

Systematics of the
Neotropical Characiform Genus
Cyphocharax Fowler
(Pisces: Ostariophysi)

RICHARD P. VARI

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A B S T R A C T

Vari, Richard P., Systematics of the Neotropical Characiform Genus *Cyphocharax* Fowler (Pisces: Ostariophysi). *Smithsonian Contributions to Zoology*, number 529, 137 pages, 93 figures, 15 tables, 1992.—The curimatid characiform genus *Cyphocharax* Fowler (1906) is revised. *Cyphocharax* has three synonyms: *Xyrocharax* Fowler (1913), *Hemicurimata* Myers (1929), and *Curimatoides* Fowler (1940a). Thirty-three species are recognized in *Cyphocharax*: *C. abramoides* (Kner, 1859a) of the northern Amazon and southern Orinoco basins; *C. aspilos*, new species, a Lago Maracaibo basin endemic; *C. festivus*, new species, of the Amazon basin, Guyana, and eastern Venezuela; *C. gangamon*, new species, of the Rio Tapajós; *C. gilberti* (Quoy and Gaimard, 1824) of coastal Brazil from Rio de Janeiro to Bahia; *C. gillii* (Eigenmann and Kennedy, 1903) of the Río de La Plata; *C. gouldingi*, new species, of Amapá, the Rio Capim, Rio Tocantins, and Rio Xingu; *C. helleri* (Steindachner, 1910) of eastern Venezuela, the Guianas, and Amapá, Brazil; *C. leucostictus* (Eigenmann and Eigenmann, 1889) of the Amazon and Amapá, Brazil; *C. magdalenae* (Steindachner, 1879a) ranging from Costa Rica to Colombia; *C. meniscaprorus*, new species, of the Río Orinoco; *C. mestomyllon*, new species, of the Rio Negro in Brazil; *C. microcephalus* (Eigenmann and Eigenmann, 1889) of Surinam and Guyana; *C. modestus* (Fernández-Yépez, 1948) of the upper Rio Paraná; *C. multilineatus* (Myers, 1927) of the central Amazon; *C. nagelii* (Steindachner, 1882) endemic to the upper Rio Paraná; *C. nigripinnis*, new species, from the central Amazon; *C. notatus* (Steindachner, 1908) widely distributed in the Amazon; *C. oenas*, new species, of the Río Orinoco; *C. pantostictus* Vari and Barriga (1990) of the western Amazon; *C. platanus* (Günther, 1880) of most of the Río de La Plata basin; *C. plumbeus* (Eigenmann and Eigenmann, 1889) widely distributed in the Amazon; *C. punctatus* (Vari and Nijssen, 1986) of the Marowijne River; *C. saladensis* (Meinken, 1933) of southeastern Brazil and part of the Río de La Plata basin; *C. santacatarinae* (Fernández-Yépez, 1948) of the coastal rivers of Santa Catarina, Paraná, and São Paulo, Brazil; *C. signatus*, new species, of the Río Araguaia; *C. spilolus* (Vari, 1987) of the Río de La Plata basin; *C. spiluropsis* (Eigenmann and Eigenmann, 1889) of the central and western Amazon; *C. spilurus* (Günther, 1864) of southeastern Venezuela, the Guianas, the upper Rio Branco in Brazil, and perhaps the Río Orinoco; *C. stilbolepis*, new species, of the Río Xingu and Rio Tocantins; *C. vanderi* (Britski, 1980) of the upper Rio Paraná; *C. vexillapinnus*, new species, of the central and western Amazon; and *C. voga* (Hensel, 1869) of Uruguay, southeastern Brazil and portions of the Río de La Plata basin. Keys to the species of *Cyphocharax* are provided.

Fourteen species and subspecies are synonymized. *Pseudocurimata steindachneri* Fernández-Yépez (1948) described from the Río Magdalena is a synonym of *Cyphocharax magdalenae*. *Curimatus albula* Lütken (1874) from the Río São Francisco, and *Pseudocurimata grandocule* Fernández-Yépez (1948) from Espírito Santo, Brazil, are considered synonyms of *Cyphocharax gilberti*. *Curimata gnaca* Azpelicueta and Braga (1988) from Resistencia, Argentina is tentatively synonymized into *Cyphocharax spilolus*. *Curimatus Vandeli* Puyo (1943) from French Guiana and *Curimatus (Hemicurimata) esperanzae pijperzi* Géry (1965) of Surinam are synonyms of *Cyphocharax helleri*. *Curimatopsis maculatus* Ahl (1934) described from Argentina is a juvenile *Cyphocharax voga*. *Curimatus hermanni* Ahl (1931) described from the Rio Capim is a synonym of *Cyphocharax notatus*. *Curimatus (Curimatella) xinguensis* Steindachner (1908), based on a specimen from the Rio Xingu, is a synonym of *Cyphocharax leucostictus*. *Curimatella rehni* Fowler (1932) from the Mato Grosso is synonymized in *Cyphocharax gillii*. *Curimatus surinamensis* Steindachner (1910) from Surinam is a synonym of *Cyphocharax spilurus*. *Curimatus stigmaturus* Fowler (1913) from the Río Maranhão, *Curimatoides ucayalensis* Fowler (1940a) from the Río Ucayali, and *Curimata esperanzae* Myers (1929) based on juveniles that originated in the Rio Madeira basin are all synonyms of *Cyphocharax spiluropsis*.

Lectotypes are designated for *Curimatus albula* Lütken, *Curimatus (Hemicurimata) esperanzae* Myers, *Curimatus leucostictus* Eigenmann and Eigenmann, *Curimatus Magdalenae* Steindachner, *Curimatus microcephalus* Eigenmann and Eigenmann, *Curimatus platanus* (Günther), *Curimatus plumbeus* Eigenmann and Eigenmann, *Curimatus spiluropsis* Eigenmann and Eigenmann, *Curimatus spilurus* Günther, and *Curimatus voga* Hensel.

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Systematics of the Neotropical Characiform Genus *Cyphocharax* Fowler (Pisces: Ostariophysi)

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Introduction

The genus *Cyphocharax* Fowler (1906) is exceptional in the characiform family Curimatidae both for its speciose nature and broad geographic distribution. Although *Cyphocharax* is one of eight genera in the Curimatidae (Vari, 1989a), it includes thirty-three or slightly over one-third of the 95 species recognized in the family. Not surprisingly *Cyphocharax* has the greatest North to South range of any genus in the family and largely overlaps the distributions of all other curimatid genera east of the Andean Cordilleras. The single *Cyphocharax* species (*magdalenae*) that occurs west of the Andean cordilleras has a wide distribution through the precipitous coastal rivers of the Pacific versant of Central America in southern Costa Rica (Bussing, 1967:221) and Panama; an area otherwise uninhabited by curimatids. Several *Cyphocharax* species occur in the majority of the Caribbean versant drainages west and north of the Andean Cordilleras. The genus is, however, absent in the rivers of the Pacific versants of Colombia, Ecuador, and northern Peru inhabited by species of the curimatid genera *Pseudocurimata* Fernández-Yépez (Vari, 1989d) and *Steindachnerina* Fowler (Vari, 1991).

Cyphocharax is most speciose east of the Andean Cordilleras where it inhabits most of the myriad river systems that drain the Atlantic slopes of South America from the Río Orinoco south to the small coastal drainages in central Argentina. Within that broad expanse some *Cyphocharax* species have ranges extending across vast reaches of the Amazon basin

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whereas others are known from a single, relatively small river system, or only one locality. One notable gap in the range of *Cyphocharax* on the Atlantic slopes of the continent is the absence of the genus in eastern Brazil between the Rio Capim basin of northeastern Pará to somewhere south of the mouth of the Rio São Francisco.

Members of *Cyphocharax* do not occur in the precipitous, colder waters of the higher slopes of the Andean Cordilleras; a situation typical of all curimatids. The genus is otherwise ubiquitous in freshwater ecosystems ranging from still backwaters and oxbow lakes, through slow flowing, often meandering floodplain rivers, to the swifter rivers and associated rapids of the Guayana and Brazilian Shields and Andean piedmont. Some *Cyphocharax* species are evidently limited to black, clear, or white waters, whereas others have cosmopolitan distributions in all water types.

Species of *Cyphocharax* were among the first curimatids described by European scientists; a not unexpected situation given the broad distribution and large populations of many members of the genus. The description of species of *Cyphocharax* commenced with Quoy and Gaimard's 1824 account of *Curimata Gilbert* (= *Cyphocharax gilbert*) and proceeded episodically during the following seventeen decades. During that period nominal species of *Cyphocharax* have been assigned to diverse genera and repeatedly cited in biogeographic studies (e.g., Ringuelet, 1975), fisheries publications (e.g., Rodríguez, 1973), and faunal checklists (e.g., Britski et al., 1984). Even cursory examination of that literature reveals inconsistencies as to the recognized species and disagreements on the distinguishing features and ranges of the accepted species. Such problems are not idiosyncratic to *Cyphocharax*, but rather ubiquitous for the freshwater ichthyofauna of Central and South America (Böhlke et al., 1978).

The evaluation of the validity, or lack thereof, of the nominal species assigned by Vari (1989a) to *Cyphocharax* was

previously made difficult, if not impossible, by various factors. Most noteworthy are the relatively subtle differences in meristics, morphometrics, and pigmentation between many species. The problems engendered by that situation were exacerbated by the brief or uninformative original descriptions of many nominal species, and limited access of most researchers to vital comparative materials, particularly critical type series. Those difficulties and the restriction of most studies of South American freshwater fishes along political boundaries or other subcontinental regions resulted in confusion as to which nominal species of *Cyphocharax* should be recognized and how they might be distinguished.

Fernández-Yépez (1948) was the last author to treat most of the species united by Vari (1989a) in *Cyphocharax*. Fernández-Yépez (1948:45, 72) suggested that *Cyphocharax* (misspelled as *Ciphocharax*) was unidentifiable, but nonetheless simultaneously listed it as a senior, albeit unutilized, synonym of *Pseudocurimata*, first proposed in the same paper. Under Fernández-Yépez' classification the species of *Cyphocharax* of the present paper were assigned to 11 genera (*Allenina* Fernández-Yépez, *Apolinarella* Fernández-Yépez, *Bondia*, Fernández-Yépez, *Curimatella* Eigenmann and Eigenmann, *Curimatoides* Fowler, *Curimatopsis* Steindachner, *Curimatorbis* Fernández-Yépez, *Hemicurimata* Myers, *Pseudocurimata* Fernández-Yépez, *Rivasella* Fernández-Yépez, and *Semítapicis* Eigenmann and Eigenmann). Lack of material prevented Fernández-Yépez from including three nominal species (*Curimatus helleri* Steindachner, *Curimatus notatus* Steindachner, and *Curimatus surinamensis* Steindachner) in his classification. Those Steindachner species were assigned by Vari (1989a) to *Cyphocharax*.

To a degree the inconsistencies between the classifications of Fernández-Yépez (1948) and Vari (1989a) reflect the differing underlying methodologies of those authors. Fernández-Yépez (1948) recognized genera and suprageneric taxa, explicitly or by default, on degrees of similarity or difference. That system does not critically examine the correlation, or lack thereof, between recognized supraspecific taxa and hypothesized evolutionary lineages. Phylogenetic systematics, the methodology used in Vari (1989a), in contrast, requires that taxa reflect the hypothesized evolutionary history of the included species. Note, however, that the common application of that criterion in phylogenetic studies of fishes postdates Fernández-Yépez's effort by two decades.

This paper continues a series dealing with the phylogeny, taxonomy, distribution, and historical biogeography of curimatid characiforms (Vari, 1982a, 1982b, 1983, 1984a, 1984b, 1987, 1988, 1989a, 1989b, 1989c, 1989d, 1991, 1992; Vari and Barriga, 1990; Vari and Castro, 1988; Vari and Géry, 1985; Vari and Nijssen, 1987; Vari and Vari, 1989; and Vari and Weitzman, 1990). This paper focuses on two major questions. First, what are the recognizable species of *Cyphocharax* and their distinguishing features? Second, what are the known distributions of those species? The third central theme in many

of the just cited papers involved phylogenetic relationships of and within the Curimatidae. Little information relative to the resolution of that question for *Cyphocharax* was discovered in this study (see "Phylogenetic Comments").

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	British Museum (Natural History), London, now the Natural History Museum, London
CAS	California Academy of Sciences, San Francisco
CIMLP	Colección Ictológico del Museo de La Plata, La Plata
CM	Carnegie Museum, Pittsburgh (fish collections now largely at FMNH)
FMNH	Field Museum of Natural History, Chicago
FONAIAP-AMZ	Estacion Experimental Amazonas, Puerto Ayacucho, Venezuela
GC	Personal collection of Jacques Géry (now at MHNG)
INPA	Instituto Nacional de Pesquisas da Amazônia, Manaus
IU	Former Indiana University collections (now dispersed to various repositories)
LACM	Los Angeles County Museum of Natural History
MAC	Ministerio de Agricultura y Cría, Caracas (fish collections now at MBUCV)
MBUCV	Museo de Biología, Universidad Central de Venezuela, Caracas
MCP	Museu de Ciências da Pontificia Universidade Católica do Rio Grande do Sul, Porto Alegre
MCZ	Museum of Comparative Zoology, Cambridge
MEPN	Museo de Biología de la Escuela Politécnica Nacional, Quito
MHNG	Muséum d'Histoire Naturelle, Geneva
MNHN	Muséum National d'Histoire Naturelle, Paris
MNRJ	Museu Nacional, Rio de Janeiro
MUSM	Museo de Historia Natural de la Universidad Nacional Mayor 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
RMNH	Rijksmuseum van Natuurlijke Historie, Leiden
ROM	Royal Ontario Museum, Toronto
SU	Stanford University (fish collections now at CAS)
UFPB	Universidade Federal de Paraíba, João Pessoa, Brazil
UMMZ	University of Michigan, Museum of Zoology, Ann Arbor
USNM	Former United States National Museum, collections in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.
USP-RP	Universidade de São Paulo, Ribeirão Preto, Brazil
ZMA	Instituut voor Taxonomische Zoölogie, Zoölogisch Museum, Amsterdam
ZMUC	Københavns Universitet, Zoologisk Museum, Copenhagen
ZUEC	Zoologia, Universidade Estadual de Campinas, Campinas, Brazil
ZMB	Zoologisches Museum, Humboldt-Universität, Berlin

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METHODS AND MATERIALS.—Measurements were made with dial calipers and data recorded to tenths of a millimeter. Counts and measurements were made on the left side of specimens whenever possible. Counts of total vertebrae were usually taken from radiographs with supplementary information derived from cleared and stained specimens. In vertebral counts the fused PU_1+U_1 is considered a single bone, and the vertebrae incorporated into the Weberian apparatus are counted as four elements. Numbers in parentheses following a particular vertebral count are the numbers of radiographed and cleared and stained specimens with that count.

In species descriptions, 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). In counts of median- and pelvic-fin rays, the unbranched fin rays are indicated by lower case roman numerals, and the branched fin rays as arabic numerals. The observed range in the values of each count and proportional measurement is presented first, followed by the value of the holotype or lectotype for a particular count or measurement, when available, in square brackets. When recognized species of *Cyphocharax* have junior synonyms, available morphometric and meristic data are presented in tabular form for holotypes and lectotypes of all the nominal species herein considered conspecific.

The "Material Examined" section of each species account is arranged in the following sequence: number of specimens of the species examined (in parentheses), the number of specimens forming the basis for meristic and morphometric data, and the range of standard lengths (in mm) for these specimens), collection locality of specimens, institutional abbreviation, catalog number, number of specimens in the lot (in parentheses), the number of specimens in the lot from which counts and measurements were taken if less than the total number of specimens, and the standard lengths (in mm) of those individuals). Geographic descriptors are in the sequence of

country (capitalized), the state, province, department, or district (italicized), followed by specific locality data. Information on collectors and date of collection of specimens is presented only for type series of species described as new in this paper. Modern, corrected, and more detailed locality information for specimens collected during the Thayer Expedition to Brazil follows Higuchi (ms).

The common names are those reported in the literature or by researchers. Such terminology is not standardized. In the synonymies for each species, localities are presented as originally cited, followed by modern or corrected equivalents, in parentheses, if that differs. Generic genders follow Eschmeyer (1990).

Osteological preparations were cleared and counterstained for cartilage and bone using a modification of the method outlined by Taylor and Van Dyke (1985). Previously cleared specimens stained solely with alizarin Red-S were supplemental sources of osteological data. Osteological terminology follows Vari (1989a). The cleared and stained specimens of *Cyphocharax* that are the basis for osteological text illustrations and/or specific observations noted in the text are cited in the "Material Examined" section of each species account. The observations on osteological characters in outgroups to *Cyphocharax*, both in the Curimatidae and other taxa in the Characiformes, are based on specimens cited in Vari (1989a:10–11).

Genus *Cyphocharax* Fowler

TABLE 1

Cyphocharax Fowler, 1906:297 [type species: *Curimatus spilurus* Günther, 1864, by original designation; proposed as a subgenus of *Curimata*; gender masculine].—Fowler, 1913:673 [specimens that were basis for description of subgenus identified as *Curimatus stigmaturus* Fowler, 1913, not *C. spilurus*].—Fernández-Yépez, 1948:72 [subgenus cited as unidentifiable, listed as a synonym of *Pseudocurimata* Fernández-Yépez, 1948; misspelled as *Ciphocharax*].—Vari, 1989a, tables 2, 3 [recognized as a genus].

Xyrocharax Fowler, 1913:673 [type species: *Curimatus stigmaturus* Fowler, 1913, by original designation; proposed as a subgenus of *Curimatus*; gender masculine].—Fernández-Yépez, 1948:72 [cited as unidentifiable; misspelled as *Xirocharax*].—Vari, 1989a, tables 2, 3 [placed as a synonym of *Cyphocharax*].

Hemicurimata Myers, 1929:620 [type species: *Curimata esperanzae* Myers, 1929, by original designation; proposed as a subgenus of *Curimata*; gender feminine].—Fernández-Yépez, 1948:70 [recognized as a genus].—Vari, 1989a, tables 2, 3 [placed as a synonym of *Cyphocharax*].

Curimatoides Fowler, 1940a:255 [type species: *Curimatoides ucayalensis* Fowler, 1940a, by original designation; gender masculine].—Vari, 1989a, tables 2, 3 [placed as a synonym of *Cyphocharax*].

DIAGNOSIS.—Earlier I noted that I was unable to discover any derived characters congruent with a hypothesis that the species of *Cyphocharax* constituted a monophyletic lineage (Vari, 1989a:58). I instead defined *Cyphocharax* to include those species with the derived features synapomorphic for the clade consisting of *Cyphocharax*, *Curimatella* Eigenmann and Eigenmann, *Steindachnerina* Fowler, and *Pseudocurimata*

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

Nominal species	<i>Cyphocharax</i>
<i>Curimatus abramoides</i> Kner 1859a	<i>abramoides</i>
<i>Curimatus albula</i> Lütken, 1874	<i>gilberti</i>
<i>Cyphocharax aspilos</i> , new species	<i>aspilos</i>
<i>Curimata (Hemicurimata) esperanzae</i> Myers, 1929	<i>spiluroopsis</i>
<i>Cyphocharax festivus</i> , new species	<i>festivus</i>
<i>Cyphocharax gangamon</i> , new species	<i>gangamon</i>
<i>Curimata Gilbert</i> Quoy and Gaimard, 1824	<i>gilberti</i>
<i>Curimatus gillii</i> Eigenmann and Kennedy, 1903	<i>gillii</i>
<i>Curimata gnaca</i> Azpelicueta and Braga, 1988	<i>spilotus</i>
<i>Cyphocharax gouldingi</i> , new species	<i>gouldingi</i>
<i>Pseudocurimata grandocule</i> Fernández-Yépez, 1948	<i>gilberti</i>
<i>Curimatus helleri</i> Steindachner, 1910	<i>helleri</i>
<i>Curimatus hermanni</i> Ahl, 1931	<i>notatus</i>
<i>Curimatus leucostictus</i> Eigenmann and Eigenmann, 1889	<i>leucostictus</i>
<i>Curimatopsis maculatus</i> Ahl, 1934	<i>voga</i>
<i>Curimatus Magdaleneae</i> Steindachner, 1879a	<i>magdaleneae</i>
<i>Cyphocharax meniscaprorus</i> , new species	<i>meniscaprorus</i>
<i>Cyphocharax mestomylon</i> , new species	<i>mestomylon</i>
<i>Curimatus microcephalus</i> Eigenmann and Eigenmann, 1889	<i>microcephalus</i>
<i>Curimatorbis modestus</i> Fernández-Yépez, 1948	<i>modestus</i>
<i>Curimatus multilineatus</i> Myers, 1927	<i>multilineatus</i>
<i>Curimatus Nagelii</i> Steindachner, 1881	<i>nagelii</i>
<i>Cyphocharax nigripinnis</i> , new species	<i>nigripinnis</i>
<i>Curimatus notatus</i> Steindachner, 1908	<i>notatus</i>
<i>Cyphocharax oenas</i> , new species	<i>oenas</i>
<i>Cyphocharax pantostictos</i> Vari and Barriga, 1990	<i>pantostictos</i>
<i>Curimatus platanus</i> Günther, 1880	<i>platanus</i>
<i>Curimatus plumbeus</i> Eigenmann and Eigenmann, 1889	<i>plumbeus</i>
<i>Curimata (Hemicurimata) esperanzae pijperzi</i> Géry, 1965	<i>helleri</i>
<i>Curimata punctata</i> Vari and Nijssen, 1986	<i>punctatus</i>
<i>Curimatella rehni</i> Fowler, 1932	<i>gillii</i>
<i>Curimatopsis saladensis</i> Meinken, 1933	<i>saladensis</i>
<i>Pseudocurimata santacatarinae</i> Fernández-Yépez, 1948	<i>santacatarinae</i>
<i>Cyphocharax signatus</i> , new species	<i>signatus</i>
<i>Curimata spilota</i> Vari, 1987	<i>spilotus</i>
<i>Curimatus spiluroopsis</i> Eigenmann and Eigenmann, 1889	<i>spiluroopsis</i>
<i>Curimatus spilurus</i> Günther, 1864	<i>spilurus</i>
<i>Pseudocurimata steindachneri</i> Fernández-Yépez, 1948	<i>magdaleneae</i>
<i>Curimatus (Xyrocharax) stigmaturus</i> Fowler, 1913	<i>spiluroopsis</i>
<i>Cyphocharax stilbolepis</i> , new species	<i>stilbolepis</i>
<i>Curimatus surinamensis</i> Steindachner, 1910	<i>spilurus</i>
<i>Curimatoides ucayalensis</i> Fowler, 1940a	<i>spiluroopsis</i>
<i>Curimatus Vandeli</i> Puyo, 1943	<i>helleri</i>
<i>Curimata vanderi</i> Britski, 1980	<i>vanderi</i>
<i>Cyphocharax vexillapinnus</i> , new species	<i>vexillapinnus</i>
<i>Curimatus voga</i> Hensel, 1869	<i>voga</i>
<i>Curimatus (Curimatella) zinguensis</i> Steindachner, 1908	<i>leucostictus</i>

NOTES: *Curimatus Alberti* cited by Günther (1880) and Eigenmann and Eigenmann (1889) is evidently a lapsus for *Curimatus gilberti* (see discussion in "Remarks" under *Cyphocharax gilberti*). The reference to *Curimatus hasemani* by Fernández-Yépez (1948) is presumed to be an erroneous citation of *Curimatus hermanni* Ahl (see discussion in "Remarks" under *Cyphocharax notatus*).

Fernández-Yépez (Synapomorphies 93 to 96 (Vari, 1989a:57),) but which lacked the shared derived features unique to each of the other genera (*Curimatella*, *Steindachnerina*, *Pseudocurimata*). As a consequence I commented (1989a:58) that such a definition of *Cyphocharax* “leaves open the possibility that some components of *Cyphocharax* may be more closely related to one or more of the other genera [*Curimatella*, *Steindachnerina*, and *Pseudocurimata*] in the multitomy, than to the remaining species of *Cyphocharax*.” The anatomical studies reported herein were similarly unproductive in revealing any derived character unique to *Cyphocharax*. *Cyphocharax* thus remains diagnosed by the possession in common with *Steindachnerina*, *Curimatella*, and *Pseudocurimata*, of four synapomorphies involving the fourth ceratobranchial, basihyal tooth plate, and various components of the infraorbital series (Vari, 1989a:57), and by the lack of the synapomorphies unique to *Steindachnerina* (Vari, 1989a:58, 1991:23–24), *Curimatella* (Vari, 1989a:58), and *Pseudocurimata* (Vari, 1989a:58, 1989b:8).

Maximum known standard lengths of species of *Cyphocharax* 33.5 to 212.8 mm. Branched dorsal-fin rays 8 to 12 (9 most common; 8 very rare; only one species with range of 10 to 12 rays; 10 very rare and 11 and 12 unknown in other members of genus); branched anal-fin rays 6 to 8 (7 most common); pectoral-fin rays 10 to 17 (13 to 15 most common; 10 to 12 in only one species); pelvic-fin rays usually i,8, sometimes i,7 or i,9; adipose fin rarely absent, moderately developed. Scales in longitudinal series from supracleithrum to hypural joint range from 27 to 97 with 39 or more scales present in only a few species; sensory canals in lateral-line scales straight; lateral-line scale series completely pored in most species, some with pores only anteriorly. Number of scales in transverse series from origin of dorsal fin to lateral line $4\frac{1}{2}$ to 30, 10 or more in only a few species; number of scales in transverse series from origin of anal fin to lateral line $3\frac{1}{2}$ to 25, 8 or more in only a few species. Total vertebrae 28 to 37. Roof of mouth with three simple, longitudinal, fleshy flaps lacking secondary flaps or lobulate processes.

DISTRIBUTION.—As noted in the “Introduction,” *Cyphocharax* has a broad distribution from southern Costa Rica to central Argentina; the greatest North to South range in the Curimatidae. Specimens of *Cyphocharax* are unknown from portions of the southern tributaries of the mainstream Rio Amazonas. Those gaps are probably artifacts of the poor collections of fishes available from many of those river systems rather than indicative of the actual absence of the genus. *Cyphocharax* is also unknown in four other regions of South America occupied by other curimatid genera. The available samples from those areas, though not exhaustive, indicate that the lack of *Cyphocharax* specimens from those regions is probably not a collecting artifact.

Cyphocharax is unknown in the Pacific versant rivers of Colombia, Ecuador, and northern Peru inhabited by species of the genera *Steindachnerina* (Vari, 1991) and *Pseudocurimata*

(Vari, 1989b). Species of *Cyphocharax* are unknown from the series of rivers in northeastern Brazil between the Rio Capim in northeastern Pará south to beyond the mouth of the Rio São Francisco, and from the lower reaches of the latter river. Although samples of the ichthyofauna from that region are less than satisfactory, they do include curimatids of the genera *Curimata* (Vari, 1989c:44–46, fig. 34), *Psectrogaster* (Vari, 1989d:35–37, fig. 27), and *Steindachnerina* (Vari, 1991:89–92, fig. 60). The lack of *Cyphocharax* species from that region thus probably represents the absence of the genus. Although *Cyphocharax gilbert* occurs in the central and upper sections of the Rio São Francisco system, no population samples of that species, or any congener are known from the lower portions of the river basin. *Cyphocharax* species are also unknown in the small rivers on the Caribbean versant of northern Venezuela and of the western portions of the island of Trinidad, inhabited by the curimatid *Steindachnerina argentea* (Vari, 1991, fig. 20).

Finally, it is noteworthy that neither *Cyphocharax* nor any other curimatid genus is known from the Rio Iguazu above Iguazu Falls in southeastern Brazil. That tributary of the Rio Paraná is surrounded by a series of river basins inhabited by a variety of curimatid species of several genera. The depauperate fish fauna of the upper Rio Iguazu basin was first commented on by Haseman (1911a, b). Various other major groups of characiforms widespread through South America (e.g., Prochilodontidae (Castro, 1990), and Hemiodontidae and Erythrinidae (Sampaio, 1988)) are also absent in the system.

REMARKS.—Vari (1989a, tables 2, 3) included in *Curimatella* two nominal species assigned to *Cyphocharax* in this study. The type series of both *Curimatus leucostictus* Eigenmann and Eigenmann (1889) and *Curimatus (Curimatella) xinguensis* Steindachner (1908) have some scales at the base of the caudal-fin rays. The examination of recently collected specimens from the Amazon basin and adjoining regions shows, however, that in these two nominal species the relative size of the scales at the base of the caudal fin and the extent to which the scales extend posteriorly over the fin rays differs from the condition in *Curimatella*. *Curimatus leucostictus* and *Curimatus (Curimatella) xinguensis* are consequently transferred from *Curimatella* to *Cyphocharax*.

Fernández-Yépez (1948:45) placed *Cyphocharax* (misspelled as *Ciphocharax*) as a synonym of *Pseudocurimata* described in the same paper. He did not recognize *Cyphocharax* because it (and *Xyrocharax*, misspelled *Xirocharax*) were, he felt, based on “characters without importance, which in reality cannot be clearly defined” [my translation]. He nonetheless assigned the type species of *Cyphocharax*, *Curimatus spilurus*, to *Pseudocurimata*. The confusion engendered by these unusual actions is moot since as noted by Vari (1989a) *Pseudocurimata* is defined by a series of derived characters and is distinct from *Cyphocharax*.

Cyphocharax as defined by Vari (1989a) and herein) is the most speciose assemblage in the Curimatidae. Nonetheless,

only four of the 34 generic names proposed to date for components of the Curimatidae (sensu Vari, 1983) are available in the assemblage. Three of the four (*Xyrocharax*, *Hemicurimata*, and *Curimatoides*) have type species considered synonyms of *Cyphocharax spiluroopsis* in this paper. Thus only the senior name of the three, *Xyrocharax*, is available. *Cyphocharax spiluroopsis*, in turn, is close phenetically to *Curimatus spilurus* the type species of *Cyphocharax*, the fourth genus available in the assemblage. Such similarity does not a priori indicate a close phylogenetic relationship between the species. *Cyphocharax spiluroopsis* and *C. spilurus* do, however, share one hypothesized derived character found in some but not all species of *Cyphocharax*, the patch of dark pigmentation on the midlateral surface of the caudal peduncle (see discussion of "Pigmentation" under "Phylogenetic Comments"). No generic-level names are, however, available for those species of *Cyphocharax* lacking such pigmentation. Two options exist. First, retain both *Cyphocharax* and *Xyrocharax* and propose one or more new genera for those species lacking a patch of midlateral pigmentation. Second, expand *Cyphocharax* to include all the species treated in this study. The latter choice is judged preferable in light of the uncertainty about the monophyletic nature of *Cyphocharax* (see comments above) and given our poor understanding of the phylogenetic relationships in the genus (see "Summary" under "Phylogenetic Comments").

Interestingly the majority of characters originally cited for each of the genera available for species herein assigned to *Cyphocharax* are not typical for adults of the type species of each genus. Rather they represent postmortem abnormalities resulting from the poor condition of the type specimens, an evident loss due to damage or developmental abnormality, or are juvenile features.

Fowler (1906:297) based the subgenus *Cyphocharax* on a series of poorly preserved specimens he identified as *Curimatus spilurus* which he designated as the type species. Seven years later Fowler (1913:673) decided that his material, which originated in Peru, was not conspecific with *C. spilurus* described from Guyana (see also following paragraph). That conclusion, confirmed in this study, meant that the purported distinguishing features for *Cyphocharax* were based on specimens of a species other than the designated type species for the subgenus.

In 1913 Fowler described *Curimatus stigmaturus* based on the specimens he cited in 1906 as *C. spilurus*. At the same time he proposed a second subgenus of *Curimatus*, *Xyrocharax*, with *C. stigmaturus* as the type species. The brief diagnoses of the subgenera (*Cyphocharax* and *Xyrocharax*), based as they were on the same specimens, were as expected nearly identical. That for *Cyphocharax* (Fowler, 1906:297) stated "back well elevated, or hunched, anteriorly. Scales large, in even longitudinal series which slope a little from head posteriorly," and that for *Xyrocharax* (Fowler, 1913:673) "back elevated or hunched conspicuously in front. Scales large, smooth, in even length-

wise series. Caudal lobes naked." As noted in "Remarks" under *Cyphocharax spiluroopsis*, the elevated dorsal surface of the body in the individuals on which Fowler based his 1906 and 1913 diagnoses of *Cyphocharax* and *Xyrocharax* is a consequence of a post-mortem break in the vertebral column. Analysis has shown that those specimens rather are conspecific with *Cyphocharax spiluroopsis*, a species without a gibbosity in the dorsal profile of the body (see "Remarks" under *Cyphocharax spiluroopsis*). Thus the main purported distinguishing feature cited by Fowler (1906, 1913) for his taxa *Cyphocharax* and *Xyrocharax* does not occur in undamaged specimens of the type species of either subgenus. The other features Fowler cited in his diagnoses of *Cyphocharax* and *Xyrocharax* are common to most curimatids and not diagnostic for the taxa either singly or in combination.

Myers (1929:620) did not provide an explicit diagnosis for his subgenus *Hemicurimata*. His discussion makes it clear, however, that the subgenus was restricted to the species of *Curimata* Bosc (sensu lato, but excluding *Curimatella*, *Semitaipicis* Eigenmann and Eigenmann, and *Curimatopsis* Steindachner) with "incomplete lateral lines." Myers (1929:620) noted that the specimens of the type species, *Curimata esperanzae*, are juveniles as indicated by the pectoral fins which "are fleshy flaps with radiating rays." The incomplete poring of the lateral line is another juvenile character. The types of *C. esperanzae* are rather evidently conspecific with *Cyphocharax spiluroopsis*, a species with a completely pored lateral line in adults. Similarly the holotype of *Curimata pearsoni*, the second species assigned by Myers (1929) to the subgenus *Hemicurimata*, is also a juvenile, in this case of *Psectrogaster curviventris* (see discussion in Vari (1989d:30)).

The remaining available genus in this assemblage is *Curimatoides* based by Fowler (1940a:255) on a specimen that originated in the Río Ucayali in Amazonian Peru. As noted by Fowler (1940a:255) *Curimatoides* "differs at once from *Curimata*, with which it is allied, in the absence of the adipose fin." The adipose fin is irregularly absent in individuals of various curimatid species otherwise characterized by a fin. Intraspecific variation in the presence and absence of the fin occurs in other Neotropical characiforms, and the holotype of *Curimatoides ucayalensis* is apparently an aberrant or damaged individual of *Cyphocharax spiluroopsis* (see also "Remarks" under the latter species).

COMMENTS ON "KEYS" TO THE SPECIES OF *Cyphocharax*

Two types of keys to the species of *Cyphocharax* are provided. The first, the "Key to the Species of *Cyphocharax*," includes all known species in the genus. The speciose nature of *Cyphocharax* makes it tedious and time consuming to identify species which lie at the end of a long chain of sequential couplets. The known distributions of many species of *Cypho-*



FIGURE 1.—Map of South America showing regions of endemism for curimatids proposed by Vari (1988). See that publication for a more detailed discussion of the regions of endemism and the various groups of curimatids inhabiting them (Figure modified from Vari, 1988, fig. 3).

charax lie within a single, albeit often very large, river basin. If having broader distributions than a single river system, the species are usually limited to one of the areas of endemism proposed by Vari (1988 and Figure 1), or in a few cases to two or three adjoining regions of endemism. In many instances some of those regions (e.g., “Western” of Vari, 1988) may contain only two or three species. Even when the diversity of

Cyphocharax species in a region is relatively high (e.g., Amazon endemic region), the keys for the species of *Cyphocharax* of a particular region of endemism permit a more rapid identification of species.

Keys for seven such areas of endemism are provided after the inclusive “Key to the Species of *Cyphocharax*.” As noted under “Distribution” above, no *Cyphocharax* species is known from

the "Northeast" area of endemism identified by Vari (1988).

Several cautionary comments are in order. The actual ranges of many species discussed in this paper are likely more extensive than the known distributions based on the material examined during this study. Thus species thought endemic to a

single region of endemism may occur in adjoining areas. Finally, it is noteworthy that over 40% of the *Cyphocharax* species recognized in this study are described as new herein or have been described as new since 1980. Thus it is likely that a number of *Cyphocharax* species remain to be discovered.

Key to the Species of *Cyphocharax*

1. Lateral-line scales from supracleithrum to hypural joint 39 to 97 2
Lateral-line scales from supracleithrum to hypural joint 27 to 38 (37 or 38 scales present only in some specimens of *C. nigripinnis*, *C. aspilos*, *C. gilbert*, *C. magdalenae*, and *C. voga*) 6
2. Lateral-line scales from supracleithrum to hypural joint 77 to 97; scales in transverse series above lateral line to origin of dorsal fin 24 to 30; scales in transverse series below lateral line to origin of anal fin 20 to 25; anteriorly bifurcate procumbent spine that is triangular in lateral view present at base of first ray of dorsal fin, spine covered by skin, with lateral surfaces overlain by scales *C. abramoides*
(Rio Amazonas basin in Brazil and Venezuela and upper Rio Orinoco in Venezuela and Colombia)
Lateral-line scales from supracleithrum to hypural joint 39 to 62; scales in transverse series above lateral line to origin of dorsal fin 6¹/₂ to 13; scales in transverse series below lateral line to origin of anal fin 5 to 10; no procumbent spine present anterior to dorsal fin 3
3. Lateral-line scales from supracleithrum to hypural joint 48 to 62; scales in transverse series above lateral line to origin of dorsal fin 10¹/₂ to 13; scales in transverse series below lateral line to origin of anal fin 8 to 10 4
Lateral-line scales from supracleithrum to hypural joint 39 to 45; scales in transverse series above lateral line to origin of dorsal fin 6¹/₂ to 9; scales in transverse series below lateral line to origin of anal fin 5 to 7¹/₂ 5
4. Lateral-line scales from supracleithrum to hypural joint 54 to 62; diameter of orbit 0.31–0.34 of HL; distance from tip of snout to origin of anal fin 0.83–0.88 of SL; no distinct dark spot at base of middle rays of caudal fin; 32 vertebrae *C. stilbolepis*
(Rio Tocantins and Rio Xingu basins)
Lateral-line scales from supracleithrum to hypural joint 48 to 54; diameter of orbit 0.25–0.29 of HL; distance from tip of snout to origin of anal fin 0.78–0.83 of SL; dark stripe on midlateral surface of caudal peduncle continuous with distinct dark spot at base of middle rays of caudal fin; 33 to 35 vertebrae *C. platanus*
(Río de La Plata system other than for upper Rio Paraná basin)
5. Distinct dark, midlateral stripe on caudal peduncle; length of pelvic fin 0.17–0.20 of SL; diameter of orbit 0.25–0.30 of HL; 7¹/₂ to 9 scales above lateral line to origin of dorsal fin; 34 vertebrae *C. nagelii*
(upper Rio Paraná basin)
No distinct dark, midlateral stripe on caudal peduncle; length of pelvic fin 0.21–0.25 of SL; diameter of orbit 0.30–0.36 of HL; 6¹/₂ to 7¹/₂ scales above lateral line to origin of dorsal fin; 31 to 33 vertebrae *C. leucostictus*
(Rio Amazonas basin and coastal rivers of state of Amapá, Brazil)
6. Body with multiple longitudinal dark stripes or with multiple horizontal series of dark spots situated over center of scales on dorsolateral and lateral surfaces of body 7
Body lacking multiple longitudinal dark stripes or multiple horizontal series of dark spots on dorsolateral and lateral surfaces; sometimes with single dark midlateral stripe 9

7. Body with multiple longitudinal series of discrete rotund spots situated along center of longitudinal scale rows; dark midlateral stripe present on caudal peduncle *C. pantostictos*
(western portions of Rio Amazonas basin)
Body with multiple series of dark longitudinal stripes positioned along areas of overlap of horizontal rows of body scales; caudal peduncle either with dark rotund midlateral spot or without dark midlateral markings other than for longitudinal body stripe 8
8. Large rotund spot of dark pigmentation on midlateral surface of posterior portion of caudal peduncle and basal portions of middle rays of caudal fin; head without dark, midlateral longitudinal stripe; greatest body depth 0.38–0.45 of SL *C. helleri*
(coastal drainages of eastern Venezuela, Guyana, Surinam, French Guiana, and northern coastal rivers of Amapá state of Brazil)
Midlateral surface of caudal peduncle without large rotund spot of dark pigmentation; head with discrete, dark stripe extending across midlateral surface both anterior and posterior to orbit; greatest body depth 0.31–0.36 of SL *C. multilineatus*
(upper Rio Negro in Brazil and Venezuela and upper Río Orinoco basin in Venezuela)
9. Dorsal fin with large spot of dark pigmentation on basal portions of anterior rays [see Figures 20–22], or with discrete patch of dark pigmentation on distal portions of anterior rays [see Figures 23, 24] 10
Dorsal fin ranging from hyaline to dusky, but without large discrete patches of dark pigmentation either on basal or distal portions of anterior rays 11
10. Dark pigmentation on dorsal fin consisting of large patch on basal portions of anterior fin rays [see Figures 20–22]; pores developed only on anterior 5 to 8 scales of longitudinal scale series including lateral line; greatest body depth 0.38–0.47 of SL; greatest depth of caudal peduncle 0.14–0.16 of SL *C. vexillapinnus*
(central and western portions of Rio Amazonas basin)
Dark pigmentation on dorsal fin consisting of large patch on distal portions of anterior fin-rays [see Figures 23, 24]; all scales of lateral line with pores; greatest body depth 0.31–0.37 of SL; greatest depth of caudal peduncle 0.11–0.13 of SL *C. notatus*
(Rio Amazonas basin)
11. Caudal peduncle without distinct midlateral dark spot or longitudinal stripe 12
Caudal peduncle with distinct midlateral dark spot or longitudinal stripe 17
12. Depth of caudal peduncle 0.10–0.13 of SL 13
Depth of caudal peduncle typically 0.14–0.16 of SL, only occasionally 0.13 in some individuals of *Cyphocharax magdalenae* from Panama 15
13. Length of postorbital portion of head 0.33–0.39 of SL; adipose fin hyaline to slightly dusky; greatest body depth 0.33–0.37 of SL *C. festivus*
(Rio Amazonas, Río Orinoco, and Essequibo River basins)
Length of postorbital portion of head 0.40–0.48 of SL; adipose fin hyaline to slightly dusky, or with distal portion black; greatest body depth 0.29–0.33 of SL 14
14. Adipose fin with distal portion black; length of head 0.31–0.35 of SL; distance from tip of snout to insertion of pelvic fin 0.55–0.61 of SL; 34 to 37 pored lateral-line scales to hypural joint; 6 or 6½ scales in transverse series from lateral line to origin of dorsal fin *C. nigripinnis*
(Rio Amazonas basin)
Distal portion of adipose fin hyaline or slightly dusky but not black; length of head

- 0.26–0.31 of SL; distance from tip of snout to insertion of pelvic fin 0.51–0.56 of SL; 30 to 34 pored lateral-line scales to hypural joint; $4\frac{1}{2}$ or 5 (5 rare) scales in transverse series from lateral line to origin of dorsal fin *C. plumbeus*
(Rio Amazonas basin)
15. Lateral-line scales to hypural joint 29 to 32 *C. microcephalus*
(Guyana, Surinam, and French Guiana)
Lateral line scales to hypural joint 34 to 38 16
16. Interorbital width 0.47–0.52 of HL; vertebral number modally 33, range 32 to 34
. *C. magdalенаe*
(southern Costa Rica, Panama, Río Magdalena
basin in northwestern Colombia)
Interorbital width 0.43–0.47 of HL; vertebral number modally 32, range 31 to 33
. *C. aspilos*
(Lago Maracaibo basin, northwestern Venezuela)
17. Body with longitudinal series of 3 to 8 moderate to large dark spots distributed somewhat irregularly along midlateral surface; anterior spot typically along vertical line through anterior rays of dorsal fin, posterior spot on posterior portion of caudal peduncle; anterior spots sometimes obscure in larger individuals of *C. vanderi* of upper Rio Paraná system in which relative depth of caudal peduncle is unusually high (0.16–0.20 of SL in contrast to 0.12–0.16 in remaining species in key) 18
Body with rotund spot or longitudinally elongate stripe on midlateral surface of caudal peduncle, but that spot not preceded anteriorly by other large midlateral spots on body 19
18. Least depth of caudal peduncle 0.13–0.15 of SL; greatest body depth 0.35–0.37 of SL; length of pelvic fin 0.24–0.27 of SL; 30 vertebrae; anterior rays of dorsal fin often somewhat dusky; 8 to 20 scales of lateral line pored in specimens up to 25 mm SL, number of pored scales increases with standard length, lateral line may be completely pored in larger specimens *C. punctatus*
(Marowijne River of Surinam and French Guiana)
Least depth of caudal peduncle 0.16–0.20 of SL; greatest body depth 0.38–0.42 of SL; length of pelvic fin 0.21–0.23 of SL; 28 or 29 vertebrae; anterior rays of dorsal fin not notably dusky; lateral line completely pored to hypural joint in all examined specimens *C. vanderi*
(Upper Rio Paraná basin)
19. Pores developed only on anterior 5 to 9 scales of lateral line scale series 20
Pores developed in all scales along lateral line scale series, or if pores developed only along part of series the specimen is a juvenile (less than approximately 15–25 mm SL) 21
20. Greatest body depth 0.34–0.36 of SL; 10 to 12 pectoral-fin rays; caudal peduncle relatively short and anal-fin rays relatively long [Figure 47], tips of depressed anal fin extending posteriorly to vertical line through posterior terminus of dark spot on midlateral surface of caudal peduncle *C. signatus*
(Rio Tocantins basin)
Greatest body depth 0.39–0.43 of SL; 13 or 14 pectoral-fin rays; caudal peduncle not shortened and anal-fin rays not notably elongate, tips of depressed anal fin rays extending posteriorly only to vertical line through middle of dark spot on midlateral surface of caudal peduncle *C. saladensis*
(Río Paraguay, lower Río Paraná basins,
coastal rivers of southeastern Brazil)
21. Branched rays in dorsal fin 10 to 12; vertebrae 30 to 32, most commonly 31; length of pelvic fin 0.22–0.26 of SL *C. spilotus*
(Río Paraguay and Río Paraná basins)
Branched rays in dorsal fin 9 (rarely 10 in *C. modestus* which has 32 to 34, most

- commonly 33 vertebrae, with length of pelvic fin 0.18–0.22 of SL) 22
22. Upper lip very fleshy, with ventral margin extending ventrally over anterior margin of lower lip when mouth is closed; greatest body depth 0.28–0.31 of SL
 *C. mestomyllon*
 (Rio Negro system of Rio Amazonas basin)
 Upper lip not fleshy and not extending ventrally over anterior margin of lower lip when mouth is closed; greatest body depth 0.31–0.42 of SL (rarely 0.31 of SL in some specimens of *Cyphocharax spilurus*) 23
23. Juveniles, subadults, and many adults with pattern of random small dark spots on lateral and dorsolateral surfaces of body [Figures 55, 56]; vertebrae 34 to 37 (typically 35 or 36); middle caudal-fin rays without marked pigmentation; spot of pigmentation in larger specimens on midlateral surface of caudal peduncle not continued anteriorly as thin midlateral stripe; caudal peduncle spot ranging from vertically ovoid to rotund, not distinctly horizontally elongate *C. voga*
 (coastal rivers of Rio Grande do Sul and southern Santa Catarina states in Brazil, Uruguay, region of Buenos Aires and the rivers of Río de La Plata estuary regions in Argentina, Río Paraguay and lower Río Paraná basins)
 Body without scattered, small dark spots on lateral and dorsolateral surfaces at any age; vertebrae 28 to 35 (if 34 or 35 vertebrae, species either with pigmentation on caudal fin in moderate to larger-sized specimens extending posteriorly across middle rays of caudal fin [*C. modestus*, Figures 60, 61] or pigmentation continuing anterior as thin midlateral stripe in moderate-sized [*C. gilbert*, Figures 62–66] or moderate to large specimens [*C. santacatarinae*, Figure 70], or caudal peduncle spot horizontally elongate [*C. gilbert*, Figures 63–66]) 24
24. Dark pigmentation on midlateral surface of caudal peduncle in the form of an elongate stripe extending posteriorly across middle rays of caudal fin in moderate and large specimens *C. modestus*
 (upper Rio Paraná system above Sete Quedas Falls)
 Midlateral spot on caudal peduncle usually rotund, if horizontally elongate then not extending posteriorly across middle rays of caudal fin (caudal-fin ray pigmentation occasionally present in some populations of *C. cf. gilbert* from Bahia; see discussion under that species) 25
25. Dark pigmentation on midlateral surface of caudal peduncle horizontally elongate at all sizes; scales along lateral line to hypural joint 33 to 38 *C. gilbert*
 (rivers of eastern coastal Brazil from Rio de Janeiro to Bahia)
 Dark pigmentation on midlateral surface of caudal peduncle in the form of rotund patch at all sizes; scales along lateral line to hypural joint 27 to 34 26
26. Length of postorbital portion of head 0.42–0.47 of SL; head length 0.26–0.30 of SL; orbital diameter 0.26–0.31 of HL; lateral-line scales to hypural joint 32 to 34; vertebrae 32 to 34, usually 33; spot of dark pigmentation on lateral surface of caudal peduncle large and rotund *C. santacatarinae*
 (coastal rivers of states of Santa Catarina, Paraná, and southern São Paulo in Brazil)
 Length of postorbital portion of head less than 0.41 of HL except in *C. oenas* and *C. spiluroopsis*; *C. oenas* (postorbital length 0.38–0.43) with head length 0.31–0.35 of SL, orbital diameter 0.31–0.35 of HL, lateral-line scales to hypural joint 29 to 32, and vertebrae 29 to 31; *C. spiluroopsis* (postorbital length 0.38–0.46) with 30 to 32 vertebrae, typically 31, and spot of pigmentation of caudal peduncle relative small 27
27. Lateral-line scales to hypural joint 27 or 28; relative gape width 0.18–0.23 of HL; larger specimens usually with pronounced reticulate pattern on body [Figure 72] *C. gangamon*
 (Rio Tapajós of Amazon basin)

- Lateral-line scales to hypural joint 28 to 34; if lateral-line scales 28 or 29 then without pronounced reticulate pattern on body, and relative width of gape 0.22–0.29 of HL (*C. gillii*, *C. meniscaprorus*, *C. oenas*, *C. spiluroopsis*) 28
28. Spot of pigmentation on midlateral surface of caudal peduncle typically horizontally elongate; greatest body depth 0.31–0.37 of SL; least depth of caudal peduncle 0.12–0.13 of SL; head length 0.25–0.31 of SL; length of postorbital portion of head 0.33–0.39 of HL; vertebrae 30 to 32, typically 31 *C. spilurus*
(eastern Venezuela, Guianas, Rio Branco, Rio Orinoco)
- Spot of pigmentation on midlateral surface of caudal peduncle rotund (*C. spiluroopsis*, *C. gillii*, *C. gouldingi*, *C. oenas*) or somewhat triangular with posterior border darker (*C. meniscaprorus*); greatest body depth in *C. gouldingi* 0.38–0.42 of SL; least depth of caudal peduncle 0.14–0.15 of SL in *C. oenas*; head length 0.31–0.35 of SL in *C. oenas* and 0.31–0.34 in *C. meniscaprorus*; length of postorbital portion of head 0.38–0.43 of HL in *C. oenas* and 0.38–0.46 in *C. spiluroopsis*; vertebrae 29 to 31, typically 30 in *C. gillii* and *C. oenas* 29
29. Spot of pigmentation on midlateral surface of caudal peduncle typically triangular with vertical posterior border, usually with posterior border distinctly darker than remaining portion of spot [Figure 79]; dorsal profile of snout and anterior portion of head distinctly rounded; greatest body depth 0.33–0.39 of SL; length from origin of dorsal fin to hypural joint 0.51–0.55 of SL; head length 0.31–0.34 of SL; snout length 0.29–0.35 of HL; length of postorbital portion of head 0.34–0.39 of SL; vertebrae 30 to 32, typically 31 *C. meniscaprorus*
(Río Orinoco basin)
- Spot of pigmentation on midlateral surface of caudal peduncle typically rotund, posterior border not notably darker than remainder of spot; dorsal profile of snout and anterior portion of head not distinctly rounded; greatest body depth 0.38–0.42 of SL in *C. gouldingi*; length from origin of dorsal fin to hypural joint 0.55–0.60 of SL in *C. gouldingi*, 0.54–0.61 in *C. gillii*, 0.54–0.58 in *C. oenas*; head length 0.27–0.31 of SL in *C. gouldingi*; snout length 0.24–0.30 of HL in *C. spiluroopsis* and 0.25–0.30 in *C. oenas*; length of postorbital portion of head 0.38–0.46 of SL in *S. spiluroopsis*; vertebrae 29 to 31, typically 30 in *C. gillii* and *C. oenas* 30
30. Greatest body depth 0.38–0.43 of SL; least depth of caudal peduncle 0.12–0.14 of SL, typically 0.13; head length 0.27–0.31 of SL; dark spot on midlateral surface of caudal peduncle approximately one-half diameter of orbit; vertebrae 31 or 32, typically 31 *C. gouldingi*
(coastal rivers of state of Amapá, Brazil, Rio Tocantins and lower Rio Xingu in Rio Amazonas basin)
- Greatest body depth 0.33–0.39 of SL in *C. spiluroopsis*, 0.35–0.39 of SL in *C. oenas*; least depth of caudal peduncle 0.14–0.15 of SL in *C. oenas*; head length 0.31–0.35 of SL in *C. oenas*; dark spot on midlateral surface of caudal peduncle approximately equal to diameter of orbit in *C. gillii*; vertebrae 29 to 31, typically 30 in *C. gillii* and *C. oenas* 31
31. Spot of dark pigmentation on caudal fin more diffuse, without distinct margin, with fields of chromatophores extending to dorsal and ventral margins of caudal peduncle in juveniles; greatest body depth 0.36–0.45 of SL; no regular series of median scales along midventral line anterior to insertion of pelvic fins *C. gillii*
(Río Paraguay basin in Brazil and Paraguay)
- Spot of dark pigmentation on caudal fin quite discrete, with distinct margin in juveniles and adults, not merging into dorsal and ventral borders of caudal peduncle in juveniles, greatest body depth 0.34–0.39 of SL; prepelvic region of

- body with distinct median series of scales at least proximate to insertion of pelvic fins 32
32. Head length 0.28–0.33 of SL; least depth of caudal peduncle 0.12–0.14 of SL; vertebrae 30 to 32, typically 31; margin of upper lip not notably darker than adjoining regions; discrete median series of scales developed along entire prepelvic region of body *C. spituropsis*
(central and western portions of Rio Amazonas basin)
- Head length 0.32–0.36 of SL; least depth of caudal peduncle 0.14–0.15 of SL; vertebrae 29 to 31, typically 30; margin of upper lip typically very dark; discrete median series of scales on prepelvic region of body in distinct series only proximate to pelvic fin insertion *C. oenas*
(Río Orinoco basin)

Keys to the Species of *Cyphocharax* within Areas of Endemism

As noted in the comments preceding the above key, the following keys should simplify the identification of the species of *Cyphocharax* within each area of endemism. The actual geographic ranges of various species are very likely more extensive than indicated by the distribution of specimens examined during this study. In those instances where the range extends into other areas of endemism it will be necessary to refer to the above key to identify such material. The regions of endemism on which the following keys are based are those proposed by Vari (1988) and are shown on Figure 1. One region proposed by Vari, the Northeast endemic region, is not known to be inhabited by any species of *Cyphocharax*.

Orinoco Endemic Region

1. Lateral-line scales from supracleithrum to hypural joint 77 to 97; anteriorly bifurcate procumbent spine, triangular in lateral view present at base of first ray of dorsal fin, spine covered with skin, with lateral surfaces overlain by scales *C. abramoides*
Lateral-line scales from supracleithrum to hypural joint 25 to 34; no procumbent spine present anterior to dorsal fin 2
2. Body with multiple series of dark longitudinal stripes positioned along areas of overlap of horizontal rows of body scales; dark midlateral stripe extends across surface of head both anterior and posterior to orbit *C. multilineatus*
Body without multiple dark longitudinal stripes; head without dark midlateral stripe 3
3. Midlateral surface of caudal peduncle without distinct spot of dark pigmentation *C. festivus*
Midlateral surface of caudal peduncle with distinct spot of dark pigmentation 4
4. Patch of dark pigmentation on midlateral surface of caudal peduncle ovoid, typically horizontally elongate; head length 0.25–0.31 of SL *C. spilurus*
Patch of dark pigmentation on midlateral surface of caudal peduncle round, or somewhat triangular with vertical posterior margin typically darker; head length 0.31–0.36 of SL 5
5. Patch of pigmentation on midlateral surface of caudal peduncle typically triangular, usually with vertical posterior border darker [Figure 79]; dorsal profile of snout and anterior portion of head distinctly rounded; snout length 0.29–0.35 of HL; length of postorbital portion of head 0.34–0.39 of HL; vertebrae 30 to 32, typically 31 *C. meniscaprorus*
Spot of pigmentation on midlateral surface of caudal peduncle round; dorsal profile

of snout and anterior portion of head only slightly convex; snout length 0.25–0.30 of HL; length of postorbital portion of head 0.38–0.43 of HL; vertebrae 29 to 31, typically 30 *C. oenas*

Western Endemic Region

Interorbital width 0.47–0.52 of HL; vertebrae modally 33, range 32 to 34
 *C. magdalенаe*
 Interorbital width 0.43–0.47 of HL; vertebrae modally 32, range 31 to 33
 *C. aspilos*

Guianas Endemic Region

1. Midlateral surface of caudal peduncle with distinct patch of dark pigmentation 2
 Midlateral surface of caudal peduncle without distinct patch of dark pigmentation 5
2. Body with series of dark longitudinal stripes along junctions of horizontal scale rows *C. helleri*
 Body without series of dark longitudinal stripes along junctions of horizontal scale rows 3
3. Body with longitudinal series of 3 or 4 large dark spots along midlateral surface; lateral line incompletely pored posteriorly; 27 to 30 scales along lateral line to hypural joint *C. punctatus*
 Body without large dark spots along midlateral surface; lateral line completely pored; 30 to 34 scales along lateral line to hypural joint 4
4. Greatest body depth 0.38–0.42 of SL; length of postorbital portion of head 0.38–0.44 of HL; length of pectoral fin 0.20–0.25 of SL; dark spot on midlateral surface of caudal peduncle round *C. gouldingi*
 Greatest body depth 0.31–0.37 of SL; length of postorbital portion of head 0.33–0.39 of HL; length of pectoral fin 0.19–0.21 of SL; dark spot on midlateral surface of caudal peduncle typically horizontally elongate *C. spilurus*
5. Greatest body depth 0.33–0.37 of SL; least depth of caudal peduncle 0.12–0.13 of SL; orbital diameter 0.35–0.40 of HL; length of postorbital portion of head 0.33–0.39 of HL *C. festivus*
 Greatest body depth 0.38–0.43 of SL; least depth of caudal peduncle 0.14–0.16 of SL; orbital diameter 0.28–0.34 of HL; length of postorbital portion of head 0.42–0.47 of HL *C. microcephalus*

Amazon Endemic Region

1. Lateral line scales from supracleithrum to hypural joint 39 to 97 2
 Lateral line scales from supracleithrum to hypural joint 29 to 37 4
2. Lateral-line scales from supracleithrum to hypural joint 77 to 97; anteriorly bifurcate procumbent spine triangular in lateral view present at base of first ray of dorsal fin, spine covered with skin, with lateral surfaces overlain by scales *C. abramoides*
 Lateral-line scales from supracleithrum to hypural joint 39 to 62; no procumbent spine present anterior to dorsal fin 3
3. Lateral-line scales from supracleithrum to hypural joint 54 to 62; scales above lateral line to origin of dorsal fin 10¹/₂ to 11¹/₂; scales below lateral line to origin of anal fin 8¹/₂ to 9¹/₂ *C. stilbolepis*

- Lateral-line scales from supracleithrum to hypural joint 39 to 45; scales above lateral line to origin of dorsal fin $6\frac{1}{2}$ to $7\frac{1}{2}$; scales below lateral line to origin of anal fin 5 to $6\frac{1}{2}$ *C. leucostictus*
4. Body with multiple longitudinal dark stripes or with longitudinal series of dark spots over center of scales on dorsolateral and lateral surfaces 5
 Body lacking multiple longitudinal dark stripes or series of dark spots on dorsolateral and lateral surfaces; sometimes with single midlateral stripe 6
 5. Body with multiple longitudinal series of discrete rotund spots situated over center of scale rows; head with scattered dark chromatophores on lateral surface, but lacking distinct dark, midlateral band both anterior and posterior to orbit; length of postorbital portion of head 0.42–0.46 of HL *C. pantostictos*
 Body with multiple series of dark longitudinal stripes positioned along areas of overlap of horizontal rows of body scales; head with discrete dark band across midlateral surface anterior and posterior to orbit; length of postorbital portion of head 0.35–0.40 of HL *C. multilineatus*
 6. Midlateral surface of caudal peduncle without patch of dark pigmentation 7
 Midlateral surface of caudal peduncle with patch of dark pigmentation 11
 7. Dorsal fin with patch of dark pigmentation either on proximal portion or distal region of anterior rays 8
 Dorsal fin hyaline to dusky, but without distinct patch of dark pigmentation either on proximal or distal portions of anterior rays 9
 8. Dark pigmentation on dorsal fin consisting of dark patch on basal portions of anterior fin-rays [see Figures 20–22]; pores developed only on anterior 5 to 8 scales of longitudinal scale series including lateral line; greatest body depth 0.38–0.47 of SL; least depth of caudal peduncle 0.14–0.16 of SL *C. vexillapinnus*
 Dark pigmentation on dorsal fin consisting of dark patch on distal portions of anterior fin-rays [see Figures 23, 24]; all scales of lateral line with pores; greatest body depth 0.31–0.37 of SL; least depth of caudal peduncle 0.11–0.13 of SL *C. notatus*
 9. Length of postorbital portion of head 0.33–0.39 of SL; adipose fin hyaline to slightly dusky; greatest body depth 0.33–0.37 of SL *C. festivus*
 Length of postorbital portion of head 0.40–0.48 of SL; adipose fin hyaline to slightly dusky, or with distal portion black; greatest body depth 0.29–0.33 of SL 10
 10. Adipose fin with distal portion black; length of head 0.31–0.35 of SL; distance from tip of snout to insertion of pelvic fin 0.55–0.61 of SL; 34 to 37 pored lateral-line scales to hypural joint; 6 or $6\frac{1}{2}$ scales in transverse series from lateral line to origin of dorsal fin *C. nigripinnis*
 Distal portion of adipose fin hyaline to slightly dusky, but not black; length of head 0.26–0.31 of SL; distance from tip of snout to insertion of pelvic fin 0.51–0.56 of SL; 30 to 34 pored lateral-line scales from lateral line to origin of dorsal fin; 5 or $5\frac{1}{2}$ scales in transverse series from lateral line to origin of dorsal fin *C. plumbeus*
 11. Pores developed only in anterior 5 to 7 scales of lateral line scale series; 10 to 12 pectoral-fin rays; caudal peduncle relatively short and anal-fin rays relatively long, tips of depressed anal-fin rays extending posteriorly to vertical line through posterior terminus of dark spot on midlateral surface of caudal peduncle *C. signatus*
 Pores developed in all scales along lateral line scale series, or if pores developed only along part of series the specimen is a juvenile (less than approximately 15–25 mm SL); pectoral-fin rays 13 to 16; caudal peduncle not foreshortened; anal-fin rays not lengthened 12
 12. Upper lip very fleshy and extending ventrally over anterior margin of lower lip

- when mouth is closed; greatest body depth 0.28–0.31 of SL *C. mestomyllon*
- Upper lip not fleshy and not extending ventrally over anterior margin of lower lip when mouth is closed; greatest body depth 0.31–0.42 of SL (rarely 0.31 of SL in some specimens of *Cyphocharax spilurus*) 13
13. Lateral-line scales to hypural joint 27 or 28; relative gap width 0.18–0.23 of HL; larger specimens with pronounced reticulate pattern on body; vertebrae 28 to 30, most usually 29 *C. gangamon*
- Lateral-line scales to hypural joint 28 to 34; if lateral-line scales 28 then without pronounced reticulate pattern of body, and relative width of gape 0.22–0.29 of HL (*C. spiluropsis*); vertebrae 30 to 32, most usually 31 14
14. Patch of dark pigmentation on midlateral surface of caudal peduncle horizontally elongate; length of postorbital portion of head 0.33–0.39 of HL *C. spilurus*
- Patch of dark pigmentation on midlateral surface of caudal peduncle round; length of postorbital portion of head 0.38–0.46 of HL 15
15. Greatest body depth 0.38–0.42 of SL; length of postorbital portion of head 0.34–0.40 of HL *C. gouldingi*
- Greatest body depth 0.33–0.39 of SL; length of postorbital portion of head 0.38–0.46 of HL *C. spiluropsis*

São Francisco and Coastal Endemic Regions

Only one species of *Cyphocharax*, *C. gilberti*, is known from the coastal and São Francisco endemic regions.

Upper Rio Paraná Endemic Region

1. Lateral-line scales to hypural joint 39 to 45; scales above lateral line to origin of dorsal fin $7\frac{1}{2}$ to 9; scales below lateral line to origin of anal fin $6\frac{1}{2}$ to $7\frac{1}{2}$ *C. nagelii*
- Lateral-line scales to hypural joint 27 to 36; scales above lateral line to origin of dorsal fin $4\frac{1}{2}$ to 7; scales below lateral line to origin of anal fin $4\frac{1}{2}$ to 6 2
2. Body with midlateral series of large dark spots; lateral-line scales to hypural joint 27 to 29; least depth of caudal peduncle 0.16–0.20 of SL; interorbital width 0.46–0.52 of HL; vertebrae 28 or 29 *C. vanderi*
- Body without midlateral series of large dark spots; lateral-line scales to hypural joint 31 to 36; least depth of caudal peduncle 0.13–0.15 of SL; interorbital width 0.40–0.46 of HL; vertebrae 32 to 34 *C. modestus*

Rio Paraguay Endemic Region

1. Lateral line scales to hypural joint 48 to 54; scales above lateral line to origin of dorsal fin $10\frac{1}{2}$ to 13; scales below lateral line to origin of anal fin 8 to 10 *C. platanus*
- Lateral line scales to hypural joint 27 to 37; scales above lateral line to origin of dorsal fin $4\frac{1}{2}$ to $6\frac{1}{2}$; scales below lateral line to origin of anal fin 4 to 6 2
2. Pores developed on only anterior 8 or 9 scales of lateral line *C. saladensis*
- Pores developed on all scales of lateral line except in juveniles of some species 3

- 3. Dorsal fin with 10 to 12 branched rays *C. spilotus*
Dorsal fin with 9 branched rays 4
- 4. Juveniles and many adults with series of spots on lateral and dorsolateral surfaces of body [Figures 55, 56]; vertebrae 34 to 37 (typically 35 or 36); spot of pigmentation in larger specimens on midlateral surface of caudal peduncle not continued anteriorly as thin midlateral stripe *C. voga*
Body without series of spots on lateral and dorsolateral surfaces at any age; vertebrae 29 to 31 in *C. gillii* or 32 to 34 typically 33 in *C. santacatarinae*; spot of pigmentation on midlateral surface of caudal peduncle rotund in *C. gillii* or continuing anteriorly as thin midlateral line in larger specimens in *C. santacatarinae* 5
- 5. Orbital diameter 0.26–0.31 of HL; length of postorbital portion of head 0.42–0.47 of HL; vertebrae 32 to 34, typically 33; adults with patch of dark pigmentation on midlateral surface of caudal peduncle continued anteriorly as thin midlateral stripe *C. santacatarinae*
Orbital diameter 0.30–0.37 of HL; length of postorbital portion of head 0.36–0.42 of HL; vertebrae 29 to 31, typically 30; patch of dark pigmentation on midlateral surface of caudal peduncle rotund, not continued anteriorly as thin midlateral stripe *C. gillii*

***Cyphocharax abramoides* (Kner)**

FIGURES 2–4

Curimatus abramoides Kner, 1859a:142, pl. 2: fig. 3 [type-locality: Brazil: mouth of Rio Negro]; 1859b:76 [abstract of Kner, 1859a, species description].—Günther, 1864:293 [*Curimatus abramoides* Kner erroneously placed as a synonym of *Charax planirostris* Gray, 1854; species account, however, based on Kner, 1859a].—Eigenmann and Eigenmann, 1889:431 [*Curimatus abramoides* considered a synonym of *Charax planirostris*].—Vari, 1984a:13–16 [removal of *Curimatus abramoides* from synonymy of *Charax planirostris*]; 1989a, tables 2, 3 [assignment to *Cyphocharax*].
Curimatus planirostris.—Günther, 1864:293 [in part, meristic data taken from Kner, 1859a; only *C. abramoides* citation].—Eigenmann and Eigenmann, 1889:431 [citations in part, not Gronow (= Gronovius) citations; Brazil: Rio Negro, Óbidos]; 1891:48 [reference].
Curimatus (Semítapicis) planirostris.—Pellegrin, 1909:148 [Brazil: Santarém].
Semítapicis planirostris.—Eigenmann, 1910:422 [in part, *Curimatus abramoides* citation; not synonymy of that species in *Charax planirostris*].—Fernández-Yépez, 1948:36, fig. 16 [in part, *Charax planirostris* citation; Brazil].—Fowler, 1950:302, fig. 363 [literature compilation, not Gray, 1854, citations]; 1975:375 [reference].—Mago-Leccia, 1971:10 [Venezuela: Río Casiquiare region].

DIAGNOSIS.—The autapomorphic presence of a prominent procumbent spine at the anterior of the dorsal fin (Figure 3) and distinct median keel extending from slightly posterior of the dorsal fin to the anterior of the adipose fin are unique to *Cyphocharax abramoides* among all curimatids. Similarly the very deep, laterally flattened body also serves to distinguish *C. abramoides*, not only from its congeners, but also from all other species in the family. *Cyphocharax abramoides* is further distinguished from its congeners by the 77 to 97 scales in the lateral line, 24 to 30 scales in a transverse series from the lateral line to the origin of the dorsal fin, and 20 to 25 scales in a transverse series from the lateral line to the origin of the anal fin. This contrasts with a maximum of 62 lateral-line scales, 13 scales above the lateral line to the origin of the dorsal fin, and

10 scales below the lateral line to the origin of the anal fin in other *Cyphocharax* species.

DESCRIPTION.—Body very deep in specimens over 40 mm SL, more so in ripe females, greatly compressed laterally. Dorsal profile of head straight or very slightly concave to tip of supraoccipital spine. Dorsal profile of body smoothly curved from tip of supraoccipital spine to origin of dorsal fin; somewhat convex and distinctly posteroventrally slanted at base of dorsal fin, convex from base of last dorsal-fin ray to caudal peduncle, convexity more pronounced in larger specimens. Dorsal surface of body with indistinct median keel anterior to dorsal fin, with distinct median keel extending from slightly behind posterior terminus of dorsal fin posteriorly to origin of adipose fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region transversely rounded anteriorly, somewhat flattened with indistinct median keel in region proximate to pelvic fin origin. Well developed, acute median keel posterior to pelvic fin origin. Secondary obtuse keel on each side of postpelvic portion of body about six scales dorsal of ventral midline.

Greatest body depth at origin of dorsal fin, relatively deeper in ripe females, strongly positively allometric until 40 mm SL; body depth 0.48–0.61 (in specimens over 46 mm SL) [0.54]; snout tip to origin of dorsal fin 0.52–0.57 [0.56]; snout tip to origin of anal fin 0.82–0.89 [0.87]; snout tip to origin of pelvic fin 0.58–0.61 [0.58]; snout tip to anus 0.80–0.88 [0.85]; origin of dorsal fin to hypural joint 0.59–0.63 [0.58]. Dorsal fin pointed in profile distally; last unbranched and first branched rays in moderate and larger sized specimens very elongate, extending posteriorly to origin of adipose fin; those elongate rays about five to six times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.17–0.20 [0.19], extends to or slightly beyond point one-half distance to

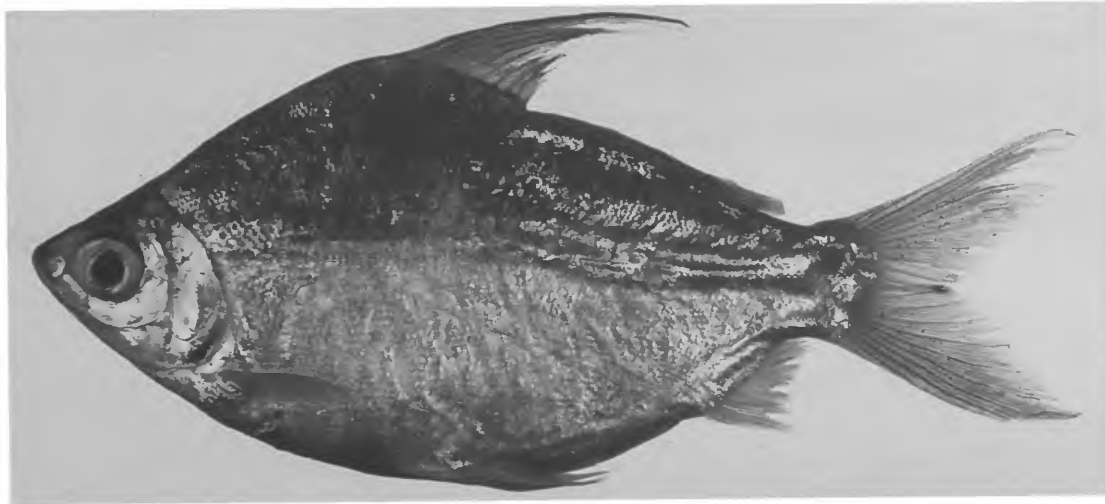


FIGURE 2.—*Cyphocharax abramoides*, USNM 267952, 132.7 mm SL; Brazil, Pará, Rio Xingu, Belo Monte.

vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally, length of pelvic fin 0.18–0.24 [0.22], tip reaches nearly to origin of anal fin in small specimens, falling well short of that point in larger individuals. Caudal fin forked. Adipose fin well developed, with relatively elongate base. Anal fin border emarginate, anteriormost branched rays two and one-half to three times length of ultimate ray. Least depth of caudal peduncle 0.12–0.15 [0.14].

Head profile obtusely pointed, head length 0.26–0.31 [0.29]; jaws nearly equal or upper slightly longer than lower, mouth terminal to barely subterminal; snout length 0.26–0.31 [0.27]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.30–0.35 [0.34]; adipose eyelid well developed, with vertically ovoid opening over center of eye; length of postorbital portion of head 0.39–0.45 [0.40]; gape width 0.23–0.29 [0.25]; interorbital width 0.43–0.48 [0.45].

Scales somewhat deciduous, more so in smaller individuals. Pored lateral-line scales from supracleithrum to hypural joint 77 to 97 [85]; all scales of lateral line pored, canals in scales straight; 4 to 9 series of pored scales extend beyond hypural joint onto caudal-fin base; 24 to 30 [approximately 24] scales in transverse series from origin of dorsal fin to lateral line; 20 to 25 [approximately 25] scales in transverse series from lateral line to origin of anal fin.

Dorsal fin with anteromedially bifurcate procumbent spine at base of first dorsal-fin ray (Figure 3), spine covered with layer of skin continuous with that underlying scales on proximate portions of body; lateral margins of spine overlain by scales; spine closely associated with and moves in unison with first to first to third dorsal-fin rays (number of rays involved a function of number of unbranched rays); anterior bifurcation of spine less pronounced in larger individuals; dorsal-fin rays (not

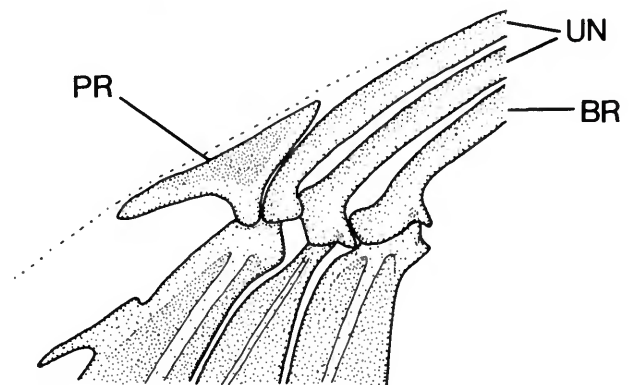


FIGURE 3.—*Cyphocharax abramoides*, USNM 267953, 99.3 mm SL; anteroventral portion of dorsal fin and proximate portions of basal pterygiophores showing procumbent spine (left side, lateral view, anterior to left, dotted line indicates dorsal surface of body; BR = branched dorsal fin ray; PR = procumbent spine; UN = unbranched dorsal fin rays).

including procumbent spine) i,9 or ii,9 or iii,9 (ii,9 most common; when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or 8 or iii,7 or 8 (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,8 most common) [i,8].

Total vertebrae 32 (4), 33 (22).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales golden or silvery-golden, darker on dorsal portions of head and body. Ground coloration of specimens lacking guanine on scales tan to brown, darker dorsally. No pronounced pigmentation pattern on head and body. Larger specimens with margins of scales outlined by series of small, dark chromatophores. Fin rays and distal margins of dorsal and adipose fins outlined by series of small, dark chromatophores.



FIGURE 4.—Map of central and northern South America showing geographic distribution of *Cyphocharax abramoides* (filled in circles, 1 = type locality) and *Cyphocharax stilbolepis* (squares, 2 = type locality); the two species are sympatric at locality 2 (some symbols represent more than one locality or lot of specimens).

DISTRIBUTION.—Blackwaters of the Rio Negro basin and upper Río Orinoco, and tributaries to lower Rio Amazonas (Figure 4).

AUTAPOMORPHIES OF *Cyphocharax abramoides*.—The transversely flattened, vertically deep body of *Cyphocharax abramoides* is unique within the Curimatidae and its hypothesized sister-group the Prochilodontidae (Vari, 1983, 1989a). Similarly the distinct middorsal keel extending from slightly behind the posterior terminus of the dorsal fin to the origin of the adipose fin occurs neither in other curimatids nor in prochilodontids. The overall body form and the middorsal keel are thus considered unequivocal autapomorphies for the species. A third feature, the procumbent spine at the anterior of the dorsal fin (Figure 3) is unique to *C. abramoides* in the Curimatidae. The spine, which apparently results from the pronounced enlargement of the small first unbranched dorsal fin ray typical of other curimatids, is approximated in the two most speciose genera of the Prochilodontidae, *Semaprochilodus* Fowler and *Prochilodus* Agassiz, but is absent in the third prochilodontid genus *Ichthyoelephas* Posada-Arango. Nonetheless, within the most parsimonious hypothesis of relationships between curimatids and prochilodontids, and among curimatids (Vari, 1983, 1989a), it is most parsimonious to hypothesize that the procumbent spine in *Cyphocharax abramoides* is autapomorphic for that species in the Curimati-

dae albeit homoplastically present in most members of the Prochilodontidae.

Two other features of *C. abramoides*, although derived, occur homoplastically elsewhere in the Curimatidae. *Cyphocharax abramoides* has the last unbranched and first branched dorsal-fin rays in adults developed into filamentous extensions reaching to the adipose fin in many individuals. Similar elongations of those dorsal-fin rays occur in *Curimata cyprinoides* (Linnaeus) and *C. knerii* Steindachner (Vari, 1989c, figs. 28, 31). These extensions were hypothesized synapomorphic for the two species (Vari, 1989c:18), a hypothesis congruent with the distribution of other derived characters in the genus. Under the overall most parsimonious hypotheses of relationships in the Curimatidae (Vari, 1989a) and *Curimata* (Vari, 1989c) the simplest hypothesis is that the elongate anterior dorsal-fin rays of the *C. cyprinoides*-*C. knerii* clade are homoplastic relative to the filamentous rays in *Cyphocharax abramoides*.

