

**A PHYLOGENETIC STUDY OF THE NEOTROPICAL BANJO CATFISHES
(TELEOSTEI: SILURIFORMES: ASPREDINIDAE)**

by

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Date: 13 Dec. 1994

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Dissertation submitted in partial fulfillment of
the requirements for the degree of Doctor
of Philosophy in the Department of
Zoology in the Graduate School of
Duke University

1994

ABSTRACT
(ZOOLOGY)

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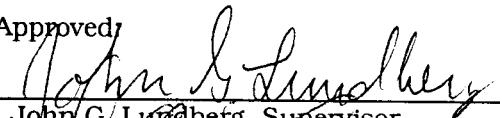
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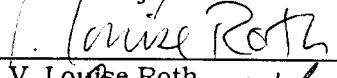
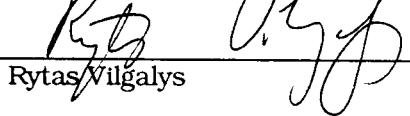
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Abstract

The Neotropical catfish family Aspredinidae, commonly known as banjo catfishes, contains 34 valid nominal species (plus numerous undescribed species) distributed throughout the principal river systems of tropical South America and the coastal region from the Orinoco to Amazon deltas. This study was undertaken to elucidate the phylogenetic relationships within the Aspredinidae and of the Aspredinidae to other catfishes.

Based on examination of most aspredinid specimens available and a phylogenetic analysis of morphological features, this study supports the monophyly of the Aspredinidae and revises their taxonomy to include 12 genera. The phylogenetic relationships among genera of aspredinids are fully resolved as follows: (*Pseudobunocephalus* new genus, (*Acanthobunocephalus* new genus, ((*Bunocephalus*, *Amaralia*), ((*Pterobunocephalus*, (*Platystacus*, (*Asredo*, *Aspredinichthys*))), (*Xylipterus*, (*Hoplomyzon*, (*Dupouyichthys*, *Ernestichthys*)))))). A key to genera, diagnoses of genera, and lists of valid species are presented.

This study reveals that the traditionally recognized subfamily Aspredininae is not the sister group to all other Aspredinidae but is nested higher up in the phylogeny of aspredinids. Furthermore, the subfamily Bunocephalinae, tribe Bunocephalini and genera *Dysichthys* sensu Mees (1989) and *Asredo* sensu Mees (1987) are paraphyletic taxa.

Major taxonomic and nomenclatural changes resulting from this phylogenetic study include the following: Species originally placed in *Bunocephalus* Kner, 1855 and recently transferred to *Dysichthys* Cope, 1874 by Mees (1989) are reassigned to *Pseudobunocephalus* new genus, *Pterobunocephalus* Fowler, 1943, and *Bunocephalus* Kner, 1855. In addition, several genera are synonymized in this study. *Petacara* Böhlke, 1959 is a junior subjective synonym of *Pterobunocephalus* Fowler, 1943; *Dysichthys* Cope, 1874 is a junior subjective synonym of *Bunocephalus* Kner, 1855; and *Bunocephalichthys*

Bleeker 1858 and *Agmus* Eigenmann, 1910 are junior objective synonyms of *Bunocephalus* Kner, 1855.

Results of the phylogenetic analysis also support a novel hypothesis that the sister group of the Aspredinidae are the doradoid catfishes (Mochokidae, Doradidae, Centromochlidae and Auchenipteridae). This proposal challenges previous hypotheses of a sister group relationship with either sisoroid catfishes (Amblycipitidae, Sisoridae and Akysidae) or loricarioid catfishes (Nematogenyidae, Trichomycteridae, Callichthyidae Scolopacidae, Astroblepidae and Loricariidae). Evidence supporting this relationship with doradoid catfishes comes primarily from synapomorphies of the musculature and skeletal elements of the pectoral-spine complex.

Notice

In accord with articles 8 and 9 of the third edition of the International Code of Zoological Nomenclature (ICZN, 1985), this work is not issued for permanent scientific record and as such is not an available work. All names for new genera and species are provisional and are not officially available until they are eventually published in an available work such as a peer reviewed journal.

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Introduction

Dissertation Objectives

Despite recent taxonomic treatments of the three traditional subgroups (Subfamily Aspredininae, tribes Bunocephalini, and Hoplomyzontini) within the Aspredinidae (Ma, 1977; Mees, 1987, 1988, 1989; Stewart, 1985), the relationships of these subgroups to each other has remained problematic. Furthermore, two recent phylogenetic studies of the higher level relationships of catfish families (Pinna, 1993, Mo, 1991) have not fully resolved the placement of the Aspredinidae relative to other catfishes. Both these problems are in part due to a poor understanding of the range of morphological diversity within the family and the lack of a phylogeny for the Aspredinidae.

To address these problems, I have done a phylogenetic revision of the Aspredinidae for my dissertation research. There are three main objectives of this dissertation: (1) to demonstrate the monophyly of the Aspredinidae, (2) to resolve the phylogenetic relationships among the genera and larger clades within the Aspredinidae, and (3) to identify the sister group to the Aspredinidae. To achieve these objectives I have conducted a broad survey of the gross morphology of all available aspredinid species and representatives of all other catfish families. A data set based on this morphological survey was analyzed using modern cladistic methods to reconstruct phylogenetic relationships and to identify synapomorphies which support these relationships. The results of this analysis have been used to revise the nomenclature of aspredinid genera to reflect this new information on their phylogenetic relationships.

Introduction to the Aspredinidae

Fishes of the family Aspredinidae are commonly known as banjo catfishes due to their overall body shape, a depressed head and slender caudal peduncle, which when seen in dorsal view somewhat resembles the musical instrument (Myers, 1960). They occur throughout the tropical rivers of South America (Magdalena, Orinoco, Amazon, and Paraguay-Paraná), a few rivers west of the Andes Mountains (Atrato, San Juan, and Patia) and the coastal region from the Orinoco to Amazon deltas. Local names for aspredinids include “banjaman” or “banjo-man” (Guyana), “croncron” (French Guiana), “rabeca” (Brazil), and “guitarillo” (Venezuela). Banjo catfishes maybe found in habitats ranging from shallow backwaters to deep river channels to tidal estuaries. In general, most species are cryptically pigmented, benthic and sluggish unless disturbed. Many are semi-fossorial, during the day often resting just beneath the substrate surface.

Approximately 60 extant species of banjo catfishes have been described and no fossil aspredinids have yet been identified. A large proportion of the described species are now considered subjective junior synonyms of earlier described species. As defined in this work, the family contains 34 valid nominal species placed in 12 genera. Two of these genera, *Acanthobunocephalus* and *Pseudobunocephalus* along with their type species are described as new in this work (Appendices 1 & 2). In addition, I am aware of new species of *Bunocephalus*, *Amaralia*, *Pterobunocephalus* and *Hoplomyzon* which await future description.

Despite the relatively small number of species in this family as compared to other catfish families, aspredinids are quite diverse in their morphology. They range from miniature armored species such as *Hoplomyzon papillatus*, less than 20 mm SL, to large elongate species such as *Aspredo aspredo*, reaching up to 380 mm SL. This large degree of morphological divergence within the family has led some researchers to question the monophyly of the family and to divide the group into two families.

Aspredinids are a highly derived group of catfishes and display some very unusual features. Their “warty” skin is completely keratinized and covered by uculiferous tubercles (Roberts, 1982). Periodically the entire outer layer of skin is shed just like that of a snake (Friel, 1989). While aspredinids may swim by typical undulatory movements, they can also use jets of water thrust from their opercular openings to skip along the substrate (Gradwell, 1971). When agitated, some species produce audible stridulatory sounds by repeatedly abducting and adducting their pectoral spines (Gainer, 1967).

Very little is known about the general ecology of any aspredinid species. Based on little published work (Saul, 1975; Taphorn & Marrero, 1990) and personal observation, most aspredinids appear to be generalized omnivores and their stomachs often contain aquatic invertebrates, terrestrial insects and debris. One notable exception are members of the genus *Amaralia*. Based on my studies they appear to be feeding specialists on the eggs of other catfishes (Friel, 1992).

Few specifics are known about reproduction of aspredinids. Parental care is known with certainty in one clade which contains *Pterobunocephalus*, *Platystacus*, *Asredo*, and *Aspredinichthys*. Females of this clade carry developing embryos attached to the ventral surface of their bodies. In *Pterobunocephalus*, the eggs are directly attached to the body whereas in *Platystacus*, *Asredo*, and *Aspredinichthys* they are attached to cotylephores, fleshy stalks which seasonally develop on their ventral surface. The cotylephores may function in exchange of materials between the mother and her developing embryos (Wetzel, Wourms, & Friel, in review).

Accounts of *Bunocephalus* spawning in aquaria vary in their details. Petrovicky (1987) reports that the eggs are scattered and not protected by either parent. In contrast, Burgess (1989) claims males build a depression for a nest and guard the eggs once they have been deposited in the nest.

Most aspredinids are sexually dimorphic in size. Mature females are typically larger than mature males but this dimorphism is reversed in *Hoplomyzon sexpapilostoma*

where the males are larger and have different pigmentation than females (Taphorn & Marrero, 1990). One other instance of sexual dimorphism is males of *Aspredo* and *Platystacus* which have much longer dorsal spines than females (Mees, 1987).

Historical Overview of the Systematics of the Aspredinidae

Compared to many other families of catfishes, the Aspredinidae have quite a long taxonomic history. The limits of what we recognize as the Aspredinidae today and some of its subgroups have remained relatively constant for the past 150 years with only the ranking and labels applied to these groups changing over time.

The earliest group name applied to aspredinids was “subfamily Aspredinae”, introduced by Swainson (1838). However this name is not valid according to article 39 of the third edition of the International Code of Zoological Nomenclature (ICZN, 1985; Mees, 1987). The type genus for Swainson’s group is *Aspredo* Swainson, 1838 which is a junior homonym of *Aspredo* Scopoli, 1777 and a junior synonym of *Platystacus verrucosus* Bloch, 1794 (= *Bunocephalus verrucosus*).

The first available name for the aspredinids can be traced to Bleeker’s (1858) “familia Aspredinoidei” which contained two subgroups, the “Aspredini” (“long anal-fin” species) and “Bunocephalini” (“short anal-fin” species). Bleeker (1862, 1863) continued to recognize the same groups but subsequently changed the names of his subgroups to “subfamilia Asprediformes” and “subfamilia Bunocephaliformes”. Günther (1864) assigned the aspredinids as his “group Aspredinina” and allied them with his “group Hypostomatina” (Loricariidae, Astroblepidae, Callichthyidae, and Sisoridae) on the basis of a few plesiomorphic and homoplasious characters.

Cope (1871) first introduced the form of the name we use today, “family Aspredinidae”. He based membership in this family on a single character, the absence of an opercle. This was an error as all aspredinids do possess an opercle bone albeit highly reduced in comparison to other catfishes. Confusion about the condition of the opercle in aspredinids continued for several decades. Eigenmann (1892) claimed to have found the opercle in *Aspredo aspredo* but in fact he had incorrectly identified part of the

preopercle as the opercle. Regan (1911) was the first to properly identify the opercle of aspredinids.

Gill (1872) continued to use the name Aspredinidae. However Eigenmann & Eigenmann (1888, 1889, 1890) changed the name for the group. Instead they used the name "family Bunocephalidae" with the "subfamily Bunocephalinae" ("short anal-fin" species) and "subfamily Platystacinae" ("long anal-fin" species). Furthermore they provided the following derived characters to distinguish aspredinids from other catfishes: neural spines of Weberian complex coalesced to form a continuous ridge from occiput to dorsal fin; gill openings restricted to small slits in front of the pectoral-fin bases; adipose fin absent; and caudal vertebrae compressed with neural spines expanded.

Eigenmann & Eigenmann introduced these nomenclatural changes because they sank *Aspredo* in synonymy with *Platystacus* which they considered to be the older available name. Later researchers have pointed out that these changes were not necessary as *Aspredo* Scopoli, 1777 predates *Platystacus* Bloch, 1794 (Myers, 1960).

Boulenger (1904), however, did not recognize Eigenmann & Eigenmann's changes and instead continued to use the name Aspredinidae. Regan (1911), however, did follow these nomenclatural changes and provided additional characters for aspredinids such as: mesocoracoid arch absent; pre-caudal vertebrae without parapophyses; and horizontal processes on centra.

Eigenmann (1910, 1912a, 1912b) without comment resurrected the name "family Aspredinidae", containing the "subfamily Aspredininae" and the "subfamily Bunocephalinae". Jordan (1923) without discussion raised each of these subfamilies to familial status, but misplaced one of the "short anal-fin" species *Agmus* (= *Bunocephalus verrucosus*) in his "long anal-fin" group.

Most ichthyologists since Jordan have placed the banjo catfishes in a single family, usually the Aspredinidae or occasionally the Bunocephalidae, with two subfamilies, the Aspredininae ("long anal-fin" species) and the Bunocephalinae ("short

anal-fin" species) (Eigenmann, 1922; Eigenmann & Allen, 1942; Fowler, 1954; Gosline, 1945; Mees 1987, 1988, 1989; Myers, 1942, 1960; Stewart, 1985; Taylor, 1977).

The latest changes in subgroups within the Aspredinidae was Fernández-Yépez's (1953) splitting of the "family Bunocephalidae" into the "subfamily Hoplomizoninae" for the armored genera *Hoplomyzon*, *Dupouyichthys*, and *Ernstichthys* and the "subfamily Bunocephalinae" for all other "short tailed" species. Interestingly, Myers (1960), unaware of Fernández-Yépez's changes, independently recognized the same two subgroups but uses the names "tribe Hoplomyzontini" and "tribe Bunocephalini" (Stewart, 1985).

Recently, the alpha level taxonomy of several subgroups within the family has been revised. Both Taylor (1977) and Mees (1987) revised the subfamily Aspredininae. Stewart (1985) revised the tribe Hoplomyzontini. Both Ma (1977) and Mees (1989) have revised *Bunocephalus* (= *Dysichthys*), the largest genus of Aspredinidae. Ma (1977) is an unavailable work for nomenclatural purposes and includes descriptions of three new species.

Recent reassessments of species traditionally placed in the genus *Bunocephalus* to other genera are a result of Mees's (1988) non-phylogenetic revision and erroneous conclusion that the type species for *Bunocephalus* is *Bunocephalus hypsiurus* Kner, 1855 (= *Amaralia hypsiura*). This proposal has resulted in reassignment of most species placed in *Bunocephalus* to either *Dysichthys* or *Bunocephalichthys*. Ferraris (1991) challenged Mees's actions and pointed out Mees's incorrect interpretation of the International Code of Zoological Nomenclature. Ferraris correctly demonstrated that the type species for *Bunocephalus* is *Platystacus verrucosus* Bloch, 1794. For a detailed explanation of the valid type fixation of *Bunocephalus* see Ferraris (1991).

To summarize, the Aspredinidae have historically been divided into two subfamilies, the Aspredininae for the "long anal-fin" species and the Bunocephalinae for the "short anal-fin" species. The Bunocephalinae have been further subdivided into two tribes, the Bunocephalini for the unarmored species and the Hoplomyzontini for the

armored species. Prior to this phylogenetic study the systematics and nomenclature of the Aspredinidae including the most recent changes by Mees (1988) are as follows:

Family Aspredinidae

Subfamily Aspredininae

Asredo

Aspredinichthys

Subfamily Bunocephalinae

Tribe Bunocephalini

Bunocephalus

Bunocephalichthys

Dysichthys

Petacara

Xylipterus

Tribe Hoplomyzontini

Hoplomyzon

Dupouyichthys

Ernstichthys

A phylogenetic hypothesis based on this traditional classification but using the genera recognized in this dissertation is presented in Figure 4 for comparison with the results of my phylogenetic analysis which are described in later sections of this work.

Methods and Materials

All materials examined in this study are listed in Table 4. Families and lower taxa are arranged alphabetically within orders. For each lot the following information is listed: the number of specimens, type of preparation, the range of standard length in mm if known, and general localities. The codes for preparations are: alc = alcoholic, cast = epoxy cast, c&s = cleared and stained, dry = dry skeleton, xr = radiograph, diss = dissection. Institutional abbreviations follow Leviton et. al. (1985) and uncataloged specimens are listed as "UNCAT".

Specimens of all genera and most species of aspredinids were examined along with representatives of all extant siluriform families. Only three species of aspredinids were not examined in this study, *Pseudobunocephalus quadriradiatus*, *Xylipterus barbatus* and *Xylipterus lombarderoi*. Whenever possible type specimens were examined to aid identifications. In addition, information on many outgroup taxa was gleaned from previously published systematic works on the following taxa: Ageneiosidae (now placed within the Auchenipteridae) (Walsh, 1990); Amblycipitidae (Chen, 1994); Ariidae (Kailola, 1990a, 1990b); Auchenipteridae (Curran, 1989; Ferraris 1988); Bagridae (Mo, 1991); Cetopsidae (de Olivera, 1988; Milani de Aranal, 1991); Chacidae (Roberts, 1982; Brown & Ferraris, 1988); Diplomystidae (Arratia, 1987); Doradidae (Eigenmann, 1925; Higuchi, 1992); Helogenidae (Vari & Ortega, 1986); †Hypsidoridae (Grande, 1987); Ictaluridae (Lundberg, 1970, 1982, 1992); Loricariidae (Howes, 1983b; Schaefer, 1987, 1991); Malapteruridae (Howes, 1985); Pangasiidae (Roberts & Vidthayanon, 1991; Vidthayanon, 1993); Pimelodinae (Lundberg, Mago-Leccia & Nass, 1991); Pseudopimelodinae (Lundberg, Bornbusch & Mago-Leccia, 1991); Rhamdiinae (Lundberg, Bornbusch & Mago-Leccia, 1991; Lundberg & McDade 1986) Scoloplacidae (Schaefer, Weitzman & Britski, 1989; Schaefer, 1990); Siluridae (Bornbusch, 1988, 1991); Siluriformes (Chardon, 1968; Fink & Fink, 1981; Howes, 1983a; Lundberg &

Baskin, 1969; Mo, 1991; Pinna, 1993; Royero, 1987); Trichomycteridae (Baskin, 1972; Pinna, 1992).

The operational taxonomic units (OTUs) recognized within the Aspredinidae for this study are *Pseudobunocephalus* new genus, *Acanthobunocephalus* new genus, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Platystacus*, *Aspredo*, *Aspredinichthys*, *Xyliophius*, *Hoplomyzon*, *Dupouyichthys*, and *Ernstichthys*. All are demonstrably monophyletic except for the genus *Bunocephalus*. Although no synapomorphies were found to support the monophyly of *Bunocephalus*, there is no evidence that any species still retained in this genus shares a more recent common ancestor with species placed in the other genera.

In addition to the genera listed above I also used an OTU labeled as Aspredinidae ANC in one analysis. Aspredinidae ANC represents the hypothetical ancestor of all Aspredinidae. The character states assigned to this OTU were parsimoniously reconstructed using PAUP and MacClade with the aspredinid phylogeny produced in the a preliminary analysis which included all 12 aspredinid genera. If more than a single character state is most parsimoniously assigned to this ancestor the characters states are coded as uncertain.

Outgroup OTUs used in this study include several clades of catfishes which share several derived character states with the Aspredinidae and were considered a priori as potential sister groups. These include: the Asian Amblycipitidae, the Asian Sisoridae, the Asian Akysidae, the African Amphiliidae, the Neotropical "loricarioids" (Nematogenyidae, Trichomycteridae, Callichthyidae, Scolopacidae, Astroblepidae and Loricariidae) (Baskin, 1972; Howes, 1983b; Mo, 1991; Pinna, 1993; Schaefer, 1987, 1990; Stiassny & Pinna, 1994), the Neotropical pseudopimelodines (Lundberg, Bornbusch & Mago-Leccia, 1991) and African and Neotropical "doradoids" (Mochokidae, Doradidae, Centromochlidae, Auchenipteridae and Ageneiosidae) (Royero, 1987; Lundberg, 1993; Mo, 1991; Pinna, 1993). In addition, two basal siluriform clades the Neotropical

Diplomystidae (Arratia, 1987) and the Nearctic[†]Hypsidoridae (Grande, 1987) were included as outgroup OTUs.

Skeletal characters were examined on cleared and stained specimens (Potthoff, 1984), radiographs or dry skeletons prepared with dermestid beetles. Anatomical illustrations were done freehand or with the assistance of a camera lucida attached to a Wild M-5 microscope. Osteological terminology generally follows Lundberg (1975, 1982), and Royero (1987). Myological characters were examined by dissection of preserved specimens stained with alizarin red to accentuate bone. Myological terminology follows Winterbottom (1974) and Bornbusch (1988). Anatomical abbreviations on figures appear in the section entitled **Abbreviations for Figures**. Scale bars on all figures are 1 mm.

All distance measurements were taken to the nearest 0.1 mm with digital calipers or from calculated distances between landmark points recorded with the aid of a Wild M-5 microscope equipped with a camera lucida. All fish lengths are given as standard length (SL). Head length is measured to the end of the supraoccipital spine. Caudal peduncle depth was taken at the level of the last anal-fin ray. All lepidotrichs are included in the fin-ray counts. Stiffened dorsal- and pectoral-fin lepidotrichs are indicated by Roman numerals. Total vertebral counts include the five fused vertebrae in the Weberian complex and the compound caudal vertebra which is counted as one even if a separate U2 autocentrum is present.

