpa (= Itacoatiara).

those on posterior portions of caudal peduncle. Adipose fin well developed. Border of anal fin emarginate, anteriormost branched rays two and one-half to three times length of ultimate ray. Caudal peduncle depth 0.11–0.12 [0.11].

Profile of head distinctly pointed anteriorly, head length 0.28–0.33 [0.28]; upper jaw slightly longer than lower, mouth subterminal; snout length 0.29–0.36 [0.33]; nostrils of each side of head very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.27–0.34 [0.33]; adipose eyelid moderately developed, with broad, vertically ovoid opening over center of eye; length of postorbital portion of head 0.38–0.44 [0.44]; gape width 0.28–0.34; interorbital width

0.45–0.50 [0.45].

Pored lateral-line scales from supracleithrum to hypural joint 35 to 39 [35 or 36]; all scales of lateral line pored, canals in scales straight; 3 to 7 pored scales extend beyond hypural joint onto caudal fin base; 6 to 7 [6] scales in transverse series from origin of dorsal fin to lateral line;  $4\frac{1}{2}$  to  $5\frac{1}{2}$  [5] scales in transverse series from lateral line to origin of anal fin.

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

Total vertebrae 35 (9), 36 (98), 37 (3).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery-olive; ground coloration

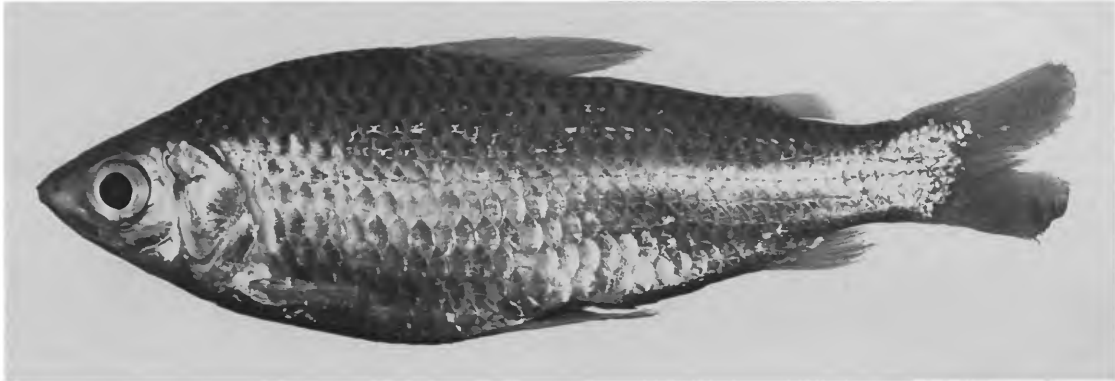


FIGURE 16.—*Curimatella meyeri*, holotype of *Curimata reticulata*, CAS 60628 (formerly IU 17857, in part), 95.5 mm SL; Peru, Lago Cashiboya.

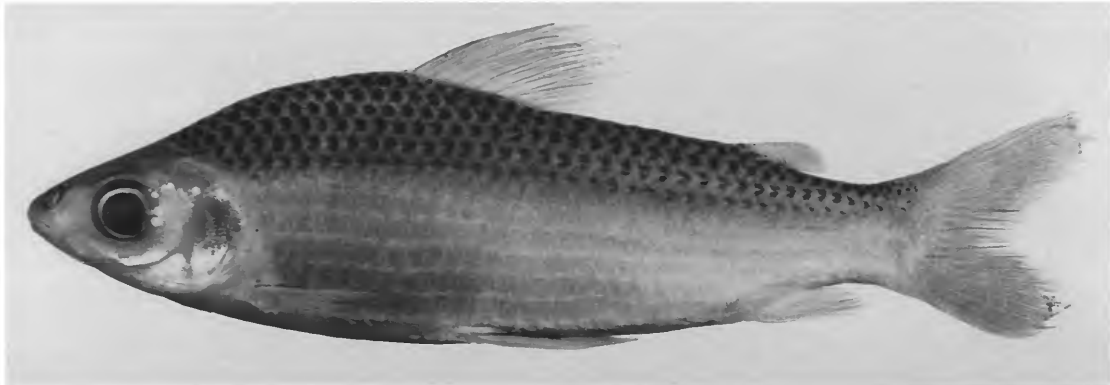


FIGURE 17.—*Curimatella meyeri*, MZUSP 6953, 114.4 mm SL; Brazil, Amazonas, Rio Madeira, 25 km from Nova Olinda.

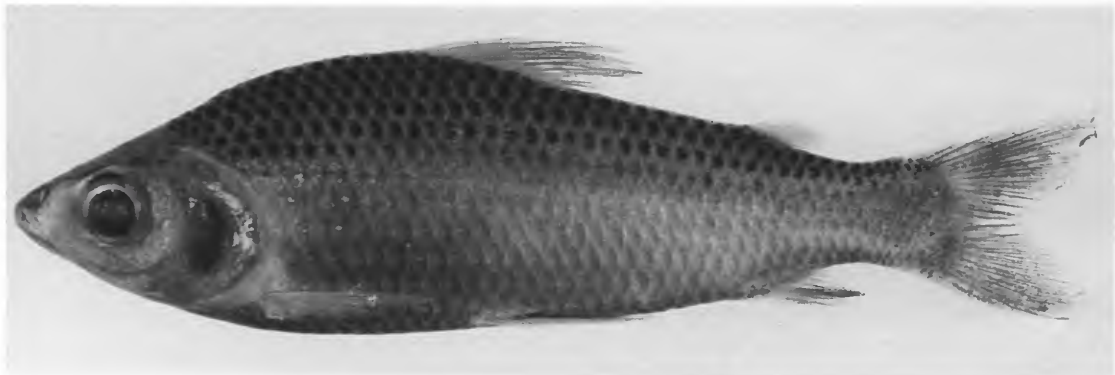


FIGURE 18.—*Curimatella meyeri*, USNM 311164, 75.8 mm SL; Peru, Loreto, Pucallpa, Romaineococha, Río Ucayali.

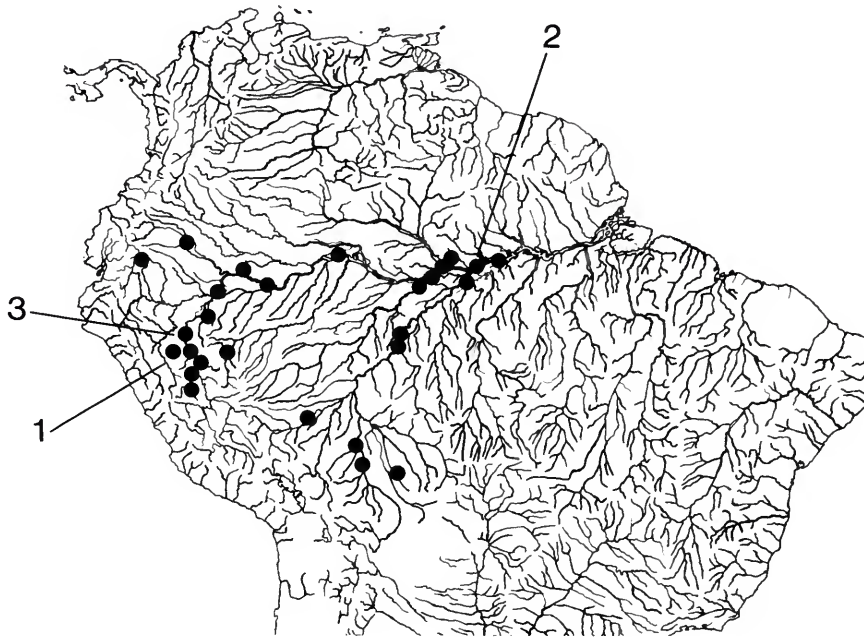


FIGURE 19.—Map of central and northern South America showing geographic distribution of *Curimatella meyeri* (filled in circles; 1 = Río Huallaga, type locality of *Curimatus Meyer*; 2 = type locality of *Curimatus serpae*; 3 = type locality of *Curimata reticulata*) (some symbols represent more than one collecting locality or lot of specimens).

distinctly darker dorsal of lateral line. Ground coloration of specimens lacking guanine on scales tan ventral of lateral line, much darker dorsally. Scales dorsal of lateral line with crescent-shaped patch of dark chromatophores on exposed surface. Proportion of exposed surface of scale covered by dark pigmentation somewhat variable (see Figures 16–18). One lot of specimens from the Río Ucayali basin Peru (USNM 261499) very dark overall, with ground coloration masking patch of dark pigmentation on each scale. Mid-dorsal region of body immediately posterior of tip of supraoccipital spine with deep-lying, longitudinally elongate, dusky spot. Second, less elongate, deep-lying middorsal dusky spot immediately anterior of origin of dorsal fin. Two middorsal spots less apparent in larger specimens; masked by overall dark ground pigmentation and/or guanine on scales in some specimens. Median fins peppered with small chromatophores, particularly distally. Paired fins hyaline.

DISTRIBUTION.—Middle and upper Amazon basin (Figure 19).

REMARKS.—Steindachner (1882:113) described *Curimatus Meyer* based on a specimen from the Río Huallaga, a tributary of the Amazon in northeastern Peru. Repeated searches through the collections of the Naturhistorisches Museum, Vienna, over a period of a decade failed to locate the holotype. The original description of *C. Meyer* and the accompanying drawing

(Steindachner, 1882, pl. 1: fig. 4) reproduced herein as Figure 14, nonetheless, leave little doubt that the name *meyeri* applies to the specimens from the central and western Amazon basin (compare Figures 14, 17, 18).

Several years after Steindachner's description of *Curimatus meyeri*, Eigenmann and Eigenmann (1889a:7) described *C. serpae* from Serpa (= Itacoatiara), Brazil, in the central Amazon. In their key to the then-known species of curimatids, Eigenmann and Eigenmann (1889b:415–417) used relatively minor differences in body depth to distinguish *Curimatus meyeri* and *C. serpae*, both of which they assigned to their subgenus *Curimatella*. The body depths of some of the syntypes of *Curimatus serpae* (0.31–0.32 of SL) approximate the value reported by Steindachner for the holotype of *C. meyeri* (0.29). Furthermore the range of body depths in samples of *C. meyeri* from the Andean piedmont in Peru encompass the values for the holotype of *C. meyeri* and the syntypes of *C. serpae*. In the absence of any known character to distinguish them (Table 5), *Curimatus serpae* Eigenmann and Eigenmann is synonymized under *Curimatella meyeri* (Steindachner).

The original description of *Curimatus serpae* was based on four specimens from Serpa (= Itacoatiara), Brazil. The specimen (70.4 mm SL) that is in the best overall condition (Figure 15) is designated as the lectotype (MCZ 20320), and the three smaller syntypes (MCZ 92959) become paralectotypes.

TABLE 5.—Morphometrics and meristics of (A) holotype of *Curimatus Meyeri* based on original species description (Steindachner, 1882:11), asterisks (\*) indicate values based on illustration, dashes indicate data not reported in that paper and that are not apparent on figure; (B) lectotype of *Curimatus serpae* (MCZ 20320); (C) holotype of *Curimata reticulata* (CAS 60628; formerly IU 17857, in part); and (D) all specimens of *Curimatella meyeri* 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.

Character	A	B	C	D
MORPHOMETRICS				
Standard length	~130.0	70.4	95.5	49.7-156.0
1. Greatest body depth	0.29	0.31	0.35	0.29-0.36
2. Snout to dorsal-fin origin	0.44*	0.47	0.47	0.44-0.50
3. Snout to anal-fin origin	0.82*	0.84	0.84	0.81-0.88
4. Snout to pelvic-fin origin	0.52*	0.54	0.53	0.51-0.56
5. Snout to anus	-	0.78	0.78	0.75-0.81
6. Origin of rayed dorsal fin to hypural joint	0.59*	0.59	0.59	0.56-0.61
7. Pectoral-fin length	-	0.20	0.19	0.17-0.21
8. Pelvic-fin length	0.20*	0.21	0.23	0.20-0.24
9. Caudal-peduncle depth	0.11*	0.12	0.11	0.11-0.12
10. Head length	0.28	0.31	0.29	0.28-0.33
11. Snout length	0.33	0.31	0.31	0.29-0.36
12. Orbital diameter	0.33*	0.33	0.32	0.27-0.34
13. Postorbital length	0.44*	0.44	0.45	0.38-0.45
14. Interorbital width	0.45	0.45	0.45	0.45-0.49
MERISTICS				
Lateral-line scales	35-36	35	37	35-40
Scale rows between dorsal-fin origin and lateral line	6	6	6	6-7
Scale rows between anal-fin origin and lateral line	5	5	5	4 <sup>1</sup> / <sub>2</sub> -5 <sup>1</sup> / <sub>2</sub>
Branched dorsal-fin rays	9	9	9	9
Branched anal-fin rays	7	7	7	7
Total pectoral-fin rays	-	15	14	14-16
Branched pelvic-fin rays	8*	8	8	8-9
Vertebrae	-	36	36	35-37

Allen (in Eigenmann and Allen, 1942:295) based *Curimata reticulata* on a series of specimens from the Río Ucayali system of Peru that he described as having "a few diminishing series of scales at the base [of the caudal-fin rays]." In the same publication (p. 291) he also recognized the genus *Curimatella* to which he assigned *C. meyeri*. *Curimatella* was, according to Allen (p. 291), "A *Curimatus* having caudal lobes covered with scales to their extremities...." The holotype (Figure 16) and paratypes of *Curimata reticulata* (CAS 60629, USNM 167807, and UMMZ 185274), however, all have the lobes of the caudal fins extensively covered with a dense sheet of small scales. Allen evidently failed to note the feature, diagnostic for *Curimatella*, in the type series of *Curimata reticulata*. No attribute separating *Curimatella meyeri* and *Curimata reticulata* has been discovered among the meristic and morphometric features (Table 5), nor in any other examined characters. *Curimata reticulata* is consequently considered a junior synonym of *Curimatella meyeri*.