Cyphocharax abramoides has small, relatively deciduous scales contrary to the condition of most of its congeners. The relative size of the scales is reflected both in the number of scales along the lateral line to the hypural joint (77 to 97), and in the number in a transverse series above (24 to 30) and below (20 to 25) the lateral line. No other member of *Cyphocharax* has such large numbers of scales in these series, nor do such

high numbers occur in *Curimatella*, *Steindachnerina*, and *Pseudocurimata*, the other components of the terminal polytomy within the Curimatidae proposed by Vari (1989a). Indeed the only other curimatids with such high numbers of lateral-line scales are the species of *Potamorhina* Cope with 85 to 110 scales in the lateral-line series. As discussed by Vari (1984:7–8), the high number of scales in *Potamorhina* on the one hand and *Cyphocharax abramoides* on the other is evidently homoplastic. This hypothesis was reinforced by the phylogenetic hypothesis for curimatids proposed by Vari (1989a) under which *Potamorhina* and *Cyphocharax* are widely separated lineages of the family distinguished by differences in numerous derived features. Thus the small scales of *C. abramoides* are considered an autapomorphy for the species homoplastically present in the species of *Potamorhina*.

REMARKS.—Soon after *Curimatus abramoides* was described by Kner (1859a:142), that species was placed by Günther (1864:293) as a synonym of *Charax planirostris* Gray (1854), a species based on *Charax* 378 of Gronovius (1763:123). Günther did not detail the basis for his synonymization of *Curimatus abramoides* and as discussed by Vari (1984a:13–16) that synonymy is apparently invalid. *Charax planirostris* is rather a synonym of *Salmo* (= *Curimata*) *cyprinoides* Linnaeus (Vari, 1989c:39–40), a species with only 46 to 56 lateral-line scales to the hypural joint.

The confusion resulting from Günther's incorrect synonymization of *Curimatus abramoides* into *Charax planirostris* was compounded by the fact that his 1864 redescription of *Curimatus planirostris* was based largely on characters reported by Kner (1859a) for *C. abramoides*, a species that differs in multiple features. Günther's action was not reviewed for 120 years, with the result that the majority of references to *Curimatus planirostris* in various genera (see synonymy) have actually referred to specimens of *Cyphocharax abramoides*.

Eigenmann and Eigenmann (1889:431) proposed the subgenus *Semitapicis* for a group of three species with very high lateral-line scale counts relative to most curimatids. Eigenmann (1910:422), in turn, designated *Charax planirostris* Gray as the type species for *Semitapicis* which he recognized as a genus rather than subgenus. The erroneous application of the characters of *Curimatus abramoides* to the morphologically very different *Charax planirostris* by authors commencing with Günther (1864) (see preceding paragraph) lead to the incorrect association of *Charax planirostris* with several species that Vari (1984a) assigned to the curimatid genus *Potamorhina*. Vari (1989a) advanced a phylogenetic hypothesis demonstrating that the similarities of *Cyphocharax abramoides* and the species of *Potamorhina* are homoplastic within the Curimatidae.

MATERIAL EXAMINED.—1081 specimens (56, 55.3–212.8).

BRAZIL. *Pará*: Óbidos, MCZ 20202, 2 (110.0–138.3). Rio Tapajós, Itaituba, USNM 267950, 10 (8, 88.4–96.3). Rio Tapajós, Ilha Tapaiuna, MZUSP 21345, 1. Rio Tapajós, between Itaituba and São Luís, MZUSP 32259, 82. Rio

Tapajós, São Luís, MZUSP 22104, 7. Belém, MZUSP 3580, 5. Rio Trombetas, Cuminá, USNM 267951, 20; MZUSP 32261, 836 (15, 90.7–143.6). Rio Trombetas, 20 km from mouth, MZUSP 32260, 12. Lago Jacupá, Oriximiná, MZUSP 5513, 1. Lago Parauacui, Oriximiná, MZUSP 5565, 1. Rio Xingu, Belo Monte, USNM 267952, 5 (124.2–135.5). Santarém, NMW 66904, 1 (122.0); MNHN 09-58-60, 3 (102.7–126.5); NMW 66905, 1. *Amazonas*: Mouth of Rio Negro, NMW 67402, 1 (133.0, holotype of *Curimatus abramoides*). Vicinity of Manaus, MZUSP 6686, 9; GC, 1 (140.1). Lower Rio Negro, USNM 229206, 1. Rio Negro, Barcelos, USNM 242137, 4; USNM 289298, 4 (68.8–81.3). Rio Negro, Ilha de Tamaquaré, USNM 242138, 1 (212.8); USNM 289297, 10 (3, 55.3–58.3). Rio Negro, above mouth of Rio Urubaxi, Lago Central of Ilha de Buiú-Açu, USNM 289299, 2 (67.3–69.3). Rio Negro, Paraná de Jacaré, USNM 289295, 1 (116.1); USNM 242139, 1. Rio Negro, Urumari, USNM 242140, 1 (156.3). Rio Negro, Anavilhanas, USNM 267953, 3 (1 specimen cleared and counterstained for cartilage and bone). Rio Negro, Arirará, USNM 289300, 1 (81.1). Rio Negro, Mandiquié, USNM 242135, 3 (156.0–174.1). Rio Urubaxi, near mouth, USNM 289451, 1 (73.7). Rio Negro, Bucury (= Bucuri), CAS 41732, 1 (77.9). Rio Canumã, MZUSP 7046, 10. Lagoa Central between Rio Camaráu and Rio Apaú, MZUSP 21059, 2. Rio Purus, NMW 66906, 1.

VENEZUELA. *Territorio Federal Amazonas*: Río Negro at mouth of Río Casiquiare, USNM 289296, 2 (67.0–76.2). Caño Momoni, tributary of Río Casiquiare, MBUCV V-6026, 1. Caño Amanamo, tributary of Río Negro, about 45 km upstream of San Carlos de Río Negro, MBUCV V-11279, 17. Río Negro, about 7 km upstream of San Carlos de Río Negro, MBUCV V-11283, 4. Laguna Titi, San Fernando de Atabapo, MBUCV V-8533, 4. Laguna El Loro, along Río Atabapo, 1 km from San Fernando de Atabapo, MBUCV V-7886, 3.

COLOMBIA. *Guainia*: Río Guaviare, Cuayare, NRM 26202, 5.

Cyphocharax stilbolepis, new species

FIGURES 4, 5

DIAGNOSIS.—The 54 to 62 scales in the lateral line to the hypural joint, $10\frac{1}{2}$ to $11\frac{1}{2}$ scales in a transverse series from the lateral line to the origin of the dorsal fin, and $8\frac{1}{2}$ to $9\frac{1}{2}$ scales from the lateral line to the origin of the anal fin discriminate *Cyphocharax stilbolepis* from the vast majority of *Cyphocharax* species that have 45 or fewer lateral-line scales and 9 or fewer scales above and $7\frac{1}{2}$ or fewer scales below the lateral line, and from *C. abramoides* which has 77 to 97 lateral-line scales, and 24 to 30 scales above and 20 to 25 scales below the lateral line. The counts of scales in transverse series above and below the lateral line in *C. stilbolepis* are similar to those of *C. platanus*, but the species differ in the number of lateral-line scales (54 to 62 in *stilbolepis* versus 48 to 54 in

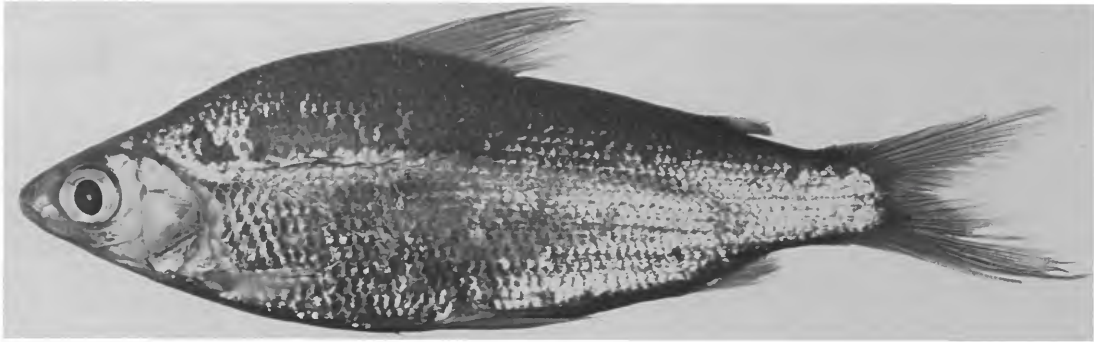


FIGURE 5.—*Cyphocharax stilbolepis*, new species, holotype, MZUSP 41759, 104.5 mm SL; Brazil, Pará, Rio Xingu, Belo Monte, at bottom of rapids.

platanus), relative width of the orbit (0.31–0.34 of HL versus 0.25–0.29 respectively), relative distance from tip of snout to origin of anal fin (0.83–0.88 versus 0.78–0.83), number of vertebrae (32 versus 33 to 35), and in the presence of a dark spot at the base of the middle rays of the caudal fin in *C. platanus* that is lacking in *C. stilbolepis*.

DESCRIPTION.—Body relatively elongate, compressed laterally, more so in smaller specimens. Dorsal profile of head slightly convex anteriorly from tip of upper lip to vertical line through posterior nostril, straight from that line to tip of supraoccipital spine. Dorsal profile of body slightly convex from tip of supraoccipital spine to origin of dorsal fin; straight and slightly posteroventrally slanted at base of dorsal fin, straight from base of last dorsal fin ray to caudal peduncle. Dorsal surface of body with median keel from tip of supraoccipital spine to origin of 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 irregular longitudinal series of scales. Obtuse median keel posterior to origin of pelvic fin. 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 0.34–0.37 [0.37]; snout tip to origin of dorsal fin 0.46–0.50 [0.50]; snout tip to origin of anal fin 0.83–0.88 [0.84]; snout tip to origin of pelvic fin 0.52–0.54 [0.54]; snout tip to anus 0.76–0.80 [0.78]; origin of dorsal fin to hypural joint 0.57–0.60 [0.58]. Dorsal fin pointed in profile distally; last unbranched and first two branched rays approximately two and one-half to three times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.16–0.20 [0.18], extends about one-half distance to vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally, length of pelvic fin 0.19–0.24 [0.21], reaching one-half to two-thirds distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays two and one-half to three times length of ultimate ray. Least depth of caudal peduncle 0.12–0.13 [0.12].

Head distinctly pointed in profile, head length 0.25–0.28 [0.27]; upper jaw longer than lower, mouth subterminal; snout length 0.28–0.32 [0.28]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.31–0.34 [0.31]; adipose eyelid present, more developed in larger specimens, particularly anterior to orbit, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.38–0.43 [0.43]; gape width 0.24–0.28 [0.26]; interorbital width 0.40–0.44 [0.42].

Pored lateral-line scales from supracleithrum to hypural joint 54 to 62 [56]; all scales of lateral line pored, canals in lateral-line scales straight; 5 to 7 series of pored scales extend beyond hypural joint onto caudal-fin base; 10¹/₂ to 11¹/₂ [11¹/₂] scales in transverse series from origin of dorsal fin to lateral line; 8¹/₂ to 9¹/₂ [9¹/₂] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or iii,9 (when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or iii,7 (when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 15 to 17 [17]; pelvic-fin rays i,8 or 9 (i,9 rare) [i,8].

Total vertebrae 32 (17).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery, darker on dorsal portions of head and body. Specimens lacking guanine on scales tan to light brown, dusky on dorsal surface of head and on dorsolateral and dorsal surfaces of body above lateral line. Obscure dusky midlateral stripe extending from supracleithrum to caudal peduncle, stripe more obvious posteriorly, but not forming distinct spot on caudal peduncle. Anterior border and distal margin of dorsal fin dark, remainder of fin dusky. Caudal-fin rays outlined by small chromatophores on membranes. Adipose fin dusky. Anal and paired fins hyaline.

DISTRIBUTION.—Rio Tocantins and Rio Xingu basins (Figure 4).

ETYMOLOGY.—The specific name, *stilbolepis*, from the Latin for shining and scales, refers to the bright silvery coloration of the species.

TYPE MATERIAL EXAMINED.—11 specimens (11, 78.9–107.8).

HOLOTYPE.—BRAZIL. *Pará*: Rio Xingu, Belo Monte, at bottom of rapids (approx. 3°10'S, 5°50'W), collected by M. Goulding, 20 Sep 1983, MZUSP 41759, 1 (104.5).

PARATYPES.—BRAZIL. *Pará*: Rio Xingu, Belo Monte, at bottom of rapids (approx. 3°10'S, 5°50'W), collected by M. Goulding, 20 Sep 1983; 10 specimens collected with holotype: USNM 268057, 5 (78.9–107.8; 1 specimen cleared and stained for cartilage and bone); MZUSP 41760, 5 (79.3–104.5).

NON-TYPE MATERIAL EXAMINED.—13 specimens (13, 70.7–122.4).

BRAZIL. *Pará*: Rio Tocantins, Tucuruí, USNM 267985, 1 (107.7). Igarapé Muru, Rio Tocantins, below Tucuruí, MZUSP 21283, 5 (70.7–89.7). Rio Tocantins, Icangui, INPA Toc 524, 6 (100.9–122.4). *Goiás*: Rio Araguaia, Aruanã, MZUSP 4849, 1 (90.4).

Cyphocharax platanus (Günther)

FIGURES 6, 7

Curimatus platanus Günther, 1880:12 [type locality: Rio de La Plata].—Eigenmann and Eigenmann, 1889:426 [reference]; 1891:47 [reference].—Eigenmann, 1907:451 [Argentina: Buenos Aires].—Eigenmann and Ogle, 1907:3 [Paraguay].—Eigenmann, 1910:422 [reference].—Marelli, 1923:557 [Argentina: lower Río Paraná and Río de La Plata systems].—Fowler, 1926:261 [Río de La Plata].—Devincenzi and Teague, 1942:59 [Uruguay].—Pozzi, 1945:271 [Río de La Plata].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Curimata platana.—Fowler, 1943:312 [Rio Paraguay, Paysandu]; 1950:290 [literature compilation].—Nani, 1948:57, fig. 9 [redescription, discussion of parasites; Argentina: Rosario, Río Paraná; Concepción del Uruguay, Río Uruguay].—de Buen, 1949:85 [Uruguay].—Ringuelet and Aramburu, 1961:36 [Argentina].—Bertoletti, 1986:275 [Brazil: Rio Grande do Sul, Rio Uruguai basin].—Géry et al., 1987:415 [Paraguay: Río Paraná at Puerto Carlo Lopez and Campichuela; Argentina: Misiones, Río Paraná, Buenos Aires Province, Río de La Plata].

Curimatorbis platanus.—Fernández-Yépez, 1948:43 [assignment to *Curimatorbis*].—Ringuelet et al., 1967:194 [Río Paraná, Río Uruguay, Río de La Plata, Río Paraguay].—Bonetto, Cardiviola de Yuan, Pignalberi, and Oliveros, 1969:213 [Argentina: Río Paraná; not seen].—Bonetto, Cardiviola de Yuan, and Pignalberi, 1970:141 [middle Río Paraná; not seen].—Bonetto, Cardiviola de Yuan, Pignalberi, and Oliveros, 1970:135 [Argentina: middle Río Paraná; not seen].—Fowler, 1975:371 [reference].—Ringuelet, 1975:61, 65 [Río de La Plata, Río Paraná, Río Paraguay, Río Uruguay].—Miquelarena, 1984:618, fig. 49 [caudal skeleton].—Cardiviola de Yuan and Pignalberi de Hassan, 1985:215 [Argentina: lower Río Paraná, Diamante and San Pedro areas].—Pignalberi de Hassan and Cardiviola de Yuan, 1985:21 [Argentina: middle Río Paraná, Corrientes and Santa Fe areas].—Lopez et al., 1987:19 [Argentina].—Pignalberi de Hassan and Cardiviola de Yuan, 1988:172 [Argentina: Formosa region, Oca Lagoon, number of specimens and biomass].

Curimatorbis platanum.—Lopez et al., 1984:74 [Argentina; Río Uruguay].

Cyphocharax platanus.—Bertoletti et al., 1990:40, 45, 52, 55, 58, 63, figs. 12, 13 [Brazil: Rio Grande do Sul, Rio Uruguay basin, foz do Rio Ijuí, Rio Ijuí-Mirim, Santo Izidro; common name]

DIAGNOSIS.—The 48 to 54 scales along the lateral line to the hypural joint, 10¹/₂ to 13 scales in a transverse series from the lateral line to the origin of the dorsal fin, and 8 to 10 scales from the lateral line to the origin of the anal fin discriminate

Cyphocharax platanus from the vast majority of members of the genus, all of which have 45 or fewer lateral-line scales, and 9 or fewer scales above and 7¹/₂ or fewer scales below the lateral line, and from *C. abramoides* that has 77 to 97 lateral-line scales, and 24 to 30 scales above and 20 to 25 scales below the lateral line. The counts of scales in transverse series above and below the lateral line in *C. platanus* are similar to those of *C. stilbolepis*, but the species differ in number of lateral-line scales (48 to 54 in *platanus* versus 54 to 62 in *stilbolepis*), relative width of the orbit (0.25–0.29 of HL versus 0.31–0.34, respectively), relative distance from tip of snout to origin of anal fin (0.78–0.83 of SL versus 0.83–0.88), number of vertebrae (33 to 35 versus 32), and in the presence of a dark spot at the base of the middle rays of the caudal fin in *C. platanus* that is lacking in *C. stilbolepis*.

DESCRIPTION.—Body moderately elongate, laterally compressed, more so in specimens over 40 mm SL. Dorsal profile of head convex from upper lip to vertical line through posterior nostril, straight or very slightly concave 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 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 indistinctly flattened, scales not enlarged relative to those on adjoining portions of body. Obtuse median keel posterior to origin of pelvic fin.

Greatest body depth at origin of dorsal fin, depth 0.31–0.37 [0.33]; snout tip to origin of dorsal fin 0.46–0.50 [0.46]; snout tip to origin of anal fin 0.78–0.83 [0.81]; snout tip to origin of pelvic fin 0.53–0.57 [0.53]; snout tip to anus 0.76–0.78 [0.76]; origin of dorsal fin to hypural joint 0.56–0.59 [0.59]. Dorsal fin pointed in profile, more rounded in larger specimens; last unbranched and first branched dorsal-fin rays approximately two and one-half times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.16–0.19 [0.16], tip of fin extends slightly beyond point three-quarters of distance to vertical line through origin of pelvic fin. Pelvic fin margin pointed in profile distally; length of pelvic fin 0.18–0.21 [0.19], reaches approximately three-quarters of distance to origin of anal fin in young adults, only slightly over one-half of distance in larger specimens. Caudal fin forked. Adipose fin well developed. Anal fin distinctly emarginate, anteriormost branched rays two and one-half to three times length of ultimate ray. Least depth of caudal peduncle 0.12–0.13 [0.13].

Head profile somewhat rounded anteriorly, distinctly pointed overall, head length 0.27–0.30 [0.27]; upper jaw longer than lower, mouth subterminal; snout length 0.27–0.32 [0.31]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.25–0.29 [0.27]; adipose eyelid moderately developed, with broad, vertically ovoid

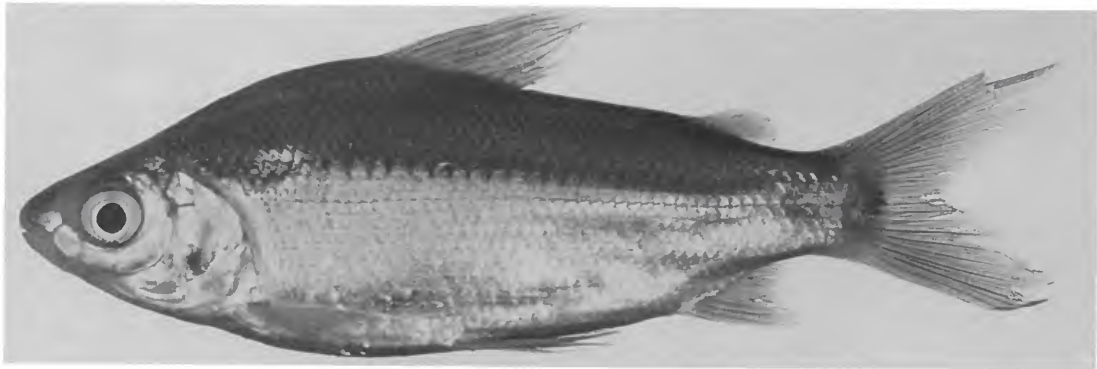


FIGURE 6.—*Cyphocharax platanus*, MCP 9370, 98.7 mm SL; Brazil, Rio Grande do Sul, Rio Ibicuí, between São Rafael and Cacequi.

opening over center of eye; length of postorbital portion of head 0.42–0.46 [0.43]; gape width 0.24–0.28 [0.24]; interorbital width 0.41–0.45 [0.44].

Pored lateral-line scales from supracleithrum to hypural joint 48 to 54 [51]; all scales of lateral line pored, canals in lateral-line scales straight; 3 to 5 series of pored scales extend beyond hypural joint onto caudal-fin base; $10\frac{1}{2}$ to 13 [11] scales in transverse series from origin of dorsal fin to lateral line; 8 to 10 [8] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or iii,9 (when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or iii,7 (when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 16 [14]; pelvic-fin rays i,8 [i,8].

Total vertebrae 33 (1), 34 (23), 35 (1).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery or silvery-golden, darker on dorsal portions of head and body. Specimens lacking guanine on scales tan, darker dorsally. No pronounced pigmentation pattern on head or body. Horizontally elongate patch of dark chromatophores extends along midlateral surface of posterior portion of caudal peduncle and anterior section of bases of middle caudal-fin rays. Chromatophore patch extending six to eight scales horizontally and one and one-half to two scales vertically. Caudal-fin rays outlined by series of small, dark chromatophores. Other fins hyaline.

DISTRIBUTION.—Río de La Plata basin other than for upper Río Paraná above Sete Quedas Falls (Figure 7).

COMMON NAME.—Brazil, Rio Grande do Sul: birú (Bertoletti et al., 1990:40).

REMARKS.—Günther (1880:12) based *Curimatus platanus* on two specimens from an unspecified locality in the “Río de La Plata” (Figure 7, locality 4). The larger of the syntypes, which is also in the best overall condition (BMNH 1878.5.16:59), is designated as the lectotype. The second syntype (BMNH 1878.5.16:60) becomes a paralectotype.

In his description of *Curimatus platanus*, Günther (1880:12) noted that his species was “allied to *Curimatus Alberti*, but with

considerably smaller scales.” As noted under “Remarks” for *Cyphocharax gilbert*, there is no other known citation to the species name *Alberti* within the Curimatidae other than for the reference to the Günther citation by Eigenmann and Eigenmann (1889). *Curimatus Alberti* is consequently considered a lapsus for *Curimatus gilbert*.

MATERIAL EXAMINED.—61 specimens (36, 63.3–133.7).

ARGENTINA. Río de La Plata, BMNH 1878.5.16:59, 1 (114.2, lectotype of *Curimatus platanus* Günther); BMNH 1878.5.16:60, 1 (111.7, paralectotype of *Curimatus platanus* Günther). Buenos Aires: Río de La Plata, Buenos Aires, ANSP 104624, 1 (114.7); GC, 1. Río Lujan at Escobar, GC, 1. Buenos Aires, USNM 176031, 3; NMW 67043, 2. Río Paraná, San Pedro, AMNH 12253, 2 (122.3–126.8). Misiones: Río Paraná, GC, 1. Formosa: Río Paraguay, BMNH 1971.2.12:3–16, 4 (63.3–75.6). Entre Ríos: Río Paraná, MZUSP 1705, 1. Santa Fe: Rosario, MCZ 790, 1.

URUGUAY. No exact locality, NMW 67033a, 6. Paysandú: Río Uruguay, Paysandu, ANSP 54101, 1 (86.0); MZUSP 21376, 1.

BRAZIL. Rio Grande do Sul: Rio Ibicuí, between São Rafael and Cacequi, MCP 9370, 5 (83.0–99.1). Rio Ibicuí, near mouth, Município de Itaqui, USNM 295976, 1 (133.7); MCP uncat., 1 (99.4); MZUSP 39784, 1 (117.4). Rio Uruguai, Itaqui, USNM 295979, 1 (125.0); MZUSP 1735, 3; MZUSP 1431, 2. Rio Uruguai, USNM 295977, 5 (83.1–90.9; 1 specimen cleared and counterstained for cartilage and bone). Itaqui, MZUSP 1735, 3.

PARAGUAY. No exact locality, USNM 55661, 1 (110.6). Central: Asunción Bay, USNM 295978, 1 (114.0).

Cyphocharax nagelii (Steindachner)

FIGURES 7, 8

Curimatus Nagelii Steindachner, 1881:98 [type locality: “vicinity of Rio [de] Janeiro”]; 1882:11 [“vicinity of Rio [de] Janeiro,” based on Steindachner, 1881 publication].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*]. *Curimatus nagelii*.—Eigenmann and Eigenmann, 1889:425 [citation]; 1891:47 [reference].—Eigenmann, 1910:421 [reference].

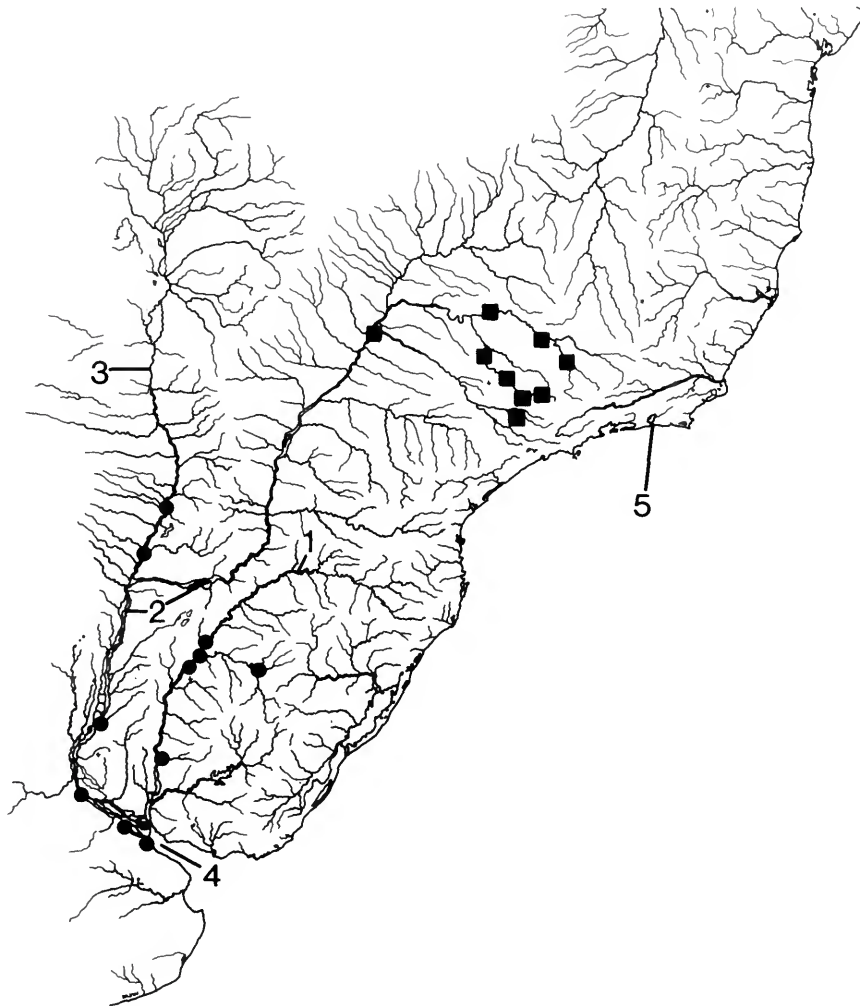


FIGURE 7.— Map of southeastern Brazil, Uruguay, and adjoining regions of Argentina showing geographic distribution of *Cyphocharax platanus* (filled in circles; type locality "Rio de La Plata" inexact) and *Cyphocharax nagelii* (squares; stated type locality "vicinity of Rio [de] Janeiro" questionable, see "Remarks" under that species; 1 = Rio Uruguay; 2 = Rio Paraná; 3 = Rio Paraguay; 4 = Rio de La Plata; 5 = Rio de Janeiro) (some symbols represent more than one locality or lot of specimens).

Curimatus elegans.—Amaral Campos, 1945:460 [Brazil: São Paulo, Rio Mogi-Guaçu].

Curimatus plumbeus? Amaral Campos, 1945:461 [Brazil: São Paulo, Rio Mogi-Guaçu; not *C. plumbeus*, probably *C. nagelii*].

Bondia nageli.—Femández-Yépez, 1948:67 [assignment to *Bondia*].

Curimata nagelii.—Fowler, 1950:288 [literature compilation].

Curimata plumbea.—Gomes and Monteiro, 1955:89 [Brazil: São Paulo, Pirassununga].

Curimatus cf. *platanus*.—Foresti et al., 1974:249 [Brazil: São Paulo, Rio Mogi-Guaçu; karyotype].—Oliveira et al., 1988:594 [Brazil: São Paulo, Botucatu; karyotype].

Pseudocurimata plumbea.—de Godoy, 1975:594, fig. 133 [Brazil: Rio Mogi Guassu (= Mogi-Guaçu); life history].

DIAGNOSIS.—The 39 to 45 scales in the lateral line to the

hypural joint discriminate *Cyphocharax nagelii* from *C. abramoides*, *C. stilbolepis*, and *C. platanus*, that have 48 or more scales in that series, and from all other species of *Cyphocharax*, with the exception of *C. leucostictus*, that have 38 or fewer lateral-line scales. The dark, midlateral stripe on the caudal peduncle of *C. nagelii* distinguishes it from *C. leucostictus* that lacks that pigmentation pattern. The two species also differ in the relative length of the pelvic fin (0.17–0.20 of SL in *nagelii* versus 0.21–0.25 in *leucostictus*), relative orbital diameter (0.25–0.30 versus 0.30–0.36), number of vertebrae (34 versus 31 to 33), and less discretely in the number of scales in a transverse series from the lateral line to the origin of the dorsal fin ($7\frac{1}{2}$ to 9 versus $6\frac{1}{2}$ to $7\frac{1}{2}$).

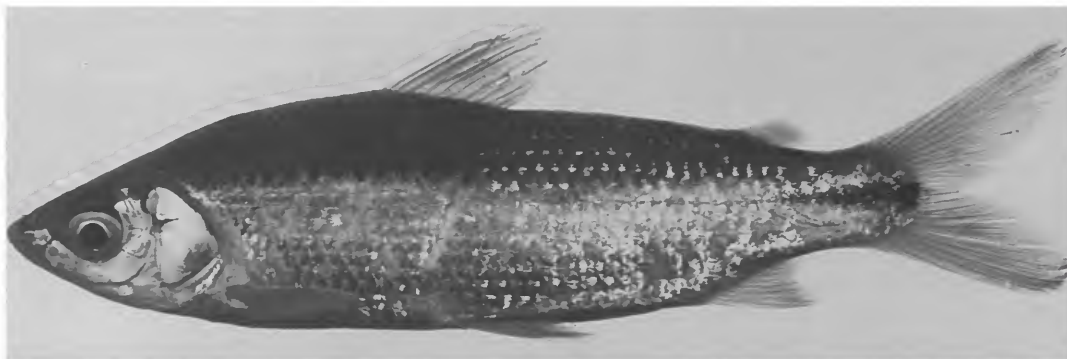


FIGURE 8.—*Cyphocharax nagelii*, USNM 295975, 107.8 mm SL; Brazil, São Paulo, Rio Mogi-Guaçu, Piraçununga.

DESCRIPTION.—Body elongate, laterally compressed, more so in larger specimens. Dorsal profile of head somewhat rounded from upper jaw to vertical line through posterior nostril, straight or very 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 slightly posteroventrally slanted at base of dorsal fin, straight or very 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 very obtusely flattened, scales not enlarged relative to those on adjoining portions of body. Obtuse median keel posterior to pelvic fin insertion.

Greatest body depth at origin of dorsal fin, depth 0.29–0.33 [0.33]; snout tip to origin of dorsal fin 0.46–0.50 [0.47]; snout tip to origin of anal fin 0.80–0.84 [0.82]; snout tip to insertion of pelvic fin 0.52–0.56 [0.55]; snout tip to anus 0.75–0.79 [0.77]; origin of dorsal fin to hypural joint 0.55–0.60 [0.56]. Dorsal fin obtusely pointed in profile distally; last unbranched and first branched rays approximately three times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.15–0.18 [0.18], extends about one-half to two-thirds distance to vertical line through insertion of pelvic fin, relatively shorter in larger specimens. Pelvic fin pointed in profile distally; length of pelvic fin 0.17–0.20 [0.18], reaches about one-half to two-thirds distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays twice length of ultimate ray. Least depth of caudal peduncle 0.12–0.13 [0.12].

Head distinctly pointed in profile overall, snout somewhat rounded, head length 0.27–0.30 [0.28]; upper jaw longer than lower, mouth subterminal; snout length 0.29–0.32 [0.29]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.25–0.30 [0.29]; adipose eyelid present, with vertically ovoid opening over center of eye;

length of postorbital portion of head 0.43–0.46 [0.45]; gape width 0.22–0.25 [0.22]; interorbital width 0.36–0.39 [0.37].

Pored lateral-line scales from supracleithrum to hypural joint 39 to 45 [41]; all scales of lateral line pored, canals in lateral-line scales straight; 4 to 6 series of pored scales extend beyond hypural joint onto caudal-fin base; $7\frac{1}{2}$ to 9 [$8\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; $6\frac{1}{2}$ to $7\frac{1}{2}$ [7] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or 10, or iii,9 [ii,9] (when three unbranched rays present, first very short); anal-fin rays ii,7 or 8 or iii,7 [ii,7] (when three unbranched rays present, first very short); pectoral-fin rays 13 to 15 [14]; pelvic-fin rays i,8 or 9 [i,8].

Total vertebrae 34 (18).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales golden or silvery-golden, darker on dorsal portions of head and body. Ground coloration of specimens lacking guanine on scales tan. No pronounced pigmentation pattern on head or body. Horizontally elongate patch of dark chromatophores extends along midlateral surface of caudal peduncle and onto anterior portions of bases of middle rays of caudal fin; pigmentation most pronounced posteriorly. Chromatophore patch extending eight to ten scales horizontally and two scales vertically. Caudal-fin rays outlined by series of small, dark chromatophores; pattern most pronounced on middle rays. Other fins hyaline.

DISTRIBUTION.—Upper Rio Paraná system above Sete Quedas Falls (Figure 7).

ECOLOGY.—de Godoy (1975:596–597) noted that *Cyphocharax nagelii* (identified in his paper as *Pseudocurimata plumbea*) engaged in large-scale seasonal migrations in the Rio Mogi Guassu (= Mogi-Guaçu), a tributary of the upper Rio Paraná. Juveniles up to 40 to 50 days in age were reported to be zooplanktivores and larger individuals were detritivores.

KARYOTYPE.—According to Foresti et al. (1974:249) followed by Oliveira et al. (1988:594) this species (listed by those authors as *Curimatus cf. platanus*) has a $2n = 54$ chromosome

count with a fundamental number of 108. There was no evidence of chromosomal heteromorphism in the species.

REMARKS.—In his original description of this species, Steindachner (1881:98) provided only an imprecise type-locality of “vicinity of Rio [de] Janeiro” [my translation]. *Cyphocharax nagelii* is, however, not known from rivers of the state of Rio de Janeiro although occurring in the neighboring states of Minas Gerais and São Paulo (Figure 7). Perhaps the cited locality actually represents the port of export of the specimens or Steindachner used the term “vicinity” in a very broad sense.

In his discussion of the life history of this species, de Godoy (1975) identified it as *Pseudocurimata plumbea*. His identification follows those of Amaral Campos (1945:461) and Gomes and Monteiro (1955:89) who cited *Curimatus plumbeus* Eigenmann and Eigenmann, in *Curimatus* and *Curimata*, respectively, from the upper Rio Paraná basin. As discussed by Vari (1989b), *Pseudocurimata* is properly applied to a group of species endemic to various drainage systems of the Pacific versant of the Andes. Although also placed in *Cyphocharax* in this study, *Curimatus plumbeus* described from the Rio Amazonas basin, differs from *Cyphocharax nagelii* in numerous meristic and morphometric features along with details of pigmentation (see “Key to the Species of *Cyphocharax*” and compare figures of the species).

The specimens listed by Amaral Campos (1945) as the basis for the citation of *Curimatus plumbeus* from the Rio Mogi-Guaçu (MZUSP 3463) were not located in that museum, but as noted in the preceding paragraph the record may be a misidentification of *Cyphocharax nagelii*. The record by Amaral Campos (1945) of *Curimatus elegans* from the same locality was based on a series of six specimens (MZUSP 6462). The three specimens remaining in that lot at this time are, however, *Cyphocharax nagelii*.

MATERIAL EXAMINED.—386 specimens (56, 87.0–163.0).

BRAZIL. “Vicinity of [de] Rio Janeiro,” NMW 68,808, 1 (110.0, holotype of *Curimatus Nagelii*). São Paulo: Rio Mogi Guassu (= Mogi-Guaçu), BMNH 1946.12.23:97–111, 6 (92.3–109.8); AMNH 12261, 1 (131.5). Rio Mogi-Guaçu basin, Luis Antonio, Lagoa do Mato, MZUSP 38560, 5. Rio Mogi Guassu (= Mogi-Guaçu), Emas, MNRJ 5078, 74 (10, 90.2–114.0); MZUSP 25343, 28 (18, 87.0–128.2); MZUSP 20734, 8 (5, 118.7–129.1); MZUSP 20738, 1; MZUSP 20796, 2; MZUSP 20702, 1; MZUSP 3462, 3; MZUSP 20703, 1; MZUSP 20706, 4; MZUSP 20671, 18; MZUSP 20752, 40; USNM 295974, 10 (1 specimen cleared and counterstained for cartilage and bone); MNRJ 5077, 88. Pirassununga (= Piraçununga), MZUSP 3495, 1. Rio Mogi Guassu (= Mogi-Guaçu), above mouth of Rio Jaguari, MZUSP 20859, 1. Rio Mogi-Guaçu, Cachoeira de Emas, MZUSP 20671, 18. Rio Mogi Guassu (= Mogi-Guaçu), Pirassununga (= Piraçununga), USNM 295973, 12; USNM 295975, 17. Pirassununga (= Piraçununga), Cachoeira de Emas, USNM 295972, 2; MZUSP 20692, 10 (5, 88.8–125.2). Piracicaba, NMW 68809, 1; MZUSP 322, 1. Rio Grande, Represa de Volta Grande,

Miquelópolis, MZUSP 21514, 6 (3, 136.0–145.6). Rio Paraná, Ilha Solteira, MZUSP 20873, 6; MZUSP 21428, 7. Minas Gerais: Rio Grande, Represa de Furnas, Município Alfenas, MZUSP 37933, 2 (130.0–163.0). Rio Grande, Usina Peixoto, MZUSP 21524, 1. Mato Grosso: Rio Paraná opposite Jupia, MZUSP 20682, 7 (5, 102.2–122.2); MZUSP 20715, 2; MZUSP 4031, 1.

Cyphocharax leucostictus (Eigenmann and Eigenmann)

FIGURES 9–11; TABLE 2

- Curimatus leucostictus* Eigenmann and Eigenmann, 1889:425 [type-locality: Brazil: Rio Negro and Lago Alexo (= Lago do Aleixo, on Rio Negro): 1891:47 [reference].—Eigenmann, 1910:422 [reference].—Starks, 1913:13 [Brazil: Rio Madeira].
- Curimatus (Curimatella) xinguensis* Steindachner, 1908:167 [type-locality: Brazil: Rio Xingu]. [New synonymy.]
- Curimatella xinguensis*.—Eigenmann, 1910:420 [reference].—Fernández-Yépez, 1948:25 [reference].—Fowler, 1950:298 [literature compilation]; 1975:364 [reference].
- Bondia leucosticta*.—Fernández-Yépez, 1948:67 [reference].—Fowler, 1975:365 [reference].
- Curimata leucosticta*.—Fowler, 1950:286 [literature compilation].

DIAGNOSIS.—The 39 to 45 scales in the lateral line to the hypural joint discriminates *Cyphocharax leucostictus* from *C. abramoides*, *C. stilbolepis*, and *C. platanus*, that have 48 or more scales in that series, and from all other species of *Cyphocharax*, with the exception of *C. nagelii* that have 38 or fewer lateral-line scales. The lack of a dark, midlateral stripe on the caudal peduncle of *C. leucostictus* distinguishes it from *C. nagelii* in which that pigmentation pattern is present. The two species also differ in the relative length of the pelvic fin (0.21–0.25 of SL in *leucostictus* versus 0.17–0.20 in *nagelii*), relative orbital diameter (0.30–0.36 of HL versus 0.25–0.30), number of vertebrae (31 to 33 versus 34) and less discretely in number of scales in a transverse series to the origin of the dorsal fin ($6\frac{1}{2}$ to $7\frac{1}{2}$ versus $7\frac{1}{2}$ to 9).

DESCRIPTION.—Body moderately elongate, laterally compressed. Dorsal profile of head slightly convex anteriorly, straight from vertical line through posterior nostril to tip of supraoccipital spine. Dorsal profile of body slightly convex from tip of supraoccipital spine to origin of dorsal fin; straight and slightly posteroventrally slanted at base of dorsal fin, straight from base of last dorsal-fin ray to caudal peduncle in smaller specimens, slightly convex in adults. Dorsal surface of body with 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 of body transversely flattened, with median series of scales that are slightly enlarged relative to those of adjoining portions of body. Median prepelvic scale series flanked on each side by longitudinal series of scales that conform to lateral angles of body wall. Obtuse median keel present posterior to pelvic fin insertion. Secondary 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 0.31–0.38

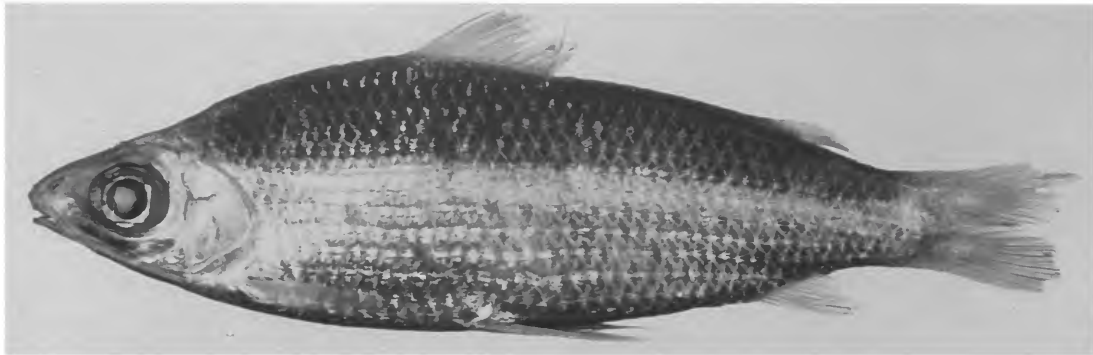


FIGURE 9.—*Cyphocharax leucostictus*, lectotype of *Curimatus leucostictus*, MCZ 787, 103.5 mm SL; Brazil, Amazonas, Rio Negro.



FIGURE 10.—*Cyphocharax leucostictus*, USNM 268020, 75.0 mm SL; Brazil, Amazonas, Rio Negro, Anavilhanas, beach on Lago do Prato.

(see also under "Geographic Variation" below with respect to differences in this feature in various population samples) [0.33]; snout tip to origin of dorsal fin 0.46–0.49 [0.46]; snout tip to origin of anal fin 0.80–0.85 [0.84]; snout tip to insertion of pelvic fin 0.51–0.55 [0.54]; snout tip to anus 0.72–0.78 [0.76]; origin of dorsal fin to hypural joint 0.56–0.61 [0.61]. Dorsal fin pointed in profile distally; last unbranched and first branched rays three to three and one-half times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.16–0.20 [0.17], extends one-half to two-thirds distance to vertical line through insertion of pelvic fin. Pelvic fin pointed in profile distally, length of pelvic fin 0.21–0.25 [0.21], reaches two-thirds distance to origin of anal fin. Caudal fin forked. Lobes of caudal fin with adherent scales extending at a maximum over basal one-third of fin; scales on caudal fin approximately of same size as those on posterior portion of caudal peduncle. Adipose fin well developed. Border of anal fin emarginate, anterior branched rays about three times length of ultimate ray. Least depth of caudal peduncle 0.10–0.12 [0.11].

Head distinctly pointed in profile anteriorly, head length 0.27–0.31 [0.27]; upper jaw longer than lower, mouth subterminal; snout length 0.26–0.31 [0.31]; nares of each side

very close, anterior circular, posterior crescent shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.30–0.36 [0.34]; adipose eyelid present, more developed anteriorly, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.35–0.40 [0.39]; gape width 0.23–0.28 [0.26]; interorbital width 0.37–0.42 [0.40].

Pored lateral-line scales from supracleithrum to hypural joint 39 to 45 (see also under "Geographic Variation" with respect to differences in different populations) [45]; all scales of lateral line pored, canals in scales straight; 3 to 6 series of pored scales extend beyond hypural joint onto caudal-fin base; $6\frac{1}{2}$ to $7\frac{1}{2}$ [7] scales in transverse series from origin of dorsal fin to lateral line; 5 to $6\frac{1}{2}$ [5] scales in transverse series from lateral line to origin of anal fin. Scales on body continue onto caudal fin as a sheet which extend a maximum over basal one-third of middle rays of each lobe of fin; scales on caudal fin approximately same size as those on posterior portions of caudal peduncle.

Dorsal-fin rays ii,9 [ii,9]; anal-fin rays ii,7 [ii,7]; pectoral-fin rays 15 to 17 [16]; pelvic-fin rays i,8 [i,8].

Total vertebrae 31 (2), 32 (48), 33 (2).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery or silvery-golden, darker on

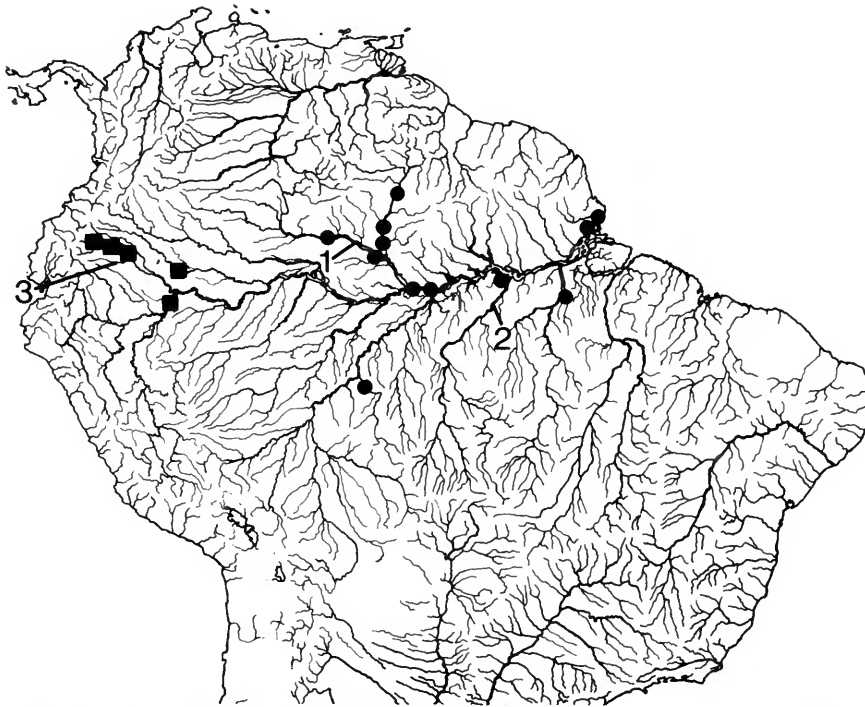


FIGURE 11.—Map of central and northern South America showing geographic distribution of *Cyphocharax leucostictus* (filled in circles; 1 = Rio Negro, type locality of *Curimatus leucostictus*; 2 = Rio Xingu, type locality of *Curimatus (Curimatella) xinguensis*), and *Cyphocharax pantostictos* (squares, 3 = type locality) (some symbols represent more than one locality or lot of specimens).

dorsal portions of head and body. Specimens lacking guanine on scales tan to brown, dorsal portion of head dusky, dorsal portions of body with diffuse dusky chromatophore field on exposed surface of each scale. Obscure midlateral stripe on body. Median fins dusky, paired fins hyaline.

DISTRIBUTION.—Rio Amazonas basin and coastal drainages of Amapá, Brazil (Figure 11).

GEOGRAPHIC VARIATION.—Population samples of *Cyphocharax leucostictus* from the coastal drainages of Amapá, Brazil, in the eastern portion of the species range agree with those from the Amazon basin in nearly all examined features. The two populations differ, however, in relative body depth (0.34–0.38 of SL in Amapá samples versus 0.31–0.35 in those from Amazon) and lateral-line scale counts (39 to 41 versus 40 to 45 respectively). Additional material from Amapá and adjoining regions is necessary to determine whether these differences should be recognized taxonomically.

REMARKS.—Eigenmann and Eigenmann's original description of *Curimatus leucostictus* (1889:425) was based on two specimens collected by the Thayer Expedition, the first at an unspecified site along the Rio Negro (Figure 11, locality 1), and the second at Lago Alexo (= Lago do Aleixo) along the lower portion of the Rio Negro. The larger individual (MCZ 787, 103.5 mm SL), captured in the Rio Negro, is designated as the

lectotype and the second syntype (MCZ 20315) becomes a paralectotype.

Steindachner (1908:167) described *Curimatus (Curimatella) xinguensis* from a single specimen (NMW 68817) collected at an unspecified location along the Rio Xingu (Figure 11, locality 2). In the original species description Steindachner (1908:167) stated that the holotype had 54 lateral-line scales and noted that "the tail fin [is] completely covered with scales" [my translation]. The cited lateral-line scale count is an evident lapsus since the holotype has only about 44 lateral-line scales to the hypural joint (specimen has partially lost the scales on the body). Furthermore, in his comparative discussion of the species, Steindachner stated that *Curimatus xinguensis* "lies between *C. lepidurus* (Sc[ales]. 9-43 to 45-7) and *C. serpae* (Sc[ales]. 6-39 to 41-5)" [my translation]. Since those counts presumably bracketed the values of *C. xinguensis*, it is evident that Steindachner considered the species to have between 39 and 45 lateral-line scales. Although Steindachner described the caudal fin in *C. xinguensis* as being totally covered with scales, only slightly less than the basal one-third of the fin is covered by scales. *Curimatus (Curimatella) xinguensis* Steindachner agrees in all examined characters with *Curimatus leucostictus* Eigenmann and Eigenmann (Table 2), and is consequently placed as a synonym of the latter species.

TABLE 2.—Morphometrics and meristics of (A) lectotype of *Curimatus leucostictus* (MCZ 787); (B) holotype of *Curimatus (Curimatella) xinguensis* (NMW 68817); (C) all specimens of *Cyphocharax leucostictus* 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
MORPHOMETRICS			
Standard Length	103.5	78.4	45.4–104.8
1. Greatest body depth	0.33	0.34	0.31–0.38*
2. Snout to dorsal-fin origin	0.46	0.49	0.46–0.49
3. Snout to anal-fin origin	0.84	0.85	0.80–0.85
4. Snout to pelvic-fin origin	0.54	0.53	0.51–0.55
5. Snout to anus	0.76	0.77	0.72–0.78
6. Origin of dorsal fin to hypural joint	0.61	0.57	0.56–0.61
7. Pectoral-fin length	0.17	0.16	0.16–0.20
8. Pelvic-fin length	0.21	0.21	0.21–0.25
9. Caudal peduncle depth	0.11	0.11	0.10–0.12
10. Head length	0.27	0.29	0.27–0.31
11. Snout length	0.31	0.30	0.26–0.31
12. Orbital diameter	0.34	0.33	0.30–0.36
13. Postorbital length	0.39	0.35	0.35–0.40
14. Interorbital width	0.40	0.39	0.37–0.42
MERISTICS			
Lateral-line scales	45	44	39–45*
Scale rows between dorsal-fin origin and lateral line	7	7½	6½–7½
Scale rows between anal-fin origin and lateral line	5	6	5–6½
Branched dorsal-fin rays	9	9	9
Branched anal-fin rays	7	7	7
Total pectoral-fin rays	16	15	15–17
Branched pelvic-fin rays	8	8	8
Vertebrae	32	32	31–33

* See under "Remarks" in the species account with respect to differences between Amazonian and Amapá population samples of *Cyphocharax leucostictus* in lateral-line scale counts and relative greatest body depth.

Vari (1989a, tables 2, 3) included both *Curimatus leucostictus* Eigenmann and Eigenmann and *Curimatus (Curimatella) xinguensis* Steindachner in *Curimatella* rather than *Cyphocharax* as in this study. Both nominal species were reported in the original descriptions as having the caudal-fin rays largely covered by scales, the derived character diagnostic for *Curimatella*. The examination of recently collected specimens of *Cyphocharax leucostictus* from the Amazon basin and adjoining regions has shown that the degree and form of the scales at the base of the caudal-fin rays differs from that in the species assigned to *Curimatella* (Vari, 1992). In particular, the scales are limited at most to the basal one-third of the middle rays of each caudal fin lobe contrary to the more extensive field of scales in *Curimatella*. In addition the scales on the caudal fin in *Cyphocharax leucostictus* are approximately the same size as those on adjoining regions of the caudal peduncle, contrary to the relatively smaller scales on the fin in *Curimatella* species. *Curimatus leucostictus* and *Curimatus (Curimatella) xinguensis* are consequently transferred in this paper from *Curimatella* to *Cyphocharax*.

MATERIAL EXAMINED.—196 specimens (49, 45.4–104.8 mm).

BRAZIL. Amapá: Rio Matuanun, Macapá, MNRJ 11211, 10 (5, 95.7–104.8). Braço do Rio Macacoari, MNRJ 11205, 1 (100.5). Pará: Rio Tapajós, Alter do Chão, USNM 267983, 2 (102.2–104.2). Rio Tapajós, Itaituba, USNM 267978, 6 (1 specimen cleared and counterstained for cartilage and bone); USNM 267980, 2. Rio Xingu, NMW 68817, 1 (78.4, holotype of *Curimatus (Curimatella) xinguensis*). Rio Xingu, Belo Monte, USNM 267982, 2. Amazonas: Rio Negro, MCZ 787, 1 (103.5, lectotype of *Curimatus leucostictus*). Rio Negro, vicinity of Manaus, MZUSP 6688, 33 (4, 70.6–99.5). Lago Alexo (= Lago do Aleixo), MCZ 20315, 1 (70.0, paralectotype of *Curimatus leucostictus*). Paraná de Janauacá, Lago do Castanho, USNM 229172, 4 (55.3–85.3). Rio Jauaperi, between mouth and 100 km up river, MZUSP 21156, 5 (63.1–94.0). Rio Jauaperi, near mouth, USNM 243231, 1 (73.2). West of Moura, near junction of Rio Negro and Rio Branco, ANSP 139329, 1 (89.3). Lago José Açu, MZUSP 7632, 2 (80.5–88.2). Rio Negro, Anavilhanas, beach on Lago da Prata, USNM 268020, 34 (14, 45.4–78.2). Cabeceira do Lago Beruri, Igarapé Chefe, MZUSP 6426, 2. Roraima: Rio Branco, Cachoeira do Bem Querer, USNM 268022, 1 (78.0). Rio Branco, Beach at Marará, near mouth of Rio Branco,

USNM 268023, 50. *Mato Grosso*: Rio Araguaia, Santa Terezina, MZUSP 20838, 2. *Rondônia*: Lago do Cururu, USNM 267984, 11 (4, 71.7–97.4). Rio Madeira, beach at Calama, USNM 267979, 1 (76.1).

VENEZUELA. *Territorio Federal Amazonas*: Río Negro, rapids below the mouth of the Río Casiquiare, approx. 10 km north of San Carlos de Río Negro, MBUCV V-11364, 1 (57.0). Caño Darigua, tributary of Río Negro entering Río Negro on the left bank approx. 17 km S of San Carlos de Río Negro, MBUCV V-11238, 10. Headwaters of the Río Atabapo, MBUCV V-7176, 5; MBUCV V-7175, 7.

Cyphocharax pantostictos Vari and Barriga

FIGURES 11, 12

Cyphocharax pantostictos Vari and Barriga, 1990:551, figs. 1–4 [type-locality: Ecuador: Napo, Laguna de Jatuncocha; distribution in Ríos Napo, Putomayo, Ucayali, and Nanay systems in eastern Ecuador and northern Peru].—Vari and Howe, 1991:19 [listing of type-specimens in NMNH].—Ortega, 1991:2 [occurrence in Peru].

DIAGNOSIS.—The striking pattern of seven to nine horizontal series of prominent dark spots situated over the center of the scales on the lateral and dorsolateral surfaces of the body is unique to *Cyphocharax pantostictos* in the genus. Only two other *Cyphocharax* species, *C. multilineatus* of the Río Negro system in Venezuela and Brazil, and *C. helleri* distributed through Guyana, Surinam, French Guiana, and the northern portion of the state of Amapá, Brazil, have patterns of horizontal dark body pigmentation somewhat reminiscent of that in *C. pantostictos*. The patterns of dark body pigmentation in *C. multilineatus* and *C. helleri* differ from that in *C. pantostictos* in forming multiple, solid, wavy, horizontal lines rather than horizontal series of discrete rotund spots (compare Figures 12, 13–17, 19). Furthermore, the dark stripes in *C. multilineatus* and *C. helleri* are positioned along the regions of overlap of horizontal rows of scales along the body, rather than being aligned along the center of the scale rows as are the spots in *C. pantostictos* (Figure 12). *Cyphocharax multilineatus* also has a discrete dark band across the midlateral surface of the head anterior and posterior to the orbit, a pigmentation pattern lacking in *C. pantostictos*. *Cyphocharax pantostictos*, in turn, is characterized by a well-developed, midlateral, horizontally elongate patch of dark pigmentation on the caudal peduncle that is absent in *C. multilineatus*. The two species also differ in the relative length of the postorbital portion of the head (0.42–0.46 of HL in *pantostictos* versus 0.35–0.40 in *multilineatus*), relative gape width (0.24–0.28 of HL versus 0.18–0.23), and to a lesser degree in relative orbital diameter (0.27–0.32 of HL versus 0.31–0.37). Finally, *Cyphocharax pantostictos* lacks the large, rotund spot of dark pigmentation that occurs on the midlateral surface of the caudal peduncle in *C. helleri*.

DESCRIPTION.—Body moderately elongate, somewhat compressed laterally. Dorsal profile of head convex from upper lip to vertical line through posterior nostril, straight from that line

to tip of supraoccipital spine. Dorsal profile of body smoothly convex from posterior portion of head to origin of dorsal fin; straight or slightly convex, posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal 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 very obtusely flattened, scales of that area not notably enlarged relative to those on ventrolateral surfaces of body. Median prepelvic scale series somewhat irregular, particularly proximate to origin of pelvic fin. No distinct median keel posterior to origin of pelvic fin. Barely discernable 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 0.35–0.40 [0.37], relatively deeper in larger specimens; snout tip to origin of dorsal fin 0.47–0.52 [0.50]; snout tip to origin of anal fin 0.83–0.85 [0.83]; snout tip to origin of pelvic fin 0.52–0.57 [0.56]; snout tip to anus 0.78–0.79 [0.78]; origin of dorsal fin to hypural joint 0.54–0.58 [0.56]. Dorsal fin obtusely pointed in profile distally; last unbranched and first branched rays approximately two to two and one-half times length of ultimate ray. Pectoral fin obtusely pointed in profile distally; length of pectoral fin 0.18–0.21 [0.20], extending slightly over one-half distance to vertical line through origin of pelvic fin. Pelvic fin pointed overall in profile distally, length of pelvic fin 0.20–0.23 [0.22], tip of fin reaches to anus in holotype, falls somewhat short of that point in larger specimens. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays about two and one-half times length of ultimate ray. Least depth of caudal peduncle 0.12–0.14 [0.14].

Head profile pointed anteriorly overall, head length 0.29–0.33 [0.31]; upper jaw somewhat longer than lower, mouth subterminal; snout length 0.27–0.31 [0.30]; nares of each side very close, anterior rotund, posterior crescent-shaped with aperture partially closed by thin flap of skin separating nares; orbital diameter 0.27–0.32 [0.31]; adipose eyelid present, moderately developed, with rotund opening over center of eye; length of postorbital portion of head 0.42–0.46 [0.44]; gape width 0.24–0.28 [0.27]; interorbital width 0.39–0.43 [0.43].

Pored lateral-line scales from supracleithrum to hypural joint 29 to 31 [29]; all scales of lateral line pored, canals in scales straight; 2 or 3 series of pored scales extend beyond hypural joint onto caudal-fin base; 4¹/₂ [4¹/₂] scales in transverse series from origin of dorsal fin to lateral line; 3¹/₂ to 4¹/₂ [4] 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 iii,7 (when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 15 [15]; pelvic-fin rays i,8 or i,7,i [i,7,i].

Total vertebrae 31 (10).

COLOR IN LIFE.—(Based on photograph of a paratype (USNM 280573) from the Río Nanay of Peru taken shortly after capture.) Overall coloration silvery with slightly olive-

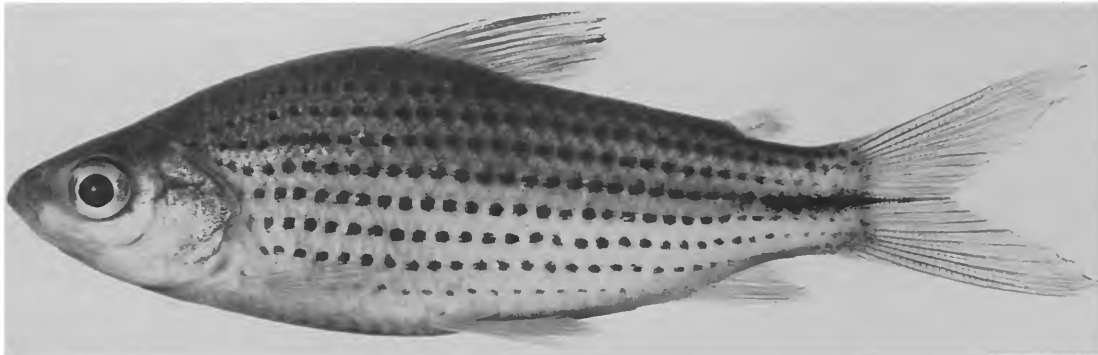


FIGURE 12.—*Cyphocharax pantostictos*, holotype, USNM 306594, 72.4 mm SL; Ecuador, Napo, Laguna de Jatuncocha.

grey cast on dorsal portions of head and body. Series of black spots arranged in horizontal series along dorsal and lateral surfaces of body. Distinct black midlateral stripe on caudal peduncle. Fins hyaline.

COLOR IN ALCOHOL.—Available specimens largely lacking guanine on scales. Overall ground coloration yellowish-tan, darker on dorsal portions of head and body. Scales on lateral and dorsal surfaces of body with dark patch of pigmentation on each scale; size of spots largest midlaterally; overall intensity of spots not as pronounced in smaller individuals. Spots arranged in seven to nine horizontal series, dorsal and ventral series of dark spots not apparent in smaller specimens. Series of dark spots on scales less developed posteriorly on scale rows ventral of lateral line; very poorly developed in series starting immediately posterodorsal to origin of pectoral fin. Intense dark spots also progressively less pronounced in horizontal series dorsal to lateral line. Patches of dark pigmentation located on center of scale, with midpoint of spots lying medial of margin of preceding scale. Scales dorsal to lateral line with secondary area of diffuse dark pigmentation posterior to discrete central dark spot; secondary dark pigmentation increasingly pronounced on dorsal portions of body, but merging into overall darker pigmentation of body along dorsal scale series. Dark pigmentation patches on scales along lateral line merging posteriorly into distinct horizontal stripe on midlateral surface of caudal peduncle; stripe continuing onto base of middle caudal-fin rays. Deeper lying, dusky band extends along midlateral surface of body from supracleithrum to caudal peduncle.

Caudal fin with short horizontal streak of dark pigmentation on basal portions of middle rays; basal two-thirds of fin somewhat more dusky than remainder of fin. Median and paired fins somewhat dusky.

DISTRIBUTION.—Río Napo, Río Putumayo, Río Ucayali, and Río Nanay systems in eastern Ecuador and northeastern Peru (Figure 11).

AUTAPOMORPHIES OF *Cyphocharax pantostictos*.—The pattern of multiple series of dark spots over the center of the scales on the lateral and dorsolateral surfaces of the body in

Cyphocharax pantostictos (Figure 12) is unique in the genus, but paralleled to a degree by the pigmentation pattern of *Steindachnerina fasciata* (Vari and Géry) (compare Figure 12 and fig. 39 in Vari, 1991). Within the context of the overall most parsimonious hypothesis of relationships within *Steindachnerina* (Vari, 1991) the pigmentation patterns of *S. fasciata* and *Cyphocharax pantostictos* are considered homoplastic. Thus the pigmentation pattern of *C. pantostictos* is considered autapomorphic for the species.

ECOLOGY.—Two specimens from Peru (USNM 280573; NRM 26567, formerly NRM SOK/1986293.5292) were collected in acidic blackwaters among grass and submerged vegetation. The specimens from the type-locality were collected in submerged vegetation in blackwaters of pH 5.5 at a depth of 1.5 m. The Río Yasuni specimens came from a slow flowing turbid stream with a pH of 6.0 and lacking submerged vegetation.

REMARKS.—As noted by Vari and Barriga (1990), *Cyphocharax pantostictos* is very similar in body form and pigmentation to *Steindachnerina fasciata*, a species endemic to upper portions of the eastern drainages of the Rio Madeira basin in Brazil (Vari 1991, fig. 40). Although the two species can be confused on first examination, they differ in many meristic and morphometric features (Vari and Barriga, 1990; Vari, 1991). *Cyphocharax pantostictos* furthermore lacks the derived characters that define *Steindachnerina* and the clades within that genus that include *S. fasciata* (see Vari, 1991, for details). The pronounced superficial similarities between two distantly related curimatid species would at first consideration apparently represent a case of intergeneric mimicry. There is, however, no overlap in the distributions of the two species, whose known ranges are separated by over 2000 river kilometers (compare Figure 11 and fig. 41 in Vari, 1991). Thus mimicry would not appear to be involved in the external resemblances between *Cyphocharax pantostictos* and *Steindachnerina fasciata*.

MATERIAL EXAMINED.—10 specimens (10, 34.4–98.2 mm).

ECUADOR. *Napo*: Laguna de Jatuncocha (01°00'S, 75°29'W), USNM 306594, 1 (72.4, holotype of *Cyphocharax*

pantostictos); MEPN 4554, 1 (74.9, paratype of *Cyphocharax pantostictos*). Estero Culebrero, tributary of Río Yasuni (0°54'45"S, 076°13'03"W), USNM 305617, 1 (98.2, paratype of *Cyphocharax pantostictos*; MEPN 4557, 1 (81.8, paratype of *Cyphocharax pantostictos*). Río Napo, 2.7 km along river above the bridge at Coca (00°29.0'S, 077°04.0'W), USNM 305616, 1 (66.7, paratype of *Cyphocharax pantostictos*; specimen cleared and counterstained for cartilage and bone); MEPN 4558, 1 (63.0, paratype of *Cyphocharax pantostictos*).

PERU. Loreto: Río Nanay, Nanay beach along river west of Iquitos (approx. 03°50'S, 073°11'W), USNM 280573, 1 (72.0, paratype of *Cyphocharax pantostictos*). Small stream ~65 km upstream from mouth of Río Nanay, ANSP 164981, 1 (34.4, paratype of *Cyphocharax pantostictos*). Río Putumayo drainage, El Estrecho, Quebrada de Las Granjas, NRM 26567, 1 (94.0, paratype of *Cyphocharax pantostictos*; formerly NRM SOK/1986293.5292). Along road from Genero Herrera towards Peruvian-Brazilian border, Río Ucayali drainage, ANSP 164980, 1 (39.3, paratype of *Cyphocharax pantostictos*).

Cyphocharax helleri (Steindachner)

FIGURES 13–18; TABLE 3

Curimatus spilurus.—Günther, 1864:288 [Essequibo (= Essequibo River, Guyana); in part, deep-bodied syntype herein designated as paralectotype of *Curimatus spilurus*; see "Remarks" under that species].

Curimatus helleri Steindachner, 1910:266 [type-locality: Surinam: upper Surinam River].—Fernández-Yépez, 1948:73 [reference].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Curimatus Vandeli Puyo, 1943:145, fig. 3 [type-locality: French Guiana: small creek in region of upper Marouni (River)].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*]. [New synonymy.]

Curimatus vandeli.—Puyo, 1949:120, fig. 61 [based on Puyo, 1943; French Guiana: small creek in region of upper Marouni (River)].

Curimatus (Hemicurimata) esperanzae pijperzi Géry, 1965:123, pl. 2, fig. 18 [type-locality: Surinam: Sipaliwini River Basin, Paru Savannah, "Vier Gebroeders Creek"].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*]. [New synonymy.]

Curimata helleri.—Fowler, 1975:369 [reference].—Boujard et al., 1990:178 [French Guiana: Arataye River].—Géry and Planquette, 1982:68 [French Guiana: Maroni basin, Crique Balaté (5°28'30"N, 54°2'30"W) and Saut Gostou, near Langa Tabiki; *Curimatus Vandeli* Puyo indicated as a possible synonym].

Curimata vandeli.—Fowler, 1975:370 [reference].

DIAGNOSIS.—Other than for *Cyphocharax helleri*, only two other species of *Cyphocharax*, *C. pantostictos* and *C. multilineatus*, have dark pigmentation on the body arranged in multiple discrete longitudinal rows. The pattern in *C. helleri* differs from that in *C. pantostictos* in forming irregular stripes along the junctions of horizontal scale rows, whereas in *C. pantostictos* the pigmentation consists of dark spots over the centers of the exposed surfaces of the scales on the lateral and dorsolateral surfaces of the body. *Cyphocharax pantostictos* also lacks the large, dark spot on the caudal peduncle of *C. helleri*. The species further differ in relative eye size (0.32–0.38 in *C.*

helleri versus 0.27–0.32 in *C. pantostictos*) and relative length of the postorbital portion of the head (0.36–0.42 versus 0.42–0.46). *Cyphocharax helleri* lacks the distinct midlateral stripe on the caudal peduncle that characterizes *C. multilineatus*, having rather a large rotund spot of dark pigmentation on the posterior portion of the caudal peduncle and basal portion of the middle rays of the caudal fin. The species also differ in relative body depth (0.38–0.45 of SL in *C. helleri* versus 0.31–0.36 in *C. multilineatus*).

Within its known range *Cyphocharax helleri* is most similar in overall appearance, meristics, and morphometrics to *C. microcephalus* and *C. gouldingi*; species sympatric with *C. helleri* in portions of its distribution. *Cyphocharax helleri* has a pattern of distinct dark irregular longitudinal stripes on the lateral and dorsolateral surfaces of the body, pigmentation lacking in the two other species. Although some individuals of *C. microcephalus* have faint longitudinal stripes along the body (Figure 36) that pigmentation differs from the condition in *C. helleri* both in intensity and form of the stripes. The presence of a spot of dark pigmentation on the midlateral surface of the caudal peduncle in *C. helleri* further separates that species from *C. microcephalus* in which such pigmentation is absent. *Cyphocharax helleri* is further distinguished from *C. microcephalus* in the relative length of the postorbital portion of the head (0.36–0.42 of HL versus 0.42–0.47 of HL, respectively) and less distinctly in the relative depth of the caudal peduncle (0.12–1.14 of SL versus 0.14–0.16 of SL respectively).

DESCRIPTION.—Body moderately elongate, deeper in ripe females, somewhat compressed laterally. Dorsal profile of head convex from tip of snout to vertical line through posterior nostril, straight from that line to tip of supraoccipital spine. Dorsal profile of body smoothly convex from tip of supraoccipital spine to origin of dorsal fin, more so in deeper bodied individuals; straight and posteroventrally slanted at base of dorsal fin, straight from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with obtuse median keel extending from rear of supraoccipital spine to anterior of dorsal fin, smoothly rounded transversely posterior to fin. Ventral profile of body curved from tip of lower jaw to caudal peduncle, more convex in ripe females. Prepelvic region obtusely flattened, with median series of scales; scales in that series approximately of same size as those on proximate ventrolateral portions of body. Obtuse median keel present posterior to pelvic-fin insertion. Secondary obtuse keel on each side of postpelvic portion of body one scale dorsal of ventral midline.

(Note: values in square brackets are those for syntypes of *Curimatus helleri* presented in the original description of the species (Steindachner, 1910:266); see also discussion under "Remarks" below.) Greatest body depth at origin of dorsal fin, depth 0.38–0.45 [0.35–0.39]; snout tip to origin of dorsal fin 0.48–0.53; snout tip to origin of anal fin 0.81–0.86; snout tip to insertion of pelvic fin 0.54–0.59; snout tip to anus

0.77–0.82; origin of dorsal fin to hypural joint 0.55–0.61. Dorsal-fin margin slightly rounded distally; last unbranched and first branched rays two and one-half to three and one-half times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.20–0.25, extends three-quarters or slightly more of distance to vertical line through insertion of pelvic fin. Pelvic fin obtusely pointed in profile distally, length of pelvic fin 0.21–0.25, reaches one-half to three-quarters of distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays two and one-quarter to two and three-quarters times length of ultimate ray. Least depth of caudal peduncle 0.12–0.14.

Snout rounded, overall head profile pointed, head length 0.27–0.32 [0.29]; upper jaw slightly longer than lower, mouth barely subterminal; snout length 0.28–0.34; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.32–0.38; adipose eyelid present, more

developed anteriorly, with broad, vertically ovoid opening over center of eye; length of postorbital portion of head 0.36–0.42; gape width 0.22–0.28; interorbital width 0.43–0.47.

Pored lateral-line scales from supracleithrum to hypural joint 29 to 34 [31–32]; all scales of lateral line pored in specimens over 30 mm SL, individuals below that length with posterior portion of lateral line incompletely pored to varying degrees (see also discussion under “Remarks” below); canals in scales straight; 3 to 5 series of pored scales extend beyond hypural joint onto caudal-fin base in specimens over 40 mm SL; $4\frac{1}{2}$ to 6 ($4\frac{1}{2}$ rare) [$4\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; $4\frac{1}{2}$ or 5 [5] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,8 or 9, or iii,9 (ii,8 rare; when three unbranched rays present, first very short) [11 dorsal-fin rays reported by Steindachner, presumably ii,9]; anal-fin rays ii,7 or 8, or iii,7 (ii,8 rare; when three unbranched rays present, first very short) [9 anal-fin rays reported by Steindachner, presumably ii,7]; pectoral-fin rays 12 to 14; pelvic-fin rays i,7 or 8 (i,7

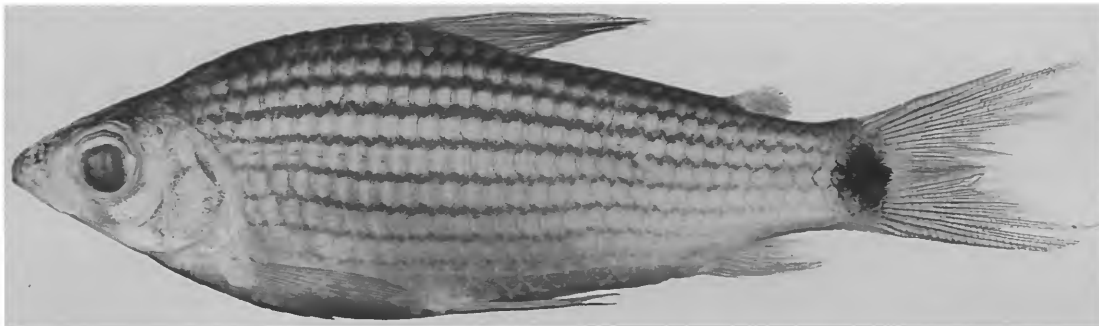


FIGURE 13.—*Cyphocharax helleri*, ZMA 106.466, 81.5 mm SL; Surinam, Brokopondo District, Sara Kreek, approximately 27 km S of Brokopondo Dam.

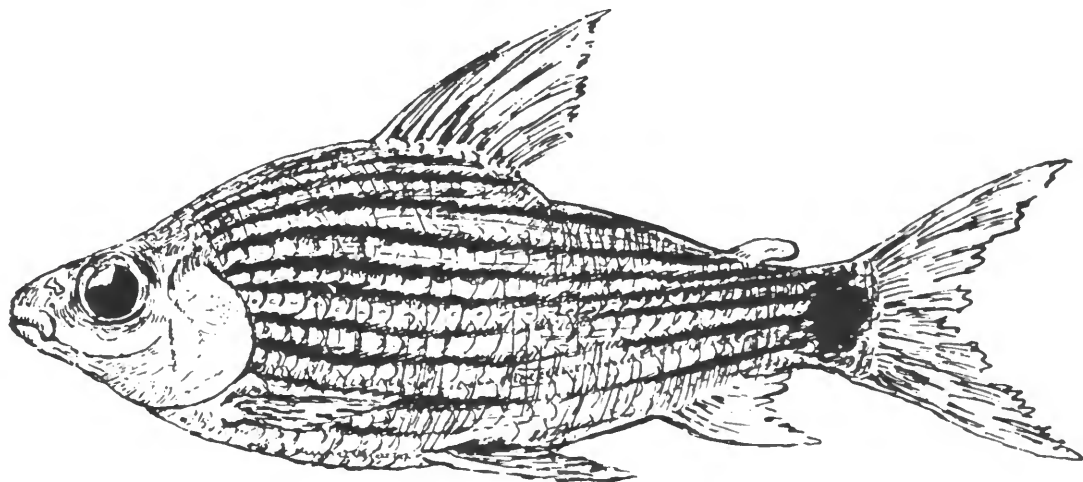


FIGURE 14.—Reproduction of drawing of holotype of *Curimatus vandeli* from Puyo (1949, fig. 61).

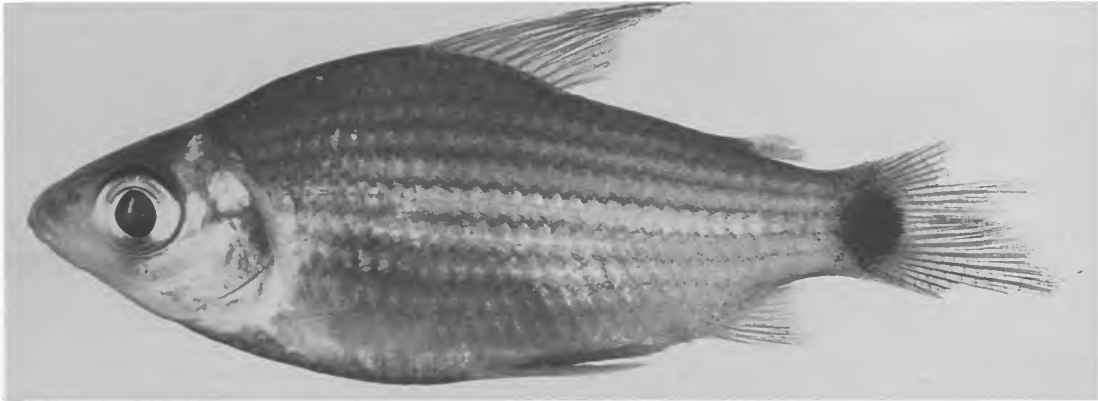


FIGURE 15.—*Cyphocharax helleri*, holotype of *Curimatus (Hemicurimata) esperanzae pijpersi*, ZMA 104.283, 39.2 mm SL; Surinam, Sipaliwini River, Viers Gebroeders Kreek.