Cladistic methods of phylogenetic reconstruction used in this study are based on principles first presented by Hennig (1966) and further elaborated on by Wiley (1981) and others. Monophyletic taxa and their relationships were inferred from the distributions of shared derived character states.

Character data were entered and initially checked using MacClade version 3.04 (Maddison & Maddison, 1992). Parsimony analysis of the data set was performed using PAUP (Phylogenetic Analysis Using Parsimony) version 3.1 (Swofford, 1991).

Unrooted phylogenetic trees were constructed using the branch and bound search option in PAUP which is guaranteed to find the most parsimonious trees. Trees generated from analyses were rooted and character polarities were assessed by the outgroup comparison method of Watrous & Wheeler (1981) and Maddison et al. (1984). The outgroup framework used in this study is as follows: the Diplomystidae is considered to be the sister group to all other catfishes and the †Hypsidoridae the next clade up in the phylogeny (Grande, 1987; Pinna, 1993). The position of this basal doublet allows for unambiguous determinations of character polarity of most skeletal characters.

Reconstruction of character state transformations on the phylogenetic trees was optimized both under both ACCTRAN and DELTRAN options of PAUP and MacClade. The ACCTRAN option accelerates character transformation within a tree and favors character reversals. The DELTRAN option delays character transformation within a tree and favors parallelisms. If a hypothesis of character evolution is the same under both options, I considered the character state changes to be unambiguous. Only unambiguous character states changes are cited as support for clades recognized in this work.

The robustness of phylogenetic trees produced was evaluated in two ways, by bootstrap analysis and by decay indices. The bootstrap analysis involves random sampling with replacement of the characters in the original data set to construct a series of bootstrap replicate data sets which are the same size as the original data set. Each of these bootstrap replicate data sets is then analyzed with the branch and bound option of PAUP to find the most parsimonious trees.. A majority-rule consensus tree is then constructed for all the resulting bootstrap trees. If an internal branch appears in X % of the bootstrap trees, the confidence level associated with that branch is taken as X %. All boot strap analyses presented in this study are based on 1000 replicates.

The decay index is a measure of how many extra steps are required to lose resolution of an internal branch in the shortest tree(s) in a strict consensus tree of

longer trees. Mishler & Albert (1991) suggest that the decay index is a more conservative estimate of robustness than bootstrap analysis. It is calculated by comparing the shortest tree or consensus tree to a strict consensus tree of all trees one-step longer. If an internal branch in the shortest tree is lost in the strict consensus tree of all trees one-step longer that branch is given a decay index of 0. This procedure is repeated for trees two-steps longer. If an internal branch in the shortest tree is lost in the consensus tree of all trees up to two-steps longer that branch is given a decay index of 1. The procedure can be repeated again and again but the maximum decay index calculated is limited by the number of trees that PAUP can store in memory.

Three separate analyses were performed on the data set (Table 1). Analysis #1 included all OTUs except Aspredinidae ANC. To avoid the excessive time requirements necessary for generating bootstraps and decay indices for the entire data set, I partitioned the data into two subsets. In analysis #2, I used all outgroup taxa plus Aspredinidae ANC, to generate bootstrap and decay indices for branches outside the Aspredinidae. As previously mentioned, Aspredinidae ANC was generated using the results of the analysis #1 to reconstruct the character states for this ancestor. Finally, in analysis #3, I used only the ingroup OTUs and the two most basal outgroup taxa Diplomystidae and †Hypsidoridae to generate bootstrap and decay indices for branches within the Aspredinidae.

Character Descriptions

This section contains descriptions of all characters used in the phylogenetic analyses. Characters are numbered consecutively and the numbers correspond to those in the data matrix (Table 1) and those referred to in later sections. For example the notation [35:2] would refer to state 2 of character number 35. Character descriptions are grouped by major morphological complexes (e.g., neurocranium, splanchnocranium, etc.) and are generally presented in an anterior-posterior or distal-proximal sequence.

In order to reduce unnecessarily repetitive prose, a telegraphic style for the character descriptions has been adopted. To reduce repeated lists of taxon names in the character descriptions, I will refer to two well supported clades within the Aspredinidae in addition to genera listed as OTUs in the data matrix: the “*Aspredo* clade” (= Aspredininae) composed of *Platystacus*, *Aspredo*, and *Aspredinichthys*, and the “*Hoplomyzon* clade” (= Hoplomyzontini) composed of *Hoplomyzon*, *Dupouyichthys*, and *Ernstichthys*.

Each character description begins with the plesiomorphic character state for siluriforms as determined by outgroup analysis using the †Hypsidoridae and Diplomystidae as consecutive outgroups. This plesiomorphic character state is coded as 0 unless stated otherwise. This is followed by all other characters states found in the Aspredinidae. Consecutive numbering of character states does not necessarily indicate ordering of character states. If a character is ordered, this is clearly stated in the description. Finally, any derived character states within the Aspredinidae known to occur in any outgroup taxa are noted.

The complete data matrix used in analyses appears in Table 1. Character states coded as "?" indicate missing data for OTUs, "&" indicates known polymorphism in OTUs and "*" indicates uncertainty.

Neurocranium

1. Mesethmoid medial notch and cornua. 0, mesethmoid with a distinct medial notch and paired cornua; *Pterobunocephalus*, *Aspredo* clade, *Xyliophius*, and *Hoplomyzon* clade. 1, medial notch and cornua absent (Fig. 9); *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus* and *Amaralia*.

State 1 is also occurs in some Sisoridae, Akysidae, Pimelodinae, Ariidae, Amphiliidae, loricarioids and doradoids (Lundberg, Mago-Leccia & Nass, 1991; Mo, 1991).

2. Dorsal processes of mesethmoid. 0, dorsal surface of mesethmoid without dorsal processes; all Aspredinidae except *Aspredinichthys*. 1, mesethmoid bears prominent paired dorsal processes (Fig. 14); *Aspredinichthys*.

These dorsal processes are best developed and are hook-like in *Aspredinichthys tibicen*. Some individuals of *Ernstichthys* and *Dupouyichthys* also have processes which originate from the same region of the mesethmoid but in these taxa they are laminar and directed laterally or ventro-laterally.

3. Ethmoid cartilage. 0, ethmoid cartilage continuous along anterior margin of lateral ethmoid with cartilage at tip of condyle that articulates with palatine. 1, lateral ethmoid facet for palatine produced laterally, its distal cartilage discontinuous with ethmoid cartilage on midline; all Aspredinidae.

State 1 also occurs in all Amblycipitidae, Sisoridae, Akysidae and some Amphiliidae. (Chen, 1994; Mo, 1991; Pinna, 1993).

4. Skull contact with eye. 0, Skull not in close contact with eye, skull margin not emarginate around eye; *Xyliophius*. 1, Skull in close contact with eye, skull margin emarginate around eye (Fig. 11); all Aspredinidae except *Xyliophius*.

State 1 also occurs in all doradoids (except *Ageneiosus*) and in some loricarioids, Amphiliidae, Sisoridae and Akysidae. The apparent primitive condition in *Xyliophius* is likely a reversal due to the highly reduced eyes in this taxon.

5. Epiphyseal bar. 0, epiphyseal bar formed by the paired frontals separates the anterior and posterior cranial fontanelles; *Pseudobunocephalus lundbergi* n. sp., *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Aspredo* clade, *Xyliophius*, and *Hoplomyzon* clade. 1, epiphyseal bar absent; all *Pseudobunocephalus* spp. except *P. lundbergi* n. sp.

State 1 was also occurs in some Akysidae (*Parakysis*).

6. Supraoccipital-frontal contact. 0, supraoccipital with sutural contact with frontals medial to the sphenotic; all Aspredinidae except *Amaralia*. 1, sphenotic blocks contacts between the supraoccipital and frontals and contacts the posterior cranial fontanel (Fig. 10); *Amaralia*.

7. Posterior cranial fontanel. 0, posterior cranial fontanel present, all Aspredinidae except *Acanthobunocephalus*. 1, posterior cranial fontanel is absent (Fig. 8); *Acanthobunocephalus*.

State 1 also occurs in some Ariidae, doradoids and loricarioids (Pinna, 1993; Schaefer, 1990).

8. Pterotic laminar processes. 0, laminar processes of pterotic directed posteriorly. 1, laminar processes rounded and directed laterally (Fig. 15); *Xyliophius*. 2, laminar processes are broadly pointed and directed laterally (Fig. 9); *Pseudobunocephalus*,

Acanthobunocephalus, *Bunocephalus*, *Amaralia*, and *Hoplomyzon* clade. 3, laminar processes are sharply pointed and project laterally at a distinct right angle (Fig. 11); *Pterobunocephalus*. 4, laminar processes blunt and directed anteriorly (Fig. 13); *Aspredo* clade.

State 2 also occurs in some loricarioids (*Scolopax*).

9. Supraoccipital process. 0, supraoccipital with an elongate posterior process which passes over the Weberian apparatus and often contacts the nuchal plates. 1, supraoccipital process truncated; all Aspredinidae.

State 1 is also occurs in *Olyra*, all doradoids, Amblycipitidae, some loricarioids and some Sisoridae (*Glyptosternum* group).

10. Knobby skull ornamentation. 0, knobby skull ornamentation pattern poorly developed or absent, *Acanthobunocephalus*, some *Bunocephalus*, *Pterobunocephalus*, *Aspredo* clade, and *Xyliophius*. 1, knobby skull ornamentation pattern well developed, *Pseudobunocephalus*, some *Bunocephalus*, *Amaralia*, and *Hoplomyzon* clade.

This ornamentation pattern is due to bony knobs which often form above bifurcation points of the lateralis system on the skull. This pattern is best developed in *Bunocephalus verrucosus* and *Amaralia*.

11. Vomer. 0, vomer present. 1, vomer absent; all Aspredinidae.

State 1 also occurs in Chacidae, most pseudopimelodines (except *Pseudopimelodus zungaro*), some loricarioids (*Scolopax*) and Pimelodinae (*Gladioglanis*, *Phreatobius*) (Brown & Ferraris, 1988; Ferraris & Mago-Leccia, 1989; Lundberg, Bornbusch & Mago-Leccia, 1991; Mo, 1991).

Splanchnocranium

12. Premaxillae shape. 0, premaxillae roughly rectangular to triangular in shape; *Pseudobunocephalus lundbergi* n. sp., *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, and *Xyliophius*. 1, premaxillae “boomerang” shaped with a long posterior limb; all *Pseudobunocephalus* except *P. lundbergi* n. sp. 2, premaxillae with an anterior limb; *Aspredo* clade and *Hoplomyzon* clade.

State 2 also occurs in some Akysidae (some *Akysis* spp.).

13. Premaxillae knobs. 0, ventral surface of premaxillae without bony knobs; all Aspredinidae except *Hoplomyzon*. 1, ventral surface each premaxilla with two bony knobs; *Hoplomyzon*.

These bony knobs are present beneath the fleshy papillae on the upper jaw of *Hoplomyzon* specimens. Interestingly, similar fleshy papillae are also present on the upper lip of *Horiomyzon retropinnis*, a pimelodid catfish from the deep-river channels of the Amazon (Stewart, 1986).

14. Premaxillary teeth. 0, acicular teeth present on premaxillae; *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, and *Aspredo* clade. 1, teeth absent on premaxillae; *Xyliophius* and *Hoplomyzon* clade.

State 1 also occurs in some Ictaluridae (*Trogloglanis*), Pimelodinae (*Hypophthalmus*), and doradoids (tribe Doradini, *Epapterus*) (Ferraris, 1988; Higuchi, 1992; Lundberg, 1982)

15. Premaxillae position. 0, medial portion of premaxillae contact each other and ventral surface of mesethmoid; all Aspredinidae except *Xyliophius*. 1, premaxillae separated from one another and lie completely lateral to mesethmoid; *Xyliophius*.

State 1 also occurs in some doradoids (*Gelanoglanis*) (Ferraris, 1988).

16. Dentary symphysis. 0, symphysis well developed between dentary bones; all Aspredinidae except *Xyliophius* and *Hoplomyzon* clade. 1, symphysis highly reduced or absent leaving a distinct gap between ossified ends of dentary bones; *Xyliophius* and *Hoplomyzon* clade.

State 1 also occurs in some loricarioids (Trichomycteridae, Astroblepidae, Loricariidae) (Schaefer, 1990).

17. Symphysial ossification. 0, no ossified element posterior to dentary symphysis; all Aspredinidae except *Aspredo* clade. 1, a distinct oval ossification present just posterior to dentary symphysis; *Aspredo* clade.

This ossification should not be confused with the "hyomandibular cartilage" present in Astroblepidae and Loricariidae which is a large spherical mass of cartilage and connective tissue located between the symphysis of the lower jaw and the hyoid arch (Pinna, 1993; Schaefer, 1990). Furthermore, there is no indication that this ossification in the *Aspredo* clade is an endochondral bone.

18. Mandibular lateralis canal. 0, mandibular lateralis canal complete and embedded in bones of the lower jaw. 1, lateralis canal complete and free of lower jaw (Fig. 21); *Aspredo* clade. 2, lateralis canal truncated and does not contact the lower jaw (Fig. 20); all Aspredinidae except *Aspredo* clade.

Character state 2 also occurs in all loricarioids except Nematogenyidae (Pinna, 1993; Schaefer, 1988, 1990).

19. Dentary teeth. 0, acicular teeth present on dentary bones; *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Aspredo* clade, *Xyliophius*, and *Hoplomyzon*. 1, teeth absent on dentary bones; *Dupouyichthys*, and *Ernstichthys*.

State 1 also occurs in some Ictaluridae (*Trogloglanis*), Pimelodinae (*Hypophthalmus*), and doradoids (*Oxydoras*, Tribe Doradini, *Epapterus*) (Ferraris, 1988; Higuchi, 1992; Lundberg, 1982).

20. Ascending process of Meckel's cartilage. 0, ascending process of Meckel's cartilage well developed; *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, and *Xylipterus*. 1, ascending process displaced posteriorly and discontinuous with rest of Meckel's cartilage; *Hoplomyzon* clade. 2, ascending process highly reduced or absent; *Pterobunocephalus*, and *Aspredo* clade.

State 2 also occurs in *Olyra*, *Preatobius*, *Heteropneustes*, *Malapterurus*, all Amphiliidae, loricarioids, Sisoridae and some doradoids (Mochokidae) and Amblycipitidae (Mo, 1991; Pinna, 1993).

21. Coronomeckelian. 0, coronomeckelian present as an ossification medial to Meckel's cartilage at the crux of the ascending process; *Acanthobunocephalus*, *Pseudobunocephalus*, *Bunocephalus*, *Amaralia*, and *Aspredo* clade 1, coronomeckelian absent; *Pterobunocephalus*, *Xylipterus*, and *Hoplomyzon* clade.

State 1 also occurs in *Malapterurus*, most loricarioids, and some doradoids (Mochokidae), Amblycipitidae and Akysidae (Mo, 1991; Pinna, 1993)

Suspensorium

22. Hyomandibula contact with neurocranium. 0, cartilaginous portion of hyomandibula contacts both pterotic and sphenotic. 1, cartilaginous portion of hyomandibula contacts sphenotic only; all Aspredinidae.

State 1 also occurs in all Amphiliidae, Amblycipitidae, Sisoridae, Akysidae, Chacidae and some doradoids (Mo, 1991)

23. Anterior process of hyomandibula. 0, bony process anterior to hyomandibula articulation with neurocranium present (Fig. 20); all Aspredinidae except *Aspredo* clade. 1, anterior process of hyomandibular absent (Fig. 21); *Aspredo* clade.
24. Metapterygoid. 0, metapterygoid present, contacts quadrate but not lateral ethmoid; *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, and *Xylipterus*. 1, metapterygoid present but does not contact quadrate or lateral ethmoid; *Pseudobunocephalus*. 2, metapterygoid expanded to contact both quadrate and lateral ethmoid; *Hoplomyzon* clade. 3, metapterygoid absent (Fig. 21); *Aspredo* clade
State 2 also occurs in some loricarioids (Loricariidae) (Schaefer, 1987; Pinna, 1993).

Members of the *Aspredo* clade and *Hoplomyzon* clade have only a single ossified element in the pterygoid series whereas all other Aspredinidae have two elements, a metapterygoid (endochondral bone) and an endopterygoid (membrane bone). In the *Aspredo* clade I homologize the single element as the endopterygoid instead of the metapterygoid as did Gosline (1975). In the *Hoplomyzon* clade I homologize the single element as the metapterygoid based on its sutural contact with the quadrate. Until an ontogenetic series exists for any member of this clade, the true identity of this element will remain dubious.

25. Endopterygoid. 0, endopterygoid present; all Aspredinidae except *Hoplomyzon* clade. 1, endopterygoid absent; *Hoplomyzon* clade.

State 1 also occurs in some Ictaluridae (*Trogloglanis*, *Prietella*, and some *Noturus*) (Lundberg, 1982)

26. Posterior cartilage of palatine. 0, cartilage at posterior end of palatine well developed; all Aspredinidae except *Acanthobunocephalus*. 1, cartilage at posterior end of palatine highly reduced or absent; *Acanthobunocephalus*.

State 1 also occurs in *Phreatobius*, *Malapterurus*, all loricarioids, Amphiliidae and some doradoids (some Mochokidae) (Mo, 1991; Pinna, 1993),

27. Shape of posterior end of palatine. 0, posterior end of palatine round in cross section with a simple rounded margin. 1, compressed laterally with simple rounded margin; all Aspredinidae except *Pseudobunocephalus*. 2, posterior end of palatine distinctly bifurcated with dorsal and ventral arms tipped with cartilage (Fig. 22); *Pseudobunocephalus*.

State 1 also occurs in Amblycipitidae, Akysidae, Sisoridae, pseudopimelodines, Plotosidae, Chacidae and doradoids (Pinna, 1993). State 2 also occurs in *Malapterurus*, and Amphiliidae, but in these taxa there is no cartilage at the tips of the forked portion (Pinna, 1993). Pinna (1993) also cites the "posterior portion of palatine double" as a synapomorphy of members of the *Hoplomyzon* clade. Most members of this clade have state 1 but some individuals do have the dorsal and ventral portions of the posterior end of the palatine ossified with only a remnant of cartilage in the middle. However, there are no separate dorsal and ventral limbs such as those developed in *Pseudobunocephalus*.

Opercular Series

28. Suprapreopercles. 0, suprapreopercles present; *Xylipterus*. 1, suprapreopercles absent; all Aspredinidae except *Xylipterus*.

State 1 also occurs in some Sisoridae, Amphiliidae, loricarioids and doradoids.

29. Opercle shape. (ordered) 0, opercle shape broadly triangular. 1, opercle with narrow, pointed posterior limb. 2, opercle "L" shaped, reduced in size to resemble an enlarged branchiostegal ray (Fig. 20); all Aspredinidae

State 1 also occurs in *Heteropneustes*, Clariidae, and some pseudopimelodines, loricarioids, Amblycipitidae, Sisoridae, and Akysidae (Pinna, 1993). This highly modified opercle apparently lead early ichthyologists such as Cope (1871) and Eigenmann (1892) to consider the opercle as absent in the Aspredinidae.

30. Opercle-interopercle connection. 0, interopercles present but not tightly attached to ventral limb of opercle; *Pseudobunocephalus*. 1, interopercle tightly attached to shortened ventral limb of opercle often by a butt suture (Fig. 20); *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Xylipterus*, and *Hoplomyzon* clade. 2, interopercle absent (Fig. 21); *Aspredo* clade.

State 2 also occurs in some loricarioids (Scolopacidae, Loricariidae) (Pinna, 1993; Schaefer, 1990).

31 Opercular apertures. 0, opercular apertures not restricted to ventral slits. 1, opercular apertures reduced to ventral slits just anterior to pectoral spine insertions; all Aspredinidae.

The opercular apertures of aspredinids are the most restricted of any Siluriformes. Furthermore, in aspredinids dissected there is a de novo muscle which originates on the dorsal surface of the cleithrum and inserts on the valve-like flap of the opercular aperture. I speculate that this unique morphology may allow fine control of the aperture and may be associated with aspredinids ability to locomote by jet propulsion (Gradwell, 1971; pers. obser.).

Hyoid Arch

32. Dorsohyal. 0, dorsohyal present. 1, dorsohyal absent; all Aspredinidae.

State 1 is also occurs in all Chacidae, Akysidae, Amphiliidae, pseudopimelodines, and some Amblycipitidae, Sisoridae and loricarioids (Trichomycteridae, Astroblepidae, Loricariidae) (Brown & Ferraris, 1988; Chen, 1994; Mo, 1991)

33. Anterohyal lamina. 0, anterohyal without anterolateral lamina developed;

Pseudobunocephalus. 1, anterohyal with a well developed anterolateral lamina; all Aspredinidae except *Pseudobunocephalus*.

State 1 also occurs in all Chacidae, pseudopimelodines and some Sisoridae (*Gagata*) and loricarioids (Callichthyidae, Astroblepidae, Loricariidae) (Mo, 1991).