In his original description of *Curimata reticulata*, Allen (in Eigenmann and Allen, 1942:295) designated a "type," presumably the holotype, out of a series of 12 specimens (IU 17857) from Lago Cashiboya in the Peruvian Amazon. Allen failed, however, to separate the "type" from other individuals in the

lot. The specimen that best matches the data provided for holotype by Allen is now cataloged as CAS 60628, and the paratypes from that lot are now divided between CAS 60629 and USNM 167807. The paratype from the Río Ucayali near Orellana, cited by Allen as IU 17856, is now registered as UMMZ 185274.

Géry (1964a:36) placed *Curimatus serpae* Eigenmann and Eigenmann as a synonym of *Curimatella alburna*. Fowler (1975:364) more recently placed *Curimata reticulata* Allen into the synonymy of *Anodus alburnus*. Both *Curimatus serpae* and *Curimata reticulata* are, rather, synonyms of *Curimatella meyeri*.

MATERIAL EXAMINED.—144 specimens (94, 49.7-156.0 mm).

BRAZIL. Amazonas: Serpa (= Itacoatiara), MCZ 20320, 1 (70.4, lectotype of *Curimatus serpae*); MCZ 92959, 3 (61.9-70.1, paralectotypes of *Curimatus serpae*; formerly MCZ 20320, in part). Rio Madeira, 25 km from Nova Olinda, MZUSP 6953, 4 (3, 69.2-114.4). Lago Beruri, Rio Purus, MZUSP 5999, 1 (113.0). Lower Rio Negro, Igarapé Chiborena, 30 km upstream from Manaus, USNM 311517, 1 (80.6). Vicinity of Manaus, MZUSP 19291, 3 (123.8-135.5). Lago Januári, USNM 311165, 1 (139.8); MZUSP 19291, 3. Paraná do Mocambo, near Parantins, MZUSP 7587, 3 (83.7-116.5).

Lago Amaná, mouth of Rio Japurá, MZUSP 36234, 1 (124.8). Igarapé Ubi, Lago Amaná, mouth of Rio Japurá, MZUSP 36241, 1 (135.0). Mouth of Rio Purus, MZUSP 5951, 1 (123.8). Igarapé Manduaçu, Paraná de Iupia, NW of Fonte Boa, MZUSP 20966, 1. Igarapé Xicanga, 5 km E of Humaitá, GC, 5 (1, 87.3). Humaitá, Igarapé Joari, MZUSP 35545, 1. *Rondonia*: Rio Madeira, Calama, USNM 242142, 8 (4, 129.5–139.5); USNM 268036, 3. *Acre*: Rio Juruá, Cruzeiro do Sul, USNM 315369, 1 (132.0).

PERU. *Loreto*: Lago Cashiboya, CAS 60628, 1 (95.5, holotype of *Curimata reticulata*; formerly IU 17857, in part); CAS 60629, 3 (80.0–90.2, paratypes of *Curimata reticulata*; formerly IU 17857, in part); USNM 167807, 8 (67.0–89.0, paratypes of *Curimata reticulata*; formerly IU 17857, in part). Río Ucayali near Orellana, UMMZ 185274, 1 (113.0, paratype of *Curimata reticulata*; formerly IU 17856). Río Ucayali, Contamana, ANSP 73168, 6 (4, 103.3–132.1). Río Amazonas, Santa Rosa, opposite Tabatinga, Brazil, USNM 261444, 3 (2, 65.0–76.2). Río Marañon near Iquitos, GC, 1 (101.4). Iquitos, NMW 68807, 1 (103.3). Vicinity of Pevas (Pebas), USNM 311163, 1 (86.4); SU 36890, 1 (98.9, now in CAS). Río Samiria, upstream of Pithecia, NRM 26462, 2. *Ucayali*: Río Ucayali basin, Cochacocha, AMNH 35685, 1 (71.5). Río Neshuya, km 60 on Pucallpa to Huanuco road, USNM 261399, 2 (103.7–118.7); USNM 261413, 1. Pucallpa, Cashibococha, USNM 261471, 3 (1, 67.4). Pucallpa, Río Ucayali, USNM 243229, 3 (52.0–104.5); USNM 261395, 7 (3, 56.2–79.7); USNM 261459, 1; MZUSP 26405, 10. Pucallpa, Yarinacocha, USNM 243230, 2 (96.0–98.2). Río Ucayali, Romainecochca, USNM 311376, 6; USNM 311164, 5 (1, 75.8). Río Ucayali, Masisea, USNM 261508, 3 (3, 98.8.7–114.3). Iamiriacocha, Río Tamaya, near Masisea, USNM 261499, 3 (113.4–129.3). *Pasco*: Río Yamushimas, tributary of Río Palcazu, tributary to Río Pachitea, USNM 229204, 1 (127.5). *Huanuco*: Mouth of Río Pachitea, BMNH 1969.7.15:43, 1 (156.0).

ECUADOR. *Napo*: Jatuncocha, BMNH 1970.4.3:83, 1 (134.2).

BOLIVIA. *Beni*: Mouth of Río Ibarre (Ibare), AMNH 77519, 5 (52.7–59.7); AMNH 77518, 12 (9, 49.7–67.4). Puerto Almacén, USNM 278571, 1. Río Blanco, USNM 278582, 1. *Pando*: Río Madre de Dios basin, Laguna San Luis, USNM 278578, 3; USNM 278577, 2.

### *Curimatella alburna* (Müller and Troschel)

FIGURES 20–24; TABLES 2, 6

*Anodus alburnus* Müller and Troschel, 1844:83 [type locality: Guiana (= Guyana)]; 1845:26, pl. 4: fig. 3 [description of species expanded; type locality refined to Guiana (= Guyana), "See Amucu" (= Lake Amucu)]; 1848:633 [Lake Amucu; based on Müller and Troschel, 1844, 1845].—Vari, 1989a, tables 2, 3 [phylogenetic relationships].

*Curimatus alburnus*.—Valenciennes in Cuvier and Valenciennes, 1849:18 [Guyana: Lake Amucu, based on Müller and Troschel, 1844].—Kner, 1859:144 [Río Guaporé].—Günther, 1864:289 [based on Müller and

Troschel, 1844, and Kner, 1859].—Steindachner, 1877:81 [literature compilation].—Eigenmann and Eigenmann, 1889b:418 [in part, Brazil: Coary (= Lago do Coari), Lake Hyanuary (= Paraná do Jaunuari), Rio Negro, Jutahy (= Rio Jutaf), Ueranduha, Tefé (= Tefé), Manacapuru (= Lago Grande de Manacapuru), Hyavary (= Rio Javari along Brazilian-Peruvian border), Tonantins (= Rio Tonantins at Tonantins); not Surinam citation]; 1891:46 [reference].—Regan, 1905:189 [Brazil: Rio Negro].—[not Steindachner, 1879:163; Boulenger, 1896:34, 1898:426; Pellegrin, 1899:157; Puyo, 1949:118].

*Curimatus alburnus lineatus* Eigenmann and Eigenmann, 1889b:419 [type locality: Brazil: Jutahy (= Rio Jutaf)]; 1891:46 [reference].—Vari, 1989a, tables 2, 3 [phylogenetic relationships]. [New synonymy.]

*Curimatus* (*Curimatella*) *alburnus*.—Pellegrin, 1909:148 [Brazil: Rio Negro, Tefé (= Tefé)].—Steindachner, 1917:17, pl. 5: fig. 4 [Brazil, Rio Surumú, Serra do Melo].

*Curimatella alburna*.—Eigenmann, 1910:420 [reference]; 1912:262 [references in part; specimens from Rupununi, British Guiana (= Guyana), not specimens cited from Twoca Pan, British Guiana (= Guyana)].—Fowler, 1945:114 [references, in part; not cited occurrence of species in Paraguay].—Terrasas-Urquidí, 1970:30 [reference].—[not Fowler, 1919:130; Schultz, 1944:249; Boeseman, 1952:183; Mago-Leccia, 1967:254].

*Curimatella alburna lineata*.—Eigenmann, 1910:420 [reference].—Fowler, 1950:297 [literature compilation].

*Curimatella alburnus*.—Cockerell, 1914:93 [scale anatomy].—[not Fowler, 1906:297; Eigenmann et al., 1907:124; Fowler, 1919:130].

*Lepinna alburna*.—Fernández-Yépez, 1948:26 [designation as type species of *Lepinna*; genus misspelled].

*Lepinna lineata*.—Fernández-Yépez, 1948:27, fig. 8 [reference, genus misspelled].

*Curimatella alburna*.—Fowler, 1950:295 [literature compilation; references in part; not fig. 356].—[not Bertoni, 1914:9, 1939:54; Géry, 1965:123; Mago-Leccia, 1970:75].

*Lepinna alburna*.—Fowler, 1975:364 [reference].

*Bitricarinata aspera lineata*.—Fowler, 1975:366 [reference, placement as a subspecies of *Curimatus aspera* Günther].

DIAGNOSIS.—The 32 to 35 scales along the lateral line to the hypural joint and 5 or 5½ scales in a transverse series between the lateral line and the origin of the dorsal fin discriminate *Curimatella alburna* from *C. lepidura*, which has 38 to 41 and 9 to 10½ scales respectively. *Curimatella alburna* lacks the distinctive mid-lateral dark spot on the caudal peduncle characteristic of *C. dorsalis* and has 33 to 35 vertebrae in contrast to 31 or 32 in *C. dorsalis*. *Curimatella alburna* differs from *C. meyeri* in relative greatest body depth (0.37–0.41 of SL versus 0.30–0.36, respectively), relative depth of the caudal peduncle (0.13–0.14 of SL versus 0.11–0.12), scales in a transverse series from the lateral line to the origin of the dorsal fin (5 or 5½ versus 6 or 7), and less discretely in the number of lateral-line scales to the hypural joint (32 to 35 versus 35 to 39), and the number of vertebrae (33 to 35, most commonly 34, versus 35 to 37, most commonly 36; Table 2). Finally, *C. alburna* differs from *C. immaculata* in relative maximum interorbital width (0.45–0.50 of HL versus 0.38–0.45, respectively), relative gape width (0.28–0.33 of HL versus 0.24–0.29), relative length of the postorbital portion of the head (0.39–0.46 of HL versus 0.36–0.39), relative orbital diameter (0.27–0.32 of HL versus 0.33–0.39), and number of vertebrae (33 to 35, usually 34, versus 31 to 33, usually 32, rarely 33).

DESCRIPTION.—Body moderately elongate, compressed.

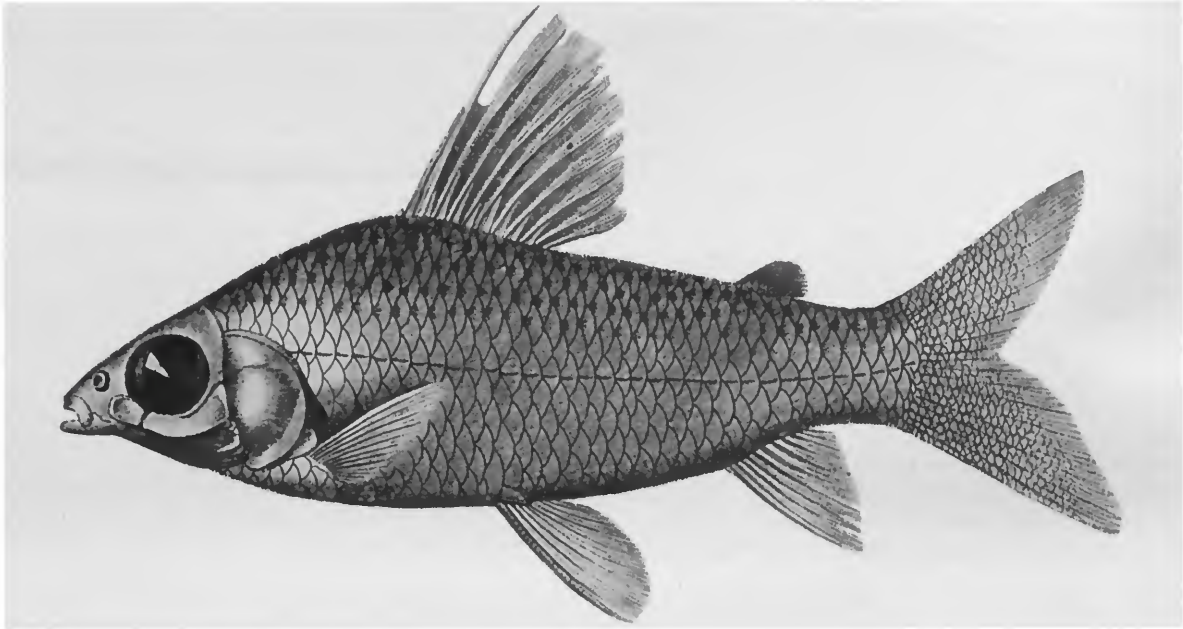


FIGURE 20.—*Curimatella alburna*, lectotype of *Anodus alburnus*, reproduction of figure in Müller and Troschel (1845, pl. 4: fig. 3); figure enlarged from original.



FIGURE 21.—*Curimatella alburna*, holotype of *Curimatus alburnus lineatus*, MCZ 20297, 68.1 mm SL; Brazil, Jutahy (= Rio Jutaf).