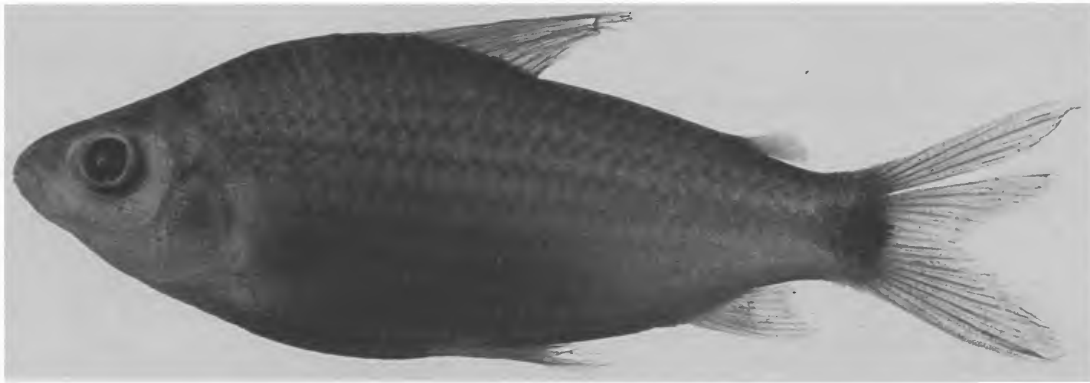


FIGURE 16.—*Cyphocharax helleri*, MBUCV V-10106, 59.8 mm SL; Venezuela, Bolívar, Caño Caballape, near Tumereno.

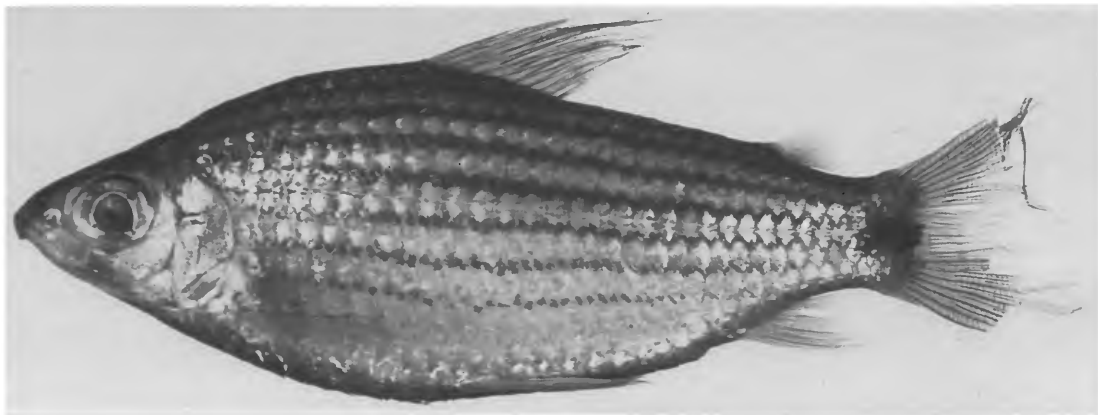


FIGURE 17.—*Cyphocharax helleri*, USNM 267965, 85.5 mm SL; Brazil, Amapá, Rio Cupixi, at road to Serra do Navio.

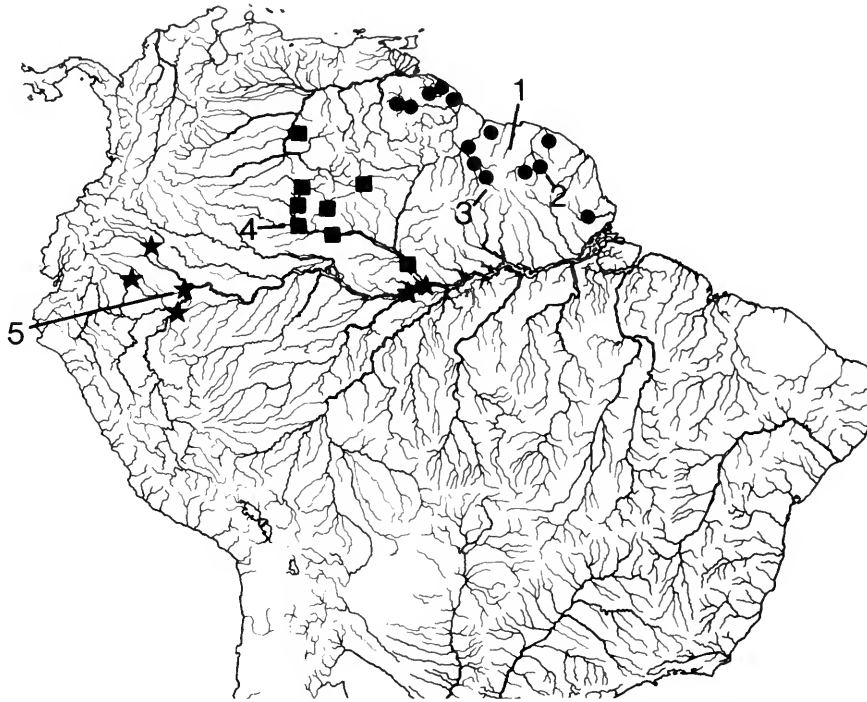


FIGURE 18.—Map of central and northern South America showing geographic distribution of *Cyphocharax helleri* (filled in circles; 1 = Surinam River, type locality of *Curimatus helleri*; 2 = upper Marouni River, type locality of *Curimatus Vandeli*; 3 = Sipaliwini River basin, type locality of *Curimatus (Hemicurimata) esperanzae pijpersi*), *Cyphocharax multilineatus* (squares; 4 = type locality of *Curimatus multilineatus* and *Cyphocharax vexillipinnus* (stars; 5 = type locality) (some symbols represent more than one locality or lot of specimens).

rare) [9 pelvic-fin rays reported by Steindachner, presumably i,8].

Total vertebrae 30 (20), 31 (91), 32 (10).

COLOR IN LIFE.—Géry and Planquette (1982, fig. 8) included a photograph of a live or recently captured specimen of *Cyphocharax helleri*. Overall coloration of that specimen silvery-yellow, with yellow pigmentation most notable on lateral and dorsal surfaces of body. Ventral surface of body silvery. Series of dark, wavy, longitudinal lines apparent on lateral and dorsal surfaces of body. Prominent black, somewhat vertically ovoid spot on midlateral surface of caudal peduncle.

COLOR IN ALCOHOL.—Specimens retaining guanine on scales silvery to golden, darker on dorsal portions of head and body. Specimens lacking guanine on scales tan to yellowish brown, darker dorsally. Dorsal portion of snout and head dusky. Body with series of variably developed darker, horizontal stripes aligned along junctions between horizontal scale rows (Figures 13–17). Stripes most developed dorsal of lateral line, extending three to five scale rows ventral of lateral line in some individuals. Stripes variably developed, somewhat masked in specimens with large amounts of guanine remaining on scales, or in individuals that are very dark overall (see also discussion under “Geographic Variation” below). Prominent dark rotund spot on midlateral surface of caudal peduncle.

Median fins variably dusky; paired fins hyaline.

DISTRIBUTION.—Río Cuyuni basin of eastern Venezuela, Atlantic drainages of Guyana, Surinam, French Guiana, and the Río Cupixi of the state of Amapá, Brazil (Figure 18).

GEOGRAPHIC VARIATION.—The development of the longitudinal body stripes in *Cyphocharax helleri* demonstrates a notable degree of variation across the species range. The only two specimens available from the southern extreme of the species range, the Río Cupixi in the state of Amapá, Brazil, have prominent horizontal dark lines on the body (Figure 17). Material of the species from eastern Surinam (Figure 13) and adjoining regions of French Guiana (Géry and Planquette, 1982, fig. 8) typically has well-developed pigmentation. Smaller specimens of the species from the Corantijn River basin along the western border of Surinam usually, but not always have less prominent stripes than those from regions to the south. All specimens from the Río Cuyuni system of Venezuela (MBUCV V-9492; USNM 295589, 308903) and in the western portions of the species range have faint, but still obvious, horizontal lines (Figure 16). A series of small specimens from the Waini River system in Guyana (UMMZ 216028), the northernmost known record of the species, have very faint stripes.

REMARKS.—Steindachner (1910:266) described *Curimatus*

TABLE 3.—Morphometrics and meristics of (A) type series of *Curimatus helleri* (specimens evidently lost (see "Remarks" in species account); data in table based on information in original description of species; Steindachner, 1910:266); (B) type series of *Curimatus Vandeli* (specimens evidently lost (see "Remarks" in species account for *Cyphocharax helleri*); data in table based on information in original description of species; Puyo, 1943:145; (C) holotype of *Curimatus (Hemicurimata) esperanzae pijperzi* (ZMA 104.283); and (D) all specimens of *Cyphocharax helleri* from which counts and measurements were taken. Dashes indicate values not provided in the original descriptions of *Curimatus helleri* and/or *C. Vandeli*. Measurements provided by Puyo were made using non-standard methods. Selected presented proportions for *C. Vandeli* estimated from original figure. 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	to 57.0	~78	39.2	27.4–95.5
1. Greatest body depth	0.35–0.39	0.39	0.41	0.38–0.45
2. Snout to dorsal-fin origin	–	–	0.53	0.48–0.53
3. Snout to anal-fin origin	–	–	0.82	0.81–0.86
4. Snout to pelvic-fin origin	–	–	0.56	0.54–0.59
5. Snout to anus	–	–	0.78	0.77–0.82
6. Origin of dorsal fin to hypural joint	–	–	0.57	0.55–0.61
7. Pectoral-fin length	–	–	0.26	0.20–0.25
8. Pelvic-fin length	–	–	0.22	0.21–0.25
9. Caudal peduncle depth	–	–	0.14	0.12–0.14
10. Head length	0.29	–	0.30	0.27–0.32
11. Snout length	–	–0.32	0.34	0.28–0.34
12. Orbital diameter	–	–0.32	0.35	0.32–0.38
13. Postorbital length	–	–0.46	0.41	0.36–0.42
14. Interorbital width	–	–	0.45	0.43–0.47
	MERISTICS			
Lateral-line scales	29–32	34	32	31–34
Scale rows between dorsal-fin origin and lateral line	4½	5	5½	4½–6
Scale rows between anal-fin origin and lateral line	5	5	5	4½–5
Branched dorsal-fin rays	9 ^a	9 ^b	9	8–9
Branched anal-fin rays	7 ^c	7 ^d	7	7–8
Total pectoral-fin rays	–	–	13	12–14
Branched pelvic-fin rays	8 ^e	–	8	7–8
Vertebrae	–	–	31	30–32

^a Steindachner reported 11 dorsal-fin rays, presumably including 2 unbranched rays.

^b Puyo reported 10 dorsal-fin rays, possibly counting only 1 unbranched ray.

^c Steindachner reported 9 anal-fin rays, presumably including 2 unbranched rays.

^d Puyo reported 8 anal-fin rays, possibly counting only 1 unbranched ray.

^e Steindachner reported 9 ventral (= pelvic) -fin rays, presumably including 1 unbranched ray.

helleri based on "3 specimens of up to 5.7 cm in length (excluding the caudal fin) from the upper Surinam" [my translation] (Figure 18, locality 1). A series labelled as syntypes of the species in the NMW collections (NMW 68813) differs in numerous details from the specimens described by Steindachner. There are eight rather than three specimens in the lot with only two individuals 5.7 cm SL or less. The specimens also have relatively shallower bodies (body depth going 3 or more times into SL) than the specimens of the original description (body depth reported by Steindachner as 2½ times in SL). In addition none of the specimens in the lot has the pattern of prominent longitudinal stripes cited by Steindachner. Equally noteworthy is the fact that one specimen is actually *Steindach-*

nerina leucisca Günther (1868), a curimatid widespread in the Amazon basin but unknown from Atlantic slopes of the Guianas (Vari, 1991, fig. 14). Given the discrepancies between the data in Steindachner's description (1910) and the specimens now in NMW 68813, that lot is considered to be incorrectly identified as the syntypes of *Curimatus helleri*. Although the actual type series of *Curimatus helleri* was not located during repeated searches through the NMW holdings, the information in the original description (Steindachner, 1910), most notably the cited distinctive pattern of longitudinal stripes, particularly prominent in the adults, and the noted "large blackish-brown mark at the base of the caudal fin" [my translation] leaves little doubt as to the identity of the species.

Puyo (1943:145) described *Curimatus Vandeli* from a single specimen collected in a creek in the upper Marouni drainage system of French Guiana (Figure 18, locality 2). In the original species description, Puyo noted that the species "is easily distinguished from the six other [curimatid] species of the colony [French Guiana] by its pigmentation that consists of a large number of longitudinal stripes of brown color" [my translation]. In a subsequent publication (1949:120) he commented that the species "is easily distinguished from the other species of *Curimatus*" by those pigmentation features. There is no indication that Puyo was aware of Steindachner's description of *Curimatus helleri*. More recently, Géry and Planquette (1982:68) questionably equated *Curimatus Vandeli* with *C. helleri*. The types of Puyo's species do not appear to be extant (see comments concerning Puyo specimens by Géry (1959:345–346) and Géry and Planquette (1982:68)). Nonetheless, Puyo's original description and accompanying rough sketch of the holotype of *Curimatus Vandeli* (reproduced herein as Figure 15) make it very likely that his species is conspecific with *Cyphocharax helleri*. *Curimatus Vandeli* is herein considered a synonym of *Cyphocharax helleri*.

Géry (1965:123) described *Curimatus (Hemicurimata) esperanzae pijpersi* from the Sipaliwini River basin of southern Surinam (Figure 18, locality 3). In his description Géry noted that "The subgenus *Hemicurimata* may be no more than a juvenile stage of *Curimatus* ... indeed, the number of pores in the lateral line [in Géry's species] seems correlated with the age (or, more simply, the standard length ...". An examination of a broad size-range series of *Cyphocharax helleri* from diverse Surinamese localities has shown that the number of pored lateral-line scales increases progressively in the 15 to 30 mm SL range. The size at which the lateral line is completely pored differs in various populations of *C. helleri* but poring is complete in all examined 40 mm SL specimens. Géry's material appears to represent, as he proposed, a juvenile of *Curimatus* (sensu lato). Examination of the type-series of *Curimatus (Hemicurimata) esperanzae pijpersi* have shown it to agree with examined specimens of *Cyphocharax helleri* from the Surinam River, the type locality of the latter species. The only notable difference is the lighter overall coloration of the type-series of *Curimatus (Hemicurimata) esperanzae pijpersi*. The lighter pigmentation of the holotype and residual guanine on the scales also mask the longitudinal stripping on the body (Figure 15), which is not apparent in the photograph of the holotype in Géry (1965). Examination of material from various localities in Surinam demonstrates that the intensity of the dark pigmentation on the body varies in different areas, perhaps as a consequence of differing water types. Specimens from Savannah regions, such as the type-locality of *pijpersi*, are typically lighter overall than are samples of the species from blackwater rainforest streams (see also discussion above under "Geographic Variation" for this species). No difference between the holotype of *Curimatus (Hemicurimata) esperanzae pijpersi*

and material of *Cyphocharax helleri* was discovered among examined meristic and morphometric features (Table 3). As a consequence, *Curimatus (Hemicurimata) esperanzae pijpersi* is considered a synonym of *Curimatus helleri*.

Günther (1864:288) described *Curimatus spilurus* (= *Cyphocharax spilurus* of this study) from two specimens collected in the "Essequibo" (= Essequibo River, Guyana). He noted "the two specimens on which I have founded this species differ most remarkably in the form of the body, although they agree in every other point, so that there can be no doubt that they are of one species. One has the body elevated like a *C. cyprinoides*, its depth being two-fifths of the total length (without caudal); the other has the body oblong, its depth being contained thrice and a third in the total. Both are of the same length." Examination of the two specimens reported on by Günther revealed that the syntype series was indeed complex, with the paralectotype of *Curimatus spilurus* (BMNH 1864.1.21:71) being a specimen of *Cyphocharax helleri*. The relative body depth (0.42 of SL) falls within the range for *C. helleri* (0.38–0.45), but outside that for *C. spilurus* (0.31–0.37).

MATERIAL EXAMINED.—179 specimens (78, 27.4–95.5).

VENEZUELA. *Bolívar*: Caño Guanarapero, between Guassipati and Villa Lola, MBUCV V-10319, 1 (56.0); MBUCV V-10131, 2 (55.8–65.2). Caño Caballape, near Tumereno, MBUCV V-10106, 3 (56.0–60.2). MBUCV V-9492, 9. Río Cuyuni, Isla Jacobo, near Raudal de Kinotovaca, USNM 295589, 2 (formerly MBUCV V-10005, in part); USNM 308903, 3 (formerly MBUCV V-9492, in part).

GUYANA. Essequibo (= Essequibo River), BMNH 1864.1.21:71, 1 (62.1, paralectotype of *Curimatus spilurus*). *Essequibo*: Yarakita Creek, AMNH 14280, 7 (37.7–43.3); AMNH 14437, 4 (44.4–63.0). Santa Rosa, AMNH 14441, 17 (34.0–71.1). Barama River, approx. 20–30 mi from mouth, Waini River system, UMMZ 216028, 12.

SURINAM. No specific locality, USNM 16404, 1. *Nickerie*: Sisa Creek, USNM 225300, 35 (13, 36.8–48.1). Lower Lucie River, USNM 225314, 1 (42.9). "Vier Gebroeders Kreek," Sipaliwini River system, ZMA 104.283, 1 (39.2, holotype of *Curimatus (Hemicurimata) esperanzae pijpersi*); ZMA 104.285, 3 (28.4–30.1, paratypes of *Curimatus (Hemicurimata) esperanzae pijpersi*); GC, 3 (29.2–29.7, paratypes of *Curimatus (Hemicurimata) esperanzae pijpersi*); ZMA 104.284, 8 (27.4–37.3, paratypes of *Curimatus (Hemicurimata) esperanzae pijpersi*). *Brokopondo*: Gran Kreek, 63 km S of Afobaka, USNM 220158, 3 (54.2–83.2; 1 specimen cleared and counterstained for cartilage and bone); MCZ 52045, 3 (61.5–73.4); BMNH 1976.10.21:104–106, 3 (2, 69.3–86.7); CAS 37745, 3 (59.0–68.7). Sara Kreek, ZMA 106.465, 26; ZMA 106.466, 19. *Marowijne*: Maka Kreek, ZMA 106.588, 3. Rio Lawa, Pleike Village, MZUSP 21365, 1.

FRENCH GUIANA. Comté River, below Saut Bief, GC, 1 (51.8). Upper Mana River, GC, 2.

BRAZIL. *Amapá*: Rio Cupixi, at road to Serra do Navio, USNM 267965, 2 (85.5–95.5).

Cyphocharax multilineatus (Myers)

FIGURES 18, 19

Curimatus multilineatus Myers, 1927:109 [type locality: Brazil: Rio Negro, Bucury (= Bucuri)].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].
Curimatorbis multilineatus.—Fernández-Yépez, 1948:43 [reference].—Mago-Leccia, 1970:75 [reference].—Fowler, 1975:370 [reference].
Curimata multilineata.—Fowler, 1950:287 [literature compilation].—Géry, 1977:235 [illustration].

DIAGNOSIS.—Other than for *Cyphocharax multilineatus*, only two other species of *Cyphocharax*, *C. pantostictos* and *C. helleri*, have dark pigmentation arranged in multiple discrete longitudinal rows on the body. *Cyphocharax pantostictos* of the western portions of the Rio Amazonas system in Ecuador and Peru, has a pattern of multiple horizontal series of discrete rotund spots rather than solid wavy horizontal lines such as in *C. multilineatus* (compare Figures 12 and 19). Furthermore, the dark stripes in *C. multilineatus* are positioned along the regions of overlap of horizontal rows of scales along the body, rather than being aligned along the center of the scale rows as are the spots in *C. pantostictos*. *Cyphocharax multilineatus* also has a discrete dark band across the midlateral surface of the head anterior and posterior to the orbit, a pigmentation pattern lacking in *C. pantostictos*. *Cyphocharax pantostictos*, in turn, is characterized by a well-developed, midlateral, horizontally elongate patch of dark pigmentation on the caudal peduncle that is absent in *C. multilineatus*. The two species also differ in the relative length of the postorbital portion of the head (0.35–0.40 of HL in *multilineatus* versus 0.42–0.46 in *pantostictos*), relative gape width (0.18–0.23 of HL versus 0.24–0.28) and to a lesser degree in relative orbital diameter (0.31–0.37 of HL versus 0.27–0.32). *Cyphocharax helleri* shares with *C. multilineatus* a pattern of dark horizontal lines on the dorsal and dorsolateral surfaces of the body. *Cyphocharax multilineatus* lacks the large, dark spot on the caudal peduncle of *C. helleri*. The species also differ in relative body depth (0.31–0.36 of SL in *C. multilineatus* versus 0.38–0.45 in *C. helleri*).

DESCRIPTION.—Body moderately elongate, somewhat compressed laterally. Dorsal profile of head slightly convex from upper lip to vertical line through posterior nostril; straight or very 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, straight or 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 indistinctly flattened, with median series of scales not enlarged relative to those on adjoining portions of body. Obtuse median keel posterior to origin of pelvic fin. Indistinct 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 0.31–0.36 [0.33]; snout tip to origin of dorsal fin 0.47–0.51 [0.47]; snout tip to origin of anal fin 0.80–0.87 [0.86]; snout tip to origin of pelvic fin 0.54–0.59 [0.56]; snout tip to anus 0.77–0.82 [0.80]; origin of dorsal fin to hypural joint 0.52–0.57 [0.54]. Dorsal fin obtusely pointed in profile distally; last unbranched and first branched rays three to three and one-half times length of ultimate ray. Pectoral fin obtusely pointed in profile distally; length of pectoral fin 0.17–0.22 [0.17], extending approximately one-half distance to vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally; length of pelvic fin 0.22–0.24 [0.23], reaching about one half to two-thirds of distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays three to three and one-half times length of ultimate ray. Least depth of caudal peduncle 0.12–0.13 [0.12].

Head profile distinctly pointed overall, head length 0.26–0.31 [0.28]; jaws equal, or upper very slightly longer than lower, mouth terminal; snout length 0.27–0.34 [0.31]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.31–0.37 [0.37]; adipose eyelid present, with broad ovoid opening over center of eye; length of postorbital portion of head 0.35–0.40 [0.40]; gape width 0.18–0.23 [0.19]; interorbital width 0.40–0.44 [0.43].

Pored lateral-line scales from supracleithrum to hypural joint 30 or 31 [31]; all scales of lateral line pored, canals in scales straight; 3 or 4 series of pored scales extend beyond hypural joint onto caudal-fin base; $4\frac{1}{2}$ [$4\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; $4\frac{1}{2}$ [$4\frac{1}{2}$] scales in transverse series from lateral line to origin of anal fin.

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

Total vertebrae 31 (12).

COLOR IN LIFE.—(Based on color transparency of a recently collected specimen from a tributary of the Río Casiquiare, Amazonas, Venezuela (USNM 269987).) Overall coloration of body brassy, with definite purplish tint dorsally. Dorsal, dorsolateral, and lateral surfaces of body with a series of narrow, longitudinal, wavy, dark stripes situated along regions where adjoining rows of body scales overlap. Head with a purple tint dorsally, brassy ventrally, with distinct stripe of pigmentation both anterior and posterior to orbit. All fins with a definite red tint.

COLOR IN ALCOHOL.—Overall ground coloration of head and body tan, darker on dorsal portions. Upper lip, snout, dorsal half of opercle, and dorsal surfaces of head covered by field of small, dark chromatophores. Particularly dark horizontal band extending across midlateral surface of preorbital portion of head from upper lip to orbit. Somewhat irregular, slightly posteroventrally inclined dark band extending from rear of orbit to posterior margin of opercle. Body with series of eight or nine longitudinal narrow, wavy, dark stripes oriented along region of vertical overlap of horizontal series of scales. Ventral stripe somewhat irregular, consisting in some specimens of a

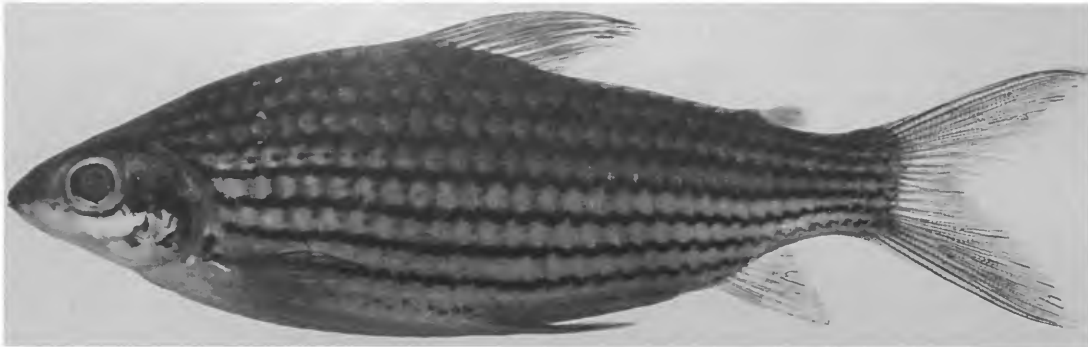


FIGURE 19.—*Cyphocharax multilineatus*, USNM 269987, 111.8 mm SL; Venezuela, Territorio Federal Amazonas, Departamento Río Negro, Caño Tremblador, where crossed by road from San Carlos de Río Negro to Solano.

series of unconnected dark spots. Dorsal and caudal fins very dusky, with fin rays outlined by series of small dark chromatophores. Adipose fin dusky. Pectoral and pelvic fins hyaline in juveniles, dusky in adults.

DISTRIBUTION.—Upper Río Negro in both Brazil and Venezuela and upper portions of Río Orinoco in Venezuela (Figure 18).

AUTAPOMORPHIES OF *Cyphocharax multilineatus*.—The stripe of dark pigmentation on the midlateral surface of the head anterior and posterior to the orbit in *C. multilineatus* is unique to the species within *Cyphocharax*. The only other curimatid known to have a similar pigmentation pattern is *Steindachnerina atratoensis* (Eigenmann), a species endemic to the Río Atrato system of northwestern Colombia (Vari, 1991). The pigmentation posterior to the orbit in the two species differs in both shape and position (compare Figure 19 herein and fig. 37 in Vari, 1991) and is apparently non-homologous. Although the pigmentation anterior to the orbit in *Cyphocharax multilineatus* and *Steindachnerina atratoensis* is evidently identical, it is judged an independent acquisition in the two species under the most parsimonious hypothesis of relationships within *Steindachnerina* (Vari, 1991). The stripe of dark pigmentation on the midlateral surface of the head in *Cyphocharax multilineatus* is thus considered autapomorphic.

MATERIAL EXAMINED.—25 (23, 32.4–109.3).

BRAZIL. *Amazonas:* Rio Negro below Daraá, USNM 274102, 1 (40.6); USNM 274103, (41.4). Rio Negro at Bucuri, CAS 58605, 1 (38.7, holotype of *Curimatus multilineatus*, formerly IU 17672); CAS-SU 58986, 1 (48.7). Rio Paduari, MZUSP 21161, 1 (47.8).

VENEZUELA. *Territorio Federal Amazonas:* Caño La Esmeralda, tributary of Río Orinoco, SE of La Esmeralda, MBUCV V-4479, 1 (34.4). Río Sipapo, near mouth of Río Guayapo, FONAIAP-AMZ 0672, 2 (35.1–36.8). Río Mawarinuma (0°55'N, 66°10'W), AMNH uncat., 5 (60.2–109.3). Río Urumi, tributary to Río Negro upstream of Santa Lucia (1°17'N, 66°51'W), USNM 270241, 1 (50.0); AMNH uncat., 3 (32.4–32.6). Caño Tremblador where crossed by road from San

Carlos de Río Negro to Solano, USNM 269987, 7 (6, 57.2–109.1; 1 specimen cleared and counterstained for cartilage and bone). Río Barria (00°50'N, 66°10'W), MBUCV V-14898, 1.

Cyphocharax vexillapinnus, new species

FIGURES 18, 20–22

DIAGNOSIS.—The combination of 28 to 31 scales in a longitudinal series along the body, the black spot on the central portion of the anterior rays of the dorsal fin, and the limitation of the pores of the laterosensory canal system of the body to the 5 to 8 anterior scales of the midlateral scale series distinguishes *Cyphocharax vexillapinnus* from all congeners, and indeed all curimatids.

The only other *Cyphocharax* species with a distinct patch of dark pigmentation on the dorsal fin is *C. notatus*, in which the distal rather than central portions of the fin are intensely pigmented. The two species also differ in the degree of development of pores along the lateral-line scale series (pores developed only on anterior 5 to 8 scales in *vexillapinnus* versus along entire series in *notatus*), relative body depth (0.38–0.47 of SL versus 0.31–0.37 respectively), and relative depth of caudal peduncle (0.14–0.16 of SL versus 0.11–0.13).

DESCRIPTION.—Body moderately deep, more so in larger individuals (compare Figures 20–22); compressed laterally. Dorsal profile of head convex from tip of snout to vertical line through posterior nostril, straight or 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, straight 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 somewhat flattened, with regular median series of scales that are not enlarged relative to those of adjoining portions of body. Median scale

series flanked on each side by series of scales matching obtuse lateral angles of prepelvic region of body. Obtuse median keel posterior to origin of pelvic fin. 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 0.38–0.47 [0.46], specimens larger than 20 mm SL with distinctly deeper bodies; snout tip to origin of dorsal fin 0.51–0.55 [0.53]; snout tip to origin of anal fin 0.86–0.92 [0.90]; snout tip to origin of pelvic fin 0.54–0.60 [0.58]; snout tip to anus 0.82–0.88 [0.86]; origin of dorsal fin to hypural joint 0.53–0.59 [0.58]. Dorsal fin pointed in profile anterodistally; last unbranched and first branched rays about three times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.19–0.23 [0.20], extends about two-thirds distance to vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally, length of pelvic fin 0.25–0.30 [0.27], tip of fin falling short of origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays about two and one-half times length of ultimate ray. Least depth of caudal peduncle 0.14–0.16 (0.16 rare) [0.15].

Head pointed, head length 0.29–0.35 [0.29]; upper jaw somewhat longer than lower, mouth subterminal; snout length 0.24–0.30 [0.28]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.33–0.36 [0.34]; adipose eyelid weakly developed, with broad opening over eye; length of postorbital portion of head 0.40–0.45 [0.43]; gape width 0.26–0.31 [0.27]; interorbital width 0.41–0.45 [0.43].

Scales in longitudinal midlateral series from supracleithrum to hypural joint 28 to 31 (most often 29 or 30) [29]; anterior 5 to 8 scales of midlateral scale series pored [5], canals in pored scales straight; 2 or 3 scales in horizontal series continuous with that including pored portion of lateral line extend beyond hypural joint onto caudal-fin base; $5\frac{1}{2}$ to $6\frac{1}{2}$ scales in transverse series from origin of dorsal fin to horizontal scale series including pored scales [$6\frac{1}{2}$]; $4\frac{1}{2}$ scales in transverse series below horizontal scale series including pored scales to origin of anal fin; 12 to $13\frac{1}{2}$ [13] scales in transverse series from origin of dorsal fin to midventral line.

Dorsal-fin rays ii,9 or iii,9 (iii,9 much less common, when three unbranched fin rays present, first very short) [iii,9]; anal-fin rays ii,7 or 8 or iii,7 (when three unbranched rays present, first very short) [ii,8]; pectoral-fin rays 13 or 14 [14]; pelvic-fin rays i,8 [i,8].

Total vertebrae 30 (4), 31 (25), 32 (2).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery. Ground coloration of specimens lacking guanine on scales yellowish-tan, darker on dorsal portions of head and body. Head without pronounced pigmentation pattern. Scale margins on dorsal and dorsolateral portions of body with margins outlined by series of small chromatophores; dark chromatophore fields along scale margins more pronounced dorsally. Dorsal fin with prominent

rotund patch of dark pigmentation extending from anterior margin of fin across unbranched and anterior branched rays. Dark pigmentation located on basal half of fins, but with ventral margin of pigmentation patch distinctly separated ventrally from dorsal surface of body by a horizontally elongate unpigmented region along ventral margin of fin (see Figures 20–22). Dark pigmentation on dorsal fin particularly intense and distinct in smaller specimens. This pigmentation not as dark or discrete in larger individuals. Remainder of dorsal fin and caudal fin with fin rays outlined by series of small dark chromatophores. Other median fins and paired fins hyaline.

AUTAPOMORPHIES OF *Cyphocharax vexillapinnus*.—The form of the patch of dark pigmentation on the dorsal fin in *C. vexillapinnus* is unique to that species in the Curimatidae. Dark spots of pigmentation on the dorsal fin are found in some other curimatids, most notably *Cyphocharax notatus* and various species of *Steindachnerina*. The pigmentation in those species differs, however, in the distribution of dark chromatophores on the fin. In *C. vexillapinnus*, contrary to *C. notatus*, the central rather than distal portions of the anterior rays of the dorsal fin are dark (compare Figures 20–22 and 23, 24). The dark spot of pigmentation in many species of *Steindachnerina*, in turn, occurs on the basal portions of the middle rays of the fin (see figures in Vari, 1991). The dark dorsal fin pigmentation in *Cyphocharax vexillapinnus* is consequently hypothesized to be an autapomorphy for the species.

As noted in the discussion of the infraorbital ossifications under “Phylogenetic Comments” there is a pronounced reduction in the development of the infraorbital series and the associated segments of the laterosensory canal in *Cyphocharax vexillapinnus*. The absence of the laterosensory canal segment in the first infraorbital and the pronounced reduction of the sixth infraorbital are derived features shared with some other members of the genus. *Cyphocharax vexillapinnus* is unique in the genus, however, in the pronounced reduction in the degree of development of the laterosensory canal segments in infraorbitals 2 through 4. Contrary to the situation in other curimatids, the laterosensory system associated with these elements is not enclosed in ossified canals, but rather, is at the most superficial to the lateral surface of the bone with a dorsal ridge of bone abutting the upper margin of the sensory canals.

DISTRIBUTION.—Middle and upper portions of Amazon basin (Figure 18).

ETYMOLOGY.—The specific name, *vexillapinnus*, from the Latin for flag and fin, is in reference to the prominent black spot on the dorsal fin.

TYPE MATERIAL EXAMINED.—22 specimens (22, 41.0–63.0).

HOLOTYPE.—PERU. *Loreto*: Río Itaya, main river channel and mouth of caños entering river, 10 km upstream of Belén (Iquitos) (approx. $3^{\circ}51'S$, $073^{\circ}12'W$), collected by R.P. Vari, H. Ortega, and A. Gerberich, 20 Aug 1986, USNM 296394, 1 (63.0).

PARATYPES.—PERU. *Loreto*: Río Itaya, main river chan-

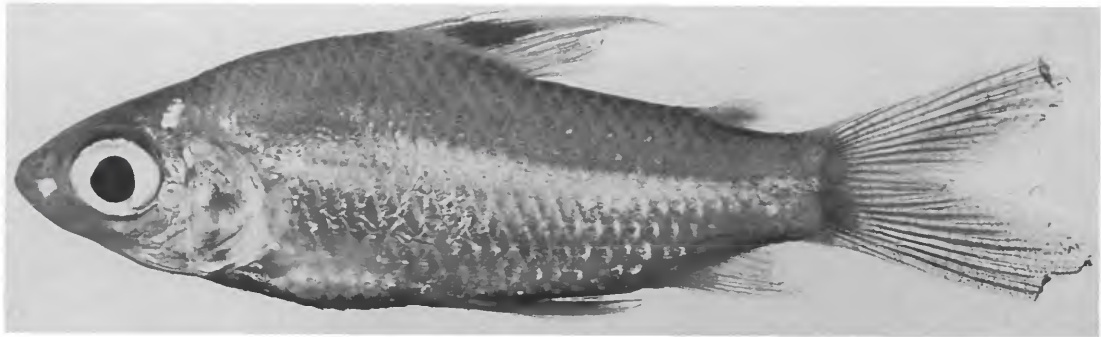


FIGURE 20.—*Cyphocharax vexillapinnus*, new species, USNM 229173, 26.2 mm SL; Brazil, Amazonas, Lago Terra Preta, Januari.

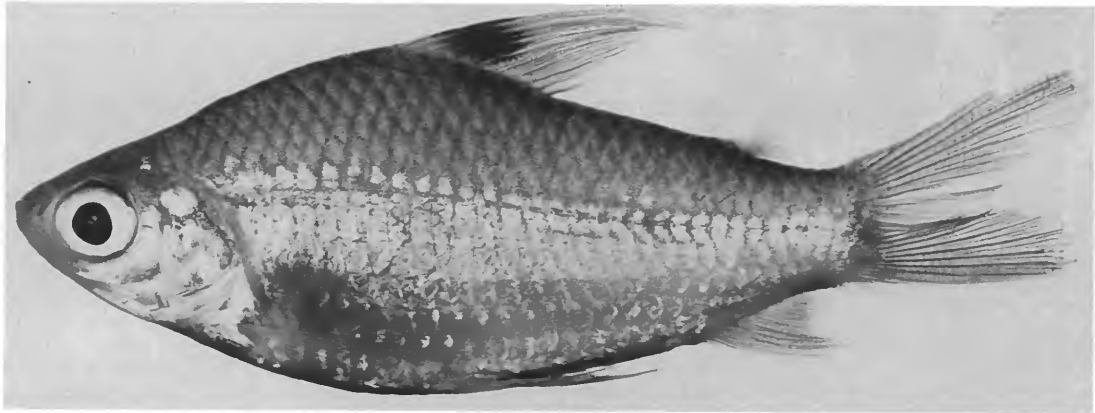


FIGURE 21.—*Cyphocharax vexillapinnus*, new species, USNM 229174, 41.3 mm SL; Brazil, Amazonas, Lago Terra Preta, Januari.



FIGURE 22.—*Cyphocharax vexillapinnus*, new species, holotype, USNM 296394, 63.0 mm SL; Peru, Loreto, Río Itaya, main river channel and mouth of caños entering river, 10 km upstream of Belén (Iquitos) (approx. 3°51'S, 73°12'W).

nel and mouth of caños entering river, 10 km upstream of Belén (Iquitos) (approx. 3°51'S, 073°12'W), collected by R.P. Vari, H. Ortega, and A. Gerberich, 20 Aug 1986; 15 specimens collected with holotype: USNM 296361, 8 (41.6–62.2); MUSM 2721, 4 (47.1–58.6); MZUSP 41761, 3 (46.4–52.4). Río Corrientes drainage, Teniente López, pool in forest on right bank opposite military camp, S.O. Kullander et al., 30 Jul 1986, NRM 26569, 6 (41.0–48.3).

NON-TYPE MATERIAL EXAMINED.—438 specimens (19, 22.4–41.3).

BRAZIL. *Amazonas*: Lago Terra Preta, Januari, USNM 229174, 1 (41.3); USNM 229173, 4. Rio Solimões, Ilha Marchantaria, INPA uncat., 16 (10, 22.4–28.7). Lake near Manaus, USNM 296232, 3 (29.7–35.9). Rio Solimões, Lago de Marchantaria, USNM 268045, 5 (23.3–27.8); USNM 313443, 8 (2 specimens cleared and counterstained for cartilage and bone). Mouth of Rio Negro, NMW 68815, 1.

PERU. *Loreto*: Río Itaya drainage, Quebrada Tocón Grande and nearby pools, at km 33 on carretera Iquitos-Nauta, NRM 26570, 2. Río Corrientes, Teniente López, NRM 26619, 396.

ECUADOR. *Napo*: Jatuncocha, BMNH 1970.4.3:92–93, 2.

Cyphocharax notatus (Steindachner)

FIGURES 23–25; TABLE 4

Curimatus notatus Steindachner, 1908:166 [type locality: Brazil: Pará (= Belém) fish market].—Eigenmann, 1910:421 [reference].—Fernández-Yépez, 1948:73 [reference].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Curimatus hermanni Ahl, 1931:207 [type locality: Brazil: Pará, Rio Capim].—Vari, 1989a, tables 2,3 [assignment to *Cyphocharax*]. [New synonymy.]

Curimatus hasemani.—Fernández-Yépez, 1948:73 [erroneous citation of *C. hermanni* Ahl].

Curimata notata.—Fowler, 1950:288 [literature compilation]; 1975:369 [reference].

Curimata hermanni.—Fowler, 1975:369 [reference].

DIAGNOSIS.—*Cyphocharax notatus* is the only member of the genus with a discrete patch of dark pigmentation on the distal portions of the last unbranched and anterior branched rays of the dorsal fin. The only other species of *Cyphocharax* with a distinct patch of dark pigmentation on the dorsal fin is *C. vexillapinnus* in which the middle rather than distal portions of the fin are pigmented. The two species also differ in the degree of development of pores along the lateral-line scale series (pores developed along entire series in *notatus* versus only on anterior 5 to 8 scales in *vexillapinnus*), relative body depth (0.31–0.37 of SL versus 0.38–0.47 respectively), and relative depth of caudal peduncle (0.11–0.13 of SL versus 0.14–0.16).

DESCRIPTION.—Body relatively elongate, somewhat compressed laterally. Dorsal profile of head convex from tip of snout to vertical line running between nostrils, straight or very slightly concave from that line to tip of supraoccipital spine. Dorsal profile of body smoothly curved from tip of supraoccip-

ital spine to origin of dorsal fin, curvature more pronounced in larger specimens; straight and posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with distinct, although obtuse, 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 obtusely flattened, with median series of scales that are not noticeably enlarged relative to those on ventrolateral portion of body. Median scale series flanked on each side by series of similar-sized scales flexed medially to conform to shape of obtuse lateral angles along that portion of body. Obtuse median keel present posterior to pelvic-fin origin. Secondary obtuse keel on each side of postpelvic portion of body one scale dorsal of ventral midline.

Greatest body depth at origin of dorsal fin, typically relatively deeper in larger specimens, depth 0.31–0.37 [0.32]; snout tip to origin of dorsal fin 0.46–0.52 [0.47]; snout tip to origin of anal fin 0.82–0.87 [0.86]; snout tip to origin of pelvic fin 0.52–0.57 [0.54]; snout tip to anus 0.76–0.81 [0.80]; origin of dorsal fin to hypural joint 0.55–0.60 [0.56]. Dorsal fin obtusely pointed in profile distally; more rounded distally in larger specimens; last unbranched and first branched rays approximately 2.5–3.0 times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.18–0.22 [0.19], extends slightly over one-half distance to vertical line through origin of pelvic. Pelvic fin pointed in profile distally, length of pelvic fin 0.21–0.25 [0.23], reaches slightly less than two-thirds distance to origin of anal fin in smaller specimens, slightly less than one-half that distance in larger specimens. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays about two and one-half times length of ultimate ray. Least depth of caudal peduncle 0.11–0.13 [0.11].

Head profile obtusely pointed anteriorly in profile; head length 0.25–0.30 [0.27]; upper jaw slightly longer than lower, mouth barely subterminal; snout length 0.27–0.33 [0.31]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.29–0.35 [0.34]; adipose eyelid present in specimens of all sizes, with vertically ovoid opening over center of eye, eyelid most developed anteriorly, overall degree of development of eyelid greater in larger specimens; length of postorbital portion of head 0.37–0.43 [0.38]; gape width 0.23–0.28 [0.23]; interorbital width 0.39–0.45 [0.40].

Pored lateral-line scales from supracleithrum to hypural joint 30 to 35 [32]; all scales of lateral line pored, canals in lateral-line scales straight; 2 to 4 series of pored scales extend beyond hypural joint onto caudal-fin base; 5 to 6 (5½ in most specimens, 5 and 6 rare) [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. Small patch of scales extending onto central portion of each lobe of

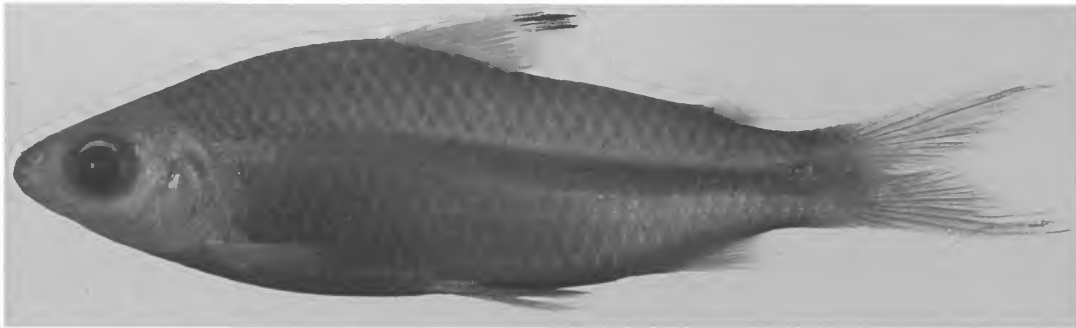


FIGURE 23.—*Cyphocharax notatus*, AMNH 37717, 61.8 mm SL; Bolivia, Beni, Río Itenez, 9 km SE of Costa Marques, Brazil.

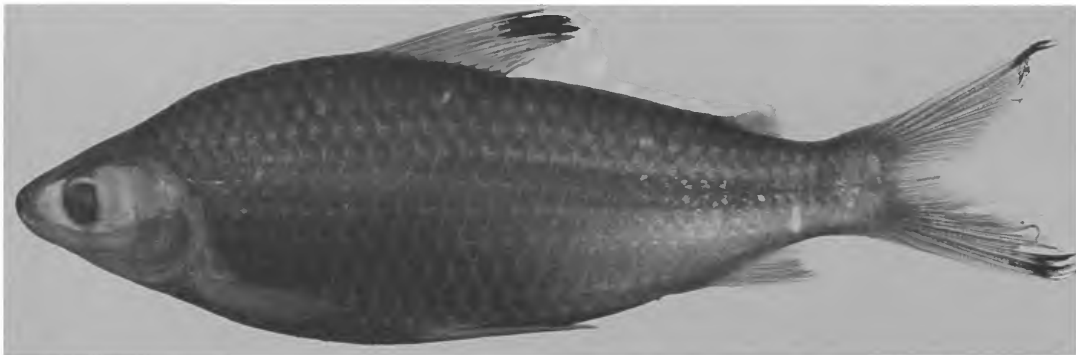


FIGURE 24.—*Cyphocharax notatus*, AMNH 37712, 111.5 mm SL; Bolivia, Beni, Arroyo Grande, 4 km W of Guayamerín, at Riberalta road.

caudal fin; scales slightly smaller than those on proximate portion of caudal peduncle. Scale patches limited to basal one-quarter of associated fin rays in smaller individuals, extending about one third distance along center of each lobe in largest specimens examined.

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

Total vertebrae 32 (7), 33 (7).

COLOR IN LIFE.—Géry (1977:237) included a life photo of an unidentified curimatid that is apparently *Cyphocharax notatus*. The head and body are bright silver, somewhat darker dorsally. The distal one-third of the anterior half of the dorsal fin and the tips of the lobes of the caudal fin are black.

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery, darker on dorsal surface of head and somewhat darker on dorsal portions of body. Ground coloration of specimens lacking guanine on scales tan to light brown, larger specimens darker overall. Deep-lying dusky band extends along midlateral surface of body. Band extends from supracleithrum to region of hypural joint in specimens up to 60 mm SL, extends anteriorly only to under dorsal fin in specimens greater than 80 mm SL.

Last unbranched dorsal-fin ray and first five branched

dorsal-fin rays with distinct black spot on distal portions of rays and associated membranes (Figures 23, 24). Spot most intense and most developed anteriorly; pigmentation more diffuse and covering relatively smaller portions of distal sections of fourth and fifth branched fin rays. Remainder of dorsal-fin membranes hyaline in specimens under 50 mm SL but with fin rays outlined by series of small chromatophores in larger individuals. Distal portions of caudal-fin lobes with faint dusky pigmentation in smaller specimens retaining complete fins; pigmentation on that portion of fin more intense in larger individuals, forming distinct black patches (Figure 24). Remainder of caudal fin hyaline in smaller individuals, dusky with fin ray segments outlined by series of very small chromatophores in larger specimens. Anal fin hyaline in specimens up to 80 mm SL, dusky with scattered dark chromatophores on membranes in larger specimens. Occasional larger specimens with distinct spot of dark pigmentation on distal portions of middle rays of anal fin. Paired fins hyaline in most examined specimens, but relatively dusky in some population samples from the Rio Guaporé basin in Brazil (MZUSP 37440).

AUTAPOMORPHIES OF *Cyphocharax notatus*.—Two features of the pigmentation of *Cyphocharax notatus* are unique to the

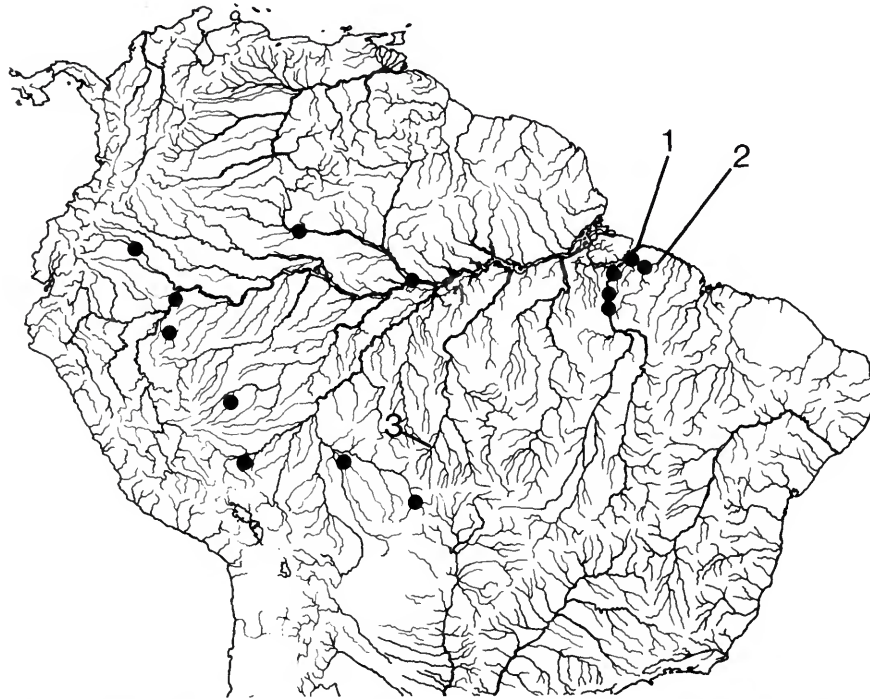


FIGURE 25.—Map of central and northern South America showing geographic distribution of *Cyphocharax notatus* (filled in circles; 1 = Belém, locality at which holotype of *Curimatus notatus* was purchased; 2 = Rio Capim, type locality of *Curimatus hermanni*; 3 = upper Rio Jurucua region where several examined lots of specimens originated) (some symbols represent more than one locality or lot of specimens).

species in the Curimatidae. In *C. notatus* the distal portions of the anterior rays of the dorsal fin are black (Figures 23, 24), whereas in other curimatids that portion of the fin is hyaline, or at most slightly dusky. The pigmentation in *C. notatus* is thus considered autapomorphic for the species. Mid- to large-sized individuals of the species also have blackened distal portions of the lobes of the caudal fin (Figure 24), another feature not found elsewhere in the family, and thus hypothesized autapomorphic for *C. notatus*.

DISTRIBUTION.—Rio Tocantins, Rio Amazonas, and Rio Capim basins (Figure 25).

REMARKS.—Ahl (1931:207) described *Curimatus hermanni* based on two specimens collected in the Rio Capim, in northeastern Pará, Brazil (Figure 25, locality 2). In the original description of the species Ahl neither contrasted it with already described curimatids nor suggested why he thought it was new to science. Ahl (1931:207) noted that the types were deposited in "Zoologisches Museum Berlin," but failed to provide ZMB register numbers. Dr. H.-J. Paepke (ZMB) informs me (in litt.) that the types of *Curimatus hermanni* are not listed in the ZMB catalogues and that the type series has not been located in the museum holdings. It thus is questionable whether the types were ever deposited in the ZMB collections.

In the original description of *Curimatus hermanni* Ahl

(1931) noted that the dorsal fin had a "striking black tip" [my translation]. The only other nominal species in the Curimatidae with that character is *Curimatus notatus*. That species was described by Steindachner (1908) from a specimen purchased in the Pará (= Belém) fish market (Figure 25, locality 1) in the region of the type locality of *Curimatus hermanni*. In addition to sharing the same general type locality and the distinctive black-tipped dorsal fin, the two nominal forms also agree in available meristic and morphometric features (Table 4). Furthermore, population samples of the *Cyphocharax* species with a black-tipped dorsal fin from the Rio Capim, the type locality of *Curimatus hermanni* (MZUSP 21221) do not differ from population samples of *Cyphocharax notatus*. *Curimatus hermanni* is consequently considered herein to be a synonym of *Cyphocharax notatus*.

Fernández-Yépez (1948:73) cited a "*Curimatus hasemani* Ahl 1931" in a list of the nominal curimatid species he was unable to classify due to a lack of specimens. No other reference to that species has been encountered and it is evidently a lapsus for *Curimatus hermanni*.

MATERIAL EXAMINED.—294 specimens (70, 44.1–123.0).

BRAZIL. Pará: "Area surrounding Pará, Pará [= Belém] fish market," NMW 75793, 1 (75.3, holotype of *Curimatus notatus*). Rio Tocantins, vicinity of Cameté, Igarapé Maloca,

TABLE 4.—Morphometrics and meristics of (A) holotype of *Curimatus notatus* (NMW 75793); (B) type series of *Curimatus hermanni* (specimens evidently lost (see "Remarks" in species account of *Cyphocharax notatus*); data in table based on information in original description of species; Ahl, 1931:207); and (C) all examined specimens of *Cyphocharax notatus* from which counts and measurements were taken. Proportions are given only for those values provided in original description of *Curimatus hermanni*. Complete data on holotype of *Curimatus notatus* and range of values for all examined specimens are in text. Standard length is expressed in mm; measurements 1 and 2 are proportions of standard length.

Character	A	B	C
	MORPHOMETRICS		
Standard Length	75.3	7 ^a	44.1–123.0
1. Greatest body depth	0.32	0.30	0.31–0.37
2. Head length	0.27	0.30	0.25–0.30
	MERISTICS		
Lateral-line scales	32	33–34	30–35
Scale rows between dorsal-fin origin and lateral line	5½	5	5–6
Scale rows between anal-fin origin and lateral line	4½	5	4½–5
Branched dorsal-fin rays	9	9 ^b	9
Branched anal-fin rays	7	7 ^c	7

^a Cited as 72 mm total length by Ahl (1931).

^b Ahl listed 11 dorsal-fin rays, presumably 2 unbranched and 9 branched.

^c Ahl listed 9 anal-fin rays, presumably 2 unbranched and 7 branched.

MZUSP 21255, 2. Lago along margin of Igarapé Espírito Santo, between Baião and Tucuruí, along Rio Tocantins, MZUSP 21278, 1. Rio Tocantins, Lago Trocará, below Tucuruí, MZUSP 21339, 7 (70.5–102.0). Rio Capim, Lago Jurunundéua, MZUSP 21221, 9 (50.1–59.0). Rio Tocantins, Laguinho near Tucuruí, MZUSP 21238, 102. *Amazonas*: Rio Negro, Paraná do Jacaré, USNM 311134, 4 (44.1–50.3). Rio Madeira basin, Rio Livramento, MCZ 34130, 3 (2, 109.5–111.5); AMNH 12709, 2 (95.6–110.0), AMNH uncat., 3 (93.9–106.5); AMNH uncat., 2 (97.3–110.3); AMNH uncat., 2 (96.7–109.7); AMNH uncat., 2 (109.0–115.3); AMNH uncat., 3 (98.5–102.5); AMNH uncat., 2 (94.5–111.2). Rio Urubu, 25 mi [= 45 km] from Itacoatiara, USNM 179550, 2 (67.0–76.8; 1 specimen cleared and counterstained for cartilage and bone). *Mato Grosso*: Rio Tapajós system, upper Rio Juruena, USNM 194342, 1 (74.8). Rio Guaporé, vicinity of Vila Bela da Santíssima Trindade, MZUSP 37440, 106 (5, 60.8–82.7); USNM 313403, 10 (76.5–97.5); MZUSP 37516, 16. Rio Alegre, tributary to Rio Guaporé, 30 km from Vila Bela da Santíssima Trindade, MZUSP 37472, 1.

PERU. *Loreto*: Río Ucayali system, isolated pool at left bank of Quebrada Carahuayte at km 20 on road from Jenaro Herrera to Colonia Angamos, NRM 23731, 1 (59.5). Río Itaya, AMNH uncat., 1 (44.1). Río Ucayali system, Quebrada Copal, at km 15 on road from Jenaro Herrera to Colonia Angamos, NRM 23737, 1 (82.7). *Madre de Dios*: Río Tambopata system, Quebrada San Roque at km 11 on Puerto Maldonado to Cuzco road, NRM 23739, 2 (108.8–118.3).

ECUADOR. *Napo*: Jatuncocha, BMNH 1970.4.3:54, 1 (86.0).

BOLIVIA. *Beni*: Río Itenez, 9 km SE of Costa Marques,

Brazil, AMNH 37717, 4 (56.0–61.8). Arroyo Grande, 4 km W of Guayaramerín, at Riberalta road, AMNH 37712, 3 (111.5–123.0).

Cyphocharax festivus, new species

FIGURES 26–28; TABLE 5

Curimatus microcephalus.—Eigenmann, 1912:421, pl. XXXIV: fig. 2 [references, not all cited specimens].

DIAGNOSIS.—*Cyphocharax festivus* is distinguished in the genus by the combination of the absence of multiple series of dark horizontal stripes or multiple series of dark spots in a longitudinal pattern on the lateral and dorsolateral surfaces of the body, the absence of a large spot of dark pigmentation on the dorsal fin, the absence of a rounded spot or longitudinal stripe of dark pigmentation on the midlateral surface of the caudal peduncle, the possession of 29 to 33 lateral-line scales, and the relative depth of the caudal peduncle (0.12–0.13 of SL).

Cyphocharax festivus is most similar in body form, pigmentation, and overall appearance to *C. plumbeus*, another species widely distributed throughout the Amazon basin. The species are distinguished by the relative depth of the body (0.33–0.37 of SL in *C. festivus* versus 0.29–0.33 in *C. plumbeus*); relative length of the postorbital region of the head (0.33–0.39 of HL versus 0.42–0.48 respectively), and less discretely in the number of vertebrae (31 in *C. festivus* versus 31–33, typically 32, in *C. plumbeus*).

DESCRIPTION.—Body moderately elongate, somewhat laterally compressed. Dorsal profile of head distinctly convex anterior to vertical line through nostrils, straight from that line to tip of supraoccipital spine. Dorsal profile of body smoothly

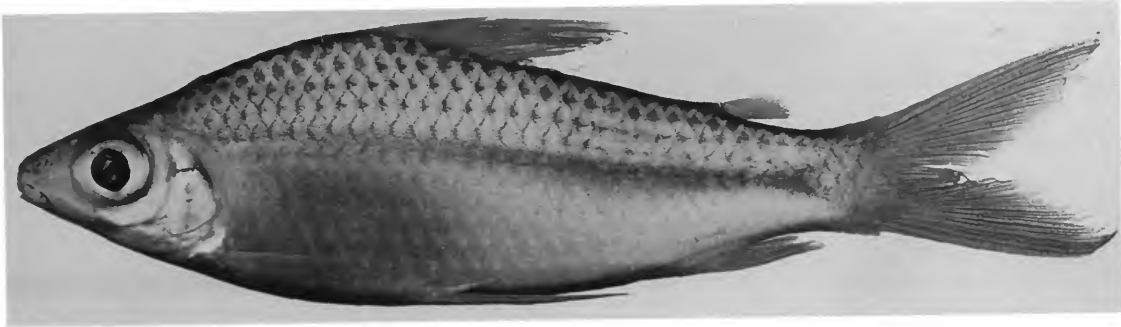


FIGURE 26.—*Cyphocharax festivus*, new species, holotype, USNM 280426, 62.6 mm SL; Peru, Loreto, caños entering Río Nanay, northeast of Iquitos (approx. 3°49'S, 73°11'W).

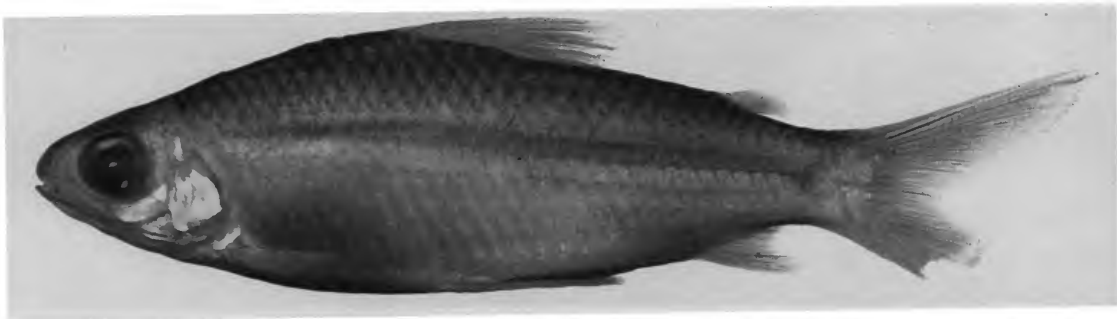


FIGURE 27.—*Cyphocharax festivus*, USNM 235479, 66.2 mm SL; Venezuela, Monogas, caño between Río Orinoco and Laguna Guatero, near Barrancas.

curved from tip of supraoccipital spine to origin of dorsal fin, somewhat more convex in larger specimens; straight and posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with 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 obtusely flattened, more obviously so in larger specimens, with median series of scales of approximately same size as scales of ventrolateral surface of proximate region of body. Median scale series flanked on each side by series of similarly-sized scales that conform to shape of obtuse lateral angles of body. Obtuse median keel posterior to pelvic-fin origin. Secondary 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 0.33–0.37 [0.35]; snout tip to origin of dorsal fin 0.47–0.51 [0.47]; snout tip to origin of anal fin 0.85–0.89 [0.86]; snout tip to origin of pelvic fin 0.53–0.58 [0.57]; snout tip to anus 0.77–0.81 [0.79]; origin of dorsal fin to hypural joint 0.57–0.62 [0.61]. Dorsal fin pointed in profile distally in smaller specimens; becoming more rounded with increasing age; last unbranched and first branched rays approximately $2\frac{3}{4}$ to 3 times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.18–0.23 [0.20], tip of fin extending nearly to vertical line

through origin of pelvic fin in smaller adults, falling short of that line in largest specimens examined. Pelvic fin pointed in profile distally; length of pelvic fin 0.22–0.26 [0.25], reaching to origin of anal fin in smaller specimens, only three-quarters of distance in larger specimens. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anterior branched rays twice length of ultimate ray. Least depth of caudal peduncle 0.12–0.13 [0.13].

Head pointed in profile, somewhat more rounded anteriorly in some populations; head length 0.28–0.31 [0.28]; upper jaw longer than lower, mouth subterminal; snout length 0.26–0.33 [0.30]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.35–0.40 [0.38]; adipose eyelid present, with vertically ovoid opening over center of eye, eyelid more developed anteriorly; length of postorbital portion of head 0.33–0.39 [0.34]; gape width 0.22–0.27 [0.25]; interorbital width 0.40–0.44 [0.41].

Pored lateral-line scales from supracleithrum to hypural joint 29 to 33 [31]; all scales of lateral line pored, canals in lateral-line scales straight; 3 or 4 series of pored scales extend beyond hypural joint onto caudal-fin base; $5\frac{1}{2}$ [$5\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; 4 or $4\frac{1}{2}$ (4 rare) [$4\frac{1}{2}$] scales in transverse series from lateral line to origin of anal fin. Two or three series of scales comparable in

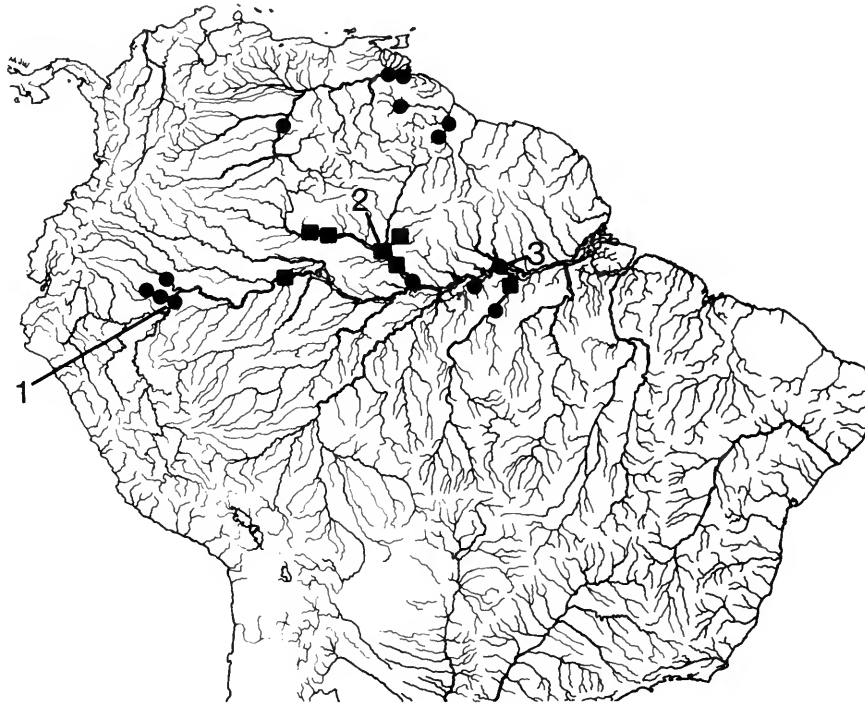


FIGURE 28.—Map of central and northern South America showing geographic distribution of *Cyphocharax festivus* (filled in circles; 1 = type locality) and *Cyphocharax nigripinnis* (squares; 2 = type locality); both *Cyphocharax festivus* and *Cyphocharax nigripinnis* captured at locality 3 (some symbols represent more than one locality or lot of specimens).

size to those on caudal peduncle extend onto middle rays of each lobe of caudal fin.

Dorsal-fin rays ii,9 or iii,9 (when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or 8, or iii,7 (ii,8 rare; when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 15 [14]; pelvic-fin rays i,8 [i,8].

Total vertebrae 31 (21).

COLOR IN ALCOHOL.—Specimens retaining some guanine on scales silvery, distinctly darker on dorsal portions of head and body. Specimens lacking guanine on scales with ground coloration tan to light brown overall. Dorsal surface of head and dorsal midline of body from tip of supraoccipital spine to dorsal fin and between dorsal fin and adipose fin distinctly darker. Deep-lying dusky midlateral stripe extending from supracleithrum nearly to hypural joint; band narrow anteriorly, progressively widening posteriorly, with anterior portion relatively less obvious in larger specimens. Band masked in specimens retaining guanine on scales. Scales on dorsolateral and dorsal surface of body with field of dark chromatophores on exposed posterior margin, pattern less obvious in larger specimens. Dorsal fin somewhat dusky, more so on distal portions of anterior rays in some individuals. Caudal-fin rays outlined by series of small chromatophores. Anal, pectoral, and pelvic fins hyaline.

DISTRIBUTION.—Rio Amazonas, Río Orinoco, and Essequibo River systems (Figure 28).

ETYMOLOGY.—The species name, *festivus*, from the Latin for pleasing refers to the pleasing aspect of the species.

REMARKS.—As shown on Figure 28 *Cyphocharax festivus* has a broad distribution with populations in the Amazon, Orinoco, and Essequibo river basins. Population samples from the Amazon basin tend to be somewhat less robust than those from the Orinoco and Essequibo systems (compare Figures 26, 27), and with a somewhat longer snout in the Amazonian populations (Note: this difference exaggerated by depressed gill arches and lower jaw in the specimen illustrated in Figure 27). Nonetheless, samples from different regions broadly overlap in examined meristics and morphometrics (Table 5), albeit with minor differences in the degree of overlap of ranges for relative pelvic-fin length, relative depth of caudal peduncle, number of scale rows between the anal-fin origin and lateral line, and number of vertebrae. In no instance do the ranges in particular features from the different populations demonstrate discrete differences. Further samples are necessary to determine whether it will be appropriate to recognize these differences taxonomically.

Eigenmann (1912:265) reported *Curimatus microcephalus* from a variety of localities in British Guiana (= Guyana). Some

TABLE 5.—Morphometrics and meristics of (A) examined specimens of *Cyphocharax festivus*, new species, originating in the Amazon basin from which counts and measurements were taken; (B) examined specimens of *Cyphocharax festivus* originating in the upper Río Orinoco basin in the state of Amazonas, Venezuela, from which counts and measurements were taken; (C) examined specimens of *Cyphocharax festivus* originating in the Essequibo River, Río Cuyuni, and lower Río Orinoco from which counts and measurements were taken. See under "Type Material Examined and Non-Type Material Examined" for complete listing of specimens and localities. Standard length is expressed in mm; measurements 1 to 10 are proportions of standard length; 11 to 14 are proportions of head length. Meristic values indicated by asterisk (*) are much less common.

Character	A	B	C
	MORPHOMETRICS		
Standard Length	30.0–82.5	37.1–43.3	36.2–66.2
1. Greatest body depth	0.33–0.37	0.33–0.35	0.32–0.35
2. Snout to dorsal-fin origin	0.47–0.51	0.46–0.51	0.48–0.52
3. Snout to anal-fin origin	0.85–0.89	0.84–0.89	0.84–0.88
4. Snout to pelvic-fin origin	0.53–0.58	0.55–0.58	0.53–0.59
5. Snout to anus	0.77–0.81	0.77–0.82	0.78–0.92
6. Origin of dorsal fin to hypural joint	0.57–0.62	0.57–0.61	0.55–0.61
7. Pectoral-fin length	0.18–0.23	0.18–0.21	0.18–0.23
8. Pelvic-fin length	0.22–0.26	0.22–0.27	0.22–0.28
9. Caudal peduncle depth	0.12–0.13	0.12–0.13	0.12–0.14
10. Head length	0.28–0.31	0.29–0.32	0.28–0.32
11. Snout length	0.26–0.33	0.27–0.32	0.26–0.31
12. Orbital diameter	0.35–0.40	0.36–0.40	0.35–0.41
13. Postorbital length	0.33–0.39	0.36–0.40	0.34–0.40
14. Interorbital width	0.40–0.44	0.40–0.44	0.39–0.44
	MERISTICS		
Lateral-line scales	29–33	30–32	29–33
Scale rows between dorsal-fin origin and lateral line	5 ¹ / ₂	5 ¹ / ₂	5*–5 ¹ / ₂
Scale rows between anal-fin origin and lateral line	4*–4 ¹ / ₂	4 ¹ / ₂ –5*	4 ¹ / ₂ –5*
Branched dorsal-fin rays	9	9	8*–9
Branched anal-fin rays	7–8*	7	7–8*
Total pectoral-fin rays	13–15	14–15	13–16
Branched pelvic-fin rays	8	8	8
Vertebrae	31	31	31–32*

of the specimens that served as the basis for that record (USNM 66141, 307859; AMNH 7118) are *Cyphocharax festivus*.

TYPE MATERIAL EXAMINED.—29 specimens (29, 39.4–62.2).

HOLOTYPE.—PERU. *Loreto*: Caños entering Río Nanay, northeast of Iquitos (approx. 3°49'S, 73°11'W), collected by R.P. Vari et al., 18 Aug 1986, USNM 280426, 1 (62.6).

PARATYPES.—PERU. *Loreto*: Río Nanay, approx. 20 km upstream of confluence with Río Amazonas; side channels, mainstream, and pools along river (approx. 3°51'S, 73°15'W), collected by R.P. Vari et al., 19 Aug 1986, USNM 280427, 5 (39.4–90.2; 1 specimen cleared and counterstained for cartilage and bone). Río Nanay, both banks near caño draining from Yaranacocha, at second left bend above Mishana, collected by S.O. Kullander et al., 20–21 Aug 1983, NRM 26547, 3 (50.4–63.4). Río Nanay system, small tahuampa cocha on left bank, second left bend above Mishana, collected by S.O. Kullander et al., 21 Aug 1983, NRM 26628, 10 (52.0–65.3); MZUSP 41300, 5 (51.5–60.1); MUSM 2596, 5 (49.0–59.1).

NON-TYPE MATERIAL EXAMINED.—233 specimens (64, 30.0–82.5).

PERU. *Loreto*: Río Nanay system, small tahuampa cocha on left bank, second left bend above Mishana, NRM uncat., 16 (collected with NRM 26628, MZUSP 41300, and MUSM 2596). Río Nanay, left bank sand playa opposite mouth of Quebrada Agua Negra, NRM 24061, 3 (2, 57.0–58.1). Río Nanay, left bank sand playa opposite Llanchocha Cocha, NRM 24087, 7. Río Napo system, Río Mazán, right bank cocha, 2 hours upstream of Puerto Alegre, NRM 24088, 32 (5, 30.0–40.1). Río Napo system, Río Mazán, left bank sand playa, approx. 20 minutes upstream of Puerto Alegre, NRM 24077, 1 (48.9).

VENEZUELA. *Bollvar*: Río Cuyuni, Isla de Jacobo, near the Raudal de Kinotovaca, MBUCV V-9489, 71 (15, 38.4–48.3); USNM 295586, 4 (formerly MBUCV V-10198, in part). Raudal de Kinotovaca, approx. 40 km S of El Dorado, MBUCV V-9985, 3. Río Orocopiche, approx. 15 km from mouth in Río Orinoco, downstream from Route 19 bridge (approx. 8°03'N, 63°40'W), USNM 235460, 5 (3, 40.5–43.0). *Monagas*: Caño between Río Orinoco and Laguna Guatero, near Barrancas, 142 nautical miles from Sea Buoy, USNM 235479, 1 (66.2). Caño Chivera, Isla Chivera, near Barrancas, USNM 235508, 3

(44.4–45.8). Secondary caño about 500 m from its mouth in Caño Guarapo (approx. 8°39'24"N, 62°14'W), USNM 235458, 3 (36.2–42.0). *Territorio Federal Amazonas*: Río Cataniapo, where crossed by road from Puerto Ayacucho to Samariapo, USNM 269920, 2 (44.2–43.3). Río Orinoco, Raudales de Ature, eastern shore, USNM 269919, 2 (37.1–40.4).

BRAZIL. *Pará*: Rio Tapajós, Ilha da Barreirinha, near São Luís, MZUSP 22100, 62 (15, 66.3–82.5). Oriximiná, MZUSP 5563, 1. *Amazonas*: Município de Maués, Igarapé do Rio Marauá, MZUSP 7283, 2. Igarapé Tarumãzinho, N of Manaus, MZUSP 6816, 1. Uruará, Paraná de Uruará, MZUSP 5775, 1.

GUYANA. *Essequibo*: Lower Potaro River, Tumatumari, USNM 66141, 5 (42.3–50.5); USNM 307859, 6 (43.0–59.1); Rockstone, AMNH 7118, 2 (1, 47.4).

Cyphocharax nigripinnis, new species

FIGURES 28–30

Curimata sp. n.—Goulding et al., 1988:139, 140, 144 [Brazil: Amazonas, Rio Negro basin, Ilha Buiu-Açu, Ilha Tamaquaré; detritivory].

DIAGNOSIS.—The patch of black pigmentation on the distal portions of the adipose fin is unique to *Cyphocharax nigripinnis* among all curimatids. *Cyphocharax nigripinnis* is further distinguished in the genus by the combination of 34 to 37 lateral-line scales, the relative depth of the caudal peduncle 0.10–0.12 of SL, the absence of multiple series of longitudinal patterns of dark pigmentation on the body, the absence of a large spot of pigmentation on the dorsal fin, and the absence of a rotund spot or longitudinal stripe of dark pigmentation on the midlateral surface of the caudal peduncle.

Cyphocharax nigripinnis is most similar in body form and overall appearance to *C. plumbeus*, *C. festivus*, and *C. notatus*, none of which have dark pigmentation on the distal portions of the adipose fin. In addition, *Cyphocharax nigripinnis* lacks the distinct dark pigmentation on the distal portions of the dorsal and often caudal fins typical of *C. notatus*. *Cyphocharax nigripinnis* is further separable from *C. plumbeus* in relative head length (0.31–0.35 of SL versus 0.26–0.31, respectively) and in the number of scales in the lateral line to the hypural joint (34 to 37 versus 30 to 34). *Cyphocharax nigripinnis* and *C. festivus* also differ in relative head length (0.31–0.35 of SL versus 0.28–0.31, respectively), relative eye width (0.28–0.35 of HL versus 0.35–0.40), and relative length of the postorbital portion of the head (0.40–0.46 of HL versus 0.33–0.39).

DESCRIPTION.—Body relatively elongate, somewhat compressed laterally. Dorsal profile of head slightly convex from upper lip to vertical line between nostrils of each side, straight or slightly convex from that line posteriorly to tip of supraoccipital spine; 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 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 obtusely flattened, with median series of scales; scales of approximately same size as those of proximate ventrolateral portions of body. Median scale series flanked on each side by series of comparably sized scales that conform to obtuse lateral angles of that region of body. Obtuse median keel posterior to pelvic-fin origin. Secondary 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 0.26–0.31 [0.27]; snout tip to origin of dorsal fin 0.46–0.52 [0.48]; snout tip to origin of anal fin 0.82–0.89 [0.82]; snout tip to origin of pelvic fin 0.55–0.61 [0.56]; snout tip to anus 0.77–0.82 [0.77]; origin of dorsal fin to hypural joint 0.53–0.58 [0.58]. Dorsal fin pointed in profile; more rounded distally in larger specimens; last unbranched and first branched rays 2.5 to 3 times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.18–0.21 [0.18], extending about two-thirds distance to vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally; length of pelvic fin 0.19–0.23 [0.20], reaching approximately two-thirds distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays about two times length of ultimate ray. Least depth of caudal peduncle 0.10–0.12 [0.11].

Head profile pointed overall; head length 0.31–0.35 [0.32]; upper jaw longer than lower, mouth subterminal; snout length 0.26–0.32 [0.28]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.28–0.35 [0.29]; adipose eyelid present, with vertically ovoid opening over center of eye, more developed anteriorly; length of postorbital portion of head 0.40–0.46 [0.44]; gape width 0.22–0.27 [0.22]; interorbital width 0.36–0.41 [0.36].

Pored lateral-line scales from supracleithrum to hypural joint 34 to 37 [35]; all scales of lateral line pored, canals in lateral-line scales straight; 2 to 4 series of pored scales extend beyond hypural joint onto caudal-fin base; 6 to 6^{1/2} [6^{1/2}] scales in transverse series from origin of dorsal fin to lateral line; 4^{1/2} to 6 [5^{1/2}] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or iii,9 (iii,9 less common; when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,6 or 7 or iii,7 (ii,6 in only 1 specimen; when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 16 [15]; pelvic-fin rays i,8 [i,8].

Total vertebrae 31 (55).

COLOR IN ALCOHOL.—All examined specimens lacking guanine on scales, ground coloration ranging from tan to brown, darker on dorsal portions of head and body. No pronounced pigmentation pattern on either head or body. Distal one-third to one-half of adipose fin with a patch of black pigmentation. Other fins ranging from hyaline to dusky.