34 Lateral end of anterohyal. 0, lateral portion of anterohyal equal in size to corresponding medial portion of posteroxyal; *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, and *Aspredo* clade. 1, lateral portion of anterohyal expanded, much larger than corresponding medial portion of posteroxyal; *Xyliophius*, and *Hoplomyzon* clade.

34. Lateral end of posteroxyal. 0, lateral end of posteroxyal tapered, all Aspredinidae except *Xyliophius*. 1, lateral end of posteroxyal expanded; *Xyliophius*

State 1 is also occurs in some Sisoridae (*Pseuedecheneis*).

36. Interhyal. 0, interhyal present between posteroxyal and hyomandibula; all Aspredinidae except *Pseudobunocephalus* and *Hoplomyzon* clade. 1, interhyal absent; *Pseudobunocephalus* and *Hoplomyzon* clade.

State 1 is also found in most loricarioids and some Amblycipitidae, Sisoridae, Akysidae and doradoids (Arratia, 1990; Mo, 1991).

37. Modal number of branchiostegal rays. (ordered) 0, more than five branchiostegal rays. 1, five branchiostegal rays (Fig. 19); *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Pterobunocephalus*, and *Aspredo* clade. 2, four branchiostegal rays (Fig. 20); *Amaralia*, *Xylipterus*, and *Hoplomyzon* clade.

States 1 and 2 also occur in some Sisoridae and loricarioids (McAllister, 1968).

38. Urohyal shape. 0, urohyal with dorsal keel or lamina, horizontal lamina moderately developed; *Pseudobunocephalus*. 1, urohyal with dorsal keel highly reduced or absent, horizontal lamina well developed with diverging lateral arms, element "boomerang" shaped; *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, and *Xylipterus*. 2, urohyal without dorsal keel, horizontal lamina moderately developed, strong ventral keel present; *Aspredo* clade. 3, urohyal reduced to small bony nodule; *Acanthobunocephalus*. 4, urohyal absent, *Hoplomyzon* clade.

State 2 also occurs in all doradoids (Mo, 1991; Pinna 1993).

Branchial Arches

39. First pharyngobranchial. 0, first pharyngobranchial present. 1, first pharyngobranchial absent; all Aspredinidae.

State 1 is also occurs in all Chacidae, Clariidae, Amphiliidae, Sisoridae, pseudopimelodines, doradoids, loricarioids and some Ictaluridae, Pimelodinae (*Preatobius*) and Rhamdiinae (Pinna, 1993).

40. Second pharyngobranchial. 0, second pharyngobranchial present and ossified.

1, second pharyngobranchial present as a cartilage. 2, second pharyngobranchial absent; all Aspredinidae.

State 1 occurs in all pseudopimelodines, doradoids and some Amphiliidae. State 2 is also occurs in all Amblycipitidae, Sisoridae, Akysidae, loricarioids and some Amphiliidae.

41. Fourth pharyngobranchial. 0, fourth pharyngobranchial ossified; all Aspredinidae except *Pseudobunocephalus* and *Hoplomyzon* clade. 1, fourth pharyngobranchial cartilaginous; *Hoplomyzon* clade. 2, fourth hypobranchial absent, *Pseudobunocephalus*.

State 1 also occurs in some Akysidae (*Parakysis*).

42. Fifth epibranchial. 0, remnant of fifth epibranchial present; *Pseudobunocephalus*. 1, fifth epibranchial absent; All Aspredinidae except *Pseudobunocephalus*.

State 1 also occurs in some Sisoridae, Amphiliidae and loricarioids.

43. Gill rakers. 0, gill rakers present on some or all ceratobranchial and epibranchial elements; all Aspredinidae except *Pseudobunocephalus*. 1, gill rakers absent on all ceratobranchial and epibranchial elements; *Pseudobunocephalus*

State 1 also occurs in some loricarioids, Akysidae and Sisoridae.

44. First hypobranchial. 0, first hypobranchial partially ossified with cartilage present along posterior margin. 1, first hypobranchial without posterior cartilage; *Pseudobunocephalus*, *Bunocephalus*, *Amaralia*, some *Pterobunocephalus*, *Asredo* clade, and *Xyliphius*. 2, first hypobranchial completely cartilaginous; *Acanthobunocephalus* and some *Pterobunocephalus*. 3, first hypobranchial absent; *Hoplomyzon* clade.

State 1 also occurs in *Preatobius*, *Malapterurus*, all Amphiliidae, loricarioids, Sisoridae, Akysidae, and some Amblycipitidae, pseudopimelodines and doradoids (Pinna, 1993).

45. Second hypobranchial. 0, second hypobranchial partially ossified with posterior cartilage. 1, second hypobranchial without posterior cartilage; some *Pseudobunocephalus*. 2, second hypobranchial completely cartilaginous; *Acanthobunocephalus*, some *Pseudobunocephalus*, *Bunocephalus* clade, *Pterobunocephalus*, *Aspredo* clade, and *Xylipterus*. 3, second hypobranchial absent; *Hoplomyzon* clade.

State 1 also occurs in Amphiliidae. State 2 also occurs in some Amblycipitidae, Sisoridae, Akysidae, and loricarioids.

46. Third hypobranchial. 0, third hypobranchial present; all Aspredinidae except *Hoplomyzon* clade. 2, third hypobranchial absent; *Hoplomyzon* clade.

47. Second basibranchial. 0, second basibranchial ossified; all Aspredinidae except *Hoplomyzon* clade. 1, second basibranchial reduced to small cartilage or absent; *Hoplomyzon* clade .

State 1 also occurs in some Akysidae (*Parakysis*).

48. Third basibranchial. 0, third basibranchial present; all Aspredinidae except *Acanthobunocephalus* and *Hoplomyzon* clade. 1, third basibranchial absent; *Acanthobunocephalus* and *Hoplomyzon* clade.

49. Lower pharyngeal tooth plates. 0, teeth widespread on lower pharyngeal tooth plates; *Aspredo* clade. 1, teeth restricted to mesial edge of lower pharyngeal tooth plates; all Aspredinidae except *Aspredo* clade.

State 1 also occurs in some loricarioids (Trichomycteridae, Callichthyidae, Scolopacidae) (Pinna, 1993).

Weberian Apparatus

50. Dorsal lamina of Weberian apparatus. 0, dorsal lamina of Weberian apparatus with a concave margin, does not contact dorsal surface. 1, dorsal lamina of the Weberian apparatus with a straight margin; does not contact dorsal. 2, dorsal lamina of the Weberian apparatus contacts dorsal surface, forms a continuous bony ridge from supraoccipital to middle nuchal plate; all Aspredinidae

State 1 occurs in Chacidae, *Olyra*, *Bagroides*, *Pelteobagrus*, *Batasio*, *Rita* and Rhamdinae (Pinna, 1993).

51. Os suspensorium. 0, distal tip of os suspensorium free; all Aspredinidae except *Xyliophius* and *Hoplomyzon* clade. 1, distal tip of os suspensorium fused to complex centra to form a bony canal; *Xyliophius* and *Hoplomyzon* clade.

State 1 also occurs in some Sisoridae where the os suspensorium contacts and may fuse with a ventral outgrowth of the complex centra. In *Xyliophius* and the *Hoplomyzon* clade, the os suspensorium appear to be fused directly to the body of the compound centra. This character is coded as unknown in Amphiliidae and loricarioids which have an encapsulated Weberian apparatus.

52. Contact between parapophyses of fourth and fifth centra. 0, little or no contact between parapophyses of fourth and fifth centra (Fig. 7); *Pseudobunocephalus*. 1, broad contact between parapophyses of fourth and fifth centra (Fig. 8); all Aspredinidae except *Pseudobunocephalus*.

State 1 also occurs in all Amphiliidae, loricarioids and some Sisoridae.

53. Origin of parapophysis of the fifth centrum. 0, parapophysis of fifth centrum originates on dorso-lateral surface of centrum. 1, origin of parapophysis of fifth centrum shifted ventrally; all Aspredinidae

State 1 also occurs in Amblycipitidae, Sisoridae, and Akysidae. Loricarioids are coded as unknown.

54. Orientation of parapophysis of fifth centrum. 0, parapophysis of fifth centrum directed lateral or slightly posteriorly; all Aspredinidae except *Pseudobunocephalus*. 1, parapophysis of fifth centrum directed anteriorly (Fig. 7); *Pseudobunocephalus*.

55. Length of parapophysis of fifth centrum. 0, parapophysis of fifth centrum does not extend laterally past parapophysis of fourth centrum. 1, parapophysis of fifth centrum extends laterally past parapophysis of fourth centrum; all Aspredinidae (Fig. 8).

State 1 also occurs in some Sisoridae.

56. Distal end of parapophysis of fifth centrum. 0, distal end of parapophysis of fifth centrum not expanded; *Pseudobunocephalus*, some *Bunocephalus*, *Amaralia*, *Asredo* *Aspredinichthys*, *Xylipterus*, *Hoplomyzon* and *Dupouyichthys*. 1, distal end parapophysis of fifth centrum expanded (Fig. 9); *Acanthobunocephalus*, some *Bunocephalus*, *Pterobunocephalus*, *Platystacus*, and *Ernstichthys*

State 1 also occurs in some Sisoridae.

Vertebrae & Ribs

57. Horizontal lamina on centra. (ordered) 0, horizontal lamina on centra absent; *Pseudobunocephalus* and *Hoplomyzon* clade; 1, horizontal lamina present only on posterior centra; *Acanthobunocephalus*; 2, horizontal lamina present on all centra (fig. 23), *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Asredo* clade and *Xylipterus*

State 1 occurs in some Akysidae (*Acrochordonichthys*) and Sisoridae (*Sisor*). State 2 occurs in some Akysidae (*Breitensteinia*) (Ferraris, 1989; Mahajan, 1967). The

functional significance of these lamina processes is unknown but I speculate they may function as lever arms to allow for slow and sustainable bending on the body.

Specimens of *Bunocephalus* and *Amaralia* can flex their bodies laterally such that their caudal fin actually wraps around their heads and remain in this position for long periods of time (pers. obers.).

58. Vertebral armor. 0, vertebrae armor (formed by dorsal and ventral vertebral processes which form bony plates beneath skin surface (Fig. 23) absent; all Aspredinidae except *Hoplomyzon* clade. 1, vertebral armor present but plates do not overlap plates on adjacent vertebrae; *Hoplomyzon*. 2, vertebral armor present and plates overlap each other; *Dupouyichthys* and *Ernstichthys*.

State 2 also occurs in some Amphiliidae (*Belonoglanis*, *Phractura*). An analogous condition is also found in some loricarioids (Scolopacidae, Loricariinae). These fishes have vertebral processes which support separate dermal plates in their skin (Schaefer. 1990).

59. Pre-anal-fin plates. 0, no paired or unpaired pre-anal-fin plates; all Aspredinidae except *Hoplomyzon* clade. 1, one pair of pre-anal-fin plates; *Dupouyichthys*. 2, two sets of paired pre-anal-fin plates; *Ernstichthys*. 3, three or four sets of paired pre-anal-fin plates; *Hoplomyzon*. 4, more than four sets of paired pre-anal-fin plates.

State 4 occurs in some Amphiliidae (*Belonoglanis*, *Phractura*).

The pre-anal-fin plates are those elements of vertebral armor anterior to the anal-fin origin (Fig. 24). Most members of this clade have 3 unpaired plates anterior to the first anal-fin ray, the first two are expanded hemal spines and third is an expanded pterygiophore. There is considerable variation on the shape and size of these unpaired plates. There is also variation in the number of paired pre-anal-fin plates. This variation between genera is due to a shift in anal-fin position and loss of one pair of plates. The anal-fin origin in *Hoplomyzon* is relatively more posterior than that of

Dupouyichthys and *Ernstichthys*. This accounts for the 3-4 pairs of plates in *Hoplomyzon* versus the 2 pairs in *Ernstichthys*. *Dupouyichthys* have the same anal-fin position as *Ernstichthys* but only have one set of paired plates. Although the first pair of vertebral processes are present, they do not reach the ventral surface and lack expanded tips which form the bony plates in *Ernstichthys*.

60. Neural spines. 0, neural spines slender, needle-like, obliquely oriented. 1, neural spines compressed in lamina and oriented more vertically (Fig. 27); all Aspredinidae
State 1 also occurs in some Sisoridae, Akysidae, Amphiliidae, loricarioids and doradoids.

61. Height of neural spines. 0, neural spines greater in height than neural arches; *Acanthobunocephalus*, some *Bunocephalus*, *Amaralia*, *Aspredo* clade, *Xyliophius*, and *Hoplomyzon* clade. 1, neural spines equal or less than height of neural arches; *Pseudobunocephalus*, some *Bunocephalus* and *Pterobunocephalus*.

62. Distal tips of neural spines. 0, distal tips of neural spines not expanded, all Aspredinidae except *Aspredo* clade. 1, distal tips of neural spines greatly expanded, forming a bony ridge on the dorsal midline; *Aspredo* clade.
State 1 also occurs in some Akysidae (*Breitensteinia*).

63. Bifid hemal spines. 0, bifid hemal spines absent, *Pseudobunocephalus*. 1, some hemal spines are bifid and articulate laterally with the anal fin pterygiophores; all Aspredinidae except *Pseudobunocephalus*.
State 1 also occurs in some Akysidae, Amphiliidae, and loricarioids.

64. Hemal canal formation. 0, hemal canals form by ventral rotation and fusion of rib parapophyses at posterior limit of abdominal cavity. 1, hemal arches form de novo at

anterior end of abdominal cavity without any transformation of rib parapophyses (Fig. 25); all Aspredinidae.

State 1 also occurs in some loricarioids (Scolopacidae, Astroblepidae, Loricariidae). In aspredinids the dorsal aorta enters the first hemal canal by the 7th vertebrae.

65. Connections between abdominal vertebrae. 0, no additional articulations between abdominal vertebrae. 1, additional ligamentous connections between abdominal vertebrae. 2, peg and socket articulation between abdominal vertebrae (Fig. 25); all Aspredinidae.

State 1 occurs in some Sisoridae, Akysidae, Amphiliidae, and loricarioids. State 2 also occurs in some loricarioids (Scolopacidae, Astroblepidae, Loricariidae) (Pinna, 1993). Pinna cites state 1 in Amblycipitidae but I have not seen this character state in any specimens I examined.

66. Interdigitating connections between vertebrae. 0, no well developed interdigitating processes between neural and hemal arches of vertebrae, all Aspredinidae except *Hoplomyzon* clade. 1, well developed interdigitating connections between neural and hemal arches of vertebrae, *Hoplomyzon* clade.

67. Parapophyses for ribs. 0, well developed parapophyses for ribs. 1, parapophyses for ribs highly reduced or absent (Fig. 25); all Aspredinidae.

State 1 also occurs in some loricarioids (Scolopacidae, Astroblepidae, Loricariidae).

68. Ribs. 0, ribs with straight proximal bases. 1, ribs with contorted proximal bases; all Aspredinidae except *Hoplomyzon* clade. 2, ribs absent; *Hoplomyzon* clade.

State 1 also occurs in all Amblycipitidae, Sisoridae, Akysidae, Amphiliidae, loricarioids, pseudopimelodines, and doradoids (Schaefer, 1990; Pinna, 1993)

Dorsal Fin

69. Spinelet erector muscle canals. 0, spinelet erector muscles absent; all Aspredinidae except *Acanthobunocephalus*. 1, spinelet erector muscles pass through bony canals formed by lateral expansions of the middle nuchal plate and dorsal fin pterygiophore; *Acanthobunocephalus*.

State 1 also occurs in *Parauchenoglanis*, Amblycipitidae, Sisoridae, and Akysidae (Chen, 1994).

70. Anterior nuchal plate. 0, anterior nuchal plate present. 1, anterior nuchal plate absent; all Aspredinidae.

State 1 also occurs in all Amblycipitidae, Sisoridae, Akysidae, Amphiliidae, and loricarioids.

71. Middle nuchal plate ornamentation. 0, middle nuchal plate not ornamented with bony knobs; *Acanthobunocephalus*, *Pterobunocephalus*, *Aspredo* clade, and *Xylipterus*. 1, middle nuchal plate ornamented with one or more bony knobs; *Pseudobunocephalus*, *Bunocephalus*, *Amaralia*, and *Hoplomyzon* clade.

72. Posterior nuchal plate processes. 0, lateral processes of posterior nuchal plate not expanded laterally; *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, and *Amaralia*. 1, lateral processes of posterior nuchal plate expanded laterally ; *Pterobunocephalus*, *Aspredo* clade, *Xylipterus*, and *Hoplomyzon* clade.

State 1 also occurs in some Sisoridae and Akysidae.

73. Dorsal spinelet. 0, dorsal spinelet present (Fig. 26), without recurved process; *Acanthobunocephalus*. 1, dorsal spinelet with recurved process. 2, dorsal spinelet absent; all Aspredinidae except *Acanthobunocephalus*.

State 1 occurs in all Akysidae, doradoids and some Sisoridae. State 2 also occurs in all Amphiliidae, some loricarioids (Nematogenyidae, Trichomycteridae, Astroblepidae) and Sisoridae.

74. Dorsal spine. 0, dorsal spine rigid; *Acanthobunocephalus*. 1, dorsal spine flexible; all Aspredinidae except *Acanthobunocephalus*.

State 1 also occurs in all Amphiliidae, some loricarioids (Nematogenyidae, Trichomycteridae, Astroblepidae) and Sisoridae

75. Dorsal spine length. 0, dorsal spine not much longer than first branched dorsal ray; all Aspredinidae except *Asredo* clade. 1, dorsal spine much longer than first branched ray in males only; *Platystacus* and *Asredo*. 2, dorsal spine much longer than first branched ray in both sexes; *Aspredinichthys* (Mees, 1987).

76. Modal number of dorsal-fin rays. (ordered) 0, 5 or more dorsal-fin rays; *Hoplomyzon* clade. 1, 4 dorsal-fin rays; some *Pseudobunocephalus*, *Bunocephalus*, *Pterobunocephalus*, *Asredo* clade, and *Xylipterus*. 2, 3 dorsal-fin rays; some *Pseudobunocephalus* and *Acanthobunocephalus*. 3, fewer than 3 dorsal-fin rays; *Amaralia*.

State 1 also occurs in some Sisoridae, Akysidae pseudopimelodines, and doradoids. State 2 also occurs in some Akysidae.

77. Dorsal fin adnate. 0, dorsal fin membrane not adnate with body; *Pseudobunocephalus*, *Acanthobunocephalus* and *Amaralia*. 1, dorsal fin membrane

adnate with body; *Bunocephalus*, *Pterobunocephalus*, *Aspredo* clade, *Xyliophius*, and *Hoplomyzon* clade.

Anal Fin

78. Anal-fin adnate. 0, anal fin membrane not adnate with body; *Pseudobunocephalus*, *Acanthobunocephalus* and some *Xyliophius* 1, anal fin membrane partially or completely adnate with body; *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Aspredo* clade, some *Xyliophius*, and *Hoplomyzon* clade.

79. Modal number of anal-fin rays. (ordered) 0, 10 or fewer anal-fin rays; *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Xyliophius*, and *Hoplomyzon* clade 1, 10-20 anal-fin rays; *Pterobunocephalus*. 2, more than 50 anal-fin rays; *Aspredo* clade.

Note state 1 occurs in Diplomystidae and †Hypsidoridae and is considered the primitive character state. State 0 also occurs in some Sisoridae, Akysidae, and loricarioids. State 2 also occurs in *Heteropneustes*, Clariidae, Plotosidae, Schilbeidae, Siluridae, some doradoids (*Epapterus*) (Mo, 1991).

Caudal Fin

80. Modal number of principal caudal-fin rays. 0, more than 5+5 principal caudal-fin rays. 1, 5+5 principal caudal-fin rays (Fig. 27); *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus* (except *B. chamaizelus*), *Pterobunocephalus*, *Aspredo*, *Aspredinichthys*, and *Xyliophius*. 2, 5+4 principal caudal-fin rays (Figs. 28 & 30); *Bunocephalus chamaizelus*, *Amaralia*, and *Hoplomyzon* clade. 3, 4+5 principal caudal-fin rays (Fig. 29); *Platystacus*.

State 1 and 2 also occurs in some Akysidae (*Breitensteinia*) (Roberts, 1989).

81. Expanded bases of caudal-fin rays. 0, bases of all caudal-fin rays similar in size and shape. 1, uppermost and bottommost caudal-fin rays with expanded bases (Fig. 27); all Aspredinidae.

State 1 also occurs in some Sisoridae (*Sisor*) and loricarioids (*Scolopax*). These expanded bases are the insertion points of the supracarinalis posterior on the uppermost principal caudal ray and infracarinalis posterior on the bottommost principal caudal ray.

82. Length of outer caudal-fin rays. 0, outermost caudal-fin rays not much shorter than other rays; all Aspredinidae except *Pseudobunocephalus*, and *Acanthobunocephalus*. 1, outermost caudal-fin rays much shorter than other rays; *Pseudobunocephalus*, and *Acanthobunocephalus*.