Dorsal profile of head slightly convex from upper lip to just anterior of vertical line through anterior margin of anterior nostril, straight or very slightly convex from that line to tip of supraoccipital spine. Dorsal profile of body smoothly convex from tip of supraoccipital spine to origin of dorsal fin; straight and slightly posteroventrally slanted at base of dorsal fin, straight to gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with indistinct median keel anterior to dorsal fin, keel less pronounced in larger

specimens; dorsal surface of body smoothly rounded transversely posterior to dorsal fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region transversely flattened, with median series of scales. Median scale series flanked on each side by a longitudinal series of scales that conform to shape of lateral angles in that portion of the body. Scales of prepelvic region approximately same size as those on adjoining regions of body. Obtuse median keel present posterior to pelvic fin insertion. Secondary



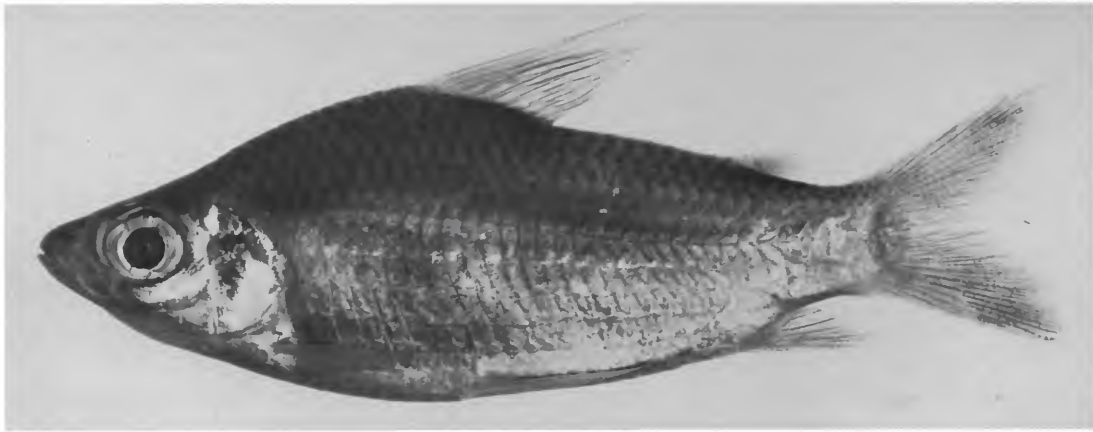


FIGURE 22.—*Curimatella alburna*, USNM 268028, 71.5 mm SL; Brazil, Roraima, Rio Branco, Maraá, near mouth of Rio Branco.



FIGURE 23.—*Curimatella alburna*, MZUSP 6425, 94.2 mm SL; Brazil, Amazonas, Igarapé Chefe, Lago Beruri.

obtuse keel on each side of postpelvic portion of body one scale dorsal of ventral midline.

Greatest body depth at origin of dorsal fin, depth 0.37–0.41 [0.37]; snout tip to origin of dorsal fin 0.48–0.53 [0.50]; snout tip to origin of anal fin 0.84–0.89 [0.85]; snout tip to insertion of pelvic fin 0.53–0.58 [0.54]; snout tip to anus 0.77–0.84 [0.81]; origin of dorsal fin to hypural joint 0.56–0.60 [0.59]. Dorsal-fin margin pointed anterodistally, particularly in some specimens over 160 mm SL in which last unbranched and first branched rays distinctly elongate; anteriormost rays typically three and one-quarter to three and three-quarters times length of

ultimate ray; five or more times longer than last ray in specimens with elongate anterior fin rays. Pectoral-fin margin pointed in profile distally; length of pectoral fin 0.19–0.23, extending about two-thirds distance to vertical through insertion of pelvic fin. Pelvic-fin margin pointed in profile, length of pelvic fin 0.20–0.26 [0.20], reaching two-thirds to three-quarters of distance to origin of anal fin. Caudal fin forked. Patch of small scales on both lobes of fin; patch of scales limited to basal portion of fin rays in specimens of up to approximately 50 mm SL. Scales extending over approximately two-thirds to three-quarters of fin rays other than those

in middle of fin in specimens greater than 70 mm SL (Figures 20, 22, 23). Larger specimens with greater proportion of fin rays covered by scales. Scales on caudal fin distinctly smaller than those on posterior portion of caudal peduncle. Adipose dorsal fin well developed. Anal fin emarginate, anteriormost branched rays three to three and three-quarters times length of ultimate ray. Caudal-peduncle depth 0.13–0.14 [0.14].

Head pointed in profile, somewhat more rounded anteriorly in larger individuals (compare Figures 22 and 23); head length 0.28–0.35 [0.32]; jaws equal or upper slightly longer than lower, mouth terminal; snout length 0.27–0.33 [0.29]; 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 0.27–0.32 [0.32]; adipose eyelid present, more developed anteriorly, particularly in larger individuals, with broad, vertically ovoid opening over center of eye; length of postorbital portion of head 0.39–0.45 [0.41]; gape width 0.28–0.33 [0.28]; interorbital width 0.45–0.50 [0.46].

Pored lateral-line scales from supracleithrum to hypural joint 32 to 35 [33]; all scales of lateral line pored, canals in scales straight; 3 to 6 series of scales extend beyond hypural joint onto caudal-fin base; 5 to 5½ [5½] scales in transverse series from origin of dorsal fin to lateral line; 4½ to 5 [4½] scales in

transverse series from lateral line to origin of anal fin. Caudal-fin rays variably covered with scales (see above).

Dorsal-fin rays ii,9 or iii,9 (when three unbranched rays present, first very short) [iii,9]; anal-fin rays ii,7 or iii,7 (when three unbranched rays present, first very short) [iii,7]; pectoral-fin rays 13 to 17; pelvic-fin rays i,8 [i,8].

Total vertebrae 33 (11), 34 (58), 35 (5).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery-golden, distinctly darker on dorsal portions of head and body. Ground coloration of specimens lacking guanine on scales tan to light brown. Scales dorsal of lateral line with crescent-shaped field of dark chromatophores on exposed surface. Middorsal region of body between tip of supraoccipital spine and origin of dorsal fin, and between dorsal and adipose fins dark. Median fins dusky. Paired fins hyaline.

DISTRIBUTION.—Rio Amazonas and Rio Tocantins basins (Figure 24).

REMARKS.—Müller and Troschel (1844:83) based their description of *Anodus alburnus* on an unspecified number of specimens collected by Richard Schomburgk in "See Amucu" (= Lake Amucu or Amuku), Guiana (= Guyana), in the basin of a headwater tributary of the Rio Branco. Two syntypes of the species have been located in the Zoologisches Museum,

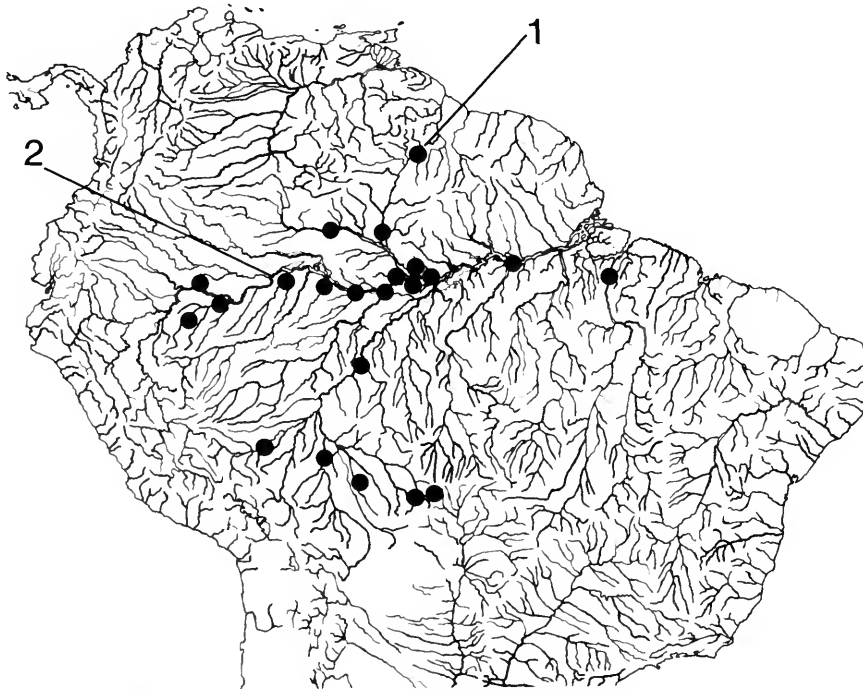


FIGURE 24.—Map of central and northern South America showing geographic distribution of *Curimatella alburna* (filled in circles; 1 = type locality of *Anodus alburnus*; 2 = type locality of *Curimatus alburnus lineatus*) (some symbols represent more than one collecting locality or lot of specimens).

Humboldt University, Berlin (ZMB 3527). The larger of these individuals is the specimen illustrated by Müller and Troschel (1844, pl. 4: fig. 3; herein reproduced as Figure 20) and is designated as the lectotype. The type species is complex and the smaller specimen, an individual of *Curimatella immaculata*, becomes a paralectotype (see also "Remarks" under *Curimatella immaculata*).

Eigenmann and Eigenmann (1889b:419) described *Curimatus alburnus lineatus* var. nov. on the basis of a single specimen (MCZ 20297; see Figure 21) collected at Jutahy (= Rio Jutaf) in the Amazon basin. Neither the characters cited by Eigenmann and Eigenmann nor any examined during this study distinguish that nominal form from *Curimatella alburna* (Table 6). Eigenmann and Eigenmann's subspecies is consequently placed into the synonymy of *Curimatella alburnus*.

Fowler (1975:366) placed *Curimatus alburnus lineatus* as a subspecies of *Curimatus asper* Günther (1868). These two nominal forms differ in various meristic and morphometric values (see redescription of *Curimata aspera* by Vari (1989b:50). They are also members of different phyletic lineages within the Curimatidae (Vari, 1989a), making such an association untenable.

*Anodus alburnus* of Müller and Troschel was among the first species of the Curimatidae described. That factor, in combination with the relatively subtle differences that discriminate

*alburna* from some other nominal species in *Curimatella*, has led to numerous erroneous references to *alburna* under various genera from a broad geographic range across South America. The origin of these incorrect attributions is discussed below.

Citations of *Curimatella alburna* (in various genera) from the Río de La Plata basin began with Boulenger (1896:34), who reported *Curimatus alburnus* from Descalvados in the Mato Grosso region of Brazil. The purported presence of this species in the Río de La Plata basin was also noted by Eigenmann et al. (1907:124) on the basis of specimens from Paraguay. Those early records were presumably the basis for subsequent citations of the species, in various genera, from the Río de La Plata basin by Bertoni (1914:9, 1939:54) and Ringuelet (1975:72). The specimens examined by Boulenger from Descalvados (BMNH 1895.5.17:136-137) proved to be *Curimatella dorsalis*. I have been unable to locate the specimens examined by Eigenmann et al. (1907), but *Curimatella alburna* has not been found in the material from the Río de La Plata system examined during this study. It would appear that their record and subsequent citations of the species in that basin are erroneous.

*Curimatella alburna* has been cited from, or considered to be a member of, the Río Orinoco ichthyofauna by Steindachner (1879:153), Pellegrin (1899:157), Schultz (1944:249), and Mago-Leccia (1967:254; 1970:75). The species has not been

TABLE 6.—Morphometrics and meristics of (A) lectotype of *Anodus alburnus* (ZMB 3527); (B) holotype of *Curimatus alburnus lineatus* (MCZ 20297); and (C) all specimens of *Curimatella alburna* 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. Dashes indicate values that could not be taken as a consequence of condition of specimen.

Character	A	B	C
MORPHOMETRICS			
Standard length	75.8	68.1	56.5-179.9
1. Greatest body depth	0.37	-	0.37-0.41
2. Snout to dorsal-fin origin	0.50	0.51	0.48-0.53
3. Snout to anal-fin origin	0.84	0.84	0.84-0.89
4. Snout to pelvic-fin origin	0.54	0.53	0.53-0.58
5. Snout to anus	0.81	-	0.77-0.84
6. Origin of rayed dorsal fin to hypural joint	0.59	0.60	0.59-0.60
7. Pectoral-fin length	-	-	0.19-0.23
8. Pelvic-fin length	0.20	0.22	0.20-0.26
9. Caudal-peduncle depth	0.14	0.14	0.13-0.14
10. Head length	0.32	0.33	0.28-0.35
11. Snout length	0.29	0.29	0.27-0.33
12. Orbital diameter	0.32	0.31	0.27-0.32
13. Postorbital length	0.41	0.40	0.39-0.45
14. Interorbital width	0.46	0.45	0.45-0.50
MERISTICS			
Lateral-line scales	33	33	32-35
Scale rows between dorsal-fin origin and lateral line	5 <sup>1</sup> / <sub>2</sub>	-	5-5 <sup>1</sup> / <sub>2</sub>
Scale rows between anal-fin origin and lateral line	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>2</sub> -5
Branched dorsal-fin rays	9	9	9
Branched anal-fin rays	7	7	7
Total pectoral-fin rays	-	-	13-17
Branched pelvic-fin rays	8	8	8
	24	34	33-35

found in the large series of examined curimatids from that basin and it is likely that these records are based on *C. immaculata*, a species common in the Río Orinoco basin and very similar morphologically to *C. alburna*. Boulenger's record (1898:426) of *Curimatus alburnus* from the Río Juruá of the Amazon basin is based on a specimen of *Curimatella dorsalis* (BMNH 1897.12.1:104).

*Curimatella alburna* has also been erroneously cited in most of the Atlantic drainages of the Guianas. Puyo (1949:118) reported the species from French Guiana. The specimens on which Puyo based his record are apparently lost (Géry, 1959:346; Géry and Planquette, 1982:68) and no specimens of *Curimatella alburna* from French Guiana were located during this study. The description provided by Puyo agrees in many details with that of *Cyphocharax microcephalus*, a species with a wide range in the Guianas. Eigenmann and Eigenmann (1889b:418), Fowler (1906:297; 1919:130), Boeseman (1952:183), and Géry (1965:123) recorded *C. alburna* from various localities in Surinam. Examination of many of their specimens has shown that they are rather *Cyphocharax microcephalus*.