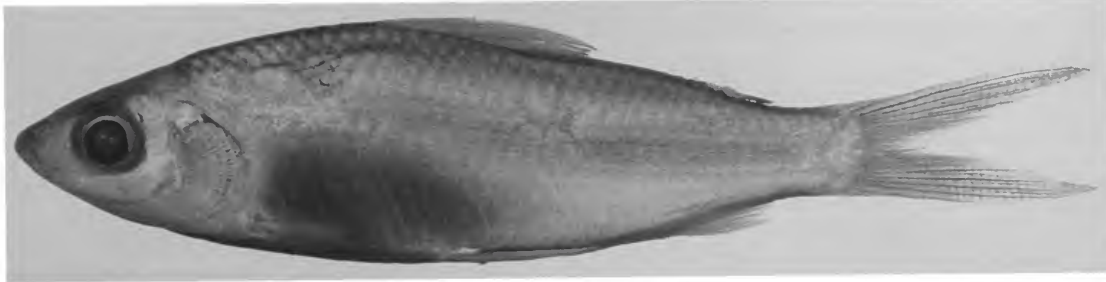


FIGURE 29.—*Cyphocharax nigripinnis*, new species, holotype, MZUSP 42025, 51.6 mm SL; Brazil, Roraima, Rio Branco, Praia do Xerui (approx. 1°S, 61°50'W). Dark distal portion of adipose fin not apparent due to depression of fin.

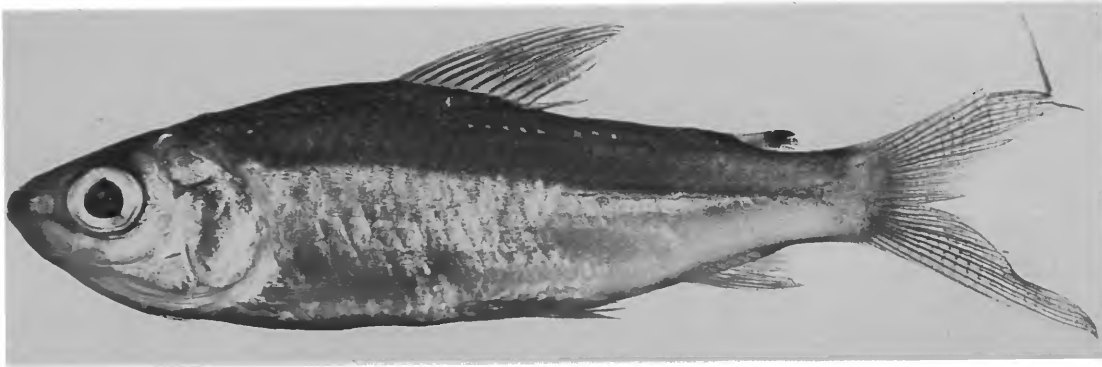


FIGURE 30.—*Cyphocharax nigripinnis*, new species, paratype, USNM 311111, 38.1 mm SL; Brazil, Amazonas, Rio Negro, lake on Ilha Tamaquaré (approx. 0°30'S, 64°55'W).

AUTAPOMORPHIES OF *Cyphocharax nigripinnis*.—Only a single autapomorphy for *Cyphocharax nigripinnis*, the black pigmentation on the distal half of the adipose fin, has been identified in this study. No other species of curimatid is known to have comparable pigmentation.

DISTRIBUTION.—Central and eastern portions of Amazon basin (Figure 28).

ETYMOLOGY.—The species name, *nigripinnis*, from the Latin *nigra*, black, and *pinna*, fin, refers to the black pigmentation on the distal portion of the adipose fin in this species.

ECOLOGY.—Goulding et al. (1988:139, 140, 144) reported this species (as *Curimata* sp. n.) from both island lakes and woody shore margins in acidic black-waters of the Rio Negro basin.

TYPE MATERIAL EXAMINED.—60 specimens (60, 34.8–54.9).

HOLOTYPE.—BRAZIL. *Roraima*: Rio Branco, Praia do Xerui (approx. 1°S, 61°50'W), collected by M. Goulding et al., 11 May 1979, MZUSP 42025, 1 (51.6).

PARATYPES.—BRAZIL. *Roraima*: Rio Branco, Praia do Xerui (approx. 1°S, 61°50'W), 3 specimens collected with holotype: MZUSP 42026, 1 (48.8); USNM 311109, 2

(48.9–53.9). Rio Branco, Praia do Xerui (approx. 1°S, 61°50'W), collected by M. Goulding et al., 12 May 1979, MZUSP 42027, 1 (48.3); USNM 311098, 2 (41.8–50.3). *Amazonas*: Rio Negro, lake on island below mouth of Rio Daraá (approx. 0°30'S, 64°40'W), collected by M. Goulding et al., 17 Feb 1980, USNM 267976, 19 (42.2–64.9); MZUSP 42028, 28 (38.9–50.5). Rio Negro, lake on Ilha Tamaquaré (approx. 0°30'S, 64°55'W), collected by M. Goulding et al., 10 Oct 1979, USNM 311111, 3 (38.1–40.0). Rio Negro, at confluence with Rio Arirará (approx. 0°30'S, 63°35'W), collected by M. Goulding et al., 1 Feb 1980, USNM 311108, 1 (43.1). Rio Negro, Lake on Ilha da Buiu-açu, near confluence with Rio Urubaxi (approx. 0°35'S, 64°45'W), collected by M. Goulding et al., 6 Feb 1980, USNM 311114, 2 (34.8–37.0).

NON-TYPE MATERIAL EXAMINED.—165 specimens (9, 39.2–42.0).

BRAZIL. *Pará*: Rio Tapajós, Barreirinha, near São Luís, MZUSP 23716, 4. Oriximiná, Lago Jacaré, MZUSP 8196, 45. *Amazonas*: Rio Negro, lake on island below mouth of Rio Daraá, USNM 311112, 1 (specimen cleared and counterstained for cartilage and bone). Rio Negro, lake on Ilha Tamaquaré, USNM 311106, 96 (8, 39.2–41.7). Lagoa dos Sapos, 70–80 km above mouth of Rio Jauaperi, MZUSP 21047, 11. Lagoa

Central, left bank of Rio Negro between Rio Camaraú and Rio Apuá, MZUSP 21055, 3. Rio Içapó, mouth of Rio Jutai, MZUSP 21022, 2.

COLOMBIA. *Amazonas*: Santa Lucia, AMNH 32947, 3 (1, 42.0).

Cyphocharax plumbeus (Eigenmann and Eigenmann)

FIGURES 31–34

Curimatus plumbeus Eigenmann and Eigenmann, 1889:425 [type locality: Brazil: Lake Hyanuary (= Paraná do Januari)]; 1891:47 [reference].—Ulrey, 1895:259 [Pará].—Pellegrin, 1909:148 [Brazil: Tonnantins].—Eigenmann, 1910:421 [reference].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].—Vari and Howe, 1991:19 [listing of type specimens in NMNH]. [Not Amaral Campos, 1945:461.]

Curimatorbis plumbeus.—Fernández-Yépez, 1948:43 [assignment to *Curimatorbis*].—Fowler, 1975:371 [reference].

Curimata plumbea.—Fowler, 1950:290 [literature compilation].—Goulding et al., 1988:127, 132, 133, 134, 135, 139, 141, 143 [Brazil: Rio Negro basin, mouth of Rio Urubaxi, Ilha Tamaquare, Anavilhanas; detriúvory]. [Not Gomes and Monteiro, 1955:89.]

DIAGNOSIS.—*Cyphocharax plumbeus* is distinguished in the genus by the combination of the absence of multiple series of longitudinal patterns of dark pigmentation on the body, the absence of a large spot of pigmentation on the dorsal fin, and the absence of a rotund spot or longitudinal stripe of dark pigmentation on the midlateral surface of the caudal peduncle, the presence of 30 to 34 lateral-line scales, and a least depth of the caudal peduncle 0.11–0.12 of SL.

Cyphocharax plumbeus is very similar to *C. festivus*, another species widely distributed throughout the Amazon basin. The two species can be distinguished by relative body depths (0.29–0.33 of SL in *C. plumbeus* versus 0.33–0.37 in *C. festivus*), relative length of the postorbital portion of the head (0.42–0.48 of HL versus 0.33–0.39, respectively), and less discretely in the number of vertebrae (31–33, typically 32 in *C. plumbeus* versus 31 in *C. festivus*).

DESCRIPTION.—Body moderately elongate, particularly in specimens under 50 mm SL, somewhat compressed laterally, more so in specimens over 60 mm SL. Dorsal profile of head convex from upper lip to vertical line through posterior nostril, straight or very slightly concave from that point to tip of supraoccipital spine. Dorsal profile of body smoothly curved from tip of supraoccipital spine to origin of dorsal fin, convexity more pronounced in larger specimens; straight and posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with obtuse median keel anterior to dorsal fin, keel more pronounced in larger specimens; profile smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region obtusely flattened, with median series of scales not notably larger than those of adjoining ventrolateral surface of body. Median scale series flanked on each side by

series of comparably-sized scales that conform in shape to indistinct ventrolateral angles of that region of body. Obtuse median keel present posterior to pelvic-fin origin. Secondary obtuse keel on each side of postpelvic portion of body one scale dorsal of ventral midline.

Greatest body depth at origin of dorsal fin, relative depth increasing with standard length, depth 0.29–0.33 [0.32]; snout tip to origin of dorsal fin 0.45–0.50 [0.46]; snout tip to origin of anal fin 0.82–0.86 [0.83]; snout tip to origin of pelvic fin 0.51–0.56 [0.52]; snout tip to anus 0.75–0.80 [0.77]; origin of dorsal fin to hypural joint 0.55–0.59 [0.57]. Dorsal fin pointed in profile distally; relatively more rounded with increasing age; last unbranched and first branched rays 2½ to 3 times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.16–0.21 [0.18], extends about two-thirds distance to vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally; length of pelvic fin 0.21–0.25 [0.23], reaching about one-half of distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays approximately twice length of ultimate ray. Least depth of caudal peduncle 0.11–0.12 [0.12].

Head distinctly pointed in profile; head length 0.26–0.31 [0.28]; upper jaw slightly longer than lower, mouth subterminal; snout length 0.26–0.32 [0.29]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.32–0.38 [0.31]; adipose eyelid present, with vertically ovoid opening over center of eye; adipose eyelid more developed anterior to eye, degree of overall development of adipose eyelid greater in larger individuals; length of postorbital portion of head 0.42–0.48 [0.43]; gape width 0.22–0.29 [0.28]; interorbital width 0.38–0.44 [0.42].

Pored lateral-line scales from supracleithrum to hypural joint 30 to 34 [32]; all scales of lateral line pored, canals in lateral-line scales straight; 2 to 4 series of pored scales extend beyond hypural joint onto caudal-fin base; 5 or 5½ (5 rare) [5½] scales in transverse series from origin of dorsal fin to lateral line; 4½ to 5 (5 rare) [4½] scales in transverse series from lateral line to origin of anal fin; basal one-quarter of middle rays in each lobe of caudal fin covered with series of scales of approximately same size as those on posterior portion of caudal peduncle.

Dorsal-fin rays ii,9 or iii,9 (when three unbranched rays present, first very short) [iii,9]; anal-fin rays ii,6 or 7 or iii,7 (ii,6 in only 1 specimen; when three unbranched rays present, first very short) [iii,7]; pectoral-fin rays 13 to 16 [15]; pelvic-fin rays i,8 [i,8].

Total vertebrae 31 (14), 32 (45), 33 (9).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery, darker on dorsal surface of head and along middorsal line from tip of supraoccipital spine

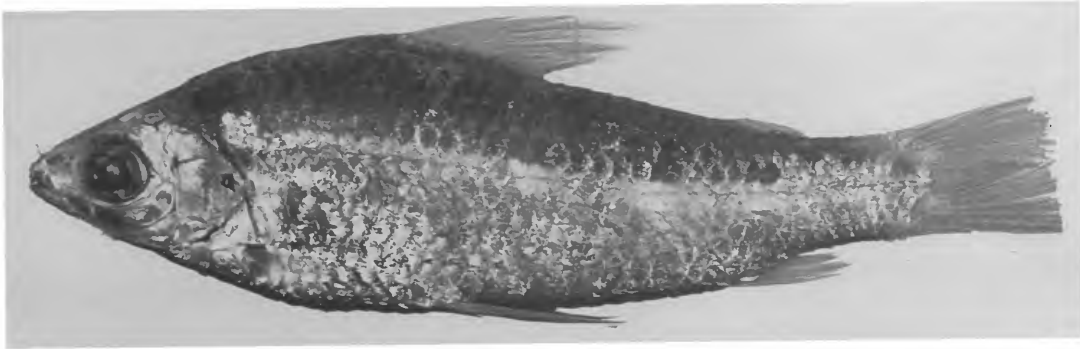


FIGURE 31.—*Cyphocharax plumbeus*, lectotype of *Curimatus plumbeus*, MCZ 31493, 97.4 mm SL; Brazil, Amazonas, Lake Hyanuary (= Paraná do Januari).

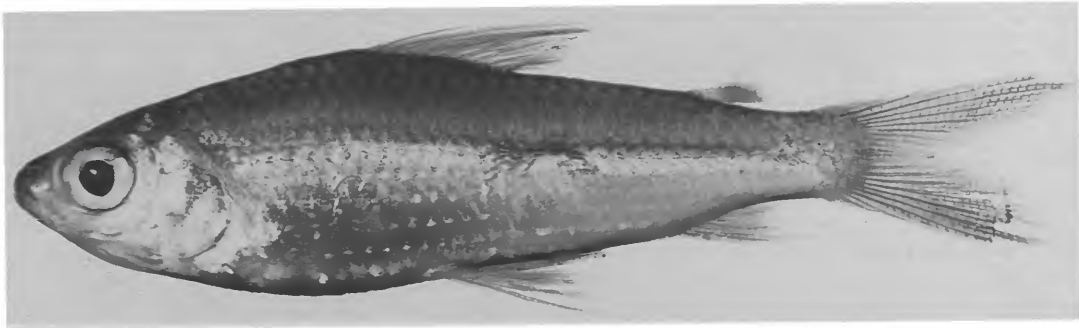


FIGURE 32.—*Cyphocharax plumbeus*, juvenile, USNM 311129, 51.5 mm SL; Brazil, Amazonas, Lago Januari.

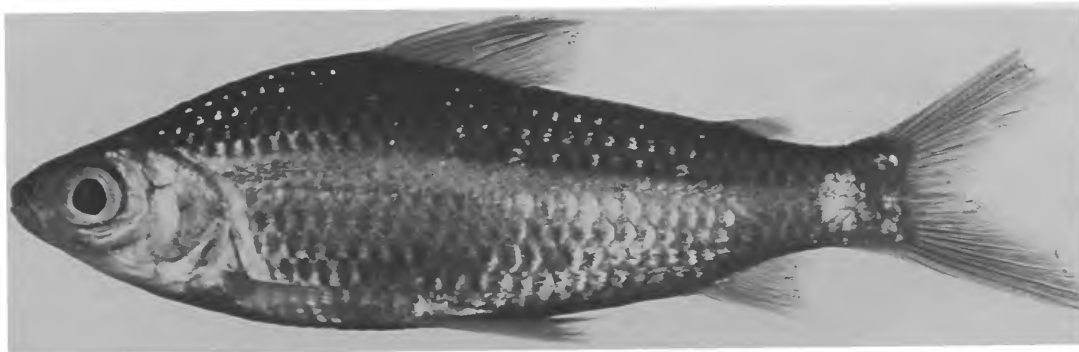


FIGURE 33.—*Cyphocharax plumbeus*, USNM 229179, 94.5 mm SL; Brazil, Amazonas, Lago Januari.

to caudal peduncle. Ground coloration of specimens lacking guanine on scales tan to brown, darker dorsally. Deep-lying dark stripe extending anteriorly from hypural joint to under dorsal fin in specimens under approximately 50 mm SL, streak extending progressively more anteriorly in larger specimens, reaching to supracleithrum in larger individuals; streak masked in specimens retaining guanine on scales. Middorsal region immediately anterior to insertion of first dorsal-fin ray with horizontally ovoid dark spot. Middorsal region immediately

posterior to tip of supraoccipital spine with diffuse, horizontally elongate dark streak in many specimens, particularly larger individuals. Scales dorsal of lateral line with patches of dusky pigmentation, degree of pigmentation more pronounced in larger specimens. Dorsal-, caudal-, and anal-fin rays outlined to varying degrees by series of small, dark chromatophores. Paired fins hyaline.

DISTRIBUTION.—Rio Amazonas and Rio Tocantins basins (Figure 34).

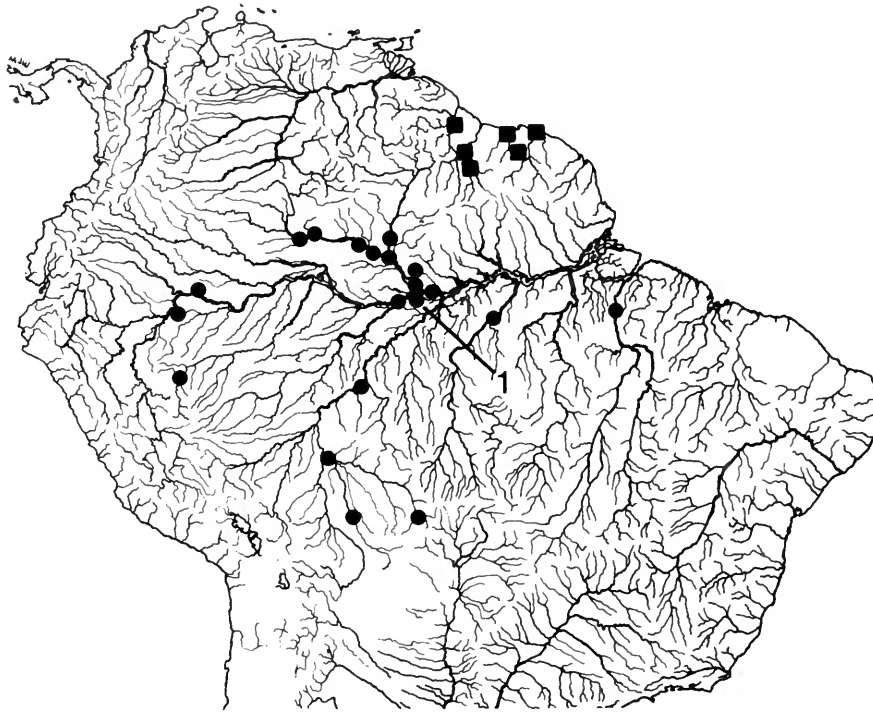


FIGURE 34.—Map of central and northern South America showing geographic distribution of *Cyphocharax plumbeus* (filled in circles; 1 = type locality of *Curimatus plumbeus*) and *Cyphocharax microcephalus* (squares; type locality inexact: Surinam) (some symbols represent more than one locality or lot of specimens).

COMMON NAME.—Brazil, Acre: Sabaru (I. Sazima, pers. comm.).

ECOLOGY.—Goulding et al., (1988) cited this species as a detritivore. It is widespread in the acidic blackwaters of the Rio Negro basin in habitats including beaches, confluence swamps, rocky pools, island lakes, and woody shores.

REMARKS.—Eigenmann and Eigenmann (1889:425) described *Curimatus plumbeus* based on two lots from Lake Hyanuary (= Paraná do Januari) in the central Amazon (Figure 34, locality 1); one lot consisted of eight specimens (MCZ 31493), and the second of 15 specimens (MCZ 20348). The specimen in the best overall condition in MCZ 31493 is designated as the lectotype. The remaining specimens originally in that lot (now catalogued as MCZ 92960) together with MCZ 20348 and USNM 120256 (formerly MCZ 20348, in part) become paralectotypes.

Amaral Campos (1945:461), Gomes and Monteiro (1955:89), and de Godoy (1975:594) cited *Cyphocharax plumbeus* in various genera from portions of the upper Rio Paraná basin in Brazil. *Cyphocharax plumbeus* is unknown from anywhere in the Río de La Plata basin, or proximate portions of the river systems bordering the Rio Paraná basin. Based on the information provided by Amaral Campos (1945), Gomes and Monteiro (1955), and most notably the scale counts cited by de Godoy (1975:595) and the accompanying figure (de

Godoy, 1975, fig. 133) in the same publication, it is likely that the cited specimens were misidentified *C. nagelii*, a species endemic to the upper Rio Paraná system.

MATERIAL EXAMINED.—447 specimens (106, 38.4–178.0).

BRAZIL. *Pará*: Rio Tapajós, Itaituba, USNM 267968, 28 (12, 60.8–77.8; 2 specimens cleared and counterstained for cartilage and bone). Rio Tocantins, below Tukuruf, lagoon along margin of Igarapé Muru, MZUSP 21288, 26. *Amazonas*: Lake Hyanuary (= Paraná do Januari), MCZ 31493, 1 (97.4, lectotype of *Curimatus plumbeus*); MCZ 92960, 7 (38.4–86.8, paralectotypes of *Curimatus plumbeus*; formerly MCZ 31493, in part); MCZ 20348, 9 (paralectotypes of *Curimatus plumbeus*); USNM 120256, 6 (59.2–101.1, paralectotypes of *Curimatus plumbeus*; formerly MCZ 20348, in part). Lago Januário, USNM 311129, 1 (51.5); USNM 311121, 1 (57.3); USNM 229179, 1 (94.5); MZUSP 6861, 3. São José, Lago do Castanho, Januário, USNM 229180, 3 (57.4–66.8); USNM 308118, 1 (89.7; specimen cleared and counterstained for cartilage and bone). Paraná de Januário, at entrance to Lago do Castanho, USNM 229170, 4. Paraná da Ilha de Marchantaria, USNM 305112, 1. Ilha de Marchantaria, USNM 346914, 6. Igarapé Taramãzinho, N of Manaus, MZUSP 6764, 126. Rio Negro, below Daraá, USNM 311118, 5; USNM 311103, 11 (4, 53.5–60.7). Rio Negro, Praia de Urumari, above Barcelos, USNM 311122, 1; USNM 307802, 4. Rio Negro, Barcelos,

USNM 311119, 4 (50.4–51.8). Rio Negro, Paraná do Jacaré, USNM 311116, 5. Rio Negro, Ilha de Buiu-açu, USNM 267969, 68 (19, 51.7–57.7). Rio Negro, near junction with Rio Branco, USNM 311125, 15. Rio Marauíá, beach at confluence with Rio Negro, USNM 311115, 5. Rio Arirará, at confluence with Rio Negro, USNM 311120, 6; USNM 307801, 4. Rio Tefé, Jurupari, USNM 267970, 55. Rio Urubaxi, tributary of Rio Negro south of E end of Ilha Tamaquaré, USNM 311135, 2 (1, 59.8); USNM 311117, 1 (63.3). Mouth of Rio Purus, MZUSP 5952, 1 (136.7). *Roraima*: Rio Branco, 20 km below Boi-açu, MZUSP 21164, 6 (49.7–54.3). *Acre*: Lago do Valparaiso, Município do Cruzeiro do Sul, ZUEC 408, 1 (105.5). *Rondonia*: Rio Madeira, mouth of Rio Machado, USNM 267967, 1 (66.0). *Mato Grosso*: Rio Guaporé, vicinity of Vila Bela da Santíssima Trindade, MZUSP 37441, 23 (147.0–178.0).

BOLIVIA. *Beni*: Río Itenez (= Guaporé), at confluence of Río Itenez and Río Machupo, USNM 278559, 1 (69.7). Río Blanco, USNM 278583, 1.

PERU. *Loreto*: Sansho Caño, USNM 175866, 1; USNM 175865, 1 (88.6). Caño draining into Río Manítí, about 8 km upriver of junction of Río Manítí and Río Amazonas, USNM 280428, 1 (65.8).

Cyphocharax microcephalus (Eigenmann and Eigenmann)

FIGURES 34–36

Curimatus microcephalus Eigenmann and Eigenmann, 1889:423 [type locality: Surinam].—Eigenmann, 1910:421 [reference]; 1912:265 [reference, not cited specimens or illustrated specimen (pl. XXXIV: fig. 2)].—Cockerell, 1914:94 [scale anatomy].—Boeseman, 1952:183 [Surinam: Coropina Creek at Republik; Nanni Creek at Coropina, near Paramaribo].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*]. [Not Ulrey, 1895:259.]

Curimatus alburnus.—Eigenmann and Eigenmann, 1889:418 [in part, Surinam, not Amazonian citations].—Puyo, 1949:118 [French Guiana: upper Mana River].

Curimatella alburnus.—Fowler, 1906:297 [Surinam ?]; 1919:130 [Surinam].—Boeseman, 1952:183 [Surinam: Marowini River basin; Nanni Creek at Coropina, near Paramaribo].

Apolinarella microcephala.—Fernández-Yépez, 1948:23 [reference].—Fowler, 1975:363 [reference].

Curimatella alburna alburna.—Géry, 1965:123 [Surinam: Albina].

DIAGNOSIS.—*Cyphocharax microcephalus* is distinguished in the genus by the combination of the absence of multiple series of longitudinal patterns of dark pigmentation on the body, the absence of a large spot of pigmentation on the dorsal fin, the absence of a rotund spot or longitudinal stripe of dark pigmentation on the midlateral surface of the caudal peduncle, the presence of 29 to 32 lateral-line scales, and a relative depth of the caudal peduncle 0.14–0.16 of SL.

Cyphocharax microcephalus is most similar in overall morphology to *C. helleri* and *C. gouldingi*, two other members of the genus occurring in the Guianas. *Cyphocharax microcephalus* differs from those two species in lacking their characteristic spot of dark pigmentation on the midlateral

surface of the caudal peduncle (see Figures 35, 36). It also differs from *C. gouldingi* in the relative length of the postorbital region of the head (0.42–0.47 of HL in *C. microcephalus* versus 0.34–0.40 in *C. gouldingi*), and less discretely in the relative depth of the caudal peduncle (0.14–0.16 of SL versus 0.12–0.14 respectively). *Cyphocharax microcephalus* lacks the series of longitudinal, distinctly dark stripes on the body characteristic of *C. helleri*, and the two species differ in the relative length of the postorbital portion of the head (0.42–0.47 of HL in *C. microcephalus* versus 0.36–0.42 in *C. helleri*), and less discretely in the relative depth of the caudal peduncle (0.14–0.16 of SL versus 0.12–0.14, respectively).

DESCRIPTION.—Body moderately elongate, relatively compressed laterally. Dorsal profile of head convex anteriorly from upper lip to vertical line extending between nostrils of each side, straight from that line to tip of supraoccipital spine. Dorsal profile of body straight or slightly 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 less obvious in larger individuals, smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region obtusely flattened transversely, flattening more pronounced proximate to pelvic-fin origin, with median series of scales approximately of same size as those on adjoining ventrolateral portions of body. Median scale series flanked on each side by longitudinal series of scales conforming in shape to lateral angles of body. Obtuse median keel posterior to origin of pelvic fin. Secondary obtuse keel on each side of postpelvic portion of body about one scale dorsal of ventral midline.

Greatest body depth at origin of dorsal fin, depth 0.38–0.43 [0.41]; snout tip to origin of dorsal fin 0.49–0.53 [0.49]; snout tip to origin of anal fin 0.83–0.87 [0.83]; snout tip to origin of pelvic fin 0.54–0.59 [0.54]; snout tip to anus 0.78–0.84 [0.78]; origin of dorsal fin to hypural joint 0.55–0.61 [0.58]. Dorsal fin pointed in profile distally; more rounded with increasing age; last unbranched and first branched rays three to three and one-half times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.19–0.24 [0.22], extends posteriorly into region limited anteriorly by vertical line about three-quarters of distance to vertical through origin of pelvic fin and posteriorly by a point slightly short of vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally, length of pelvic fin 0.23–0.29 [0.24], reaches about two-thirds to three-quarters distance to origin of anal fin. Caudal fin forked; with small patch of scales on each lobe of caudal fin; scales slightly smaller than those on posterior portion of caudal peduncle. Scales absent on middle caudal-fin rays, not extending more than one-third of distance along margin of fin, scales extending at their maximum about one-half length of middle rays of each caudal-fin lobe. Adipose fin well

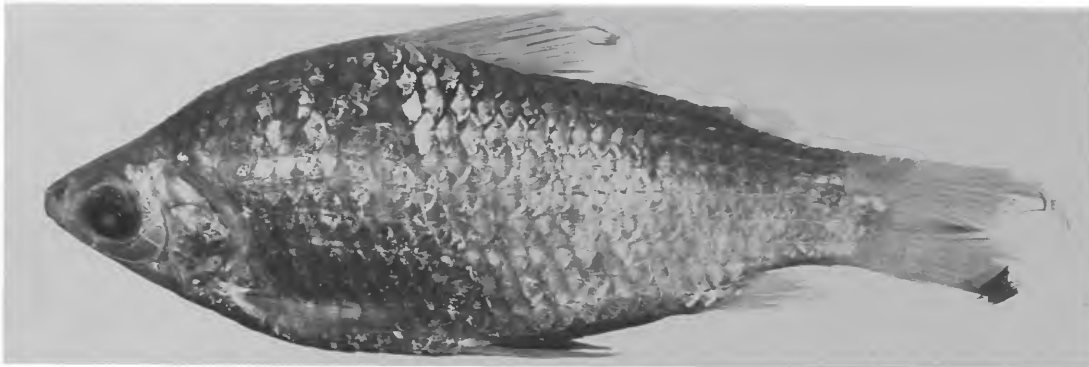


FIGURE 35.—*Cyphocharax microcephalus*, lectotype of *Curimatus microcephalus*, MCZ 785, 104.7 mm SL; Surinam, no exact locality.

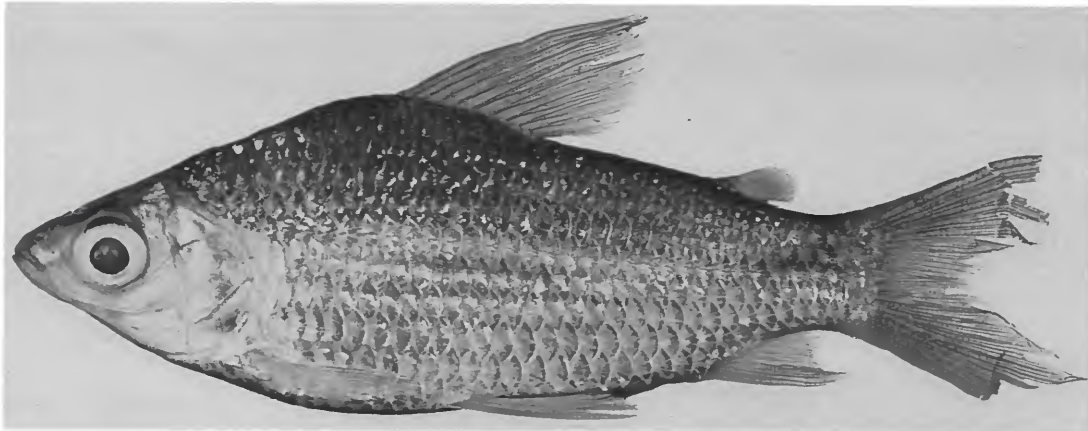


FIGURE 36.—*Cyphocharax microcephalus*, ZMA 106.815, 84.7 mm SL; Surinam, Bloomenstein Reservoir, 4 km S of Afobaka.

developed. Anal fin emarginate, anteriormost branched rays about three times length of ultimate ray. Least depth of caudal peduncle 0.14–0.16 [0.15].

Head distinctly pointed in profile, head length 0.28–0.35 [0.28]; upper and lower jaws of approximately equal length, mouth terminal; snout length 0.25–0.32 [0.27]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.28–0.34 [0.30]; adipose eyelid present, moderately developed, more developed anterior to orbit, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.42–0.47 [0.44]; gape width 0.25–0.31 [0.27]; interorbital width 0.44–0.48 [0.44].

Pored lateral-line scales from supracleithrum to hypural joint 29 to 32 [30]; 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; $5\frac{1}{2}$ [$5\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; $4\frac{1}{2}$ or 5 [$4\frac{1}{2}$] scales in

transverse series from lateral line to origin of anal fin. Caudal fin partially covered with scales basally; scales somewhat smaller than those on caudal peduncle.

Dorsal-fin rays ii,9 or iii,9 (when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or iii,7 (when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 16 [15]; pelvic-fin rays i,8 or i,9 (i,9 rare) [i,8].

Total vertebrae 31 (4), 32 (68), 33 (1).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales plumbeus to silvery, darker on dorsal portions of head and body. Obscure midlateral dusky stripe. Indistinct dusky longitudinal stripes aligned along junctions between horizontal scale rows in some specimens over 40 mm SL. Specimens lacking guanine on scales tan to brown, darker on dorsal portions of head and body, particularly along dorsal midline. Obscure dusky band extending from supracleithrum to caudal peduncle. Larger individuals with center of scales often more lightly pigmented than dorsal and ventral margins, resulting in very faint irregular darker stripes

along borders between horizontal scale rows. Median fins, particularly dorsal and caudal, dusky, with fin rays outlined by series of small, dark chromatophores. Paired fins hyaline, or sometimes very slightly dusky.

DISTRIBUTION.—Atlantic drainages of Guyana, Surinam, and possibly French Guiana (see "Remarks") (Figure 34).

REMARKS.—Eigenmann and Eigenmann based the original description (1889:423) of *Curimatus microcephalus* on four specimens from an unspecified locality in Surinam. The largest syntype (MCZ 785, 104.7 mm SL) is designated as the lectotype and the three other syntypes (MCZ 92958) become paralectotypes.

Examined specimens of *Cyphocharax microcephalus* originated solely in Surinam and Guyana. Puyo (1949:118), however, cited *Curimatus alburnus* from the upper Mana River in French Guiana, a region from which the species is otherwise unknown (Vari, 1992). Although data provided by Puyo are not sufficient to permit a definite identification, it is quite possible that his material was *Cyphocharax microcephalus*. Ulrey (1895:259) recorded *Curimatus microcephalus* from Itaituba, Brazil, a site in the Amazon basin distant from the known range of the species, and a probable misidentification. Eigenmann (1912:265) cited *Curimatus microcephalus* from various localities in British Guiana (= Guyana). Although this species does indeed occur in Guyana, some of the specimens examined by Eigenmann are rather *Cyphocharax festivus* (USNM 66141, USNM 307859, AMNH 7718), as is apparently the specimen illustrated in that publication (Eigenmann, 1912, pl. XXXIV: fig. 2).

MATERIAL EXAMINED.—173 specimens (48, 38.4–169.0).

SURINAM. No exact locality, MCZ 785, 1 (104.7, lectotype of *Curimatus microcephalus*); MCZ 92958, 3 (51.2–95.7, paralectotypes of *Curimatus microcephalus*; formerly MCZ 785, in part); MCZ 792, 2 (161.0–169.0). Steen Kreek where crossed by road from Amotopo to Paramaribo, USNM 225309, 1 (105.3). Creek entering Corantijn River 1 km north of Cow Falls, USNM 225306, 1 (61.4). Kapoeri Creek, 4 km from junction with Corantijn River, USNM 225307, 9 (5, 47.0–49.1; 1 specimen cleared and counterstained for cartilage and bone). Kamp Kreek, near Kamp Geologie (04°49'N, 57°28'W), USNM 225315, 18 (7, 38.4–54.4). Corantijn River, 180 km from mouth, USNM 225301, 68. Marowijne River basin, RMNH 21398, 2 (56.0–59.8); RMNH 19508, 2. Coropina Creek, W of Paramaribo, RMNH 18401, 1 (55.5); RMNH 18182, 9 (81.7–105.3); RMNH 19323, 2 (43.0–47.6). Coropina Creek, Republiek, RMNH 18181, 3 (71.9–78.8); RMNH 18183, 8 (82.8–105.3). Wane Kreek, RMNH 18665, 1 (109.3). Marowijne Creek (= Gran Kreek), 60 km S of Afobaka, ZMA 107.471, 13. Blommestein Reservoir, 4 km S of Afobaka, ZMA 106.815, 6. Blommestein Reservoir, approx. 3.5 km SW of Brownsweeg, ZMA 106.812, 21.

GUYANA. *Essequibo*. Essequibo River, Rockstone, AMNH 14438, 2 (49.5–54.3).

Cyphocharax magdalena (Steindachner)

FIGURES 37–40; TABLES 6, 7

Curimatus Magdalena Steindachner, 1879a:50 [type locality: Colombia: Río Magdalena]; 1879b:88 [abstract of 1879a species description]; 1879c:167 [Panama: Río Mamoni]; 1880:67 [Colombia: Río Cauca].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Curimatus magdalena.—Eigenmann and Eigenmann, 1889:424 [reference].—Steindachner, 1902:142 [Colombia: Baranquilla].—Eigenmann, 1905:19 [Panama]; 1910:421 [reference].—Cockerell, 1915:156 [scale anatomy].—Meek and Hildebrand, 1916:269 [Panama: Río Chorrera, Río Marte Amade, Río Abaco, Río Juan Díaz, Río Bayano, Río Tuyra, Río Cituro, Río Setiganti, Río Grande].—Eigenmann, 1920a:15 [Panama: western drainages; Colombia: Río Atrato, Río Magdalena]; 1920b:11 [Colombia: Río Atrato drainage]; 1920c:15 [Pacific slopes of Panama, Río Chepo, Río Tuyra; Colombia, Río Atrato]; 1920d:30 [Colombia: lower Río Magdalena]; 1922:104, pl. 17: fig. 2 [in part: Pacific slopes of Panama; Colombia: Río Magdalena, Soplaviento; Río Atrato, Boca de Ceretgui, Truando, Quibdo; not Venezuela: Lago Maracaibo basin].—Breder, 1925:143 [Panama: Río Tapia]; 1927:113 [Panama: Río Chucunaque].—Hildebrand, 1938:247 [Panama: Río Tapia, Río Cabra]. [Not Mago-Leccia, 1970:75.]

Curimatus magdalena.—Fowler, 1944:227 [Colombia: Río Juradó]; 1945b:1 [Colombia: Mariqueta].—Dahl, 1955:17 [Colombia: Río Sinú].—Dahl et al., 1963:42 [Colombia: Río San Jorge].—Dahl and Medem, 1964:53 [Colombia: Río Sinú; common name].—Gosse, 1966:9 [Panama: Río Bayano].—Bussing, 1967:221 [Costa Rica: Pacific slope rivers of Puntarenas].—Dahl, 1971:104 [Colombia: Río Magdalena, lower Río Cauca, Río San Jorge, Río Sinú].—Alpírez, 1985:303 [Costa Rica: Puntarenas Province; common name]. [Not Schultz, 1944:250.]

Curimatella magdalena.—Fernández-Yépez, 1948:25 [assignment to *Curimatella*].—Fowler, 1975:364 [reference]. [Not Fernández-Yépez and Martin, 1953:232.]

Pseudocurimata steindachneri Fernández-Yépez, 1948:48 [type locality: Colombia: Río Magdalena, Boca de Ceretgui (actual type locality probably Colombia: Truando, see under "Remarks" below for discussion of problem)].—Fowler, 1975:373 [reference].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*]. [New synonymy.]

DIAGNOSIS.—*Cyphocharax magdalena* is distinguished from all other *Cyphocharax* species with the exception of *C. aspilos* by the combination of the absence of multiple series of longitudinal patterns of dark pigmentation on the body, the absence of a large spot of pigmentation on the dorsal fin, the absence of a rotund spot or longitudinal stripe of dark pigmentation on the midlateral surface of the caudal peduncle, the presence of 34 to 38 lateral-line scales, and a depth of caudal peduncle of 0.13–0.15 of SL. *Cyphocharax magdalena* can be discriminated from *C. aspilos* by differences in the relative width of the interorbital region (0.43–0.47 of HL versus 0.47–0.52, respectively; see also Figure 37), and less discretely by modal differences in the number of vertebrae (mode 32, range 31 to 33 in *C. magdalena* versus mode 33, range 32 to 34 in *C. aspilos*; see also Table 7). *Cyphocharax magdalena* is also the only member of the Curimatidae known from Panama and southern Costa Rica, and the only *Cyphocharax* species in the Río Magdalena system of northern Colombia.

DESCRIPTION.—Body moderately elongate, somewhat more

so in larger specimens, slightly compressed laterally. Dorsal profile of head convex from tip of snout to vertical line through 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 posteroventrally slanted at base of dorsal fin, typically straight or sometimes slightly 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 very obtusely flattened proximate to origin of pelvic fin; scales of that area of same size as those on adjoining ventrolateral surfaces of body. Obtuse median keel posterior to pelvic-fin origin. 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 0.36–0.44 [0.40]; snout tip to origin of dorsal fin 0.48–0.54 [0.50]; snout tip to origin of anal fin 0.80–0.88 [0.83]; snout tip to origin of pelvic fin 0.52–0.56 [0.54]; snout tip to anus 0.77–0.84 [0.78]; origin of dorsal fin to hypural joint 0.54–0.60 [0.56]. Dorsal fin somewhat pointed anteriorly in profile; last unbranched and

first branched rays about three times length of ultimate ray. Pectoral fin obtusely pointed in profile distally; length of pectoral fin 0.19–0.22 [0.20], extends about two-thirds distance to vertical line through origin of pelvic fin. Pelvic fin obtusely pointed in profile distally, length of pelvic fin 0.22–0.26 [0.23], reaches about three-quarters distance to origin of anal fin. Caudal fin forked; with few series of scales extending onto base of caudal-fin rays. Adipose fin well developed. Anal fin border emarginate, anteriormost branched rays about three times length of ultimate ray. Least depth of caudal peduncle 0.13–0.15 [0.15].

Head profile rounded anteriorly, obtusely pointed overall, head length 0.28–0.33 [0.28]; upper jaw somewhat longer than lower, mouth barely subterminal; snout length 0.26–0.32 [0.28]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.26–0.33 [0.26]; adipose eyelid moderately developed, with broad, vertically ovoid opening over center of eye; length of postorbital portion of head 0.43–0.49 [0.43]; gape width 0.24–0.31 [0.25]; interorbital width 0.43–0.47 [0.45].

Pored lateral-line scales from supracleithrum to hypural joint 34 to 38 [35]; all scales of lateral line pored, canals in

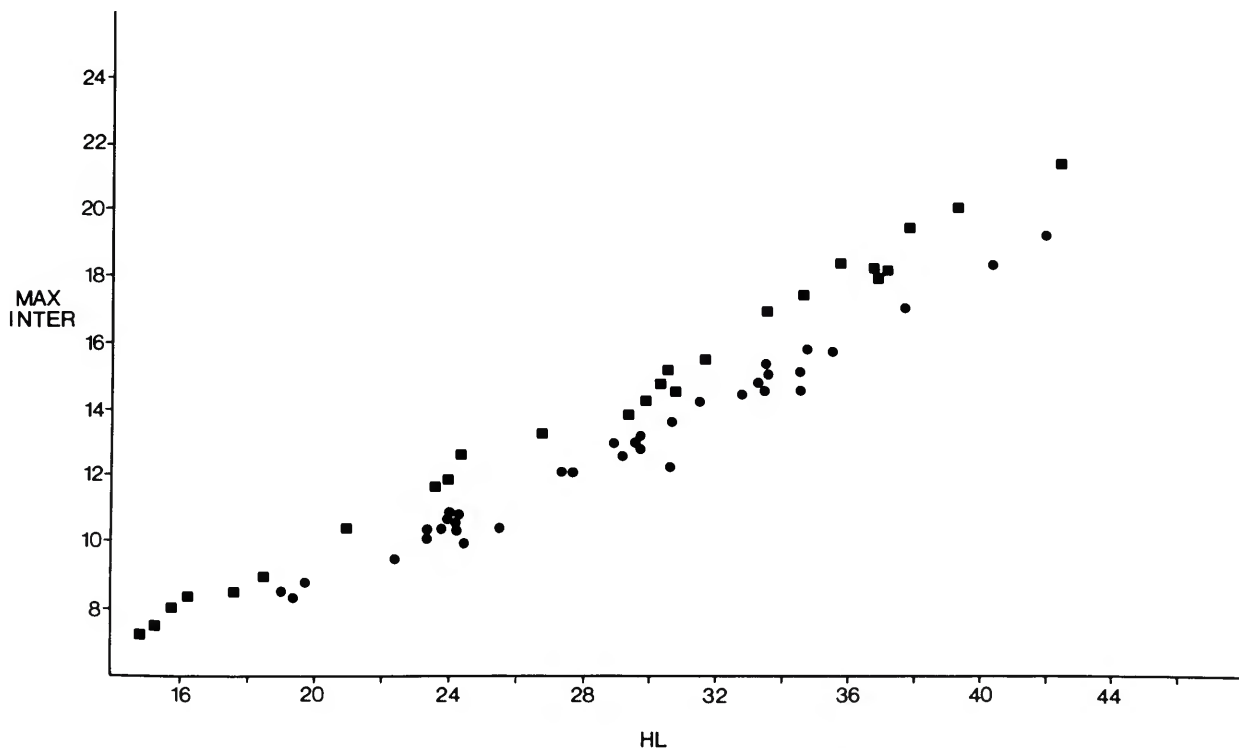




FIGURE 38.—*Cyphocharax magdalenae*, USNM 79194, 92.3 mm SL; Colombia, Bolívar, Calamar.

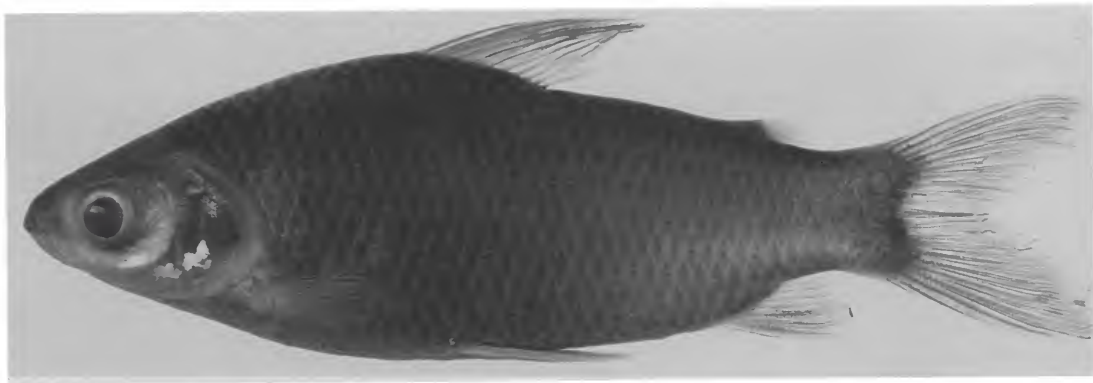


FIGURE 39.—*Cyphocharax magdalenae*, USNM 296173, 98.9 mm SL; Panama, Coclé Province, Río Grande basin, Río Anton, at Anton on Pan-American Highway.

lateral-line scales straight; 3 to 6 series of pored scales extending beyond hypural joint onto caudal-fin base; 6 to 7 [7] scales in transverse series from origin of dorsal fin to lateral line; 5 to 6 $\frac{1}{2}$ [6] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or 10, or iii,9 (ii,10 and iii,9 relatively rare; when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or 8, or iii,7 (ii,8 relatively rare; when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 14 to 16 [14]; pelvic-fin rays i,8 [i,8].

Total vertebrae 31 (15), 32 (78), 33 (10).

COLOR IN ALCOHOL.—Overall ground coloration of specimens retaining guanine on scales silvery to silvery-golden, darker on dorsal portions of head and body. Overall coloration of specimens lacking guanine on scales tan in smaller specimens, olive or brown dorsally in larger specimens with ventral portions of head and body light tan to tan. No pronounced pigmentation pattern on head and body. Fin membranes, particularly of median fins, with numerous small dark chromatophores in larger specimens; paired fins of smaller specimens hyaline.

DISTRIBUTION.—Río Magdalena and Río Atrato basins of

northwestern Colombia, rivers of Pacific versant of Panama and southwestern Costa Rica (Figure 40).

GEOGRAPHIC VARIATION.—Populations of *Cyphocharax magdalenae* from the Ríos Magdalena and Atrato of the Caribbean versant of Colombia differ somewhat from samples from the rivers of the Pacific versant of Panama and southwestern Costa Rica in the modal values for various features. The most notable difference is the relative depth of the caudal peduncle. In populations from the Río Magdalena and Río Atrato the relative depth of the caudal peduncle is 0.14–0.15 of SL with an average of 0.147 ($n = 38$). The population sample examined in detail from Panama has a somewhat broader range in the relative depth of the caudal peduncle (0.13–0.15 of SL, 0.15 rare), with a distinctly lower average of 0.136 ($n = 40$). These differences do not, however, discriminate these populations.

COMMON NAME.—Capani (Costa Rica; Alpírez, 1985:303).

REMARKS.—Steindachner (1879a:50) based his description of *Curimatus Magdalenae* on three specimens that originated at an unspecified location in the Río Magdalena of northwestern Colombia. A 127.0 mm SL syntype in the best overall condition (NMW 68873.1) is designated as the lectotype. The

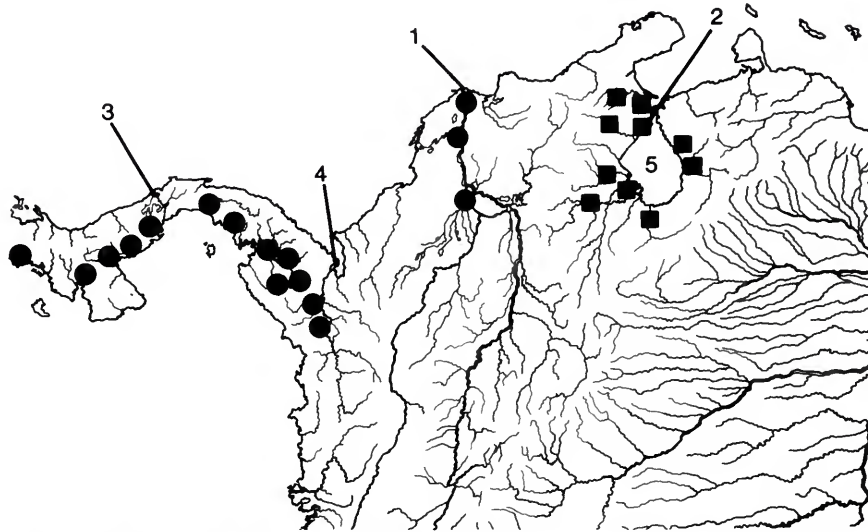


FIGURE 40.—Map of northwestern South America and Panama showing geographic distribution of *Cyphocharax magdalenae* (filled in circles; 1 = mouth of Río Magdalena, type locality of *Curimatus Magdalenae*) and *Cyphocharax aspilos* (squares; 2 = type locality) (3 = Panama Canal; 4 = mouth of Río Atrato; 5 = Lago Maracaibo) (some symbols represent more than one locality or lot of specimens).

two remaining syntypes (NMW 68873.2–3, 121.5–124.8 mm SL) become paralectotypes.

In his original description of *Curimatus Magdalenae* Steindachner (1879a) questioned whether his species was conspecific with *Curimatus argenteus* described by Gill (1858) from Trinidad. The two species differ in a number of meristic and morphometric characters and in details of pigmentation (see species account of *Steindachnerina argentea* (Vari, 1991:37). *Cyphocharax magdalenae* also lacks the derived features distinctive for *Steindachnerina* and the clades in that genus that include *S. argentea* (see Vari, 1991:23).

Fernández-Yépez (1948:49) listed the collection locality of the holotype of *Pseudocurimata steindachneri* (CAS 60623, formerly IU 13472, in part) as being Boca de Certegui, Colombia. That lot was previously cited by Eigenmann (1922:104–105) as *Curimatus magdalenae* and consisted of 85 specimens. Contrary to the statement by Fernández-Yépez the specimens in IU 13472 originated at Truando rather than Boca de Certegui (see Eigenmann, 1922:105). Only 14 specimens remained in IU 13472 when I examined it in 1979, the other specimens evidently having been exchanged to other institutions or otherwise separated from the original lot, presumably prior to the examination of the lot by Fernández-Yépez. There was no specific indication in the jar of the specimen that Fernández-Yépez designated as the holotype, a problem complicated by the non-standard methods that Fernández-Yépez used in taking measurements. An 88.0 mm SL individual that is apparently the holotype of *Pseudocurimata steindachneri* is presently catalogued as CAS 60623.

Fernández-Yépez listed a 200 mm SL paratype for *Pseu-*

docurimata steindachneri (IU 13473) that purportedly originated at Boca de Certegui, Colombia. That register number actually corresponds to a series of *P. boulengeri* collected at Colimes, Ecuador, and now deposited in the CAS collections. None of the specimens in that lot are longer than 140 mm SL. Eigenmann (1922:105) did report a single 200 mm SL specimen from Boca de Certegui as *Curimatus magdalenae*. That lot (originally CM 5125, now deposited at FMNH) is not, nor was it ever, deposited at CAS. Furthermore, based on the acknowledgements in his 1948 publication it does not appear that Fernández-Yépez visited FMNH or used its collections. It is thus unlikely that Fernández-Yépez examined the 200 mm SL specimen of *C. magdalenae* (CM 5125) cited by Eigenmann. The complexity of these errors makes it impossible to identify the specimen Fernández-Yépez designated as the paratype of *Pseudocurimata steindachneri*.

As noted above, the holotype of *Pseudocurimata steindachneri* was originally identified by Eigenmann (1922:105) as part of a large series of *Curimatus magdalenae*. Examination of the holotype of *Pseudocurimata steindachneri* and of the other specimens originally in that lot has not revealed any differences between *Pseudocurimata steindachneri* and examined specimens of *Cyphocharax magdalenae* (Table 6), thus confirming the original Eigenmann identification. *Pseudocurimata steindachneri* Fernández-Yépez is consequently placed into the synonymy of *Cyphocharax magdalenae*.

Cyphocharax magdalenae of this study is distributed in a series of independent drainage basins from southwestern Costa Rica, through Panama, into northern Colombia. Various authors commencing with Eigenmann (1922:104) have also

TABLE 6.—Morphometrics and meristics of (A) lectotype of *Curimatus Magdalenae* (NMW 68873.1); (B) holotype of *Pseudocurimata steindachneri* (CAS 60623, formerly IU 13472, in part); and (C) all examined specimens of *Cyphocharax magdalenae* 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
MORPHOMETRICS			
Standard Length	127.0	88.0	49.5-151.0
1. Greatest body depth	0.40	0.39	0.36-0.44
2. Snout to dorsal-fin origin	0.50	0.51	0.48-0.54
3. Snout to anal-fin origin	0.83	0.83	0.80-0.88
4. Snout to pelvic-fin origin	0.54	0.54	0.52-0.56
5. Snout to anus	0.78	0.79	0.77-0.84
6. Origin of dorsal fin to hypural joint	0.56	0.58	0.54-0.60
7. Pectoral-fin length	0.20	0.21	0.19-0.22
8. Pelvic-fin length	0.23	0.25	0.22-0.26
9. Caudal peduncle depth	0.15	0.15	0.13-0.15
10. Head length	0.28	0.30	0.28-0.33
11. Snout length	0.28	0.29	0.26-0.32
12. Orbital diameter	0.26	0.29	0.26-0.33
13. Postorbital length	0.43	0.44	0.43-0.49
14. Interorbital width	0.45	0.45	0.43-0.47
MERISTICS			
Lateral-line scales	35	36	34-38
Scale rows between dorsal-fin origin and lateral line	7	6	6-7
Scale rows between anal-fin origin and lateral line	6	5	5-6½
Branched dorsal-fin rays	9	9	9-10
Branched anal-fin rays	7	7	7-8
Total pectoral-fin rays	14	13	14-16
Branched pelvic-fin rays	8	8	8

reported *C. magdalenae* (in various genera) from the rivers draining into Lago Maracaibo in northwestern Venezuela. Some minor geographic variation in modal values was found between the Panamanian and Colombian populations of *Cyphocharax magdalenae* (see discussion under "Geographic Variation" above), albeit not sufficient to justify recognition of two species. In contrast, the interorbital width of the *Cyphocharax* population samples from Lago Maracaibo (0.47-0.52 of HL) differentiates them from samples of *C. magdalenae* from both Colombia and Panama (0.43-0.47 of HL). No overlap between the populations in this value occurs in any particular size range (see Figure 37). There are also less discrete but notable differences in the range and modal value for vertebral counts between the Lago Maracaibo populations and populations to the west (Table 7). Material from the Lago Maracaibo basin has a range of 32 to 34 vertebrae with a mode of 33 elements (68 of 83 individuals [82%]) albeit with 11% of individuals with 32 vertebrae. Radiographed Panamanian and Colombian specimens have 31 to 33 vertebrae, with a very strong mode at 32 vertebrae for both populations (Panama: 28 of 37 specimens [73%]; Colombia: 50 of 66 specimens [76%]). These differences in combination permit the ready distinction of the population within Lago Maracaibo, a basin whose ichthyofauna demonstrates a notable degree of endemism (see

discussion in Vari, 1988:350 and references cited therein; Vari and Raredon, 1991). Therefore the *Cyphocharax* populations of the Lago Maracaibo basin previously identified as *Cyphocharax magdalenae* are recognized herein as a new species, *Cyphocharax aspilos* (see following species account).

MATERIAL EXAMINED.—319 specimens (60, 49.5-151.0).

PANAMA. Chiriquí, 3 m W of San Juan on Inter-American Highway, USNM 220197, 9 (4, 63.5-77.5; 2 specimens cleared and counterstained for cartilage and bone). 8 m N of Puerto Armuelles, USNM 220159, 7 (76.5-115.3). Chiriquí, 24.2 km S of Pan American Highway on Conoas to Puerto Armuelles Road, ANSP 151085, 1. Río Calobre, USNM 78572, 54 (5, 56.0-125.0). Río Calobre at Pacora, USNM

TABLE 7.—Number of specimens of *Cyphocharax aspilos*, new species, and *Cyphocharax magdalenae* from Colombia and Panama with cited number of vertebrae. Vertebrae incorporated into fused PU_1+U_1 counted as a single element and vertebrae in Weberian apparatus counted as four elements.

Species	Vertebrae			
	31	32	33	34
<i>aspilos</i>		9	68	6
Colombian <i>magdalenae</i>	11	50	5	
Panamanian <i>magdalenae</i>	4	28	5	

231487, 10 (5, 57.8–87.4). Río Bayano system, MCZ 54119, 5 (105.0–133.6). Río Marte Arnade, USNM 78588, 3 (112.1–118.7); USNM 78585, 13. Río Cupe, Boca de Cupe, USNM 78576, 5 (2, 105.2–151.0). Río Mamoni, El Capitan, USNM 78581, 8 (4, 80.5–122.0). Río Mamoni, Chepo, USNM 78582, 5. Río Seteganti, Cana, USNM 78583, 1; USNM 78587, 7. Río Seteganti, USNM 220157, 26. Río Aruza, Aruza, USNM 78573, 6; USNM 78579, 5. Río Tuira between Calle Larga and Pinogana above El Real, USNM 293122, 8. Río Tuira basin, Río Pirre, above El Real, USNM 293175, 24. Río Tuira, 0.5 km above Boca de Cupe, USNM 293195, 10. Río Tuira, Boca de Río Cupe, USNM 78584, 1; USNM 78586, 4. Río Tuira basin, Río Pirre at Pijibasal, USNM 293225, 1. Río Pucuro just above confluence with Río Tuira, USNM 293146, 3. Creek, 3 km W of Aguadulce on Inter-American Highway, USNM 220201, 12. Creek near Chorrera, USNM 78578, 2. Río Chorrera, USNM 78580, 3; USNM 78577, 1. Río Juan Diaz, USNM 78574, 2. Río Abaco, USNM 78571, 2. Río Grande, Cana, USNM 78575, 3. Río Yape, USNM 78585, 17. Río Bayano basin, stream along Pan American Highway, 3.5 km E of Carti Road, USNM 293201, 1. Río Grande basin, Río Anton, at Anton along Pan American Highway, USNM 296173, 5. Darien, pool along Pan American Highway 140 km E of Bayano bridge, ANSP 151049, 1.

COLOMBIA. Río Magdalena, USNM 296258, 4. Río Magdalena, Ciénega, NMW 68873.1, 1 (127.0, lectotype of *Curimatus Magdalenae*); NMW 68873.2–3, 2 (121.5–124.8, paralectotypes of *Curimatus Magdalenae*). *Chocó*: Río Truandó, USNM 76949, 12 (6, 63.3–81.0); BMNH 1920.12.20:69–70, 2; BMNH 1924.3.3:52–54, 3; CAS 60623, 1 (88.0, holotype of *Pseudocurimata steindachneri*; formerly IU 13472, in part; locality incorrectly cited by Fernández-Yépez as Boca de Certegui); CAS 60624, 13 (4, 63.5–111.8; formerly IU 13472, in part); USNM 296258, 4; USNM 83645, 1. Río Salado near Teresita, USNM 220006, 6 (68.0–92.8). *Bolívar*: Río San Jorge, San Marcos, USNM 175321, 2 (49.5–49.7). Calamar, USNM 79194, 3 (90.3–103.4).

Cyphocharax aspilos, new species

FIGURES 37, 40–42; TABLE 7

- Curimatus magdalenae*.—Eigenmann, 1922:104 [in part: Venezuela: Zulia, Encontrados (Lago Maracaibo basin), not records from Pacific slopes of Panama, and citations from Colombia: Río Magdalena, Río Atrato].—Rodríguez, 1973:290 [Venezuela: Lago Maracaibo basin; commercial importance, common name].—Mago-Leccia, 1970:75 [Venezuela].
- Curimata magdalenae*.—Schultz, 1944:250 [Venezuela: Río Maracaibo basin].—Rodríguez, 1973:180, 181, 219, 220 [Venezuela: Lago Maracaibo basin; commercial importance, ecology, common name].
- Curimatella magdalenae*.—Fernández-Yépez, 1948:25 [reference in part, Lago Maracaibo citation, not Colombia: Río Truando and Río Magdalena].—Fernández-Yépez and Martin, 1953:233, fig. [Venezuela: Lago Maracaibo basin, Río Negro, Tokio].

DIAGNOSIS.—*Cyphocharax aspilos* is distinguished from its congeners with the exception of *C. magdalenae* by the

combination of the absence of multiple series of longitudinal patterns of dark pigmentation on the body, the absence of a large spot of pigmentation on the dorsal fin, the absence of a rotund spot or longitudinal stripe of dark pigmentation on the midlateral surface of the caudal peduncle, the presence of 36 to 38 lateral-line scales, and the relative depth of the caudal peduncle 0.14–0.16 of SL. *Cyphocharax aspilos* can be discriminated from *C. magdalenae* by differences in the relative width of the interorbital region (0.47–0.52 of HL versus 0.43–0.47 respectively; see also Figure 37) and less discretely by modal differences in the number of vertebrae (range 32 to 34 in *C. aspilos* with a strong mode of 33 (82% of specimens) versus range 31 to 33 in *C. magdalenae* with a strong mode of 32 (76% of specimens) (see also Table 7). *Cyphocharax magdalenae* is also the only member of the genus known from the Lago Maracaibo basin.

DESCRIPTION.—Body moderately elongate, somewhat compressed laterally in juveniles, increasingly robust in larger specimens; largest individuals rather rotund in cross-section. Dorsal profile of head convex from tip of snout to vertical line through posterior nostril, straight from that line to tip of supraoccipital spine. Dorsal profile of body typically smoothly convex from tip of supraoccipital spine to origin of dorsal fin, convexity more pronounced anteriorly in some individuals; straight and posteroventrally slanted at base of dorsal fin; straight or sometimes slightly 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 very obtusely flattened transversely in juveniles, particularly proximate to origin of pelvic fin, scales of that area not enlarged relative to scales on adjoining ventrolateral portion of body; transverse flattening of prepelvic region less pronounced in larger individuals. Obtuse median keel posterior to origin of pelvic fin. 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 0.36–0.42 [0.36]; snout tip to origin of dorsal fin 0.49–0.54 [0.49]; snout tip to origin of anal fin 0.82–0.88 [0.82]; snout tip to origin of pelvic fin 0.53–0.58 [0.53]; snout tip to anus 0.78–0.84 [0.78]; origin of dorsal fin to hypural joint 0.55–0.60 [0.56]. Dorsal fin obtusely pointed in profile distally; last branched and first branched rays about three times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.19–0.22 [0.19], extending about two-thirds distance to vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally; length of pelvic fin 0.23–0.26 [0.23], reaches about two-thirds of distance to origin of anal fin. Caudal fin forked; with several series of scales extending onto base of caudal-fin rays in smaller specimens, scale field on caudal fin more pronounced in adults, but still extending over only a small proportion (approximately one-quarter) of fin surface. Adipose

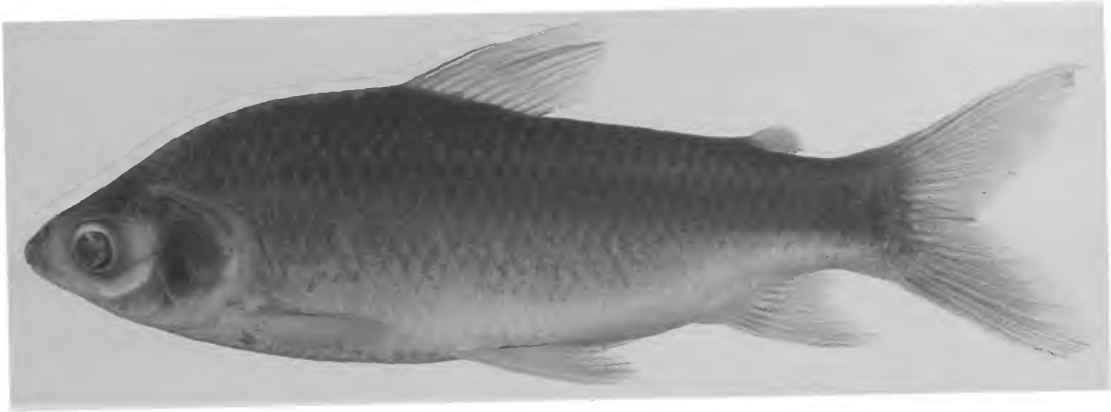


FIGURE 41.—*Cyphocharax aspilos*, new species, holotype, MBUCV V-13286, 130.7 mm SL; Venezuela, Zulia, Carrasquero, Estación Centro Adiestramiento Don Bosco.



FIGURE 42.—*Cyphocharax aspilos*, new species, USNM 121310, 77.0 mm SL; Venezuela, Zulia, Lago Tulé, approximately 75 km W of Maracaibo.

fin well developed. Distal border of anal fin ranging from moderately to markedly emarginate, anteriormost branched rays about three to four times length of ultimate ray. Least depth of caudal peduncle 0.14–0.16 [0.14].

Head obtusely pointed in profile, head length 0.27–0.32 [0.28]; upper jaw somewhat longer than lower, mouth barely subterminal; snout length 0.26–0.32 [0.30]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.27–0.32 [0.27]; adipose eyelid moderately developed, with broad vertically ovoid opening over center of eye, eyelid most developed in larger specimens; length of postorbital portion of head 0.44–0.48 [0.47]; gape width 0.26–0.30 [0.30]; interorbital width 0.47–0.52 [0.49].

Pored lateral-line scales from supracleithrum to hypural joint 36 to 38 [37]; 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; $5\frac{1}{2}$ to $6\frac{1}{2}$ [$6\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; $5\frac{1}{2}$ to $6\frac{1}{2}$ [$5\frac{1}{2}$] scales in transverse series from the lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or 10, or iii,9 (ii,10 and iii,9 rare; when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or iii,7 (iii,7 relatively rare; when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 15 [14]; pelvic-fin rays i,8 [i,8].

Total vertebrae 32 (9), 33 (68), 34 (6).

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery golden, darker on dorso-lateral and dorsal surfaces of head and body. Specimens lacking guanine on scales tan to brown, with ground coloration darker dorsally. Lateral and dorsal surfaces of head and body with scattered small, dark chromatophores on surface, and deeper lying, diffuse stripe of dusky pigmentation midlaterally on body; stripe less obvious in some larger specimens. All fins in larger specimens with scattered small, dark chromatophores; paired fins in smaller specimens hyaline.

DISTRIBUTION.—Northwestern Venezuela, tributaries to Lago Maracaibo (Figure 40, locality 5).

ETYMOLOGY.—The species name from the Greek, *aspilos*, meaning unspotted or spotless, in reference to the absence of

any pronounced pigmentation pattern on the head and body of the species.

COMMON NAME.—Venezuela, Lago Maracaibo basin: Bocachico (Rodríguez, 1973:290).

REMARKS.—The *Cyphocharax* population in the Lago Maracaibo basin was identified as *Curimatus magdalenae* by authors commencing with Eigenmann (1922:104). Schultz (1944:250) recognized *Curimatus magdalenae* as ranging from the Lago Maracaibo basin through the Río Magdalena to the Pacific slopes of Panama. Although Schultz noted it might be appropriate to recognize subspecies within this range, he neither discussed possible geographic subunits of the species nor how they might be discriminated. Some modal differences exist between Panamanian and Colombian populations of Schultz's *Curimatus magdalenae*, but do not discriminate geographic subunits of the species (see also discussion of "Geographic Variation" under *Cyphocharax magdalenae* above). The *Cyphocharax* population in the Lago Maracaibo system is, however, distinct from samples of *Curimatus magdalenae* in the Río Magdalena (the type location) and regions further to the west in several features. The populations in the Lago Maracaibo are thus described herein as a new species, *Cyphocharax aspilos*. *Cyphocharax aspilos* differs from *C. magdalenae* in the relative width of the interorbital region of the head (0.43–0.47 of HL versus 0.47–0.52, respectively), with no overlap in this value within any particular size range (see Figure 37). The species also have different ranges and modal values for total vertebrae although demonstrating some overlap in this feature (Table 7). Population samples of *C. magdalenae* have 31 to 33, most typically 32 vertebrae (73% of 107 specimens) with *C. aspilos* having 32 to 34 vertebrae, most typically 33 (82% of 83 specimens).

TYPE MATERIAL EXAMINED.—9 specimens (9, 46.2–180.0).

HOLOTYPE.—VENEZUELA. *Zulia*: Carrasquero, Estación Centro Adiestramiento Don Bosco, F. Provenzano, 12 Nov 1981, MBUCV V-13286, 1 (130.7).

PARATYPES.—VENEZUELA. *Zulia*: Caño El Sargento, caserío El Sargento, Carretera to Carrasquero, MBUCV V-13300, 3 (46.2–80.5). Ciénaga El Gran Eneal, between Paraquaipea and Sinamaica, MBUCV V-6914, 2 (70.8–80.0). Río Palmar, near Totuma, about 100 km SW of Maracaibo, USNM 121311, 2 (101.1–105.3). Río de las Pajoreas, 3.0 km from Lago Maracaibo, USNM 121319, 1 (180.0).

NON-TYPE MATERIAL EXAMINED.—152 specimens (28, 45.7–160.4).

VENEZUELA. *Zulia*: Caño 0.75 km W of Sinamaica, USNM 121316, 16 (5, 109.8–121.4). Ciénaga del Guanavana, approx. 10 km N of Sinamaica, USNM 121308, 1. Lago Tulé approx. 75 km W of Maracaibo, USNM 121310, 14 (1, 75.2; 2 specimens cleared and counterstained for cartilage and bone). Río Socuy, 3 km above mouth, USNM 121318, 25 (10, 103.0–147.0). Río San Pedro at bridge south of Mene Grande, Río Motatán system, USNM 121312, 1. Río San Juan, near bridge south of Mene Grande, Río Motatán system, USNM

121315, 29. Río Negro below mouth of Río Yasa, USNM 121317, 52 (4, 74.0–103.5). Río Machango, at bridge south of Lagunillas, USNM 121309, 4. Lago Maracaibo, at mouth of Río Concha, USNM 121314, 2. Río de Motatán, Via de Mene Grande to Concepcion, MBUCV V-8861, 5 (45.7–60.7). Lago Maracaibo basin, Encontrados, FMNH 6334, 3 (147.3–160.4).

Cyphocharax punctatus (Vari and Nijssen)

FIGURES 43, 44

Curimata punctata Vari and Nijssen, 1986:52, pl. I [type locality: Surinam: Marowijne District, upper Marowijne River system, Litani River near Kawatop Village].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].—Vari and Howe, 1991:17 [listing of type specimens in NMNH].

DIAGNOSIS.—*Cyphocharax punctatus* can be distinguished from all its congeners with the exception of *C. vanderi* by the combination of 27 to 30 scales in the lateral line series to the hypural joint, the absence of multiple series of longitudinal dark stripes or series of dark spots arranged in multiple horizontal patterns on the body, absence of a discrete patch of dark pigmentation on the dorsal fin, and the presence of 3 to 6 large spots of dark pigmentation on the midlateral surface of the body including one on the caudal peduncle. *Cyphocharax punctatus* can be separated from *C. vanderi* by differences in the relative depth of the caudal peduncle (0.13–0.15 of SL versus 0.16–0.20, respectively), relative body depth (0.35–0.37 of SL versus 0.38–0.42), relative length of the pelvic fin (0.24–0.27 of SL versus 0.21–0.23), and number of vertebrae (30 versus 28 or 29).

DESCRIPTION.—Body moderately elongate, relatively robust in cross-section. Dorsal profile of head distinctly convex from tip of snout to vertical line through posterior nostril, very slightly convex from that line to tip of supraoccipital spine. Dorsal profile of body slightly convex from tip of supraoccipital spine to origin of dorsal fin; straight to slightly convex and posteroventrally slanted at base of dorsal fin, straight from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body somewhat flattened or rounded transversely anteriorly, with indistinct median keel immediately 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 obtusely flattened, with median series of scales that are not notably enlarged relative to those on adjoining ventrolateral surfaces of body. Obtuse median keel posterior to origin of pelvic fin. Secondary 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 0.35–0.37 [0.35]; snout tip to origin of dorsal fin 0.51–0.55 [0.51]; snout tip to origin of anal fin 0.82–0.86 [0.82]; snout tip to origin of pelvic fin 0.55–0.59 [0.56]; snout tip to anus 0.76–0.81 [0.80]; origin of dorsal fin to hypural joint 0.53–0.58 [0.53]. Dorsal fin distinctly pointed in profile anterodistally; last unbranched and

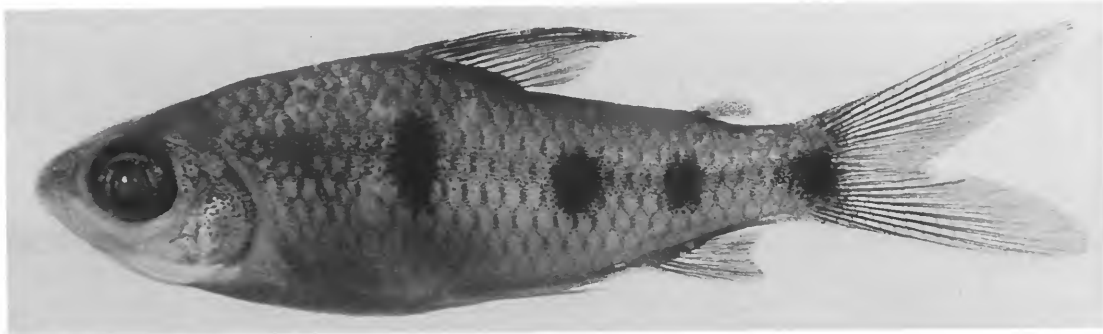


FIGURE 43.—*Cyphocharax punctatus*, holotype of *Curimata punctata*, USNM 275000, 25.9 mm SL; Surinam, Marowijne District, upper Marowijne River system, Litani River near Kawatop Village (03°11'N, 54°12'W).

first branched rays two and one-half to three times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.19–0.25 [0.19], extends about three-quarters of distance to vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally; length of pelvic fin 0.24–0.27 [0.25], reaches about three-quarters of distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays about three times length of ultimate ray. Least depth of caudal peduncle 0.13–0.15 [0.14].

Head profile rounded anteriorly, obtusely pointed overall, head length 0.30–0.32 [0.32]; upper jaw slightly longer than lower, mouth barely subterminal; snout length 0.28–0.33 [0.28]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.32–0.36 [0.34]; adipose eyelid poorly developed, limited to region anterior of eye; length of postorbital portion of head 0.37–0.41 [0.41]; gape width 0.21–0.26 [0.24]; interorbital width 0.41–0.45 [0.41].

Pored lateral-line scales from supracleithrum to hypural joint 27 to 30 [28]; 8 to 20 anterior scales in midlateral scale series pored, number of pored scales along that series increasing with standard length; canals in pored scales straight, non-pored scales with midlateral groove; 3 or 4 series of scales in series continuous with lateral line extending beyond hypural joint onto caudal-fin base; $4\frac{1}{2}$ to $5\frac{1}{2}$ (usually $5\frac{1}{2}$) [$5\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; $4\frac{1}{2}$ [$4\frac{1}{2}$] scales in transverse series from horizontal midlateral series continuous with pored scales to origin of anal fin.

Dorsal-fin rays ii,9 or iii,9 (when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or iii,7 (when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 15 [14]; pelvic-fin rays i,8 or 9 [i,8].

Total vertebrae 30 (20).

COLOR IN ALCOHOL.—Guanine lacking on scales of all available specimens. Ground coloration yellowish-tan, darker on dorsal portions of head and body. Head without any pronounced pigmentation pattern. Scales of dorsal portion of

body with margins outlined by series of small dark chromatophores. Chromatophores more densely arranged and darker dorsally and in midlateral band along body. Body with series of variably shaped patches of dark pigmentation with irregular margins (see Figure 43 and Vari and Nijssen (1986, pl. I)). Patches arranged roughly in midlateral series extending from vertical line through origin of dorsal fin backward to posterior of caudal peduncle and base of caudal-fin rays (see Figure 43 and Vari and Nijssen, 1986, pl. I). Number, size, and shape of patches variable both between individuals and on two sides of many specimens. Total of four or five spots most common; reduced number of spots consequence of absence of a spot or coalescence of two spots. Anterior and posterior spots always present; one to four spots extend between those. Pigmentation patch at base of caudal fin more diffuse in larger individuals. Dorsal fin with anterior rays dusky in some individuals. Caudal and anal fins dusky, paired fins typically hyaline.

DISTRIBUTION.—Evidently endemic to the Marowijne River system of Surinam and French Guiana (Figure 44).

REMARKS.—The number of pored lateral-line scales in this species increases with standard length. If the species attains a greater standard length than indicated by the available population sample, then it is possible that the laterosensory canal system on the body would be completely pored in larger individuals.

MATERIAL EXAMINED.—129 specimens (51, 18.6–42.5).