83. Procurrent caudal-fin rays. 0, procurrent caudal-fin rays present and upper and lower rays are symmetrical in length (Fig. 27); *Pseudobunocephalus*, *Bunocephalus*, and *Pterobunocephalus*. 1, procurrent caudal-fin rays present and lower rays longer than upper rays; *Xylipterus* and *Hoplomyzon* clade. 2, procurrent caudal rays thickened and "S" shaped (Fig. 28); *Amaralia*. 3, procurrent caudal rays absent (Fig. 29); *Acanthobunocephalus*, and *Aspredo* clade.

84. Hypurapophysis. 0, hypurapophysis not enlarged; all Aspredinidae except *Hoplomyzon* clade. 1, hypurapophysis greatly expanded to contact lateral surface of body (Fig. 30); *Hoplomyzon* clade.

State 1 also occurs in some Amphiliidae.

Pectoral Fin & Girdle

85. Supracleithra-cranium connection. 0, supracleithra with a ligamentous attachments to neurocranium, all Aspredinidae except *Hoplomyzon* clade. 1, supracleithrum sutured to neurocranium (Fig. 16); *Hoplomyzon* clade.

State 1 also occurs in all Ariidae, doradoids, Amphiliidae and some loricarioids, Sisoridae, and Akysidae.

86. Supracleithra ornamentation. 0, supracleithra lack any bony ornamentation; all Aspredinidae except *Amaralia*. 1, supracleithrum ornamented with bony knobs; *Amaralia*.

87. Humeral process of cleithrum. 0, humeral process of cleithrum tapers posteriorly, all Aspredinidae except *Asredo*. 1, humeral process expanded distally; may contact coracoid processes in large specimens, *Asredo*

State 1 also occurs in some loricarioids (Callichthyidae).

88. Anterior margin of coracoid. (ordered) 0, antero-lateral margin of each coracoid convex. 1, anterior margin of coracoid slightly concave. 2, antero-lateral margin of coracoid moderately concave (Fig. 31); *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus* and *Asredo* clade. 3, antero-lateral margin of coracoid deeply concave; *Xylipterus* and *Hoplomyzon* clade.

State 1 occurs in some Sisoridae, Akysidae, and loricarioids.

89. Posterior processes of coracoids. 0, posterior processes of the coracoids are poorly developed, 1, posterior processes of the coracoids are well developed (Fig. 31), all Aspredinidae.

State 1 also occurs in doradoids and some Sisoridae and loricarioids.

90. Mesocoracoid arch. (ordered) 0, mesocoracoid arch present. 1, mesocoracoid arch present but incomplete. 2, mesocoracoid arch absent; all Aspredinidae

State 1 occurs in some Akysidae. State 2 also occurs in all Ariidae, doradoids (except Mochokidae) and some loricarioids (Vandellinae) (Baskin 1972).

Contra to Mo 1991, the mesocoracoid is present in all Akysidae either as an incomplete arch (*Acrochordonichthys*, *Breitensteinia*, *Parakysis*) or a complete arch (*Akysis*).

91. VAD process of pectoral spine. 0, VAD process of the pectoral spine weakly developed. 1, VAD process of the pectoral spine well developed (Fig. 31 & 32); all Aspredinidae.

State 1 also occurs in all doradoids, pseudopimelodines, Chacidae, *Olyra*, *Horabagrus* and *Bagrus*. The VAD process is the insertion point of the ventral division of the arrector dorsalis muscle on the proximal base of the pectoral spine. The VAD process is equivalent to the “proximal tubercle” (Hubbs & Hibbard, 1951), the “processus axial” (Gayet & Van Neer, 1990), and the “proximal spine of the pectoral spine” (Mo, 1991).

92. Pectoral spine shape. 0, pectoral spine not elongate, slightly recurved; all Aspredinidae except *Dupouyichthys* and *Ernstichthys*. 1. pectoral spine elongate and recurved (Figs. 48 & 49); *Dupouyichthys* and *Ernstichthys*.

State 1 also occurs in some loricarioids (*Acanthicus*) and doradoids (*Physopyxis*).

93. Pre-axial serrations of pectoral spine. 0, anterior serrations weakly developed or absent; *Amaralia*, *Xyliophius*, *Hoplomyzon* clade (except *Ernstichthys intonsus*), and an undescribed *Bunocephalus* sp. from the Rio São Francisco. 1, anterior serrations well

developed; length of serrations approximately equal to diameter of spine shaft; *Pseudobunocephalus*, *Acanthobunocephalus*, most *Bunocephalus*, *Pterobunocephalus*, *Aspredo* clade, and *Ernstichthys intonsus*.

State 1 also occurs in Chacidae, most pseudopimelodines (except *Pseudopimelodus zungaro*), most doradoids, and some Sisoridae.

94. Modal number of pectoral-fin rays. (ordered) 0, 9 or more pectoral-fin rays. 1, 8 pectoral-fin rays, *Aspredinichthys*. 2, 7 pectoral fin rays, *Platystacus* and *Aspredo*. 3, 6 pectoral fin rays, *Hoplomyzon* clade 4, 5 pectoral-fin rays, most *Pseudobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus* and *Xylipterus*. 5, 4 pectoral-fin rays, *Pseudobunocephalus iheringii*, *Pseudobunocephalus quadriradiatus*, and *Acanthobunocephalus*.

State 1 also occurs in some Amblycipitidae, Sisoridae, Amphiliidae, loricarioids and pseudopimelodines(*Pseudopimelodus zungaro*). State 2 also occurs in some Amblycipitidae, Sisoridae, Akysidae, loricarioids, and pseudopimelodines. State 3 also occurs in some Amblycipitidae, Akysidae, loricarioids and doradoids. State also 4 occurs in some Sisoridae, loricarioids, and pseudopimelodines. State also 5 occurs in some doradoids.

95. Modal number of pectoral radials. 0, three proximal pectoral radials present; all Aspredinidae except, *Acanthobunocephalus*. 1, two proximal pectoral-radials present; *Acanthobunocephalus*.

96. Anterior insertion of hypaxial muscles. 0, hypaxial musculature inserts on the anterior margin of the pectoral girdle. 1, hypaxial musculature inserts on the posterior margin of pectoral girdle; all Aspredinidae.

State 1 also occurs in all doradoids (Schmidt, 1994).

97. Ventral musculature of pectoral girdle. 0, ventral surface of pectoral girdle broadly covered by pectoral musculature. 1, ventral musculature reduced, *Hoplomyzon* clade. 2, ventral musculature absent, all Aspredinidae except *Hoplomyzon* clade.

State 1 also occurs in some doradoids (*Physopyxis*, *Amblydoras*, *Merodoras*) and loricarioids (*Schizolecis*) (Schaefer, 1991). State 2 occurs in all Clariidae, *Heteropneustes*, and some loricarioids (*Hypoptompoma*) (Higuchi, 1992; Schaefer, 1991).

98. Ventral division of arrector dorsalis. (ordered) 0, ventral division of the arrector dorsalis muscle originates near midline of pectoral girdle. 1, ventral division of the arrector dorsalis muscle origin shifted laterally; all Aspredinidae 2, ventral division of the arrector dorsalis muscle absent.

State 1 also occurs in all doradoids. State 2 occurs in loricarioids.

Pelvic Fin & Girdle

99. Basipterygium anterior arms. 0, anterior arms of basipterygia present. 1, anterior arms of basipterygia absent (Figs. 33-35); all Aspredinidae.

State 1 also occurs in some loricarioids (*Scolopax*).

100. Basipterygium lateral cartilage. 0, lateral cartilage of basipterygium present anterior to pelvic-fin rays; all Aspredinidae except *Hoplomyzon* clade. 1, lateral cartilage of basipterygium absent anterior to pelvic-fin rays (Fig. 35); *Hoplomyzon* clade

101. Basipterygium posterior cartilage. 0, posterior cartilage of basipterygium extensive. 1, posterior cartilage of basipterygium reduced (Fig. 34); all Aspredinidae except

Hoplomyzon clade. 2, posterior cartilage of basipterygium absent (Fig. 35); *Hoplomyzon* clade

102. Posterior margin of basipterygium. 0, posterior margin of basipterygium smooth; all Aspredinidae except *Bunocephalus* and *Amaralia*. 1, posterior margin of basipterygium jagged (Fig. 33); *Bunocephalus* and *Amaralia*.

103. Pelvic-pectoral girdle contact. 0, pelvic girdle remote from posterior processes of pectoral girdle; all Aspredinidae except *Hoplomyzon* clade. 1, anterior portion of pelvic girdle positioned close to posterior processes of the pectoral girdle; *Hoplomyzon* clade
State 1 also occurs in some Sisoridae (*Hara*) and doradoids (*Physopyxis*).

Lateralis System

104. Length of lateral line. 0, lateral line complete to caudal-fin base; *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Asredo* clade, all *Xylipterus* except *X. lepturus*, and *Hoplomyzon* clade. 1, lateral line truncated before caudal-fin base; *Pseudobunocephalus* and *Acanthobunocephalus*. 3, lateral line extends onto caudal fin; *Xylipterus lepturus*.

State 1 also occurs in some loricarioids, pseudopimelodines and doradoids (*Merodoras*). State 2 also occurs in some Ariidae (*Bagre*) and Sisoridae (*Bagarius*).

105. Lateral line ossicles. 0, lateral line ossicles are simple tubes; *Pseudobunocephalus*, *Acanthobunocephalus*, *Pterobunocephalus*, *Asredo* clade and *Xylipterus*. 1, each lateral line ossicle with a small hook (Fig. 36); *Bunocephalus* and *Amaralia*. 2, all lateral line ossicles with well developed hooks and dorsal and ventral lamina. 3, every other lateral line ossicle with a bony knob and well developed dorsal and ventral lamina (Fig. 36); *Hoplomyzon* clade.

State 2 occurs in some doradoids (Doradidae).

106. Infraorbital lateralis canal. 0, infraorbital lateralis canal complete; *Pseudobunocephalus lundbergi* n. sp., *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Aspredo* clade, *Xylipterus*, and *Hoplomyzon* clade. 1, infraorbital lateralis canal truncated; all *Pseudobunocephalus* except *P. lundbergi* n. sp. and *Acanthobunocephalus*.

State 1 also occurs in some loricarioids (*Scolopax*) (Schaefer, 1990).

107. Accessory nasal bones. 0, only single ossification of nasal lateralis canal; all Aspredinidae except *Aspredo* clade and *Xylipterus*. 1, several separate ossifications of the nasal lateralis canal; *Aspredo* clade and *Xylipterus*.

108. Hook on antorbital bone. 0, no hook developed on antorbital bone; all Aspredinidae except *Aspredinichthys*. 1, mesial limb of antorbital bone developed into a dorsal hook; *Aspredinichthys*.

109. Accessory canal in pterotic. 0, only a single canal exits and terminates in a pore from the lateralis canal which passes through the pterotic; all Aspredinidae except *Aspredo* clade. 1, two canals exit and terminate in pores from the lateralis canal which passes through the pterotic (Fig. 12-14); *Aspredo* clade.

Miscellaneous Characters

110. Maxillary barbels adnate. 0, maxillary barbels not adnate with head; *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Platystacus*, *Aspredinichthys*, and *Xylipterus* 1; maxillary barbel partially adnate with

head; *Dupouyichthys* and *Ernstichthys*. 2, maxillary barbel completely adnate with head; *Aspredo* and *Hoplomyzon*.

111. Accessory maxillary barbels. 0, maxillary barbels simple without accessory barbels; *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Platystacus*, *Xyliophius*, some *Hoplomyzon*, *Dupouyichthys* and some *Ernstichthys*. 1, maxillary barbels with accessory maxillary barbels; *Aspredo*, *Aspredinichthys*, some *Hoplomyzon*, and some *Ernstichthys*.

State 1 also occurs in some doradoids.

112. Mental barbel bases. 0, mental barbels and mental barbel bases absent. 1, mental barbel bases reduced, without anterior and posterior limbs; all *Aspredinidae*. 2, mental barbel bases with well developed anterior and posterior limbs.

State 1 also occurs in *Chacidae* and some *Amphiiliidae*. State 2 occurs in most other *Siluriformes*.

113. Bifid mental barbels. 0, mental barbels when present simple; all *Aspredinidae* except *Pseudobunocephalus bifidus* and *P. iheringii*. 1, antero-medial pair of mental barbels bifid; *Pseudobunocephalus bifidus* and *P. iheringii*.

State 1 also occurs in some doradoids (*Mochokidae*).

114. Accessory pairs of mental barbels. 0, accessory pairs of mental barbels absent; all *Aspredinidae* except *Aspredinichthys*, undescribed *Hoplomyzon* sp. and *Ernstichthys intonsus*. 1, several pairs of accessory mental barbels present; *Aspredinichthys*, undescribed *Hoplomyzon* sp. and *Ernstichthys intonsus*.

115. Anterior nares. 0, anterior nares contact posterior nares. 1, anterior nares remote from posterior nares; all *Aspredinidae*.

State 1 also occurs in all Amphiliidae, pseudopimelodines, doradoids and some Akysidae.

116. Papillae on anterior nares. 0, no papillae developed on anterior nares; all Aspredinidae except *Xyliophius* and *Hoplomyzon* clade. 1, papillae developed on rim of anterior nares that project dorsally across its opening (Fig. 37); *Xyliophius* and *Hoplomyzon* clade.

117. Papillae on lower jaw. 0, no fleshy papillae developed on lower jaw; all Aspredinidae except *Xyliophius*. 1, a single row of fleshy papillae developed on lower jaw which project anteriorly (Fig. 47); *Xyliophius*.

118. Jaw occlusion. 0, upper and lower jaws project equally and mouth is terminal; *Pseudobunocephalus* and *Acanthobunocephalus*. 1, lower jaw is subequal to upper jaw producing a distinct overbite; all Aspredinidae except *Pseudobunocephalus* and *Acanthobunocephalus*.

State 1 also occurs in Akysidae and some Amphiliidae.

119. Testis morphology. 0, mature testes with numerous digitiform processes, *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Xyliophius*, and *Hoplomyzon* clade; 1, mature testes without digitiform processes (Fig. 38), *Pterobunocephalus* and *Aspredo* clade.

The unusual testis morphology in *Pterobunocephalus* and the *Aspredo* clade externally resembles that of an unripe ovary. However the internal morphology is similar to the testis in other catfishes. This condition may partially explain claims by previous researchers that males of the *Aspredo* clade were rare or even unknown.

120. Egg carrying behavior. 0, developing eggs and embryos are not attached to females; *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Xylipterus*, and *Hoplomyzon* clade; 1, developing eggs and embryos attached to ventral surface of brooding females (Fig. 44), *Pterobunocephalus* and *Aspredo* clade.

I have observed embryos attached to *Pterobunocephalus* and members of the *Aspredo* clade. The chorion of the developing eggs adheres either directly to the ventral surface as in *Pterobunocephalus* or to fleshy pedicles termed cotylephores (Fig. 45) in the *Aspredo* clade. The distal tips of cotylephores form a calyx which adheres to the chorion of the developing embryo. These cotylephores develop seasonally in brooding females and are completely resorbed outside the breeding season (Wetzel, Worms & Friel, in review.).

Carrying of eggs has also been reported in the literature for other aspredinids. Miles (1945) reported a specimen of *Dupouyichthys sapito* with embryos adhering to the ventral fins. Myers (1960) states that "aquarists have reported *Bunocephalus* to carry the eggs in the same way". However, after examination of most aspredinid material available I have not observed egg carrying in any of these other taxa and I am unable to confirm any of these reports.

121. Cotylephores. 0, cotylephores, fleshy appendages for carrying developing embryos, absent; all Aspredinidae except *Aspredo* clade. 1, cotylephores seasonally develop in females, *Aspredo* clade.

122. Shape of unculi. 0, keratinized cells with projections, unculi, absent. 1, projections of unculi short and conical (Fig. 39); all Aspredinidae except *Xylipterus*. 2, projections of unculi broad and flattened; *Xylipterus*. 3, projections of unculi elongate sometimes branched (Fig. 40).

State 1 also occurs in Amphiliidae, pseudopimelodines, doradoids and some loricarioids (Loricariidae). State 3 occurs in Sisoridae and Akysidae.

123. Unculiferous tubercle rows. 0, rows of tubercles covered by unculi absent. 1, some unculiferous tubercles enlarged and arranged into longitudinal rows on body; all Aspredinidae.

State 1 also occurs in most Akysidae (*Akysis*, *Acrochordonichthys*, *Breitensteinia*) and Sisoridae (*Conta*, *Glyptothorax*)

These tubercle rows are well developed in most aspredinids but are highly reduced in *Aspredo*.

124. Saddle pigmentation pattern. 0, no pigmentation pattern of dark saddles; *Aspredo* and *Xyliophius*. 1, poorly defined and variable pattern of dark saddles present; *Pseudobunocephalus*, *Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Platystacus*, and *Aspredinichthys*. 2, well defined regular pattern of dark saddles (Figs. 48 & 49); *Hoplomyzon* clade.

State 1 also occurs in pseudopimelodines and some Akysidae.

125. Alarm cells & fright reaction. 0, alarm substance cells present in skin and fishes display a fright reaction when exposed to an alarm substance. 1, alarm substance cells absent and fishes do not display a fright reaction when exposed to an alarm substance; all Aspredinidae.

State 1 also occurs in some loricarioids (Loricariidae) (Pfeiffer, 1977).

126. Adipose fin. 0, adipose fin present. 1, adipose fin absent; all Aspredinidae.

State 1 also occurs in some Akysidae (*Parakysis*), loricarioids and doradoids.

127. Oophagy specialization. 0, egg eating specialization absent; all Aspredinidae except *Amaralia*. 1, fishes specialize on eating the eggs of other fishes (Fig. 43); *Amaralia*.

During this study I noticed several *Amaralia* specimens which had grossly distended abdomens. I initially assumed these were females with ripe ovaries but further investigation did not confirm this and instead lead to my discovery of oophagy in this genus. When I examined the stomach contents of 23 specimens of *Amaralia* from throughout the range of this genus, I found large egg masses in the stomachs of 7 specimens (6 female & 1 male) and nothing in the other 16 specimens (7 female & 9 male). This is in stark contrast to what I have found in all other aspredinids which usually contain some invertebrates (annelid worms, crustaceans, aquatic insect larvae and terrestrial insects) or organic detritus. I speculate that the eggs are probably those of loricariid catfishes given the size and the shape of the egg clutches. Further evidence for this proposition comes from one clutch which had developing embryos that I have identified as Loricariidae based on fin ray counts.

Results of Phylogenetic Analyses

Analysis #1 of the entire data set (except Aspredinidae ANC) produced two most parsimonious trees with the following diagnostics: 438 steps, Consistency index (CI) = 0.845, Homoplasy index (HI) = 0.598, CI excluding uninformative characters = 0.576, HI excluding uninformative characters = 0.618, Retention index (RI) = 0.866, Rescaled consistency index = 0.732. Both trees have identical topologies for all the ingroup taxa of aspredinids. They differ only in placement of a clade composed of Amphiliidae and the loricarioids, either as the sister group to the clade of "sisoroids" (Amblycipitidae, Sisoridae and Akysidae) or to the clade containing pseudopimelodines, doradoids and Aspredinidae. A strict consensus tree of these two trees is presented in Figure 1.

Analysis #2 (all outgroup taxa plus Aspredinidae ANC) produced two most parsimonious trees with the following diagnostics: 271 steps, Consistency index (CI) = 0.941, Homoplasy index (HI) = 0.720, CI excluding uninformative characters = 0.556, HI excluding uninformative characters = 0.750, Retention index (RI) = 0.636, Rescaled consistency index (RC) = 0.599. The two trees have identical topologies with the two trees produced in analysis #1. Decay indices and bootstrap frequencies and for the internal branches the strict consensus of these trees appear in Figure 2.

Analysis #3 (all ingroup taxa plus [†]Hypsidoridae and Diplomystidae) produced a single most parsimonious tree with the following diagnostics: 226 steps, Consistency index (CI) = 0.827, Homoplasy index (HI) = 0.257, CI excluding uninformative characters = 0.729, HI excluding uninformative character = 0.297, Retention index = 0.841, Rescaled consistency index (RC) = 0.696. The topology for all aspredinid ingroup taxa is identical to that in all trees produced in the analyses #1 and #2. Decay indices and bootstrap frequencies for the internal branches of this tree appear in Figure 3.

List of unambiguous changes for clades outside the Aspredinidae

The following is a list of unambiguous character state changes supporting clades outside the Aspredinidae. If clades have been recognized as monophyletic by previous authors their names for the clades are cited before the informal name I have used in my study. The characters were optimized on the consensus tree of the two trees produced in analysis #1 which has the following topology: (Diplomystidae (†Hypsidoridae ((Amblycipitidae (Sisoridae, Akysidae)), (Amphiliidae, loricarioids), (pseudopimelodines (doradoids, Aspredinidae))))). Diagnostics for each character (steps, CI, RI, etc.) are presented in Table 2. Lists of unambiguous characters state changes for the Aspredinidae and clades within the Aspredinidae are presented in a later section entitled **Systematic Account of the Family Aspredinidae**. Decay indices and bootstrap frequencies generated in analysis #2 are listed after the clades as measures of robustness.