Eigenmann and Eigenmann (1889b:418) listed *Curimatus alburnus* from Surinam and a variety of Amazonian localities. The examined extant Amazonian specimens that served as the basis of their record (MCZ 792, 20185, 20205, 20234, 20253, 20257, 20267, 20270, 20300, 20346) are all *Curimatella alburna*. The lot cited by Eigenmann and Eigenmann as being from Surinam (MCZ 792) includes individuals of *C. alburna* and two species of *Cyphocharax* (*microcephalus* and *abramoides*). Although *Cyphocharax microcephalus* is widespread in Surinam, *C. abramoides*, a very distinctive species relatively common in the Amazon basin (Vari, 1991, fig. 4), is not known to occur in Surinam or other portions of the Guianas. The lot reported on by Eigenmann and Eigenmann thus appears to be a mixture of specimens possibly from Surinam and the Amazon basin, casting doubt on the Surinam locality for *Curimatella alburna* they cited. Furthermore, no specimens of *C. alburna* have been located in the numerous collections of curimatids from Surinam examined in the course of this and associated studies.

Eigenmann (1912:262) reported *Curimatella alburna* from Twoca Pan and Rupununi, British Guiana (= Guyana). Eigenmann provided little information on these localities other than noting (1912:74) that the material was collected by a Mr. Grant and that "I do not know how much Rupununi includes, but certainly Twoca Pan, and a creek opposite Massara Landing." Data associated with one specimen identified by Eigenmann as *Curimatella alburna* (USNM 66138) indicates that Twoca Pan is "between Rupununi and Pununike." I have been unable to precisely locate these localities on available maps or in gazetteers. The inexact locality information does suggest, however, that the material originated in the region of the Brazilian-Guyanese border, an area with a complex pattern of headwater streams draining both to the Río Branco of the

Amazon basin and to the upper Essequibo River, which drains independently to the Atlantic Ocean. The specimen from Twoca Pan (USNM 66138) is an individual of *Curimatella immaculata*, a species widespread in the Amazon basin. The three specimens from "Rupununi" (formerly IU 12289, in part; now in CAS) are, in fact, *C. alburna*. Thus *C. alburna* may be a component of the ichthyofauna of the upper Rupununi River, a portion of the Essequibo River system.

MATERIAL EXAMINED.—136 specimens (55, 56.5–185.0).

GUYANA. *Rupununi*: no exact locality, CAS-IU 12289, 3 (66.2–82.6, formerly IU 12289). See Amucu (= Lake Amucu), ZMB 3527, 1 (75.8, lectotype of *Anodus alburnus*). Twoca Pan between Rupununi and Pununike.

BRAZIL. *Pará*: Santarém, USNM 148500, 1 (132.5). Santarém, Rio Maicá, MZUSP 9171, 1 (136.1). Lagoa along margin of Rio Tocantins, near Baião, MZUSP 21267, 31. *Roraima*: Rio Branco, Maraá, USNM 242141, 4 (129.7–159.0); USNM 268028, 3 (1, 71.5). *Amazonas*: Rio Negro, below Rio Daraá, USNM 311166, 2 (112.5–114.4). Paraná de Janauacá, USNM 229178, 1 (68.3). Lake Hyanuary (= Paraná do Januári), MCZ 20267, 2 (139.1–151.9); MCZ 20346, 1 (91.5). Lago Januári, near Manaus, MZUSP 6862, 6 (3, 84.4–145.7). Rio Negro, near Manaus, MZUSP 6687, 14 (2, 89.0–139.7). Manacapuru (= Lago Grande de Manacapuru), MCZ 20205, 11 (4, 151.0–179.9). Lago Jacaré, right bank of Rio Solimões, above Manacapuru, MZUSP 6452, 2 (98.0–123.3). Tefé (= Tefé), MCZ 20257, 1; MCZ 20253, 2. Rio Tefé, Mucura, USNM 242143, 1 (140.9). Igarapé Chefe, cabeceiras do Lago Beruri, MZUSP 6425, 1 (94.2). Lago Beruri, Rio Purus, MZUSP 6371, 1 (80.4). Lago Castro, mouth of Rio Purus, MZUSP 6309, 4 (86.5–96.4; 1 specimen cleared and counterstained for bone and cartilage). Lago Urini, mouth of Rio Japurá, MZUSP 36238, 1 (135.6). Coary (= Lago do Coari), MCZ 20185, 1. Igarapé Xicanga, 5 km E of Humaitá, on Transamazonian Highway, USNM 311156, 1 (68.9). Jutahy (= Rio Jutaf), MCZ 20297, 1 (68.1, holotype of *Curimatus alburnus lineatus*); MCZ 20300, 1. Hyavary (= Rio Javari along Brazilian-Peruvian border), MCZ 20234, 2. *Mato Grosso*: Rio Guaporé, Vila Bela de Santíssima Trindade, MZUSP 37515, 3 (160.0–170.0). Rio Branco, tributary of Rio Guaporé, above bridge along highway BR 364 between Cuiabá and Porto Velho, Município de Pontes e Lacerda, MZUSP 37422, 12.

PERU. *Loreto*: Río Ampiyacu, SU 36589, 1 (61.0, now in CAS). Río Yavari system, Río Yaquerana, NRM 26465, 1.

BOLIVIA. Río Guaporé, NMW 16366, 1 (185.0). *Beni*: Río Guaporé, AMNH 37706, 3 (67.5–82.9). Río Mamoré at 13°35'S, AMNH uncat., 5 (56.5–75.5). Río Madre de Dios, Laguna San Luis, MZUSP 27835, 3 (75.2–103.4). Río Blanco, USNM 278585, 2; USNM 278580, 5 (1, 93.8; specimen cleared and counterstained for cartilage and bone).

*Curimatella immaculata* (Fernández-Yépez)

FIGURES 25–28; TABLE 2

*Anodus alburnus*.—Müller and Troschel, 1844:83 [Guiana (= Guyana); in part, paralectotype of *Anodus alburnus*]; 1845:26 [expansion of Müller and Troschel, 1844; Guiana (= Guyana), "See Amucu" (= Lake Amuku); in part, paralectotype of *Anodus alburnus*]; 1848:633 [based on Müller and Troschel, 1844 and 1845; in part, paralectotype of *Anodus alburnus*].

*Curimatus alburnus*.—Steindachner, 1879:153 [Venezuela: Ciudad Bolívar].—Pellegrin, 1899:157 [Venezuela: Río Apure].

*Curimatus immaculatus*.—Eigenmann and Eigenmann, 1889b:418 [nomen nudem; cited in description of *Curimatus serpae* Eigenmann and Eigenmann, but no description of species provided].

*Curimatella alburna*.—Eigenmann, 1912:262 [references in part; specimens from Twoca Pan, British Guiana (= Guyana), not cited specimens from Rupununi, British Guiana (= Guyana)].—Galvis et al. 1989:39–41, 72, 100, 102, 103, 104, 107, 111, 114, 116, 117, 122, 125, 130, 135 [Colombia: Río Meta basin, Río Metica system, Laguna de Menegua; life history, food habits].

*Lepipinna immaculata* Fernández-Yépez, 1948:27, fig. 9 [type locality: Brazil: Obidos (= Óbidos); author cited as Eigenmann].—Vari, 1989a, tables 2, 3 [phylogenetic relationships].

*Curimatella alburna*.—Allen in Eigenmann and Allen, 1942:291 [Peru: Iquitos].—Mago-Leccia, 1967:254 [Venezuela: Llanos of Río Orinoco basin].

*Curimatella alburna alburna*.—Mago-Leccia, 1970:75 [Venezuela].

*Bitricarinata aspera immaculata*.—Fowler, 1975:366 [citation].

*Curimata immaculata*.—Ortega and Vari, 1986:11 [Peruvian Amazon].

**DIAGNOSIS.**—The 29 to 33 lateral-line scales to the hypural joint in *Curimatella immaculata* distinguish the species from *C. lepidura* and *C. meyeri*, which have 35 or more scales in that series. The 5 or 6 scales in a transverse series from the lateral line to the origin of the dorsal fin further separates *C. immaculata* from *C. lepidura*, which has 9 to 10½ scales in that series. *Curimatella immaculata* can also be discriminated from *C. meyeri* in the number of vertebrae (31 to 33 versus 35 to 37, respectively). *Curimatella immaculata* lacks the dark spot on the mid-lateral surface of the caudal peduncle, which character-

izes *C. dorsalis*. Finally *C. immaculata* differs from *C. alburna* in relative maximum interorbital width (0.38–0.45 of HL versus 0.45–0.50, respectively), relative gape width (0.24–0.29 of HL versus 0.28–0.33), relative length of the postorbital portion of the head (0.36–0.39 of HL versus 0.39–0.46), relative orbital diameter (0.33–0.39 of HL versus 0.27–0.32), and number of vertebrae (31 to 33, usually 32, rarely 33, versus 33 to 35, usually 34).

**DESCRIPTION.**—Body moderately elongate, somewhat compressed laterally, more so in specimens from the Río Orinoco basin. Dorsal profile of head rounded from upper lip to vertical line through region of nostrils, straight from that line to tip of supraoccipital spine. Dorsal profile of body straight to convex from tip of supraoccipital spine to origin of dorsal fin; straight and slightly posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with indistinct median keel anterior to dorsal fin, keel more pronounced proximate to fin; dorsal surface of body smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region transversely flattened, more obviously so proximate to pelvic-fin origin, with one median series of scales; posterior scales in median series enlarged, anterior scales of median series approximately of same size as those on adjoining ventrolateral portions of body. Median-scale series flanked on each side by series of scales that conform in shape to lateral angles of body. Obtuse median keel present posterior to pelvic-fin insertion. Secondary obtuse keel on each side of postpelvic portion of body one scale row dorsal of ventral midline.

Greatest body depth at origin of dorsal fin 0.36–0.43 [0.39]; snout tip to origin of dorsal fin 0.47–0.53 [0.49]; snout tip to origin of anal fin 0.82–0.88 [0.85]; snout tip to insertion of pelvic fin 0.51–0.59 [0.52]; snout tip to anus 0.77–0.83 [0.78]; origin of dorsal fin to hypural joint 0.55–0.61 [0.60].

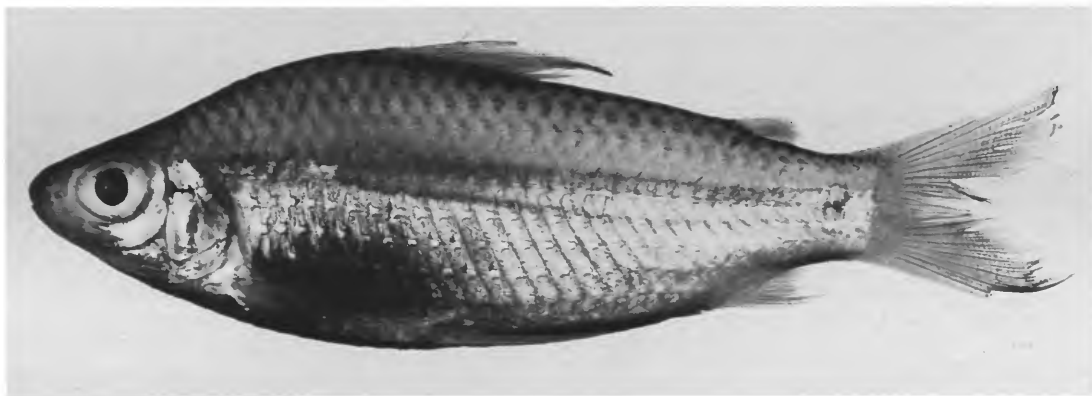


FIGURE 25.—*Curimatella immaculata*, USNM 268030, 75.8 mm SL; Brazil, Pará, Rio Tapajós, Itaituba, edge of river channel.

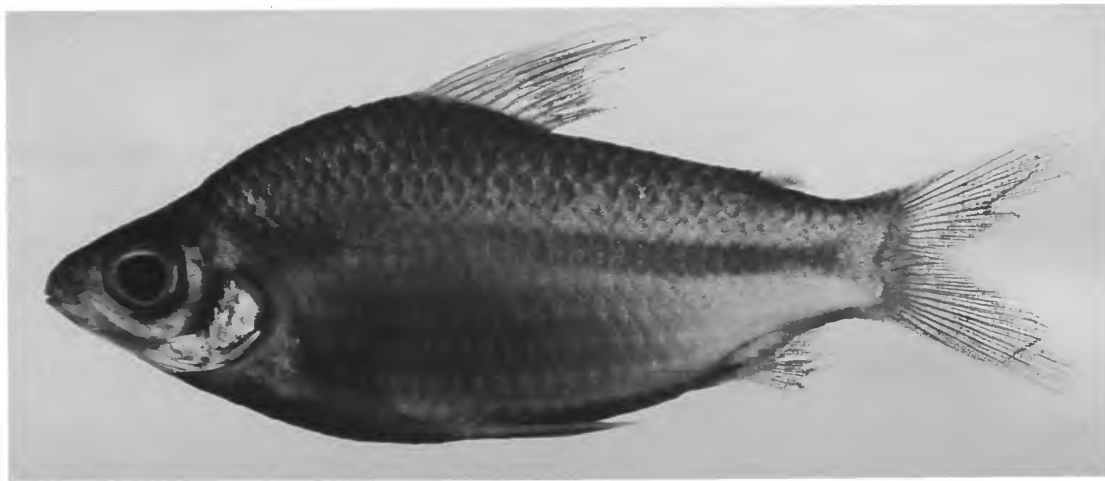


FIGURE 26.—*Curimatella immaculata*, USNM 305382, 60.5 mm SL; Bolivia, Beni, Río Matos below road crossing, 48 km E of San Borja.