SURINAM. *Marowijne District*: Upper Marowijne River system, Litani River near Kawatop Village (03°11'N, 54°12'W), USNM 275000, 1 (25.9, holotype of *Curimata punctata*); USNM 278053, 6 (25.3–27.3, paratypes of *Curimata punctata*); 3 specimens cleared and counterstained for cartilage and bone); ZMA 119.548, 3 (23.5–27.3, paratypes of *Curimata punctata*). Small tributary to Oelemari River, ANSP 158202, 3 (19.4–24.2, paratypes of *Curimata punctata*); BMNH 1986.3.26:1–3, 3 (19.1–25.1, paratypes of *Curimata punctata*); CAS 58151, 3 (20.8–23.0, paratypes of *Curimata punctata*); FMNH 96906, 3 (21.1–23.7, paratypes of *Curimata punctata*); ISNB 651, 76 (5, 21.1–23.7, paratypes of *Curimata punctata*); MHNG 2251.05, 3 (20.4–23.8, paratypes of

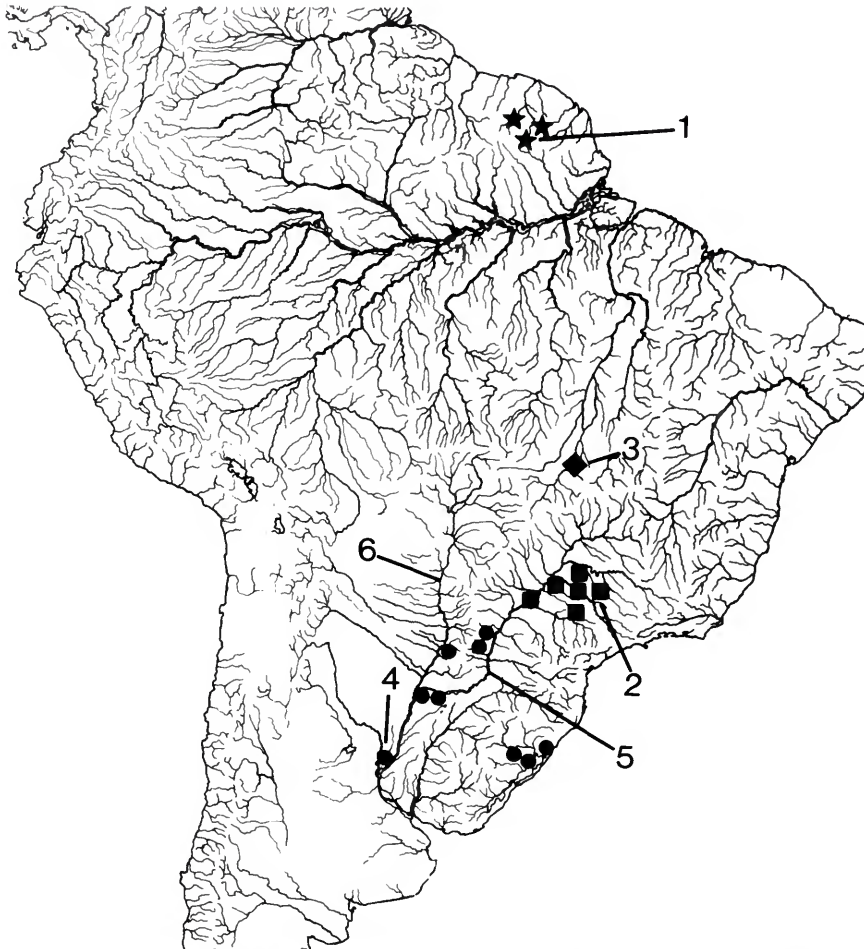


FIGURE 44.—Map of South America showing geographic distribution of *Cyphocharax punctatus* (stars; 1 = type locality of *Curimata punctata*), *Cyphocharax vanderi* (squares; 2 = type locality of *Curimata vanderi*), *Cyphocharax signatus* (diamond; 3 = type locality, only known locality), and *Cyphocharax saladensis* (filled in circles; 4 = Río Salado, type locality of *Curimatopsis saladensis*) (5 = Río Paraná; 6 = Río Paraguay) (some symbols represent more than one locality or lot of specimens).

Curimata punctata); MNHN 1986-395, 3 (18.6–19.9, paratypes of *Curimata punctata*); NMW 82174, 3 (21.8–26.0, paratypes of *Curimata punctata*); USNM 278054, 5 (19.2–25.1, paratypes of *Curimata punctata*); ZMA 119.424, 4 (26.8–31.3, paratypes of *Curimata punctata*); ZMA 119.425, 3 (25.8–26.4, paratypes of *Curimata punctata*). Litani River, small left bank stream, 1 km downstream of Jamaïke (approx. 02°51'N, 54°11'W), USNM 313072, 2. Litani River, small pool to side of Oelemarie Kreek (approx. 03°12'N, 54°69'W), USNM 313071, 3. Tapanahoni River system, right bank stream, downriver of Portoetoe, along Paloemeu River, (approx. 03°16'N, 55°26'W), USNM 313069, 2.

FRENCH GUIANA. Tributary on right bank of Irini River, at Saut Sonnelle, ISNB 652, 3 (39.7–42.5, paratypes of *Curimata punctata*).

Cyphocharax vanderi (Britski)

FIGURES 44–46

Curimata vanderi Britski, 1980:327 [type locality: Brazil: São Paulo, Rio Corumbataí].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

DIAGNOSIS.—*Cyphocharax vanderi* can be distinguished from its congeners with the exception of *C. punctatus* by the combination of the possession of 27 to 29 scales in the lateral line to the hypural joint, the absence of multiple series of longitudinal dark stripes or multiple longitudinal series of dark spots on the body, absence of a discrete patch of dark pigmentation on the dorsal fin, and the presence of 4 to 6 large spots of dark pigmentation on the midlateral surface of the body including one on the caudal peduncle. *Cyphocharax vanderi* can be separated from *C. punctatus* by differences in

the relative depth of the caudal peduncle (0.16–0.20 of SL versus 0.13–0.15, respectively), relative body depth (0.38–0.42 of SL versus 0.35–0.37), relative length of the pelvic fin (0.21–0.23 of SL versus 0.24–0.27), and number of vertebrae (28 or 29 versus 30).

DESCRIPTION.—Body robust, slightly compressed laterally, more so in specimens under 25 mm SL. Dorsal profile of head distinctly convex from tip of snout to vertical line though posterior nostril, slightly convex from that line to tip of supraoccipital spine in smaller individuals, straight in that region in adults. 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 to slightly convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body transversely rounded both anterior and posterior of dorsal fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region obtusely flattened transversely, with median series of scales not notably enlarged relative to those on adjoining portions of body. Obtuse median keel present posterior to origin of pelvic fin. 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 0.38–0.42 [0.42]; snout tip to origin of dorsal fin 0.51–0.55 [0.54]; snout tip to origin of anal fin 0.83–0.87 [0.85]; snout tip to origin of pelvic fin 0.56–0.59 [0.56]; snout tip to anus 0.78–0.83 [0.79]; origin of dorsal fin to hypural joint 0.52–0.58 [0.54]. Dorsal fin rounded distally in profile, last unbranched and first branched rays three to three and one-half times length of ultimate ray. Pectoral fin obtusely pointed distally in profile; length of pectoral fin 0.18–0.22 [0.19], extends about two-thirds distance to vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally; length of pelvic fin 0.21–0.23, reaches two-thirds distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays about two and one-half times length of ultimate ray. Least depth of caudal peduncle 0.16–0.20 [0.17].

Head profile rounded anteriorly, obtusely pointed overall, head length 0.27–0.31 [0.30]; upper jaw longer than lower, mouth small, subterminal; snout length 0.28–0.32 [0.30]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.30–0.36 [0.30]; adipose eyelid slightly developed anteriorly, absent posteriorly; length of postorbital portion of head 0.39–0.44 [0.44]; gape width 0.18–0.26 [0.20]; interorbital width 0.46–0.52 [0.46].

Pored lateral-line scales from supracleithrum to hypural joint 27 to 29 [28]; all scales of lateral line pored, canals in scales straight; 3 or 4 series of pored scales extend beyond hypural joint onto caudal-fin base; $4\frac{1}{2}$ [$4\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; 4 or 5 [5] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 [ii,9]; anal-fin rays ii,7 [ii,7]; pectoral-fin rays 13 or 14 [14]; pelvic-fin rays i,8 [i,8].

Total vertebrae 28 (2), 29 (5).

COLOR IN ALCOHOL.—Juvenile specimens lacking guanine on scales with yellowish-tan ground coloration and single longitudinal series of five to eight irregular patches of dark pigmentation; centers of each patch of pigmentation typically near or slightly above lateral line (Figure 45), although in rare instances situated below lateral line. Individual spots vary in intensity of pigmentation and form between different specimens of same size, and sometimes on two sides of a single specimen; typically vertically ovoid or distinctly vertically elongate. Spot of pigmentation along vertical line through base of adipose fin most variable in intensity in available specimens, absent in some individuals. Prominent, vertically elongate spot at posterior portion of caudal peduncle and sometimes on basal portions of middle rays of caudal fin always developed. The latter spot uniformly dark in most individuals under 30 mm SL; dorsal and ventral portions of spot less intensely pigmented in specimens 30–45 mm SL, with dark central portion becoming more horizontally elongate and extending onto basal portions of middle rays of caudal in larger specimens. Remainder of caudal fin and other median fins with series of small chromatophores scattered along fin membranes, otherwise hyaline.

Individuals retaining guanine on scales with overall silvery coloration, darker on dorsal portions of head and body. Scales of lateral and dorsal portions of body with patches of dark chromatophores over anterior and central portions of exposed scale surface; extent and intensity of pigmentation increasing ontogenetically. Chromatophore patches on scales particularly dark and broad dorsally on larger specimens (Figure 46). Series of large midlateral spots in specimens of approximately 40 mm more distinct and darker than in juveniles, but typically becoming more diffuse and masked by overall darker pigmentation in specimens over 45 mm than in smaller specimens. In some specimens midlateral patches almost appear to form an indistinct midlateral band with a separate large dark spot on the caudal peduncle. Larger specimens with caudal peduncle spot rotund rather than vertically elongate as in juveniles; with dark rotund central section centered on midlateral surface of caudal peduncle; rare individuals with notably less intense field of chromatophores extending to dorsal and ventral margins of caudal peduncle. Larger specimens lacking guanine on scales with noticeable vertically elongate spots of dark pigmentation on anterior portion of exposed surfaces of scales; anterior margin of spot convex. Spots apparent on scale rows dorsal of lateral line in all larger specimens, variably present on three horizontal rows of scales ventral of lateral line. All rayed fins with rays outlined by series of small, dark chromatophores.

AUTAPOMORPHIES OF *Cyphocharax vanderi*.—As noted in the discussion of “Pigmentation” under “Phylogenetic Comments” the pattern of large dark spots on the lateral surface of the body in *Cyphocharax vanderi* that is shared with *C.*

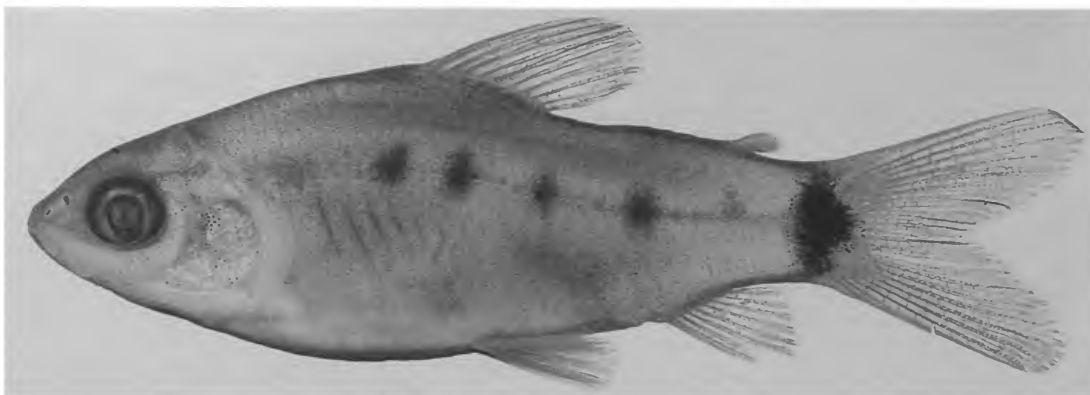


FIGURE 45.—*Cyphocharax vanderi*, juvenile, USNM 296257, 22.8 mm SL; Brazil, São Paulo, Corumbataí.



FIGURE 46.—*Cyphocharax vanderi*, NRM 26502, 51.6 mm SL; Brazil, São Paulo, Rio Tietê, Município de Promissão.

punctatus is a hypothesized synapomorphy for the species pair. Adults of *C. vanderi* undergo an ontogenetic development to a more complex mottled pattern autapomorphic for the species in the family. The examined cleared and counterstained specimens of *C. vanderi* have a notably deep, rather square second infraorbital relative to that in congeners and outgroups, another derived feature unique for the species.

DISTRIBUTION.—Upper Rio Paraná system (Figure 44).

MATERIAL EXAMINED.—80 specimens (59, 16.5–68.3).

BRAZIL. São Paulo: No specific locality, USNM 243241, 2 (55.7–64.7; 1 specimen cleared and counterstained for cartilage and bone). Lagoa marginal do Rio Corumbataí, Corumbataí, MZUSP 4325, 1 (42.6, holotype of *Curimata vanderi*); MZUSP 4305–4324, 20 (18.3–39.3, paratypes of *Curimata vanderi*); MZUSP 4326–4327, 2 (36.0–39.3, paratypes of *Curimata vanderi*); MZUSP 4328–4337, 10 (20.7–30.7, paratypes of *Curimata vanderi*). Corumbataí, USNM 296257, 5. Córrego do Bueno, Corumbataí, MZUSP 13395–13396, 2 (66.5–68.3, paratypes of *Curimata vanderi*). Corumbataí, Lagoa da Ponte Seca, MZUSP 4338–4342, 5 (21.6–49.2, paratypes of *Curimata vanderi*). Corumbataí, pool above

mouth of Córrego da Machadinho, MZUSP 20764, 5 (16.5–22.0). Rio Tietê, Município de Promissão, km 143 on SP 153, NRM 26502, 3 (49.0–62.3); MZUSP 21731, 3 (54.7–62.4). Botucatu, Fazenda Edgardia, MZUSP 21476, 1 (54.7); MZUSP 21470, 1 (58.4). Lagoa on Rio Paraná, 30 km from Pôrto Tibiriça, MHNG uncat., 6 (4, 38.7–45.7). Murutinga do Sul, Córrego Fundo, MZUSP 35731, 1. Município de São José do Rio Preto, Rio Preto, MZUSP 38523, 12. Represa de São José do Rio Preto, MZUSP 21684, 1.

Cyphocharax signatus, new species

FIGURES 44, 47

DIAGNOSIS.—*Cyphocharax signatus* is the only member of *Cyphocharax* with only 10 to 12 pectoral-fin rays contrary to 13 to 17 in its congeners. The relatively foreshortened caudal peduncle and lengthened anal-fin rays reflected in the significant overlap of the distal portions of the anal-fin rays and the basal portions of the caudal fin also distinguish *C. signatus* in the genus. The combination of 27 scales to the hypural joint

in the longitudinal scale series including the lateral line, the absence of multiple series of longitudinal dark stripes or multiple horizontal series of small dark spots on the body, absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, and the development of pores in only the anterior 5 to 7 scales of the lateral line further distinguish *C. signatus* from all congeners with the exception of *C. saladensis*. Those two species differ in relative body depths (0.34–0.36 of SL in *signatus* versus 0.39–0.43 in *saladensis*), number of pectoral-fin rays (10 to 12 versus 13 or 14, respectively), in the pronounced development of the anal fin and foreshortened caudal peduncle of *C. signatus*, that do not occur in *C. saladensis*, and in details of pigmentation (compare Figure 47 with Figures 48, 49).

DESCRIPTION.—Body moderately elongate, relatively robust in cross section. Dorsal profile of head convex from margin of upper jaw to vertical line through anterior nares; slightly convex from that line to rear of supraoccipital spine. Dorsal profile of body smoothly curved from tip of supraoccipital spine to origin of dorsal fin; straight to slightly convex, posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body transversely rounded anteriorly, with indistinct median keel immediately 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 obtusely flattened, with somewhat irregular median series of scales approximately of same size as those on adjoining regions of body. Median keel posterior to pelvic-fin origin absent. Secondary 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 0.34–0.36 [0.35]; snout tip to origin of dorsal fin 0.51–0.53 [0.53]; snout tip to origin of anal fin 0.83–0.86 [0.85]; snout tip to origin of pelvic fin 0.55–0.58 [0.58]; snout tip to anus 0.78–0.81 [0.80];

origin of dorsal fin to hypural joint 0.54–0.58 [0.57]. Distal margin of dorsal fin slightly convex; last unbranched and first branched rays about $2\frac{1}{2}$ times length of ultimate ray. Distal margin of pectoral fin rounded; length of pectoral fin 0.19–0.21 [0.20], extends nearly to vertical line through origin of dorsal fin, about three-fifths distance to origin of pelvic fin. Distal margin of pelvic fin rounded; length of pelvic fin 0.21–0.23 [0.22], reaches about three-quarters distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Distal margin of anal fin slightly convex, anteriormost branched rays about $1\frac{1}{2}$ times length of ultimate ray; posterior rays contacting basal portions of ventral rays of caudal fin in depressed fin. Caudal peduncle relatively deep, depth 0.15–0.16 [0.15].

Head rounded anteriorly in lateral profile; head length 0.29–0.31 [0.31]; upper jaw slightly longer than lower, mouth barely subterminal; snout length 0.27–0.31 [0.29]; nostrils of each side separated by a distance equal to diameter of anterior nares; anterior nares longitudinally ovoid, posterior somewhat tear-dropped, transversely elongate, without raised thin flap of skin along anterior margin; orbital diameter 0.31–0.34 [0.33]; adipose eyelid absent in all available specimens; length of postorbital portion of head 0.37–0.41 [0.41]; gape width 0.21–0.24 [0.23]; interorbital width 0.43–0.46 [0.43].

Scales in midlateral series from supracleithrum to hypural joint 27 in all examined specimens [27]; 5 to 7 anterior scales of series with pores, canals in pored lateral-line scales straight; 3 series of scales extend from series continual with truncated lateral line posteriorly beyond hypural joint onto caudal-fin base; $4\frac{1}{2}$ or 5 [$4\frac{1}{2}$] scales in transverse series from origin of dorsal fin to midlateral scale series continuous with pored lateral-line scales; 4 or $4\frac{1}{2}$ [$4\frac{1}{2}$] scales in transverse series from midlateral scale series continuous with pored lateral-line scales to origin of anal fin.

Dorsal-fin rays ii,9 in all examined specimens [ii,9]; anal-fin rays ii,7 in all examined specimens [ii,7]; pectoral-fin rays 10 to 12 [11]; pelvic-fin rays i,8 [i,8].



FIGURE 47.—*Cyphocharax signatus*, holotype, new species, MZUSP 41757, 33.4 mm SL; Brazil, Goiás, Rio Vermelho where crossed by road from Aruanã to Britânia.

Total vertebrae 28 (1), 29 (2), 30 (2).

COLOR IN ALCOHOL.—All available specimens lack guanine on scales, ground color tan. Upper lip, snout, dorsal portion of opercle and dorsal portion of head covered by a series of small dark chromatophores, dusky overall. Posterior margins of scales along dorsal portion of body outlined by fields of small dark chromatophores; chromatophore fields more developed along regions on contact of longitudinal series of scales, resulting in irregular faint longitudinal stripes on dorsolateral portion of body. Deep-lying dusky, midlateral band extending from supracleithrum to caudal peduncle; deep-lying pigmentation most intense along line of contact between hypaxial and epaxial musculature, forming narrow dark line. Caudal peduncle with longitudinally ovoid spot of dark pigmentation on midlateral surface. Spot formed by both deep-lying and epidermal dark chromatophores. All fins with fin rays outlined by series of small dark chromatophores.

AUTAPOMORPHIES OF *Cyphocharax signatus*.—The relatively elongate anal-fin rays and foreshortened caudal peduncle of *C. signatus* are not approximated elsewhere in *Cyphocharax* and are thus hypothesized autapomorphic for the species. The reduced number of pectoral-fin rays (10 to 12) is unique to the species in *Cyphocharax* and proximate outgroups in the Curimatidae and is thus deemed an additional autapomorphy for the species.

DISTRIBUTION.—Known only from the type locality, the Rio Vermelho, a tributary of the Rio Araguaia of the Rio Tocantins system (Figure 44).

ETYMOLOGY.—The species name, *signatus*, from the Latin for mark or stamp, refers to the distinct spot of dark pigmentation on the midlateral surface of the caudal peduncle.

TYPE MATERIAL EXAMINED.—5 specimens (5, 29.0–33.4).

HOLOTYPE.—BRAZIL. Goiás: Rio Vermelho, where crossed by road from Aruanã to Britânia, pool along side of main channel, collected by R.P.L. Peters, 30 Apr 1976, MZUSP 41757, 1 (33.4).

PARATYPES.—BRAZIL. Goiás: Rio Vermelho, where crossed by road from Aruanã to Britânia, pool along side of main channel; collected by R.P.L. Peters, 30 Apr 1976, 4 specimens collected with holotype: MZUSP 41758, 1 (29.5); USNM 308392, 3 (29.0–33.0; 1 specimen cleared and counterstained for cartilage and bone).

Cyphocharax saladensis (Meinken)

FIGURES 44, 48, 49

Curimatopsis saladensis Meinken, 1933:71, fig. [type locality: Argentina: Santa Fe region, tributary to Río Salado].—Pozzi, 1945:271 [Río Paraguay, Río Salado, Río Paraná].—Fernández-Yépez, 1948:69 [reference].—Fowler, 1950:298, fig. 360 [literature compilation].—Ringuet and Aramburu, 1961:36 [Argentina].—Ringuet et al., 1967:194 [reference].—Hoedeman, 1974:609 [breeding].—Fowler, 1975:376 [reference].—Lopez et al., 1980:439, fig. 2a [Argentina: Corrientes, Colonia Carlos Pellegrini].—Grosser and Hahn, 1981:64 [Brazil: Rio Grande de Sul, Lagoa Negra,

Viamão].—Miquelarena, 1984:619, fig. 48 [caudal skeleton].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Curimata(?) saladensis.—Géry et al., 1987:427, fig. 43 [Paraguay: Río Paraná system, Arroyo Yuqury, Río Güyraugua, Panchiot-Lopez; Argentina: 66 km E of Corrientes].

Cyphocharax saladensis.—Bertoletti et al., 1989a:8, 15, 30 [Brazil: Rio Grande do Sul, upper Rio Uruguai between Aratiba and Esmeralda; frequency of occurrence; common name]; 1989b:46, 49, 50 [Brazil: Santa Catarina, upper Rio Uruguai system, Rio Canoas; frequency of occurrence; common name].—Malabarba, 1989:124 [Brazil: Rio Grande do Sul, Laguna dos Patos system].

DIAGNOSIS.—The combination 27 to 30 scales to the hypural joint in the longitudinal scale series including the lateral line, the absence of multiple series of longitudinal dark stripes or multiple longitudinal series of small dark spots on the body, absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, and the development of pores in only the anterior 8 or 9 scales of the lateral line distinguish *C. saladensis* from its congeners with the exception of *C. signatus*. The species differ in relative body depths (0.39–0.43 of SL in *saladensis* versus 0.34–0.36 in *signatus*), number of pectoral-fin rays (13 or 14 versus 10 to 12 respectively), in the pronounced development of the anal fin and the foreshortening of the caudal peduncle in *C. signatus* that do not occur in *C. saladensis*, and in details of pigmentation (compare Figures 48, 49 with Figure 47).

DESCRIPTION.—(Cited data for holotype taken from original description of *Curimatopsis saladensis* (Meinken, 1933), when available in that publication; see also "Remarks" below.) Body moderately elongate in juveniles, robust in adults, slightly compressed laterally, relatively less so in larger individuals. Dorsal profile of head smoothly convex from tip of snout to tip of supraoccipital spine. Dorsal profile of body smoothly curved from tip of supraoccipital spine to origin of dorsal fin; straight and slightly posteroventrally slanted at base of dorsal fin, straight from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body transversely rounded anteriorly, with indistinct median keel immediately anterior to dorsal fin, smoothly rounded transversely posterior to fin. Ventral profile of body distinctly curved from tip of lower jaw to caudal peduncle in adults. Prepelvic region obtusely flattened transversely, with median series of scales of approximately same size as those on adjoining portions of body. Obtuse median keel posterior to origin of pelvic fin. Secondary obtuse keel on each side of postpelvic portion of body about one scale dorsal of ventral midline.

Greatest body depth at origin of dorsal fin, depth 0.39–0.43 [0.40]; snout tip to origin of dorsal fin 0.49–0.53 [0.48]; snout tip to origin of anal fin 0.76–0.84 [0.75]; snout tip to origin of pelvic fin 0.53–0.57 [0.53]; snout tip to anus 0.77–0.80; origin of dorsal fin to hypural joint 0.54–0.59 [0.54]. Distal margin of dorsal fin rounded; last unbranched and first branched rays about two and one-half times length of ultimate ray. Pectoral-

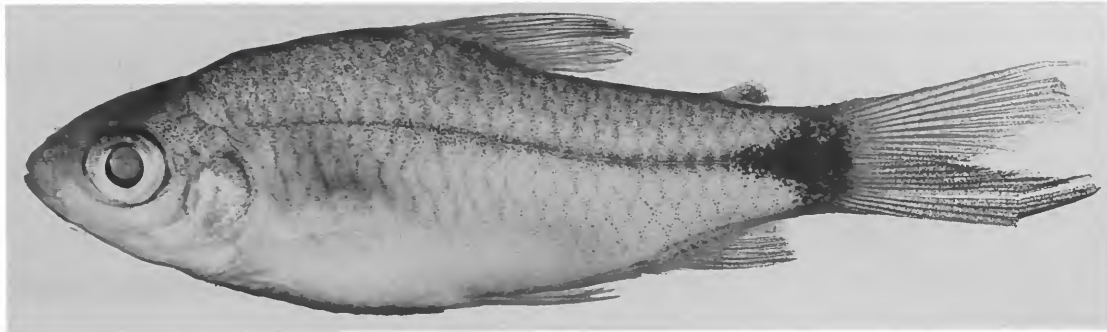


FIGURE 48.—*Cyphocharax saladensis*, juvenile, MCP 8414, 26.2 mm SL; Brazil, Rio Grande do Sul, Arroio Dom Marcos, at BR 290.

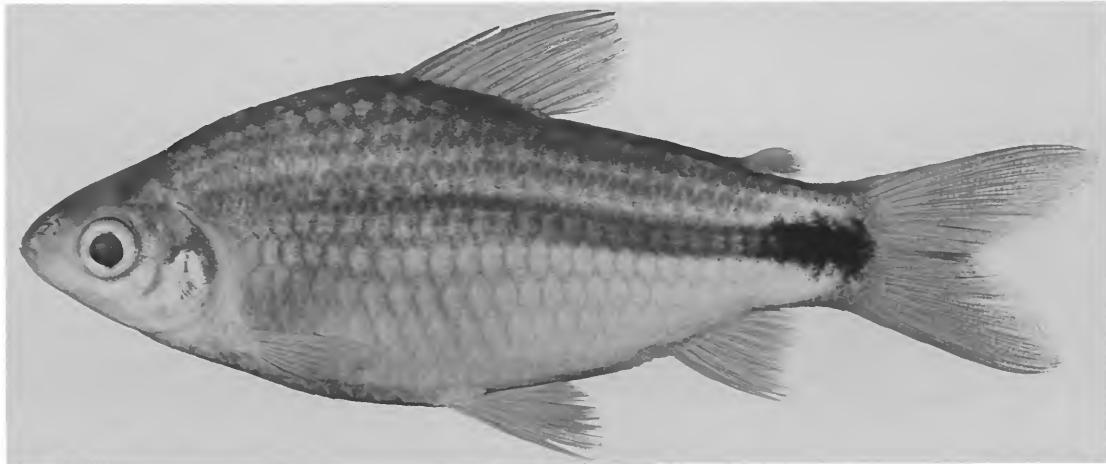


FIGURE 49.—*Cyphocharax saladensis*, adult, USNM 269374, 63.5 mm SL; Brazil, Rio Grande do Sul, along road from Porto Alegre to Pelotas.

fin margin obtusely pointed; length of pectoral fin 0.21–0.24, extending about one-half distance to vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally, length of pelvic fin 0.21–0.25, reaching about two-thirds distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anterior branched rays two and one-half to three times length of ultimate ray. Least depth of caudal peduncle 0.15–0.17 [0.15].

Head profile relatively rounded overall, head length 0.27–0.31 [0.27]; upper and lower jaws equal, mouth small, terminal; snout length 0.27–0.32 [0.24]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.27–0.34 [0.28]; adipose eyelid poorly developed, more apparent anteriorly; length of postorbital portion of head 0.39–0.43; gape width 0.18–0.24; interorbital width 0.44–0.50 [0.48].

Scales in midlateral longitudinal series from supracleithrum to hypural joint 27 to 30 [type described as having 32 scales, a

count that presumably includes 3 or 4 scales extending posterior of hypural joint along the series continuous with lateral line]; 8 or 9 anterior scales of midlateral longitudinal series with laterosensory pores, laterosensory canals in pored scales straight; 3 or 4 series of scales in series continuous with lateral line extending posterior of hypural joint onto caudal-fin base; $4\frac{1}{2}$ to 6 [$4\frac{1}{2}$] scales in transverse series from origin of dorsal fin to horizontal series continuous with pored scales of lateral line; $4\frac{1}{2}$ or 5 [6] scales in transverse series from horizontal series continuous with pored scales of lateral line to origin of anal fin (scales under lateral line cited in original description were evidently in series to midventral line rather than to anal fin); $11\frac{1}{2}$ to $12\frac{1}{2}$ scales in transverse series from origin of dorsal fin to mid-ventral line.

Dorsal-fin rays ii,9 or 10 [ii,10 very rare; holotype reported as having 11 rays, presumably ii,9]; anal-fin rays ii,7 or 8 [holotype reported as having 9 rays, presumably ii,7]; pectoral-fin rays 13 or 14; pelvic-fin rays i,8 [i,8].

Total vertebrae 29 (3), 30 (6).

COLOR IN LIFE.—Meinken (1933:72) reported that in life males have a blackish-olive coloration dorsally that becomes green or blue green laterally. The anterolateral and ventral portions of the body are red and the opercle is brass colored. A narrow dark line begins immediately posterior to the opercle, and widens on the caudal peduncle, ending at the base of the middle caudal-fin rays. The dark band of pigmentation on the caudal peduncle is bordered by copper-red pigmentation. The caudal fin is an intense red-orange basally and brownish-red along its margins. The other fins with the exception of the pectorals are an intense reddish-yellow. Females have similar, but less intense pigmentation.

COLOR IN ALCOHOL.—Specimens retaining guanine on scales silvery with distinct, horizontally elongate, stripe on midlateral surface of caudal peduncle. Ground coloration of specimens lacking guanine on scales yellowish-tan, darker on dorsal portions of head and body. Scale margins on dorsal and dorsolateral portions of body outlined by series of small dark chromatophores. Chromatophore series more intense on dorsal portions of body. Longitudinally elongate patch of dark pigmentation centered along midlateral surface of caudal peduncle. Pigmentation patch in specimens under 30 mm SL most intense along midlateral region, with less dense concentrations of chromatophores extending to dorsal and ventral margins of posterior portion of caudal peduncle (Figure 48). Dark spot on caudal peduncle more elongate and rounded, continuing anteriorly to vertical line through or anterior to adipose fin in specimens longer than approximately 40 mm SL. Dorsal and ventral margins of dark spot on caudal peduncle in such larger specimens somewhat irregular, but dark pigmentation not extending dorsally and ventrally to margins of caudal peduncle (Figure 49). Specimens greater than 40 mm SL with dark pigmentation along scale margins more noticeable than in juveniles, forming a reticulated pattern. Dark pigmentation along scale margins more concentrated in areas where horizontal rows of scales meet, forming indistinct dusky longitudinal stripes. Such stripes more obvious on dorsolateral surface of body. All fins other than pectorals with fin rays outlined by series of small dark chromatophores on membranes. Adipose fin dark distally in some smaller specimens, dusky but without distinct dark spot distally in individuals above 40 mm SL. Pectoral fins hyaline.

DISTRIBUTION.—Southern portions of Río de La Plata basin and coastal drainages of states of Rio Grande do Sul and Santa Catarina, Brazil (Figure 44).

COMMON NAME.—Biru (Brazil, Santa Catarina and Rio Grande do Sul; Bertoletti et al., 1989a:8, 1989b:46).

REMARKS.—Meinken based the original description (1933) of the species on a series of aquarium specimens collected in the Río Salado, an Argentinean tributary of the Río de La Plata (Figure 44). The specimens that served as the basis for the original description were not located in the holdings of the Zoologisches Museum, Humboldt University, Berlin (H. Paepke, pers. comm.). G.S. Myers deposited in the Smith-

sonian collections two series of *Cyphocharax saladensis* (USNM 94306, 94307) which he received from individuals in Hamburg, Germany, the city into which the type specimens of the species were imported (Meinken, 1933). According to Myers (in litt., 18 Sep 1934; USNM Office of the Registrar, Accession 131034), the two specimens of USNM 94306 were of the “stock from which types came,” and the two individuals in USNM 93407 were “some of the same lot from which came Meinken’s types.” It is not apparent from Myers’ comments whether these specimens represent part of the wild stock originally captured in Argentina, or some of the “numerous animals bred at later dates” [my translation] noted by Meinken (1933). The USNM specimens are somewhat faded but agree with data in the original description and with more recently captured material from throughout the species range. This lends further support to the hypothesis that the material herein identified as *Cyphocharax saladensis* is conspecific with Meinken’s species. Meinken assigned his species, *saladensis*, to *Curimatopsis* Steindachner (1876) as a consequence of the incompletely pored laterosensory system on the body; a character at that time considered diagnostic for *Curimatopsis* in the Curimatidae. A reduction in the development of the laterosensory canal system is considered derived among curimatids in the context of the most parsimonious hypothesis of relationships of the Curimatidae to other characiforms (Vari, 1983, 1989a). Vari (1989a) proposed a hypothesis of intrafamilial relationships in the Curimatidae based on reductive and innovative characters. That hypothesis indicates that a reduction of the laterosensory canal system on the body occurred twice independently in the Curimatidae. Such reductions are found in *Curimatopsis* as restricted by Vari (1984a) and in various species of *Cyphocharax* (*saladensis*, *vexillapinnus*, *punctata*, *signatus*). In the context of the more encompassing phylogenetic hypothesis proposed by Vari (1989a), Meinken’s *Curimatopsis saladensis* is considered a member of *Cyphocharax*. The species of *Cyphocharax*, in turn, are separated from the *Curimatopsis* clade by a number of dichotomies supported by a large series of derived characters (Vari, 1989a).

MATERIAL EXAMINED.—81 specimens (31, 27.7–66.5).

ARGENTINA. Río Salado, USNM 94307, 2 (37.9–38.0; evidently part of the “stock” that originally included the types, see “Remarks” above); USNM 94306, 2 (31.0–31.8; evidently part of the “stock” that originally included the types, see “Remarks” above). *Corrientes*: Río Paraná, Laguna in Itati, 66 km E of Corrientes, GC, 2 (42.3–44.7). Río Paraná system, USNM 296328, 3 (33.4–38.7). Manatiales, Estero Santa Lucia, MZUSP uncat., 3. Bella Vista, Arroio Carrizal, MZUSP 10221, 1. San Cosme, Laguna Totorá, 40 km from Corrientes, MZUSP 10252, 4. *Chaco*: Vicinity of Resistencia, USNM 313070, 6.

PARAGUAY. *Candendiyu*: Río Carapa, above cataracts along road from Stroessner (= Ciudad del Este) to Guiara waterfall, USNM 247310, 1 (66.5). *San Pedro*: Arroyo Pindo, at bridge on Rt. #3, approx. 9.2 km N of Mbutuy, approx. 67

km N of Coronel Oviedo (24°52'54"S, 56°19'48"W), UMMZ 206838, 2 (1, 47.4). *Concepción*: Río Ypane System, Arroyo Peguajhó at bridge on highway to Concepción, approx. 68.1 km SW of Yby-Yau, 17.5 km ENE of Belén (24°29'S, 57°5'24"W), UMMZ 207752, 32 (10, 44.9–62.2).

BRAZIL. *Rio Grande do Sul*: Rio Sanga Funda, Rodovia BR 101, Osório, MCP 8532, 5 (27.7–58.7). Km 16 on BR 116, between Porto Alegre and Pelotas, USNM 220578, 4 (3, 52.2–57.2; 1 specimen cleared and counterstained for cartilage and bone). Along road between Porto Alegre and Pelotas, USNM 296374, 2 (61.0–63.5). Along highway BR 116, between Porto Alegre and Pelotas, MZUSP 21670, 6. Arroio Don Marcos, along BR 290, MCP 8414, 6.

Cyphocharax spilotos (Vari)

FIGURES 50–53; TABLE 8

Curimata spilota Vari, 1987:603, figs. 1, 2 [type locality: Brazil: Rio Grande do Sul, Rio Santa Maria, at bridge on highway BR 293, between Dom Pedrito and Livramento]; 1989a, tables 2, 3 [assignment to *Cyphocharax*].—Vari and Howe, 1991:17 [listing of type specimens in NMNH].

Curimata gillii.—Géry et al., 1987:416 [in part; some of reported specimens from Paraguay: Río Paraguay basin, Caaguazú, marécages (swamp) N of Coronel Oviedo].

Curimata gnaca Azpelicueta and Braga, 1988:118, fig. 1 [type locality: Argentina: Chaco Province, pond of the Barrio Toba, city district of Resistencia]. [New synonymy.]

DIAGNOSIS.—*Cyphocharax spilotos* differs from its congeners in its increased number of branched dorsal-fin rays (10 to 12). Other species of *Cyphocharax* typically have 9 branched dorsal-fin rays, although some specimens of *C. saladensis*, *C. aspilos*, *C. magdalenae*, *C. modestus*, and *C. nagelii* have 10 fin rays as an uncommon individual variant.

Cyphocharax spilotos can be further distinguished from its congeners by the combination of 29 to 33 scales to the hypural joint in the longitudinal scale series including the lateral line, the absence of multiple series of longitudinal dark stripes or multiple longitudinal series of small dark spots on the body, absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, and the development of pores along the entire lateral line.

Cyphocharax spilotos is very similar to *C. gillii*, a species also widely distributed through the Río de La Plata basin. The two species are distinguished by the 10 to 12 branched dorsal-fin rays of *C. spilotos* contrary to the 9 branched rays in *C. gillii*. *Cyphocharax spilotos* has 30 to 32 vertebrae, with 87% of the 72 radiographed specimens having 31 or 32 vertebrae. *Cyphocharax gillii*, in contrast, has 29 to 31 vertebrae with 91% of the 107 radiographed specimens having 29 or 30 vertebrae. The spot of dark pigmentation on the midlateral surface of the caudal peduncle in *C. spilotos* is horizontally elongate contrary to the rotund spot in that portion of the body in *C. gillii*.

DESCRIPTION.—Body moderately elongate, somewhat compressed laterally, more so in juveniles. Dorsal profile of head convex anteriorly, straight from vertical line through posterior nostril to tip of supraoccipital spine. Dorsal profile of body slightly convex from tip of supraoccipital spine to origin of dorsal fin; straight to slightly convex 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 transversely rounded anteriorly, with indistinct median keel immediately 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 obtusely flattened transversely, with median series of scales proximate to pelvic-fin origin preceded medially by irregularly arranged scales; scales of prepelvic region of approximately same size as those on adjoining ventrolateral regions of body. Obtuse median keel posterior to origin of pelvic fin.

Greatest body depth at origin of dorsal fin, depth 0.37–0.45 [0.39] (minimum value incorrectly cited as 0.33 by Vari (1987:605); see also comments below under “Geographic Variation”); snout tip to origin of dorsal fin 0.48–0.54 [0.52]; snout tip to origin of anal fin 0.81–0.86 [0.84]; snout tip to origin of pelvic fin 0.53–0.59 [0.58]; snout tip to anus 0.78–0.82 [0.81]; origin of dorsal fin to hypural joint 0.53–0.59 [0.53]. Distal margin of dorsal fin rounded; last unbranched and first branched rays approximately three to three and one-half times length of ultimate ray. Pectoral fin obtusely pointed in profile distally; length of pectoral fin 0.18–0.22 [0.21], extends two-thirds to three-quarters distance to vertical line through origin of pelvic fin. Pelvic fin obtusely pointed in profile distally, length of pelvic fin 0.22–0.26 [0.25], reaches approximately two-thirds distance to origin of anal fin. Caudal fin deeply forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays about two and one-half times length of ultimate ray. Least depth of caudal peduncle 0.14–0.16 [0.15].

Head profile rounded anteriorly, pointed overall, head length 0.28–0.33 [0.31]; upper jaw slightly longer than lower, mouth slightly subterminal; snout length 0.25–0.33 [0.31]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.29–0.36 [0.30]; adipose eyelid present, more developed anteriorly, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.40–0.45 [0.45]; gape width 0.20–0.25 [0.22]; interorbital width 0.40–0.47 [0.42].

Lateral-line scales from supracleithrum to hypural joint 29 to 33 [31]; all scales of lateral line pored, canals in scales straight; 2 to 4 series of pored scales extending beyond hypural joint onto caudal-fin base; 5 to 6¹/₂ [6¹/₂] scales in transverse series from origin of dorsal fin to lateral line; 4 to 5 (5 uncommon) [4¹/₂] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii, 10 to 12, or iii, 10 or 11 (92% of examined



FIGURE 50.—*Cyphocharax spilotos*, holotype of *Curimata spilota*, MZUSP 37133, 56.3 mm SL; Brazil, Rio Grande do Sul, Rio Santa Maria, at bridge on Rodovia 293, between Dom Pedrito and Livramento.

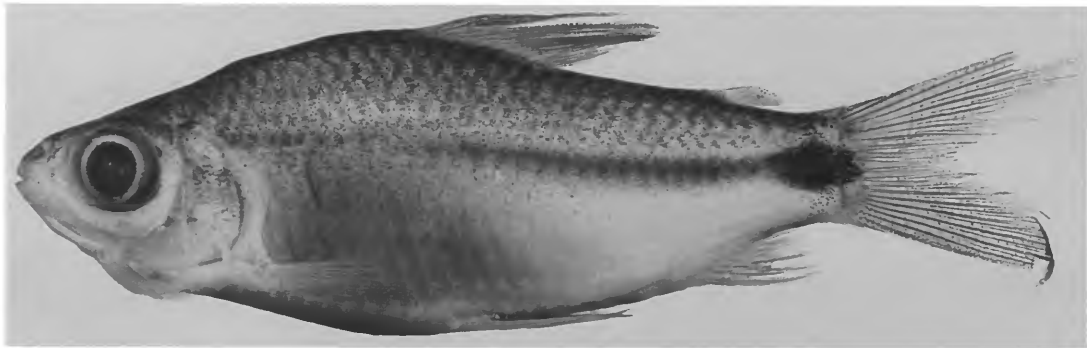


FIGURE 51.—*Cyphocharax spilotos*, MHNG 2068.22, 46.5 mm SL; Paraguay, Caaguazú, pools near Coronel Oviedo.



FIGURE 52.—*Cyphocharax spilotos*, MHNG 2068.24, 57.2 mm SL; Paraguay, Caaguazú, pools near Coronel Oviedo.

specimens with ii,10 or iii,10, remainder with ii,11, ii,12, or iii,11; when three unbranched ray present, first ray very short [iii,10]; anal-fin rays ii,7 or 8 or iii,7 (ii,8 rare; when three unbranched rays present, first very short) [iii,7]; pectoral-fin rays 13 to 15 [14]; pelvic-fin rays i,8 [i,8].

Total vertebrae 30 (9), 31 (53), 32 (10).

COLOR IN ALCOHOL.—Specimens retaining guanine on scales silvery overall, purplish dorsally and whitish ventrally (Figure 50). Head darker dorsally. Iris, opercle, and ventral portions of head silvery. Obscure midlateral dusky band



FIGURE 53.—Map of South America showing geographic distribution of *Cyphocharax spilotos* (filled in circles; 1 = type locality of *Curimata spilota*; 2 = general area of Entre Rios Province, Argentina, from which some examined specimens of *Cyphocharax spilotos* originated) and *Cyphocharax mestomyllon* (squares; 3 = type locality) (some symbols represent more than one locality or lot of specimens).

extending from supracleithrum to caudal peduncle. Horizontally elongate midlateral spot on caudal peduncle. Spot somewhat diffuse, masked by guanine.

Specimens that lack guanine on scales with dark pigmentation on head and body much more apparent (Figure 51). Ground coloration of head and body tan, darker on dorsal portions of head and body; scales on lateral and particularly dorsal portions of body with field of small dark chromatophores. Dark pigmentation of each scale discrete on midlateral surface of body, nearly continuous dorsally. Distinct spot of dark pigmentation on midlateral surface of caudal peduncle; spot nearly round in specimens of 22 to 40 mm SL, with pattern of scattered dark chromatophores extending from dorsal and

ventral borders of spot to margins of caudal peduncle. Specimens of approximately 25 mm SL with faint midlateral dark line extending from caudal peduncle anteriorly to vertical line through origin of dorsal fin. Line increasingly more apparent in specimens of up to 40 mm SL, reaching to supracleithrum.

Specimens over 50–60 mm SL retaining dark midlateral spot on caudal peduncle; spot ovoid, horizontally elongate. Field of scattered dark chromatophores flanking dorsal and ventral portions of spot in smaller specimens; absent in individuals over approximately 50 mm SL. Largest specimens examined (67.9–71.3 mm SL) with spot on midlateral surface of caudal peduncle less apparent than in smaller individuals.

Superficial dark midlateral line on body ending under dorsal fin, underlain by a deeper-lying, wider, dark stripe that extends anteriorly to supracleithrum. Streak becoming progressively narrower anteriorly.

Median fins with small, dark chromatophores scattered over membranes; dusky overall, particularly in larger individuals. Adipose fin dusky. Paired fins hyaline.

AUTAPOMORPHIES OF *Cyphocharax spilota*.—As noted in the “Keys” and “Diagnosis” for this species, the consistently increased number of dorsal-fin rays in this species is unique in the family. That feature is consequently considered autapomorphic for the species. Associated with the increased number of dorsal-fin rays is a higher number of basal pterygiophores than in other curimatid species, another uniquely derived feature for the species.

DISTRIBUTION.—Río Uruguay, and lower Río Paraná and Río Paraguay basins (Figure 53; see also “Remarks”).

GEOGRAPHIC VARIATION.—Samples of *Cyphocharax spilota* from the Rio Uruguay basin, the type locality of the species, and from western portions of the species range in the Río Paraguay basin differ somewhat in body proportions. The populations differ in the ranges of relative depth of the body (0.37–0.41 of SL in the Río Uruguay samples versus 0.38–0.45 in Argentinean samples), pelvic-fin length (0.22–0.26 of SL versus 0.19–0.24 respectively), and to a lesser degree in the relative depth of the caudal peduncle (0.14–0.15 of SL versus 0.14–0.16). All other examined meristic and morphometric features agree in the two population samples.

The ranges in greatest relative body depths of *C. spilota* populations demonstrate an unexpected pattern. The highest values (0.43–0.45 of SL) occur in the center of the species range in the area of Formosa, Argentina. Populations samples from central, northeastern, and northwestern Argentina and Paraguay have lower values (0.39–0.43 of SL) as do those in the eastern portions of the species range in southeastern Brazil (0.37–0.42 of SL).

REMARKS.—The description of *Curimata spilota* (Vari, 1987), based on specimens from the Rio Uruguay system in Brazil, was followed soon thereafter by Azpelicueta and Braga's (1988) description of *C. gnaca* based on nine specimens collected near Resistencia, Argentina. The increased number of dorsal-fin rays in the two forms is unique to these nominal forms in the Curimatidae. *Curimata spilota* and *C. gnaca* typically have 10 or 11 rays whereas other curimatid species nearly invariably have nine branched dorsal-fin rays. In his diagnosis of *C. spilota* Vari (1987:604) noted various characters that distinguished it from phenetically similar species in the Río de La Plata basin, not including *C. gnaca*, which had not yet been described. Subsequent to the description of *C. spilota*, I received additional material of *Cyphocharax spilota* from the region of its type locality, from the area of the type locality of *Curimata gnaca*, and from various other localities in the Río de La Plata basin. Although I have not been able to examine any of the type series of *C.*

gnaca, data from specimens at my disposal indicate that the latter species is probably conspecific with *C. spilota*.

Table 8 presents meristic and morphometric data for specimens of *Cyphocharax spilota* from the Río Uruguay basin (type drainage of the species), Argentina (type region for *C. gnaca*), and from the original description of *C. gnaca*. The only apparent differences in these samples involves scale counts and relative snout length. The higher counts of scales along the lateral line presented by Azpelicueta and Braga (1988) for *C. gnaca* reflect the fact that they included all the “scales in lateral line from supracleithrum to the end of body.” Vari (1987 and herein) included in the counts of lateral line scales only those scales from the supracleithrum to the hypural joint and presented pored scales beyond that point as a separate count. The addition of the 2 to 4 pored scales beyond the hypural joint to the lateral line count for *C. spilota* eliminates the difference in that feature between that species and *C. gnaca*. Examination of a larger number of specimens of *C. spilota* from the Rio Uruguay basin shows that the range in scales in a transverse series above and below the lateral line is greater than in the type series of the species. The study of the Argentinian specimens of *C. spilota* also indicates that the evident difference in transverse scale counts also reflect different methodologies used in the two papers. The only difference that cannot be definitely resolved without reference to the type series of *Curimata gnaca* involves the difference between the range of relative snout lengths given for that species and the range found in this study for *Cyphocharax spilota*. Nonetheless, measurements of specimens from the type regions of both species using comparable methods has not revealed any differences in relative snout lengths. It thus seems that the incongruities in the descriptions of the two nominal forms are a function of different methods of measuring the relative snout length. In the absence of any feature known to distinguish the two forms, *Curimata gnaca* is herein placed as a synonym of *Cyphocharax spilota*.

Géry et al. (1987:417) pointed out that some specimens they identified as *Curimata* (= *Cyphocharax*) *gillii* from the region of Coronel Oviedo in the Río Paraguay basin in Paraguay had 9 to 12 branched dorsal-fin rays. In contrast, specimens they identified as that species from the type region (Arroio Trementina, Paraguay) had an invariant count of 9 dorsal-fin rays. An examination of the material they reported on from the region of Coronel Oviedo shows that it is complex, consisting of some juveniles of *Cyphocharax voga* with 9 branched dorsal-fin rays and individuals of *C. spilota* with higher numbers of dorsal-fin rays (MHNG 2034.79–85, 2107.8–9, 2068.20–25).

MATERIAL EXAMINED.—90 specimens (69, 22.3–89.0).

BRAZIL. *Rio Grande do Sul*: Rio Santa Maria, at bridge on Rodovia BR 293, between Dom Pedrito and Livramento, MZUSP 37133, 1 (56.3, holotype of *Curimata spilota*); MZUSP 37134, 7 (34.7–43.4, paratypes of *Curimata spilota*); USNM 285194, 12 (36.9–59.7, paratypes of *Curimata spilota*); 2 specimens cleared and counterstained for cartilage and bone).

TABLE 8.—Morphometrics and meristics of (A) holotype of *Curimata spilota* (MZUSP 37133); (B) all examined specimens of *Cyphocharax spilota* originating in Rio Uruguay system from which counts and measurements were taken; (C) all examined specimens of *C. spilota* originating in Argentina from which counts and measurements were taken; and (D) holotype and paratypes of *Curimata gnaca* (specimens not examined, data taken from original description by Azpelicueta and Braga (1988)). Standard length is expressed in mm; measurements 1 to 10 are proportions of standard length; 11 to 14 are proportions of head length. Counts of lateral-line scales by Vari (1987) and herein taken using different methods than those used by Azpelicueta and Braga (1988) for *C. gnaca* (see discussion in "Remarks" in species account for *Cyphocharax spilota*). See also comments in that section relative to transverse scale counts and relative length of snout.

Character	A	B	C	D
MORPHOMETRICS				
Standard Length	56.3	34.7–81.8	37.4–63.1	47.9–55.9
1. Greatest body depth	0.39	0.37–0.42	0.38–0.45	0.32–0.39
2. Snout to dorsal-fin origin	0.52	0.49–0.53	0.48–0.53	0.45–0.49
3. Snout to anal-fin origin	0.84	0.81–0.86	0.83–0.86	0.78–0.83
4. Snout to pelvic-fin origin	0.58	0.53–0.58	0.56–0.57	0.52–0.54
5. Snout to anus	0.81	0.78–0.82	0.79–0.81	0.75–0.80
6. Origin of dorsal fin to hypural joint	0.53	0.53–0.59	0.53–0.56	0.50–0.56
7. Pectoral-fin length	0.21	0.18–0.21	0.18–0.22	0.21–0.23
8. Pelvic-fin length	0.25	0.22–0.26	0.19–0.24	0.24–0.26
9. Caudal peduncle depth	0.15	0.14–0.15	0.14–0.16	0.12–0.15
10. Head length	0.31	0.28–0.32	0.28–0.32	0.29–0.32
11. Snout length	0.31	0.26–0.31	0.25–0.33	0.20–0.23
12. Orbital diameter	0.30	0.29–0.36	0.30–0.35	0.30–0.35
13. Postorbital length	0.45	0.40–0.45	0.42–0.45	0.41–0.45
14. Interorbital width	0.42	0.40–0.46	0.42–0.47	0.40–0.46
MERISTICS				
Lateral-line scales	31	30–33	30–32	32–35
Scale rows between dorsal-fin origin and lateral line	6½	5–6½	5–6½	5
Scale rows between anal-fin origin and lateral line	4½	4–4½	4½	4
Branched dorsal-fin rays	10	10–12	10–11	9–13
Branched anal-fin rays	7	7–8	7	8–9
Total pectoral-fin rays	14	13–15	14–15	12–14
Branched pelvic-fin rays	8	8–9	9	8–9
Vertebrae	31	30–32	30–32	31–32

Upper portion of Rio Negro, Bagé, MCP 9613, 4 (43.4–62.8, paratypes of *Curimata spilota*). Arroio do Salso, on road from Livramento to Rosário do Sul, Município de Rosário do Sul (tributary of Rio Ibicuí, Rio Uruguai basin), USNM 307242, 1 (85.2); MZUSP uncat., 1 (73.6); MCP 13837, 1 (79.2). Município de Livramento, a tributary of Rio Ibicuí da Faxina, on road from Livramento to Rosário do Sul, 500 m from turn-off to Bagé (Rio Uruguai basin), USNM 307240, 2 (29.0–36.2); USNM 309182, 1 (67.9); MZUSP uncat., 1 (35.5); MZUSP 42049, 1 (71.3); MCP 13836, 2 (26.5–30.1). Rio Garupa, at road between Uruguiana and Quaraí (a tributary of Rio Quaraí, Rio Uruguai basin), USNM 307244, 3 (22.3–37.2); MZUSP 42047, 2 (27.1–27.5); MCP 13838, 2 (27.6–28.4).

ARGENTINA. *Entre Ríos*: No specific locality, CAS 69672, 1 (63.1). *Chaco*: West of Resistencia, USNM 307243, 2 (38.2–48.6). *Corrientes*: Esteros del Iberá, USNM 307241, 2 (45.9–49.1). *Santa Fe*: Río Paraná, Rosario, MZUSP uncat., 3.

Formosa: Pool by highway between Ruta Nacional 11 and J.C. Sanchez, km 896, USNM 313877, 10 (5, 46.7–72.1). Between General Sanchez and Colonia Pastoril, CIMLP uncat., 2 (45.5–89.0). *Tucumán*: Arroyo Calimayo, near Ruta Nacional 28, vicinity of Lules, CIMLP uncat., 2 (58.8–83.3).

PARAGUAY. *Caaguazú*: Small streams and overflow pools on Estancia San Ignacio, 24 km NNW of Carayao, Río Hondo system of Río Paraguay basin (25°1'36"S, 56°25'48"W), UMMZ 206242, 9 (35.0–52.4). *Marécages* (swamps) 20 km N of Coronel Oviedo, Río Paraguay basin, MHNG 2107.8–9, 2; MHNG 2034.79–85, 7. Pools near Coronel Oviedo, MHNG 2068.20–25, 6 (3, 46.5–57.2). *Cordillera*: Pool and non-flowing stream just W of dirt road, 1.6 km S of Tobatí, Río Paraguay system (25°18'30"S, 57°4'12"W), UMMZ 205714, 1 (64.6). *San Pedro*: Arroyo Pindo at bridge on route 3 approx. 9 km N of Mbutuy and 67 km N of Coronel Oviedo (24°52'54"S, 56°19'48"W), UMMZ 206836, 2 (1, 54.4).

Cyphocharax mestomyllon, new species

FIGURES 53, 54

Curimata cf. *spilura*.—Goulding et al., 1988:134 [Brazil: Amazonas, Rio Negro Basin, Rio Marauíá; detritivory].

DIAGNOSIS.—The very fleshy upper lip of *Cyphocharax mestomyllon* that overlaps the anterior margin of the lower lip when the mouth is closed distinguishes the species from its congeners. *Cyphocharax mestomyllon* is further distinguished from its congeners by the combination of a relatively shallow body (0.28–0.31 of SL), 30 to 33 scales in the lateral line to the hypural joint, the development of pores along the entire lateral line, the absence of multiple series of longitudinal dark stripes or small dark spots in longitudinal rows on the body, absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, and the possession of 9 branched dorsal-fin rays.

DESCRIPTION.—Body relatively elongate, only moderately compressed laterally in all available specimens. Dorsal profile of head distinctly convex from margin of upper lip to vertical line through anterior nares, slightly convex from that line to posterior terminus of head. Dorsal profile of body smoothly curved from tip of supraoccipital spine to origin of dorsal fin; straight and barely posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with very 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 very slightly flattened, with median series of scales comparable in size to those on adjoining portions of body. Postpelvic region of body transversely rounded.

Greatest body depth at origin of dorsal fin, depth 0.28–0.31 [0.29]; snout tip to origin of dorsal fin 0.49–0.52 [0.51]; snout tip to origin of anal fin 0.81–0.84 [0.82]; snout tip to origin of pelvic fin 0.55–0.59 [0.56]; snout tip to anus 0.75–0.80 [0.76]; origin of dorsal fin to hypural joint 0.53–0.56 [0.55]. Distal margin of dorsal fin rounded; last unbranched and first

branched rays approximately three times length of ultimate ray. Distal margin of pectoral fin obtusely pointed; length of pectoral fin 0.18–0.21 [0.18], extends approximately two-thirds distance to vertical line through origin of pelvic fin. Distal margin of pelvic fin rounded; length of pelvic fin 0.20–0.22 [0.20], fin tip reaches or falls somewhat short of anus. Caudal fin forked. Adipose fin well developed. Distal margin of anal fin emarginate, anteriormost branched rays approximately two and one-half times length of ultimate ray. Least depth of caudal peduncle 0.11–0.12 [0.11].

Head profile distinctly rounded anteriorly, somewhat pointed overall; head length 0.29–0.32 [0.31]; upper jaw longer than lower, upper lip very fleshy, with fleshy ventral margin extending ventral of anterior margin of lower lip when mouth is closed; mouth subterminal; snout length 0.29–0.34 [0.33]; nostrils of each side very close, anterior irregularly circular, posterior crescent-shaped with aperture partially closed by thin flap of skin separating nares of each side; orbital diameter 0.32–0.36 [0.35]; adipose eyelid very poorly developed, with broad opening over eye; length of postorbital portion of head 0.32–0.37 [0.34]; gape width 0.21–0.24 [0.24]; interorbital width 0.38–0.42 [0.39].

Pored lateral-line scales from supracleithrum to hypural joint 30 to 33 [31]; all scales of lateral line pored, canals in lateral-line scales straight; 3 or 4 series of pored scales extend beyond hypural joint onto caudal-fin base; 5 [5] scales in transverse series from origin of dorsal fin to lateral line; 5 [5] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 [ii,9]; anal-fin rays ii,7 [ii,7]; pectoral-fin rays 13 to 15 [15]; pelvic-fin rays i,8 or i,9 (i,9 in only 1 paratype) [i,8].

Total vertebrae 31 (25), 32 (1).

COLOR IN ALCOHOL.—All examined specimens lacking guanine on scales, with ground coloration tan. Upper lip, snout, and dorsal portion of head covered by field of small dark chromatophores. Scattered, somewhat larger, dark chromatophores on lateral surface of opercle. Lower jaw with series of small dark chromatophores on anteroventral surface. Lateral and dorsal surfaces of body with field of dark chromatophores; chromatophores along margins of scales dorsal of lateral line

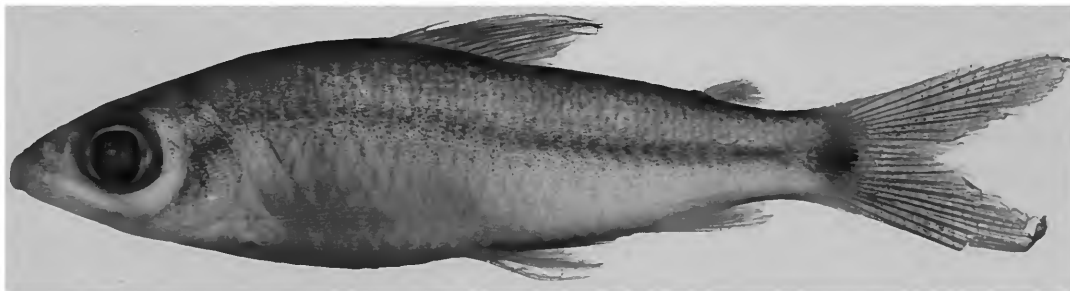


FIGURE 54.—*Cyphocharax mestomyllon*, new species, holotype, MZUSP 41755, 34.9 mm SL; Brazil, Amazonas, Rio Negro basin, Rio Marauíá, Cachoeira de Bicho-Açu (approx. 0°20'S, 65°29'W).

more concentrated, outlining posterior margins of scales. Deep-lying stripe of dark pigmentation runs from vertical line through posterior portion of dorsal-fin base to caudal peduncle, overlain on midlateral surface of caudal peduncle by rotund or horizontally elongate patch of dark pigmentation that extends posteriorly onto basal portions of middle rays of caudal fin. Dorsal, adipose, and caudal fins with scattered dark chromatophores. Anal, pectoral, and pelvic fins hyaline.

ETYMOLOGY.—The species name, *mestomyllon*, from the Greek *mestos*, full, and *myllon*, lip, refers to the fleshy upper lip of the species.

AUTAPOMORPHIES OF *Cyphocharax mestomyllon*.—The highly developed lip of *Cyphocharax mestomyllon* is a uniquely derived feature in the genus and thus autapomorphic for the species. The relatively elongate head of the species is reflected in the horizontally elongate second and third infraorbitals, with the second infraorbital having a laterosensory canal segment that is proportionally much longer than in other species of *Cyphocharax*. Both the overall elongation of the second and third infraorbitals and the elongation of the laterosensory canal segment in the second infraorbital are thus judged to be uniquely derived characters for the species.

DISTRIBUTION.—Known only from the type locality, the Cachoeira de Bicho-Açu along the Rio Marauíá, Rio Negro Basin, Brazil (Figure 53).

ECOLOGY.—Goulding et al. (1988:12) reported that the collection was made in pH 5.2 water over a sand bottom in less than 2 meters of water in a moderate current.

TYPE MATERIAL EXAMINED.—49 specimens (49, 34.2–41.6).

HOLOTYPE.—BRAZIL. *Amazonas*: Rio Negro basin, Rio Marauíá, Cachoeira de Bicho-Açu (approx. 0°20'S, 65°20'W), collected by M. Goulding, 12 Oct 1979, MZUSP 41755, 1 (34.9).

PARATYPES.—BRAZIL. *Amazonas*: Rio Negro basin, Rio Marauíá, Cachoeira de Bicho-Açu (approx. 0°20'S, 65°20'W); 48 specimens collected with holotype: MZUSP 41756, 24 (35.2–41.6); USNM 309289, 24 (34.2–40.6); 2 specimens cleared and counterstained for cartilage and bone).

Cyphocharax voga (Hensel)

FIGURES 55–58; TABLE 9

Curimatus voga Hensel, 1869:78 [type locality: Brazil: São Leopoldo, Rio dos Sinos].—Steindachner, 1874:427 [placed as a synonym of *Curimatus Gilbert* Quoy and Gaimard, 1824].—Eigenmann and Eigenmann, 1889:424 [as in Steindachner, 1874].—Eigenmann, 1910:421 [as in Steindachner, 1874].—Fowler, 1975:372 [as in Steindachner, 1874].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Curimatus Gilberti.—Steindachner, 1874:427 [in part, specimens from Brazil: Rio Macuri above Porto Alegre; *Curimatus voga* Hensel, 1869, placed as a synonym of *Curimatus Gilbert* Quoy and Gaimard].—Ihering, 1893:113 [Brazil: Rio Grande do Sul, Porto Alegre, Rio Camaguã]; 1898:176 [based on Ihering, 1893].—Pellegrin, 1909:148 [Brazil: Rio Grande do Sul].

Curimatus gilberti.—Eigenmann and Eigenmann, 1889:424 [references in part; distribution in part, not cited occurrence in regions north of Rio Grande do

Sul, Brazil; listed specimens in part, Argentina: Buenos Ayres (= Aires); Brazil: Rio Grande do Sul, Porto Alegre]; 1891:47 [in part, *Curimatus voga* citation].—Eigenmann, 1894:633 [Brazil: Rio Grande do Sul].—Eigenmann and Kennedy, 1903:511 [Paraguay: Estancia la Armonia].—Evermann and Kendall, 1906:78 [Argentina].—Eigenmann and Ogle, 1907:3 [Uruguay: Montevideo].—Eigenmann, 1907:451 [Argentina: Buenos Aires]; 1910:421 [citation in part].—Bertoni, 1914:9 [Paraguay].—Devincenzi, 1926:209 [Uruguay: Puntas del Cebollati].—Devincenzi and Teague, 1942:59, fig. [Uruguay].

Curimata gilberti.—Fowler, 1906:300 [Brazil: Rio Grande do Sul]; 1943:312 [Uruguay: Florida and Montevideo].

Curimatopsis maculatus Ahl, 1934:240 [type locality: Argentina].—Arnold and Ahl, 1936:130–131, unnumbered text fig. [brief description, aquarium requirements].—Pozzi, 1945:271 [Rio Paraná, Río Uruguay, Río Paraguay, Río Salado].—Fernández-Yépez, 1948:69 [? incorrect locality: Brazil, Amazon].—Ringuelet and Aramburu, 1961:36 [Argentina].—Ringuelet et al., 1967:19 [reference].—Fowler, 1975:376 [reference].—Lopez et al., 1987:19 [Argentina].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Curimata gilberti.—Pearson, 1937:109 [Paraguay].—Lüling, 1980:111 [Argentina].—de Buen, 1949:87 [literature compilation, evidently based on Devincenzi, 1926, and Fowler, 1943].—Bertoletti, 1986:275 [Rio Grande do Sul].—Lopez et al., 1987:19 [Argentina].

Curimata gilberti gilberti.—Bertoni, 1939:54 [Paraguay: Asunción].—Olivier, 1961:47 [Argentina: Laguna Vitel].—Ringuelet and Aramburu, 1961:36 [Argentina].

Pseudocurimata gilberti.—Fernández-Yépez, 1948:46 [assignment to *Pseudocurimata*; distribution in part].—Ringuelet et al., 1967:199 [Argentina].—Bonetto, Cordiviola de Yuan, Pignalberi, and Oliveros, 1969:213 [Argentina: Río Paraná, not seen].—Alaimo and Freyre, 1969:197 [Argentina: Buenos Aires, Laguna de Chascomús; not seen].—Bonetto, Cordiviola de Yuan, Pignalberi, and Oliveros, 1970:135 [Argentina: middle Río Paraná; not seen].—Freyre and Togo, 1971:175 [induction of spawning, ontogeny].—Ringuelet, 1975:61, 65, 72 [Río Uruguay, Río Paraguay, and Río de La Plata systems].—Bonetto et al., 1978:17 [Argentina: Río Riachuelo basin, Laguna La Brava; not seen].—Azpelicueta, 1980:85 [osteological observations].—Buckup and Malabarba, 1983:106 [Brazil: Rio Grande do Sul, Estação Ecológica do Taim].—Menni et al., 1984:10, 29 [Argentina: Córdoba].—Lopez et al., 1984:76 [Argentina: Río Paraguay].—Pignalberi de Hassan and Cordiviola de Yuan, 1985:21 [Argentina: middle Río Paraná, Corrientes and Santa Fe regions].—Cordiviola de Yuan and Pignalberi de Hassan, 1985:215 [Argentina: lower Río Paraná, Diamante and San Pedro regions].—Pignalberi de Hassan and Cordiviola de Yuan, 1988:168, 173 [Argentina: Formosa, Río Paraguay].

Curimata gilberti gilberti.—Fowler, 1950:284 [citations in part; not synonymy of *C. voga* into *C. gilberti*].—Travassos, 1960:8 [literature compilation in part; Rio Paraguay basin references, not other citations].

Curimatus gilberti gilberti.—Grosser and Hahn, 1981:64 [Brazil: Rio Grande do Sul, Lagoa Negra, Viamão].

Curimata cf. *gilberti*.—Lüling, 1981:16 [Argentina].

Curimatus sp.—Bossemeyer et al., 1981:63 [Brazil: Rio Grande do Sul, Rio Jacuí, and Rio Jacuizinho].

Curimata cf. *voga*.—Géry et al., 1987:423, fig. 39 [Paraguay: Río Paraguay].

Curimata gillii.—Géry et al., 1987:416 [in part; some of reported specimens from Paraguay: Río Paraguay basin, marécages (swamp) N of Coronel Oviedo].

Cyphocharax voga.—Malabarba, 1989:124 [Brazil: Rio Grande do Sul, Laguna dos Patos system].

DIAGNOSIS.—*Cyphocharax voga* is distinguished from its congeners by the combination of 32 to 37 scales in the lateral line to the hypural joint, the 34 to 37 (typically 35 or 36) vertebrae, the absence of multiple series of longitudinal dark stripes or small dark spots in longitudinal rows on the body,

absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of patch of dark pigmentation on the midlateral surface of the caudal peduncle ranging in shape from vertically ovoid to rotund, the absence of an anterior extension in larger specimens of the pigmentation on midlateral surface of caudal peduncle as a thin midlateral line, the absence of 4 or 5 large midlateral dark spots on the body, the presence in juveniles and many adults of a somewhat random series of spots on the lateral and dorsolateral surfaces of body, the absence of marked pigmentation on the middle caudal-fin rays, and the possession of 9 branched dorsal-fin rays.

Cyphocharax voga is most similar phenetically to the allopatric species *C. santacatarinae* and *C. gilberti*, and indeed was considered a synonym of the latter for over a century. The presence of a somewhat random series of dark spots on the lateral and dorsolateral surfaces of the body in juveniles and mid-sized specimens of *C. voga* readily discriminates it from those two species. The three species can also be differentiated by various other details of pigmentation and meristics (see "Remarks" under *C. gilberti*).

DESCRIPTION.—Body moderately elongate, somewhat compressed laterally, less so in larger individuals. Dorsal profile of head convex from tip of snout to vertical line through posterior nostril, straight or 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 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 obtusely flattened; scales of that region not enlarged relative to those on adjoining portions of body. Obtuse median keel present posterior to insertion of pelvic fin. 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 0.35–0.42 [0.39]; snout tip to origin of dorsal fin 0.49–0.53 [0.52]; snout tip to origin of anal fin 0.83–0.88 [0.84]; snout tip to origin of pelvic fin 0.54–0.61 [0.56]; snout tip to anus 0.79–0.85 [0.81]; origin of dorsal fin to hypural joint 0.53–0.59 [0.54]. Dorsal fin obtusely pointed in profile distally; last unbranched and first branched rays three to three and one-half times length of ultimate ray. Pectoral fin pointed in profile distally; length of pectoral fin 0.18–0.23 [0.18], extends about one-half distance to vertical line through origin of pelvic fin. Pelvic fin pointed in profile distally, length of pelvic fin 0.18–0.22 [0.19], reaches slightly more than one-half distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays about two and one half to three times length of ultimate ray. Least depth of caudal peduncle 0.13–0.15 [0.14].

Head profile rounded anteriorly, somewhat more obtusely pointed in smaller specimens, head length 0.26–0.32 [0.26];

upper jaw slightly longer than lower, mouth barely subterminal; snout length 0.25–0.31 [0.30]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.25–0.32 [0.27]; adipose eyelid present, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.40–0.50 [0.49]; gape width 0.25–0.30 [0.28]; interorbital width 0.40–0.46 [0.46].

Pored lateral-line scales from supracleithrum to hypural joint 32 to 37 [37]; 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; 5¹/₂ to 6¹/₂ [6] scales in transverse series from origin of dorsal fin to lateral line; 5 to 6 [5¹/₂] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or iii,9 (when three unbranched rays present, first very small; iii,9 rare) [ii,9]; anal-fin rays ii,7 or iii,7 (when three unbranched rays present, first very small) [ii,7]; pectoral-fin rays 13 to 15 [15]; pelvic-fin rays i,8 or 9 (i,9 less common) [i,8].

Total vertebrae 34 (4), 35 (56), 36 (46), 37 (5).

COLOR IN LIFE.—(Based on a transparency of recently captured specimens collected by Dr. R.M.C. Castro in the Rio Sanga Funda, Município de Osório, Rio Grande do Sul, Brazil.) Body and head silvery overall, darker dorsally. Spot of dark pigmentation on midlateral surface of caudal peduncle very obvious. Basal two-thirds of dorsal fin and basal four-fifths of caudal fin with reddish tint; distal portions of those fins mostly hyaline, but with margins of fin rays dusky. Other fins hyaline with some series of small dark spots along fin rays.

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery; darker on dorsal surfaces of head and body. Specimens lacking guanine on scales tan to light brown, darker dorsally. No pronounced pigmentation pattern on head at any age. Juveniles with dark, rhomboidal spot on caudal peduncle (Figure 55). Spot terminates posteriorly at caudal-fin base, and extends dorsally and ventrally, to or nearly to, margins of caudal peduncle, particularly in very small individuals. Juveniles with series of dark chromatophores along myomere margins above and below lateral line, and with some scattered small, irregular patches of pigmentation on lateral and dorsal surfaces of body. Overall pigmentation more developed on dorsal portions of head and body.

Dark pigmentation along myomeres decreasingly obvious in individuals above 45 mm SL, but random dark spotting on lateral and dorsal portions of body becoming more apparent, most often concentrated in irregular series of spots proximate to lateral line. Individuals above 130 mm SL with spots on body somewhat more obscure. Dark caudal peduncle spot somewhat obscure in smaller individuals, rotund or horizontally elongate. Caudal peduncle spot in specimens above 45 mm SL round or somewhat triangular, not extending to dorsal and ventral margins of caudal peduncle.

AUTAPOMORPHIES OF *Cyphocharax voga*.—The most distinctive feature of juvenile and mid-sized specimens of *C. voga*



FIGURE 55.—*Cyphocharax voga*, juvenile, USNM 295995, 35.6 mm SL; Brazil, Rio Grande do Sul, Arroio Senandes, along road from Rio Grande to Cassino.



FIGURE 56.—*Cyphocharax voga*, USNM 297380, 79.4 mm SL; Brazil, Rio Grande do Sul; Estação Ecológica do Taim.



FIGURE 57.—*Cyphocharax voga*, MCP 9200, 153.3 mm SL; Brazil, Rio Grande do Sul, Lagoa de Tramandaí, Tramandaí.

is the pattern of somewhat randomly arranged dark spots on the lateral and dorsolateral surfaces of the body (Figures 55, 56). That pigmentation pattern is not present elsewhere in the genus or family and is consequently considered autapomorphic for the species.

DISTRIBUTION.—Coastal rivers of Rio Grande do Sul and

southern Santa Catarina states, Brazil; Uruguay; Buenos Aires region and rivers draining into Río de La Plata estuary in Argentina; lower Río Paraná, Río Paraguay system in Paraguay and Argentina (Figure 58).

REMARKS.—Hensel (1869:78) described *Curimatus voga* based on six specimens collected in the Rio dos Sinos at São

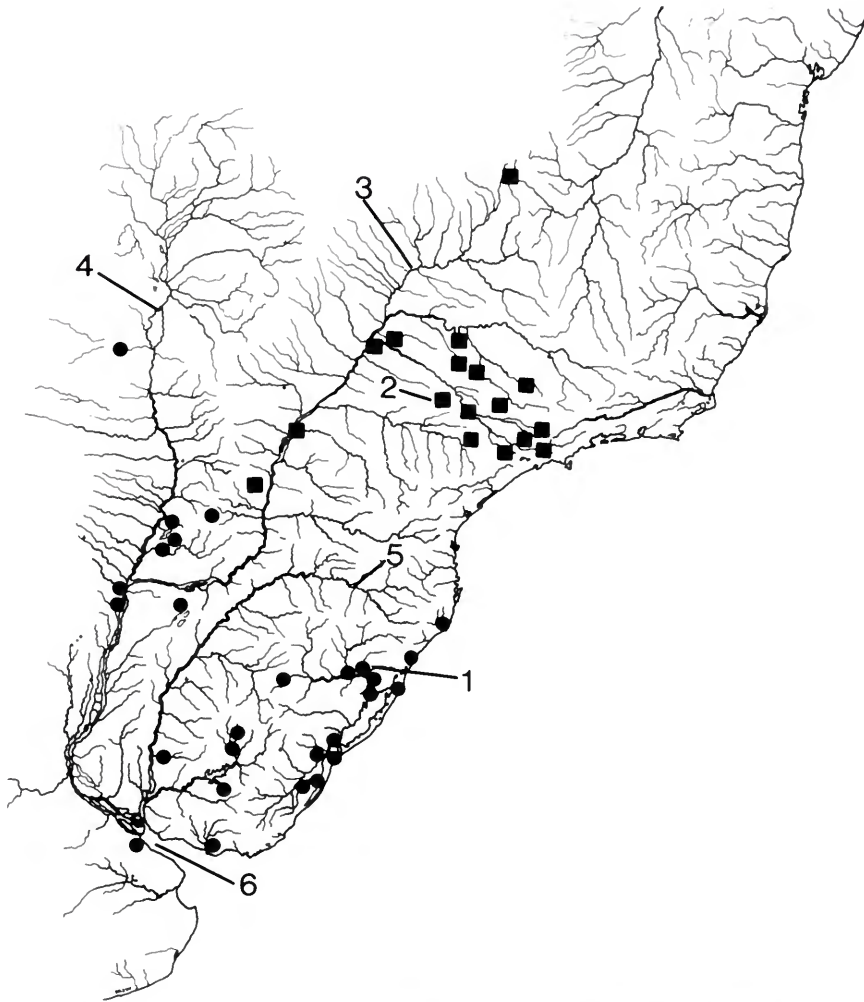


FIGURE 58.—Map of southeastern Brazil, Uruguay, and adjoining regions of Argentina showing geographic distribution of *Cyphocharax voga* (filled in circles; 1 = type locality of *Curimatus voga*) and *Cyphocharax modestus* (squares; 2 = type locality of *Curimatorbis modestus*) (3 = Rio Paraná; 4 = Rio Paraguay; 5 = Rio Uruguay; 6 = Río de La Plata) (some symbols represent more than one locality or lot of specimens).

Leopoldo, Rio Grande do Sul, Brazil. Four of the six specimens were located in the holdings of the Zoologisches Museum, Humboldt University, Berlin. The largest syntype (ZMB 7472, 161.5 mm SL) is designated as the lectotype. The three remaining syntypes, which are juveniles (ZMB 23577), thus become paralectotypes.

Soon after Hensel's description of *Curimatus voga* (1869:78), Steindachner (1874:247) synonymized the species into *Curimatus Gilbert* Quoy and Gaimard. That action, made with only a brief comment by Steindachner, was followed by subsequent authors (see synonymy). The two nominal forms differ, however, in various characters (see discussion under "Remarks" for *Cyphocharax gilbert*). *Curimatus voga* is consequently herein recognized as a distinct species. Citations

of *Cyphocharax gilbert* in various genera from the coastal drainages of Rio Grande do Sul, Brazil, the lower Río Paraná, Río Paraguay, and the series of smaller rivers emptying into the Río de La Plata estuary all appear to be based on misidentifications of *Cyphocharax voga*.

In 1934 Ahl described *Curimatopsis maculatus* based of a single specimen from Argentina. Ahl's assignment of the species to *Curimatopsis* Steindachner was based on the incompletely pored laterosensory canal system on the body in the holotype, a character considered diagnostic for *Curimatopsis* in the Curimatidae at that time. As noted in a previous publication (Vari, 1982a:10–11) *Curimatopsis maculatus* is not a member of *Curimatopsis*, nor closely related to members of that genus. Rather, *Curimatopsis maculatus* is a juvenile of

TABLE 9.—Number of specimens of *Cyphocharax gilberti*, *C. santacatarinae*, *C. modestus*, and *C. voga* with cited number of vertebrae. Vertebrae incorporated into fused PU_1+U_1 counted as a single element and vertebrae in Weberian apparatus counted as four elements.