Diplomystidae

no unambiguous character state changes

Siluroidei (in part) (Grande, 1987)

**(†Hypsidoridae, Amblycipitidae, Sisoridae, Akysidae, Amphiliidae,
Loricarioids, Pseudopimelodines, Doradoids, Aspredinidae)**

1 unambiguous character state change: [94:1] Modal # of pectoral rays: 8 rays

†Hypsidoridae

no unambiguous character state changes

Siluroidea (in part) (Grande, 1987)

(**Amblycipitidae, Sisoridae, Akysidae, Amphiliidae, Loricarioids, Pseudopimelodines, Doradoids, Aspredinidae**)

Decay index: 1; Bootstrap frequency: 88%

no unambiguous character state changes

Sisorida (in part) (Pinna, 1993)

(**Amblycipitidae, Sisoridae, Akysidae**)

Decay index: 2; Bootstrap frequency: 81%

3 unambiguous character state changes: [3:1] cartilage on facet for palatine discontinuous with ethmoid cartilage on midline; [53:1] origin of parapophysis of fifth centrum shifted ventrally; [69:1] bony canals for spinelet erector muscle present.

Amblycipitidae

1 unambiguous character state change: [9:1] supraoccipital process truncated.

Unnamed Clade

(**Sisoridae, Akysidae**)

Decay index: 0; Bootstrap frequency: 78%

2 unambiguous character state changes: [73:1] dorsal spinelet with recurved processes; [122:3] unculi with elongate projections.

Sisoridae

no unambiguous character state changes

Akysidae

2 unambiguous character state changes: [90:1] mesocoracoid arch reduced; [118:1] jaw occlusion subequal.

Loricarida (Pinna, 1993)

(Amphiliidae, loricarioids)

Decay index: 0; Bootstrap frequency: 64%

2 unambiguous character state changes: [26:1] posterior cartilage of palatine highly reduced or absent; [52:1] wide contact between parapophyses of fourth & fifth centra

Amphiliidae

1 unambiguous character state change: [45:1] second hypobranchial lacks posterior cartilage.

Loricariidi (Pinna, 1993)

loricarioids

2 unambiguous character state changes: [21:1] coronomeckelian absent; [98:2] ventral division of arrector dorsalis muscle lost.

Unnamed Clade

(Pseudopimelodines, Doradoids, Aspredinidae)

Decay index: 1; Bootstrap frequency: 66%

1 unambiguous character state change: [91:1] VAD process of pectoral spine well developed.

Pseudopimelodidae (Pinna, 1993)

pseudopimelodines

1 unambiguous character state change: [33:1] lamina developed on antero-lateral margin of anterohyal.

Unnamed Clade

(doradoids, Aspredinidae)

Decay index: 1; Bootstrap frequency: 61%

4 unambiguous character state changes: [9:1] supraoccipital process truncated; [89:1] posterior processes of coracoids well developed; [96:1] hypaxial musculature inserts on posterior margin of pectoral girdle; [98:1] origin of the ventral division of arrector dorsalis muscle shifted laterally.

Doradomorpha (Pinna, 1993)

doradoids

3 unambiguous character state changes: [32:0] dorsohyal present (character reversal); [38:2] urohyal with a ventral keel; [85:1] supracleithra sutured to crania.

Phylogenetic Relationships of the Aspredinidae to Other Catfishes

This section contains reviews of all previous hypotheses on the relationships of the Aspredinidae to other families of catfishes. In each case I review and comment on the character evidence cited to support a particular phylogenetic hypothesis. If a character is also used in my analysis, I cite the corresponding character and state used in my data matrix. Additionally, I present evidence for why I reject from my analysis some characters used in previous studies.

Prior to this study, the Aspredinidae have been allied with either Neotropical loricarioid or Asian sisoroid catfishes. Günther (1864) was the first to place the Aspredinidae together with loricarioids and the Sisoridae in his “sixth subfamily Siluridae Proteropodes”. Only one of the characters he uses to recognize this group (gill membranes confluent on isthmus) is a derived character state. However this character is not present in all members of this group.

A close relationship with loricarioid catfishes was also suggested in Chardon's (1968) classification based on his studies of the Weberian apparatus. He places the Aspredinidae along with loricarioids in his “suborder Loricariodei” based on a combination of plesiomorphic and homoplasious characters. Baskin (1972) and Howes (1983) both review the evidence presented by Chardon based on the Weberian apparatus and conclude that the Aspredinidae are not closely related to loricarioids.

Although a sister group relationship between aspredinids and loricarioids is not supported in my analysis, I would like to point out some interesting homoplastic characters I discovered during this study which are shared by aspredinids and some advanced loricarioids such as Scoloplacidae, Astroblepidae, and Loricariidae. These include the following: [18:1] mandibular lateralis canal truncated and not encased in the bones of the lower jaw; [60:1] hemal and neural spines expanded as vertical lamina; [64:1] hemal arches form without a transformation series of rib parapophyses; [65:2]

peg & socket connections between abdominal vertebrae; and [67:1] parapophysis for ribs reduced or absent. These apparently represent an amazing case of convergence in postcranial skeletal morphology.

More recently, a sister group relationship of the Aspredinidae to some or all sisoroid catfishes has been suggested. Ferraris (1989) presented a novel idea, suggesting that the Akysidae are the sister group to the Aspredinidae. He cited the following characters as support for this relationship: reduction in number of caudal-fin rays (= [80:1]); rows of unculiferous tubercles present on body (= [123:1]); and anal-fin pterygiophores articulate with bifid hemal spines (= [63:1]). In his study he had only examined some akysids (*Acrochordonichthys* & *Breitensteinia*) with some aspredinids (*Bunocephalus*, *Amaralia*, *Platystacus* & *Asredo*). I too have found derived characters shared by these taxa such as the development of bony horizontal lamina on the centra [57:1]. Nevertheless, most of these characters are present only in derived aspredinids and derived akysids such as those listed above and are not present in more basal akysids (*Akysis*) and aspredinids (*Pseudobunocephalus*). Based on my analysis these derived character states are homoplasies due to convergence in these two families.

Mo (1991) provided the first explicitly phylogenetic analysis of all families of catfishes. In his phylogenetic hypotheses, the Aspredinidae are placed either basal to or in a polytomy with a clade containing Clariidae, Amphiliidae, loricarioids, and sisoroids (Fig. 5). The characters supporting this placement are as follows: ethmoid cartilage discontinuous (= [3:1]); neural arch of compound centrum fused to cranium (?); partial or entire encapsulation of the swimbladder (?); claustrum reduced or absent; supracleithra sutured to neurocranium (= [85:1]); and anterior nuchal plate absent (= [70:1]). Two of these proposed synapomorphies (marked as ?) are absent in all Aspredinidae and supracleithra sutured to the neurocranium only occurs in the highly derived *Hoplomyzon* clade. This placement would require several subsequent reversals to explain the plesiomorphic conditions in the Aspredinidae and in my analysis those

derived character that actually do occur in aspredinids and these other taxa are interpreted as homoplasies.

A more rigorous phylogenetic analysis of higher level relationships of all catfishes is provided by Pinna (1993). Results of his analysis place the Aspredinidae in a polytomy with Amblycipitidae, Akysidae, Sisoridae, Amphiliidae and loricarioids (Fig. 5). The characters supporting this placement include the following: ethmoid cartilage discontinuous (= [3:1]); hyomandibula only articulates with the sphenotic (= [22:1]); upper pharyngeal tooth plates articulate with fourth pharyngobranchial by 2 struts of bone (?); abdominal vertebrae connected by ligaments (?) = [65:2]; fifth vertebrae with second transverse process (?) = [53:1]; first hypobranchial lacks posterior cartilage (= [44:1]) ; fifth epibranchial absent (= [42:1]), and extra ventral processes on complex centra of the Weberian apparatus (?) = [51:1].

I have checked these characters in aspredinid and sisoroid materials available to me and I have excluded those characters marked above only as (?) because I do not find them consistently or at all in the specimens I have examined. The remaining characters have been included in my analysis along with additional characters not used in Pinna's study. Based on my analysis these derived character are interpreted as homoplasies between aspredinids and sisoroid catfishes.

Chen (1994) place the Aspredinidae as the sister group to a sisoroid clade composed of Amblycipitidae, Sisoridae and Akysidae. Characters supporting this relationship include the following: ethmoid cartilage discontinuous (= [3:1]); accessory basibranchial cartilage between third and fourth basibranchials (?); preopercle lacks anterior laminar portion (?); ventral processes on complex centra (?) = [51:1]; tip of parapophysis of fifth vertebra "club-like" (?) = [55:1] & [56:1]; bony canals for dorsal-spinelet erector muscles (= [69:1]); transverse lamina of first dorsal-fin pterygiophore expanded and thickened (?); first dorsal-fin pterygiophore has dorso-medial articular surfaces with processes of the Weberian apparatus (?); and oval depression present on anterior surface of first dorsal-fin pterygiophore (?).

In the Aspredinidae, I have only found an accessory basibranchial cartilage in *Pseudobunocephalus* and *Xylipterus* and it is present in some individuals and absent in others. In addition, this character is also present in some doradoids such as Auchenipteridae (Ferraris, 1988).

The dorsal-fin pterygiophore characters are also problematic and I differ in my interpretation of these characters. The first dorsal-fin pterygiophores of aspredinid and sisoroid catfishes are both highly modified from the plesiomorphic condition in catfishes but I do not consider their transformations to be homologous.

The bony canals for the dorsal-spinelet erector muscles are only present in *Acanthobunocephalus* among aspredinids. All other aspredinids lack the dorsal spinelet and spinelet erector muscles. Given the placement of *Acanthobunocephalus* in the phylogeny of the Aspredinidae (Fig. 1), it is unclear if this character state was primitively present in the ancestor of all Aspredinidae and later lost twice within aspredinids or arose independently in *Acanthobunocephalus*.

The “depressions on the first dorsal-fin pterygiophore” in sisoroids and *Acanthobunocephalus* are actually the openings to the bony canals for the spinelet erector muscles whereas in all other aspredinids the depressions referred to are the insertion points of the supracarinalis anterior muscles. Furthermore there is considerable variation in the articulations between the first dorsal-fin pterygiophore and the Weberian complex in aspredinids. Most aspredinids have latero-medial articular surfaces and some even approach the dorso-medial condition but none have the distinctive oval-shaped articular surfaces present in sisoroids. Again based on my analysis these derived character states are homoplasies between aspredinids and sisoroids.

The results of my analysis support a novel hypothesis that the sister group to the Aspredinidae are the doradoids and together they are the sister group to the pseudopimelodines. While affinities between pseudopimelodines and aspredinids have been suggested by the results of Pinna (1993), to my knowledge a relationship between

aspredinids and doradoids has never been suggested. Prior to this study doradoids had been consider either the sister group to Ariidae (Lundberg, 1993; Mo 1993; Royero, 1987) or had been placed in a polytomy with Cranoglanidae, Ictaluridae and a large multifamily clade (Siluridae, Auchenoglaninae, Chacidae, Plotosidae and Clariidae) (Pinna, 1993).

Evidence supporting a sister group relationship between pseudopimelodines and a clade containing aspredinids and doradoids comes from the well developed VAD process on the base of the pectoral spine [91:1]. Character evidence supporting a sister group relationship between aspredinids and doradoids include the following: [9:1] supraoccipital process truncated; [89:1] posterior processes of coracoid well developed; [96:1] hypaxial musculature inserts on posterior margin of pectoral girdle; and [98:1] the origin of the ventral division of arrector dorsalis muscle shifted laterally. While the robustness of this hypothesis is not strong it is still better supported than any other hypotheses on the sister group relationships of the Aspredinidae.

Artificial Key to the Genera of the Aspredinidae

- 1a. > 50 anal-fin rays; caudal peduncle with a continuous bony dorsal ridge 2
1b. < 20 anal-fin rays; caudal peduncle without a continuous bony dorsal ridge..... 4
2a. 9 principal caudal-fin rays; tubercle rows well developed *Platystacus*
2b. 10 principal caudal-fin rays; small barbel at base of maxillary barbel present..... 3
3a. Maxillary barbel completely adnate, enlarged humeral process, tubercle rows on body highly reduced; 7 pectoral-fin rays..... *Aspredo*
3b. Maxillary barbel not adnate; additional pairs of barbels on ventral surface of body; 8 pectoral-fin rays; antorbital and mesethmoid with hook-like processes .. *Aspredinichthys*
4a. Lower lip equal to upper lip; outermost caudal fin rays shortened; anal and dorsal fins not adnate; lateral line truncated at level of dorsal fin..... 5
4b. Lower lip subequal to upper lip; anal and dorsal fins partially or totally adnate; lateral line complete..... 6
5a. Rigid, locking dorsal spine and spinelet present *Acanthobunocephalus* new genus
5b. Dorsal spine flexible; no dorsal spinelet *Pseudobunocephalus* new genus
6a. No obvious bony plates on body 7
6b. Dorsal, ventral and lateral series of bony plates present on body 10
7a. Lower lip with numerous papillae; no premaxillary teeth *Xyliophius*
7b. Lower lip without papillae; premaxillary teeth present 8
8a. 2-3 dorsal-fin rays; caudal peduncle deep, laterally compressed *Amaralia*
8b. >4 dorsal-fin rays; caudal peduncle slender, not laterally compressed..... 9
9a. Head and body extremely depressed; skull ornamentation highly reduced or absent, anal-fin with 10 - 20 rays *Pterobunocephalus*
9b. Head and body deep or moderately depressed; skull ornamentation typically developed; anal fin with 5 - 10 rays *Bunocephalus*
10a. Papillae present on upper lip; maxillary barbels completely adnate; dentary teeth present; 3 - 4 sets of paired pre-anal-fin plates *Hoplomyzon*
10b. No papillae present on upper lip; maxillary barbels on slightly adnate; dentary teeth absent; 1 - 2 sets of paired pre-anal-fin plates..... 11
11a. One set of paired pre-anal-fin plates; pectoral spines only slightly longer than first branched ray; skull ornamentation well developed..... *Dupouyichthys*
11b. Two sets of paired pre-anal-fin plates, pectoral spines much longer than first branched ray; skull ornamentation reduced..... *Ernstichthys*

Systematic Account of the Family Aspredinidae

This section contains a systematic revision of the Aspredinidae based on the results of this phylogenetic study. New diagnoses for the family and genera are provided along with decay indices and bootstrap frequencies generated in analysis #3. Diagnoses are based primarily on the unambiguous character changes supporting each clade in the consensus tree from analysis #1. Note that the diagnoses are not identical to the lists of unambiguous changes for a clade because characters may be transformed in more inclusive subclades. For example, while the character state [80:1] 5+5 caudal fin rays is assigned to the clade containing all aspredinids, some lineages within this clade have evolved [80:2] 5+4 caudal fin rays or [80:3] 4+5 caudal fin rays. Thus I described the condition in aspredinids as 10 or fewer caudal rays. Furthermore, I have supplemented the diagnoses by including additional characters (plesiomorphic & apomorphic) that are useful for identification.

Included species lists are presented for each of the 12 genera of aspredinids recognized. All synonymies of available species names presented in this work have already been suggested by other researchers (Gosline, 1945; Haseman, 1911; Ma, 1977; Mees, 1988, 1989). When possible type material was examined to confirm these subjective synonymies. Based on my examination of most aspredinid material available, I accept all previously suggested synonymies. For completeness I have also included synonymies for two species described in Ma (1977) which are not available for nomenclatural purposes. Photographs of representative species of all genera (Figs. 6, 41 - 49) and distribution maps for all species (Figs. 50 - 85) are also presented.

Family Aspredinidae (Bleeker, 1858)

Decay index: >15; Bootstrap frequency: 100%

Familia Aspredinoidei Bleeker, 1858

Group Aspredinina Günther, 1864

Family Aspredinidae Cope, 1871

Family Bunocephalidae Eigenmann & Eigenmann, 1890

Type genus. *Aspredo* Scopoli, 1777

Included genera and species:

Pseudobunocephalus lundbergi new genus & species (Figs. 7, 19, 22, 27, 50)

Pseudobunocephalus iheringii (Boulenger, 1891) (Fig. 51)

Pseudobunocephalus rugosus (Eigenmann & Kennedy, 1903) (Fig. 52)

Pseudobunocephalus bifidus (Eigenmann, 1942) (Fig. 53)

Pseudobunocephalus amazonicus (Mees, 1989) (Fig. 54)

Pseudobunocephalus quadriradiatus (Mees, 1989) (Fig. 55)

Acanthobunocephalus nicoi new genus & species (Figs. 8, 26, 31, 41, 56)

Bunocephalus verrucosus (Bloch, 1794) (Figs. 6, 42, 57)

Bunocephalus aleuropsis Cope, 1870 (Fig. 58)

Bunocephalus coracoideus (Cope, 1874) (Fig. 59)

Bunocephalus kneri Steindachner, 1882 (Fig. 60)

Bunocephalus amaurus Eigenmann, 1912b (Figs. 6, 9, 22, 61)

Bunocephalus chamaizelus Eigenmann, 1912b (Fig. 62)

Bunocephalus doriae Boulenger, 1902 (Fig. 63)

Bunocephalus colombianus, Eigenmann, 1912a (Fig. 64)

Bunocephalus larai von Ihering, 1930 (Fig. 65)

Amaralia hypsiura (Kner, 1855) (Fig. 42, 43, 66)

- Pterobunocephalus depressus* (Haseman, 1910) (Fig. 67)
- Pterobunocephalus dolicurus* (Delsman 1941) (Fig. 68)
- Platystacus cotylephorus* Bloch 1794 (Figs. 12, 29, 45, 69)
- Aspredo aspredo* (Linnaeus), 1758 (Figs. 6, 13, 46, 70)
- Aspredinichthys tibicen* (Valenciennes, 1840) (Fig. 46, 71)
- Aspredinichthys filamentosus* (Valenciennes, 1840) (Figs. 6, 14, 72)
- Xyliophius magdalena* Eigenmann 1912 (Fig. 6, 73)
- Xyliophius barbatus* de Arámburu & Arámburu 1962 (Fig. 74)
- Xyliophius melanopterus* Orcés, 1962 (Figs. 15, 75)
- Xyliophius lepturus* Orcés 1962 (Fig. 76)
- Xyliophius lombarderoi* Risso & Risso 1964 (Fig. 77)
- Xyliophius kryptos* Taphorn & Lilyestrom, 1983 (Figs. 47, 78)
- Hoplomyzon atrizona* Myers, 1942 (Figs. 16, 48, 79)
- Hoplomyzon papillatus* Stewart, 1985 (Figs. 6, 80)
- Hoplomyzon sexpapilostoma* Taphorn & Marrero, 1990 (Figs. 35, 81)
- Dupouyichtys sapito* Schultz, 1944 (Figs. 17, 48, 82)
- Ernstichthys anduzei* Fernández- Yépez, 1953 (Figs. 49, 83)
- Ernstichthys megistus* Orcés, 1961 (Figs. 18, 84)
- Ernstichthys intonsus* Stewart, 1985 (Figs. 49, 85)

25 unambiguous character state changes: [3:1] ethmoid cartilage on midline discontinuous with cartilage on lateral condyle; [8:2] laminar processes of pterotic are pointed and directed laterally; [11:1] vomer absent; [18:2] mandibular lateralis canal does not enter lower jaw; [29:2] opercle "L" shaped resembles branchiostegal rays; [31:1] opercular apertures reduced to ventral slits; [37:1] 5 or fewer branchiostegal rays; [45:2] second hypobranchial completely cartilaginous; [49:1] lower pharyngeal tooth plates with teeth restricted to mesial edge; [50:1] dorsal lamina of Weberian complex contacts dorsal surface of body; [53:1] origin of parapophysis of fifth vertebra shifted ventrally;

[55:1] parapophysis of fifth vertebrae extends past parapophysis of fourth vertebra; [64:1] hemal canal forms de novo without a transformation series of rib parapophyses; [65:2] abdominal vertebral with peg and socket articulations; [67:1] parapophyses for ribs reduced or absent; [70:1] anterior nuchal plate absent; [79:0]. modal # of anal rays 10 or fewer; [80:1] modal # of caudal rays 5+5; [81:1] expanded bases on caudal rays present; [88:2] anterior margin of coracoid moderately concave; [99:1] basipterygia anterior arms absent; [101:1] basipterygia posterior cartilage reduced; [112:1] mental barbel bases reduced; [123:1]. rows of unculiferous tubercles present on body; [125:1]. alarm cells & fright reaction absent.

Diagnosis. Catfishes characterized by the following synapomorphies: ethmoid cartilage on midline discontinuous with cartilage on lateral condyle; laminar processes of pterotic directed laterally; vomer absent; mandibular lateralis canal does not enter lower jaw; opercle "L" shaped resembles a branchiostegal ray; opercular apertures reduced to ventral slits; 5 or fewer branchiostegal rays; second hypobranchial completely cartilaginous; dorsal lamina of Weberian complex contacts dorsal surface of body; origin of parapophysis of fifth vertebra shifted ventrally; parapophysis of fifth vertebra extends past parapophysis of fourth vertebra; hemal canal forms de novo by vertebra 7 without a transformation series of rib parapophyses; abdominal vertebral with peg and socket articulations; parapophyses for ribs reduced or absent; anterior nuchal plate absent; 10 or fewer principal caudal-fin rays; expanded bases on outermost caudal rays; mesocoracoid arch absent; muscles on the ventral surface of the pectoral girdle highly reduced or absent; basipterygia without anterior arms; posterior cartilage of basipterygia reduced; mental barbel bases reduced; rows of unculiferous tubercle present on body; adipose fin absent; alarm cells & fright reaction.