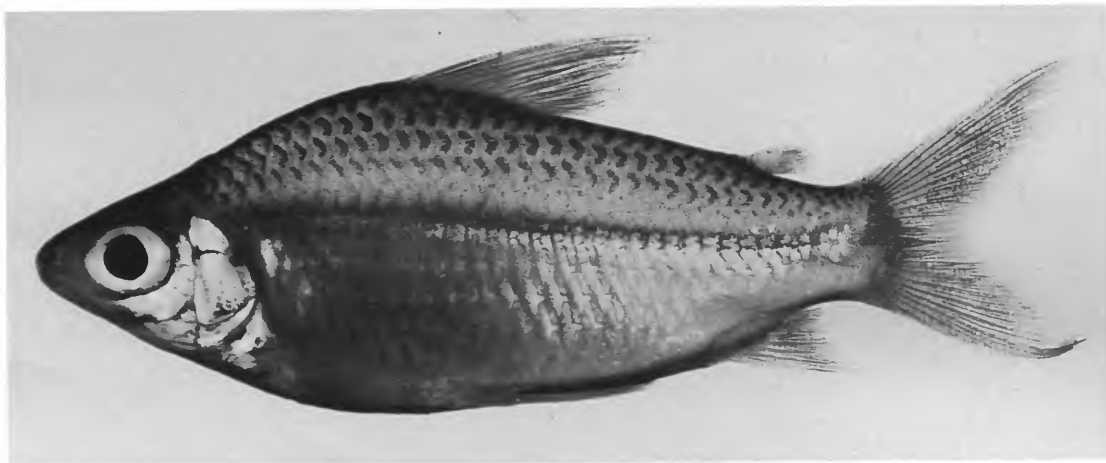


FIGURE 27.—*Curimatella immaculata*, USNM 269928, 54.8 mm SL; Venezuela, Bolívar, small caño connecting with Río Orinoco immediately south of El Burro.

Dorsal fin pointed in profile, less so with increasing age; last unbranched and first branched rays approximately three and one-half to four times length of ultimate ray. Pectoral-fin margin pointed in profile distally; length of pectoral fin 0.18–0.24, extends posteriorly about two-thirds distance to vertical line through insertion of pelvic fin. Pelvic-fin margin pointed in profile, length of pelvic fin 0.22–0.27 [0.23], reaches posteriorly about two-thirds distance to origin of anal fin. Caudal fin forked, rays variably covered with scales. Scale field less extensive on middle rays of caudal fin at all sizes.

Proportion of caudal fin covered by scales increases ontogenetically, with basal two-thirds of rays, other than on central portions of fin, thickly covered by sheet of small scales in larger individuals. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays three to three and one-half times length of ultimate ray. Caudal-peduncle depth 0.13–0.15 [0.13].

Head obtusely pointed in profile, head length 0.27–0.32 [0.29]; upper and lower jaws equal, mouth terminal; snout length 0.25–0.31 [0.29]; 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 0.33–0.39 [0.35]; adipose eyelid present, more developed anteriorly, particularly in larger specimens, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.36–0.40 [0.39]; gape width 0.24–0.29 [0.26]; interorbital width 0.38–0.45 [0.43].

Pored lateral-line scales from supracleithrum to hypural joint 29 to 33 [32]; all scales of lateral line pored, canals in scales straight; 3 to 5 pored scales extend beyond hypural joint onto caudal-fin base; 5 to 6 [5<sup>1/2</sup>] scales in transverse series from origin of dorsal fin to lateral line; 4<sup>1/2</sup> to 5<sup>1/2</sup> [5] scales in transverse series from lateral line to origin of anal fin. Caudal-fin rays variably covered with scales (see above).

Dorsal-fin rays ii,9 or iii,9 (iii,9 rare; when three unbranched rays present, first very small) [ii,9]; anal-fin rays ii,7 or 8 or iii,7 (iii,7 rare; when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 16 [13]; pelvic-fin rays i,8 or 9 (i,9 rare) [i,8].

Total vertebrae 31 (13), 32 (138), 33 (2).

**COLOR IN ALCOHOL.**—Overall coloration of specimens retaining guanine on scales silvery, darker on dorsal portions of head and body. Ground coloration of specimens lacking guanine on scales tan to light brown. Scales dorsal of lateral line with crescent-shaped field of dark chromatophores on

exposed surface. Extent of field of dark pigmentation on scales varies within and between population samples (compare Figures 25 and 27). Middorsal region between tip of supraoccipital spine and dorsal fin and between dorsal and adipose fins darker than proximate portions of body. Obscure midlateral stripe extending from supracleithrum to caudal peduncle. Paired fins dusky. Median fins hyaline.

**DISTRIBUTION.**—Río Orinoco, Río Amazonas, and Río Tocantins basins and upper portion of Rupununi River of Essequibo River system (Figure 28).

**GEOGRAPHIC VARIATION.**—Specimens of *Curimatella immaculata* from the Río Orinoco basin tend to be somewhat more compressed laterally than do individuals from the Amazon, although a wide degree of overlap occurs between the populations from the two basins. The most notable degree of intraspecific variation is demonstrated by the relative body depth, with population samples from the eastern Amazon basin often possessing shallower bodies than samples from the Río Orinoco and western Río Amazonas basins (compare Figures 25 and 27). This pattern parallels that discussed previously for *C. dorsalis*. As in the latter species, *C. immaculata* shows much overlap among populations from different regions in the Amazon basin.

**ECOLOGY.**—The ecology of *Curimatella immaculata* was studied by Galvis et al. (1989) in a lagoon in the Río Meta basin

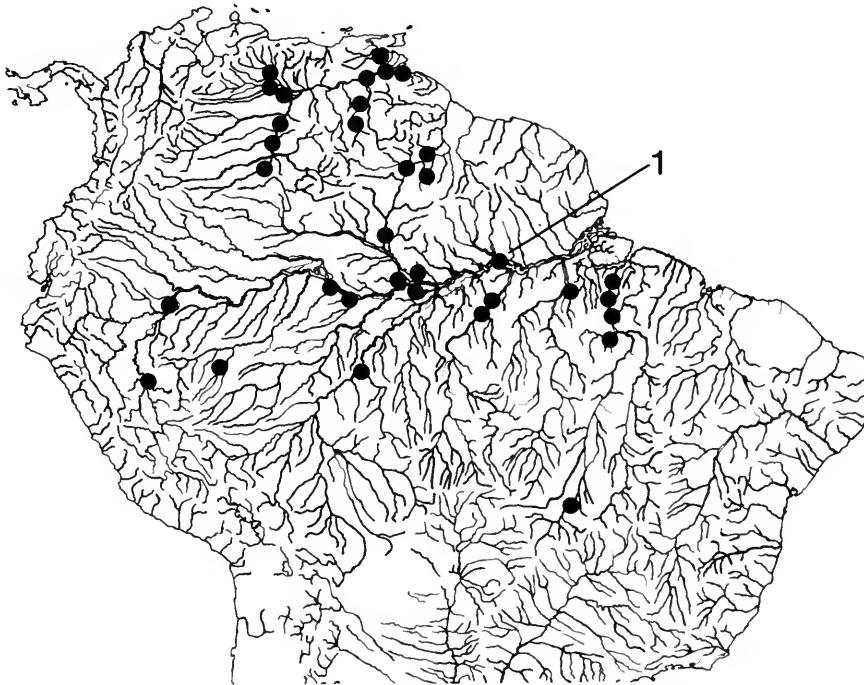


FIGURE 28.—Map of central and northern South America showing geographic distribution of *Curimatella immaculata* (filled in circles; 1 = holotype locality of *Lepipinna immaculata*) (some symbols represent more than one collecting locality or lot of specimens).

of the western portions of the Río Orinoco system. The authors, who reported on the species as *Curimatella alburna*, found that it is an inhabitant of still waters along the margins of lagoons, breeds from April to June, and feeds on a variety of algae and fungi.

REMARKS.—Handwritten notations associated with the holotype indicate that this species was first recognized as distinct by C.H. Eigenmann who, with R.S. Eigenmann (1889b:418), mentioned the species in their original description of *Curimatus serpae*. They did not, however, describe the species in that publication or subsequently. A specimen from the MCZ collections, evidently intended as the holotype, was retained by C.H. Eigenmann and cataloged into the Indiana University collection (IU 4316). That lot, along with the bulk of the Indiana University fish collection, was later transferred to the California Academy of Sciences. In 1948 Fernández-Yépez discovered the specimen in the CAS collections together with the associated Eigenmann annotation that it was an undescribed species. Fernández-Yépez names the species as *Lepipinna immaculata* in his revision of the Curimatidae but ascribed authorship to Eigenmann. Although Eigenmann may have intended to describe the species, he failed to do so for unknown reasons and the actual author is Fernández-Yépez.

*Curimatella immaculata* is partially sympatric with and very similar morphologically to *Curimatella alburna*. Not unexpectedly the two species have been confused numerous times over the last century and a half. Indeed the smaller of the two specimens in the type series of Müller and Troschel's *Anodus alburnus* is actually *Curimatella immaculata* (ZMB 3527).

Steindachner (1879:153) reported *Curimatus alburnus* from Ciudad Bolívar, Venezuela, on the main channel of the lower Río Orinoco. Pellegrin (1899:157) cited the same species from the Río Apure, a tributary of the Río Orinoco in the center of the llanos. I have not located the specimens that were the basis for those records; however, no specimens of *Cyphocharax alburnus* have been located in the extensive series of curimatids examined from the Río Orinoco system. It is consequently assumed that the records of *Curimatus alburnus* from the Río Orinoco are misidentifications of *Curimatella immaculata*.

Fowler (1975:366) placed *Lepipinna immaculata* without explanation as a subspecies of *Curimatus asper* Günther. These forms differ, however, in numerous morphometric and meristic characters (see redescription of *Curimata aspera* by Vari (1989b:50)) and are members of different phyletic lineages (Vari, 1989a), making such a generic association untenable.

Allen (in Eigenmann and Allen, 1942:291) cited *Curimatella alburna* from Iquitos, Peru. Examination of some of the specimens that served as the basis for that record (USNM 167801) has shown that they are *C. immaculata*.

Galvis et al. (1989) discussed the life history of a species that they identified as *Curimatella alburna* in the Río Meta system of the western Río Orinoco basin. Only two *Curimatella* species are known to occur in the Río Orinoco system, *C. immaculata* and *C. dorsalis*. *Curimatella dorsalis* has a distinct

black spot on the mid-lateral surface of the caudal peduncle, a pigmentation pattern not present in *C. immaculata* and not illustrated by Galvis et al. (1989) for the species that they studies. That report of *Curimatella alburna* from the Río Meta is consequently considered to be based on *C. immaculata*.

MATERIAL EXAMINED.—953 specimens (148, 41.7–93.0)

BRAZIL. No exact locality, CAS 11883, 1 (72.0). *Pará*: Rio Tocantins, Loquinho, near Tucuruí, MZUSP 21326, 22 (5, 66.6–90.6). Lagoon along margin of Rio Tocantins, near Tucuruí, MZUSP 21291, 4 (64.2–73.7); MZUSP 41678, 31. Igarapé Muru, Rio Tocantins, below Tucuruí, MZUSP 21282, 18 (5, 63.4–87.3). Rio Tocantins, lagoon near Jatobal, MZUSP 21308, 3 (1, 83.5). Rio Tocantins, near Baião, USNM 306021, 5. Rio Xingu, Belo Monte, USNM 268021, 1; USNM 268026, 1. Manaus, Lago Januari, MZUSP 41676, 1. Rio Itacaiuna, Cachoeira do Caldeirão, USNM 268025, 9. Óbidos, CAS 60630, 1 (66.8, holotype of *Lepipinna immaculata*; formerly IU 4316; evidently originally part of MCZ 20201 or MCZ 20337, see next entry); MCZ 20201 and 20337, 14 (57.7–78.7, lots intermingled). Rio Tapajós, Itaituba, USNM 268030, 14 (1, 75.8). Mouth of Rio Tapajós, near São Luís, USNM 243232, 1 (53.8). Rio Tapajós, Pedemeiras, USNM 268024, 31. *Roraima*: Rio Branco, Maraá, near mouth of Rio Branco, USNM 268047, 50. *Goiás*: Rio Araguaia, Aruanã, MZUSP 4852, 41 (10, 68.8–76.2). Tocantinia, MZUSP 20814, 18 (13, 51.8–54.4). *Mato Grosso*: Rio Araguaia, Santa Terezinha, MZUSP 20839, 2 (61.5–68.2). *Amazonas*: Lago Manacapuru, MZUSP 6520, 69 (18, 65.1–93.0). Lago Terra Preta, Januári, USNM 229201, 3 (57.2–74.5). Lago Januári, MZUSP uncat., 1 (84.8). Paraná de Januacá, entry into Lago do Castanho, USNM 229172, 3. Rio Solimões, Coari, MZUSP 20921, 1 (75.1). Tefé, MZUSP 21044, 7 (3, 57.4–70.0). *Rondonia*: Rio Madeira, between mouth of Rio Candeias and Rio Machado, USNM 311158, 1 (59.0). *Acre*: Rio Tarauacá, Tarauacá, rainforest stream, USNM 269031, 11.

COLOMBIA. *Guainia*: Puerto Inirida, NRM 26453, 1. Puerto Inirida, flooded caño, NRM 26450, 4.

PERU. *Ucayali*: Utoquinia, Río Ucayali, USNM 261441, 2. *Loreto*: Iquitos, pond, USNM 167801, 5 (75.7–89.3, formerly IU 17848, in part). Quebrada Corrientillo, at Corrientillo, on road running west from Iquitos to Río Nanay, USNM 280402, 5.