Species	Vertebrae					
	32	33	34	35	36	37
<i>gilberti</i>	16	70	50	5		
<i>santacatarinae</i>	6	29	3			
<i>modestus</i>	10	70	6			
<i>voga</i>			4	56	46	5

Cyphocharax voga in which lateral line pores had not yet developed along the posterior two-thirds of the body. The drawing of *Curimatopsis maculatus* in Arnold and Ahl (1936) differs significantly from the holotype of the species in overall appearance and details of pigmentation, although demonstrating the pattern of somewhat randomly distributed dark spots on the lateral and dorsolateral surfaces of the body characteristic of juveniles of *Cyphocharax voga*.

MATERIAL EXAMINED.—567 specimens (78, 29.3–196.3).

BRAZIL. *Santa Catarina*: Canal parallel to Rio Capivari, along road from Tubarão to Gravatá, Município de Tubarão, USNM 280063, 12. Rio Correia, along BR 101, Município de Tubarão, USNM 280059, 3. *Rio Grande do Sul*: No specific locality, ANSP 70355–70357, 3; ANSP 21838–21843, 6. Lagoa de Tramandaí, Tramandaí, MZUSP 21689, 1 (160.0); MZUSP 14193–14194, 2; MCP 9200, 1. Rio dos Sinos, São Leopoldo, ZMB 7472, 1 (161.5, lectotype of *Curimatus voga*); ZMB 23577, 3 (paralectotypes of *Curimatus voga*); MZUSP 13791, 3 (127.4–129.3); MZUSP 20892, 8 (6, 53.9–72.3); MZUSP 20903, 1 (57.3); MZUSP 4496, 2 (151.3–173.0); MZUSP 20904, 1; MZUSP 20905, 1. Rio Sanga Funda, Município de Osório, USNM 296522, 19; MZUSP 39786, 18. Município de Osório, Lagoa das Malvas, MZUSP 14197, 2 (1, 166.0). Arroio Morena, Município de Rio Pardo, MZUSP 28257, 7 (2, 84.3–90.2). Rio Paranhama at confluence with Rio dos Sinos, Taquara, MZUSP 21720, 1. Porto Alegre, Passo do Lami, MZUSP 20895, 76. Porto Alegre, Rio Guaíba, MZUSP 20845, 4; MZUSP 20846, 10. Barragem da Lomba do Sabaõa, Município de Viamão, MZUSP 21459, 1 (111.5). Lagoa dos Quadros, MZUSP 14195, 2; MZUSP 14196, 1. Pelotas, MZUSP 9618, 1 (140.5). Canal São Gonçalo, Pelotas, USNM 295891, 6 (108.2–162.0); USNM 295939, 14 (70.3–104.3; 2 specimens cleared and counterstained for cartilage and bone). Porto Alegre, Assunção, MZUSP 20893, 31. Lagoa-Mirim, Pelotas, MZUSP 21725, 2 (31.5–32.2). Canal along road from Pelotas to Rio Grande, near Pelotas, USNM 295932, 2; MZUSP 21723, 3. Arroio Pelotas where crossed by road from Pelotas to Porto Alegre, USNM 295925, 1. Rio Sanga Funda, Terra de Arcia, MCP uncat., 10. Arroio do Bolacha, along road from Rio Grande to Cassino, MZUSP 21722, 4; USNM 295931, 4. Arroio do Bolacha, MZUSP 38522, 8 (5, 76.9–

85.8). Arroio Senandes along road from Rio Grande to Cassino, MZUSP 21724, 104; USNM 295995, 38. Arroio Chasqueiro, along highway from Pelotas to Jaguarão, USNM 295928, 4 (2, 38.1–84.7); MZUSP 21729, 7. Rio Vacacaí, Município de Santa Maria, USNM 295926, 6 (40.6–76.3). Belém Novo near Porto Alegre, MZUSP 21669, 2 (1, 51.3); USNM 295925, 1. Belém Novo, Arroio Chapeu Virado, MZUSP 21672, 23 (2, 67.8–67.9). Estação Ecológica do Taim, MZUSP 21727, 9; USNM 297380, 2 (73.4–79.4); MZUSP 21726, 2 (75.1–81.2); USNM 295941, 6. Lagoa Mirim, USNM 295927, 1. Tributary to Rio Ibicuí da Faxina, along road from Rosario to Livramento, 500 m from turn-off to Bagé, Município de Livramento, USNM 295933, 1. Arroio do Salso, on road from Livramento to Rosario do Sul, USNM 295885, 12; MCP uncat., 11; MZUSP 39782, 11. Itaquí, MZUSP 1688, 1; MZUSP 1935, 1.

URUGUAY. *Maldonado*: No specific locality, NMW 67034, 2. Arroyo Miguelete, NMW 66957, 4; NMW 68748, 2; NMW 68772, 2. Laguna del Sauce, MZUSP 20821, 3 (2, 183.3–196.3). *Canelones*: Montevideo, USNM 39148, 1; BMNH 1872.5.6:29–30, 2 (95.2). Montevideo, Cerro Largo, ANSP 54066, 1. *Paysandú*: Rio Uruguay, Paysandú, MZUSP 21375, 3 (2, 111.5–120.7). *Florida*: Estancia Santa Adela, Arroyo Chamizo, MZUSP 20891, 8 (3, 58.9–67.1). Arroyo Borneo Chico, ANSP 67853, 1.

ARGENTINA. No definite locality, ZMB 20818, 1 (29.3, holotype of *Curimatopsis maculatus*). *Buenos Aires*: Buenos Aires, USNM 55576, 2 (130.2–136.7). Junin, USNM 295929, 7. Arroyo El Pescado, USNM 313875. *Choco*: Río Paraná near Barranqueras, USNM 196618, 2. Lago Chascomús, USNM 176030, 1. *Corrientes*: Bela Vista, Arroyo Carrizal, MZUSP 10220, 1.

PARAGUAY. *Central*: Arroyo Yuquy, 1 km from Capiatá, USNM 295935, 1 (110.2). *Paraguari*: Río Tebicuary, USNM 181645, 2 (92.7–95.5). Vicinity of Minas-cué, USNM 232215, 1 (84.4). Parque Nacional Ybycui, USNM 232217, 1; USNM 229437, 1 (80.7); USNM 229419, 1 (68.4).

Cyphocharax modestus (Fernández-Yépez)

FIGURES 58–61; TABLE 9

Curimata gilberti.—Amaral Campos, 1945:460 [Brazil: Rio Mogi-Guaçu].—Gomes and Monteiro, 1955:106 [Brazil: São Paulo, Pirassununga (=Piraçununga)].—Oliveira et al., 1988:594 [Brazil: São Paulo, Botucatu, Rio Mogi-Guaçu; karyotype].

Curimatorbis modestus Fernández-Yépez, 1948:43, fig. 21 [type locality: incorrectly given as Isla Victoria, São Paulo; author incorrectly listed as Amaral Campos (see Britski, 1969, for corrections)].—Britski, 1969:201, 203 [correction of authorship and locality: *Curimatorbis modestus* Fernández-Yépez, type locality: Brazil: São Paulo, Rio Batalha, tributary of Rio Tietê, near Bauru].—Fowler, 1975:370 [reference].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Curimatus gilberti.—Britski, 1972:83 [in part, Rio Paraná basin].—Foresti et al., 1974:249 [karyotype].—Nomura and Hayashi, 1980:165 [meristics and biology; Brazil: São Paulo, Rio Morgado at Matão].

Pseudocurimata gilberti gilberti.—de Godoy, 1975:598, fig. 132, 133 [Brazil: São Paulo, Rio Mogi-Guaçu (= Guaçu); life history].
Curimata modesta.—Venere and Galetti, 1985:681-687 [karyotypes, triploidy].—Castro and Arcifa, 1987:495-496, 498 [Brazil: São Paulo, Rio Tietê; life history].—Oliveira et al., 1988:594 [Brazil: São Paulo, Aguas de São Paulo; karyotype].—Arefjev, 1990:298 [karyotype].
Curimata cf. modesta.—Géry et al., 1987:418-420, fig. 36 [Paraguay: Río Paraná, ? Río Paraguay].

DIAGNOSIS.—*Cyphocharax modestus* is distinguished from its congeners by the combination of 31 to 36 lateral-line scales to the hypural joint, the development of pores along the entire lateral line in all but juvenile specimens, the 32 to 34 vertebrae, the absence of multiple series of longitudinal dark stripes or small dark spots in multiple longitudinal rows on the body, the absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, the stripe of dark pigmentation across the middle rays of the caudal fin in moderate to large-sized specimens, and the possession of 9 branched dorsal-fin rays.

Cyphocharax modestus is very similar to and has been confused with *C. gilberti*, a species allopatrically distributed in rivers of coastal Brazil north of central São Paulo state. The two species differ, however, in various details of pigmentation and meristics (see "Remarks" under *C. gilberti* for a more detailed discussion).

DESCRIPTION.—Body moderately elongate, somewhat compressed laterally. Dorsal profile of head convex from tip of snout to vertical line through posterior nostril, straight or very 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 to slightly convex and posteroventrally slanted at base of dorsal fin, nearly straight from base of last dorsal-fin ray to caudal peduncle in smaller individuals, more often gently convex in adults. 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 obtusely flattened transversely, with scales of that region not enlarged relative to those on adjoining portions of body. Obtuse median keel posterior to origin of pelvic fin. 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 0.34-0.41 [0.40]; snout tip to origin of dorsal fin 0.48-0.53 [0.53]; snout tip to origin of anal fin 0.81-0.87 [0.82]; snout tip to origin of pelvic fin 0.53-0.59 [0.53]; snout tip to anus 0.76-0.81 [0.77]; origin of dorsal fin to hypural joint 0.54-0.61 [0.57]. Dorsal fin obtusely pointed in profile distally; last branched and first branched rays about two and three-quarters to three times length of ultimate ray. Pectoral fin obtusely pointed in profile distally, length of pectoral fin 0.17-0.21 [0.18], extends approximately one-half distance to vertical line through origin

of pelvic fin. Pelvic fin obtusely pointed in profile distally; length of pelvic fin 0.18-0.22 [0.20], reaches somewhat over one-half distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays two and one-half to three times length of ultimate ray. Least depth of caudal peduncle 0.13-0.15 [0.14].

Head profile rounded anteriorly, obtusely pointed overall; head length 0.27-0.31 [0.30]; upper jaw slightly longer than lower, mouth barely subterminal; snout length 0.27-0.33 [0.28]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.26-0.32 [0.29]; adipose eyelid present, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.40-0.48 [0.44]; gape width 0.21-0.27 [0.24]; interorbital width 0.40-0.46 [0.40].

Pored lateral-line scales from supracleithrum to hypural joint 31 to 36 [33]; all scales of lateral line pored, canals in lateral-line scales straight; 3 to 5 series of pored scales extend beyond hypural joint onto caudal-fin base; 5^{1/2} to 7 [6^{1/2}] scales in transverse series from origin of dorsal fin to lateral line; 4^{1/2} to 6 [5^{1/2}] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or 10, iii,9 (when three unbranched rays present, first very small; see also discussion under "Remarks" below) [ii,9]; anal-fin rays ii,7 or iii,7 (iii,7 rare; when three unbranched rays present, first very small) [ii,7]; pectoral-fin rays 14 to 16 [14]; pelvic-fin rays i,8 or 9 (i,9 uncommon) [i,8].

Total vertebrae 32 (10), 33 (70), 34 (6).

Nomura and Hayashi (1980:168, table X) list 25 to 28 vertebrae in this species (identified by them as *Curimatus gilberti*) with 97.6% of the specimens having 28 to 30 vertebrae. Those authors apparently did not include the four vertebrae of the Weberian apparatus in their vertebral counts. If those elements are added, then 97.6% of their specimens had 32 to 34 vertebrae, the range of the specimens examined in this study. No specimens with 26 or 27 vertebrae (= 30 or 31 under the system used in this study) were listed by Nomura and Hayashi although they cited one specimen with 25 (= 29) vertebrae. Similarly, although no specimens with 32 (= 36) vertebrae were reported in that paper, they did list an individual with 33 (= 37) vertebrae. It is likely that the outlier counts of those authors (their 25 and 32 vertebrae; = 29 and 36 vertebrae in this study) were deformed or more likely misidentified specimens.

KARYOTYPES.—Foresti et al. (1974:249) reported that this species (listed by them as *Curimatus gilberti*) has 2n = 54 chromosomes with a fundamental number of 108. They did not find any indication of chromosomal heteromorphism in the species.

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery-golden, darker on dorsal portions of head and body. Individuals lacking guanine on scales with ground coloration tan to light brown. Head darker

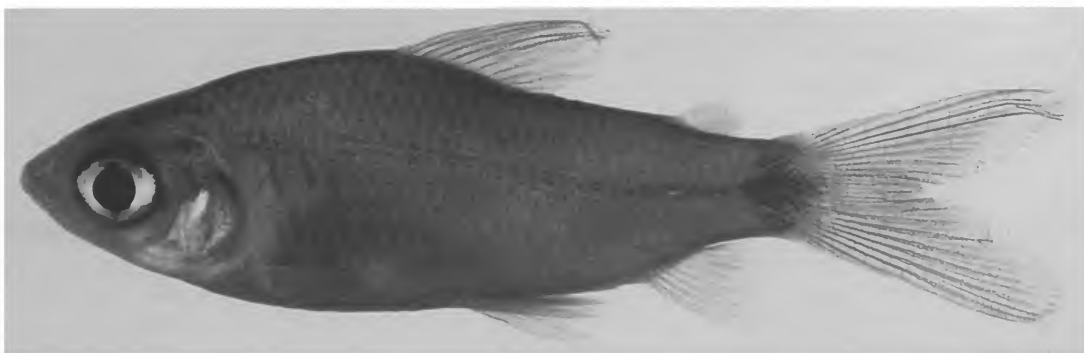


FIGURE 59.—*Cyphocharax modestus*, juvenile, USNM 297381, 24.8 mm SL; Brazil, São Paulo, Rio Corumbataí, Corumbataí.

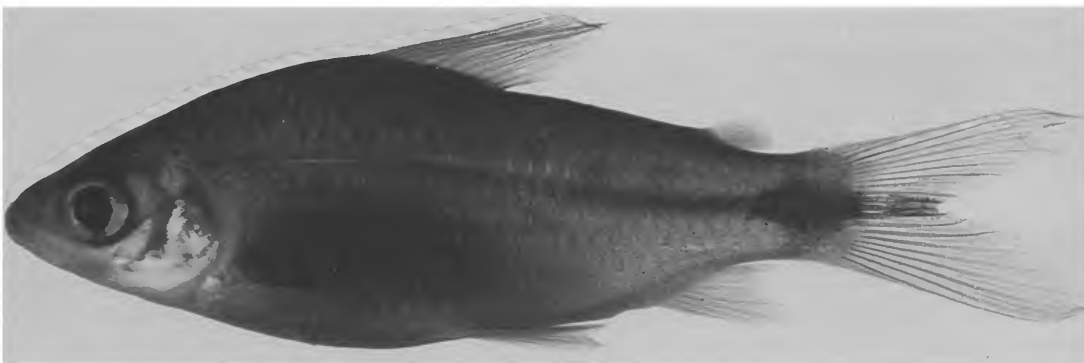


FIGURE 60.—*Cyphocharax modestus*, juvenile, USNM 243239, 39.8 mm SL; Brazil, São Paulo, Córrego da Barra, Piraçununga.



FIGURE 61.—*Cyphocharax modestus*, USNM 243239, 120.4 mm SL; Brazil, São Paulo, Córrego da Barra, Piraçununga.

dorsally but without any pronounced pigmentation pattern at any age. Juveniles under 20 mm SL with very dark midlateral spot on rear of caudal peduncle. Spot extends dorsally and ventrally to margins of caudal peduncle and posteriorly onto bases of middle rays of caudal fin. Caudal peduncle spot more elongate in specimens above 30 mm SL (Figure 60), extending posteriorly onto middle rays of caudal fin, often to tips of rays. Fields of faint chromatophores extending dorsally and ventrally from darker central spot to margins of peduncle in specimens of 30 to 50 mm SL; those chromatophore fields absent in larger individuals (Figure 61). Midlateral peduncle spot more elongate in larger individuals, forming an anteriorly obscure stripe extending forward to vertical line through anterior of base of adipose fin. Some individuals of all sizes with scattered dark spots on lateral surface of body. Pigmentation on middle caudal-fin rays most pronounced proximally, sometimes forming discrete dark spot, and continuing posteriorly as a band of faint pigmentation on middle caudal-fin rays. Fins predominantly hyaline in juveniles, somewhat dusky in adults.

DISTRIBUTION.—Upper Rio Paraná system of Brazil and Paraguay above Sete Quedas Falls (Figure 58).

COMMON NAME.—“Saguiru” (de Godoy, 1975:600).

ECOLOGY.—According to de Godoy (1975:602) *Cyphocharax modestus* (identified by him as *Pseudocurimata gilberti gilberti*) is a member of the “piracema,” the seasonal migration of fishes at Cachoeira de Emas on the Rio Mogi-Guaçu, São Paulo state, Brazil. Spawning of the species in that river system occurs from November to January. Nomura and Hayashi (1980:174) identified twelve genera of algae in the stomach contents of this species in addition to unidentifiable algal remains. Those authors also provided detailed information on the life history of the species.

REMARKS.—Fernández-Yépez (1948:44) stated that his description of *Curimatorbis modestus* was based on a holotype and three paratypes “collected at Isla Victoria, Brazil by A. do Amaral in 1906, catalogued under number 135 and deposited in the Museum of Comparative Zoology” [my translation]. Fernández-Yépez also cited the author of the species as Amaral Campos who he stated identified the species in 1906 and thus was given credit for the description. The stated type locality is highly suspect for a curimatid since it is a small offshore island, an unlikely locale for a member of this freshwater family. As noted by Britski (1969:200–201, 203), the specimens were actually captured in the Rio Batalha, a tributary of the Rio Tietê, near Bauru, state of São Paulo, Brazil, by E. Garbe in 1910. The individual who originally recognized the species as undescribed was not A. do Amaral as reported by Fernández-Yépez, but rather H.W. Clark, who examined the specimens while they were on loan at the California Academy of Sciences (CAS) but never published his conclusions. Regardless of who may have first recognized that the material represented an undescribed species, the correct authorship for the species is Fernández-Yépez as pointed out by Britski (1969).

Fernández-Yépez inexplicably cited the types of *Curimatorbis modestus* as catalogued at the Museum of Comparative Zoology. Those specimens were neither registered at that collection, nor apparently on loan to that institution. The type series is now divided between MZUSP and CAS with the holotype catalogued as CAS 20299 and the paratypes as MZUSP 1350, 5250, and 5251.

Despite the multiple errors associated with the original description of *Curimatorbis modestus* it is nonetheless distinct, although its validity was not recognized in most subsequent publications. Authors have rather identified the *Cyphocharax* population in the upper Rio Paraná basin as *Curimatus* (= *Cyphocharax*) *Gilbert* Quoy and Gaimard, a species actually limited to the coastal drainages of Brazil in Bahia, Espírito Santo, Rio de Janeiro, and the far eastern portions of São Paulo. The two species are very similar in overall meristics and morphometrics, but can be distinguished by various details of juvenile and adult pigmentation (see discussion in “Remarks” under *Cyphocharax gilberti*).

Amaral Campos (1945:460), followed tentatively by Gomes and Monteiro (1955:106), cited *Curimata gilberti* from the upper Rio Paraná basin. Although the specimens that served as the basis of the Amaral Campos record (MZUSP 3461) were not located in that museum, the information in that publication in conjunction with the locality make it likely that they were *Cyphocharax modestus*.

The vast majority of examined specimens of *Cyphocharax modestus* originated in upper portions of the Rio Paraná system in São Paulo state, Brazil. They nearly invariably have nine branched dorsal-fin rays, although ten rays occur in rare individuals. The series of Paraguayan specimens collected by, and made available by, Dr. Volker Mahnert (MNHG) differ from the upper Paraná samples in typically, although not always, having ten branched dorsal-fin rays (see also Géry et al., 1987:418–421). Another notable difference between the Paraguayan population and samples from the remainder of the upper Rio Paraná system is absence or poor development of the band of dark pigmentation extending posteriorly from the stripe on the caudal peduncle across the middle rays of the caudal fin (see Géry et al., 1987, fig. 36). Additional specimens are necessary to determine whether the Paraguayan populations herein identified as *Cyphocharax modestus* are a distinct species.

Miquelarena et al. (1990:272) questionably cited *Cyphocharax* cf. *modestus* from the Río Sali basin, in the state of Tucuman in northwestern Argentina. That locality is distant from the confirmed distribution of *C. modestus* in the upper Rio Paraná, and is presumed a misidentification.

MATERIAL EXAMINED.—909 specimens (96, 34.2–162.0).

BRAZIL. *São Paulo*: Rio Batalha, tributary of Rio Tietê, near Bauru, CAS 20299, 1 (86.5, holotype of *Curimatorbis modestus*; see under “Remarks” above concerning this locality); MZUSP 1350, 1 (94.9, paratype of *Curimatorbis*

modestus); MZUSP 5250, 1 (90.5, paratype of *Curimatorbis modestus*); MZUSP 5251, 1 (82.6, paratype of *Curimatorbis modestus*). São Paulo, Ipiranga, MZUSP 1725, 4. Parque Ecológico do Tietê, MZUSP 37059, 1; MZUSP 37742, 16 (8, 54.2–162.0); MZUSP 37222, 31 (5, 80.2–126.7). Córrego Itapura-mirim, tributary of Rio Tietê, MZUSP 20896, 2 (1, 82.0). Rio Tietê, USNM 295904, 5 (81.7–90.5). Rio Tietê, São Paulo, MZUSP 1372, 4. Rio Tietê, Barra Bonita, MZUSP 20779, 10; MZUSP 21444, 1. Rio Tietê, Ribeirão da Serra, MZUSP 20770, 1. Olimpia, CAS 11754, 1 (116.0). Rio Pardo, MZUSP 25685, 5; MZUSP 25686, 2. Rio Pardo, Limoeiro, MZUSP 20794, 1; MZUSP 20866, 2. Campinas, Instituto Agrônômico, Fazenda Santa Eliza, MZUSP 21432, 7. Rio Mogi-Guaçu, Emas, MZUSP 20754, 6 (4, 83.7–90.2); MZUSP 20698, 1 (103.0); MZUSP 20745, 3 (54.4–77.3); MZUSP 20746, 4; MZUSP 13790, 3. Rio Corumbataí, Corumbataí, MZUSP 20717, 2 (47.7–85.0); MZUSP 20760, 4 (2, 39.4–51.7); MZUSP 20757, 24 (5, 75.2–85.0); MZUSP 20719, 1 (58.0); MZUSP 26689, 5; MZUSP 20756, 22; MZUSP 20761, 9; MZUSP 20773, 14; MZUSP 20771, 24; USNM 297381, 11. Corumbataí, Lagoa Ponte Seca, MZUSP 21437, 3; MZUSP 20781, 34 (12, 74.7–91.4); MZUSP 20185, 35; MZUSP 20817, 91. Rio Mogi-Guaçu, Município de Luis Antonio, Lago do Mato, MZUSP 38530, 3 (88.2–104.0). Córrego do Machado, Corumbataí, MZUSP 20765, 7. Córrego do Bueno, Corumbataí, MZUSP 20889, 1. Pirassununga (= Piraçununga), Lagoa do Scatolim, MZUSP 20710, 139; MZUSP 20713, 3. Córrego da Barra, Pirassununga (= Piraçununga), USNM 243239, 11 (9, 34.2–119.3; 2 specimens cleared and counterstained for cartilage and bone). Botucatu, MZUSP 21473, 1; MZUSP 21475, 3. Rio Santo Inácio, Pardinho, MZUSP 35186, 1 (103.1). Botucatu, Fazenda Edgardia, MZUSP 21472, 1 (45.5); MZUSP 21474, 1 (98.2). Botucatu, Rio Capivara, MZUSP 39902, 6 (83.3–106.0); MZUSP 39879, 1. Salesópolis, MZUSP 21495, 23; MZUSP 21497, 4; MZUSP 21496, 1. Represa de Salesópolis, MZUSP 21523, 13; MZUSP 21526, 22 (3, 142.0–157.0). Represa de Ponte Nova, between Município de Salesópolis and Município de Biritiba-Mirim, MZUSP 28159, 93; MZUSP 28465, 32. Campinas, MZUSP 21432, 7 (3, 89.7–97.0). Barragem de Jupia, Lagoa at mouth of Córrego do Abrigo, MZUSP 20890, 2 (76.4–105.9). Itu, Fazenda Pau d'Alho, MZUSP 20685, 1 (144.7). Rio Paraitinga, São Luiz do Paraitinga, MZUSP 1463, 5. Município de Alfredo Castilho, Córrego do Moinho, MZUSP 3830, 3. Rio do Peixe, Anhembi, MZUSP 35451, 12. Rio Araguá, Botucatu, MZUSP 35355, 4. Represa de Taiaçupeba, MZUSP 21732, 1. Rio Tietê system, Córrego Itapura-Mirim, MZUSP 20896, 2. *Distrito Federal*: Mestre d'Armas, stream west of Planaltina, upper Rio Paraná basin, USNM 295937, 1 (46.6). *Paraná*: Rio Paraná, Guaira, above Sete Quedas Falls, MZUSP 21621, 56; MZUSP 21622, 44.

PARAGUAY. *Caaguazú*: Arroyo Yuquyry, 17 km S of Yhú, USNM 295930, 1 (72.5); MHNG uncat., 10 (67.5–75.0).

Cyphocharax gilbert (Quoy and Gaimard)

FIGURES 62–67; TABLES 9, 10

Curimata Gilbert Quoy and Gaimard, 1824:219, pl. 48: fig. 1 [type locality: freshwaters of Brazil: Rio Macacu].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Curimatus Gilberti.—Valenciennes, in Cuvier and Valenciennes, 1849:16 [based on holotype of *Curimata Gilbert*].—Steindachner, 1874:427 [in part, Rio Parahyba (= Paraíba) near Campos, Mendez and Juiz de Fora, Rio Itabapua; not Rio Macuri above Porto Alegre]. [Not Pellegrin, 1909:148.]

Curimatus gilberti.—Günther, 1864:289 [? based on original description by Quoy and Gaimard].—Eigenmann and Eigenmann, 1889:424 [references in part, not *Curimatus voga* citation; distribution in part, not Rio Plata (= Rio de La Plata) or southeastern Brazil south of southern São Paulo state; specimens in part, not Buenos Ayres (= Aires), Rio Grande do Sul, Porto Alegre]; 1891:47 [reference; not *Curimatus voga* synonymy].—Eigenmann and Norris, 1900:355 [Brazil: Taubaté (Rio Paraíba basin)].—Eigenmann, 1910:421 [reference in part, not *Curimatus voga* synonymy; not cited occurrence in Rio Paraguay basin].—Britski, 1972:83 [distribution in part; not cited occurrence in upper Rio Paraná basin]. [Not Perugia, 1897:24; Eigenmann, 1894:633; Eigenmann and Kennedy, 1903:511; Evermann and Kendall, 1906:78; Eigenmann and Ogle, 1907:3; Eigenmann, 1907:451; Miranda-Ribeiro, 1908: page 3 of 5 unpaginated; Devincenzi and Teague, 1942:59; Foresti et al., 1974:249; Nomura and Hayashi, 1980:165.]

Curimatus albula Lütken, 1874:127 [type locality: Brazil: Rio das Velhas]; 1875:186, IX [redescription in Danish and Latin, species questionably equated with *Curimatus Gilberti*].—Eigenmann and Ogle, 1907:3 [Brazil: Lagoa Santa].—Bertin, 1948:34 [listing of "paratypes" in MNHN].—Nielsen, 1974:48 [listing of syntypes in ZMUC].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*]; 1991:92, 95 [complexity of syntype series noted; one syntype identified as *Steindachnerina elegans* (Steindachner)].

Curimatus Alberti.—Günther, 1880:12 [probable lapsus for *Curimatus Gilberti*; cited as being "allied" to *Curimatus platanus* Günther].—Eigenmann and Eigenmann, 1889:410 [noted their inability to locate original description of the species].—Vari, 1989a:9 [listed as probable lapsus for *Curimatus Gilberti* Quoy and Gaimard].

Curimatus albulus.—Eigenmann, 1910:421 [reference; as a synonym of *Curimata Gilberti* Quoy and Gaimard].

Curimatorbis albulus.—Fernández-Yépez, 1948:43 [assignment to *Curimatorbis*].—Fowler, 1975:370 [reference].

Pseudocurimata grandocule Fernández-Yépez, 1948:47, fig. 23 [type locality: Brazil: Espírito Santo, Rio Doce; authorship indicated as A. do Amaral Campos].—Britski, 1969:201, 203 [correction of authorship to Fernández-Yépez; type locality refined: Espírito Santo, vicinity of Linhares and Lagoa Juparaña; transferred from *Pseudocurimata* to *Curimatorbis*].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Pseudocurimata gilberti.—Fernández-Yépez, 1948:46 [reference; distribution in part, not Rio Paraná]. [Not Ringuet et al., 1967:199; Bonetto, Cordiviola de Yuan, Pignalberi, and Oliveros, 1969:213; Alaimo and Freyre, 1969:197; Bonetto, Cordiviola de Yuan, Pignalberi, and Oliveros, 1970:135; Freyre and Togo, 1971:175; Ringuet, 1975:61, 65, 72; Bonetto et al., 1978:17; Azpelicueta, 1980:85; Buckup and Malabarba, 1983:106; Lopez et al., 1984:76; Menni et al., 1984:10, 29; Pignalberi de Hassan and Cordiviola de Yuan, 1985:21; Cordiviola de Yuan and Pignalberi de Hassan, 1985:215; Pignalberi de Hassan and Cordiviola de Yuan, 1988:168, 173.]

Curimata gilberti gilberti.—Fowler, 1950:284 [references and distribution in part].—Travassos, 1960:8 [in part, Rio Paraíba].

Curimatorbis grandocule.—Britski, 1969:203 [shift of species from *Pseudocurimata* to *Curimatorbis*].

Pseudocurimata gilberti gilberti.—Fowler, 1975:372 [reference].

DIAGNOSIS.—*Cyphocharax gilberti* is distinguished from its congeners by the combination of 33 to 38 scales in the lateral line to the hypural joint, development of pores along the entire

lateral line in all but juvenile specimens, the 32 to 35 vertebrae, the absence of multiple series of longitudinal dark stripes or small dark spots in multiple longitudinal rows on the body, absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of patch of dark pigmentation on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, the absence of a stripe of dark pigmentation across the middle rays of the caudal fin in moderate- to large-sized specimens, and the possession of 9 branched dorsal-fin rays.

Cyphocharax gilbert is most similar in overall appearance to, and has been confused with, three allopatric congeneric species (*C. santacatarinae*, *C. modestus*, and *C. voga*). The four species can be distinguished by various differences in meristic features and details of pigmentation (see "Remarks" below for a detailed discussion).

DESCRIPTION.—Body moderately elongate, somewhat compressed laterally, less so in larger specimens, particularly ripe females. Dorsal profile of head convex from tip of snout to vertical line through posterior nostril, straight or very 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 to slightly convex and slightly posteroventrally slanted at base of dorsal fin, straight or gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with indistinct median keel proximate 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 indistinctly flattened transversely, with scales not enlarged relative to those on adjoining portions of body. Obtuse median keel 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 0.36–0.42 [0.39]; snout tip to origin of dorsal fin 0.48–0.54 [0.49]; snout tip to origin of anal fin 0.80–0.87 [0.83]; snout tip to insertion of pelvic fin 0.53–0.59 [0.54]; snout tip to anus 0.76–0.82 [0.77]; origin of dorsal fin to hypural joint 0.53–0.59 [0.57]. Dorsal fin profile obtusely pointed distally; last branched and first unbranched ray about three times length of ultimate ray. Pectoral fin profile pointed distally; length of pectoral fin 0.18–0.23 [0.18], extending about three-quarters distance to vertical line through insertion of pelvic fin. Pelvic fin profile pointed distally; length of pelvic fin 0.20–0.24 [0.21], reaching three-quarters of distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays two and one half to three times length of ultimate ray. Least depth of caudal peduncle 0.13–0.15 [0.14].

Head profile somewhat blunt anteriorly, pointed overall; head length 0.28–0.32 [0.28]; upper jaw slightly longer than lower, mouth subterminal; snout length 0.25–0.31 [0.28]; nostrils of each side very close, anterior circular, posterior

crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.29–0.33 [0.32]; adipose eyelid present, more developed anteriorly, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.39–0.46 [0.41]; gape width 0.24–0.31 [0.25]; interorbital width 0.40–0.46 [0.41].

Pored lateral-line scales from supracleithrum to hypural joint 33 to 38 [34]; all scales of lateral line pored, canals in scales straight; 3 to 5 series of pored scales extending beyond hypural joint onto caudal-fin base; $5\frac{1}{2}$ to $7\frac{1}{2}$ ($5\frac{1}{2}$ very rare, $6\frac{1}{2}$ most common) [$6\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; $5\frac{1}{2}$ to $6\frac{1}{2}$ [$5\frac{1}{2}$] scales in a transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or iii,9 (when three unbranched rays present, first short) [ii,9]; anal-fin rays ii,7 or 8, or iii,7 (ii,8 rare; when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 16 [14]; pelvic-fin rays i,8 or 9 (i,9 rare) [i,8].

Total vertebrae 32 (16), 33 (70), 34 (50), 35 (5).

COLOR IN LIFE.—(Based on transparencies taken by Susan L. Jewett of recently collected fishes from the Rio Mucuri in Minas Gerais, and the Rio Gongoji in Bahia, Brazil.) Overall coloration silvery to silvery-purple, darker on dorsal portions of head and body. Fins in Rio Mucuri specimens slightly dusky, those of Rio Gongoji sample distinctly darker. Dark midlateral stripe on caudal peduncle very obvious in Bahia sample, much less apparent in specimens from Minas Gerais.

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery to silvery-golden, darker dorsally. Specimens lacking guanine on scales with ground coloration tan to light brown. No pronounced pigmentation pattern on head. Juveniles up to 60 mm SL with dark, horizontally elongate, rhomboidal midlateral spot on caudal peduncle (Figures 62, 63). Spot more attenuate anteriorly; extending posteriorly onto base of middle caudal-fin rays in specimens under 45 mm SL (Figure 62). Field of faint chromatophores extending dorsally and ventrally from main spot to margins of peduncle. Caudal peduncle spot less prominent, more elongate anteriorly in specimens over 70 mm SL; forming an elongate midlateral band that narrows anteriorly (Figure 64). Larger specimens with spot continuing forward as obscure midlateral band terminating anteriorly ventral of dorsal fin (Figure 65). A few specimens from northern portions of species range with stripe of dark pigmentation extending posteriorly across middle rays of caudal fin (see Figure 66 and discussion under "Geographic variation"). No dark spots on lateral surface of body. Fins hyaline.

DISTRIBUTION.—Coastal drainages of eastern Brazil from Bahia to Rio de Janeiro and eastern São Paulo (Figure 67).

GEOGRAPHIC VARIATION.—The single feature with the most notable intra-specific variation in *Cyphocharax gilbert* involves the degree of development of dark pigmentation on the caudal peduncle. This pigmented patch is typically diffuse in



FIGURE 62.—*Cyphocharax gilbert*, juvenile, MZUSP 20855, 27.9 mm SL; Brazil, Espírito Santo, Linhares, Lagoa Nova.

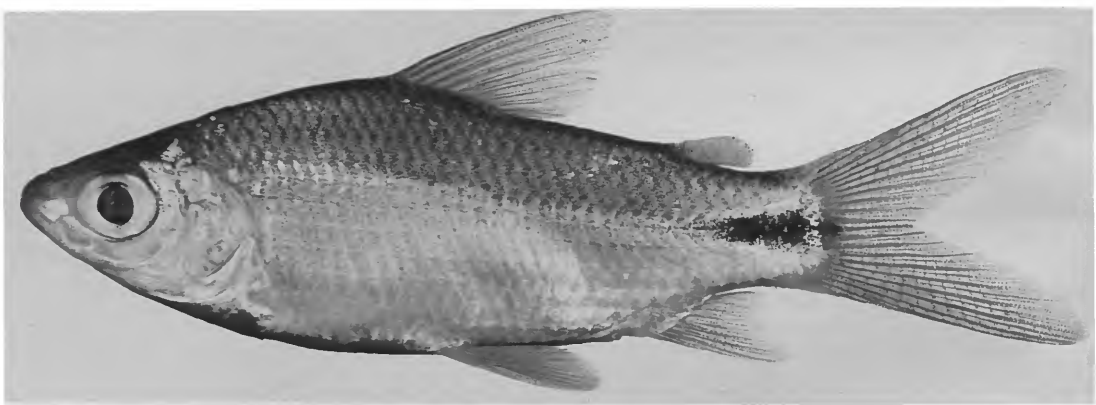


FIGURE 63.—*Cyphocharax gilbert*, juvenile, USNM 295936, 38.1 mm SL; Brazil, Minas Gerais, Ribeira das Pedras, Rio Mucuri basin, just NW of Nanuque.



FIGURE 64.—*Cyphocharax gilbert*, MNRJ 11216, 91.9 mm SL; Brazil, Rio de Janeiro, São João da Barra, Lagoa Feia.



FIGURE 65.—*Cyphocharax gilbert*, MNRJ 11212, 111.5 mm SL; Brazil, Rio de Janeiro, Rio Rabelo, Cachoeira de Macacu.

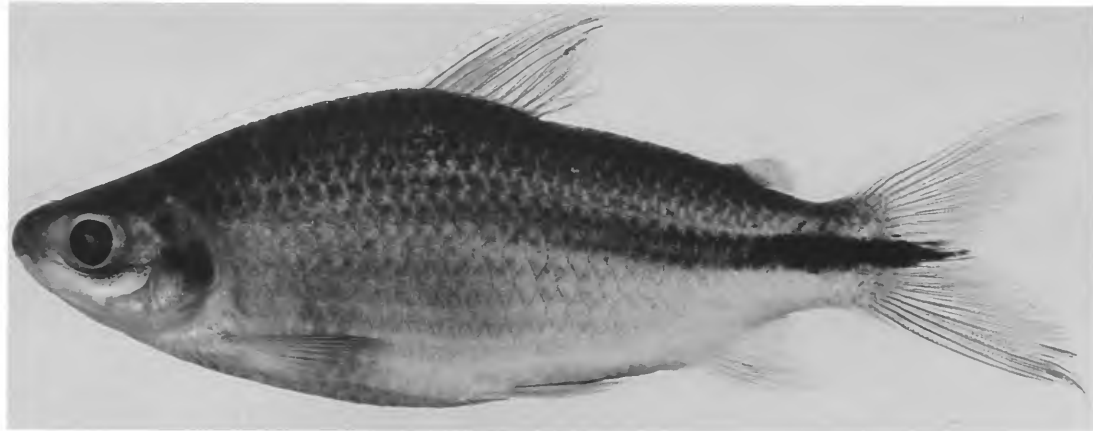


FIGURE 66.—*Cyphocharax gilbert*, USNM 298250, 92.3 mm SL; Brazil, Bahia, Rio de Contas basin, Rio Gongoji, Fazenda Itamarati, 4 km from town of Dario Meira.

most adults (Figures 64, 65), but a few individuals from northern portions of the species range (Figure 66) have a distinct, very dark stripe on the midlateral surface of the posterior portion of the body. Contrary to the condition in other populations the caudal peduncle pigmentation in such specimens continues posteriorly onto the middle rays of the caudal fin. Otherwise these individuals agree in all examined meristic and morphometric features with typical specimens of *C. gilbert*. As a consequence of the limited available material from the northern limits of the species range, it is not possible to determine the significance of this intraspecific variation in pigmentation. Those samples are tentatively considered conspecific with *C. gilbert*.

Limited data are available on the life coloration of the species. Specimens from the northern portion of the range (Rio de Contas system, state of Bahia) have darker fins with the midlateral stripe on the caudal peduncle less obvious than in recently preserved specimens from the central portions of the

species range (Rio Mucuri, state of Espírito Santo). Further information on water conditions and data on the state of the features in populations in intermediate drainages is required before we can evaluate whether the differences justify the further division of the species.

REMARKS.—Quoy and Gaimard (1924:219) described this species as *Curimata Gilbert*, with the species name being a noun in apposition. Valenciennes (in Cuvier and Valenciennes, 1849:16) changed the species epithet to the genitive (*gilberti*), an action followed by all subsequent authors other than for Fowler (1950:284, 1975:372). Although use of personal names in apposition is discouraged in the present International Code of Zoological Nomenclature (Recommendation 31A), the original spelling is to be preserved unaltered unless it is demonstrably incorrect (Article 32b). In the absence of any indication that the use of *gilbert* as a noun in apposition is incorrect that form of the species epithet is utilized in this study.

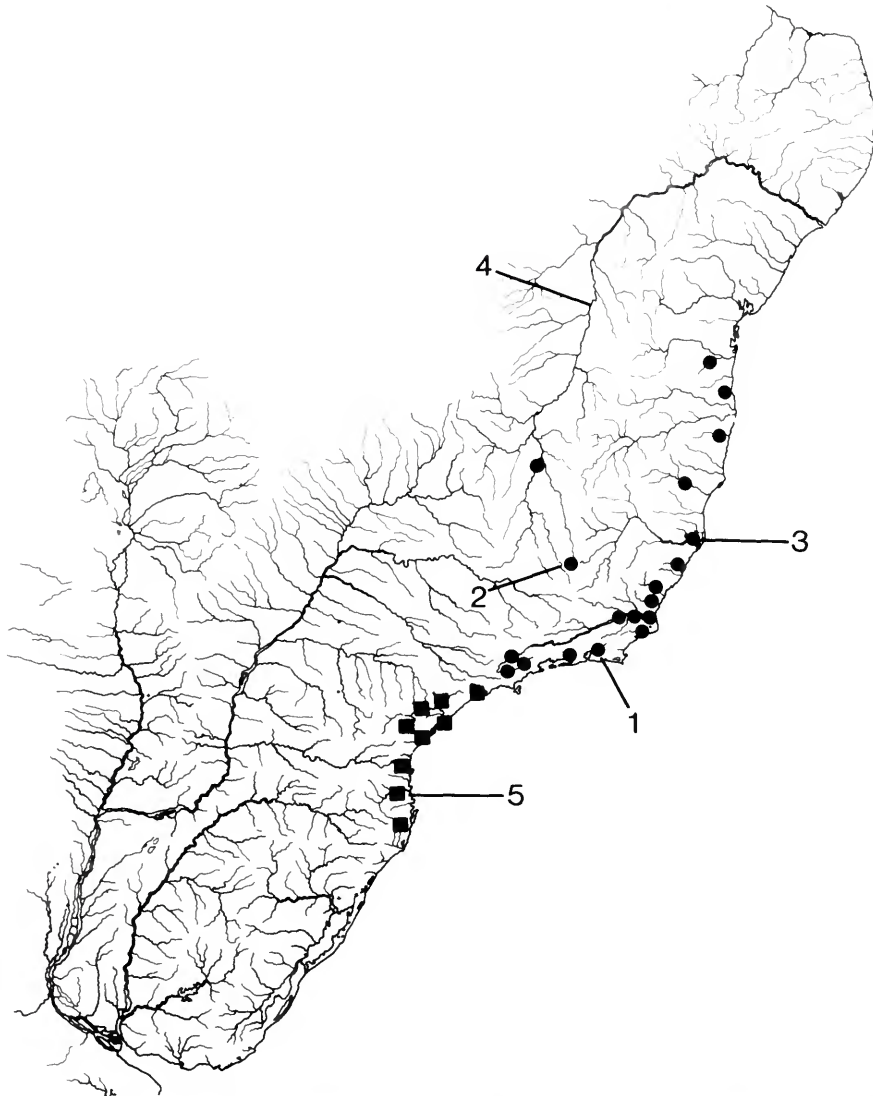


FIGURE 67.—Map of eastern and southeastern Brazil and adjoining regions showing geographic distribution of *Cyphocharax gilbert* (filled circles; 1 = type locality of *Curimata Gilbert*; 2 = type locality of *Curimatus albula*; 3 = type locality of *Pseudocurimata grandocule* (see also "Remarks" under *Cyphocharax gilbert* with respect to this locality); 4 = Rio São Francisco) and *Cyphocharax santacatarinae* (squares; 5 = type locality of *Pseudocurimata santacatarinae*) (some symbols represent more than one locality or lot of specimens).

Considerable confusion exists in the literature concerning the actual geographic range and distinguishing characteristics of *Cyphocharax gilbert*. Uncertainty also existed with respect to the nominal species that are its synonyms. Most recent authors recognized *C. gilbert* as having a very extensive distribution encompassing the series of coastal rivers from the state of Espírito Santo in Brazil through to central Argentina, and the entire Río de La Plata basin including the upper Río Paraná system. An examination of *Cyphocharax gilbert*-like material from that vast region indicates it includes four distinct,

albeit similar, allopatric species. *Cyphocharax gilbert* is limited to the coastal drainages of the Brazilian states of Bahia, Minas Gerais, Espírito Santo, and Rio de Janeiro, together with the Rio Paraíba do Sul system in the southeastern portion of the state of São Paulo. The upper Rio Paraná basin is inhabited by an endemic species, *C. modestus* (Fernández-Yépez). Specimens from the short drainages of the coastal versant of the states of São Paulo, all of Paraná, and central and northern Santa Catarina in Brazil are *C. santacatarinae* (Fernández-Yépez). Material from the Río de La Plata basin, exclusive of the upper

Rio Paraná, together with the coastal rivers of Uruguay, and the states of Rio Grande do Sul and southern Santa Catarina in Brazil is *C. voga* (Hensel) (see synonymy at beginning of this species account and those for *C. modestus*, *C. santacatarinae*, and *C. voga*, together with distribution maps for each species).

The distinguishing features of the four species are relatively subtle, especially in adults, although differences in pigmentation, particularly in juveniles and mid-sized specimens in conjunction with various meristic features allow for separation of the four forms. Such similarities and the lack of detail in the original descriptions of the nominal forms made the discrimination of the different species by previous authors difficult if not impossible.

Two meristic characters and various details of several aspects of body and caudal fin pigmentation most readily serve to separate these different forms. These are as follows:

1. *Number of vertebrae.* As seen in Table 9, the 34 to 37, most commonly 35 or 36 vertebrae of *Cyphocharax voga* distinguish the vast majority of the specimens of that species from most individuals of *C. gilbert*, *C. modestus*, and *C. santacatarinae*.
2. *Number of scales in a transverse series below the lateral line.* The 4½ or 5 scales in a transverse series below the lateral line to the origin of the anal fin in *C. santacatarinae* separates that species from *C. gilbert*.
3. *Spotting on body.* The somewhat random pattern of small dark spots on the lateral and dorsolateral surfaces of the body in *C. voga*, particularly juvenile and mid-sized specimens of the species is not found in *C. gilbert*, *C. modestus*, or *C. santacatarinae* (compare Figures in species accounts).
4. *Form of the patch of dark pigmentation on the midlateral surface of the caudal peduncle.* The horizontally elongate spot of pigmentation on the caudal peduncle in *C. gilbert* distinguishes it from comparably sized specimens of the three other species in which the spot is rotund, typically extending to the dorsal and ventral margins of the caudal peduncle. The rotund patches of dark pigmentation on the caudal peduncle in medium and large specimens of *C. voga* and *C. santacatarinae* discriminate those species from *C. gilbert* and *C. modestus* in which adults have longitudinally elongate stripes on the caudal peduncle.
5. *Pigmentation on the middle rays of the caudal fin.* The streak of dark pigmentation across the middle rays of the caudal fin in mid- and large-sized individuals of *C. modestus* separates the species from the other forms, with the exception of some specimens of *C. cf. gilbert* from Bahia (see discussion under "Geographic Variation" above).

Cyphocharax gilbert, even as restricted in this publication, has two junior synonyms. Lütken in 1874 described *Curimatus albula* from Lagoa Santa in the Rio das Velhas system of Minas

Gerais, Brazil (see Figure 67). The following year Lütken (1875:186, IX) redescribed the species in greater detail, and provided a Latin description of the meristic and morphometric features of his nominal form. In the same paper he questionably equated *albula* with *Curimatus Gilbert* previously described by Quoy and Gaimard from Rio de Janeiro. In 1910 Eigenmann listed *Curimatus albulus* as a synonym of *Curimatus Gilbert* without any discussion of the basis for his action. All subsequent authors dealing with these two nominal species retained *Curimatus albula* as a synonym of *C. gilbert* other than for Fowler (1975:370) who erroneously listed *albulus* Lütken as the senior synonym of *Gilbert* Quoy and Gaimard. Examination of the syntype series of *Curimatus albula* has shown that it consists of two species of different curimatid genera (see discussion below). Nonetheless, the analysis of the *Cyphocharax* specimens in the series has confirmed that they are conspecific with *Cyphocharax gilbert* (Table 10). *Curimatus albula* is consequently placed as a synonym of *Cyphocharax gilbert*.

Lagoa Santa, the reported type locality of *Curimatus albula*, lies in the upper reaches of the southeastern portions of the Rio São Francisco basin. The only subsequent citation of *Cyphocharax gilbert* from the Rio São Francisco basin based on additional material was that of Britski et al. (1984:58) who reported a specimen of *Curimata gilbert* from the Três Marias reservoir on that river. Surprisingly there is little material of the species from that river basin in museum collections. Available specimens from the Rio São Francisco basin are all somewhat more robust than those from elsewhere in the species range, perhaps in response to the lotic conditions in the impounded portions of the basin where they were captured. Those materials do not differ otherwise from the remaining examined populations of the species in other features and thus are considered conspecific.

The original description of *Curimatus albula* was based on a series of specimens now divided at least between ZMUC and MNHN. Examination of the major portion of the syntype series has shown it is complex, consisting largely of *Cyphocharax gilbert* (ZMUC 51, 52, 57, 59, 67, 68, MNHN 9588) and of one individual of *Steindachnerina elegans* (ZMUC 56) (see also comments in Vari (1991:95)). In order to stabilize the nomenclature of the taxon, a 81.7 mm SL syntype of *Curimatus albula* conspecific with *Cyphocharax gilbert*, and also in the best overall condition, is designated as the lectotype (ZMUC 52). The remaining portions of the type series in ZMUC and MNHN become paralectotypes (ZMUC 51, 56, 57, 59, 67, 68; MNHN 9588). Additional specimens evidently collected with the type series, but not identified as syntypes are deposited in USNM (44956), NMW (62691) and BMNH (1876.1.10:24, 1876.1.10:70-71).

Fernández-Yépez (1948:47) described *Pseudocurimata grandocule* with a stated authorship of Amaral Campos and a cited type locality of the Rio Doce in Espírito Santo, Brazil. As

TABLE 10.—Morphometrics and meristics of (A) holotype of *Curimata Gilbert* (MNHN 5430); (B) lectotype of *Curimatus albula* (ZMUC 52); (C) holotype of *Pseudocurimata grandocule* (CAS 20352), and (D) all examined specimens of *Cyphocharax gilberti* 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	81.0	81.7	80.6	49.3–126.0
1. Greatest body depth	0.39	0.37	0.40	0.36–0.42
2. Snout to dorsal-fin origin	0.49	0.49	0.52	0.48–0.54
3. Snout to anal-fin origin	0.83	0.80	0.82	0.80–0.87
4. Snout to pelvic-fin origin	0.54	0.58	0.54	0.53–0.59
5. Snout to anus	0.77	–	0.75	0.76–0.82
6. Origin of dorsal fin to hypural joint	0.57	0.59	0.57	0.53–0.59
7. Pectoral-fin length	0.18	–	0.18	0.18–0.23
8. Pelvic-fin length	0.21	0.20	0.20	0.20–0.24
9. Caudal peduncle depth	0.14	0.13	0.14	0.13–0.15
10. Head length	0.28	0.27	0.27	0.28–0.32
11. Snout length	0.28	0.29	0.27	0.25–0.31
12. Orbital diameter	0.32	0.30	0.31	0.29–0.33
13. Postorbital length	0.41	0.43	0.44	0.39–0.46
14. Interorbital width	0.41	0.43	0.44	0.40–0.46
	MERISTICS			
Lateral-line scales	34	33	35	33–38
Scale rows between dorsal-fin origin and lateral line	6½	6	6	5½–7½
Scale rows between anal-fin origin and lateral line	5½	5	5	5½–6½
Branched dorsal-fin rays	9	9	9	9
Branched anal-fin rays	7	7	7	7–8
Total pectoral-fin rays	14	14	13	13–16
Branched pelvic-fin rays	8	8	8	8–9
Vertebrae	34	34 ^a	32 ^b	32–35

^a Paralectotypes of *Curimatus albula* (ZMUC 57, MNHN 9588, BMNH 1876.1.10:24, BMNH 1876.1.10:70–71) have 32 or 33 vertebrae (not including paralectotype that is a specimen of *Steindachnerina elegans*).

^b Vertebral column in holotype of *Pseudocurimata grandocule* is deformed, with fusion of centra, but there are apparently 32 vertebrae; 33 vertebrae present in the paratype of the species.

discussed by Britski (1969:200–201, 203), the proper authorship for the species is Fernández-Yépez and the more exact type locality is the vicinity of Linhares and Lago Juparaná in Espírito Santo. Examination of the type series of *Pseudocurimata grandocule* has not revealed any differences between that nominal form and *Cyphocharax gilberti* (Table 10), and the nominal forms are thus considered conspecific.

Eigenmann and Eigenmann (1889:424) described *Curimatus gilberti brevipinnis* based on a single specimen from “Rosario (La Plata).” Various authors (Eigenmann and Eigenmann, 1891:47; Berg, 1897:279; Eigenmann, 1910:421; Pozzi, 1945:271) reiterated this record, typically without further comment. Examination of the holotype of *Curimatus gilberti brevipinnis* (MCZ 789) reveals that it differs from *Cyphocharax gilberti* in numerous details, and indeed is not even a *Cyphocharax* species. *Curimatus gilberti brevipinnis* instead shares a number of derived features with, and is a member of the lineage recognized by Vari (1989a, 1991) as *Steindachnerina* (see also discussion of *S. brevipinna* in Vari (1991:97)).

Eigenmann and Norris cited *Curimatus gilberti brevipinnis* (1900:355) from Piracicaba in the upper Rio Paraná basin in Brazil, an area outside the known range of both *Cyphocharax gilberti* and *Steindachnerina brevipinna*. The record is consequently assumed to represent a misidentification of one of the curimatid species endemic to the upper Rio Paraná, most likely *Cyphocharax modestus* or *Steindachnerina insculpta*.

In his description of *Curimatus* (= *Cyphocharax*) *platanus* Günther (1880:12) commented that the species is “allied to *Curimatus Alberti*.” Eigenmann and Eigenmann (1889:410), in their revision of the then known members of the family, noted that “one species of *Curimatus*, *C. alberti*, has been omitted, as we had no description of it.” No other reference to *Curimatus Alberti* has been found in any of the publications examined, and it would appear that the name is a lapsus for *C. gilberti*.

MATERIAL EXAMINED.—338 specimens (90, 49.3–126.0).

BRAZIL. *Rio de Janeiro*: No specific locality, USNM 295901, 3 (2, 86.5–93.7); MZUSP 1572, 2. *Rio Paraíba do Sul*, São João da Barra, MZUSP 20822, 2; MZUSP 20775, 7;

USNM 295938, 4 (3, 80.5–109.8); MZUSP 20774, 6 (3, 50.2–69.4); MZUSP 20806, 6 (3, 93.4–105.4); MZUSP 1600, 3. Rio Paraíba, NMW 66948, 3; NMW 68769, 1; NMW 68770, 1; NMW 68771, 4. Córrego da Atafona, MZUSP 21438, 6 (3, 108.5–110.3). Pontal, Atafona, MZUSP 20812, 1. Atafona, Trapiche, MZUSP 20808, 1. Ilha do Lima, Atafona, MZUSP 20811, 1. Lagoa Feia, MNRJ 11216, 2; MZUSP 2092, 1; MZUSP 2052, 8. Rio Magé, MNRJ 10907, 3. Rio Guapimirim, Magé, MZUSP 20847, 14 (85.4–116.0). Rio Guandu, MZUSP 21494, 1 (102.4). Município de Itaguaí, MZUSP 28271, 1. Rio Macacu (tributary of Bahia da Guanabara), MNHN 5430, 1 (81.0, holotype of *Curimata Gilberti*). Cabeceiras do Rio Guapiaçu, Cachoeira de Macacu, MZUSP 26861, 1 (98.9). Município de Cachoeiras de Macacu, Rio Rabelo, MNRJ 11212, 5 (2, 106.3–106.4). Paraíso, Barra de Itabapoana, MNRJ 11216, 6 (4, 78.1–88.2). Córrego Pedra d'Água, São Fidelis, MZUSP 20848, 2. Campos [= Rio Muriae at Campos], ANSP 8200, 1. São Paulo: Taubaté, CAS 11577, 1 (78.3; formerly IU 9287). Rio Paraíba, Represa de Paraibuna, MZUSP 35813, 5. Rio Paraíba, Santa Branca, MZUSP 20730, 14 (9, 67.5–119.7); MZUSP 20686, 5 (2, 83.0–86.7); MZUSP 20728, 2. Rio Paraíba, Santa Branca, Córrego do Rogero, MZUSP 20687, 1; MZUSP 20729, 2. Rio Paraibuna, Paraibuna, MZUSP 21668, 4 (2, 84.0–102.4). Minas Gerais: Lagoa Santa, ZMUC 52, 1 (81.7, lectotype of *Curimatus albula*); ZMUC 57, 1 (70.0, paralectotype of *Curimatus albula*); ZMUC 51, 1 (paralectotype of *Curimatus albula*); ZMUC 56, 1 (paralectotype of *Curimatus albula*); ZMUC 59, 1 (paralectotype of *Curimatus albula*); ZMUC 67, 1 (paralectotype of *Curimatus albula*); ZMUC 68, 1 (paralectotype of *Curimatus albula*); MNHN 9588, 2 (53.9–61.3, paralectotypes of *Curimatus albula*); BMNH 1876.1.10:24 and BMNH 1876.1.10:70–71, 3 (57.9–80.6, evidently collected with type series of *Curimatus albula*); USNM 44956, 1 (73.2, evidently collected with type series of *Curimatus albula*); NMW 62691, 1 (evidently collected with type series of *Curimatus albula*). Ribeira das Pedras, Rio Mucuri basin, USNM 295936, 38; MZUSP uncat., 37. Muriaé, NMW 68775, 2; NMW 66958, 2; NMW 79564, 2. Rio Mucuri, approx. 26 km SE of Nanuque, USNM 298249, 10. Rio São Francisco, Pirapora, MZUSP 1890, 1. Espírito Santo: Lagoa Juparana, Linhares, USNM 296896, 5 (4, 49.3–126.0; 1 specimen cleared and counterstained for cartilage and bone); MZUSP 20857, 11 (4, 97.0–114.3); MNRJ 5338, 4 (3, 94.2–110.3). Vicinity of Linhares and Lagoa Juparana, CAS 20352, 1 (80.6, holotype of *Pseudocurimata grandocule*; see Britski (1969:203) with respect to type locality); MZUSP 1958, 1 (116.3, paratype of *Pseudocurimata grandocule*). Linhares, Lagoa Nova, MZUSP 20855, 1. Rio Itapemirim between Coutinho and Pocotula, W of Cachoeira do Itapemirim, USNM 295934, 1 (102.0). Rio Doce, MZUSP 1958, 15. Rio São José des Torres at crossing of BR 101, USNM 295940, 3 (2, 78.0–85.8). Bahia: North branch of Rio Jucuruçu at Itamaraju, USNM 298253, 1. North branch of Rio Jucuruçu, Itamaraju and downstream of town,

USNM 298247, 20 (12, 92.7–104.7); MZUSP uncat., 15. Rio de Una, 3.6 km E of BR-101, Una, UFPB 1696, 1. Rio Buranhém near Vale Verde, USNM 298252, 1. Rio de Contas basin, Rio Gongoji, 5 km from Dario Meira, USNM 298254, 4. Rio de Contas basin, Rio Gongoji, 4 km from Dario Meira, USNM 298250, 5 (3, 92.0–96.6). Rio São Francisco, MZUSP 1358, 8; MZUSP 3797, 4.

Cyphocharax santacatarinae (Fernández-Yépez)

FIGURES 67–71; TABLE 9

Curimatus gilberti.—Eigenmann and Eigenmann, 1889:424 [distribution in part, not cited occurrence in Rio Plata (= Río de La Plata) or southeastern portions of Brazil south of Santa Catarina, not coastal rivers of Brazil north of central São Paulo state].—Miranda-Ribeiro, 1908: page 3 of 5 unpaginated [Brazil: São Paulo, Rio [da] Ribeira; common name].—Eigenmann, 1910:421 [distribution in part, not cited occurrence in Rio Paraguay basin].

Pseudocurimata santacatarinae Fernández-Yépez, 1948:50, fig. 25 [type locality: Brazil: Santa Catarina].—Britski, 1969:203 [type locality refined to Hansa, margin of Rio Itajai, near Blumenau, Santa Catarina, Brazil; species transferred from *Pseudocurimata* to *Curimatomorbus*].—Fowler, 1975:373 [reference].—de Godoy, 1987:233, 238 [Brazil: Santa Catarina; common name].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].

Curimatomorbus santacatarinae.—Britski, 1969:203 [shift of species from *Pseudocurimata* to *Curimatomorbus*].

DIAGNOSIS.—*Cyphocharax santacatarinae* is distinguished from its congeners by the combination of 32 to 34 scales in the lateral line to the hypural joint, the development of pores along the entire lateral line in all but juvenile specimens, the 32 to 34, typically 33 vertebrae, the relative length of the postorbital portion of head (0.42–0.47 of HL), the relative length of the head (0.26–0.30 of SL), the relative width of the orbit (0.26–0.31 of HL), the absence of multiple series of longitudinal dark stripes or small dark spots in longitudinal rows on the body, the absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, the absence of a stripe of dark pigmentation across the middle rays of the caudal fin in moderate to large-sized specimens, and the possession of 9 branched dorsal-fin rays.

Cyphocharax santacatarinae has been confused with *C. gilberti*, an allopatric species distributed in coastal rivers from Rio de Janeiro to Bahia. Those species and two similar allopatric forms (*C. modestus* and *C. voga*) can be distinguished by various meristic features and details of pigmentation (see “Remarks” under *C. gilberti* for a detailed discussion).

DESCRIPTION.—Body moderately elongate, moderately compressed laterally in juveniles, somewhat more rotund in larger specimens. Dorsal profile of head distinctly convex from tip of snout to vertical line through posterior nostril, somewhat 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, straight to gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body in adults with indistinct median keel anterior to dorsal fin, keel more obvious in smaller specimens; body smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region very obtusely flattened transversely, with irregular median series of scales that are not enlarged relative to those on adjoining regions of body. Obtuse median keel posterior to origin of pelvic fin. Adults with very obtuse secondary 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 0.35–0.40 [0.37]; snout tip to origin of dorsal fin 0.50–0.54 [0.50]; snout tip to origin of anal fin 0.79–0.84 [0.80]; snout tip to origin of pelvic fin 0.52–0.56 [0.53]; snout tip to anus 0.75–0.80 [0.77]; origin of dorsal fin to hypural joint 0.54–0.57 [0.56]. Dorsal fin obtusely pointed in profile distally, distal margin increasingly rounded with increasing age; last unbranched and first branched rays in adults two and three-quarters to three and one-quarter times length of ultimate ray. Pectoral fin obtusely pointed in profile distally; length of pectoral fin 0.18–0.22 [0.18], extending approximately two-thirds distance to vertical line through origin of pelvic fin. Pelvic fin obtusely pointed in profile distally, length of pelvic fin 0.20–0.24 [0.20], reaching to origin of anal fin in some young adults, less than three-quarters of that distance in larger specimens. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays about twice length of ultimate ray. Least depth of caudal peduncle 0.13–0.15 (0.13 rare) [0.14].

Head obtusely rounded anteriorly, somewhat pointed overall; head length 0.26–0.30 [0.28]; upper and lower jaws nearly equal, mouth terminal or barely subterminal; snout length 0.27–0.30 [0.27]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.26–0.31 [0.29]; adipose eyelid poorly developed, limited to region anterior of orbit; length of postorbital portion of head 0.42–0.47 [0.45];

gape width 0.25–0.30 [0.35]; interorbital width 0.41–0.46 [0.41].

Pored lateral-line scales from supracleithrum to hypural joint 32 to 34 [33]; all scales of lateral line pored, canals in lateral-line scales straight; 3 or 4 series of pored scales extend beyond hypural joint onto caudal-fin base; $5\frac{1}{2}$ [$5\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; $4\frac{1}{2}$ to 5 [$4\frac{1}{2}$] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or iii,9 (iii,9; when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or 8, or iii,7 (ii,8 and iii,7 rare; when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 14 to 15 [14]; pelvic-fin rays i,8 [i,8].

Total vertebrae 32 (6), 33 (29), 34 (3).

COLOR IN LIFE.—(Based on transparencies by Dr. Ricardo M.C. Castro of recently captured juveniles collected in the Município de Bertioga, São Paulo state, Brazil, and a series of adults collected in the Riacho de Cabeceira, Município de Morretes, Rio Sagrado basin, Paraná state, Brazil.) Juveniles bright silver on body and lateral surfaces of head, dorsal portions of head darker. Prominent, large, rotund black spot covering posterolateral portion of caudal peduncle. Median fins with faint yellow-red coloration. Large specimens silvery overall, distinctly darker on dorsal portions of head and body. Obscure dark spot on midlateral surface of caudal peduncle. Scales with indistinct dark pigmentation visible on posterior portions of exposed surface. Irregular thin dark stripe visible along lateral line. Anterior margin of dorsal fin distinctly dusky, remainder of fin hyaline or slightly dusky along tips of fin rays. Dorsal and ventral rays of caudal fin dusky, basal half of other fin rays tan, rest of fin hyaline with dusky shading along fin rays. Anal and paired fins tan.

COLOR IN ALCOHOL.—Overall coloration of specimens retaining guanine on scales silvery to golden in juveniles, silvery or golden olive in larger specimens, darker on dorsal portions of head and body, particularly in largest individuals. Specimens lacking guanine on scales tan to olive, darker on



FIGURE 68.—*Cyphocharax santacatarinae*, USNM 296523, 25.9 mm SL; Brazil, São Paulo, Município de Bertioga, Riacho without a name along highway SP 98.

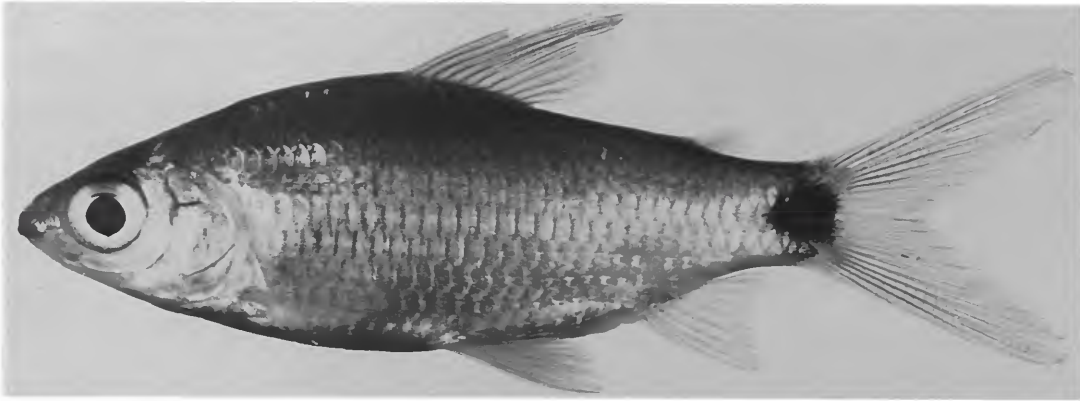


FIGURE 69.—*Cyphocharax santacatarinae*, MZUSP 21521, 48.9 mm SL; Brazil, Paraná, Município de Morretes, Riacho Passa-Sete.

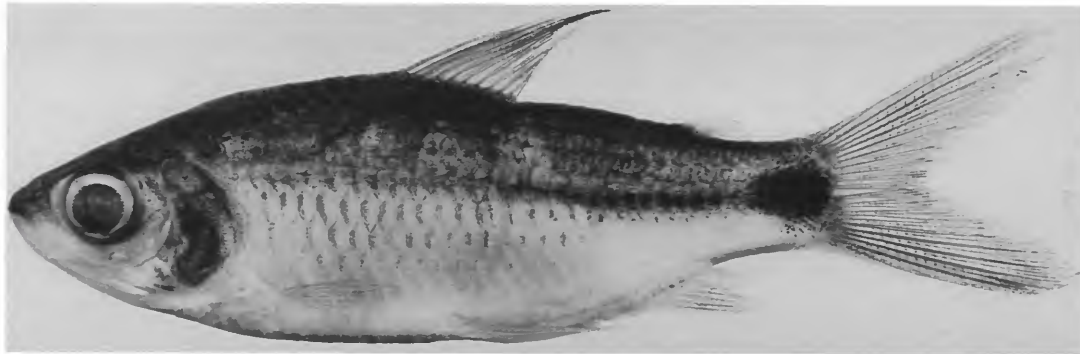


FIGURE 70.—*Cyphocharax santacatarinae*, USNM 296521, 57.8 mm SL; Brazil, Paraná, Município de Morretes, Rio Sagrado basin, Riacho de Cabeceira.



FIGURE 71.—*Cyphocharax santacatarinae*, USNM 296461, 125.9 mm SL; Brazil, Santa Catarina, Joinville.

dorsal portions of head and body. Smallest examined specimens with distinct rotund spot on caudal peduncle. Spot extending to dorsal and ventral borders of peduncle and onto basal portions of caudal-fin rays (Figure 68). Larger juveniles retaining spot on caudal peduncle, but dorsal and ventral margins of spot less heavily pigmented; central portion of spot quite distinct (Figure 69). Adults retaining spot on caudal peduncle. Spot of adults not approaching dorsal and ventral margins of caudal peduncle, more elongate than in smaller specimens, continuous anteriorly with fainter midlateral stripe (Figure 70), somewhat masked in specimens retaining guanine on scales (Figure 71). All fins, particularly dorsal and caudal fins, somewhat dusky, more so in adults.

DISTRIBUTION.—Coastal rivers of states of Paraná, Santa Catarina, and southern São Paulo states in Brazil (Figure 67).

COMMON NAME.—São Paulo, Brazil: Saguirú (Miranda-Ribeiro, 1908: page 3 of 5 unpaginated); Santa Catarina, Brazil: Peixe-Duro, Saguaru (de Godoy, 1987:233).

REMARKS.—In his description of *Pseudocurimata santacatarinae*, Fernández-Yépez (1948:51) compared it with *P. lineopunctata* (Boulenger), a species inhabiting various rivers in the trans-Andean northwestern South America. Vari (1989a, 1989b) demonstrated that *P. lineopunctata* is a member of a clade endemic to the rivers of the western versant of the Andes from northern Peru to northern Colombia. In his original description of *P. steindachneri* (= *Cyphocharax magdalenae*), another species limited to areas west of the Andes, Fernández-Yépez (1948) noted pigmentation differences between that species and his *P. santacatarinae*. Although both *santacatarinae* and *steindachneri* (= *magdalenae*) are herein assigned to *Cyphocharax* they are readily distinguishable from each other, and it is not apparent what Fernández-Yépez sought to emphasize by comparing those particular species.

The primary difficulty with distinguishing *Cyphocharax santacatarinae* involves neither *Pseudocurimata lineopunctata* nor *Cyphocharax magdalenae*, but rather three geographically proximate but allopatric species, *C. gilberti*, *C. voga*, and *C. modesta*. Fernández-Yépez did not compare his nominal species *Pseudocurimata santacatarinae* directly with *Cyphocharax gilberti* (placed by him in *Pseudocurimata*), nor did he mention *Cyphocharax voga*. The distributional range he cited for *Pseudocurimata gilberti* encompasses that of *voga* and his concept of *gilberti* presumably included *voga*. Fernández-Yépez's original description of *modesta* placed that species, in turn, within *Curimatorbis*, a junior synonym of *Steindachnerina* (Vari, 1989a, 1991). Members of *Steindachnerina* are characterized by a number of derived features (Vari, 1989a, 1991) absent in *modesta* which is rather assigned to *Cyphocharax*. Although Fernández-Yépez (1948) did not demonstrate how his *santacatarinae* could be separated from *gilberti* (including *voga*) and *modesta*, the four nominal forms, although very similar, differ in various features of juvenile pigmentation, and some meristic and morphometric features (see "Remarks" under *Cyphocharax gilberti*). They are all consequently recognized as distinct herein.

In his original description of *Pseudocurimata santacatarinae* Fernández-Yépez (1948:50–51) cited the holotype and single paratype as collected in 1909 in Santa Catarina, Brazil, by A. do Amaral. The paratype was, according to Fernández-Yépez, catalogued under IUM (= IU) 1806, but deposited in the California Academy of Sciences. Britski (1969:203–204) noted that the types of the *P. santacatarinae* species were actually collected in 1908 by W. Erhardt and that the number cited by Fernández-Yépez for the paratype is a MZUSP catalog number rather than an IU register number. In the same paper Britski refined general type locality provided by Fernández-Yépez to Hansa, along the margins of the Rio Itajaí, near Blumenau, Santa Catarina.

MATERIAL EXAMINED.—104 specimens (36, 25.5–201.0).

BRAZIL. *São Paulo*: Município de Bertiooga, Riacho along highway SP-98, USNM 296523, 10; MZUSP 39787, 10. Iguape, MZUSP 1574, 1. Município de Eldorado, stream under first bridge from Eldorado to Sete Barras, MZUSP 40034, 1. Lagoons along margin of Rio Quilombo, along SP-165 between Juquiá and Sete Barras, MZUSP 40010, 3 (25.533.3). Rio Ribeira de Iguape basin, Barra do Turvo, MZUSP 40225, 2 (156.0–201.0). Ribeirão Poço Grande, along highway SP-79, 8 km from Juquiá, MZUSP 38611, 16 (10, 90.6–104.1). Riacho Arataca, tributary of Rio Jacupiranga, along road between Pariqueira-açu and Iguape, MZUSP 39998, 1. *Paraná*: Ditch on road from Morretes to Paranaguá, MZUSP 21522, 2. Rio Cachoeira Antonina, MZUSP 21685, 4 (2, 90.2–94.2). Riacho Passa-Sete, Morretes, MZUSP 21521, 7. Rio Sagrado basin, Município de Morretes, Riacho de Cabeceira, USNM 296521, 5 (3, 57.8–86.1; 1 specimen cleared and counterstained for cartilage and bone). *Santa Catarina*: No exact locality, USNM 296460, 3 (104.5–140.0). Rio Cubatão near Joinville, MZUSP 21468, 1 (85.7). Joinville, NMW 66910, 4; NMW 66911, 5; NMW 66913, 2; NMW 66914, 2; NMW 66915, 1; NMW 66952, 2 (110.1–126.8); NMW 66954, 2; NMW 66955, 3; NMW 68767, 1; NMW 68768, 1; NMW 68919, 4; NMW 66956, 4 (104.5–125.8); USNM 296461, 2 (116.0–125.9); USNM 295898, 2 (117.1–120.0). Hansa, margin of Rio Itajaí, near Blumenau, CAS 11581, 1 (107.1, holotype of *Pseudocurimata santacatarinae*; see Britski (1969:203–204) with respect to exact type locality and correct authorship); MZUSP 1806, 1 (126.3, paratype of *Pseudocurimata santacatarinae*; see Britski (1969:203–204) with respect to exact type locality and correct depository). Rio da Madre, BR 101, Paulo Lopes, USNM 279588, 1.

Cyphocharax gangamon, new species

FIGURES 72–74; TABLES 11, 12

DIAGNOSIS.—*Cyphocharax gangamon* is distinguished from its congeners by the combination of 27 or 28 scales to the hypural joint in the longitudinal scale series including the lateral line, the development of pores along the entire lateral line in all but juvenile specimens, the 28 to 30, typically 29 or

30 vertebrae, the relative length of the postorbital portion of the head (0.35–0.41 of HL), the relative length of the head (0.31–0.34 of SL), the relative width of the orbit (0.32–0.37 of HL), the absence of multiple series of longitudinal dark stripes or small dark spots in longitudinal rows on the body, the absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, the absence of a stripe of dark pigmentation across the middle rays of the caudal fin in moderate to large-sized specimens, the reticulate pattern of dark pigmentation on the body in adults, and the possession of 9 branched dorsal-fin rays.

DESCRIPTION.—(Meristics and morphometrics based just on type series; see under “Remarks” and Table 11 with respect to second evidently conspecific population from Rio Arinos, Mato Grosso.) Body moderately elongate, moderately compressed laterally in all examined specimens. Dorsal profile of

head moderately convex from margin of upper lip to vertical line through posterior nostril, straight from that line to posterior of head. 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 or gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with moderately developed 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 somewhat flattened transversely, with median series of scales of size comparable to those on adjoining portions of body. Moderately developed median keel posterior to pelvic fin origin. Secondary obtuse keels on that portion of body not evident.

Greatest body depth at origin of dorsal fin, depth 0.35–0.40 [0.40]; snout tip to origin of dorsal fin 0.50–0.55 [0.54]; snout tip to origin of anal fin 0.80–0.84 [0.84] (see also “Remarks” and Table 11 with respect to data for population from Rio



FIGURE 72.—*Cyphocharax gangamon*, new species, holotype, MZUSP 22037, 46.8 mm SL; Brazil, Rio Tapajós, Pará, Monte Cristo, Lago da Santa Clara (approx. 4°04'S, 55°38'W).



FIGURE 73.—*Cyphocharax gangamon*, new species, USNM 267991, 55.1 mm SL; Brazil, Mato Grosso, Rio Arinos, Porto dos Gauchos (approx. 11°30'S, 57°20'W).

Arinos); snout tip to origin of pelvic fin 0.55–0.59 [0.56]; snout tip to anus 0.75–0.81 [0.78]; origin of dorsal fin to hypural joint 0.52–0.58 [0.55] (see also “Remarks” and Table 11 with respect to data for population from Rio Arinos). Distal margin of dorsal fin rounded; last unbranched and first branched rays approximately three times length of ultimate ray. Distal margin of pectoral fin barely rounded, length of pectoral fin 0.19–0.25 [0.25], extends to or nearly to vertical line through origin of pelvic fin. Distal margin of pelvic fin rounded; length of pelvic fin 0.22–0.27 [0.27], reaches beyond anus and nearly to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays twice length of ultimate ray. Least depth of caudal peduncle 0.13–0.14 [0.13] (see also “Remarks” and Table 11 with respect to data for population from Rio Arinos).

Head profile rounded anteriorly, overall profile of head pointed; head length 0.31–0.34 [0.31]; upper and lower jaws equal, mouth terminal; snout length 0.26–0.30 [0.29]; nostrils of each side separated by distance approximately equal to longitudinal width of anterior nostril, anterior nares transversely ovoid, posterior tear-drop shaped with aperture not closed by thin flap of skin separating nares; orbital diameter 0.32–0.37 [0.33]; adipose eyelid largely absent, slightly developed anterior to orbit; length of postorbital portion of

head 0.35–0.41 [0.41]; gape width 0.18–0.23 [0.22]; interorbital width 0.41–0.46 [0.43].