***Pseudobunocephalus* new genus**

Type species. *Pseudobunocephalus lundbergi* new species

Included species:

Pseudobunocephalus lundbergi new species Appendix 1

Pseudobunocephalus iheringii (Boulenger, 1891)

Bunocephalus iheringii Boulenger, 1891 (type locality: Brazil: Rio Grande do Sul)

Bunocephalus salathei Myers, 1927 (type locality: Brazil: Minas Gerais, Morro Agudo).

Bunocephalus minutus Güntert, 1942 (type locality: Paraguay: Dept. Villetta, Estao Canchali).

Bunocephalus carvalhoi Miranda Ribeiro, 1944 (type locality: Brazil: Rio de Janeiro, Magé)

Pseudobunocephalus rugosus (Eigenmann & Kennedy, 1903)

Bunocephalus rugosus Eigenmann & Kennedy, 1903 (type locality: Paraguay: Laguna near Arroyo Chagalalina)

Dysichthys australis Eigenmann & Ward, 1907 (type locality: Brazil: Minas Gerais: Corumbá)

Pseudobunocephalus bifidus (Eigenmann, 1942)

Bunocephalus bifidus Eigenmann, 1942 (type locality: Peru: Yurimanguas)

Pseudobunocephalus amazonicus (Mees, 1989)

Dysichthys amazonicus Mees, 1989 (type locality: Bolivia: Cochabamba, Rio Mamoré, Todos Santos).

“*Bunocephalus boliviensis*” Ma, 1977 (type locality: Bolivia: Cochabamba, Rio Mamoré, Todos Santos).

Pseudobunocephalus quadriradiatus (Mees, 1989).

Dysichthys quadriradiatus Mees, 1989 (type locality: Peru: Loreto: Rio Samiria)

“*Bunocephalus spelerti*” Ma, 1977 (type locality: Peru: Yanamono)

9 unambiguous character state changes: [10:1] knobby skull ornamentation well developed; [24:1] metapterygoid free of quadrate; [27:2] posterior end of palatine forked; [36:1] interhyal absent; [41:2] fourth pharyngobranchial absent; [43:1] gill rakers absent; [54:1] fifth parapophysis points anteriorly; [61:1] height of neural spines equal to or less than height of neural arches; [71:1] middle nuchal plate ornamentation well developed.

Diagnosis. A genus of relatively small banjo catfishes (up to 80 mm SL) distinguished from other aspredinids by the following characters: dentary teeth restricted to broad tooth patch near symphysis of lower jaw; metapterygoid does not contact quadrate; posterior end of palatine forked; fourth pharyngobranchial absent; gill rakers absent on all gill arches; and parapophysis of fifth vertebrae oriented anteriorly. Characters not unique but useful for identification include: jaws equal; lateral line truncated at approximately the level of the dorsal fin origin; dorsal- and ventral-most principal caudal rays much shorter than others and dorsal- and anal-fin membranes not adnate with body.

Etymology. The generic name is a combination of the Greek *pseudo* plus the aspredinid genus *Bunocephalus*. Gender masculine.

Comments. This new genus is widespread in the Orinoco, Amazon and Paraguay-Paraná basins but is not as well represented as *Bunocephalus* is in museum collections. Specimens of *Pseudobunocephalus* may be mistaken at first glance as juvenile *Bunocephalus* specimens and are often in mixed lots with larger *Bunocephalus* specimens. Based on this study the species for this genus, *Pseudobunocephalus lundbergi*, is the sister group to all other *Pseudobunocephalus* spp. Evidence supporting this hypothesis is presented in the description of *Pseudobunocephalus lundbergi* contained in Appendix 1.

Unnamed Clade

**(*Acanthobunocephalus*, *Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Platystacus*, *Aspredo*,
Aspredinichthys, *Xylipterus*, *Hoplomyzon*, *Dupouyichthys*, *Ernstichthys*)**

Decay index: 3; Bootstrap frequency: 77%

6 unambiguous character state changes: [30:1] opercle-interopercle connection present; [33:1] anterohyal lamina present; [42:1] fifth epibranchial absent; [52:1] broad contact between fourth & fifth parapophyses; [57:1] horizontal lamina present on posterior centra; [63:1] some hemal spines bifid for articulation with anal-fin pterygiophores.

***Acanthobunocephalus* new genus**

Type species. *Acanthobunocephalus nicoi* new species

Included species:

Acanthobunocephalus nicoi new species Appendix 2

11 unambiguous character state changes: [7:1] posterior cranial fontanel absent; [26:1] posterior palatine cartilage highly reduced or absent; [44:2] first hypobranchial completely cartilaginous; [48:1] third basibranchial absent; 56:1] tip of fifth parapophysis expanded; [69:1] dorsal-spinelet erector muscle canals present; [76:2] modal # of dorsal rays: 3; [83:3] procurent caudal rays absent; [94:5] modal # of pectoral rays: 4; [95:1] modal # of pectoral radials: 2; [106:1] infraorbital lateralis canal truncated.

Diagnosis. A genus of miniature aspredinid (less than 20 mm SL) distinguished from other aspredinids by the following characters: presence of a dorsal spinelet and rigid dorsal-spine; anteriorly expanded supraoccipital; absence of a posterior cranial fontanel; posterior cartilage of palatine absent; 2 pectoral radials; horizontal bony lamina developed only on last three centra and compound ural centrum; and absence of

procurent caudal-fin rays. Other characters not unique to this taxon but useful for identification are: reduced ornamentation of skull roof, dorsal lamina of Weberian complex, and nuchal plates; jaws equal; pectoral fin with spine and 4 rays; dorsal fin with spine and 3 rays; dorsal- and anal-fin membranes not adnate with body; dorsal- and ventral-most principal caudal rays much shorter than others, infraorbital lateralis canal truncated; lateral line truncated at approximately the level of the dorsal fin origin.

Etymology. The generic name is a combination of the Greek *acantho*, spiny, in reference to the rigid, locking dorsal-spine, plus the aspredinid genus *Bunocephalus*. Gender masculine.

Comments. This monotypic genus is only known from the type materials listed in Appendix 2. These miniature fishes appear to be restricted to the upper Orinoco River system of Venezuela.

Unnamed Clade

(*Bunocephalus*, *Amaralia*, *Pterobunocephalus*, *Platystacus*, *Asredo*, *Aspredinichthys*,
Xyliophius, *Hoplomyzon*, *Dupouyichthys*, *Ernstichthys*)

Decay index: 2; Bootstrap frequency: 77%

3 unambiguous character state changes: [57:2] horizontal lamina present on all centra; [78:1] anal fin partially to completely adnate with body; [118:1] jaw occlusion subequal

Unnamed Clade

(*Bunocephalus*, *Amaralia*)

Decay index: 1; Bootstrap frequency: 61%

3 unambiguous character state changes: [71:1] middle nuchal plate ornamentation well developed; [102:1] posterior margin of basipterygia jagged; [105:1] lateral line ossicles with small hooks.

***Bunocephalus* Kner, 1855**

Bunocephalus Kner, 1855 (type species: *Bunocephalus verrucosus* (Bloch, 1794))

Bunocephalichthys Bleeker, 1858 (type species: *Bunocephalus verrucosus* (Bloch, 1794))

Dysichthys Cope, 1874 (type species: *Bunocephalus coracoideus* (Cope, 1874))

Agmus Eigenmann, 1910 (type species: *Bunocephalus verrucosus* (Bloch, 1794))

Type species. *Bunocephalus verrucosus* (Bloch, 1794)

Included species:

Bunocephalus verrucosus (Bloch, 1794)

Platystacus verrucosus Bloch, 1794 (type locality: Suriname)

Aspredo gronovii Swainson, 1838

Bunocephalus gronovii Bleeker, 1858

Bunocephalus scabriceps Eigenmann & Eigenmann, 1889 (type locality: Brazil: Amazonas, Rio Jutai)

Agmus lyriformis Eigenmann, 1912b (type locality: Guyana: Gluck Island)

Bunocephalus aleuropsis Cope, 1870

Bunocephalus aleuropsis Cope, 1870 (type locality: Peru: Loreto, Pebas).

Bunocephalus melas Cope, 1874 (type locality: Peru: Loreto, Nauta)

Bunocephalus coracoideus (Cope, 1874)

Dysichthys coracoideus Cope, 1874 (type locality: Peru: Loreto, Nauta)

Bunocephalus bicolor Steindachner 1882, (type locality: Peru: Huallaga)

Bunocephalus haggini Eigenmann & Allen, 1942 (type locality: Peru: Loreto, Iquitos)

Bunocephalus kneri Steindachner, 1882

Bunocephalus kneri Steindachner, 1882 (type locality: Ecuador: Canelos)

Bunocephalus amaurus Eigenmann, 1912b

Bunocephalus amaurus Eigenmann, 1912b (type locality: Guyana: Konawaruk)

Bunocephalus amaurus aloike Hoedeman, 1961 (type locality: French Guiana: Litany River, Aloiké).

Bunocephalus amaurus sipaliwini Hoedeman, 1961 (type locality: Suriname: Sipaliwini).

Bunocephalus chamaizelus Eigenmann, 1912b

Bunocephalus chamaizelus Eigenmann, 1912b (type locality: Guyana: Erukin)

Bunocephalus doriae Boulenger, 1902

Bunocephalus doriae Boulenger, 1902 (type locality: Paraguay: Villa Rica).

Bunocephalus retropinnis Eigenmann, 1942 (type locality: Brazil: Rio Grande do Sul, Cacequi).

Bunocephalus colombianus, Eigenmann, 1912a

Bunocephalus colombianus, Eigenmann, 1912a (type locality: Colombia: Choco, Rio Atrato: Raspadura,

Bunocephalus larai von Ihering, 1930

Bunocephalus larai von Ihering, 1930 (type locality: Brazil: São Paulo, Rio Piracicaba).

No unambiguous character state changes.

Diagnosis. A genus of medium sized banjo catfishes (up to 120 mm SL) which cannot currently be defined by any shared derived character states.

Comments. The combination of species traditionally placed in this genus have made it a paraphyletic group. By transferring some species into *Pseudobunocephalus* and

Pterobunocephalus I have attempted to make this genus monophyletic. Although no unambiguous character state changes support the monophyly of *Bunocephalus*, no evidence currently exists that any of the species I maintain in this genus share a more recent common ancestor with species placed in any of the other genera. At present I have chosen not to sink *Amaralia* within *Bunocephalus*, in order to recognize the distinctiveness of this highly derived taxon. However, the possibility does exist that when the phylogenetic relationships within *Bunocephalus* are resolved in the future characters might be found that would place *Amaralia* within *Bunocephalus* as recognized here.

This is the largest genus within the Aspredinidae and in addition to the valid species listed above there are several undescribed species. Species names published in Ma (1977) are not available for nomenclature but are cited here for completeness. *Bunocephalus* has the widest distribution of any aspredinid genus (Magdalena, Orinoco, Amazon, Paraguay-Paraná & São Francisco) and is the only genus with members west of the Andes (Atrato, San Juan & Patia).

***Amaralia* Fowler, 1954**

Type species. *Amaralia hypsiura* (Kner, 1855)

Included species.

Amaralia hypsiura (Kner, 1855)

Bunocephalus hysius, Kner, 1855 (type locality: Brazil: AM, Rio Branco)

7 unambiguous character state changes: [6:1] supraoccipital-frontal contact absent; [37:2] modal number of branchiostegal rays: 4; [76:3] modal number of dorsal rays: <3; [83:2] procurent caudal-fin rays thicken and "S" shaped; [86:1] supracleithra

ornamentation present; [93:0] pre-axial pectoral spine serrations absent or weakly developed; [127:1] oophagy specialization present.

Diagnosis. A genus of medium sized banjo-catfishes (up to 133 mm SL) distinguished from all other genera of aspredinids by the following characters: contact between the frontal and supraoccipital bones; knobby ornamentation of the supracleithra; highly reduced dorsal fin with only 2-3 rays; deep, laterally compressed caudal peduncle; thickened "S" shaped procurent caudal-fin rays; and trophic specialization on the eggs of other fishes. Other characters not unique to this genus but useful for identification include: head ornamentation well developed; 4 branchiostegal rays, pre-axial spine serrations reduced or absent and 9 caudal-fin rays.

Comments. This genus is uncommon in museum collections but is widely distributed in the Amazon and Paraguay-Paraná River systems. Examination of specimens for this study revealed an undescribed species from the Paraguay-Paraná River system.

Unnamed Clade

(*Pterobunocephalus*, *Platystacus*, *Aspredo*, *Aspredinichthys*, *Xyliphius*, *Hoplomyzon*,
Dupouyichthys, *Ernstichthys*)

Decay index: 1; Bootstrap frequency: 63%

2 unambiguous character state changes: [1:0] mesethmoid medial notch present; [72:1] posterior nuchal plate processes expanded.

Unnamed Clade

(*Pterobunocephalus*, *Platystacus*, *Aspredo*, *Aspredinichthys*)

Decay index: 2; Bootstrap frequency: 85%

4 unambiguous character state changes: [20:1] ascending process of Meckel's cartilage highly reduced or absent; [79:1] modal # of anal rays 11 to 20; [119:1] testes without digitiform processes; [120:1] eggs carried by females

***Pterobunocephalus* Fowler, 1943**

Pterobunocephalus Fowler, 1943 (type species *Bunocephalus albifasciatus* Fowler, 1943)

Petacara Böhlke, 1959 (type species *Bunocephalus dolichurus* Delsman, 1941)

Type species. *Pterobunocephalus depressus* (Haseman, 1910)

Included species

Pterobunocephalus depressus (Haseman, 1910)

Bunocephalus depressus Haseman, 1910 (type locality: Bolivia: Río Machupo, San Joaquin).

Bunocephalus albifasciatus Fowler, 1943 (type locality: Bolivia: Cochabamba, Rio Mamoré, Todos)

Pterobunocephalus dolichurus (Delsman 1941)

Bunocephalus dolichurus Delsman, 1941 (type locality: Brazil: Para, Rio Trombetas at Obidos).

1 unambiguous character state change: [61:1] Height of neural spines equal to or less than height of neural arches

Diagnosis: A genus of small to medium sized banjo-catfishes (up to 90 mm SL) distinguished from all other aspredinids by the following characters: head and body extremely depressed; head ornamentation highly reduced or absent; often a distinct

notch in upper jaw; laminar process of pterotic needle-like and directed at a shape right angle; 10-20 anal fin rays; and females carry embryos directly attached to body.

Comments: This genus is rare in museum collections but is widespread in the Orinoco, Amazon and Paraguay-Paraná River systems. Based on my trawl collecting experiences they typically occur in waters >5 m in depth.

***Aspredo* clade (= Aspredininae)**

(*Platystacus*, *Aspredo*, *Aspredinichthys*)

Decay index: 15; Bootstrap frequency: 100%

16 unambiguous character state changes: [12:2] premaxillae with anterior limb; [17:1] spherical ossification present behind dentary symphysis; [18:1] mandibular lateralis canal complete and not encased in lower jaw; [23:1] anterior process of hyomandibula absent; [24:3] metapterygoid absent; [30:2] interopercle absent; [38:2] urohyal with a ventral keel; [49:0] teeth widespread on lower pharyngeal tooth plates; [62:1] distal tips of neural spines expanded, forming a dorsal bony keel on body; [75:1] dorsal spine elongate in males; [79:2] modal # of anal rays: >50; [83:3] procurent caudal rays absent; [94:2] modal # of pectoral rays: 7 rays; [107:1] accessory nasal bones present; [109:1] accessory canal in pterotic present; [121:1] cotylephores seasonally developed on females to carry embryos.

Comments: This highly derived clade corresponds to the traditionally recognized subfamily Aspredininae. Species in this clade have been collected in both freshwater and saltwater and are widespread in both coastal marine waters and the lower parts of rivers between the Orinoco and Amazon deltas.

***Platystacus* Bloch, 1794**

Platystacus Klein, 1779 unavailable

Platystacus Bloch, 1794

Platysomatos Bloch, 1797

Platistus Rafinesque, 1815

Cotylephorus Swainson, 1838

Type species. *Platystacus cotylephorus* Bloch 1794

Included species

Platystacus cotylephorus Bloch 1794

Siluris hexdactylus La Cepede, 1803

Cotylephorus blochii Swainson, 1838

Aspredo sexcirrhis Valenciennes, 1840 (type locality: Suriname)

Aspredo spectrum Gronow in Gray, 1854

Platystacus nematophorus, Bleeker, 1862 (type locality: Suriname)

1 unambiguous character state change: [80:3] modal # of caudal rays: 4+5

Diagnosis. A genus of large banjo-catfish (up to 320 mm SL) distinguished from all other aspredinids by the following character: 4+5 caudal-fin rays. They are further distinguished from other members of the *Aspredo* clade by the absence of accessory maxillary barbels and the presence of well developed unculiferous tubercles rows.

Comments. This genus has several times in its history been sunk in synonymy with *Aspredo* including most recently by Mees (1987). This study finds that this genus is the sister group to a clade containing *Aspredo* and *Aspredinichthys* and should be removed from *Aspredo* to make that genus monophyletic.

Unnamed Clade

(*Aspredo*, *Aspredinichthys*)

Decay index: 0; Bootstrap frequency: 72%

1 unambiguous character state change: [111:1] accessory maxillary barbels present

Aspredo Scopoli, 1777

Aspredo Gronow, 1763 unavailable

Aspredo Scopoli, 1777

Type species. *Aspredo aspredo* (Linnaeus) 1758

Included species

Aspredo aspredo (Linnaeus), 1758

Platystacus laevis Bloch, 1794

Aspredo sicuephorus Valenciennes, 1840

Aspredo batrachus Gronow in Gray, 1854

3 unambiguous character state changes: [87:1] humeral process of cleithrum expanded; 110:2] maxillary barbel completely adnate; [124:0] no distinct dark saddles on body.

Diagnosis: A genus of large banjo-catfish (up to 385 mm SL) distinguished from all other aspredinids by the following: humeral processes expanded often contacting posterior coracoid processes in large specimens. Other characters not unique to this genus but useful for identification include the following: maxillary barbel adnate with head; one pair of accessory barbels present; body pigmentation uniform without any pattern of dark saddles; and unculiferous tubercle rows highly reduced.

Aspredinichthys Bleeker, 1858

Aspredinichthys Bleeker, 1858

Chamaigenes Eigenmann, 1910

Type species. *Aspredinichthys tibicen* (Valenciennes, 1840)

Included species

Aspredinichthys tibicen (Valenciennes, 1840)

Aspredo tibicen Valenciennes, 1840

Aspredinichthys filamentosus (Valenciennes, 1840)

Aspredo filamentosus Valenciennes, 1840

5 unambiguous character state changes: [2:1] mesethmoid with dorsal processes present; [75:2] dorsal spine elongate in both sexes; [94:1] Modal # of pectoral rays: 8 rays; [108:1] hooks present on antorbital bone; [114:1] accessory mental barbels present

Diagnosis. A genus of large banjo-catfishes (up to 220 mm SL) distinguished from all other aspredinids by the following characters; dorsal hook-like processes developed on mesethmoid; hooks developed on antorbital bones; 8 pectoral-fin rays; and several pairs of accessory mental barbels present.

Comments. The two species placed in this genus are very similar in appearance and are most readily separated by the pattern and number of accessory mental barbels. See Mees (1977) for a key to species.

Unnamed Clade

(*Xyliophius*, *Hoplomyzon*, *Dupouyichthys*, *Ernstichthys*)

Decay index: 6; Bootstrap frequency: 96%

9 unambiguous character state changes: [14:1] premaxillary teeth absent; [16:1] dentary symphysis absent; [34:1] lateral end of anterohyhal expanded; [37:2] 4 branchiostegal rays; [51:1] os suspensorium distally fused to complex centrum; [83:1] lower procurent caudal-fin rays much longer than lower ones; [88:3] antero-lateral margin of coracoids deeply concave; [93:0] pre-axial pectoral spine serrations absent or weakly developed; [116:1] papillae present on anterior nares.

***Xyliophius* Eigenmann, 1912a**

Type species. *Xyliophius magdalena* Eigenmann 1912a

Included species:

Xyliophius magdalena Eigenmann 1912a

Xyliophius magdalena Eigenmann 1912a (type locality: Colombia: Girardot)

Xyliophius barbatus de Arámburu & Arámburu 1962

Xyliophius barbatus de Arámburu & Arámburu 1962 (type locality: Argentina:
Santa Fe, Rosario)

Xyliophius melanopterus Orcés, 1962

Xyliophius melanopterus Orcés, 1962 (type locality: Ecuador: Río Pucayacu)

Xyliophius lepturus Orcés 1962

Xyliophius lepturus Orcés 1962 (type locality: Ecuador: Río Pucayacu)

Xyliophius lombarderoi Risso & Risso 1964

Xyliophius lombarderoi Risso & Risso 1964 (type locality: Argentina: Provincia del Chaco: Río Paraná, Riacho Barranquerra, near Puerto Vilelas)

Xyliophius kryptos Taphorn & Lilyestrom, 1983

Xyliophius kryptos Taphorn & Lilyestrom 1983 (type locality: Venezuela: Zulia, Rio Aricuaisá)

8 unambiguous character state changes: [4:0] Skull not emarginate around eye; [8:1] ; Pterotic laminar processes directed laterally and rounded; [15:1] Premaxillae displaced laterally; [28:0] Suprapreopercles present; [35:1] Lateral end of posterohyal expanded; [107:1] Accessory nasal bones present; [117:1] Papillae present on lower jaw; [122:2] Unculiferous tubercles flattened

Diagnosis. A genus of moderately sized banjo catfishes (up to mm 147 mm SL) distinguished from all other aspredinids by the following characters: eyes highly reduced; premaxillae toothless and displaced lateral to mesethmoid; row of fleshy papillae projecting anteriorly off lower lip; unculi and unculiferous tubercles flattened; lamina of pterotic are rounded; and lateral end of posterohyal expanded. Other characters not unique to this taxon but useful for identification include: openings of anterior nares with papillae; coronomeckelian absent, Meckel's cartilage with high ascending process; premaxillae edentulous; pre-axial serrations absent; and no dark saddles on body.