BOLIVIA. *Beni*: Río Matos below road crossing, 48 km E of San Borja, USNM 305382, 3 (1, 60.5).

GUYANA. *Rupununi*: Pura River, USNM 224811, 48 (5, 56.8–79.3). “See Amucu” (= Lake Amucu), ZMB 3527, 1 (50.1, paralectotype of *Anodus alburnus* Müller and Troschel). South Savannahs, pond near Tukutu River, BMNH 1972.7.27:407–414, 5. Manari Creek (Amazon drainage), BMNH 1972.7.27:378–379, 1. Jacare, BMNH 1972.7.27:361, 5 (49.5–55.5). Savannah pond west of Dadanawa (Rupununi River system), AMNH 15714, 1 (69.8). Sand (Katiwau) River (Rupununi River system), BMNH 1972.7.27:380–396, 8.

VENEZUELA. *Territorio Federal Delta Amacuro*: Río



Orinoco, Caño Araguero, USNM 235525, 5 (49.3–55.5). Caño Fiscal (08°32'N, 61°02'W), USNM 235529, 14 (5, 44.7–53.0). Vicinity of Caño Araguaio, USNM 235530, 1. Tucupita, MBUCV V-11964, 1. Caño Paloma, USNM 235527, 50. *Monagas*: Isla Cocos, opposite Los Castillos, USNM 235524, 14 (5, 47.0–50.0; 3 specimens cleared and counterstained for cartilage and bone); USNM 235523, 3. Isla Tapatapa, at Los Castillos, USNM 235507, 1. Caño Guarguapo, USNM 235534, 4. Isla Chivera, USNM 235531, 1. *Bolívar*: Río Orocopiche (08°03'N, 63°40'W), USNM 235536, 5 (41.7–52.3); USNM 235535, 5; USNM 235528, 2; USNM 235533, 1; USNM 235532, 2. Río Aro (08°00'N, 64°15'W), USNM 235448, 40. Caño draining into Río Orinoco at El Burro, USNM 269928, 14 (1, 54.8). Río Aro about 3 km downstream from bridge of route 19, about 85 km from Ciudad Bolívar, USNM 235444, 40. La Paragua, caño draining into Río Chiguao, MBUCV V-4223, 5. Río Paragua, Salto Auraima, MBUCV V-4205, 5. *Guarico*: Río Guariquito, E-SE of Calabozo, USNM 257565, 67 (15, 59.5–68.7; 2 specimens cleared and counterstained for cartilage and bone). *Apure*: Río Cunaviche, Cunaviche, USNM 258022, 110. Río Apure, San Fernando de Apure, USNM 258005, 1. Río Cantaro, where crossed by bridge on road from San Fernando de Apure to Cunaviche, USNM 258031, 107. *Territorio Federal Amazonas*: Río Orinoco, Raudales de Ature, USNM 269916, 1.

**Summary Comments on the Curimatidae**

This paper is the last of a series that began a decade ago (Vari, 1982a). The complexity of species-level problems in the Curimatidae and the associated uncertainty on the phylogenetic relationships in the family necessitated simultaneous phylogenetic and generic-level revisionary studies. With the completion of the series of papers cited in the "Introduction" it is now

possible to propose a key to the genera of the Curimatidae that addresses the known variation in the family. All genera of curimatids with the exception of *Cyphocharax* are characterized by one or typically more derived features. Most of the synapomorphies for the members of the different genera are internal and often require that a specimen be cleared and counterstained for cartilage and bone to determine the condition of a character. Such features are thus of limited utility for identifying species of curimatids in most situations. The following key focuses on external features, some of which are synapomorphic for members of a genus, whereas others may represent primitive conditions or character states of more general occurrence within the family. The final couplet is based on geography for purposes of simplicity. *Pseudocurimata*, one of the two genera in that couplet, is limited to the western slopes of the Andes and defined by a series of internal characters only amenable to examination in specimens cleared and counterstained for cartilage and bone. No known external feature permits the ready discrimination of all members of *Pseudocurimata* from the species of *Cyphocharax*, a large assemblage whose species, with one exception, occur to the east of the Andean Cordilleras. The use of morphological features would consequently require multiple couplets to separate the numerous species of the two genera on the basis of external morphology, a much more tedious practice than the use of distributional information. The internal characters uniquely derived for *Pseudocurimata* were discussed in detail by Vari (1989d:3–9).

The key to the genera of the Curimatidae is followed by a key to the species of *Curimatopsis*, the only genus for which an additional species was described (Vari, 1982b) subsequent to the generic revision (Vari, 1982a). Range extensions in some species of *Curimatopsis* and *Curimata* are also discussed. This is followed by some summary comments on curimatid biogeography.

**Key to the Genera of the Curimatidae**

1. Lateral line incomplete in adults; anterior margin of maxilla distinctly rounded anteriorly without a distinct notch to receive the lateral portion of the premaxilla [Figure 29A]; anterior margin of maxilla extending anteriorly to a pronounced degree when lower jaw is depressed; males with pronounced expansion of penultimate principal ray of lower lobe of caudal fin; relative depth of caudal peduncle sexually dimorphic, deeper in males; (see figures of species in Vari, 1982a) . . . . . *Curimatopsis*  
 Lateral line complete in adults except in a few species of *Cyphocharax*; anterior margin of maxilla slightly convex to slightly concave anteriorly, often with a notch that receives the lateral portion of the premaxilla [Figure 29B], not extending anteriorly to a pronounced degree when lower jaw is depressed; no sexual dimorphism apparent in rays of caudal fin or in relative depth of caudal peduncle . . . . . 2
2. Lateral-line scales between supracleithrum and hypural joint 85 to 100; laterosensory canal segment in sixth infraorbital with four or five branches [Figure 29C]; fourth

- and fifth infraorbitals posteriorly expanded, with posterior branch of laterosensory canal in fourth infraorbital relatively elongate [Figure 31B] . . . . *Potamorhina*  
Lateral-line scales between supracleithrum and hypural joint typically less than 76, if between 77 and 97 then species is distinctly compressed laterally, with a procumbent spine at base of first dorsal-fin ray [Figure 32] and a distinct middorsal keel between rear of dorsal fin and adipose fin; laterosensory canal segment in sixth infraorbital either tripartite or a simple tube [Figures 30A,B,D]; fourth and fifth infraorbitals not posteriorly expanded and with posterior branch of laterosensory canal in fourth infraorbital relatively short [Figure 31A,C] . . . . 3
3. Roof of mouth with three prominent fleshy flaps with associated secondary flaps in all but smaller juveniles [Figure 33] . . . . . *Curimata*  
Roof of mouth with three simple flaps not paralleled by a series of secondary flaps, or with series of fleshy lobulate bodies over anterior or entire surface in all but smallest individuals [Figure 34] . . . . . 4
4. Laterosensory canal segment in sixth infraorbital tripartite [Figure 30A]; laterosensory canal segments in fourth and fifth infraorbitals forming an arch continuous with those in anterior infraorbitals; fourth infraorbital with a distinct posterior branch in the laterosensory canal segment [Figure 31A] . . . . . *Psectrogaster*  
Laterosensory canal segment in sixth infraorbital a simple tube [Figure 30D] or ossification is missing; laterosensory canal segments in fourth and fifth infraorbitals meeting at an acute angle and fourth infraorbital lacking a posterior branch in laterosensory canal [Figure 31C]; or canal segments missing or very poorly developed . . . . . 5
5. Middle rays of upper and lower lobes of caudal fins in mid- to large-size specimens covered with patches of small scales; scale patches extending over most of these rays in larger specimens [Figure 1] . . . . . *Curimatella*  
Middle rays of upper and lower lobes of caudal fins in mid- to large-size specimens without patches of small scales; if scales present on those rays, then they are limited to basal portions of rays and are approximately same size as scales on posterior portion of caudal peduncle . . . . . 6
6. Roof of mouth with series of lobulate processes extending into oral cavity in all but smaller juveniles [Figure 34], or with three thick longitudinal flaps on roof of oral cavity (latter only in *Steindachnerina binotata*) . . . . . *Steindachnerina*  
(in part; all species except *bimaculata*, *conspersa*, *binotata*, *leucisca*, *argentea*, and *biornata*)  
Roof of mouth with three simple longitudinal flaps without associated fleshy lobulate bodies, longitudinal flaps not thickened . . . . . 7
7. A distinct dark spot at base of middle rays of caudal fin [Figures 35] and/or one or more longitudinal series of small dark spots on the dorsolateral surface of body [Figure 36] with spots irregularly placed over scales; and anus separated from first ray of anal fin by 7 to 11 scales . . . . . *Steindachnerina*  
(in part; *bimaculata*, *conspersa*, *binotata*, *leucisca*, *argentea*, and *biornata*)  
No distinct dark spot at base of middle rays of caudal fin and species lacking one or more longitudinal series of small dark spots irregularly situated on the dorsolateral surface of body (if longitudinal series of dark spots present, spots situated on middle of exposed surface of scale, in seven or eight series (in *Cyphocharax pantostictos*); anus separated from first ray of anal fin by 2 to 4 scales . . . . . 8
8. Species occurring to west of Andean Cordilleras from Río Atrato of Colombia to rivers of northwestern Peru; material from Río Atrato has a distinct dark spot on midlateral surface of caudal peduncle and series of small dark spots on lateral and dorsolateral surface of body [Figure 37] . . . . . *Pseudocurimata*  
Species occurring to east of Andean Cordilleras with exception of one species from northwestern Colombia and Pacific slope rivers of Panama and southern Costa Rica, which neither has a midlateral caudal spot nor series of small spots on lateral

and dorsolateral surfaces of body; material from Río Atrato of Colombia lacks distinct dark spot on midlateral surface of caudal peduncle and a series of small dark spots on lateral and dorsolateral surface of body . . . . . *Cyphocharax*

**Key to the Species of *Curimatopsis* Steindachner**

Vari (1982a:12, 13) provided a key to the then recognized species of *Curimatopsis*. While that paper was in press a previously unknown species of the genus was discovered in collections from Paraguay and described subsequently (Vari, 1982b). The following key is for all species of *Curimatopsis* recognized in the two papers dealing with the genus (Vari, 1982a,b).

1. Scales in a longitudinal series from the supracleithrum to the lateral line 57 to 63; 12 or 13 pored lateral-line scales; approximately 25 scales in a transverse series extending posteriorly from origin of dorsal fin to midventral line (Amazon basin) . . . . . *C. microlepis*  
Scales in a longitudinal series from the supracleithrum to the lateral line 24 to 31; 3 to 5 pored lateral-line scales; 11 to 13 scales in a transverse series extending posteriorly from origin of dorsal fin to midventral line . . . . . 2
2. Lower jaw longer than upper and overlapping anterior portion of upper lip; dorsal profile of head nearly straight to tip of upper jaw, particularly in females; hypurals 1 and 2 separate; postorbital portion of head 0.45–0.53 of HL (Amazon and Orinoco basins) . . . . . *C. macrolepis*  
Lower jaw shorter than upper and not overlapping anterior portion of upper lip; dorsal profile of head convex; hypurals 1 and 2 fused; postorbital portion of head 0.39–0.44 of HL . . . . . 3
3. Patch of dark pigmentation on midlateral surface of caudal peduncle very intense, extending to anterior of vertical line through anterior of insertion of adipose fin, large proportion of patch located dorsal of midlateral line; relative greatest body depth 0.35–0.41 of SL (Río Paraguay basin) . . . . . *C. myersi*  
Patch of dark pigmentation on midlateral surface of caudal peduncle moderately intense to faint, typically extending anteriorly only about one-half distance from hypural joint to vertical line through anterior of insertion of adipose fin, if patch extends somewhat more anteriorly, then pigmentation is faint and centered below midlateral line (*evelynae*, see Vari, 1982a, figs. 19, 20); relative greatest body depth 0.27–0.35 of SL . . . . . 4
4. Posterior nostril rounded or slightly transversely elongate; distance between anterior and posterior nostrils of each side of head equal to or greater than diameter of anterior nostril; caudal peduncle unmarked or with a patch of faint chromatophores, if marking on the caudal peduncle obvious it is in form of horizontally elongate spot centered below midlateral line (Amazon and Orinoco basins) . . . . . *C. evelynae*  
Posterior nostril crescent-shaped; distance between anterior and posterior nostrils of each side of head less than diameter of anterior nostril; caudal peduncle with prominent spot centered along midlateral line (Amazon basin and coastal rivers of Guyana, Surinam, and French Guyana) . . . . . *C. crypticus*

REMARKS ON *Curimatopsis*

Vari (1989a:53–55) expanded the phylogenetic scheme for the species of *Curimatopsis* to include *C. myersi*. The redescription of *Curimatopsis microlepis* (Vari, 1982a) was based on two specimens, the holotype and a second specimen from the MNHN collections. Subsequent examination of large collections of curimatids from diverse portions of South

America have revealed several additional specimens of *C. microlepis* from the Amazon basin (Brazil, Amazonas, Rio Tefé, USNM 268035; Brazil, Amazonas, Rio Solimões, Lago near Beruri, USNM 268867; Brazil, Amazonas, Rio Negro, MZUSP 21053).