Lateral-line scales from supracleithrum to hypural joint 27 or 28 [28]; 8 scales of lateral line pored in specimens of about 25 mm SL, number of scales increasing in larger specimens, all scales pored in specimens greater than 32 mm SL, canals in pored lateral-line scales straight; 2 or 3 series of scales in horizontal series continuous with lateral line extend beyond hypural joint onto caudal-fin base; $4\frac{1}{2}$ to $5\frac{1}{2}$ ($4\frac{1}{2}$ rare) [$5\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line (see also “Remarks” and Table 11 with respect to data for population from Rio Arinos); 4 or $4\frac{1}{2}$ [$4\frac{1}{2}$] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 [ii,9]; anal-fin rays ii,7 [ii,5]; pectoral-fin rays 13 to 15 [13]; pelvic-fin rays i,7 or i,8 (i,7 in only 1 paratype) [i,8].

Total vertebrae 28 (3), 29 (32), 30 (2) (see also “Remarks” and Table 12 with respect to data for population from Rio Arinos).

COLOR IN ALCOHOL.—Type-specimens largely lacking guanine on scales, overall ground coloration light brown, with slightly silvery sheen. Upper lip, snout, and dorsal portion of head and opercle with field of small, scattered, dark chromatophores; lower jaw with field of small, dark chromatophores,

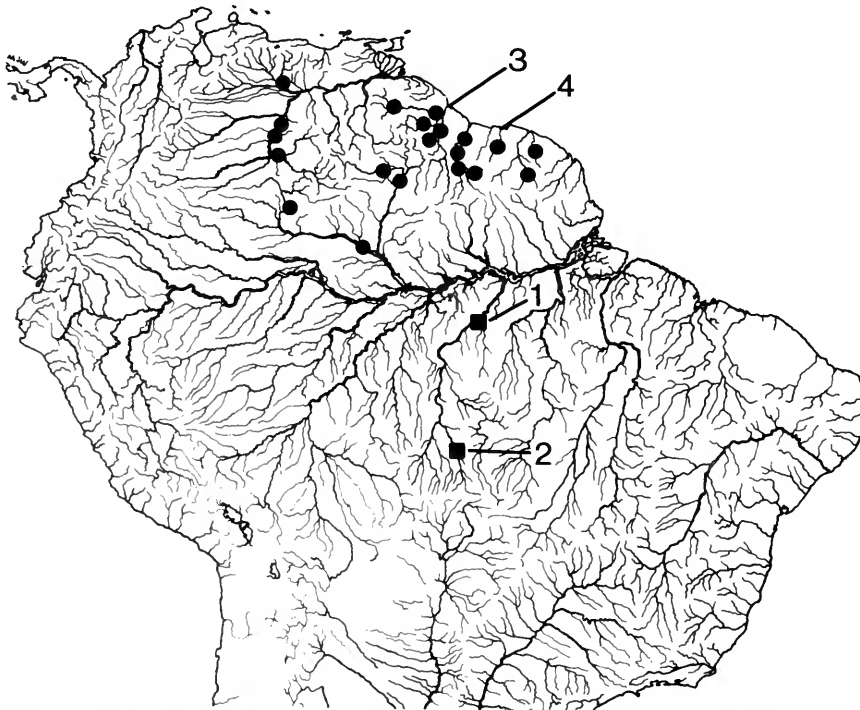


FIGURE 74.—Map of central and northern South America showing geographic distribution of *Cyphocharax gangamon* (squares; 1 = type locality; 2 = locality of population sample from Rio dos Arinos) and *Cyphocharax spilurus* (filled in circles; 3 = Essequibo River, type locality of *Curimatus spilurus*; 4 = Surinam River, type locality of *Curimatus surinamensis*) (some symbols represent more than one locality or lot of specimens).

TABLE 11.—Morphometrics of (A) holotype and paratypes of *Cyphocharax gangamon* (MZUSP 22037, MZUSP 41752, USNM 309290) originating in lower Rio Tapajós at Monte Cristo; and (B) population sample of *Cyphocharax cf. gangamon* (USNM 276991, MZUSP 41754) originating at Porto dos Gauchos on Rio Arinos, upper Rio Tapajós system. Only values showing noteworthy differences between the two populations are given in the table. Standard length is expressed in mm; other measurements are proportions of standard length.

Character	A	B
MORPHOMETRICS		
Standard Length	25.1–46.8	29.7–52.3
1. Snout to anal-fin origin	0.80–0.84	0.84–0.87
2. Snout to anus	0.75–0.81	0.80–0.83
3. Caudal peduncle depth	0.13–0.14 ^a	0.13–0.15 ^b
MERISTICS		
Scale rows between dorsal-fin origin and lateral line	4 ¹ / ₂ –5 ¹ / ₂ ^c	4 ¹ / ₂

^a Most specimens with 0.13, average for all type-specimens 0.134.

^b Most specimens with 0.14 or 0.15, average for measured specimens 0.146.

^c 4¹/₂ rare, most type specimens with 5 or 5¹/₂ scales.

most intense along margin of lower lip. Margins of scales along lateral, dorsolateral, and dorsal surface of body outlined by series of small dark chromatophores, forming reticulate pattern (Figure 72); more diffuse pattern of small dark chromatophores on dorsal portion of body giving it overall dusky appearance. Deep-lying dusky stripe running along midlateral surface of body from point under base of dorsal fin to posterior of caudal peduncle. Posterior portion of dusky stripe overlain by rotund to somewhat vertically ovoid dark spot on midlateral surface of posterior portion of caudal peduncle and basal portion of middle rays of caudal fin. Fin-rays of dorsal, caudal, and anal fins distinctly outlined by series of small, dark chromatophores. Scattered small dark chromatophores on pelvic and pectoral fins. Adipose fin dusky.

Population of *Cyphocharax gangamon* from Rio Arinos system much lighter in overall pigmentation (Figure 73). Reticulate pattern on lateral and dorsolateral surfaces of body barely apparent, largely hidden by residual guanine on scales. Spot of dark pigmentation on midlateral surface of caudal peduncle less intense and more diffuse, more vertically developed than in comparable sized specimens from the type locality.

DISTRIBUTION.—Rio Tapajós of Rio Amazonas basin (Fig-

TABLE 12.—Vertebral counts in holotype and paratypes of *Cyphocharax gangamon* (MZUSP 22037, MZUSP 41752, USNM 309290) originating in lower Rio Tapajós at Monte Cristo, and population sample of *Cyphocharax cf. gangamon* (USNM 276991, MZUSP 41754) originating in upper Rio Tapajós basin at Porto dos Gauchos on Rio Arinos. Vertebrae incorporated into fused PU₁+U₁ counted as a single element and vertebrae in Weberian apparatus counted as four elements.

Locality	Vertebrae			
	28	29	30	Average
Monte Cristo	3	32	2	28.97
Porto dos Gauchos		16	20	29.55

ure 74, localities 1 and 2; see also comments under "Remarks" below).

ETYMOLOGY.—The species name, *gangamon*, from the Greek for net, refers to the reticulate pattern on the lateral and dorsal surfaces of the body in the species.

REMARKS.—*Cyphocharax gangamon* is known from two sites in the Rio Tapajós system; Monte Cristo, the type locality in the lower portion of the basin (Figure 74, locality 1), and the Rio Arinos at Porto dos Gauchos (Figure 74, locality 2). The Rio Arinos is a tributary of the Rio Juruena that, in turn, drains into the Rio Tapajós. The sites are separated by over 1000 river kilometers and there are not unexpectedly some differences between the two populations. Most notable of the morphometric differences between the samples are the relative lengths from the snout to the anal-fin origin, distance from the origin of the dorsal fin to the hypural joint, and the depth of the caudal peduncle (Table 11). Distinct differences also exist in the number of scales between the origin of the dorsal fin and the lateral line (Table 11), and to a lesser degree in the modal number of vertebrae (Table 12). Finally, the overall coloration of the Rio Arinos population is not as dark as that of the Monte Cristo sample. These differences might justify recognizing the population from the Rio Arinos as a species distinct from *C. gangamon* as exemplified by the population sample from the type locality. I prefer not to take that action at this time given the lack of material from intervening portions of the Rio Tapajós system, in light of the relatively small body size of most available specimens, and given that the differences in pigmentation may be a consequence of differing water chemistries in areas from which samples were collected.

TYPE MATERIAL EXAMINED.—15 specimens (15, 25.1–46.8).

HOLOTYPE.—BRAZIL. *Pará*: Rio Tapajós, Monte Cristo, Lago da Santa Clara (approx. 4°04'S, 55°38'W), collected by EPA under direction of P.E. Vanzolini, 6 Dec 1970, MZUSP 22037, I (46.8).

PARATYPES.—BRAZIL. *Pará*: Rio Tapajós, Monte Cristo, Lago da Santa Clara (approx. 4°04'S, 55°38'W), 14 specimens collected with holotype: MZUSP 41752, 8 (25.2–34.0); USNM 309290, 6 (25.1–31.0); 1 specimen cleared and counterstained for cartilage and bone.

NON-TYPE MATERIAL EXAMINED.—257 specimens (25, 29.7–52.3).

BRAZIL. *Pará*: Rio Tapajós, Monte Cristo, Lago da Santa Clara (approx. 4°04'S, 55°38'W), collected with holotype, MZUSP 41753, 25. *Mato Grosso*: Rio Arinos, Porto dos Gauchos, floodplain pool (approx. 11°30'S, 57°20'W); USNM 267991, 116 (25, 29.7–52.3); MZUSP 41754, 116.

Cyphocharax spilurus (Günther)

FIGURES 74–78; TABLE 13

Curimatus spilurus Günther, 1864:288 [type locality: British Guiana (= Guyana): Essequibo].—Eigenmann and Eigenmann, 1889:419 [Günther, 1864 citation; not other references or any of cited specimens]; 1891:47 [reference].—Vaillant, 1899:155 [French Guiana: rivière Carnot].—Eigenmann, 1910:421 [reference; British Guiana (= Guyana) citation, not cited presence in Paraguay]; 1912:263, pl. 34: fig. 1 [references in part; British Guiana (= Guyana): Demerara River, Tukeit, Potaro Landing, Tumatumari, Crab Falls, Konawaruk, Packeoo Falls, Rupununi, Gluck Island, Rockstone, Wismar].—Caporiacco, 1935:60 [British Guiana (= Guyana): Demerara, Great Falls of Mabura; common name].—Puyo, 1949:119 [reference, possible common name in French Guiana].—Boeseman, 1952:183 [Surinam: Surinam river at Kabelstation, Saramacca River, Lucie River, Upper Corantyne (= Corantijn) River, Kwntufu; common name].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*]. [Not Steindachner, 1876:79; Cope, 1878:684; Steindachner, 1879c:153; Perugia, 1897:24; Boulenger, 1900:2; Regan, 1905:189; Pellegrin, 1909:148; Bertoni, 1914:9; Pearson, 1924:26; Mago-Leccia, 1967:254, 1970:75.]

Curimatus surinamensis Steindachner, 1910:267 [type locality: Surinam: upper Surinam (River)].—Femández-Yépez, 1948:73 [reference].—Vari, 1989a: tables 2, 3 [assignment to *Cyphocharax*]. [New synonymy.]

Curimata spilura.—Eigenmann and Allen, 1942:292 [references in part, not cited occurrence in Paraguay basin].—Fowler, 1950:292 [references, in part; not cited occurrence in Bolivia, Paraguay, and Peru].—Géry and Planquette, 1982:68, fig. 9 [French Guiana: Maroni River basin, Saut Gostou; Corossy]; 1983:66 [French Guiana: Maroni River basin, Saut Singatéu]. [? Lasso, 1988:134; Machado-Allison, 1990:414; not Bertoni, 1939:54; Fowler, 1940b:98; Ringuet, 1975:72.]

Pseudocurimata spilura.—Femández-Yépez, 1948:49 [cited distribution in part, Essequibo River of British Guiana (= Guyana); not cited presence in Río Orinoco].—Fowler, 1975:373 [literature citation].

Curimatus (Cyphocharax) spilurus spilurus.—Géry, 1965:123 [Surinam: Rikanau].

Curimata surinamensis.—Fowler, 1975:370 [reference].

Curimata cf. spilura.—Ferreira et al., 1988:344 [Brazil: Roraima, Rio Macajá, Paredão Island; food habits].

DIAGNOSIS.—*Cyphocharax spilurus* is distinguished from its congeners by the combination of 30 to 34 scales in the lateral line to the hypural joint, the complete poring of the laterosensory canal system on the body, the 30 to 32, typically 31 vertebrae, the relative body depth (0.31–0.37 of SL), the relative depth of the caudal peduncle (0.12–0.13 of SL), the relative length of the postorbital portion of head (0.33–0.39 of HL), the relative length of the head (0.25–0.31 of SL), the

relative width of the orbit (0.32–0.38 of HL), the absence of multiple series of longitudinal dark stripes or small dark spots in longitudinal rows on the body, the absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, the absence of a stripe of dark pigmentation across the middle rays of the caudal fin in moderate to large-sized specimens, the reticulate pattern on the body in adults, and the possession of 9 branched dorsal-fin rays.

DESCRIPTION.—Body moderately elongate, moderately compressed laterally in specimens of all ages. Dorsal profile of head distinctly convex from upper lip to vertical line through posterior 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, convexity slightly more pronounced in larger specimens; straight and posteroventrally slanted at base of dorsal fin, straight to gently convex from base of last dorsal-fin ray to caudal peduncle. Middorsal surface of body between tip of supraoccipital spine and origin of dorsal fin ranging from transversely rounded to distinctly grooved longitudinally, entire range of variation present in single population samples; smoothly rounded transversely posterior to dorsal fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region obtusely flattened transversely, with median series of scales not enlarged relative to scales on adjoining ventrolateral portions of body. Obtuse median keel posterior to pelvic fin origin. Secondary obtuse keel on each side of postpelvic portion of body about one scale dorsal of ventral midline.

Greatest body depth at origin of dorsal fin, depth 0.31–0.37 [0.32]; snout tip to origin of dorsal fin 0.48–0.53 [0.49]; snout tip to origin of anal fin 0.79–0.85 [0.80]; snout tip to origin of pelvic fin 0.53–0.59 [0.54]; snout tip to anus 0.75–0.81 [0.76]; origin of dorsal fin to hypural joint 0.53–0.58 [0.57]. Distal margin of dorsal fin slightly rounded; longest anterior ray approximately three times length of ultimate ray. Distal margin of pectoral fin obtusely pointed in profile distally; length of pectoral fin 0.19–0.24 [0.20], extends approximately one-half distance to vertical line through origin of pelvic fin. Distal margin of pelvic fin pointed; length of pelvic fin 0.21–0.25 [0.21], tip reaches approximately three-quarters of distance to anus in most individuals, somewhat longer in some specimens. Caudal fin forked. Adipose fin well developed. Distal margin of anal fin slightly emarginate, anteriormost branched rays two and one-half times length of ultimate ray. Least depth of caudal peduncle 0.12–0.13 [0.12].

Head obtusely pointed anteriorly in profile; head length 0.25–0.31 [0.26]; upper jaw slightly longer than lower, mouth subterminal; snout length 0.28–0.34 [0.31]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.32–0.38 [0.35]; adipose eyelid present,

moderately developed, with vertically ovoid opening over center of eye, opening more restricted in larger specimens; length of postorbital portion of head 0.33–0.39 [0.37]; gape width 0.23–0.29 [0.24]; interorbital width 0.38–0.44.

Pored lateral-line scales from supracleithrum to hypural joint 30 to 34 [32]; all scales of lateral line pored, canals in lateral-line scales straight; 3 to 5 series of pored scales extend beyond hypural joint onto caudal-fin base; $5\frac{1}{2}$ to $6\frac{1}{2}$ [$5\frac{1}{2}$] 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 (iii,9 less common; when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or iii,7 (iii,7 less common; when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 16 [13]; pelvic-fin rays i,8 [i,8].

Total vertebrae 30 (2), 31 (108), 32 (3).

COLOR IN LIFE.—(Based on observations on specimens collected in the Corantijn River, Nickerie District, Surinam, December 1979 and August 1980.) Overall coloration of head and body bright silver, with somewhat purplish sheen dorsally in some specimens. A very dark, longitudinally elongate spot on midlateral surface of caudal peduncle. Dorsal and caudal fins with a faint yellow coloration, other fins hyaline.

COLOR IN ALCOHOL.—Specimens retaining guanine on scales silvery, darker on dorsal portions of head and body. Specimens lacking guanine on scales with ground coloration tan to light brown. Upper lip and dorsal portions of head dusky. Body darker on dorsal and dorsolateral surfaces. Scales outlined by a pattern of dark small chromatophores; degree of development of pattern varying both within and between population samples; forming a distinct reticulate pattern in some individuals (Figure 75), but not notable in others (Figure 77). Dark spot on midlateral surface of caudal peduncle and base of middle rays of caudal fins. Spot typically horizontally elongate in adults, albeit somewhat more rotund in smaller specimens and in adults in some population samples. Spot in

most specimens very dark, but relatively faint in individuals of some populations. All fins ranging from hyaline to dusky, degree of pigmentation correlated with degree of overall pigmentation.

DISTRIBUTION.—Río Cuyuni in Guyana and eastern Venezuela, coastal rivers of the Guianas from the Essequibo River of Guyana to Fleuve Mana of French Guiana, upper Rio Branco in Brazil, and possibly various localities in Río Orinoco and upper Rio Negro (see under "Remarks" below, Figure 74).

COMMON NAME.—Maka Fisi (Surinam) (Boeseman, 1952:183); Coumarou (French Guiana) (Puyo, 1949:119); Cuticuru (Guyana) (Caporiacco, 1935:60).

LIFE HISTORY.—Ferreira et al. (1988:344) cited what is likely this species (see comments below) in the upper Rio Branco as a detritivore that reproduces in May.

REMARKS.—Günther (1864:288) described *Curimatus spilurus* (= *Cyphocharax spilurus* of this study) on the basis of two specimens collected in the "Essequibo" (= Essequibo River, Guyana; Figure 74, locality 3). He noted "The two specimens on which I have founded this species differ most remarkably in the form of the body, although they agree in every other point, so that there can be no doubt that they are of one species. One has the body elevated like a *C. cyprinoides*, its depth being two-fifths of the total length (without caudal); the other has the body oblong, its depth being contained thrice and a third in the total. Both are of the same length."

An examination of the two specimens used by Günther in his description reveals that the syntype series was indeed complex. The "oblong" specimen cited by Günther as having a body depth "thrice and a third in the total length (without caudal)" is designated as the lectotype of *Curimatus spilurus* (BMNH 1864.1.21:70). The paralectotype (BMNH 1864.1.21:71), the specimen with the body elevated like "a *C. cyprinoides*, its depth being two-fifths of the total length (without caudal)" is an individual of *Cyphocharax helleri*. The relative body depth of the paralectotype (0.42 of SL) falls within the range for *C. helleri* (0.38–0.45 of SL), but is outside that for *C. spilurus*

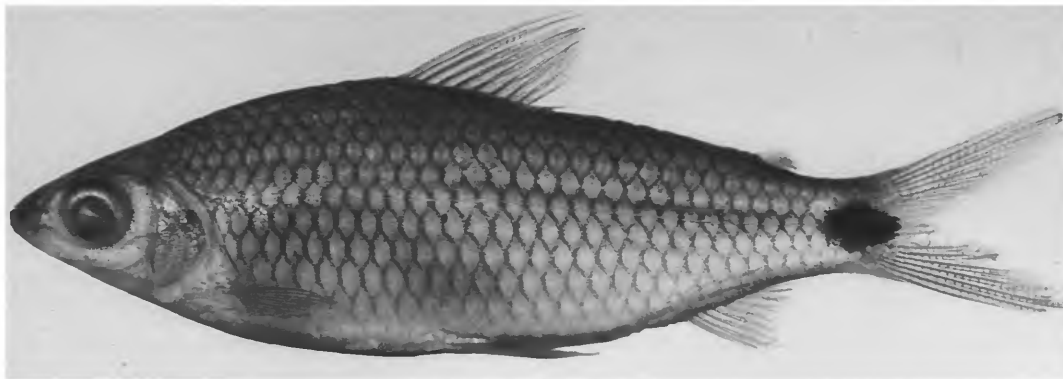


FIGURE 75.—*Cyphocharax spilurus*, AMNH 72112, 56.9 mm SL; Guyana, Essequibo, north bank of Mazaruni River.

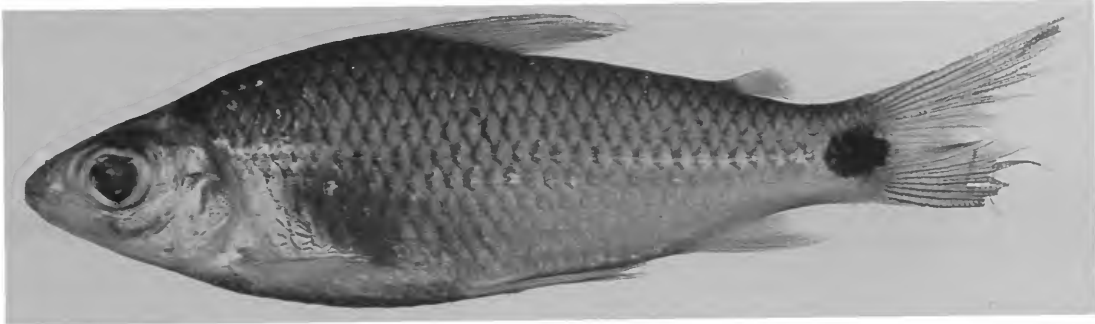


FIGURE 76.—*Cyphocharax spilurus*, USNM 308845, 76.8 mm SL; Surinam, Surinam River basin, Gran Mau Creek, at right bank of Gran Rio, 1 km NE of Doombaai Village, about 13 km SE of Djoemoe Village.

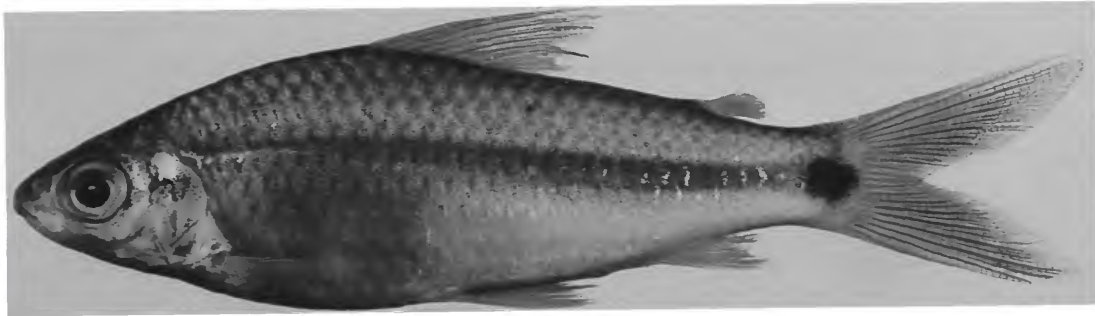


FIGURE 77.—*Cyphocharax spilurus*, USNM 269984, 48.7 mm SL; Venezuela, Territorio Federal Amazonas, Departamento Ature, Río Cataniapo, where crossed by road from Puerto Ayacucho to Samariapo.

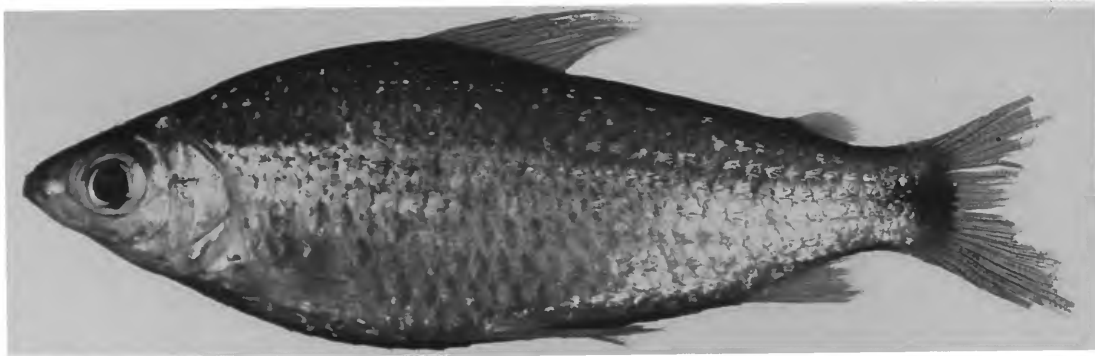


FIGURE 78.—*Cyphocharax spilurus*, USNM 268005, 83.3 mm SL; Brazil, Roraima, Rio Uraricoera, Ilha de Maraca, Igarapé do Cujobim.

(0.31–0.37 of SL). Furthermore the spot of pigmentation on the midlateral surface of the caudal peduncle is rotund in the paralectotype, a condition typical of *C. helleri* but which contrasts, with the more horizontally elongate spot typical of *C. spilurus* in the type region.

Steindachner (1910:267) described *Curimatus surinamensis* based on four specimens collected in the upper Surinam river of

Surinam (Figure 74, locality 4). Unfortunately, repeated searches by myself and other researchers through the collections of the Naturhistorisches Museum Wien (NMW) have not located the syntypes of the species. Steindachner (1910:268) suggested that the “closest related species” [my translation] of his *Curimatus surinamensis* was *C. spilurus*, but neither contrasted those two nominal forms nor discussed why he

thought his material represented a new species. The evaluation of the validity of Steindachner's species is complicated by his non-standard method of expressing many body proportions as a function of head rather than standard length. The data in the original description of *Curimatus surinamensis* expressed as a proportion of standard length, the presented meristic characters, and those proportional characters that could be approximated based on conversions from proportions of head length to proportions of standard length, agree with corresponding features for what is herein considered as *Cyphocharax spilurus* (Table 13). A series of specimens from the Surinam River system (USNM 308845), the type locality for *Curimatus surinamensis*, also agree well with the original description of *C. spilurus* (Table 13; Figure 76), the lectotype of *Cyphocharax spilurus*, and with specimens of *C. spilurus* from across the species range. In light of the agreement in those features and others described in the original description of *Curimatus surinamensis*, that species is herein placed into the synonymy of *Cyphocharax spilurus*.

Although *C. spilurus* has been reported from a number of drainage systems from the Río Orinoco to the Río de La Plata, its actual range appears much more restricted. The species is evidently limited to the coastal rivers of the Guianas between the Essequibo of Guyana and the Mana of French Guiana together with the upper Rio Branco in Brazil, the upper Rio Negro in Brazil and Venezuela, and scattered sites in the Río Orinoco system.

Various authors cited *Cyphocharax spilurus* from the Río Orinoco system (e.g., Steindachner, 1879c:153, Schultz, 1944:250; Lasso, 1988:134). The vast majority of the series of *spilurus*-like *Cyphocharax* specimens from the Río Orinoco have proved to be other species (*oenas*, *meniscaprorus*). One sample from the Río Guariquito in the central portions of the Venezuelan Llanos (USNM 309286) may represent a population of *Cyphocharax spilurus*. Unfortunately a definitive identification is impossible because individuals in the sample are all relatively small. It is noteworthy that the stream where the specimens were collected is unusual for the central portions of the Río Orinoco basin, being a clearwater stream in a region otherwise largely characterized by white-water systems. *Cyphocharax spilurus* also occurs in scattered locations in the upper portions of the Río Orinoco basin in Amazonas state of Venezuela and the upper Rio Negro system in both Brazil and Venezuela. Most, if not all, of the localities from which the species is known in that region are black-water systems. *Cyphocharax spilurus* is not known to occur in white-water systems, the predominant water type within the Orinoco basin. Thus it is unlikely that the specimens serving as the basis for many previous citations of *C. spilurus* in the central Río Orinoco basin were actually that species.

Several lots from the upper Rio Branco and Rio Negro in Brazil (see "Material Examined" below) agree with samples of *Cyphocharax spilurus* from the coastal rivers of the Atlantic

drainages of the Guianas in all examined meristic and morphometric features, although lacking the dark pigmentation pattern of scale reticulations and with the midlateral spot on the caudal peduncle not as dark as in population samples from the Guianas. These samples are tentatively considered to represent *C. spilurus*.

As noted above the type series of *Curimatus spilurus* is complex. That factor combined with brevity of the original description, and the relatively subtle differences separating *Cyphocharax spilurus* from some congeneric species with dark midlateral spots on the caudal peduncle resulted in incorrect citations of the species from various portions of the continent. Steindachner (1876:79), Cope (1878:684), Eigenmann and Eigenmann (1889:419), Perugia (1897:24), Regan (1905:189), Fowler (1906:297), Pellegrin (1909:148), Pearson (1924:26, 1937:109), and Géry (1964:36) cited *C. spilurus* (in various genera or subgenera) from various localities in the central and western portions of the Amazon basin. The specimens cited by Cope (1878), Eigenmann and Eigenmann (1889), and Fowler (1906) are *Cyphocharax spiluropsis*. Although the specimens that served as the basis for purported extralimital records by the other cited authors have not been examined, the specimens examined during this study make it most reasonable to assume that citations of *C. spilurus* from the western portions of the Amazon basin (Steindachner, 1876; Pellegrin, 1909; Géry, 1964) refer instead to *C. spiluropsis* as do those citing *C. spilurus* in the upper Rio Madeira system (Perugia, 1897; Pearson, 1924, 1937).

Boulenger (1900:2) followed by Bertoni (1914:9, 1939:54), Pearson (1937:54), and Ringuet (1975:72) reported *Curimatus spilurus* from the Río Paraguay system. As noted by Vari (1991:102) the specimen that was the basis for the Boulenger record (BMNH 1900.4.14:35) is in poor condition, but appears to be a specimen of *Steindachnerina brevipinna* (Eigenmann and Eigenmann). Citations of *Curimatus spilurus* from the Paraguay basin subsequent to Boulenger appear to be reiterations of his record and were assumed by Vari (1991) to refer to *Steindachnerina brevipinna*.

MATERIAL EXAMINED.—778 specimens (161, 32.4–107.0).

GUYANA. Essequibo (= Essequibo River), BMNH 1864.1.21:70, 1 (62.6, lectotype of *Curimatus spilurus*; see "Remarks" above with respect to paralectotype). *Essequibo*: Wismar, USNM 93436, 1 (63.4); USNM 311126, 1 (85.2). *Essequibo* River, Rockstone, USNM 66140, 5 (45.9–54.4). Lower Potaro River, Tukeit, USNM 66139, 2 (49.5–83.2); MCZ 30043, 1 (81.0). Demerara River, AMNH 13343, 1 (71.8). S shore Cuyuni River, approx. 2 mi (= 3.2 km) from Kartabo Point, AMNH 72077, 1 (63.1). Abandoned stone quarry, N bank of Mazaruni River, AMNH 72112, 1 (56.9). *Rupununi*: Kumaka Swamp, MCZ uncat., 1 (107.0). Mandari River, USNM 311131, 6. *Mazaruni-Potaro*: Sandbar on N bank of Cuyuni River, just upstream of Caowry Creek, AMNH 73025, 1 (55.3); AMNH 72969, 1 (49.4).

SURINAM. *Nickerie*: Sisa Creek, approx. 700 m down-

TABLE 13.—Morphometrics and meristics of (A) lectotype of *Curimatus spilurus* (BMNH 1864.1.21:70); (B) syntypes of *Curimatus surinamensis*, specimens evidently lost (see "Remarks" in species account for *Cyphocharax spilurus*); data in table taken from information in original description (Steindachner, 1910), dashes indicate data not provided in original description; (C) population sample of *Cyphocharax spilurus* originating in the Surinam River drainage, the type drainage system for *Curimatus surinamensis* (USNM 308845); and (D) all examined specimens of *Cyphocharax spilurus* 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	62.6	? ^a	62.0–76.0	32.4–107.0
1. Greatest body depth	0.32	0.31–0.33	0.32–0.35	0.31–0.37
2. Snout to dorsal-fin origin	0.49	–	0.48–0.51	0.48–0.53
3. Snout to anal-fin origin	0.80	–	0.80–0.82	0.79–0.85
4. Snout to pelvic-fin origin	0.54	–	0.53–0.56	0.53–0.59
5. Snout to anus	0.76	–	0.75–0.78	0.75–0.81
6. Origin of dorsal fin to hypural joint	0.57	–	0.52–0.55	0.53–0.58
7. Pectoral-fin length	0.20	0.19 ^b	0.19–0.22	0.19–0.24
8. Pelvic-fin length	0.21	0.23 ^b	0.21–0.24	0.21–0.25
9. Caudal peduncle depth	0.12	0.12–0.13 ^b	0.12	0.12–0.13
10. Head length	0.26	0.27–0.29	0.27–0.29	0.25–0.31
11. Snout length	0.31	0.29–0.32	0.32–0.34	0.28–0.34
12. Orbital diameter	0.35	0.33–0.35	0.33–0.35	0.32–0.38
13. Postorbital length	0.37	–	0.34–0.37	0.33–0.39
14. Interorbital width	–	–	0.40–0.44	0.38–0.44
MERISTICS				
Lateral-line scales	32	33	31–33	30–34
Scale rows between dorsal-fin origin and lateral line	5½	5½	5½–6	5½–6½
Scale rows between anal-fin origin and lateral line	5	5 ^c	4½	4½–5½
Branched dorsal-fin rays	9	9 ^d	9	9
Branched anal-fin rays	7	7 ^e	7	7
Total pectoral-fin rays	13	–	14–16	13–16
Branched pelvic-fin rays	8	8 ^f	8	8
Vertebrae	31	–	31–32	30–32

^a Steindachner (1910) stated with respect to the type series of *Curimatus surinamensis* "measuring 7.6–8.6 cm including the tail fin (7.6–8.6 excluding the caudal fin)" [my translation]; obviously incompatible measurements. No other data are provided that indicates which is correct range of lengths.

^b Estimate based on proportions given by Steindachner in original description for head and fin lengths and caudal peduncle depth.

^c Steindachner listed scales below lateral line to pelvic fin (? insertion) rather than to anal-fin origin as in this study.

^d Steindachner listed 11 dorsal-fin rays, presumably including 2 unbranched rays.

^e Steindachner listed 9 anal-fin rays, presumably including 2 unbranched rays.

^f Steindachner listed 9 pelvic-fin rays, presumably including 1 unbranched ray.

stream of bridge on road from Amotopo to Camp Geologie (approx. 03°42'N, 57°42'W), USNM 225390, 15 (8, 54.7–77.3; 2 specimens cleared and counterstained for cartilage and bone). Kabalebo River, stream next to Camp Anjoemara (approx. 4°50'N, 57°26'W), USNM 225404, 5 (2, 63.3–69.4). Stream near Machine Park, at km 212 along road from Amotopo to Camp Geologie (approx. 3°30'N, 57°34'W), USNM 225405, 9 (3, 65.8–70.7). Corantijn River at km 180, side channel of main river along Surinamese Shore (approx. 5°8'N, 57°18'W), USNM 225407, 99 (10, 33.7–69.2). Stream entering south bank of Lucie River, approx. 6 km upstream of Ferry Crossing

of Amotopo to Camp Geologie Road (approx. 3°36'N, 57°37'W), USNM 225389, 19 (5, 67.5–75.1). Stream on S side of Lucie River approx. 200 m downstream of ferry crossing of Amotopo to Camp Geologie Road (approx. 3°35'N, 57°39'W), USNM 225327, 42. Matapi Creek, approx. 1 km upstream of mouth into Corantijn River (approx. 5°00'N, 57°16'W), USNM 225332, 78. Creek on S shore of Corantijn River about 2 km upstream of mouth of Matapi (approx. 5°03'N, 57°17'W), USNM 225326, 25. Kamp Creek, 100 m N of turnoff to Camp Geologie along road from Amotopo to Camp Geologie (approx. 4°49'N, 57°28'W), USNM 225388, 15 (4, 59.2–92.0).

Corantijn River, pool in front of Camp Hydro (approx. 3°42'N, 57°58'W), USNM 225391, 52 (4, 58.9–62.6). Stream entering Corantijn River at approx. km 385, slightly N of Tiger Falls (approx. 4°00'N, 58°02'W), USNM 225333, 1; USNM 225406, 45. Small creek on E side of Corantijn River near Amotopo boat landing (approx. 3°33'N, 57°40'W), USNM 225328, 10. Small Creek on E side of Corantijn River about 2 km upstream of mouth of Moskita Creek (approx. 3°27'N, 57°37'W), USNM 225329, 4. Small tributary to Dalbana Creek, approx. 3 km upstream of where Dalbana Creek is crossed by Amotopo to Camp Geologie Road (approx. 4°20'N, 57°37'W), USNM 225331, 22. Small stream entering Kabalebo River approx. 200 m upstream of mouth of Dalbana Creek (approx. 4°47'N, 57°26'W), USNM 225330, 9. Surinam River basin, Gran Mau Creek, at right bank of Gran Rio, 1 km NE of Doombaai Village, about 13 km SE of Djoemoe Village, USNM 308845, 20 (17, 62.0–76.0).

FRENCH GUYANA. Upper portion of Fleuve Maroni, GC, 1 (103.8). Upper portion of Fleuve Mana, GC, 2 (91.3–94.8).

VENEZUELA. *Bolívar*: Río Cuyuni, Isla de Jacobo, near Raudal de Kinotovaca, MBUCV V-9492, 32 (18, 41.8–68.5); MBUCV V-10197, 96 (19, 43.6–56.3); USNM 295588, 4 (3, 46.5–72.0). Río Cuyuni, 40 km S of El Dorado, near Raudal de Kinotovaca, USNM 295591, 4. Río Cuyuni, Raudal de Pararuvaca, MBUCV V-10315, 3 (32.4–59.7). Río Cuyuni, pool isolated from main river near Raudal de Pararuvaca, USNM 295590, 4. Small caño connecting with Río Orinoco immediately south of El Burro (approx. 6°11'N, 67°25'W), USNM 269922, 4 (38.5–62.3). *Territorio Federal Amazonas*: Río Cataniapo where crossed by road from Puerto Ayacucho to Samariapo (approx. 5°36'N, 67°37'W), USNM 269984, 1 (48.7). Río Cataniapo, Raudal Rabipelado, MBUCV V-15199, 5 (3, 46.7–53.3). Río Orinoco, Raudales de Ature, E shore (approx. 5°36'N, 67°37'W), USNM 269923, 1 (60.2). Small caño crossed by road from Puerto Ayacucho to Samariapo, 2 km S of Mirabel (approx. 5°25'N, 67°46'W), USNM 269985, 1. San Fernando de Atabapo, Laguna Titi, MBUCV V-8510, 1 (59.7). Departamento Río Negro, small caño off Caño Urami, just upstream of Santa Lucia (approx. 1°17'N, 66°51'W), USNM 269921, 2. *Guarico*: Río Guariquito, on government reserve SSE of Calabozo (approx. 8°35'N, 67°15'W), USNM 309286, 8 (34.7–42.8).

BRAZIL. *Roraima*: Rio Uraricoera, opposite Ilha de Maraca, Igarapé do Cujobim, rainforest stream (approx. 3°20'N, 61°30'W), USNM 268005, 7 (71.8–83.3). Cachoeira do Bem Querer, Igarapé do Bota Panela (approx. 2°0'N, 61°0'W), USNM 268011, 78 (10, 54.8–65.8). Cachoeira do Bem Querer, cataract pool (approx. 2°0'N, 61°0'W), USNM 268008, 27 (10, 61.3–81.0). *Amazonas*: Rio Ararará, beach near mouth into Rio Negro (approx. 0°20'S, 63°40'W), USNM 311097, 2. Rio Marauia, Cachoeira do Bicho-açu, cataract pools (approx. 0°20'S, 65°20'W), USNM 311102, 2.

Cyphocharax meniscaprorus, new species

FIGURES 79, 80

DIAGNOSIS.—*Cyphocharax meniscaprorus* is distinguished from its congeners by the combination of 29 to 32 lateral-line scales to the hypural joint, the complete poring of the lateral line in all but juveniles, the 30 to 32, typically 31 vertebrae, the relative body depth (0.33–0.39 of SL), the relative depth of the caudal peduncle (0.12–0.14 of SL), the relative length of the postorbital portion of head (0.34–0.39 of HL), the relative length of the head (0.31–0.34 of SL), the relative width of the orbit (0.32–0.36 of HL), the absence of multiple series of longitudinal dark stripes or small dark spots in longitudinal rows on the body, the absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a triangular patch of dark pigmentation on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, the absence of a stripe of dark pigmentation across the middle rays of the caudal fin in moderate to large-sized specimens, the lack of a reticulate pattern on the body in adults, the relatively rotund anterior dorsal profile of the head, and the possession of 9 branched dorsal-fin rays.

DESCRIPTION.—Body moderately elongate, more so in larger specimens; moderately compressed laterally in all examined specimens. Dorsal profile of head distinctly convex from margin of upper lip to vertical line through posterior nostril, straight or very slightly convex from that line to posterior terminus of head. Dorsal profile of body smoothly curved from tip of supraoccipital spine to origin of dorsal fin; straight and slightly posteroventrally slanted at base of dorsal fin, very gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with barely distinct 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 barely flattened transversely, with median series of scales comparable in size to those on adjoining surfaces of body. Obtuse median keel posterior to pelvic-fin origin; secondary keels on the postpelvic portion of body not evident.

Greatest body depth at origin of dorsal fin, depth 0.33–0.39 [0.33]; snout tip to origin of dorsal fin 0.51–0.55 [0.52]; snout tip to origin of anal fin 0.82–0.87 [0.84]; snout tip to origin of pelvic fin 0.57–0.62 [0.57]; snout tip to anus 0.79–0.86 [0.80]; origin of dorsal fin to hypural joint 0.51–0.55 [0.55]. Distal margin of dorsal fin rounded; last unbranched and first branched dorsal-fin rays approximately three and one-half times length of ultimate ray. Distal margin of pectoral-fin profile somewhat pointed; length of pectoral fin 0.20–0.23 [0.22], extending to slightly beyond vertical line through origin of dorsal fin, about two-thirds of distance to origin of pelvic fin. Distal margin of pelvic fin slightly rounded; length of pelvic fin 0.22–0.26 [0.22], reaching nearly to anus in all examined specimens, falling distinctly short of origin of anal fin. Caudal fin forked. Adipose fin well developed. Distal margin of anal

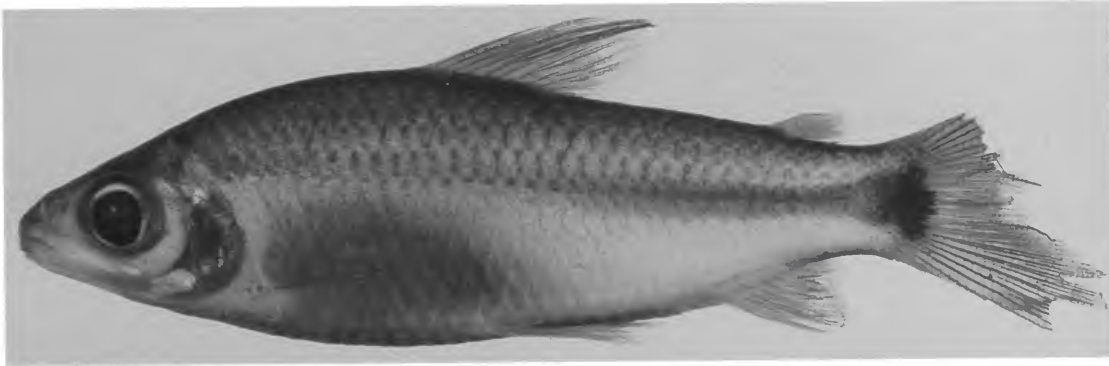


FIGURE 79.—*Cyphocharax meniscaprorus*, new species, holotype, MBUCV V-20333, 57.0 mm SL; Venezuela, Bolívar, Río Aro, about 3 km downstream from bridge at Rt. 19, about 85 km from Ciudad Bolívar (approx. 8°0'N, 64°15'W).

fin emarginate, anteriormost branched rays approximately two and one-half times length of ultimate ray. Least depth of caudal peduncle 0.12–0.14 (0.12 and 0.14 rare) [0.13].

Head profile rounded anteriorly, but pointed overall; head length 0.31–0.34 [0.31]; upper jaw longer than lower, mouth barely subterminal; upper lip somewhat fleshy; snout length 0.29–0.35 [0.30]; nostrils of each side very close, anterior irregularly circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.32–0.36 [0.35]; adipose eyelid present but poorly developed, with broad opening over eye; length of postorbital portion of head 0.34–0.39 [0.36]; gape width 0.23–0.27 [0.27]; interorbital width 0.40–0.45 [0.41].

Pored lateral-line scales from supracleithrum to hypural joint 29 to 32 [32]; all scales of lateral line pored, canals in lateral-line scales straight; 3 or 4 series of pored scales extend beyond hypural joint onto caudal-fin base; 5 or 5½ (5 rare) [5½] scales in transverse series from origin of dorsal fin to lateral line; 4½ or 5 (5 rare) [4½] 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 iii,7 (when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 15 [15]; pelvic-fin rays i,8 [i,8].

Total vertebrae 30 (5), 31 (18), 32 (5).

COLOR IN ALCOHOL.—All examined specimens lacking guanine on scales, overall ground coloration tan. Upper lip, snout, and dorsal portions of head with field of small dark chromatophores. Scattered larger dark chromatophores on dorsal half of opercle, and over infraorbital series posterior and posteroventral to orbit. Lateral, dorsolateral, and dorsal surfaces of body with field of small dark chromatophores; overall intensity of field more pronounced dorsally. Pigmentation on those portions of body form irregular reticulate pattern. Deep-lying dusky stripe extending along midlateral surface of body from below dorsal fin to hypural joint in specimens under 40 mm SL; stripe extending forward to supracleithrum in two larger specimens examined (47.9–57.0 mm SL); stripe most

obvious posteriorly. Deep-lying stripe becoming notably wider on posterior portion of caudal peduncle. Wider portion of deep-lying stripe overlain by roughly triangular patch of more superficially located dark chromatophores; patch of superficial chromatophores extending posteriorly onto basal portions of middle rays of caudal fin; posterior portion of superficial patch of chromatophores distinctly darker in some individuals, giving appearance of vertical bar on basal portion of caudal fin. Dorsal, adipose, and caudal fins somewhat dusky, with scattered small, dark chromatophores. Anal, pectoral, and pelvic fins hyaline.

DISTRIBUTION.—Known only from the type locality, the Río Aro of the Río Orinoco basin (Figure 80, locality 1).

ETYMOLOGY.—The species name, *meniscaprorus*, from the Greek *meniskos*, crescent, and *prora*, prow, refers to the rounded anterior portion of the head in this species.

ECOLOGY.—The type locality is a stream in gallery forest with muddy water with the bottom consisting of sand, gravel, boulder, and detritus.

TYPE MATERIAL EXAMINED.—31 specimens (31, 29.4–57.0).

HOLOTYPE.—VENEZUELA. *Bolívar*: Río Aro, about 3 km downstream from bridge at Rt. 19, about 85 km from Ciudad Bolívar (approx. 8°0'N, 64°15'W), collected by J. Baskin et al., 4 Nov 1979, MBUCV V-20333, 1 (57.0).

PARATYPES.—VENEZUELA. *Bolívar*: Río Aro, about 3 km downstream from bridge at Rt. 19, about 85 km from Ciudad Bolívar (approx. 8°0'N, 64°15'W); 30 specimens collected with holotype: MBUCV V-20334, 15 (29.4–37.8); USNM 235484, 15 (30.0–47.9; 2 specimens cleared and counterstained for cartilage and bone).

NON-TYPE MATERIAL EXAMINED.—151 specimens (11, 22.1–32.9).

VENEZUELA. *Bolívar*: Río Aro, about 3 km downstream from bridge at Rt. 19, about 85 km from Ciudad Bolívar (approx. 8°0'N, 64°15'W) (collected with holotype), USNM 309288, 75 (10, 22.1–29.8); MBUCV V-20335, 75; USNM 235461, 1 (32.9).

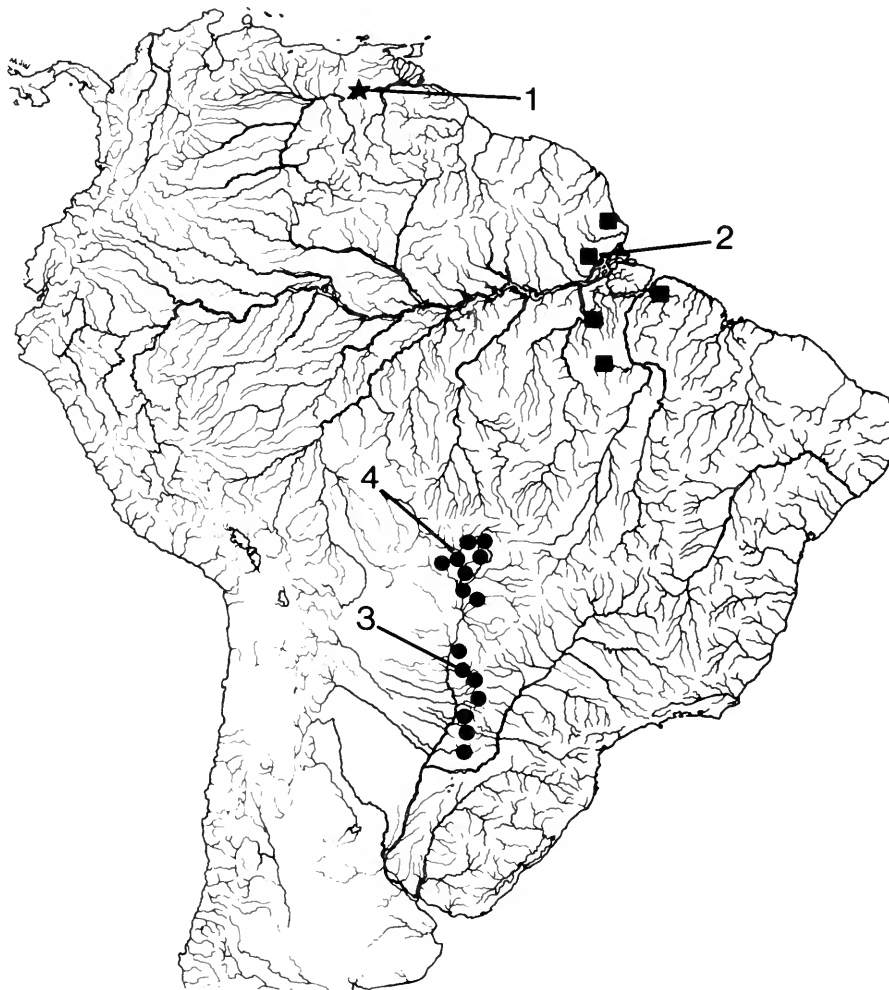


FIGURE 80.—Map of South America showing geographic distribution of *Cyphocharax meniscaprorus* (star; 1 = type locality), *Cyphocharax gouldingi* (squares; 2 = type locality), and *Cyphocharax gillii* (filled in circles; 3 = type locality of *Curimatus gillii*; 4 = type locality of *Curimatella rehni*) (some symbols represent more than one locality or lot of specimens).

Cyphocharax gouldingi, new species

FIGURES 80–82

DIAGNOSIS.—*Cyphocharax gouldingi* is distinguished from its congeners by the combination of 30 to 33 lateral-line scales to the hypural joint, the completely pored laterosensory canal system on the body, the 31 or 32, typically 31 vertebrae, the relative body depth (0.38–0.42 of SL), the relative depth of the caudal peduncle (0.12–0.14 of SL), the relative length of the postorbital portion of the head (0.34–0.40 of HL), the relative length of the head (0.27–0.31 of SL), the relative width of the orbit (0.32–0.38 of HL), the absence of multiple series of longitudinal dark stripes or small dark spots in longitudinal rows on the body, the absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a rotund patch

of dark pigmentation about one-half the diameter of the orbit on the midlateral surface of the caudal peduncle not preceded by 4 or 5 large midlateral dark spots on the body, the absence of a stripe of dark pigmentation across the middle rays of the caudal fin in moderate to large-sized specimens, the lack of a reticulate pattern on the body in adults, and the possession of 9 branched dorsal-fin rays.

Cyphocharax gouldingi is very similar in morphometric and meristic features to *C. helleri* and *C. microcephalus* that also occur in the Guianas and adjoining areas. *Cyphocharax gouldingi* and *C. helleri* are sympatric at least in the Rio Cupixi system of Amapá state, Brazil. The two species are readily distinguished by the series of dark horizontal stripes along the lateral surface of the body in *C. helleri* that are absent in *C. gouldingi* (compare Figures 17 and 81). *Cyphocharax gould-*

ingi and *C. microcephalus* which have allopatric distributions, differ in the relative length of the postorbital portion of the head (0.34–0.40 of HL in *C. gouldingi* versus 0.42–0.47 in *C. microcephalus*) and in the absence in *C. microcephalus* of the large rotund spot of dark pigmentation on the midlateral surface of the caudal peduncle that occurs in *C. gouldingi*. They also differ, but less discretely, in the relative depth of the caudal peduncle (0.12–0.14 of SL in *C. gouldingi* versus 0.14–0.16 in *C. microcephalus*).

DESCRIPTION.—Body moderately elongate, somewhat compressed laterally. Dorsal profile of head slightly convex from tip of snout to vertical line through posterior nares, 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 posteroventrally slanted at base of dorsal fin, straight or gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with indistinct median keel immediately 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 obtuse lateral keels proximate to origin of pelvic fins, with irregular median series of scales. Median scale series proximate to origin of pelvic fins flanked on each side by series of scales that conform in shape to obtuse lateral angles of body wall. Scales of prepelvic region approximately of same size as on adjoining ventrolateral portions of body. Obtuse median keel posterior to pelvic-fin origin. Secondary 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 0.38–0.42 [0.42]; snout tip to origin of dorsal fin 0.50–0.54 [0.54]; snout tip to origin of anal fin 0.82–0.88 [0.87]; snout tip to origin of pelvic fin 0.55–0.59 [0.59]; snout tip to anus 0.79–0.84 [0.84]; origin of dorsal fin to hypural joint 0.55–0.60 [0.57]. Distal margin of dorsal fin straight or with anterior rays slightly longer; anterior branched rays two and three-quarters to slightly over three times length of ultimate ray. Pectoral fin pointed in profile; length of pectoral fin 0.20–0.25 [0.23], extends approximately to vertical line through origin of dorsal fin,

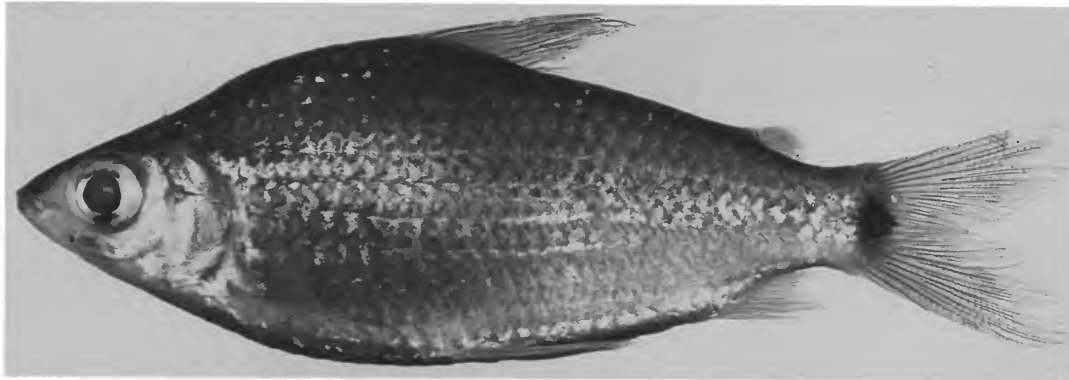


FIGURE 81.—*Cyphocharax gouldingi*, new species, holotype, MZUSP 41762, 86.7 mm SL; Brazil, Amapá, Rio Cupixi, along road to Serra Navio, mouth of rainforest stream (approx. 0°40'N, 51°40'W).

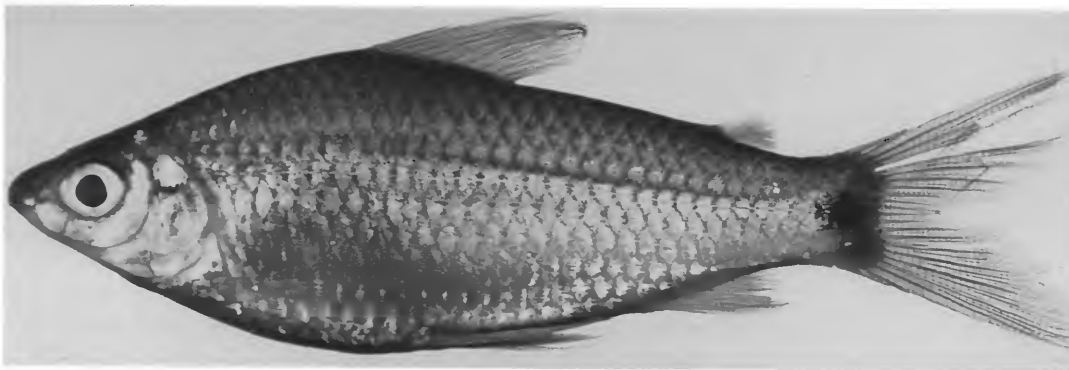


FIGURE 82.—*Cyphocharax gouldingi*, new species, USNM 268004, 55.3 mm SL; Brazil, Pará, Rio Xingu, Belo Monte.

about three-quarters of distance to origin of pelvic fin. Pelvic fin pointed in profile; length of pelvic fin 0.21–0.26 [0.24], reaches to or falls slightly short of anus. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, last unbranched and first branched rays about two and one-half times length of ultimate ray. Least depth of caudal peduncle 0.12–0.14 [0.12].

Head somewhat pointed anteriorly in lateral profile; head length 0.27–0.31 [0.31]; upper jaw longer than lower, mouth subterminal; snout length 0.27–0.32 [0.28]; nares of each side very close, anterior circular, posterior crescent-shaped with aperture partially closed by thin flap of skin separating nares; orbital diameter 0.32–0.38 [0.36]; adipose eyelid present, more developed anteriorly, with vertically ovoid opening over center of eye; length of postorbital portion of head 0.34–0.40 [0.36]; gape width 0.22–0.28 [0.25]; interorbital width 0.41–0.46 [0.42].

Pored lateral-line scales from supracleithrum to hypural joint 30 to 33 [31]; all scales of lateral line pored, canals in lateral-line scales straight; 3 or 4 series of pored scales extends beyond hypural joint onto caudal-fin base; 5 to 6 (6 rare) [5¹/₂] scales in transverse series from origin of dorsal fin to lateral line; 4¹/₂ or 5 (5 rare) [4¹/₂] scales in transverse series from lateral line to origin of anal fin.

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) [ii,7]; pectoral-fin rays 13 to 16 [16]; pelvic-fin rays i,8 or i,9 (i,9 in one specimen) [i,8].

Total vertebrae 31 (33), 32 (1).

COLOR IN ALCOHOL.—All specimens in type series retaining some guanine on scales, somewhat silvery to golden, darker on dorsal portions of head and body. Upper lip, snout, dorsal portion of opercle, and dorsal surface of head dark; head otherwise without distinct dark pigmentation. Scales on dorsal and dorsolateral surfaces of body outlined by varying developed darker pigmentation. Deep-lying midlateral stripe extending approximately from vertical line through origin of dorsal fin to caudal peduncle; stripe masked to varying degrees in specimens retaining guanine on midlateral surface of body. Dark rotund spot of dark pigmentation on midlateral surface of caudal peduncle; intensity of dark pigmentation in spot varies among individuals. Less intense fields of small dark chromatophores extending from dorsal and ventral margins of midlateral spot to dorsal and ventral margins of caudal peduncle; that secondary pigmentation absent in some individuals, most notably larger specimens from the Rio Capim system of northeastern Pará state in Brazil (MZUSP 20800). Dorsal and caudal fins dusky, with fin rays outlined by series of small dark chromatophores. Adipose and anal fin hyaline to dusky, latter fin with fin rays outlined by dark chromatophores when dusky. Pectoral and pelvic fins hyaline.

DISTRIBUTION.—Rivers of state of Amapá, and Rio Capim, Rio Tocantins, and lower Rio Xingu in state of Pará, Brazil (Figure 80).

ETYMOLOGY.—Named after Dr. Michael Goulding, collector of the type series, who has contributed greatly to our knowledge of the life history of many Amazonian species, and whose collecting efforts have resulted in large series of valuable specimens.

TYPE MATERIAL EXAMINED.—27 specimens (27, 62.3–86.9).

HOLOTYPE.—BRAZIL. *Amapá*: Rio Cupixi, along road to Serra Navio, mouth of rainforest stream (approx. 0°40'N, 51°40'W), collected by M. Goulding et al., Jan 1984; MZUSP 41762, 1 (86.7).

PARATYPES.—BRAZIL. *Amapá*: Rio Cupixi, along road to Serra Navio, mouth of rainforest stream (approx. 0°40'N, 51°40'W), collected by M. Goulding et al., Jan 1984, 26 specimens collected with holotype: USNM 268010, 13 (62.3–85.0; 1 specimen cleared and counterstained for cartilage and bone); MZUSP 41763, 13 (63.8–86.9).

NON-TYPE MATERIAL EXAMINED.—236 specimens (57, 47.3–112.2).

BRAZIL. *Amapá*: Rio Cupixi, along road to Serra do Navio, river channel (approx. 0°40'N, 51°40'W), USNM 267999, 10 (5, 76.8–84.3). Rio Cupixi, along road to Serra Navio, mouth of rainforest stream (approx. 0°40'N, 51°40'W), USNM 267998, 12 (8, 70.8–85.4). Rio Amapá, Cachoeira Grande, forest pool (approx. 2°10'N, 51°0'W), USNM 268006, 15 (7, 70.7–112.2). *Pará*: Rio Itacaiuna, Serra dos Carajás, Igarapé do Pojuca (approx. 5°30'S, 50°30'W), USNM 268009, 10 (5, 72.3–87.3); USNM 267992, 48 (10, 100.2–108.2). Rio Itacaiunas, Cachoeira Carreira Comprida (approx. 5°30'S, 50°30'W), USNM 268003, 4. Rio Xingu, Belo Monte, rocky pool (approx. 3°10'S, 51°50'W), USNM 268004, 25 (10, 47.3–56.6). Rio Apeú, Boa Vista, Município de Castanhal (Rio Capim system), MCZ 46114, 96 (6, 59.7–66.7); USNM 314608, 6 (58.3–69.7). Igarapé Apeú, Boa Vista, MZUSP 20800, 10.

Cyphocharax gillii (Eigenmann and Kennedy)

FIGURES 80, 83–86; TABLE 14

- Curimatus gillii* Eigenmann and Kennedy, 1903:510 [type locality: Paraguay: Arroyo Tremintina].—Vari, 1989a, tables 2, 3 [assigned to *Cyphocharax*].
Curimatus gillii.—Eigenmann, 1910:421 [reference].—Bertoni, 1914:9 [Paraguay].
Curimatella rehni Fowler, 1932:343, fig. [type locality: Brazil: Mato Grosso, Descalvados]; 1950:297, fig. 358 [literature compilation].—Ringuet, 1975:72 [Rio Paraguay system].—Vari, 1989a, tables 2, 3 [assigned to *Cyphocharax*]. [New synonymy].
Curimata gillii.—Pearson, 1937:109 [Paraguay].—Fowler, 1950:285 [literature compilation].—Ringuet, 1975:72 [Rio Paraguay system].—Géry et al., 1987:416, fig. 35 [in part, specimens from Paraguay: Concepcion, Laguna Negra, Estancia Laguna Negra; Riacho Postillon; not specimens from marécages (swamps) N of Coronel Oviedo].
Curimata gillii.—Bertoni, 1939:54 [Paraguay].

Apolinarella rehni.—Fernández-Yépez, 1948:22 [assignment to *Apolinarella*].—Fowler, 1975:363 [reference].

Rivasella gillii.—Fernández-Yépez, 1948:57 [assignment to *Rivasella*].

Rivasella gillii.—Fowler, 1975:374 [reference].

Cyphocharax cf. gillii.—Venere and Galetti, 1989:20, 21 [Brazil: Mato Grosso, Rio Paraguay basin, Rio Bento Gomes near Poconé; cytotaxonomy].

DIAGNOSIS.—*Cyphocharax gillii* can be distinguished from its congeners by the combination of 28 to 33 lateral-line scales to the hypural joint, the development of the pores along the entire lateral line in all but juveniles, the 29 to 31, typically 30 vertebrae, the relative body depth (0.36–0.45 of SL), the relative depth of the caudal peduncle (0.13–0.15 of SL), the relative length of the postorbital portion of head (0.36–0.42 of HL), the relative length of the head (0.28–0.33 of SL), the relative width of the orbit (0.30–0.37 of HL), the absence of multiple series of longitudinal dark stripes or small dark spots in longitudinal rows on the body, the absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a round patch of dark pigmentation about equal in size to diameter of the orbit on the midlateral surface of the caudal peduncle with an irregular border reaching to the dorsal and ventral margins of the caudal peduncle in juveniles, the absence of 4 or 5 large midlateral dark spots on the body, the absence of a stripe of dark pigmentation across the middle rays of the caudal fin in moderate to large-sized specimens, the lack of a reticulate pattern on the body in adults, and the possession of 9 branched dorsal-fin rays.

Among the curimatids known from the Río Paraguay basin *Cyphocharax gillii* can be most easily confused with *C. spilotus* which has a broad distribution in that system. The two species can, however, be distinguished by the 9 branched dorsal fin rays of *C. gillii* contrary to the 10 to 12 branched fin rays in *C. spilotus*. *Cyphocharax gillii* has 29 to 31 vertebrae with 91% of the 107 radiographed specimens having 29 or 30 vertebrae. *Cyphocharax spilotus* has 30 to 32 vertebrae, a range partially overlapping that of *C. gillii*; however, in *C. spilotus* 87% of the 72 radiographed specimens have 31 or 32 vertebrae. Finally, the spot of dark pigmentation on the midlateral surface of the caudal peduncle is rounded in *C. gillii* and typically horizontally elongate in *C. spilotus*, although somewhat diffuse in the largest examined specimens of the latter species.

DESCRIPTION.—Body moderately elongate, somewhat compressed laterally at all sizes. Dorsal profile of head convex from tip of upper lip to vertical line through anterior nostril, straight or very 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; nearly straight and posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with 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 somewhat flattened transversely, without discrete median series of scales. Obtuse median keel

posterior to pelvic-fin origin. Secondary 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 0.36–0.45 [0.38]; snout tip to origin of dorsal fin 0.50–0.54 [0.53]; snout tip to origin of anal fin 0.82–0.87 [0.83]; snout tip to origin of pelvic fin 0.53–0.59 [0.57]; snout tip to anus 0.76–0.81 [0.80]; origin of dorsal fin to hypural joint 0.54–0.61 [0.56]. Distal margin of dorsal fin slightly convex; last unbranched and first branched rays two and three-quarters to three times length of ultimate ray. Pectoral fin pointed in profile; length of pectoral fin 0.20–0.23, extending about two-thirds distance to vertical line through origin of pelvic fin. Margin of pelvic fin pointed; length of pelvic fin 0.23–0.26, reaching about two-thirds distance to origin of anal fin. Caudal fin forked, lobes pointed. Adipose fin well developed. Anal fin emarginate. Least depth of caudal peduncle 0.13–0.15.

Head profile pointed overall, rounded anteriorly; head length 0.28–0.33 [0.30]; upper jaw slightly longer than lower, mouth slightly subterminal; snout length 0.27–0.32 [0.31]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.30–0.37 [0.32]; adipose eyelid present but only moderately developed, with nearly rotund opening over center of eye; length of postorbital portion of head 0.36–0.42 [0.39]; gape width 0.21–0.27 [0.24]; interorbital width 0.42–0.48 [0.43].

Pored lateral-line scales from supracleithrum to hypural joint 28 to 33 [30]; all scales of lateral line pored in specimens above 27 mm SL, smaller specimens with pores developed to varying degrees along lateral line, canals in pored lateral-line scales straight; 2 to 4 series of pored scales extending beyond hypural joint onto caudal-fin base; 5¹/₂ to 6¹/₂ [5¹/₂] scales in transverse series from origin of dorsal fin to lateral line; 4¹/₂ or 5 [4¹/₂] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or iii,9 (iii,9 rare; when three unbranched rays present, first very short) [ii,9]; anal-fin rays ii,7 or iii,7 (iii,7 rare; when three unbranched rays present, first very short) [ii,7]; pectoral-fin rays 13 to 15; pelvic-fin rays i,8 [i,8].

Total vertebrae 29 (5), 30 (92), 31 (10).

COLOR IN LIFE.—Photographs in Sazima (1988) show that the fish in life is silvery with a dark spot obvious on the midlateral surface of caudal peduncle.

COLOR IN ALCOHOL.—Specimens retaining guanine on scales silvery overall. Overall coloration of specimens lacking guanine on scales tan, darker on snout, dorsal portions of head and dorsal surface of body. Deep-lying dark stripe extending along lateral surface of body from supracleithrum to caudal peduncle; expanded on lateral surface of peduncle into a triangular spot. Streak more obvious and discrete in specimens under 35 mm SL, less noticeable anteriorly and more diffuse posteriorly in larger specimens. Spot of dark pigmentation about size of orbit formed by large series of small chromatophores overlying deeper situated spot on caudal peduncle. Spot

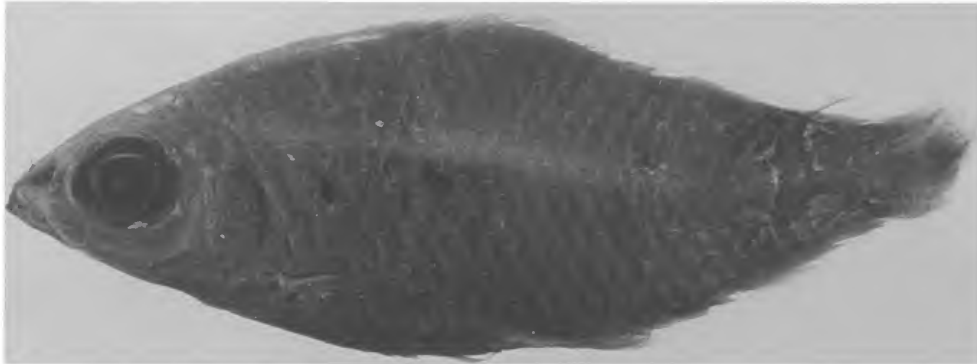


FIGURE 83.—*Cyphocharax gillii*, holotype, CAS 39829 (formerly IU 9939), 35.9 mm SL; Paraguay, Concepcion, Arroyo Trementina.



FIGURE 84.—*Cyphocharax gillii*, MHNG 2239.35, 38.4 mm SL; Paraguay, Concepcion, Laguna Negra, 15 km E of Paso Bareto.

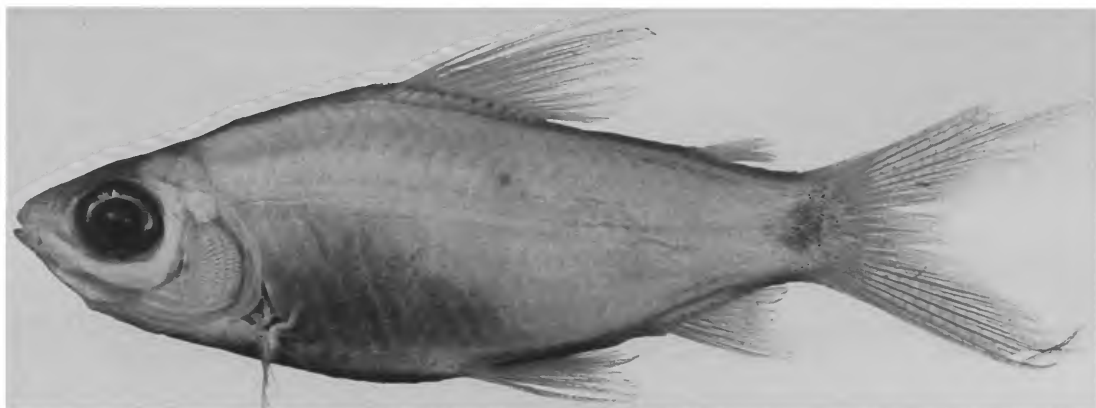


FIGURE 85.—*Cyphocharax gillii*, holotype of *Curimatella rehni*, ANSP 53721, 35.2 mm SL; Brazil, Mato Grosso, Descalvados.



FIGURE 86.—*Cyphocharax gillii*, ZUEC 512, 68.2 mm SL; Brazil, Mato Grosso, Município de Poconé, Rodovia Transpantaneira.

of surface pigmentation rotund, or slightly triangular anteriorly. Margin of spot not distinct, with less dense field of chromatophores extending dorsal and ventral of central spot to dorsal and ventral margins of caudal peduncle. Dorsal, caudal, and anal fins somewhat dusky, more so in larger specimens; pectoral and pelvic fins hyaline.

DISTRIBUTION.—Rio Paraguay system in Brazil and Paraguay (Figure 80).

KARYOTYPE.—Venere and Galetti (1989:19–21) reported $2n = 54$ chromosomes in the species.

ECOLOGY.—Sazima (1986:55) reported that *Cyphocharax gillii* (cited as *Curimata spilura*) swims near the bottom when feeding, and scoops up and ingests portions of the substrate containing food items including diatoms, desmids, and epiphytic filamentous algae. In a later paper Sazima (1988:191) noted that some members of the species defended territories that included submerged grassy plants with algal cover. Such territories were defended by chases, nips, strikes, and mouth fighting. Individuals protecting territories would attack their own image in mirrors. Other individuals of *Cyphocharax gillii* in the same region did not protect territories, but rather formed schools of up to 30 individuals. Sazima and Pellegrini Caramaschi (1989:326) noted that contrary to some other curimatids, the species “visually inspects the substrate, takes successive mouthfuls from the substrate and rarely spits out part of the sediment,” with the predominant dietary item being filamentous algae. Géry et al. (1987:418) reported that *C. gillii* typically inhabits small streams or regions of weak currents in adjoining swampy areas. In rivers it is usually captured along the banks.

REMARKS.—The holotype of *Curimatus gillii* is in very poor condition (Figure 83), but the 9 branched dorsal-fin rays, 30 vertebrae, and other meristic and morphometric data in conjunction with the type locality (Figure 10, locality 3), support the hypothesis that it is conspecific with specimens herein considered *Cyphocharax gillii*. Recent collections, evidently conspecific with the type of *Curimatus gillii*, from

the type region of the species (MHNG 2239.35) have the rounded dark spot on the midlateral surface of the caudal peduncle (Figure 84) that distinguishes *C. gillii* from *C. spilurus*, a very similar sympatric species (see discussion under “Diagnosis”).

Fowler (1932:343) described *Curimatella rehni* on the basis of six specimens collected at Descalvados, Mato Grosso, Brazil (Figure 80, locality 4). In the “Diagnosis” of the species Fowler noted it “resembles *Curimatus gillii* Eigenmann and Kennedy, but it [*gillii*] is said to have ‘caudal lobes naked’ and the ‘scales of the sides all crenulate.’” Fowler’s accompanying figure (1932:344) showed a series of scales covering about three-quarters of the caudal fin, with these caudal-fin scales being notably smaller than those on the posterior portions of the body. Such an extensive series of scales, which is characteristic of *Curimatella* Eigenmann and Eigenmann, presumably lead Fowler to assign his nominal species to that genus. Examination of the holotype and paratypes of *Curimatella rehni* (ANSP 53721 and ANSP 53722–53727) failed to confirm the multiple series of small scales on the caudal fin shown in Fowler’s figure. Rather there are two incomplete series of scales at the base of the caudal fin, with the scales equal in size to those on the caudal peduncle (Figure 85). Thus the assignment of *rehni* to *Curimatella* by Fowler is judged to have been incorrect.

Fowler also distinguished *Curimatella rehni* from the previously described *Curimatus gillii* on the basis of differences in the form of “the scales of the sides” which Eigenmann and Kennedy in their description of *gillii* (1903:510) described as crenulate. The scales in the type series of the two species are identical with small irregularities along the posterior margins of the scales. No differences between the two nominal species have been discovered in examined meristics, morphometrics, or details of pigmentation (Table 14). *Curimatella rehni* is consequently placed as a synonym of *Cyphocharax gillii*.

In their study of the non-characid characiforms of Paraguay, Géry et al. (1987:417) noted that their material of *Curimatus gillii* from the type region of the species all had 9 branched

TABLE 14.—Morphometrics and meristics of (A) holotype of *Curimatus gillii* (CAS 39829; formerly IU 9939); (B) holotype of *Curimatella rehni* (ANSP 53721); and (C) all examined specimens of *Cyphocharax gillii* from which counts and measurements were taken. Dashes indicate measurements that could not be taken due to poor condition of holotype of *Curimatus gillii*. 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	35.9	35.2	25.5–87.9
1. Greatest body depth	0.38	0.38	0.36–0.45
2. Snout to dorsal-fin origin	0.53	0.52	0.50–0.54
3. Snout to anal-fin origin	0.83	0.84	0.82–0.87
4. Snout to pelvic-fin origin	0.57	0.59	0.53–0.59
5. Snout to anus	0.80	0.80	0.76–0.81
6. Origin of dorsal fin to hypural joint	0.56	0.55	0.54–0.61
7. Pectoral-fin length	–	0.20	0.20–0.23
8. Pelvic-fin length	–	0.25	0.23–0.26
9. Caudal peduncle depth	–	0.14	0.13–0.15
10. Head length	0.30	0.33	0.28–0.33
11. Snout length	0.31	0.29	0.27–0.32
12. Orbital diameter	0.32	0.34	0.30–0.37
13. Postorbital length	0.39	0.40	0.36–0.42
14. Interorbital width	0.43	0.43	0.42–0.48
	MERISTICS		
Lateral-line scales	30	30	28–33
Scale rows between dorsal-fin origin and lateral line	5½	6	5½–6½
Scale rows between anal-fin origin and lateral line	4½	4½	4½–5
Branched dorsal-fin rays	9	9	9
Branched anal-fin rays	7	7	7
Total pectoral-fin rays	–	14	13–15
Branched pelvic-fin rays	8	8	8
Vertebrae	30	30	29–31

dorsal-fin rays, whereas population samples from other areas demonstrated much broader ranges in dorsal-fin ray counts. An examination has shown that the samples examined by Géry et al. (1987) from the area north of Coronel Oviedo consisted of both *Cyphocharax spilatus* (dorsal-fin rays 10–12) and juveniles of *C. voga* (dorsal-fin rays 9).

MATERIAL EXAMINED.—178 specimens (62, 25.5–87.9).

PARAGUAY. *Concepcion*: Arroyo Trementina, “a tributary of Río Aquido Canigi,” CAS 39829, 1 (35.9, holotype of *Curimatus gillii*; formerly IU 9939). Arroyo Chagalalina, “a tributary of Río Aquido Canigi,” FMNH 52627, 1 (39.0, co-type = paratype of *Curimatus gillii*; formerly IU 9938 and CM 956). Laguna Negra, 15 km E of Paso Bareto, MHNG 2239.35, 29 (5, 33.0–72.3). Riacho Postillon, Estancia El Postillon, 6 km from Puerto Max, MHNG 2034.69–77, 9. *San Pedro*: Río Corrientes and adjacent flood pool, 32.4 km W of turnoff to Curuguaty (60 km NE of Mbutuy intersection) (24°22′54″S, 55°56′25″W), UMMZ 206557, 10 (61.7–87.9). 3 km NW of Lima, USNM 232219, 2 (1, 74.3; specimen cleared and counterstained for cartilage and bone). Río Aguaray-Guazu, at bridge on highway approx. 5.4 km S of junction to San Pedro, approx. 102 km N of Coronel Oviedo (23°54′30″S, 56°33′W), UMMZ 206626, 9 (5, 45.3–66.3). *Misiones*: Pond

about 100 m from Río Tebuicary, approx. 200 m E of confluence of Río Tebuicary and Laguna Tebuicary (approx. 26°33′S, 56°51′W), USNM 232218, 1 (50.6). *Paraguari*: Arroyo Corrientes, approx. 3 km downstream of Ybycui National Park, USNM 229440, 1 (73.3). *Cordillera*: Scattered pools 1.6 km S of Tobati, Río Paraguay basin, UMMZ 205729, 1 (68.5). Lago Ypacaray, near San Bernardino (approx. 25°16′S, 57°19′W), USNM 181643, 1 (27.0).