Comments: Although this genus is not well represented in most museum collections, it appears to be widespread in the Magdalena, Orinoco, Amazon and Paraguay-Paraná systems. This is certainly due to the fact that these fishes are most common in deeper waters and most specimens have been collected in trawls. I unfortunately have not been able to see the types of *X. barbatus* and *X. lombarderoi* or any other *Xyliophius* specimens from the Paraguay-Paraná basin.

Hoplomyzon Clade (=Hoplomyzontini)

(*Hoplomyzon*, *Dupouyichthys*, *Ernstichthys*)

Decay index: >15; Bootstrap frequency: 100%

27 unambiguous character state changes: [10:1] knobby skull ornamentation well developed; [12:2] each premaxillae with an anterior limb; [20:2] ascending process of Meckel's cartilage displaced posteriorly and discontinuous with anterior cartilage; [24:2] metapterygoid contacts both quadrate and lateral ethmoid; [25:1] endopterygoid absent; [36:1] interhyal absent; [38:4] urohyal absent; [41:1] fourth pharyngobranchial completely cartilaginous; [44:3] first hypobranchial absent; [45:3] second hypobranchial absent; [46:1] third hypobranchial absent; [47:1] second basibranchial cartilaginous or absent; [48:1] third basibranchial absent; [57:0] bony horizontal lamina absent on all centra (reversal); [66:1] interdigitating connections present on neural and hemal arches of centra; [68:2] ribs absent; [71:1] middle nuchal plate ornamentation well developed; [76:0] modal # of dorsal rays: ≥ 5 ; [80:2] 5+4 caudal-fin rays; [84:1] hypurapophysis greatly enlarged and contacts lateral body wall; [85:1] supracleithra sutured to cranium; [94:3] modal # of pectoral ray: 6 rays [97:1] ventral pectoral musculature highly reduced (reversal); [100:1] no cartilage on basipterygia anterior to pelvic-fin rays; [101:2] posterior cartilage of basipterygia absent; [103:1] anterior portion of basipterygia lies medial to and contacts posterior processes of coracoids; [105:3] every other lateral line ossicle with dorsal and ventral lamina and a bony knob.

Comments: Members of this clade have a body armor formed by dorsal and ventral vertebral processes and by expanded lateral line ossicles. Together these components form a complete armor around the body. Taphorn & Marrero (1990) speculate that this morphology is an adaptation to living in the interstices of a constantly shifting substrate of gravel and that the armor serves to protect them from being crushed.

***Hoplomyzon* Myers, 1942**

Type species. *Hoplomyzon atrizona* Myers, 1942

Included species:

Hoplomyzon atrizona Myers, 1942

Hoplomyzon atrizona Myers, 1942 (type locality: Venezuela: Tachira, trib. of Río Zulia)

Hoplomyzon atrizona petroleus Schultz, 1944 (type locality: Venezuela: Río Montatán)

Hoplomyzon papillatus Stewart, 1985

Hoplomyzon papillatus Stewart, 1985 (type locality: Ecuador: Napo: Rio Aquarico)

Hoplomyzon sexpapilostoma Taphorn & Marrero, 1990

Hoplomyzon sexpapilostoma, Taphorn & Marrero, 1990 (type locality: Venezuela: BA: Rio Masparro)

1 unambiguous character state change: [13:1] premaxillary knobs present

Diagnosis. A genus of small, armored banjo-catfishes (up to mm 32 mm SL) distinguished from all other aspredinids by the following characters: each premaxilla with two bony knobs superficially covered by fleshy papillae; dorsal and ventral armor plates do not overlap; and 2-3 sets of paired pre-anal-fin plates. Other characters not unique to this taxon but useful for identification include: maxillary barbel adnate with head and pectoral spine less than 25% of standard length.

Comments: Based on material examined, this genus is distributed in the Lago Maracaibo, Orinoco, Amazon basins. In addition to the three described species of

Hoplomyzon there are at least 2 undescribed species including a blind and unpigmented species from the lower Orinoco River (Baskin, Lundberg & Mago Leccia, 1979).

Unnamed Clade

(*Dupouyichthys*, *Ernstichthys*)

Decay index: 1; Bootstrap frequency: 90%

2 unambiguous character state changes: [19:1] dentary teeth absent; [92:1] pectoral spine elongate, strongly recurved.

***Dupouyichthys* Schultz, 1944**

Type species. *Dupouyichtys sapito* Schultz, 1944

Included species:

Dupouyichtys sapito Schultz, 1944

Dupouyichtys sapito Schultz 1944 (type locality: Venezuela: Rio Montatán)

no unambiguous character state changes

Diagnosis. A genus of small, armored banjo catfishes (up to 27 mm SL) distinguished from all other aspredinids by the following character: only one set of paired pre-anal-fin plates. Other characters not unique to this taxon but useful for identification include; bony ornamentation of skull better developed than in any other members of the *Hoplomyzon* clade.

Comments: Based on material examined this genus appears to be restricted to the Magdalena and Maracaibo basins.

***Ernstichthys* Fernández-Yépez, 1953**

Type species. *Ernstichthys anduzei* Fernández- Yépez, 1953

Included species:

Ernstichthys anduzei Fernández- Yépez, 1953

Ernstichthys anduzei Fernández-Yépez 1953 (type locality: Venezuela: Cojedes, Río Salinas)

Ernstichthys megistus Orcés, 1961

Ernstichthys megistus Orcés, 1961 (type locality: Ecuador: Río Bobonaza: Chicherota)

Ernstichthys intonsus Stewart, 1985

Ernstichthys intonsus Stewart, 1985 (type locality: Ecuador: Napo, Río Napo at Añangu)

1 unambiguous character state change: [56:1] tip of parapophysis of fifth expanded.

Diagnosis. A genus of small to medium sized, armored banjo catfishes (up to 50 mm SL) distinguished from all other aspredinids by the following characters: tip of parapophysis of fifth vertebrae expanded; 2 sets of paired pre-anal-fin plates; and pectoral spine strongly recurved, much longer than first branched pectoral-fin ray.

Comments. Based on material examined, this genus occurs in Orinoco and Amazon River basins.

Discussion and Conclusions

Within the Aspredinidae two different lineages, the *Aspredo* clade and the *Hoplomyzon* clade have undergone much greater rates of morphological evolution (as measured by relative branch lengths) than other lineages in the family. This asymmetry has led to this family being divided into three main groups based on overall similarity, the subfamily Aspredininae (= *Aspredo* clade), and the subfamily Bunocephalinae with the tribes Hoplomyzontini (= *Hoplomyzon* clade) and Bunocephalini (all other aspredinid taxa). Only the Aspredininae and Hoplomyzontini are natural groups and the characters previously used to diagnose are indeed derived character states which support their monophyly. However, the third and largest group, the Bunocephalini, is not a natural group. All characters previously used to define the Bunocephalini are symplesiomorphies of all aspredinids and cannot define any monophyletic group within the family. This interpretation is supported by this study of the Aspredinidae which uses explicit phylogenetic methods and seeks to identify synapomorphies for all clades up to the level of genera. Results of this study demonstrate for the first time that the *Aspredo* clade and *Hoplomyzon* clade are in fact nested within the tribe Bunocephalini.

Besides the obvious taxonomic changes necessitated by this new placement of the Aspredininae within the Bunocephalinae, this action also has implications for possible biogeographic hypotheses, in particular, whether the ancestor of aspredinids dispersed to South America across some marine barrier such as the Pacific Ocean. Such a hypothesis had been inferred to explain the disjunct distribution of a clade containing both the Neotropical aspredinids and the Asian sisoroids. The traditional idea of Aspredinidae with a euryhaline “subfamily Aspredininae” and the stenohaline “subfamily Bunocephalinae” suggested the possibility that the common ancestor of all Aspredinidae might also have been euryhaline. However, results of my phylogenetic analysis clearly demonstrate that “subfamily Aspredininae” is not the sister group to all

other aspredinids and is in fact nested within the "subfamily Bunocephalinae". Thus the ability to tolerate marine waters is clearly a derived condition of the *Aspredo* clade and the common ancestor of all aspredinids is most parsimoniously considered to have been a strictly freshwater fish.

One other novel result of this phylogenetic study is the hypothesis that the doradoid catfishes are the sister group to the Aspredinidae. Most evidence that supports this hypothesis comes from characters of the pectoral girdle. This part of the anatomy has received very little attention in studies of siluriform relationships. Based on my research, this system contains much phylogenetic information and future research on the pectoral girdle will provide many more characters for use in systematic studies.

My hypothesis of a sister group relationship between aspredinids and doradoids has implications for both the ages and biogeography of catfishes. If we accept a simple drift-vicariance model to explain the splitting of the lineages leading to the African Mochokidae and the Neotropical doradoids (Doradidae, Centromochlidae and Auchenipteridae) then a minimum age of 84 million years is implied for the doradoid lineage (Lundberg, 1993). This in turn implies a minimum age of at least 84 million years for the splitting of the lineages leading to the Aspredinidae and the doradoids and even older ages for all other lineages of catfishes in my phylogeny. This age currently predates the oldest known fossil catfishes from the late Cretaceous (~ 70-75 million years ago) of South America (Cione, 1987; Cione & Lafitte; Cione et al., 1985; Gayet & Brito, 1989; Wenz, 1969). If the lineage leading to aspredinids was actually present that distantly in the past and predates the separation of Africa and South America why are there no aspredinids in Africa? There are two possible explanations which are consistent with a vicariant model of biogeography. Either the lineage leading to aspredinids was not originally widespread on Gondwana and thus was not split when the African and South American continents separated, or there had been subsequent extinction of sister lineage in Africa.

Appendix 1. Description of *Pseudobunocephalus lundbergi* new gen. & sp.

Type species. *Pseudobunocephalus lundbergi* n. sp.

A list of included species and synonymies are listed in the **Systematic Account of the Aspredinidae.**

Diagnosis. A genus of relatively small (< 80 mm SL) aspredinids distinguished from all other confamilials by the following unique synapomorphies: no contact between metapterygoid and quadrate; posterior end of palatine forked; gill rakers absent on all branchial arches, fourth pharyngobranchial absent; a uniquely shaped dentary tooth patch; and transverse processes of fifth vertebrae bend anteriorly. Other characters not unique to this genus but useful for identification include: lateral line truncated at approximately the level of dorsal fin origin; jaws equal; interhyal absent; skull and middle nuchal plate ornamented with bony knobs and outermost principal caudal rays shorter than other principal caudal rays.

Etymology. The generic name is a combination of the Greek pseudo plus the aspredinid genus *Bunocephalus*. Gender: masculine.

***Pseudobunocephalus lundbergi*, new sp.**

Holotype. ANSP 168817, 28.4 mm SL; Venezuela: Estado Bolívar, Caño Barranca, ca. 1.25 hours downstream from Jabillal (opposite bank) on Rio Caura (07°08'N 65°04'W); collected by Böhlke & Saul; 30 January 1977.

Paratypes: ANSP 172504, 10 specimens, 20.5-29.1 mm SL; same data as holotype.

ANSP 172505, 425 specimens (420 alcoholic + 5 cleared & stained), 20-30 mm SL; same data as holotype. MCNG 21122, 3 specimens, 24.6-26.4 mm SL; Venezuela: Estado Bolívar, 5 km N. of Jabillal; collected by Taphorn et. al.; 3 March 1989.

Non-type specimens examined

ANSP 131574, 4 specimens, 19.5-22.5 mm SL; Colombia: Meta, Caño Rico at La Defensa (03°59'N 73°08'W); collected by Böhlke et. al.; 25 February 1972. ANSP 134530, 1 specimen, 24.3 mm SL; Colombia: Meta, ca. 5 km N. of La Siberia (04°07'N 73°05'W); collected by Böhlke et. al.; 28 March 1975. ANSP 168815, 4 specimens, 22-23 mm SL; Colombia: Meta, Caño La Raya, N. of La Siberia (04°50'N 73°05'W); collected by Böhlke et. al.; 29 March 1975. MCNG 23669, 2 specimens, 22.5-23; Venezuela: Estado Barinas, selva de Ticoporo; collected by Taphorn et. al.; 9 December 1982. MCNG 23671, 13 specimens (12 alcoholic + 1 cleared & stained), 20-23 mm SL; Venezuela: Estado Apure, Río Meta between San Carlos de Meta and Buena Vista; collected by Taphorn et. al.; 14 January 1982.

Diagnosis. Distinguished from all other *Pseudobunocephalus* spp. by the following characters: skull ornamented with numerous bony knobs all approximately equal in size; epiphyseal bar present; infraorbital canal exiting from sphenotic; and infraorbital lateralis canal complete.

Description

Dorsal view in Figure 41 illustrates general body form. Morphometric data for holotype and 10 syntopic paratypes are summarized in Table 5.

Head depressed with slight depression between orbits. Skull ornamentation well developed with a paired series of bony knobs beginning behind eyes and converging on occiput and continuing on dorsal lamina of Weberian complex and middle nuchal plate. All bony knobs approximately equal in size. Anterior and posterior fontanelles present and separated by a bony epiphyseal bar. Integument covered with small unculiferous tubercles (Roberts, 1982), those on posterior body in longitudinal rows; mid-dorsal row well defined; 2-3 well defined rows on each side of caudal peduncle; several poorly defined rows beneath these. Caudal peduncle slender, round in cross section, tapering to caudal fin.

Mouth terminal, jaws and lips equal. Premaxillae with 5-6 rows of acicular teeth. Dentaries with 12 to 15 rows of teeth restricted to a "tear-shaped" patch near symphysis of lower jaw. Anterior nostrils tubular, located at tip of snout, projecting beyond upper lip. Posterior nostrils simple without flap or barbel, open antero-medial to eye. Eyes without free orbital rim. All barbels simple, unbranched; maxillary barbels reach pectoral spine insertions. Postero-lateral mental barbels at least twice as long as antero-medial pair. Gular fold absent, branchiostegal membranes united to each other and to isthmus, 5 branchiostegal rays. Opercular openings reduced to small valvular slits on ventral surface just anterior to pectoral spine insertions.

Gill rakers absent on all branchial arches. Pharyngeal teeth well developed on upper tooth plate; 1-2 rows of teeth on lower tooth plates. First and second hypobranchials ossified; fourth pharyngobranchials absent. Urohyal triangular with slight dorsal keel.

Openings of sensory canals on head darkly pigmented. Infraorbital canal exists sphenotic and forms complete infraorbital series. Lateral line truncated just posterior of the parapophyses of the fifth vertebra and anterior to the dorsal fin origin.

Dorsal fin without spinelet; consists of flexible spine and four rays. Dorsal fin membrane not adnate with body. Anterior nuchal plate and supraneural absent. Middle nuchal plate ornamented with a single bony knob. Adipose fin absent. Anal fin with 5-7 rays (6 in holotype), anal fin membrane not adnate with body. Pectoral fin with spine and 5 rays. Shaft of pectoral spine curved with serrations on both pre-axial and post-axial margins. Flexible tip on pectoral spine in undamaged specimens. Axial pore present. Coracoid processes of pectoral girdle extend slightly past cleithral processes in lateral view. Pelvic fin with 6 rays, second and third rays longest, no pelvic splint, does not reach anal-fin origin. Caudal-fin margin rounded with outermost rays much shorter than rest; principal caudal rays, 5+5; one upper and one lower procurent caudal-fin rays.

Total vertebrae 32-34 (34 in holotype). Ribs present on vertebrae 6-9; dorsal-fin pterygiophores associated with compound Weberian centrum to vertebra 11. Dorsal lamina of compound Weberian centrum ornamented with a series of three bony knobs. Parapophysis of fourth vertebra form broad lamina over swim bladder. Parapophysis of fifth vertebrae long curved anteriorly and extend laterally to body surface. A deep notch separates the parapophyses of fourth and fifth vertebrae. No horizontal bony lamina developed on precaudal, caudal or ural centra.

Coloration. Refer to Figure 41 for dorsal view of pigmentation pattern (dark morph). Coloration in alcohol variable with two color morphs (dark morph and light morph). Dark morph with head light brown and irregularly mottled with darker pigment; overall body light brown with three poorly defined dark saddles, first at level of dorsal fin, and two more on posterior body. Individual unculiferous tubercles may be unpigmented or darkly pigment giving the body a speckled appearance. Ventral surface light brown with

dark pigment concentrated in unculiferous tubercles. All fins and barbels mottled with dark pigment. Light morphs have a similar pigmentation pattern to the dark morphs but lack the series of dark saddles on the dorsal surface.

Size and maturity. Specimens range in standard length from 19.5 -30 mm. The largest specimens are females with ripening ova (0.5 mm in diameter). No specimens examined are in spawning condition.

Distribution. *Pseudobunocephalus lundbergi* appears to be widespread in the Orinoco River basin of Colombia and Venezuela.

Habitat. The holotype and syntopic paratypes were taken with a fish toxicant from Caño Barranca, ca. 1.25 hours down stream from Jabillal (opposite bank) on Rio Caura (7°08' N 65°04' W). The type locality was 25 by 85 foot pool, up to two meters deep, with a mud bottom covered with debris and branches.

Etymology. Specific name patronymic in honor of Dr. John G. Lundberg, in recognition of his numerous contributions to Neotropical ichthyology and the phylogenetic systematics of catfishes.

Comments. Based on my phylogenetic analysis of the Aspredinidae, *Pseudobunocephalus* is the sister group to all other Aspredinidae. In addition to the derived characters which support monophyly of this genus, *Pseudobunocephalus* also retains several primitive character states not found in any other aspredinids including: ossified second hypobranchials; lack of bony horizontal lamina on any precaudal or

caudal vertebrae; no bifid hemal spines and little or no contact between the transverse processes vertebrae 4 and 5. Furthermore, *P. lundbergi* appears to be the sister group to all other species in this genus. All other *Pseudobunocephalus spp.* share the following derived character states: infraorbital lateralis canal exits from frontal and is truncated; epiphyseal bar absent; “boomerang” shaped premaxillae with a posterior limb ; and first dorsal-fin pterygiophore does not articulate with the Weberian complex.

Appendix 2. Description of *Acanthobunocephalus nicoi* new gen. & sp.

Type-species. *Acanthobunocephalus nicoi*, new species.

Diagnosis. A miniature (maximum observed SL less than 20 mm) aspredinid readily distinguished from confamilials by the presence of a dorsal spinelet and rigid dorsal-spine; by an anteriorly expanded supraoccipital; by absence of a posterior cranial fontanel; by horizontal bony lamina developed only on last three centra and compound ural centrum; and by absence of procurent caudal-fin rays. Other characters not unique to this taxon but useful for identification are: reduced ornamentation of skull roof, dorsal lamina of Weberian complex, and nuchal plates; jaws equal; pectoral fin with spine and 4 rays; dorsal fin with spine and 3 rays; dorsal- and anal-fin membranes not adnate with body; dorsal- and ventral-most principal caudal rays much shorter than others, and lateral line truncated at approximately the level of the dorsal fin origin.

Etymology. The generic name is a combination of the Greek acantho, spiny, in reference to the rigid, locking dorsal-spine, plus the aspredinid genus *Bunocephalus*.
Gender: masculine.

***Acanthobunocephalus nicoi*, new sp.**

Holotype. MCNG 29000, 16.1 mm SL; Venezuela: Estado Amazonas, Río Sipapo, 200 m from Salto Remo (04°34'N 67°18'W); L. Nico; 2 June 1989.

Paratypes. MCNG 21843, 9 (7 alcoholic + 2 cleared & stained) specimens, 14.5-19.7 mm SL; same data as holotype. ANSP 160698, 1 specimen, 11.8 mm SL; Venezuela; Estado

Amazonas, Río Sipapo, ca. 6 km upstream from Pendare ($04^{\circ}51'N$ $67^{\circ}43'W$); J. Fernandez and L. Aguana; 13 November 1985. ANSP 168816, 3 specimens, 12.6-13.0 mm SL; Venezuela: Estado Amazonas, caño of Río Casiquire ca. 22 km downstream from mouth of Río Pamoni (east side) ($02^{\circ}47'N$ $66^{\circ}03'W$); Chernoff et al.; 20 March 1989.

Diagnosis. Same as for genus.

Description. Dorsal view in Fig. 41 illustrates general body shape. Morphometric data for holotype and 8 syntopic paratypes are summarized in Table 6.