The original description of *Curimatopsis myersi* was based on a series of 40 specimens from a single locality in Paraguay. More recently examined collections have shown that the

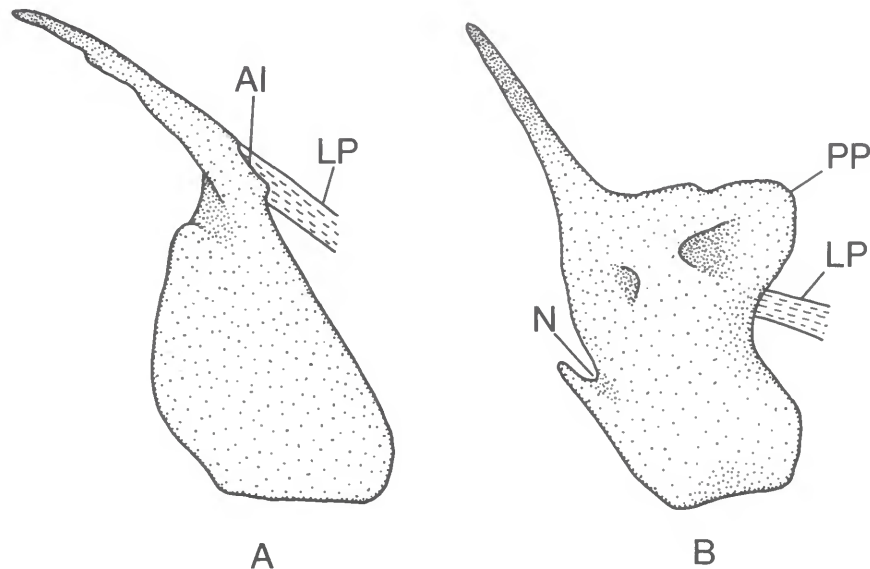


FIGURE 29.—Maxilla and anterodorsal portion of ligamentum primordiale: A, *Curimatopsis microlepis*, USNM 268867, 75.8 mm SL; and B, *Psectrogaster ciliata*, 94.8 mm SL, USNM 269990 (left side, lateral view, area of insertion of ligamentum primordiale on maxilla not obvious in lateral view in *P. ciliata*; AI = area of insertion of ligamentum primordiale, LP = ligamentum primordiale, N = notch of maxilla receiving lateral portion of premaxilla; PP = posterior process of maxilla).

distribution of the species extends notably farther north in the Rio Paraguay basin into the state of Mato Grosso, Brazil (Itiquira, Lagoas between Rios Piquiri and Itiquira, MZUSP 35915; Rio Itiquira at Itiquira, USNM 313074; Rio Itiquira 15 km W of Itiquira, USNM 313073; Município de Corumbá, Nhecolândia, Fazenda Nhumirim, MZUSP 36316, MZUSP 36317).

#### COMMENTS ON *Curimata vittata* KNER

Vari (1989c:29), in his revision of *Curimata*, noted that a single specimen of *C. vittata* Kner in the MNHN collections bore an indefinite locality of Río Orinoco and was evidently collected by Chaffanjon. The specimen was presumed to have originated in the Río Atabapo, a blackwater tributary of the Río Orinoco along the Venezuelan-Colombian border where Chaffanjon collected (see Collette, 1966:11, and references therein). No other specimens of *C. vittata* with definite locality information from the Río Orinoco basin were then available and the presence of the species in that system remained questionable. I have subsequently received two specimens of *C. vittata* from the Río Mavaca, an upper tributary of the Río Orinoco in the southeastern portion of Amazonas state, Venezuela. This material (USNM 304862) confirms the presence of the *C. vittata* in the upper Río Orinoco basin, although its occurrence farther downstream in the Río Atabapo region remains to be confirmed.

The remaining genera of the Curimatidae have been more

recently treated in a series of publications (*Potamorhina*, Vari, 1984; *Psectrogaster*, Vari, 1989c; *Pseudocurimata*, Vari, 1989d; *Steindachnerina*, Vari, 1991; *Cyphocharax*, Vari, in press; and *Curimatella*, this publication). Keys to the species in these genera, along with descriptions of the species and discussions of their distributions can be found in those papers.

#### Summary Comments on the Biogeography of the Curimatidae

Vari (1988) provided an overview of the historical biogeography of the Curimatidae based on the less-extensive phylogenetic data on the family and its components then available. One of the main hypotheses of that paper was that under an allopatric speciation model, the evolutionary history of the Curimatidae and its close relatives was replete with episodes of large-scale dispersal. Supporting this hypothesis was the high degree of sympatry of sister taxa at all phylogenetic levels examined to that time. Subsequent intrageneric phylogenetic studies (*Curimata*, Vari, 1989b; *Psectrogaster*, 1989c; *Steindachnerina*, 1991; and this study) have confirmed that secondary dispersal is very widespread in the components of those curimatid genera distributed to the east of the Andean Cordilleras. In addition to revealing a probable extinction of a *Steindachnerina* species within the Río Magdalena of Colombia (Vari, 1991:105–106), those revisionary and phylogenetic studies also highlighted repeated distribu-

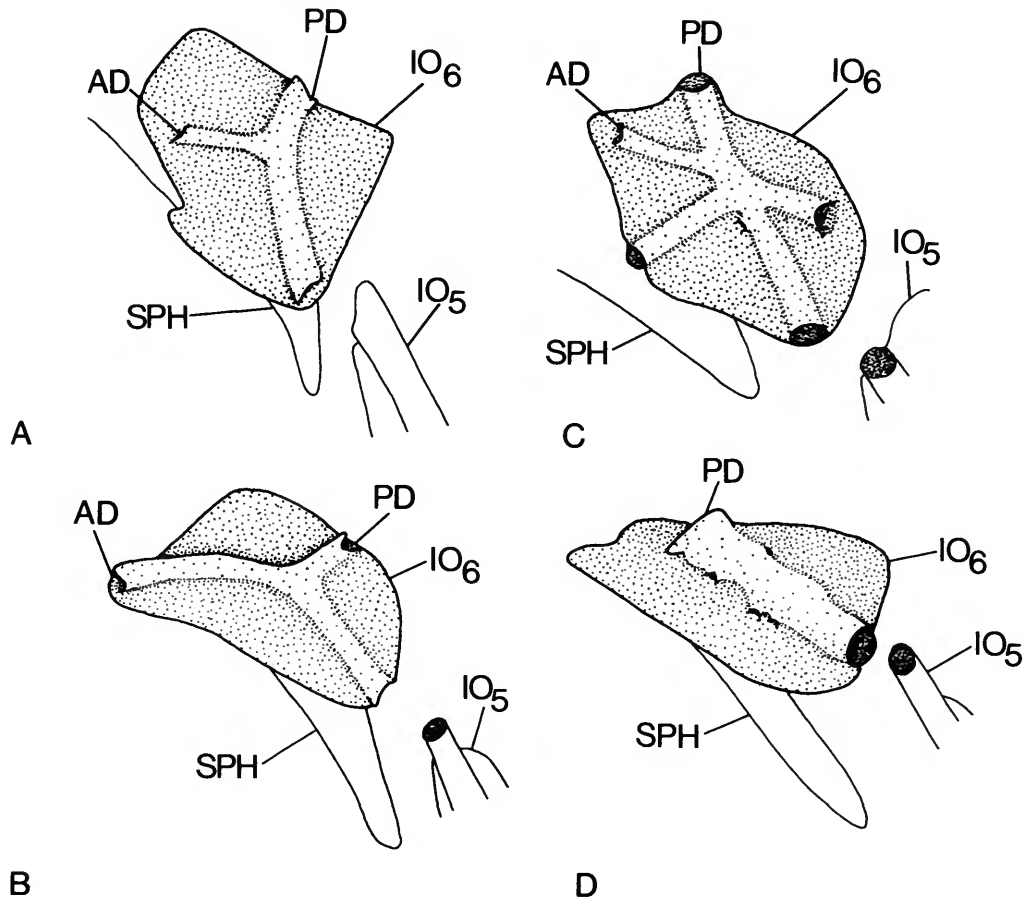


FIGURE 30.—Sixth infraorbital (dermosphenotic): A, *Psectrogaster amazonica*, USNM 261518, 106.0 mm SL; B, *Curimata cyprinoides*, USNM 267964, 125.0 mm SL; C, *Potamorhina altamazonica*, USNM 257367, 119.8 mm SL; and D, *Steindachnerina conspersa*, USNM 232224, 83.2 mm SL. (Left side, lateral view, anterior to left; AD = anterodorsal laterosensory canal segment of sixth infraorbital; IO = infraorbitals 5 and 6; PD = posterodorsal laterosensory canal segment of sixth infraorbital; SPH = sphenotic.)

tional patterns indicative of historical associations between regions of endemism (e.g., northeastern Brazil and the Amazon). The sister-group relationships across the Andes in various curimatid genera and its implications for hypotheses about the age of the Curimatidae and its components were discussed in detail by Vari (1988) and Vari and Weitzman (1990).

In a paper that appeared after Vari's revision of *Steindachnerina* (1991) was in press, Frailey et al. (1989) published a hypothesis on the age of the Amazon River basin. One intriguing aspect of their hypothesis was their proposal of a very large Amazonian lake extending from the downwarped western portions of the present Amazon basin as far east as Óbidos in the state of Pará, Brazil (see Frailey et al., 1989, fig. 8). Frailey et al. hypothesized that the lake, their Lago Amazonas, drained intermittently to the north through the Río Orinoco

valley; their hypothesis of such an extensive lake, if correct, correlates with various details of phylogeny and species distribution in the Curimatidae.

Sister-species relationships between species of the Orinoco and Amazon basins were discovered in *Curimata* (Vari, 1989b, fig. 42) and *Steindachnerina* (Vari, 1991, fig. 78). Comparable patterns have been previously reported for other fishes (e.g., the gymnotiform genus *Adontosternarchus*, Mago-Leccia et al., 1985:4). Paralleling the sister-species relationships between the basins were curimatid species with disjunct populations in the Amazon and Orinoco basins (e.g., *Curimatopsis macrolepis*, Vari, 1982a, fig. 12; *Potamorhina altamazonica*, Vari, 1984, fig. 11; *Steindachnerina bimaculata* (Vari, 1991, fig. 44)). The common occurrence of a number of curimatid species and lineages in the Amazon and Orinoco basins is expected if the Amazon had at some point a northern outlet through the

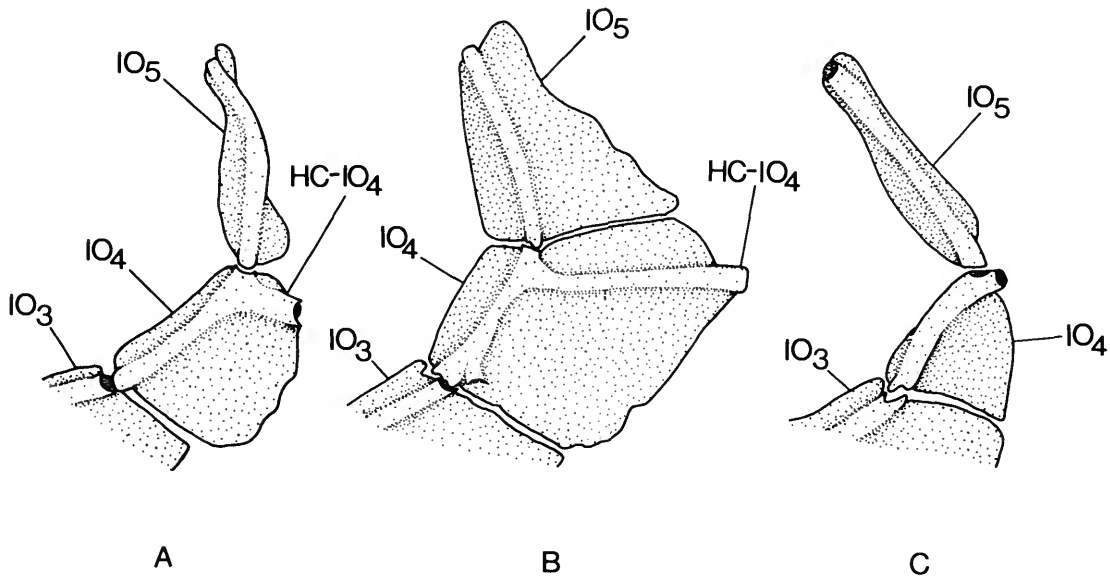


FIGURE 31.—Fourth and fifth infraorbitals and dorsal portion of third infraorbital: A, *Psectrogaster curviventris*, USNM 243221, 72.9 mm SL; B, *Potamorhina altamazonica*, USNM 257367, 119.8 mm SL; and C, *Curimatella meyeri*, USNM 261508, 100.1 mm SL. (Left side, lateral view, anterior to left; HC-IO4 = horizontal laterosensory canal segment of fourth infraorbital; IO = Infraorbitals 3 to 5.)

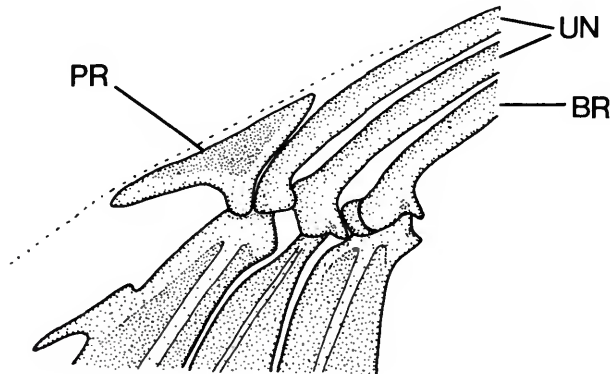


FIGURE 32.—*Cyphocharax abramoides*, USNM 267953, 99.3 mm SL; anteroventral portion of dorsal fin and proximate portions of basal pterygiophores showing procumbent spine. (Left side, lateral view, anterior to left, dotted line indicates dorsal surface of body; BR = branched dorsal-fin ray; PR = procumbent spine, UN = unbranched dorsal-fin rays).