BRAZIL. *Mato Grosso*: Descalvados, ANSP 53721, 1 (35.2, holotype of *Curimatella rehni*); ANSP 53722–53727, 6 (25.5–32.8, paratypes of *Curimatella rehni*). Município de Cáceres, Rio Paraguai, Descalvados, MZUSP 38153, 9. Município de Cáceres, Santo Inácio, first bridge along road from Cáceres to Porto Limão, MZUSP 21595, 2. Rio Paraguai, Porto de Cáceres, MZUSP 21734, 10. Município de Poconé, pools along Rodovia Transpantaneira, ZUEC 510 and 512, 2 (68.2–75.4). Município de Poconé, Rio Pixaim, Campo do Jofre, MZUSP 21590, 1. Pool along Rodovia Transpantaneira, approx. 10 km from Poconé, MZUSP 28464, 3. Rio Paraguai system, Rio Bento Gomes, along highway from Cuiabá to Poconé, MZUSP 38524, 6 (66.4–81.9). Município Barão de Melgaço, Rio Cuiabá, mouth of Croará, MZUSP 21660, 3. Santo Antonio do Paraíso, Município de Itiquira, USNM

311133, 4 (3, 68.2–73.8). Município do Itiquira, Fazenda Santo Antonio do Paraíso, lagoons between Rio Piquiri and Rio Itiquira, MZUSP 21714, 3; MZUSP 36742, 2. Município do Itiquira, Fazenda Santo Antonio do Paraíso, Rio Itiquira, Baía Grande, MZUSP 21712, 11. Rio Paraguai, Ilha de Taimã, MZUSP 21739, 2 (29.0–40.7). Rio Jaurú, Porto Espiridião, MZUSP 28102, 1 (68.3); MZUSP 28088, 11. Porto Espiridião, lagoa near Rio Jaraú, MZUSP 28078, 18 (10, 48.7–55.2); MZUSP 28902, 1. Santo Antonio de Leverger, MZUSP 4448, 5. Município de Santo Antonio de Leverger, Fazenda Conceição, Baía Pedra Branca, MZUSP 21552, 1. *Mato Grosso do Sul*: Município de Corumbá, Rio Miranda, MZUSP 21678, 5. Rio Miranda, Salobra, MNRJ 8899, 5 (4, 63.4–70.8). Município de Corumbá, Nhecolândia, Fazenda Nhumirim, MZUSP 36315, 1.

Cyphocharax spiluroopsis (Eigenmann and Eigenmann)

FIGURES 87–92; TABLE 15

- Curimatus spilurus*.—Cope, 1878:684 (Peruvian Amazon).—Pearson, 1924:26 [Bolivia: Río Beni system, Lake (= Lago) Rogoagua].
- Curimatus spiluroopsis* Eigenmann and Eigenmann, 1889:420 [type locality: Iça (= Rio Iça (tributary of Rio Solimões) near Brazilian-Colombian border); 1891:47 [reference].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*].—Vari and Howe, 1991:19 [location of portion of syntype series]. [Not Eigenmann and Norris, 1900:355; Bertoni, 1914:10.]
- Curimata spilura*.—Fowler, 1906:297, fig. 4 [Peruvian Amazon, based on specimens cited by Cope (1878) as *Curimatus spilurus*].—Eigenmann, 1912:264 [identification of specimens cited by Fowler (1906) as *Curimata spilura* questioned].—Ortega and Vari, 1986:11 [Peruvian Amazon, based on Fowler, 1950].
- Curimatus spiluroopsis*.—Eigenmann, 1910:421 [reference, species name misspelled].
- Curimatus (Xyrocharax) stigmaturus* Fowler, 1913:673 [type locality: Peru: Marañon River, Nauta; based on same specimens cited by Cope (1878) as *Curimatus spilurus* and by Fowler (1906) as *Curimata spilura*; designated as type species of subgenus *Xyrocharax*].—Fernández-Yépez, 1948:72 [possible assignment of species to *Semelcarinata*].—Böhlke, 1984:67 [type specimen depository].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*]. [New synonymy.]
- Curimatopsis macrolepis*.—Pearson, 1924:26 [in part, specimens from Bolivia: Río Beni basin, Cachueta Esperanza; some of these specimens later became type series of *Curimata (Hemicurimata) esperanzae* Myers].
- Curimata (Hemicurimata) esperanzae* Myers, 1929:620 [type locality: Bolivia: Río Beni, Cachueta Esperanza; designation as type species of subgenus *Hemicurimata*; based on specimens identified as *Curimatopsis macrolepis* by Pearson (1924:26)].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*; species name incorrectly cited as *esperanze*]. [New synonymy.]
- Curimata esperanzae*.—Pearson, 1937:109 [Río Beni basin, based on Myers, 1929].—Fowler, 1940b:98 [based on Myers, 1929]; 1950:284 [literature compilation].
- Curimata spilurus*.—Pearson, 1937:109 [in part, [Río] Beni-Mamoré system, based on Pearson, 1924; not cited occurrence of species in Río Paraguay system].
- Curimatoides ucayalensis* Fowler, 1940a:256, fig. 55 [Peru: Ucayali River basin, Contamana].—Eigenmann and Allen, 1942:299 [reference].—Fowler, 1942:209 [reference]; 1945a:119 [reference].—Fernández-Yépez, 1948:68 [based on Fowler, 1940a].—Fowler, 1950:298, fig. 359 [literature compilation, figure taken from Fowler, 1940a]; 1975:370 [reference].—Böhlke, 1984:67 [location of holotype].—Ortega and Vari, 1986:11 [Peruvian Amazon, based on Fowler, 1940a].—Vari, 1989a, tables 2, 3 [assignment to *Cyphocharax*]. [New synonymy.]
- Curimata stigmatura*.—Fowler, 1940a:287 [reference]; 1942:209 [reference]; 1945a:117 [reference]; 1950:293, fig. 352 [literature compilation].—Ortega and Vari, 1986:11 [Peruvian Amazon; based on Fowler, 1950].
- Allenina spiluroopsis*.—Fernández-Yépez, 1948:39 [assignment to *Allenina*].—Fowler, 1975:366 [reference].
- Hemicurimata esperanzae*.—Fernández-Yépez, 1948:70 [reference].—Fowler, 1975:377 [reference].
- Curimata spiluroopsis*.—Fowler, 1950:293 [literature compilation, not Eigenmann and Norris, and Bertoni citations; not cited presence in (Río) Paraná system]. [Not Bertoni, 1939:54.]
- Curimatus (Cyphocharax) spilurus*.—Géry, 1964:36 [Peruvian Amazon].
- Semelcarinata stigmatura*.—Fowler, 1975:374 [reference].

DIAGNOSIS.—*Cyphocharax spiluroopsis* is distinguished from its congeners by the combination of 29 to 33 lateral-line scales to the hypural joint, the development of pores along the entire lateral line in all but juvenile specimens, the 30 to 32, typically 31 vertebrae, the relative body depth (0.33–0.39 of SL), the relative depth of the caudal peduncle (0.12–0.14 of SL), the relative length of the postorbital portion of head (0.38–0.46 of HL), the relative length of the head (0.28–0.33 of SL), the relative width of the orbit (0.29–0.34 of HL), the absence of multiple series of longitudinal dark stripes or small dark spots in longitudinal rows on the body, the absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a rotund patch of dark pigmentation about one-half to two-thirds the diameter of the orbit on the midlateral surface of the caudal peduncle, the presence of a relatively discrete border on the spot and the absence of secondary pigmentation fields reaching to the dorsal and ventral margins of the caudal peduncle in juveniles, the absence of 4 or 5 large midlateral dark spots on the body, the absence of a stripe of dark pigmentation across the middle rays of the caudal fin in moderate to large-sized specimens, the lack of a reticulate pattern on the body in adults, and the possession of 9 branched dorsal-fin rays.

Cyphocharax spiluroopsis is very similar to *C. spilurus*, which also occurs in portions of the Amazon basin. The two species can be most readily distinguished by the form of the spot of dark pigmentation on the midlateral surface of the caudal peduncle (typically horizontally elongate in *spilurus* versus round in *spiluroopsis*) and in the relative length of the postorbital portion of the head (0.38–0.46 of HL in *C. spiluroopsis* versus 0.33–0.39 of HL in *C. spilurus*).

DESCRIPTION.—Body moderately elongate, moderately compressed laterally. Dorsal profile of head distinctly convex from upper lip to vertical line through posterior nostril, straight from that line to posterior tip of supraoccipital spine. Dorsal profile of body smoothly curved from tip of supraoccipital spine to origin of dorsal fin, convexity more pronounced in population samples from the upper Rio Madeira system; almost straight and posteroventrally slanted at base of dorsal fin, gently convex from base of last dorsal-fin ray to caudal peduncle. Dorsal surface of body with middorsal region

between tip of supraoccipital spine and origin of dorsal fin ranging from distinctly grooved, through flattened, to slightly rounded transversely within population samples, an indistinct median keel anterior to dorsal fin in specimens with transversely rounded predorsal regions; middorsal region smoothly rounded transversely posterior to fin. Ventral profile of body gently curved from tip of lower jaw to caudal peduncle. Prepelvic region obtusely flattened, with median series of scales of approximately same size as those on adjoining ventrolateral surfaces of body. Median keel present posterior to pelvic-fin origin. Secondary obtuse keel on each side of postpelvic portion of body present in many curimatids indistinct or not apparent.

Greatest body depth at origin of dorsal fin, depth 0.33–0.39 [0.35]; snout tip to origin of dorsal fin 0.48–0.55 [0.49]; snout tip to origin of anal fin 0.82–0.87 [0.82]; snout tip to origin of pelvic fin 0.53–0.59 [0.54]; snout tip to anus 0.75–0.81; origin of dorsal fin to hypural joint 0.53–0.60 [0.59]. Distal margin of dorsal fin slightly convex or straight; last unbranched and first branched rays approximately three times length of ultimate ray. Pectoral fin distally pointed; length of pectoral fin 0.18–0.23 [0.20], extends slightly over three-quarters distance to vertical line through origin of pelvic fin. Distal margin of pelvic fin somewhat pointed; length of pelvic fin 0.22–0.27 [0.24], reaches approximately two-thirds distance to origin of anal fin. Caudal fin forked. Adipose fin well developed. Anal fin emarginate, anteriormost branched rays approximately three times length of ultimate ray. Least depth of caudal peduncle 0.12–0.14 [0.12].

Head profile rounded anteriorly, pointed overall; head length 0.28–0.33 [0.31]; upper jaw slightly longer than lower, mouth slightly subterminal; snout length 0.24–0.30 [0.26]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture closed by thin flap of skin separating nares; orbital diameter 0.29–0.34 [0.31]; adipose eyelid present, more developed in larger examined individuals, with vertically ovoid opening over center of eye; length of postorbital portion of head 0.38–0.46 [0.45]; gape width 0.22–0.29 [0.24]; interorbital width 0.39–0.46 [0.40].

Pored lateral-line scales from supracleithrum to hypural joint 29 to 33 [32]; all scales of lateral line pored, canals in lateral-line scales straight; 2 to 4 series of scales extend beyond hypural joint onto caudal-fin base; 5¹/₂ to 6¹/₂ [6] scales in transverse series from origin of dorsal fin to lateral line; 4¹/₂ or 5 [5] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 or iii,9 (when three unbranched rays present, first very short) [iii,9]; anal-fin rays ii,7 or 8, or iii,7 (when three unbranched rays present, first very short; ii,8 rare) [iii,7]; pectoral-fin rays 13 to 16 [15]; pelvic-fin rays i,7 to 9 (i,7 and i,9 rare) [i,8].

Total vertebrae 30 (1), 31 (55), 32 (3).

COLOR IN LIFE.—(Based on observations of specimens from the western portions of the Amazon basin in the vicinity of

Iquitos, Peru.) Overall coloration silvery, with slight purplish tint dorsally. Black spot on midlateral surface of caudal peduncle. Dorsal, caudal, and anal fins with a slight yellow or reddish tint.

COLOR IN ALCOHOL.—Overall coloration of specimens lacking guanine on scales ranging from light tan to brown. Upper lip, snout, dorsal surface of head, and upper portion of opercle with scattered dark chromatophores. Body with scattered dark chromatophores on dorsal and dorsolateral surfaces; chromatophore fields outlining posterior borders of scales more pronounced in specimens from population samples that have darker overall pigmentation. Distinct rotund dark spot on midlateral surface of caudal peduncle; spot ranges in size from one-half to two-thirds diameter of orbit; without secondary fields of chromatophores extending to dorsal and ventral margins of caudal peduncle in juveniles. Unpaired fins with rays outlined by series of small dark chromatophores; distal portions of those fins dusky in population samples with dark overall pigmentation. Pelvic and pectoral fins ranging from hyaline to slightly dusky.

DISTRIBUTION.—Central and western portions of the Rio Amazonas basin (Figure 92).

GEOGRAPHIC VARIATION.—The population samples of this species from the upper portions of the Rio Madeira system in Peru and Bolivia differ slightly from available samples of the species from the central portions of the Amazon basin and from those originating to the north along the Andean piedmont. The average relative length of the postorbital portion of the head in the Rio Madeira populations (0.38–0.44 of HL) tends to be proportionally somewhat less than for the population samples from the other portions of the species range (0.40–0.46 of HL), albeit with pronounced overlap in ranges. The Rio Madeira samples also tend to have darker pigmentation than do many specimens from Peru and central portions of the Amazon basin. Such dark pigmentation does occur in some population samples from those latter areas, and may simply reflect different water types from which the samples were taken. These differences consequently do not serve to discriminate the populations as recognizable species.

REMARKS.—Eigenmann and Eigenmann (1889:420) based *Curimatus spiluropsis* on five specimens (MCZ 20218) collected at “Iça” (the Rio Iça of the western portions of Amazonas, Brazil; Figure 92, locality 1). The five syntypes of the species became intermingled at some point with material of two other non-type lots (MCZ 20216, originally 1 specimen; and MCZ 27408, originally 2 specimens) also collected at Iça. Two of the specimens of the three intermingled lots were, in turn, exchanged to the Smithsonian Institution (now catalogued as USNM 120403). The single specimen in the present intermingled lot at MCZ retaining a tag from the type series (MCZ 20218) is designated as the lectotype of *Curimatus spiluropsis*. In order to avoid confusion with the remaining specimens originally in that lot (MCZ 20218) that are now intermingled with MCZ 20216 and 27408, the lectotype is

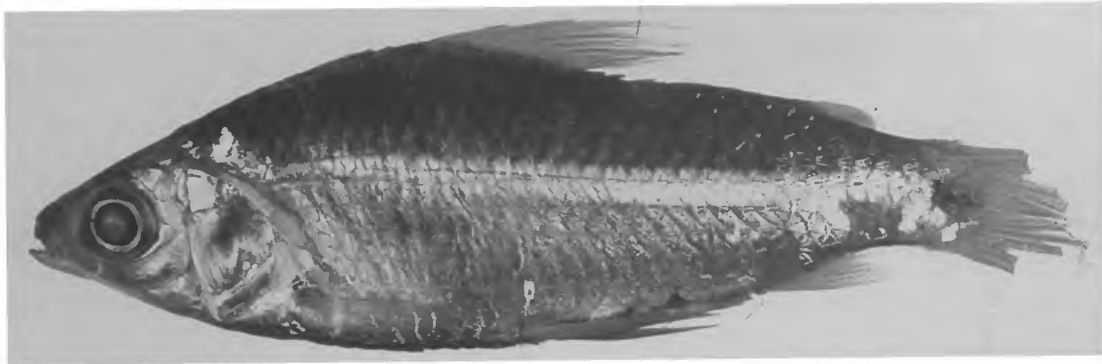


FIGURE 87.—*Cyphocharax spiluroopsis*, lectotype of *Curimatus spiluroopsis*, MCZ 92961, 70.7 mm SL; Brazil, Amazonas, Iça (= Rio Iça).

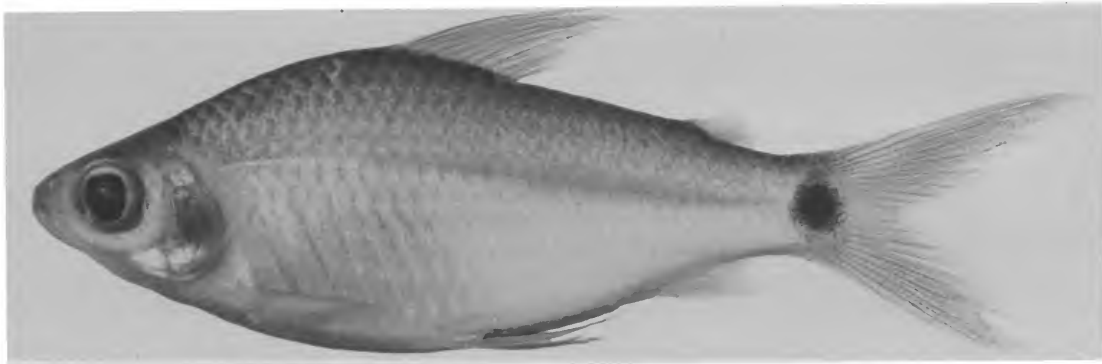


FIGURE 88.—*Cyphocharax spiluroopsis*, USNM 311100, 61.3 mm SL; Peru, Ucayali, Pucallpa.

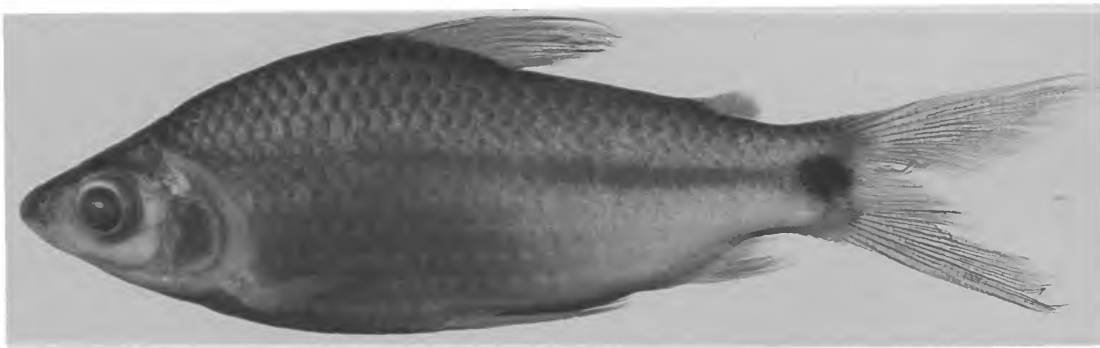


FIGURE 89.—*Cyphocharax spiluroopsis*, USNM 305335, 63.6 mm SL; Bolivia, Beni, 1.5 km W of Rio Matos along road crossing, 45 airkm E of San Borja.

recatalogued as MCZ 92961. The four specimens originally in MCZ 20218 and the irretrievably intermingled non-type specimens from MCZ 20216, and 27408 are consequently all treated as paralectotypes (MCZ 20216, 20218, 27408; USNM 120403).

In their key to the then-known species of curimatids, Eigenmann and Eigenmann (1889:415) noted that the “predor-

sal region [was] depressed or grooved to near the dorsal” in *Curimatus spilurus*, whereas they indicated that the “predorsal region [was] keeled” in *C. spiluroopsis*. Eigenmann and Eigenmann’s description of *C. spiluroopsis* (1889:420) is brief, but noted that in that species the “depth [is] $2\frac{3}{4}$ -3 [of SL], otherwise as in *C. spilurus*.” An examination of the type series of *C. spiluroopsis* reveals variation in the form of the predorsal



FIGURE 90.—*Cyphocharax spiluroopsis*, holotype of *Curimatoides ucayalensis*, ANSP 68670, 58.7 mm SL; Peru, Loreto, Río Ucayali, Contamana.

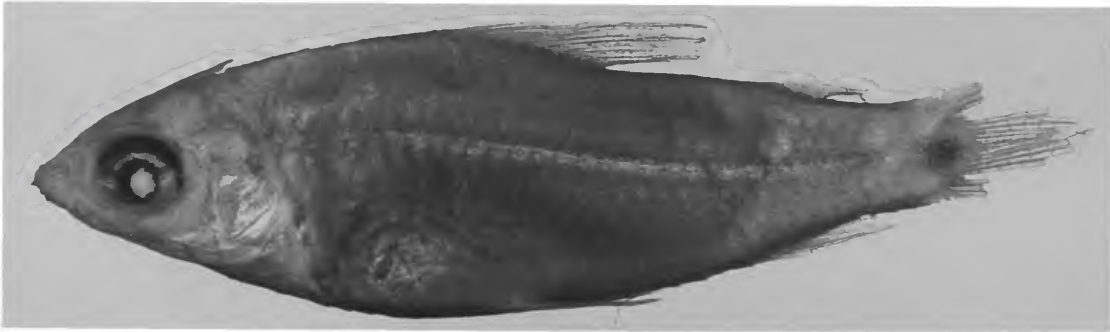


FIGURE 91.—*Cyphocharax spiluroopsis*, lectotype of *Curimata (Hemicurimata) esperanzae*, CAS 63049 (formerly IU 17281, in part), 23.3 mm SL; Bolivia, Beni, Río Beni, Cachueta Esperanza.

region of the body, with both the lectotype and some but not all of the paralectotypes having a medially grooved predorsal region of the body. Similar intra-specific variation in the presence or absence of the predorsal groove also occurs in population samples of *Cyphocharax spilurus*. Consequently that feature fails to distinguish the two nominal species. Examination of the types of *Curimatus spiluroopsis* confirms the relative body depth cited by Eigenmann and Eigenmann ($2\frac{3}{4}$ –3 [presumably of SL] (= 0.33–0.36 of SL)). Although those authors indicated that the cited relative body depth separates *C. spiluroopsis* from *C. spilurus*, they listed a completely overlapping range in relative body depth ($2\frac{1}{4}$ –3 (= 0.33–0.44 of SL) for the latter species. Specimens of *Cyphocharax spilurus* examined during this study do have a range of relative body depths (0.31–0.37 of SL) overlapping those of *C. spiluroopsis* (0.33–0.42), although the range is not as broad as cited by the Eigenmanns. The greater range in relative body depth for *C. spilurus* cited by Eigenmann and Eigenmann may have been taken from the original description of the species (Günther, 1864) that was based on a complex type series (see “Remarks” under *C. spilurus* and *C. helleri*).

Although none of the features cited by Eigenmann and Eigenmann (1889) as distinguishing *Curimatus spilurus* and *C. spiluroopsis* serve to separate those nominal forms, the species

differ in the relative length of the postorbital portion of the head, and to a degree in the form of the spot of dark pigmentation on the midlateral surface of the caudal peduncle (see “Key” and “Diagnosis”) and are recognized as distinct herein.

Three other nominal species with dark pigmentation on the midlateral surface of the caudal peduncle and type localities in the western portions of the Amazon basin were assigned by Vari (1989a, tables 2, 3) to *Cyphocharax*. Two of these, *Curimatus stigmaturus* Fowler (1913:673) and *Curimatoides ucayalensis* Fowler (1940a:256), originated in northeastern Peru, and the third, *Curimata (Hemicurimata) esperanzae* Myers (1929:620), was based on a series of specimens from the Río Beni of Bolivia in the upper Río Madeira basin.

The type series of *Curimatus stigmaturus*, which originated in the Peruvian Amazon (Figure 92, locality 2), was originally cited by Cope (1878:684) as *Curimatus spilurus*. Fowler concurred with Cope’s identification (1906:297) and used those specimens (identified by Fowler as *Curimata spilura*) as the basis for his description of the subgenus *Cyphocharax* of *Curimata*. In 1913, however, Fowler decided his material was not conspecific with *Curimatus spilurus* Günther and described it as a new species, *Curimatus stigmaturus*, that he placed in the subgenus *Xyrocharax*, also first proposed in the same paper

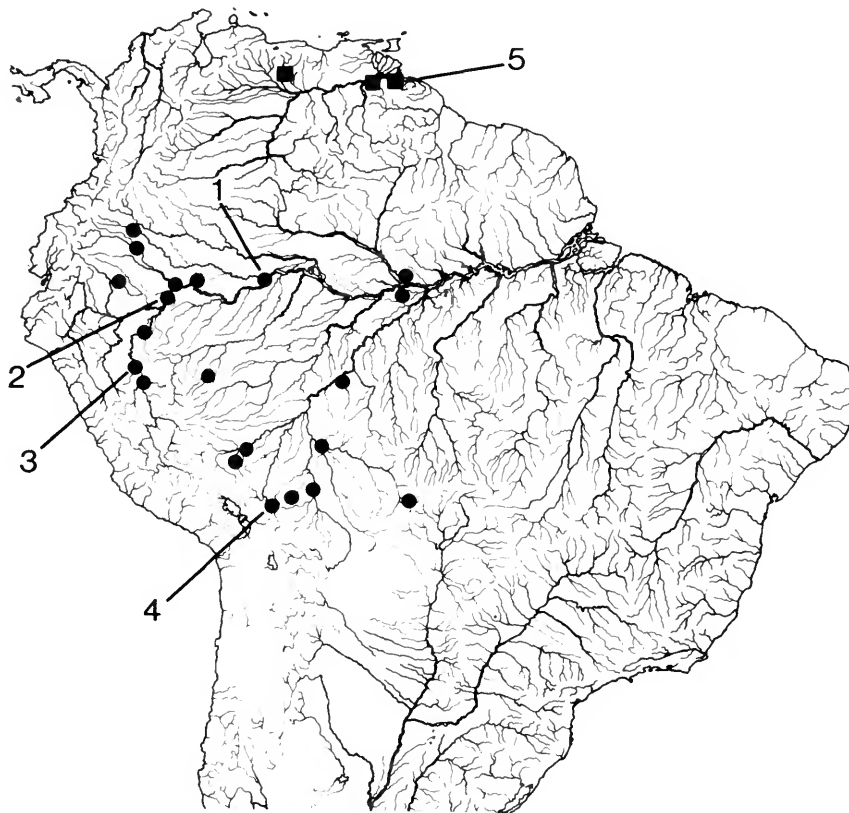


FIGURE 92.—Map of central and northern South America showing geographic distribution of *Cyphocharax spiluroopsis* (filled in circles; 1 = type locality of *Curimatus spiluroopsis*; 2 = type locality of *Curimatus stigmaturus*; 3 = type locality of *Curimatoides ucayalensis*; 4 = type locality of *Curimata (Hemicurimata) esperanzae* and *Cyphocharax oenas* (squares; 5 = type locality) (some symbols represent more than one locality or lot of specimens).

(1913:673). In his description of *Cyphocharax*, Fowler (1906:297) described it as having the “back well elevated, or hunched, anteriorly,” a feature he listed in the description of *Curimatus stigmaturus* (1913:673) as “body ... deepest or hunched at dorsal origin, so that predorsal forms well-curved convex profile.” The holotype and paratypes of *Curimatus stigmaturus* (ANSP 21424 and 21425–21427, respectively) are in very poor condition, evidently having been dried-out at some point. Radiographs of the specimens reveal that the anterodorsal gibbosity noted by Fowler is the result of a postmortem foreshortening of the specimens and the dorsal displacement of the anterior portion of the medially incomplete vertebral column. Thus the pronounced anterior convexity in the dorsal profile of the body illustrated by Fowler (1906, fig. 4) is artificial and fails to distinguish *Curimatus stigmaturus* from other nominal curimatid species. In his 1906 discussion of the specimens Fowler (p. 298) noted that “the closely related forms, *Curimata spiluroopsis* (Eigenmann and Eigenmann) and *Curimata dorsale* (Eigenmann and Eigenmann) do not appear

to differ markedly. In fact it is not difficult to discover most of the characters assigned to each by Dr. and Mrs. Eigenmann in the examples before me. Under *Curimatus spilurus* these writers state that the predorsal region is depressed or grooved till near the dorsal fin. This I am unable to determine.” Seven years later in his original description of *C. stigmaturus* Fowler (1913:675) commented that “this species is related to *Curimatus dorsalis* Eigenmann and Eigenmann” and continued that “*C. dorsalis* has the pores of the anterior scales of the lateral line imperfectly developed or wanting, while in *C. stigmaturus* they are about equally developed.” Fowler did not, however, further discuss his earlier suggestion (1906) that *Curimatus stigmaturus* might be closely related to *C. spiluroopsis*.

Fowler’s suggestions in 1906 and 1913 that *Curimatus stigmaturus* was possibly aligned with *C. dorsalis* may have been a consequence of inconsistencies in the original description of the latter species by Eigenmann and Eigenmann (1889:420). Those authors noted that in *Curimatus dorsalis* the “basal half of the caudal [fin] rays [are] scaled,” a statement at

TABLE 15.—Morphometrics and meristics of (A) lectotype of *Curimatus spiluroopsis* (MCZ 92961); (B) holotype of *Curimatus stigmaturus* (ANSP 21424; specimen in very poor condition, only some meristic data could be taken with any accuracy); (C) lectotype of *Curimata (Hemicurimata) esperanzae* (CAS 63049); (D) holotype of *Curimatoides ucayalensis* (ANSP 68670); and (E) all examined specimens of *Cyphocharax spiluroopsis* 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	E
	MORPHOMETRICS				
Standard Length	70.7	—	23.3	58.7	23.3–89.9
1. Greatest body depth	0.35	—	0.33	0.36	0.33–0.39
2. Snout to dorsal-fin origin	0.49	—	0.48	0.49	0.48–0.55
3. Snout to anal-fin origin	0.82	—	0.82	0.83	0.82–0.87
4. Snout to pelvic-fin origin	0.54	—	0.55	0.55	0.53–0.59
5. Snout to anus	—	—	0.75	—	0.75–0.81
6. Origin of dorsal fin to hypural joint	0.59	—	0.54	0.59	0.53–0.60
7. Pectoral-fin length	0.20	—	—	0.20	0.18–0.23
8. Pelvic-fin length	0.24	—	—	0.23	0.22–0.27
9. Caudal peduncle depth	0.12	—	0.12	0.13	0.12–0.14
10. Head length	0.31	—	0.29	0.29	0.28–0.33
11. Snout length	0.26	—	0.25	0.25	0.24–0.30
12. Orbital diameter	0.31	—	0.33	0.31	0.29–0.34
13. Postorbital length	0.45	—	0.39	0.40	0.38–0.46
14. Interorbital width	0.40	—	0.40	0.43	0.39–0.46
	MERISTICS				
Lateral-line scales	32	30	31	31	29–33
Scale rows between dorsal-fin origin and lateral line	6	6	5½	5½	5½–6½
Scale rows between anal-fin origin and lateral line	5	5	4½	4½	4½–5
Branched dorsal-fin rays	9	9	9	9	9
Branched anal-fin rays	7	8	7	7	7–8
Total pectoral-fin rays	15	—	—	14	13–16
Branched pelvic-fin rays	8	8	8	8	7–9
Vertebrae	31	—	31	31	30–32

variance with the couplet in the key in the same publication that indicates that the species has the “caudal lobes mostly naked.” Examination of the damaged caudal fins of the syntypes of *C. dorsalis* (MCZ 20210, 20183, 20241, and 20330), shows that the scales originally extended over more than one-half the length of the caudal-fin rays. More recently collected, evidently conspecific, specimens have the fins nearly completely covered with scales, particularly in larger specimens (Vari, 1992). As a consequence of their incorrect evaluation of the degree of caudal-fin squamation in the type specimens, Eigenmann and Eigenmann placed *dorsalis* in *Curimatus* rather than in the subgenus *Curimatella*, which they proposed in the same publication for those curimatids with scaly caudal fins. Fowler did not note any scales on the caudal fin in his 1906 discussion of the type material of *Curimatus stigmaturus*, nor were they indicated in his illustration of one of the specimens (1906, fig. 4). In 1913 he further noted (p. 673) in his description of the subgenus *Xyrocharax* (type species *Curimatus stigmaturus*) that the “caudal lobes [are] naked.” Furthermore an examination of the holotype and paratypes of *Curimatus stigmaturus* also failed to reveal any indication that the now highly

damaged caudal-fin lobes were once covered with scales. The available data consequently does not support Fowler’s suggestion that *stigmaturus* is closely aligned to *dorsalis*. As noted the type material of *C. stigmaturus* is in very poor condition making it impossible to accurately take morphometric measurements. Nonetheless, the type series of *stigmaturus* agrees with the examined specimens of *Cyphocharax spiluroopsis* in the meristic features that could be counted with reasonable accuracy (Table 15) along with details of pigmentation. That information in combination with data on curimatids species known from the region of the type locality of *Curimatus stigmaturus*, makes it likely that Fowler’s original suggestion (1906:298) that *Curimatus stigmaturus* was “closely related” to *Curimata spiluroopsis* is correct. Indeed they appear to be conspecific on the basis of available information. *Curimatus stigmaturus* is consequently placed into the synonymy of *Cyphocharax spiluroopsis*.

Fowler (1940a:255) proposed the genus *Curimatoides* to include a single species, *C. ucayalensis*, based on a specimen that originated at Contamana, in the Río Ucayali system of Peru (Figure 92, locality 3). In his discussion Fowler noted

(1940a:255) that "this genus differs at once from *Curimata*, with which it is allied, in the absence of the adipose fin. It agrees in the largely scaleless caudal, complete lateral line and general appearance." The examination of the holotype of *Curimatoides ucayalensis* (ANSP 68670) shows that it agrees with *Cyphocharax spiluroopsis* in all examined meristic and morphometric features (Table 15) along with details of pigmentation. Indeed the absence of an adipose fin in the holotype of *Curimatoides ucayalensis* (Figure 90) is the only feature distinguishing that nominal species from specimens of *Cyphocharax spiluroopsis*. The middorsal region of the body where the adipose fin should be located is somewhat depressed in the holotype of *Curimatoides ucayalensis* relative to specimens of *Cyphocharax spiluroopsis* (compare Figures 87-89 and 90). This may reflect the loss of the fin due to a developmental abnormality or as a consequence of injury. Adipose fins are in rare instances lacking in other curimatid species in which the vast majority of individuals otherwise have the structures. That fin is also variably present in certain other characiforms (*Nannostomus eques* Steindachner (1876:126), *N. harrisoni* Eigenmann (Weitzman, 1966:6, 39), and *Klausewitzia aphanes* Weitzman and Kanazawa (1977:155), and certain Neotropical siluriforms (*Auchenipterus nuchalis* (Spix) (Mees, 1974:22) and *Helogenes marmoratus* Günther (Vari and Ortega, 1986:4-5). In light of such intra-specific variation and given the absence of any other discovered differences between *Curimatoides ucayalensis* and examined specimens of *Cyphocharax spiluroopsis* (Table 15) the species are herein considered conspecific. The absence of the adipose fin in the holotype of *Curimatoides ucayalensis* is hypothesized an individual variant or the consequence of injury.

The final nominal species to be discussed at this point is *Curimata esperanzae*, proposed by Myers (1929:620) as the type species of his genus *Hemicurimata* described in the same paper. *Hemicurimata* was proposed by Myers for curimatids with pores limited to the anterior portion of the lateral-line scale series and which lacked the anteriorly convex margin of the maxilla characteristic of the species of *Curimatopsis*. In his description of *Curimata (Hemicurimata) esperanzae* Myers noted that the "pectorals are fleshy flaps with radiating rays, indicating juvenile specimens." The number of pored lateral-line scales in various species of curimatids in general and *Cyphocharax* species in particular increases ontogenetically in the size range of the syntypes of *Curimata esperanzae* (see for example discussion under "Remarks" for *Cyphocharax helleri* and Géry, 1965, fig. 20). The incomplete development of the poring in the lateral line in *Curimata esperanzae* is evidently a consequence of the relatively small size of the specimens. The form of the jaws, the presence of a black spot on the caudal peduncle, the number of vertebrae, the number of scales in a longitudinal series to the hypural joint, and the lack of scales on the caudal fin indicate that it is a specimen of *Cyphocharax*. Although the type series of *Curimata esperanzae* is in

somewhat poor condition (Figure 91) and is furthermore complex (see following discussion), the majority of the type series agrees with *Cyphocharax spiluroopsis* in examined features (Table 15) and *Curimata esperanzae* is herein considered a synonym of *Cyphocharax spiluroopsis* (see following section with respect to lectotype designation).

Myers (1929) based his description of *Curimata (Hemicurimata) esperanzae* on a portion of the specimens from Cachueta Esperanza along the Río Beni of Bolivia (Figure 92, locality 4) identified by Pearson (1924:26) as *Curimatopsis macrolepis* (Steindachner). Pearson reported 17 specimens of *Curimatopsis macrolepis* from that locality (IU 17281). Myers (1929) neither stated the number of specimens in the lot at the time he examined it, nor designated a holotype. Seven of the 17 specimens reported by Pearson remained in the lot when I first examined it. One of these is an individual of *Curimatopsis macrolepis*, the name applied to the entire lot by Pearson, and the remaining six specimens are *Cyphocharax spiluroopsis*.

Myers (1929:620) discriminated *Curimata* (sensu lato) from *Curimatopsis* on the basis of the difference in the form of the maxilla in the two groups. He, in turn, proposed *Hemicurimata* as a subgenus of *Curimata* for the species "with incomplete lateral lines" that he described in the same paper. Given that it is obvious that Myers' concept of the subgenus *Hemicurimata* and indeed of the genus *Curimata* excluded the species of *Curimatopsis*, it is appropriate that a *Cyphocharax* specimen be designated the lectotype of *Curimata (Hemicurimata) esperanzae*. The *Cyphocharax* specimen among the syntypes of *Curimata (Hemicurimata) esperanzae* in the best overall condition is designated as the lectotype of the species (CAS 63049). The six other known syntypes thus become paralectotypes (CAS 63050, five *Cyphocharax* specimens; CAS 63061, one specimen of *Curimatopsis macrolepis*).

Cyphocharax spiluroopsis has rarely been cited other than for references to the original description. This is probably a consequence of the difficulty in identifying the species on the basis of the original description. Eigenmann and Norris (1900:355) cited *Curimatus spiluroopsis* from two localities in the state of São Paulo, Brazil, far distant from the type locality and known range of the species. Although I have been unable to locate the specimens that were the basis of the record, no material of *Cyphocharax spiluroopsis* or a phenetically similar species has been discovered in the large series of curimatids from that region examined during this and related studies. The Eigenmann and Norris record is consequently judged to be erroneous. Bertoni (1914:10) questionably cited *Curimatus spiluroopsis* from Paraguay without indicating the basis for that record. Once again there is no evidence that the species occurs in the Río de La Plata system, and the citation is considered to be a misidentification, perhaps of *Cyphocharax gillii*.

MATERIAL EXAMINED.—314 specimens (90, 23.3-89.9).

BRAZIL. Amazonas: Iça (= Río Içá (tributary of Río Solimões) near Brazilian-Colombian border), MCZ 92961, 1 (70.7, lectotype of *Curimatus spiluroopsis*; formerly MCZ

20218, in part); MCZ 20216, 20218, 27408, 5 (3, 47.6–approx. 55; type and non-type lots intermingled, paralectotypes of *Curimatus spiluroopsis*); USNM 120403, 2 (51.3–53.8, paralectotypes of *Curimatus spiluroopsis*; out of intermingled lots MCZ 20216, 20218, 27408). Lake Hyanuary (= Paraná do Januári), MCZ 20268, 25 (5, 48.9–67.5). Paraná da Ilha de Marchantaria, USNM 309297, 1 (48.0). Ilha de Marchantaria, Camaleao, USNM 309292, 2. São José, Lago do Castanho, Janauacá, USNM 229183, 2 (61.6–73.0); USNM 311130, 1 (49.3). Lago Januári, USNM 309296, 1 (63.4); USNM 309294, 2 (48.4–49.5; 1 specimen cleared and counterstained for cartilage and bone); USNM 311132, 42 (10, 39.7–46.8). Lago Januári, near its outflow channel, USNM 229182, 4 (43.3–63.4). Lago Terra Preta, Januári, USNM 311124, 2 (36.4–41.3). *Acre*: Rio Tarauacá, Tarauacá, Lago da Esperança, USNM 268012, 15 (9, 59.2–80.2). *Matto Grosso*: Rio Guaporé basin, Rio Alegre, approx. 3 km from Vila Bela da Santíssima Trindade, MZUSP 37474, 1. Rio Guaporé system, Vila Bela da Santíssima Trindade, MZUSP 37767, 23. *Rondônia*: Rio Madeira, Porto Velho, MZUSP 20675, 9.

PERU. *Loreto*: Rio Marañon, Nauta, ANSP 21424, 1 (holotype of *Curimatus stigmatulus*; specimen in poor condition, not possible to determine SL); ANSP 21425–21427, 3 (paratypes of *Curimatus stigmatulus*; specimens in poor condition, not possible to determine SL). Rio Ucayali system, isolated pool at left bank of Quebrada Carahuayate, at km 20 on road from Jenaro Herrera to Colonia Angamos, NRM 26542, 32 (10, 52.0–75.0). Rio Corrientes system, Teniente Lopez, pools on right bank, opposite OXY Camp, NRM 26576, 2 (46.8–65.8). Rio Nanay system, Quebrada Correntillo, 20 km from Iquitos on road from Iquitos to Puerto Aimendra, NRM 26544, 1 (61.3). Yaguas Yacu, CAS-SU 60541, 1; USNM 311123, 10. Rio Ucayali, Contamana, ANSP 68670, 1 (58.7, holotype of *Curimatoides ucayalensis*). *Ucayali*: Pucallpa, Cashibococha, MZUSP 26305, 6. Rio Ucayali system, Masisa, Lobococha, USNM 311100, 5 (53.1–76.9). *Madre de Dios*: Reserva Natural de Tambopata (approx. 12°50'30"S, 69°17'30"W), USNM 263973, 2 (46.5–65.5). Reserva Natural de Tambopata, Laguna Chica (approx. 12°50'30"S, 69°17'30"W), USNM 263980, 8 (7, 39.4–89.9). Reserva Natural de Tambopata, Laguna Cocococha, approx. 5.1 km E of Explorer's Inn (approx. 12°49'S, 69°17'30"W), USNM 263974, 4. Reserva Natural de Tambopata, stream entering Rio Tambopata from S bank, approx. 500 m downstream of Explorer's Inn boat-landing (approx. 12°49'35"S, 69°17'30"W), USNM 263976, 1. Rio Tambopata system, quebrada and roadside pools at km 14 along road from Puerto Maldonado to Cuzco, NRM 26543, 1 (56.0).

ECUADOR. *Napo*: Rio Chespirito, below the bridge on the road to Tarapoa, USNM 311318, 2 (72.5–86.0). Laguna Añangococha (0°32'S, 76°26.7'W), USNM 311324, 2 (66.0–69.7).

BOLIVIA. *Beni*: Rio Beni, Cachuela Esperanza, CAS 63049, 1 (23.3, lectotype of *Curimata (Hemicurimata) esper-*

anzae; formerly IU 17281, in part); CAS 63050, 5 (paralectotypes of *Curimata (Hemicurimata) esperanzae*; formerly IU 17281, in part). Borrow-pit by road approx. 1.5 km W of crossing of Rio Matos, 45 airm E of San Borja (approx. 14°56'S, 66°17'W), USNM 305335, 75 (10, 39.2–72.5). Rio Mamore, Laguna Santa Rosa, USNM 278565, 3. Rio Itenez (= Guaporé), at confluence of Rio Itenez and Rio Machupo, USNM 278560, 5 (3, 39.3–52.5). Provincia Ballivia, marsh channel draining Lago Normandia, approx. 1 km N of lake, 40 airm E of San Borja (approx. 14°55'S, 66°18'W), USNM 305404, 5.

Cyphocharax oenas, new species

FIGURES 92, 93

DIAGNOSIS.—*Cyphocharax oenas* is distinguished from its congeners by the combination of 29 to 32 lateral-line scales to the hypural joint, the development of pores along the entire lateral line in all but juveniles, the 29 to 31, typically 30 vertebrae, the relative body depth (0.32–0.40 of SL), the relative depth of the caudal peduncle (0.14–0.15 of SL), the relative length of the postorbital portion of head (0.38–0.43 of HL), the relative length of the head (0.32–0.36 of SL), the relative width of the orbit (0.31–0.35 of HL), the absence of multiple series of longitudinal dark stripes or small dark spots in longitudinal rows on the body, the absence of a discrete patch of dark pigmentation on the dorsal fin, the presence of a rotund patch of dark pigmentation about one-half the diameter of the orbit on the midlateral surface of the caudal peduncle, the presence of a relatively discrete border on the spot and the absence of secondary pigmentation fields reaching to the dorsal and ventral margins of the caudal peduncle in juveniles, the absence of 4 or 5 large midlateral dark spots on the body, the absence of a stripe of dark pigmentation across the middle rays of the caudal fin in moderate to large-sized specimens, the lack of a reticulate pattern on the body in adults, and the possession of 9 branched dorsal-fin rays.

DESCRIPTION.—Body moderately elongate, moderately compressed laterally. Dorsal profile of head very slightly convex from margin of upper lip to vertical line through anterior margin of anterior nostril, straight from that line to tip of supraoccipital spine. Dorsal profile of body nearly straight or very slightly convex from tip of supraoccipital spine to about four scales anterior of origin of dorsal fin, slightly convex from that point to origin of dorsal fin; straight and slightly posteroventrally slanted at base of dorsal fin, straight from rear of dorsal fin to base of adipose fin and from rear of base of adipose fin to caudal peduncle. Dorsal surface of body somewhat to distinctly flattened in region proximate to supraoccipital spine and posteriorly from tip of spine to approximately four scales anterior of dorsal fin origin; with distinct median keel immediately 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 somewhat flattened, with median series of scales in region proximate to insertion of pelvic fins; scales anterior to median series irregularly arranged; scales on prepelvic region comparable in size to those on adjoining regions of body. Very obtuse median keel posterior to pelvic fin origin; secondary keels not evident on each side of postpelvic portion of body.

Greatest body depth at origin of dorsal fin, depth 0.32–0.40 [0.40]; snout tip to origin of dorsal fin 0.51–0.54 [0.51]; snout tip to origin of anal fin 0.84–0.87 [0.84]; snout tip to origin of pelvic fin 0.56–0.60 [0.57]; snout tip to anus 0.79–0.83 [0.79]; origin of dorsal fin to hypural joint 0.54–0.58 [0.54]. Distal margin of dorsal fin slightly rounded; last unbranched and first branched rays about three to three and one-half times length of ultimate ray. Distal margin of pectoral fin rounded; length of pectoral fin 0.20–0.24 [0.20], fin tip extends to or falls slightly short of vertical line through origin of pelvic fin. Distal margin of pelvic fin rounded; length of pelvic fin 0.21–0.24 [0.21], reaches to origin of anal fin in smaller individuals, falls slightly short of fin or reaches only to anus in largest specimens examined. Caudal fin forked. Adipose fin well developed. Distal margin of anal fin emarginate, anteriormost branched rays about two and one-half times length of ultimate ray. Least depth of caudal peduncle 0.14–0.15 [0.14].

Head profile distinctly pointed overall; head length 0.32–0.36 [0.32]; upper and lower jaws equal, mouth terminal; snout pointed, snout length 0.25–0.30 [0.30]; nostrils of each side very close, anterior circular, posterior crescent-shaped with aperture partially closed by thin flap of skin separating nares; orbital diameter 0.31–0.35 [0.32]; adipose eyelid present, weakly developed, with broad vertically ovoid opening over center of eye; length of postorbital portion of head 0.38–0.43 [0.39]; gape width 0.24–0.28 [0.26]; interorbital width 0.40–0.45 [0.41].

Pored lateral-line scales from supracleithrum to hypural joint 29 to 32 [30]; all scales of lateral line pored, canals in lateral-line scales straight; 3 or 4 series of scales extend beyond hypural joint onto caudal-fin base; $5\frac{1}{2}$ to $6\frac{1}{2}$ [$5\frac{1}{2}$] scales in transverse series from origin of dorsal fin to lateral line; $4\frac{1}{2}$ or 5 [$4\frac{1}{2}$] scales in transverse series from lateral line to origin of anal fin.

Dorsal-fin rays ii,9 [ii,9]; anal-fin rays ii,7 [ii,7]; pectoral-fin rays 13 to 15 [14]; pelvic-fin rays i,7 or i,8 (i,7 rare) [i,8].

Total vertebrae 29 (7), 30 (55), 31 (2).

COLOR IN ALCOHOL.—Available specimens all largely lacking guanine on scales; overall ground coloration ranging from light tan to light brown; ground coloration within populations constant. Darker specimens with upper lip, snout, dorsal portion, of head and upper half of opercle covered by field of small, very dark chromatophores. Same portions of head and particularly upper lip, covered by field of less dense chromatophores in lighter individuals. Darker individuals with posterior margins of scales outlined by narrow band of small dark chromatophores; this pigmentation faint or absent in members of lighter colored populations. Center of scales dorsal of lateral line distinctly darker in all populations. Diffuse deep-lying midlateral stripe extending from supracleithrum to caudal peduncle in all populations. Patch of dark superficial chromatophores on midlateral surface of posterior portion of caudal peduncle, spot ranging from rotund to slightly horizontally elongate, with distinct margins and no secondary field of chromatophores extending ventral and dorsal of central spot to dorsal and ventral margins of caudal peduncle in juveniles. Fin-rays of dorsal, caudal, and anal fins outlined by series of small, dark chromatophores in all populations; intensity of pigmentation more pronounced in darker individuals. Adipose fin dusky. Pectoral and pelvic fins hyaline in lightly pigmented individuals, with some dark pigmentation along margin of fin rays in individuals with darker overall pigmentation.



FIGURE 93.—*Cyphocharax oenas*, new species, holotype, MBUCV V-20336, 44.1 mm SL; Venezuela, Territorio Federal Delta Amacuro, secondary caño off Caño Paloma, 92 nautical miles from sea buoy ($8^{\circ}28'00''N$, $61^{\circ}25'36''W$).

DISTRIBUTION.—Central and eastern portion of the Río Orinoco basin (Figure 92).

ETYMOLOGY.—The species name, *oenas*, from the Greek for wild pigeon or dove, in reference to the name of the type locality, Paloma, which is Castilian for pigeon or dove.

TYPE MATERIAL EXAMINED.—21 specimens (21, 31.2–47.6).

HOLOTYPE.—VENEZUELA. *Territorio Federal Delta Amacuro*: Secondary caño off Caño Paloma, 92 nautical miles from sea buoy (8°28'00"N, 61°25'36"W), collected by D.J. Stewart et al., 21 Nov 1979, MBUCV V-20336,1 (44.1).

PARATYPES.—VENEZUELA. *Territorio Federal Delta Amacuro*: Secondary caño off Caño Paloma, 92 nautical miles from sea buoy (8°28'00"N, 61°25'36"W), collected with holotype: USNM 235485, 10 (33.3–47.6; 1 specimen cleared and counterstained for cartilage and bone); MBUCV V-20337, 10 (31.2–47.4).

NON-TYPE MATERIAL EXAMINED.—453 specimens (28, 29.5–52.7)

VENEZUELA. *Territorio Federal Delta Amacuro*: Secondary caño off Caño Paloma, 92 nautical miles from sea buoy (8°28'00"N, 61°25'36"W), collected with holotype, USNM 309287, 168; MBUCV V-20338, 168. First small caño on W side of Caño Paloma, 100 m above its mouth, 92 nautical miles from sea buoy (approx. 8°29'N, 61°25'W), USNM 235486, 3; USNM 235465, 1; USNM 235503, 2. Small caño at mouth of Caño Fiscal, 64 nautical miles from sea buoy (approx. 8°32'N, 61°02'W), USNM 235482, 2. Río Orinoco, small caño and marsh on S shore, 83 nautical miles from sea buoy, USNM 235487, 6; MBUCV V-20339, 6. Río Orinoco, Laguna on Isla Tortola, 134 nautical miles upstream from sea buoy (approx. 8°41'N, 62°03'W), USNM 235509, 3. Small caño tributary to Caño Araguao, 112 nautical miles upstream from sea buoy (approx. 8°38'N, 61°43'W), USNM 235483, 21 (10, 33.2–37.9); MBUCV V-20340, 22. Cove on sand bar near E end of Isla Portuguesa, 117 nautical miles from sea buoy (approx. 8°36'N, 61°48'W), USNM 235476, 14 (9, 32.2–40.3); MBUCV V-20341, 14. *Monagas*: Río Orinoco, 161 nautical miles upstream from sea buoy, Laguna Tapatapa on Isla Tapatapa, near downstream end of Caño Limón (approx. 8°32'N, 62°26'W), USNM 235510, 1. Isolated pools on Cocos, small island on N side of river, opposite Los Castillos, between Puerto Ordaz and Barrancas (8°30'42"N, 62°26'06"W), USNM 235477, 2. Río Orinoco, Barrancas, Laguna El Guatero, 143 nautical miles upstream from sea buoy (approx. 8°41'N, 62°11'W), USNM 235481, 2; USNM 235444, 6. *Bolívar*: Río Orocopiche, about 15 m from mouth in Río Orinoco, downstream from Rt. 19 bridge (approx. 8°03'N, 63°40'W), USNM 235496, 1. Río Aro, about 3 km downstream from Rt. 19 bridge, about 85 km from Ciudad Bolívar (approx. 8°00'N, 64°15'W), USNM 235495, 2. *Guarico*: Río Guariquito, at government reserve, ESE of Calabozo (approx. 8°35'N, 67°15'W), USNM 257527, 9 (29.5–52.7).

Phylogenetic Comments

Diverse body systems demonstrate discrete variation in the Curimatidae. These features have been the source of a great deal of information pertinent to the elucidation of the hypothesized phylogenetic relationships of and within the family (Vari, 1982a, 1983, 1984a, 1989a, b, c, d). One exception to that generalization is the subject of this study, the genus *Cyphocharax*. In his analysis of phylogenetic relationships in the Curimatidae, Vari (1989a) was unable to identify any synapomorphies supporting the hypothesis that *Cyphocharax* as defined therein was monophyletic. The anatomical studies associated with this study have been similarly unsuccessful in identifying any uniquely derived features indicating that the species of *Cyphocharax* share a common, exclusive evolutionary history. The lack of a derived defining feature for *Cyphocharax* in conjunction with the multitomy between that genus, *Curimatella*, *Steindachnerina*, and *Pseudocurimata* (Vari, 1989a) means that no evidence now exists to refute an alternative hypothesis that components of *Cyphocharax* may be more closely related to one or more of the other genera in that multitomy than to the remaining species of *Cyphocharax* (see also comments under "Remarks" under discussion of *Cyphocharax*).

Vari (1989a:58–59) tentatively identified some possible groupings in *Cyphocharax* largely based on data from two systems, head and body pigmentation, and reductive features of the laterosensory canal system and associated canal-bearing bones. Modifications of the systems remain the most informative phylogenetically among the various anatomical features studied, albeit providing an incomplete and somewhat contradictory picture. Although variation exists in various other body systems, the range of differences in such systems within *Cyphocharax* is typically relatively limited compared with the situation in other lineages of curimatids. The problems engendered by that lack of diversity are exacerbated by the continuous nature of the variation in many features in *Cyphocharax*. This typically makes it impossible to non-arbitrarily assign the condition in a particular species to discrete character states.

Many derived changes in both those body systems and others are autapomorphic for particular species. Autapomorphies are uninformative in phylogenetic studies, but are rather pertinent to problems of species definition. Those diverse characters and the evidence for their derived natures are discussed within the appropriate species accounts (e.g., "Autapomorphies of *Cyphocharax abramoides*").

PIGMENTATION.—One of the pigmentation patterns noted by Vari (1989a:58–59) within *Cyphocharax* was the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle in ten nominal species and subspecies of the genus, five of which (*stigmaturus*, *esperanzae*, *ucayalensis*, *vandeli*, and *esperanzae pijpersi*) are considered synonyms in this study. Over one-half of the recognized species of

Cyphocharax (*gangamon*, *gilbert*, *gillii*, *gouldingi*, *helleri*, *meniscaprorus*, *mestomyllon*, *modestus*, *oenas*, *pantostictos*, *punctatus*, *saladensis*, *santacatarinae*, *signatus*, *spilotus*, *spiluroopsis*, *spilurus*, *vanderi*, and *voga*) have a patch of dark pigmentation on the midlateral surface of the caudal peduncle. The form of that pigmentation in this assemblage of 19 species varies from a relatively elongate stripe (e.g., *C. pantostictos*, Figure 12) to a rotund spot (e.g., *C. gillii*, Figure 86). Discrete broad patches of dark pigmentation centered on the midlateral surface of the caudal peduncle have a relatively limited distribution within the Curimatidae, and are absent in the Prochilodontidae, the sister group to the Curimatidae. Thus the presence of a patch of dark pigmentation on the midlateral surface of the caudal peduncle is hypothesized to be derived within the family. It is noteworthy that such a pigmentation pattern also occurs in all species of *Pseudocurimata* (Vari, 1989b), some species of *Steindachnerina* (Vari, 1991), and in one species of *Curimatella* (Vari, 1992). The presence of such pigmentation on the caudal peduncle in these outgroups, in particular in all species of *Pseudocurimata*, in conjunction with the unresolved nature of the relationships of those genera and *Cyphocharax* (Vari, 1989a) introduces some uncertainty into the hypothesis that the presence of such pigmentation defines a monophyletic assemblage within *Cyphocharax*. Various combinations of species within the assemblage of 19 species with caudal peduncle pigmentation do, however, share other derived features (see below) lending credence to the hypothesis that components of the assemblage of species with a patch of dark pigmentation constitute a natural assemblage.

A second pigmentation pattern distinctive for a subunit of *Cyphocharax* is the pattern of dark longitudinal stripes on the lateral and dorsolateral surfaces of the body in *C. helleri* (Figure 13) and *C. multilineatus* (Figure 19). Such intense pigmentation positioned along areas where horizontal rows of body scales overlap is unique to these species within the Curimatidae. Thus the feature is hypothesized to represent a derived feature for the two species. The very faint longitudinal stripes in *C. microcephalus* (Figure 36) may be homologous at a higher level of generality with the intense striping in *C. helleri* and *C. multilineatus*. If that is the case then the presence of the longitudinal stripes, either faint or well developed, would be a derived feature common to three species (*helleri*, *multilineatus*, and *microcephalus*).

Two species within the subunit of *Cyphocharax* with dark pigmentation on the midlateral surface of the caudal peduncle (*punctatus* and *vanderi*) also share a distinctive pattern of large dark spots on the midlateral surface of the body (see Figures 43, 45, 46). Although a scattering of small spots on the lateral and dorsolateral surfaces of the body characterizes juveniles and moderate-sized specimens of *Cyphocharax voga* (see Figures 55, 56) that pigmentation pattern differs notably from the spots in *C. punctatus* and *C. vanderi* and represents an evidently non-homologous, albeit autapomorphic, feature. No other species in the Curimatidae has a pigmentation pattern of spots

on the midlateral surface of the body comparable to that in *C. punctatus* and *C. vanderi*, nor is such a pattern known in the Prochilodontidae. Thus the pigmentation on the body in those two species is considered a synapomorphy for the species pair.

LATEROSENSORY CANAL SYSTEM OF BODY.—The one notable modification of the laterosensory canal system on the body in *Cyphocharax* is the incomplete poring of the lateral line in three members of the genus (*saladensis*, *vexillapinnus*, and *punctatus*). The homology of the condition in *C. punctatus* and that in *C. vexillapinnus* and *C. saladensis* is questionable. Both *C. vexillapinnus* and *C. saladensis* have a relatively constant number of pored scales along the anterior portion of the lateral line scale series (8–9 and 5–8 pored scales respectively) across a relatively broad size range (22.4–63.0 mm SL and 27.7–66.5 mm SL, respectively) that includes adults. The available material of *Cyphocharax punctatus*, alternatively, demonstrates a pronounced ontogenetic increase in the number of pored scales (8–20 pored out of 27–30 total) across a distinctly smaller size range (18.6–42.5 mm SL). In their description of this latter species, Vari and Nijssen (1986:54) noted that “there is an increase in the number of pored lateral line scales in this species with increasing size. If the species attains a larger maximum size than indicated by the present sample, then it is possible that larger individuals would have a completely pored laterosensory canal system on the body.” None of the subsequently examined specimens of *C. punctatus* are larger than the type specimens making it impossible to test the hypothesis. Nonetheless various other species of *Cyphocharax* with completely pored lateral lines as adults undergo a comparable progressive increase in the number of pored scales within the size range of the known specimens of *C. punctatus* (see also comments on *Curimatus (Hemicurimata) esperanzae pijpersi* in “Remarks” under *Cyphocharax helleri*). Such an ontogenetic elaboration of the canal in other species of *Cyphocharax* makes it likely that the incompletely pored laterosensory system on the body in *C. punctatus* represents a juvenile condition, and that larger specimens of the species would have completely pored lateral lines. Although it is not possible to confirm that hypothesis in the absence of larger specimens, the available data indicates that the incompletely pored but ontogenetically lengthened lateral line in *C. punctatus* is not homologous with the invariably truncated lateral line of *C. vexillapinnus* and *C. saladensis*. The reduced laterosensory canal system on the body in *C. vexillapinnus* and *C. saladensis* is consequently hypothesized to be a homologous derived feature unique for that pair of species in the genus. A reduced laterosensory canal system on the body was hypothesized by Vari (1982a) as synapomorphic for the species of *Curimatopsis*. As discussed by Vari (1989a:61–63) the common occurrence of these reductive features in the five species of *Curimatopsis* and the cited subunit of *Cyphocharax* is hypothesized homoplastic within the context of the overall most parsimonious hypothesis of intergeneric relationships among curimatids.

FIRST INFRAORBITAL (IO_1).—In his phylogenetic study of the Curimatidae Vari (1989a:37) noted that the first infraorbital, the most anterior of the ossifications that borders the ventral and posterior margins of the orbit, typically has a discrete tube-like laterosensory canal segment in most characiforms. Such a canal segment is evidently universal to the Prochilodontidae, the sister group to the Curimatidae, and is also typical of the vast majority of species among curimatids in general and *Cyphocharax* in particular. Such a laterosensory canal segment in IO_1 is lacking in only two components of the Curimatidae, all species of *Curimatopsis* and some species of *Cyphocharax*. The absence of the canal in the two genera was hypothesized to represent independent losses in the context of the overall most parsimonious hypothesis of relationships in the Curimatidae (Vari, 1989a:37, 60). The lack of a laterosensory canal segment in the first infraorbital in the species of *Curimatopsis* was proposed as an additional synapomorphy for the species of the genus (Vari, 1989a:54).

Given the broad phylogenetic distribution of a canal in the first infraorbital in the various groups cited above, the presence of an ossified laterosensory canal associated in that bone hypothesized to represent the primitive condition for *Cyphocharax*. Thus the lack of the structure in nine members of the genus (*gangamon*, *meniscaprorus*, *nigripinnis*, *oenas*, *punctatus*, *saladensis*, *signatus*, *vanderi*, *vexillapinnus*) is hypothesized derived. Although several of the *Cyphocharax* species (*saladensis*, *vanderi*, *vexillapinnus*) lacking a laterosensory canal segment in the first infraorbital reach a moderate body size, the other six species of the genus lacking that canal (*gangamon*, *meniscaprorus*, *nigripinnis*, *oenas*, *punctatus*, *signatus*) have among the smallest known maximum standard lengths in the genus, and indeed in the family. Among other curimatids only some species of *Curimatopsis* remain so small as adults. The reduced body sizes of the six noted species of *Cyphocharax* relative to other members of the genus raises the question of whether the absence of the IO_1 canal is perhaps correlated with reduced body length. Weitzman and Vari (1988:445) following Myers (1958:29), noted that one of the paedomorphic morphological features typical of miniature species is the reduction of the laterosensory canal system of the head and body. Such presumably reductive, putatively paedomorphic features occur not only among characiforms, but also in other ostariophysans (e.g., Siluriformes (Schaefer et al., 1989:204)). Although none of the diminutive species of *Cyphocharax* fall within the size limit for miniatures proposed by Weitzman and Vari (1988), the small body size of the species relative to congeners and other curimatids raises the possibility that we are dealing with independent losses consequent not upon common ancestry but rather reduced body size. This may explain the incongruities that exist between the distribution of the absence of a laterosensory canal segment in the first infraorbital versus other derived features within *Cyphocharax* (see also discussion below).

SIXTH INFRAORBITAL (IO_6).—The sixth infraorbital (the

dermosphenotic of some authors) is the dorsal of the typically canal-bearing bones in the infraorbital series and overlies the dilatator fossa on the dorsolateral surface of the neurocranium (see Vari, 1989a, fig. 36). Vari (1989a:39) noted a reduced IO_6 in two species of *Curimatopsis* and the absence of the ossification in the other members of the genus. A similar two-stage reductive trend occurs within *Cyphocharax* with the sixth infraorbital in *C. vexillapinnus* and *C. gangamon* reduced relative to that typical among curimatids and with the ossification absent in *C. signatus* and *C. punctatus*. Given the general occurrence of the ossification in outgroups to *Cyphocharax* both in and outside of the Curimatidae, the reduction and loss of the bone are considered derived features at different levels of universality within *Cyphocharax*. Within the overall most parsimonious hypothesis of relationships within the Curimatidae (Vari, 1989a) it is assumed that these reductions are homoplastically manifested in *Curimatopsis*.

The reduction and loss of the sixth infraorbital in these species of *Cyphocharax*, three of which (*gangamon*, *signatus*, and *punctatus*) have the shortest known maximum standard lengths in the genus again raises the possibility that we are dealing with a paedomorphic truncation of the developmental sequence of the sixth infraorbital. Alternatively, the presence of a complete IO_6 in specimens of other species of *Cyphocharax* of comparable size to the species under question, renders that generalization less tenable. Indeed specimens of *Cyphocharax vanderi* comparable in size to the examined cleared and stained specimens of *C. vexillapinnus* have the sixth infraorbital notably well developed.

SUMMARY.—The detailed characters suggest at best some general groupings within *Cyphocharax*, but with the evidence demonstrating a high degree of incongruity. The largest subunit of *Cyphocharax* defined by any discussed characters consists of the 19 species (*gangamon*, *gilbert*, *gillii*, *gouldingi*, *helleri*, *meniscaprorus*, *mestomyllon*, *modestus*, *oenas*, *pantostictos*, *punctatus*, *saladensis*, *santacatarinae*, *signatus*, *spilotus*, *spiluroopsis*, *spilurus*, *vanderi*, and *voga*) having a patch of dark pigmentation on the midlateral surface of the caudal peduncle. Nonetheless, only one of the two other derived features of pigmentation common to more than one species in the genus has a distribution congruent with this grouping. The presence of distinct large dark spots on the midlateral surface of the body at some point in development is unique to *C. punctatus* and *C. vanderi*, both members of the 19 species assemblage characterized by the caudal peduncle pigmentation. In contrast, *C. helleri*, which has a distinct spot on the caudal peduncle, shares a second distinctive feature of body pigmentation, the presence of multiple dark horizontal stripes with *C. multilineatus* which, however, lacks a patch of dark pigmentation on the caudal peduncle. Similarly *C. microcephalus*, a species with faint longitudinal striping on the body perhaps homologous with the pigmentation in *C. helleri* and *C. multilineatus* (see discussion under "Pigmentation"), also lacks a patch of dark pigment on the caudal peduncle. If both pigmentation features, body

striping and a dark patch on the caudal peduncle, are derived, then we are either dealing with homoplasy or secondary loss.

The superimposition of information from the laterosensory canal system of the body complicates the picture further. The derived absence of the laterosensory canal segment in the first infraorbital characterizes both some species with dark caudal peduncle pigmentation (*meniscaprorus*, *oenas*, *punctatus*, *saladensis*, *signatus*, *vanderi*) and some lacking it (*vexillapinnus*, *gangamon*, *nigripinnis*). Similarly, incongruities exist between the distribution across species of the occurrence of pigmentation on the midlateral surface of the caudal peduncle on the one hand, and the pattern of occurrence of the various types of modifications of the infraorbitals (absence of a laterosensory canal segment in the first infraorbital; reduction of loss of the sixth infraorbital) on the other. These incongruities make it premature to propose any hypothesis of phylogenetic relationships in the genus at this time.

Endemic Species

The available information on character polarity and distribution is relatively uninformative as to the phylogenetic relationships within *Cyphocharax*, a deficiency that also precludes any rigorous comments about the historical biogeography of the genus. It is noteworthy nonetheless that the distributions of approximately 82% of the species of *Cyphocharax* agree with the areas of endemism noted by Vari (1988). The areas of endemism and their included species (in parentheses) are as follows: Western (*aspilos*, *magdalenae*); Orinoco (*meniscaprorus*, *oenas*); Guianas (*helleri*, *microcephalus*, *punctatus*), Amazon (*gangamon*, *mestomyllon*, *multilineatus*, *nigripinnis*, *notatus*, *pantostictus*, *plumbeus*, *signatus*, *spiluropsis*, *stilbolepis*, *vexillapinnus*); upper Rio Paraná (*modestus*, *nagelii*, *vanderi*); and Paraguay (*gillii*, *platanus*, *saladensis*, *santacatarinae*, *spilotus*, *voga*). Two of the other species of *Cyphocharax* (*gouldingi*, *leucostictus*) extend from the state of Amapá, Brazil, the southern portion of the Guianas region of endemism into the a portion of (*gouldingi*) or across much of the Amazon endemic region (*leucostictus*). *Cyphocharax abramoides* has a distribution extending beyond the central portions of the Amazon endemic region and the upper reaches of the Río Orinoco basin, drainage systems that are joined by the Río Casiquiare. This pattern, apparently reflective of the occurrence of the species in acidic blackwaters, is paralleled by the distribution of various species of *Curimata* (see comments in Vari, 1989c, concerning *C. vittata* and *C. ocellata*). *Cyphocharax gilberti* has a broad distribution across the southern and central portions of the neighboring Coastal and Rio São Francisco areas of endemism. The remaining two species in the genus (*festivus*, *spilurus*) apparently range across at least parts of three regions of endemism (Orinoco, Amazon,

Guianas) but with some variation between the populations. Analyses of additional population samples are necessary to determine whether these differences may indicate that these species are complex (see also "Remarks" under each species account).

Finer scale analysis of the distribution of the various species demonstrates some correlations with other less extensive areas of endemism proposed by various authors, or with the distributions of other recently revised groups of fishes. Within the Guiana endemic region the most notable of these involves *Cyphocharax punctatus* which is evidently endemic to the Marowijne River system of Surinam and French Guiana (Figure 44), a region that shows a notable degree of endemism in the cichlid fauna (see Kullander and Nijssen, 1989:xxv). Many of the species of *Cyphocharax* within the Amazon basin have relatively limited distributions. These may be more reflective of the still sparse collections of fishes from many portions of the basin, but in several cases do match with areas of endemism noted for other groups of fishes. The distribution of *Cyphocharax pantostictus* (Figure 11, squares) fits the "Western Amazonian endemic area" proposed by Kullander (1986:40) based on data from various neotropical genera of the perciform family Cichlidae. *Cyphocharax signatus*, in turn, is only known from the Rio Tocantins basin, a system whose fish fauna includes a number of evidently endemic species (see examples in Costa, 1990; Costa et al., 1988, 1990; Vari, 1991).

The Paraguay endemic region is relatively complex hydrographically, encompassing both a series of smaller drainages emptying into the Atlantic Ocean along the eastern coast of Brazil and major rivers which contribute to the internal Río de La Plata system. Along the coastal versant the relatively limited range of *C. santacatarinae* (Figure 67, squares) matches that noted for the glandulocaudin characid *Mimagoniates lateralis* (Nichols), tetragonopterin characid *Hyphessobrycon griemi* (Hoedeman), and callichthyid catfish *Corydoras macropterus* Regan by Weitzman et al. (1988:390, 420, 424), with the southern distributional limit of *Cyphocharax santacatarinae* being in common with that of the "lowland species group" of the characid genus *Oligosarcus* Günther reported by Menezes (1988:298). The northern limit along the coastal versant of the distribution of *Cyphocharax voga* (Figure 58, filled in circles) matches known limits of the distribution of the glandulocaudin *Mimagoniates rheocharis* Menezes and Weitzman (1990), the Neotropical cichlid genus *Gymnogeophagus* Ribeiro (Reis and Malabarba, 1988), and various species of the characid genus *Oligosarcus* (Menezes, 1988). The similarities of these distributional limits is suggestive of some general patterns of speciation in those regions, a suggestion that can only be tested by revisionary studies of other freshwater fish groups in the region.

RESUMO

O gênero *Cyphocharax* Fowler (1906), uma subunidade da família Curimatidae, ordem Characiformes, é aqui revisado. *Cyphocharax* possui três sinônimos juniores, os gêneros *Xyrocharax* Fowler (1913), *Hemicurimata* Myers (1929), e *Curimatoides* Fowler (1940a). São reconhecidas 33 espécies em *Cyphocharax*: *C. abramoides* (Kner, 1859a), amplamente distribuída na bacia do rio Amazonas e tributários meridionais do rio Orinoco; *C. aspiilos*, uma nova espécie, endêmica dos rios da bacia do lago Maracaibo; *C. festivus*, uma nova espécie, conhecida de várias porções da bacia Amazônica e dos rios das Guianas e leste da Venezuela; *C. gangamon*, uma nova espécie, do rio Tapajós, na bacia Amazônica; *C. gilbert* (Quoy & Gaimard, 1824), das drenagens costeiras do Rio de Janeiro até o estado da Bahia, no nordeste do Brasil; *C. gillii* (Eigenmann & Kennedy, 1903), da bacia do Rio da Prata; *C. gouldingi*, dos rios do estado do Amapá e também dos rios Capim, Tocantins e Xingu, todos no estado do Pará, Brasil; *C. helleri* (Steindachner, 1910), do leste da Venezuela, Guianas e parte central do estado do Amapá, no Brasil; *C. leucostictus* (Eigenmann & Eigenmann, 1889), conhecido da bacia do rio Amazonas e rios costeiros do Amapá, Brasil; *C. magdalenae* (Steindachner, 1879a), ocorrendo desde o sudoeste da Costa Rica até o sistema do rio Magdalena, no noroeste da Colômbia; *C. meniscaprorus*, uma nova espécie, do rio Aro, tributário do rio Orinoco, na Venezuela; *C. mestomyllon*, uma nova espécie, do sistema do rio Negro, no Brasil; *C. microcephalus* (Eigenmann & Eigenmann, 1889), encontrado em uma série de rios no Suriname e na Guiana; *C. modestus* (Fernández-Yépez, 1948), endêmica da porção superior da bacia do rio Paraná; *C. multilineatus* (Myers, 1927), das porções centrais do sistema do rio Amazonas; *C. nagelii* (Steindachner, 1882), endêmica do rio Paraná superior; *C. nigripinnis*, uma nova espécie da bacia Amazônica; *C. notatus* (Steindachner, 1908), amplamente distribuída através da bacia Amazônica; *C. oenas*, uma nova espécie, da bacia do rio Orinoco; *C. pantostictos* Vari & Barriga (1990), das porções ocidentais da bacia Amazônica no Equador e Peru; *C. platanus* (Günther, 1880), da bacia do Rio da Prata, excluindo o rio Paraná superior; *C. plumbeus* (Eigenmann & Eigenmann, 1889), amplamente distribuída através da bacia Amazônica; *C. punctatus* (Vari & Nijssen, 1986), endêmica do sistema do rio Marowijne, no Suriname e Guiana Francesa; *C. saladensis* (Meinken, 1933), das drenagens costeiras do sudeste do Brasil e porções da bacia do Rio da Prata; *C. santacatarinae* (Fernández-Yépez, 1948), dos rios costeiros dos estados brasileiros de Santa Catarina, Paraná e São Paulo; *C. signatus*, uma nova espécie, do sistema do rio Araguaia, estado de Goiás, no Brasil; *C. spilolus* (Vari, 1987), do sistema do rio Uruguai no sudeste do Brasil e regiões próximas na Argentina; *C. spiluroopsis* (Eigenmann & Eigenmann, 1889) das porções central e ocidental da bacia Amazônica; *C. spilurus* (Günther, 1864), do rio Cuyuni na Venezuela e Guiana, rios costeiros da Guiana, Suriname, e Guiana Francesa, porção superior do rio Branco no Brasil e, talvez, sistema do rio Orinoco; *C. stilbolepis*, uma nova espécie, conhecida somente dos sistemas dos rios Xingu e Tocantins; *C. vanderi* (Britski, 1980), da bacia do rio Paraná superior; *C. vexillapinnus*, uma nova espécie, dos cursos médio e superior do rio Amazonas, no Brasil, Peru e Equador; e *C. voga* (Hensel), dos rios costeiros do estado Rio Grande do Sul e parte sul do estado de Santa Catarina, no Brasil, e também do Uruguai e porções do sistema do Rio da Prata.

Quatorze espécies e subespécies são colocadas como sinônimos neste estudo. *Pseudocurimata steindachnerina* Fernández-Yépez (1948), baseada em material do sistema do rio Magdalena, é considerada um sinônimo de *Cyphocharax magdalenae*. *Curimatus albula* Lütken (1874), do sistema do Rio das Velhas, pertencente à bacia do rio São Francisco, e *Pseudocurimata grandocule* Fernández-Yépez (1948), do estado brasileiro do Espírito Santo, são considerados sinônimos de *Cyphocharax gilbert*. *Curimata gnaca* Azpelicueta & Braga (1988), da região de Resistência, na Argentina, é tentativamente colocada como um sinônimo de *Cyphocharax spilolus*. *Curimatus vandeli* Puyo (1943), descrito da Guiana Francesa, e *Curimatus (Hemicurimata) esperanzae pijperzi* Géry (1965), baseado em espécimes do Suriname, são sinônimos de *Cyphocharax helleri*. *Curimatopsis maculatus* Ahl (1934), descrito da Argentina, foi baseado em um juvenil de *Cyphocharax voga*. *Curimatus hermanni* Ahl (1931), descrito com base em dois exemplares coletados no rio Capim, no estado brasileiro do Pará, é considerado um sinônimo de *Cyphocharax notatus*. *Curimatus (Curimatella) xinguensis* Steindachner (1908), baseado em material do sistema do rio Xingu, é colocado na sinonímia de *Cyphocharax leucostictus*. *Curimatella rehni* Fowler (1932), com a série-típica proveniente de Mato Grosso, é considerado um sinônimo de *Cyphocharax gillii*. *Curimatus surinamensis* Steindachner (1910), baseado em espécimes da porção superior do rio Suriname, no Suriname, é um sinônimo de *Cyphocharax spilurus*. *Curimatus stigmatulus* Fowler (1913), descrito do sistema do rio Marañon, no Peru, *Curimatoides ucayalensis* Fowler (1940a), baseado

em um único exemplar da bacia do rio peruano Ucayali, e *Curimata esperanzae* Myers (1920), baseada em uma série de exemplares juvenis originários da porção superior do rio Madeira, na Bolívia, são todos colocados como sinônimos de *Cyphocharax spiluropsis*.

Lectótipos são designados para *Curimatus albula* Lütken, *Curimatus (Hemicurimata) esperanzae* Myers, *Curimatus leucostictus* Eigenmann & Eigenmann, *Curimatus magdalenae* Steindachner, *Curimatus microcephalus* Eigenmann & Eigenmann, *Curimatus platanus* Günther, *Curimatus plumbeus* Eigenmann & Eigenmann, *Curimatus spiluropsis* Eigenmann & Eigenmann, *Curimatus spilurus* Günther, e *Curimatus voga* Hensel.

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