Orinoco Valley as proposed by Frailey et al. (1989). With the shift of the Amazon system to its present mouth, the connection between the Amazon and Orinoco was reduced to the much smaller Rio Casiquiare. Interchange of ichthyofaunas between those two basins would have been limited not only by the reduction in the size of their interconnection and by the associated exposure of rapids in the upper courses of the Rio Negro and Rio Orinoco. Those factors may account for the

disjunct populations of the curimatid species common to the two basins (*Curimatopsis macrolepis*, *Potamorhina altamazonica*, *Steindachnerina bimaculata*). This decreased contact between the ichthyofaunas of the Amazon and Orinoco basin may be the vicariance event reflected in the sister-species relationships between species within *Curimata* and *Steindachnerina*.

Vari (1991a) noted that a synthesis of phylogenetic and

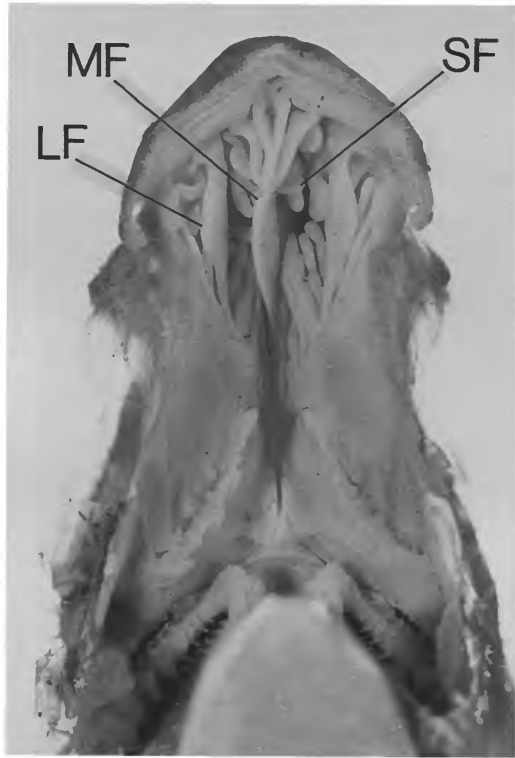


FIGURE 33.—Roof of buccopharyngeal chamber and anterior portion of dorsal section of gill arches of *Curimata cyprinoides*, USNM 267963, ventral view showing buccopharyngeal complex. (Hyoid apparatus, ventral portions of gill arches, eyes and associated tissues removed; abbreviations: LF = lateral fleshy fold of buccopharyngeal complex; MF = median fleshy fold of buccopharyngeal complex; SF = secondary fleshy folds of buccopharyngeal complex).

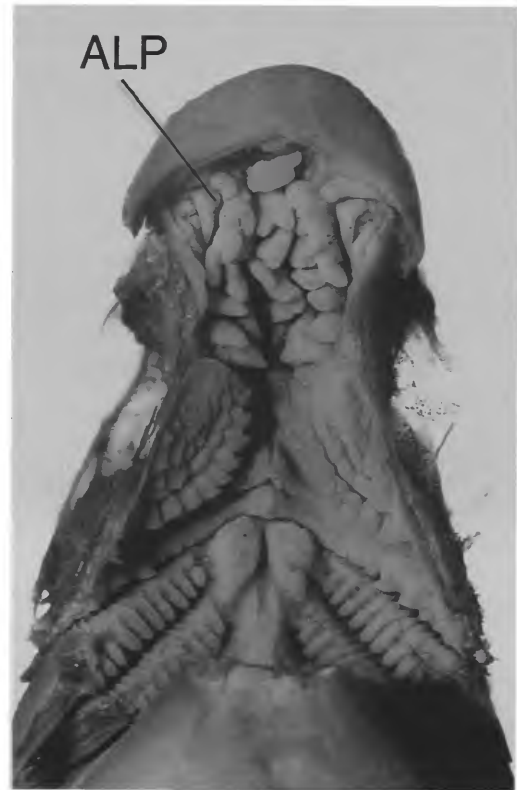


FIGURE 34.—Roof of buccopharyngeal chamber and anterior portion of dorsal section of gill arches of *Steindachnerina hypostoma*, USNM 261493, ventral view showing buccopharyngeal complex. (Hyoid apparatus, ventral portions of gill arches, eyes and associated tissues removed; ALP = anterior lobulate processes of buccopharyngeal complex).

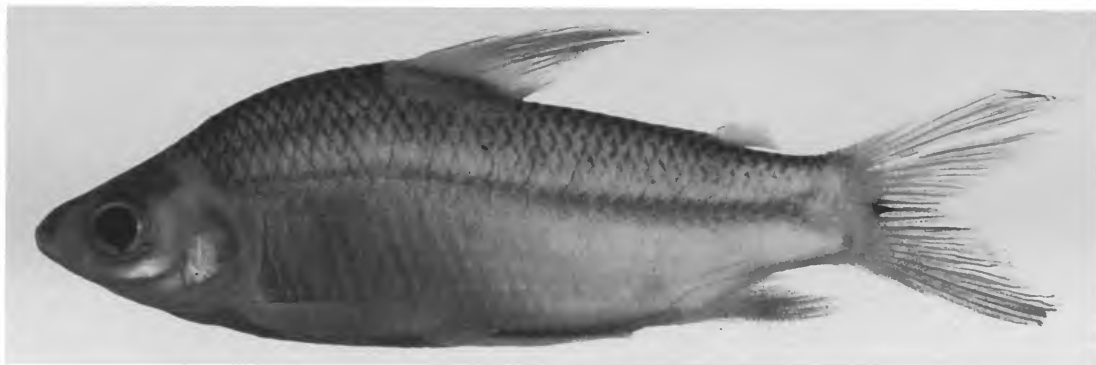


FIGURE 35.—*Steindachnerina conspersa*, USNM 229442, 62.7 mm SL; Paraguay, Presidente Hayes, 194 km N of Asunción on Trans-Chaco Highway; showing spot of dark pigmentation on basal portions of middle rays of caudal fin.

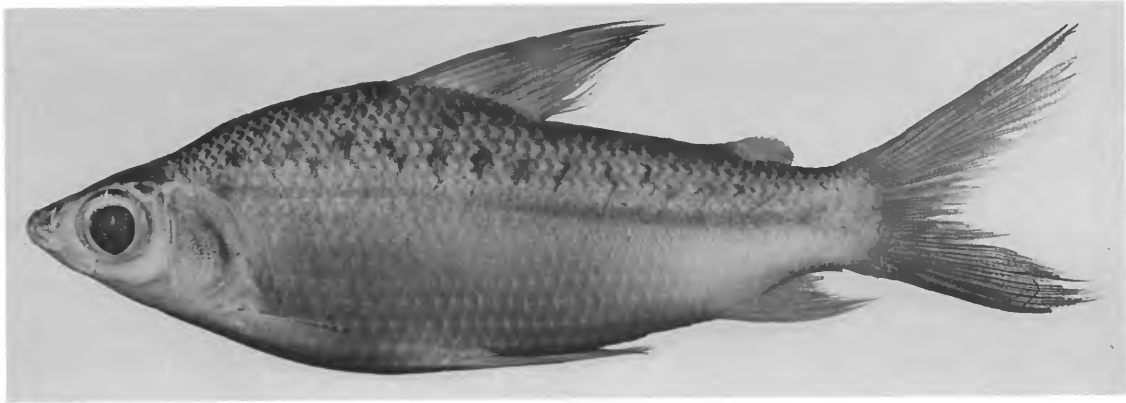


FIGURE 36.—*Steindachnerina bimaculata*, USNM 261450, 90.8 mm SL; Peru, Loreto, Río Amazonas, Santa Rosa, opposite Tabatinga, Brazil; showing spot of dark pigmentation on basal portions of middle rays of caudal fin and longitudinal series of spots on dorsolateral surface of body.

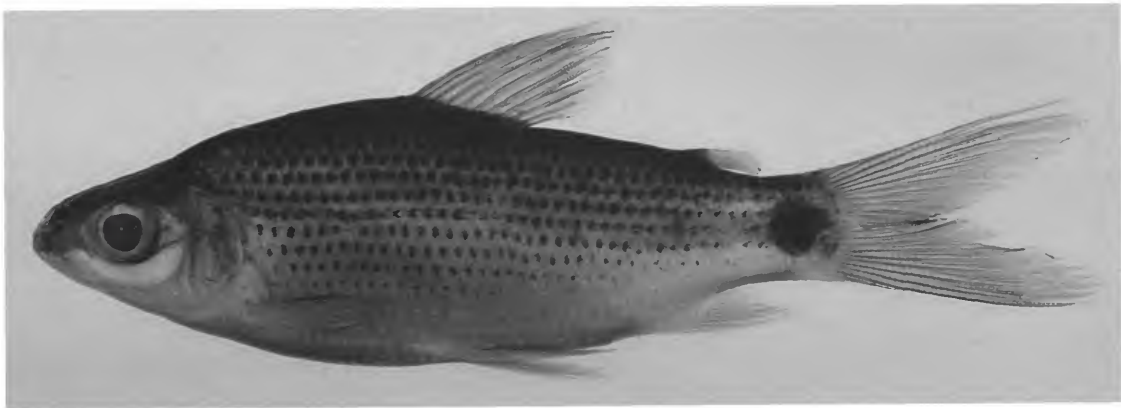


FIGURE 37.—*Pseudocurimata lineopunctata*, USNM 287744, 83.7 mm SL; Ecuador, Esmeraldas, Estero La Boveda, 4 km from Camerones (Atahualpa).

distributional data revealed an interesting pattern in the largest clade in *Steindachnerina*. Species of the basal portions of the lineage were distributed outside the Amazon basin or, if in that system, were peripheral to the central Amazon (Vari, 1991, fig. 79). Members of the terminal branches of the generic phylogeny, in contrast, occur largely in the central portions of the Amazon and the associated Río Tocantins (Vari, 1991, fig. 80). The Lago Amazonas basin hypothesis of Frailey et al. (1989) correlates with this distributional pattern in *Steindachnerina*. The limits of the proposed lake roughly match the distribution of the terminal taxa within the major clade of *Steindachnerina* (compare Frailey et al., 1989, fig. 8, with Vari, 1991, fig. 80). This match may reflect the speciation in that lineage within the rivers of the Amazon basin that developed

after the draining of Lago Amazonas.

The limitation of various species of fishes along the western portions of the Amazon basin previously commented upon by Géry (1964b, 1984), Vari (1988, 1991), and other authors may be associated with an extensive Lago Amazonas. Various species, such as *Steindachnerina guentheri*, occur along at least portions of the arch extending from Guyana along the foothills of the Andean cordilleras and associated uplands to Bolivia (Vari, 1991, fig. 60). The present drainage pattern in those areas are aligned roughly radial to that arch. That pattern makes it difficult to visualize how the species would have migrated along the arch to achieve their present distributions. Migrations of the species or their ancestors along the periphery of Lago Amazonas would be a possible explanation for these patterns.



## RESUMO

O gênero *Curimatella* Eigenmann & Eigenmann é proposto como uma unidade monofilética da família de caraciformes Curimatidae. *Curimatella* é definida pelo caráter apomórfico representado pela cobertura de pequenas escamas estendendo-se pelo menos sobre os dois-terços basais dos raios centrais de cada lobo da nadadeira caudal em exemplares adultos.

*Curimatella* é redefinida, e três gêneros (*Apolinarella*, *Walbaunina*, e *Lepipinna*) descritos por Fernández-Yépez (1948) são sinonimizados com *Curimatella*. Cinco espécies de *Curimatella* são reconhecidas: *C. alburna* (Müller & Troschel, 1844), com ampla distribuição na bacia Amazônica e talvez também presente na bacia do alto Rupununi; *C. dorsalis* (Eigenmann & Eigenmann, 1889b), distribuída pelo Río Orinoco, Rio Amazonas e partes da bacia do Río de La Plata; *C. immaculata* (Fernández-Yépez, 1948), com ampla distribuição no Río Orinoco e Rio Amazonas; *C. lepidura* (Eigenmann & Eigenmann, 1889a), endêmica do Río São Francisco; e *C. meyeri* (Steindachner, 1882) ocorrendo nas porções central e ocidental da bacia do Amazonas. Uma chave para as espécies de *Curimatella* é fornecida.

Sete espécies ou subespécies são colocadas em sinonímia. *Curimatella alburna australe* Eigenmann & Kennedy (1903), baseada em exemplares de Asunción, Paraguay, *Curimatus elegans paraguayensis* Eigenmann & Kennedy (1903), com localidade-tipo no Río Paraguay, Paraguai, *Curimatus (Curimatella) alburnus* var. *caudimaculata* Pellegrin (1909) descrita com base em exemplares coletados na Amazônia central, e *Curimatus bolivarensis* Steindachner (1910) com série tipo originária do baixo Río Orinoco são consideradas sinônimos de *Curimatella dorsalis*. *Curimatella meyeri* tem dois sinônimos, *Curimatus serpae* Eigenmann & Eigenmann (1889a) descrita com base em exemplares coletados em Serpa (= Itacoatiara) ao longo do Rio Amazonas, e *Curimata reticulata* Allen (in Eigenmann & Allen) (1942) com base em exemplares coletados na bacia do Río Ucayali no Peru. *Curimatus alburnus lineatus* Eigenmann & Eigenmann (1889b) com base em um exemplar da bacia Amazônica ocidental é sinônimo de *Curimatella alburna*.

Lectótipos são designados para *Curimatus lepidurus* Eigenmann & Eigenmann, *Curimatus (Curimatella) alburnus* var. *caudimaculata* Pellegrin, *Curimatus bolivarensis* Steindachner, e *Anodus alburnus* Müller & Troschel.

Uma chave é fornecida para os gêneros de Curimatidae e uma chave expandida é fornecida para o gênero *Curimatopsis* Steindachner. Extensões de distribuição são apresentadas para *C. microlepis* Eigenmann & Eigenmann e *C. myersi* Vari, e a presença de *Curimata vittata* Kner no Río Orinoco é confirmada.

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