Head depressed, flat in profile with a slight depression between orbits that continues anteriorly between ridges formed by lateral margins of mesethmoid. Skull ornamentation reduced, only two low ridges converging at the posterior limit of supraoccipital. Anterior cranial fontanel present, supraoccipital expanded anteriorly, posterior fontanel absent. Integument covered with small unculiferous tubercles (Roberts, 1982), those on posterior body in longitudinal rows; mid-dorsal row poorly defined; 2 well defined rows on each side of caudal peduncle; several poorly defined rows beneath these. Caudal peduncle slender, round in cross section, tapering to caudal fin.

Mouth terminal, jaws and lips equal. Premaxillae and dentaries with 3-4 rows of aciculae teeth. Anterior nostrils tubular, located at the tip of snout, projecting beyond upper lip. Posterior nostrils simple without flap or barbel, open antero-medial to eye. Eyes without free orbital rim. All barbels simple, unbranched; maxillary barbels reach slightly past pectoral spine insertions; postero-lateral mental barbels twice as long as antero-medial pair. Gular fold absent, brachiostegal membranes united to each other and to isthmus, 5 branchiostegal rays. Opercular openings reduced to small valvular slits just anterior to pectoral spine insertions.

Gill rakers reduced or absent on branchial arches 1 and 2, 2 rows of gill rakers present on branchial arches 3 and 4. Pharyngeal teeth well developed on upper tooth

plates; 2-3 rows of teeth on lower tooth plates. All hypobranchials unossified; basibranchial 3 absent; urohyal reduced to a nodule without lateral wings.

Sensory canals of head not readily visible but openings of pores darkly pigmented. Infraorbital canal exits sphenotic and immediately ends in a pore; remaining infraorbital neuromasts and pores are not connected to one another by a canal. Lateral line truncated just posterior of the transverse process of fifth vertebra and anterior to the dorsal fin origin.

Dorsal fin with well developed spinelet, dorsal spine and 3 rays. Dorsal-fin membrane not adnate. Dorsal spine rigid, lacking any serrations (Note: spines slightly flexible in holotype, MCNG 29000, and some paratypes, MCNG 21843, an artifact of specimens being slightly decalcified). Anterior nuchal plate and supraneural absent. Middle and posterior nuchal plates without ornamentation. Adipose fin absent. Anal fin with 5 - 6 rays, (6 in holotype), anal-fin membrane not adnate. Pectoral fin with spine and 4 rays. Shaft of pectoral spine curved with serrations on both pre-axial and post-axial margins. Well developed flexible extension on pectoral spines of undamaged specimens. Axial pore present. Coracoid processes of pectoral girdle extend slightly past cleithral processes in lateral view. Pelvic fin with 6 rays, third ray longest, no pelvic splint, barely reaches anal fin origin. Caudal fin margin rounded with outermost rays much shorter than rest; principal caudal rays, 5+5; procurrent rays absent.

Total vertebrae 29 - 30 (30 in holotype). Ribs present on vertebrae 6-10; dorsal-fin pterygiophores associated with compound Weberian centrum to vertebra 9. Dorsal lamina of compound Weberian centrum flattened distally at surface, without ornamentation. Transverse processes of vertebra 4 form broad lamina over swim bladder. Transverse processes of vertebra 5 long, extend laterally to body surface. Horizontal bony lamina developed only on last three centra and compound ural centrum. No free second ural centrum, all hypurals fused to compound ural centra.

Coloration. Refer to Figure 41 for a general view of pigmentation pattern. Coloration in alcohol variable; head light brown and irregularly mottled with darker pigment; overall body light brown with three dark saddles, first at level of dorsal fin, and two more on posterior body; saddles may fuse and expand ventrally and laterally to give appearance of a dark body with two light dorsal patches as in holotype; anterior ventral surface much lighter than dorsal surface; distinct light rectangular patch between base of pelvic fins and anal fin origin; dark spot at base of caudal fin; diffuse band through middle of caudal fin; all barbels, pectoral fins, anal fin banded; pelvic fins immaculate; dorsal uniformly dark with light distal margin. Often dark patches below eyes and two dark spots on lower lip.

Size and maturity. Specimens range in standard length from 11.8 to 19.7 mm.

Females containing mature ova (1 mm in diameter) range in size from 16.4-19.7 mm SL.

Males with mature testes range in size from 16.1-17.3 mm SL.

Distribution. Known only from localities in the Río Sipapo, upper Orinoco system and the Río Pamoni, Casiquiare system of Venezuela. Presence of this species in the Casiquiare system suggests it may also occur in the upper Rio Negro as well.

Habitat. The holotype and syntopic paratypes was taken from the edge of the Río Sipapo in flooded plants, primarily grasses and sedges, about 200 m downstream of Salto Remo, 04°34'N 67°18'W at altitude ca. 115 m, 2 June 1989. The river was characterized as black water (clear, tannin stained); collection site was 0.5-1.0 m deep, pH 5.1, water temperature 25° C.

Etymology. Specific name patronymic in honor of Dr. Leo G. Nico, who collected the type series of this new taxon.

Comments. *Acanthobunocephalus nicoi* meets the criterion of Weitzman & Vari (1988) for miniature freshwater fishes, being sexually mature at under 20 mm SL. In addition, like other miniature freshwater fishes, *A. nicoi* possesses several reductive, possibly paedomorphic features such as reductions of the laterosensory canals system of head and body, reduced numbers of dorsal- and pectoral-fin rays and reduced ornamentation of skull roofing bones.

Acanthobunocephalus nicoi also has several non-reductive apomorphic features (i.e., expanded supraoccipital and loss of the posterior cranial fontanel). While non-reductive characters are uncommon in miniature fishes, there are examples of other miniature catfishes such as scolopacids (Schaefer et al., 1989) and some armored banjo-catfishes that possess apomorphic features along with the usual reductive features of miniatures.

Besides *A. nicoi*, there are two other Aspredinidae, *Hoplomyzon papillatus* and *Dupouyichthys sapito*, which are also miniatures (Weitzman & Vari, 1988). Until now, the smallest known aspredinid was *H. papillatus*, at 16.9 mm SL (Stewart, 1987). It is known from a single specimen and size at sexual maturity for this species is unknown. These two taxa of armored banjo-catfishes are not closely related to *A. nicoi*. Thus miniaturization appears to have evolved at least twice in the Aspredinidae.

Reduced fin-ray counts similar to those seen in *A. nicoi* are found in *Pseudobunocephalus iheringii* (Boulenger, 1891) with a pectoral fin count, I4, and dorsal fin count, I3, and *Pseudobunocephalus quadriradiatus* (Mees, 1989) with pectoral fin count, I4. While both are relatively small fishes, they are not miniatures. Both *P. iheringii* and *P. quadriradiatus* have sister species with plesiomorphic meristic counts for aspredinids (i.e., pectoral fin, I5 and dorsal fin, I5) (Friel, 1994). Therefore, these reduced fin-ray counts are interpreted as being homoplasious and have arisen independently in *A. nicoi* and each of the other species.

Initially the apparent plesiomorphic dorsal fin condition suggested that *Acanthobunocephalus* might be a basal lineage among aspredinids. However my phylogenetic analysis of the Aspredinidae revealed *Acanthobunocephalus* is nested higher up in the phylogeny above a basal clade of aspredinids which lack a dorsal spinelet. Furthermore, its sister clade also lacks the dorsal spinelet . Given this position, it is unclear if the presence of the dorsal spinelet in *A. nicoi* is a plesiomorphic condition or a character reversal. It is equally parsimonious to assume two independent losses of the spinelet within the Aspredinidae or a loss in the common ancestor of all aspredinids and a reversal in *A. nicoi*.

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Table 1. Character x Taxon Matrix

	1	2	3	4	5	6	7	8	9	10
DIPLOMYSIDAE	0	0	0	0	0	0	0	0	0	0
HYPSIDORIDAE	0	0	?	0	0	0	0	0	0	0
AMBLYCIPITIDAE	0	0	1	0	0	0	0	0	1	0
SISORIDAE	0&1	0	1	0&1	0	0	0	0	0&1	0
AKYSIDAE	0&1	0	1	0&1	0&1	0	0	0	0	0
AMPHILIIDAE	0&1	0	0	0&1	0	0	0	0	0	0
LORICARIOIDS	0&1	0	0	0&1	0	0	0&1	0&2	0&1	0
PSEUDOPIMELODINES	0	0	0	0	0	0	0	0	0	0
DORADOIDS	0&1	0	0	0&1	0	0	0&1	0	1	0
ASPREDINIDAE ANC	1	0	1	1	0	0	0	2	1	0
<i>Pseudobunocephalus</i>	1	0	1	1	0&1	0	0	2	1	1
<i>Acanthobunocephalus</i>	1	0	1	1	0	0	1	2	1	0
<i>Bunocephalus</i>	1	0	1	1	0	0	0	2	1	0&1
<i>Amaralia</i>	1	0	1	1	0	1	0	2	1	1
<i>Pterobunocephalus</i>	0	0	1	1	0	0	0	3	1	0
<i>Platystacus</i>	0	0	1	1	0	0	0	4	1	0
<i>Aspredo</i>	0	0	1	1	0	0	0	4	1	0
<i>Aspredinichthys</i>	0	1	1	1	0	0	0	4	1	0
<i>Xylipterus</i>	0	0	1	0	0	0	0	1	1	0
<i>Hoplomyzon</i>	0	0	1	1	0	0	0	2	1	1
<i>Dupouyichthys</i>	0	0	1	1	0	0	0	2	1	1
<i>Ernstichthys</i>	0	0	1	1	0	0	0	2	1	1

Table 1. Character x Taxon Matrix Cont.

	11	12	13	14	15	16	17	18	19
Vomer		Premaxillae shape	Premaxillae knobs	Premaxillae teeth	Premaxillae position	Dentary symphysis	Symphysis ossification	Mandibular lateralis canal	Dentary teeth
DIPLOMYSIDAE	0	0	0	0	0	0	0	0	0
HYPSIDORIDAE	0	0	0	0	0	0	0	0	0
AMBLYCIPITIDAE	0	0	0	0	0	0	0	0	0
SISORIDAE	0	0	0	0	0	0	0	0	0
AKYSIDAE	0	0&2	0	0	0	0	0	0	0
AMPHILIIDAE	0	0	0	0	0	0	0	0	0
LORICARIODS	0&1	0	0	0	0	0&1	0	0&2	0
PSEUDOPIMELODINES	0&1	0	0	0	0	0	0	0	0
DORADOIDS	0	0	0	0&1	0	0	0	0	0&1
ASPREDINIDAE ANC	1	0	0	0	0	0	0	2	0
<i>Pseudobunocephalus</i>	1	0&1	0	0	0	0	0	2	0
<i>Acanthobunocephalus</i>	1	0	0	0	0	0	0	2	0
<i>Bunocephalus</i>	1	0	0	0	0	0	0	2	0
<i>Amaralia</i>	1	0	0	0	0	0	0	2	0
<i>Pterobunocephalus</i>	1	0	0	0	0	0	0	2	0
<i>Platystacus</i>	1	2	0	0	0	0	1	1	0
<i>Aspredo</i>	1	2	0	0	0	0	1	1	0
<i>Aspredinichthys</i>	1	2	0	0	0	0	1	1	0
<i>Xylipterus</i>	1	0	0	1	1	1	0	2	0
<i>Hoplomyzon</i>	1	2	1	1	0	1	0	2	0
<i>Dupouyichthys</i>	1	2	0	1	0	1	0	2	1
<i>Ernstichthys</i>	1	2	0	1	0	1	0	2	1

Table 1. Character x Taxon Matrix Cont.

	20	21	22	23	24	25	26	27	28	29		
	Ascending process of Meckel's cartilage			Coronomeckelian			Hyomandibula-skull contact			Anterior process of hyomandibula		
DIPLOMYSTIDAE	0	0	0	0	0	0	0	0	0	0		
HYPSIDORIDAE	?	?	0	?	0	?	?	0	0	0		
AMBLYCIPITIDAE	0&1	0&1	1	0	0	0	0	1	0	0&1		
SISORIDAE	1	0	1	0	0	0	0	1	0&1	0&1		
AKYSIDAE	1	0&1	1	0	0	0	0	1	0	0&1		
AMPHILIIDAE	1	0	1	0	0	0	1	2	0&1	0		
LORICARIOIDS	1	1	0	0	0	0	1	3	0&1	0&1		
PSEUDOPIMELODINES	0	0	0	0	0	0	0	1	1	0&1		
DORADOIDS	0	0&1	0&1	0	0	0	0&1	1	0&1	0		
ASPREDINIDAE ANC	0	0	1	0	0	0	0	1	1	2		
<i>Pseudobunocephalus</i>	0	0	1	0	1	0	0	2	1	2		
<i>Acanthobunocephalus</i>	0	0	1	0	0	0	1	1	1	2		
<i>Bunocephalus</i>	0	0	1	0	0	0	0	1	1	2		
<i>Amaralia</i>	0	0	1	0	0	0	0	1	1	2		
<i>Pterobunocephalus</i>	1	1	1	0	0	0	0	1	1	2		
<i>Platystacus</i>	1	0	1	1	3	0	0	1	1	2		
<i>Aspredo</i>	1	0	1	1	3	0	0	1	1	2		
<i>Aspredinichthys</i>	1	0	1	1	3	0	0	1	1	2		
<i>Xyliophius</i>	0	1	1	0	0	0	0	1	0	2		
<i>Hoplomyzon</i>	2	1	1	0	2	1	0	1	1	2		
<i>Dupouyichthys</i>	2	1	1	0	2	1	0	1	1	2		
<i>Ernstichthys</i>	2	1	1	0	2	1	0	1	1	2		

Table 1. Character x Taxon Matrix Cont.

	30	31	32	33	34	35	36	37	38
	Opercle-interopercle connection								
	Opercular apertures								
	Dorsohyal								
	Anterohyal lamina								
	Lateral end of anterohyal								
	Lateral end of posterohyal								
	Interhyal								
	Modal # of branchiostegal rays (ordered)								
	Urohyal shape								
DIPLOMYSTIDAE	0	0	0	0	0	0	0	0	0
HYPSIDORIDAE	0	?	?	0	0	0	?	0	0
AMBLYCIPITIDAE	0	0	0&1	0	0	0	0&1	0	0
SISORIDAE	0	0	0&1	0&1	0	0&1	0&1	0&1&2	0
AKYSIDAE	0	0	0	0	0	0	0&1	0	0
AMPHILIIDAE	0	0	1	0	0	0	0	0	0
LORICARIOIDS	0	0	0&1	0&1	0	0	0&1	0&1&2	0
PSEUDOPIMELODINES	0	0	1	1	0	0	0	0	0
DORADOIDS	0	0	0	0	0	0	0&1	0	2
ASPREDINIDAE ANC	0	1	1	0	0	0	0	1	0
<i>Pseudobunocephalus</i>	0	1	1	0	0	0	1	1	0
<i>Acanthobunocephalus</i>	1	1	1	1	0	0	0	1	3
<i>Bunocephalus</i>	1	1	1	1	0	0	0	1	1
<i>Amaralia</i>	1	1	1	1	0	0	0	2	1
<i>Pterobunocephalus</i>	1	1	1	1	0	0	0	1	1
<i>Platystacus</i>	2	1	1	1	0	0	0	1	2
<i>Aspredo</i>	2	1	1	1	0	0	0	1	2
<i>Aspredinichthys</i>	2	1	1	1	0	0	0	1	2
<i>Xylipterus</i>	1	1	1	1	1	1	0	2	1
<i>Hoplomyzon</i>	1	1	1	1	1	0	1	2	4
<i>Dupouyichthys</i>	1	1	1	1	1	0	1	2	4
<i>Ernstichthys</i>	1	1	1	1	1	0	1	2	4

Table 1. Character x Taxon Matrix Cont.

	39	40	41	42	43	44	45	46	47
	1st pharyngobranchial	2nd pharyngobranchial	4th pharyngobranchial	5th epibranchial	Gill rakers	1st hypobranchial	2nd hypobranchial	3rd hypobranchial	2nd basibranchial
DIPLOMYSTIDAE	0	0	0	0	0	0	0	0	0
HYPSIDORIDAE	?	?	?	?	?	?	?	?	?
AMBLYCIPITIDAE	1	2	0	1	0	0&1	0&2	0	0
SISORIDAE	1	2	0	0&1	0&1	1	0&2	0	0
AKYSIDAE	1	2	0&1	1	0&1	1	0&2	0	0&1
AMPHILIIDAE	1	1&2	0	0&1	0	1	1	0	0
LORICARIOIDS	1	2	0	0&1	0&1	1	0&2	0	0
PSEUDOPIMELODINES	1	1	0	0	0	0&1	0	0	0
DORADOIDS	1	1	0	0	0	0&1	0	0	0
ASPREDINIDAE ANC	1	2	0	0	0	1	2	0	0
<i>Pseudobunocephalus</i>	1	2	2	0	1	1	1&2	0	0
<i>Acanthobunocephalus</i>	1	2	0	1	0	2	2	0	0
<i>Bunocephalus</i>	1	2	0	1	0	1	2	0	0
<i>Amaralia</i>	1	2	0	1	0	1	2	0	0
<i>Pterobunocephalus</i>	1	2	0	1	0	1&2	2	0	0
<i>Platystacus</i>	1	2	0	1	0	1	2	0	0
<i>Aspredo</i>	1	2	0	1	0	1	2	0	0
<i>Aspredinichthys</i>	1	2	0	1	0	1	2	0	0
<i>Xyliophius</i>	1	2	0	1	0	1	2	0	0
<i>Hoplomyzon</i>	1	2	1	1	0	3	3	1	1
<i>Dupouyichthys</i>	1	2	1	1	0	3	3	1	1
<i>Ernstichthys</i>	1	2	1	1	0	3	3	1	1

Table 1. Character x Taxon Matrix Cont.

	48	49	50	51	52	53	54	55	56		
	3rd basibranchial		Lower pharyngeal toothplates		Weberian complex dorsal lamina	Contact between 4th & 5th parapophyses		Origin of 5th parapophysis	Orientation of 5th parapophysis	Length of 5th parapophysis	Tip of 5th parapophysis
DIPLOMYSTIDAE	0	0	0	0	0	0	0	0	0	0	
HYPSIDORIDAE	?	?	0	0	0	0	0	0	0	0	
AMBLYCIPITIDAE	0	0	0	0	0	1	0	0	0	0	
SISORIDAE	0	0	0	0&1	0&1	1	0	0&1	0&1		
AKYSIDAE	0	0	0	0	0	1	0	0	0	0	
AMPHILIIDAE	0	0	0	?	1	0	0	0	0	0	
LORICARIOIDS	0	0&1	0	?	1	?	0	0	0	0	
PSEUDOPIMELODINES	0	0	0	0	0	0	0	0	0	0	
DORADOIDS	0	0	0	0	0	0	0	0	0	0	
ASPREDINIDAE ANC	0	1	1	0	0	1	0	1	0		
<i>Pseudobunocephalus</i>	0	1	1	0	0	1	1	1	1	0	
<i>Acanthobunocephalus</i>	1	1	1	0	1	1	0	1	1		
<i>Bunocephalus</i>	0	1	1	0	1	1	0	1	0&1		
<i>Amaralia</i>	0	1	1	0	1	1	0	1	0		
<i>Pterobunocephalus</i>	0	1	1	0	1	1	0	1	1		
<i>Platystacus</i>	0	0	1	0	1	1	0	1	1		
<i>Aspredo</i>	0	0	1	0	1	1	0	1	0		
<i>Aspredinichthys</i>	0	0	1	0	1	1	0	1	0		
<i>Xyliophius</i>	0	1	1	1	1	1	0	1	0		
<i>Hoplomyzon</i>	1	1	1	1	1	1	0	1	0		
<i>Dupouyichthys</i>	1	1	1	1	1	1	0	1	0		
<i>Ernstichthys</i>	1	1	1	1	1	1	0	1	1		

Table 1. Character x Taxon Matrix Cont.

	57	58	59	60	61	62	63	64
	Horizontal lamina on centra (ordered)							
	Vertebral armor							
	Pre-anal-fin plates							
	Neural spine shape							
	Height of neural spines							
	Distal tips of neural spines							
	Bifid hemal spines							
	Hemal canal formation							
DIPLOMYSTIDAE	0	0	0	0	0	0	0	0
HYPSIDORIDAE	0	0	0	0	0	0	0	0
AMBLYCIPITIDAE	0	0	0	0	0	0	0	0
SISORIDAE	0&1	0	0	0&1	0	0	0	0
AKYSIDAE	0&1&2	0	0	0&1	0	0&1	0&1	0
AMPHILIIDAE	0	0&2	0&4	0&1	0	0	0&1	0
LORICARIOIDS	0	0	0	0&1	0	0	0&1	0&1
PSEUDOPIMELODINES	0	0	0	0	0	0	0	0
DORADOIDS	0	0	0	0&1	0	0	0	0
ASPREDINIDAE ANC	0	0	0	1	0	0	0	1
<i>Pseudobunocephalus</i>	0	0	0	1	1	0	0	1
<i>Acanthobunocephalus</i>	1	0	0	1	0	0	1	1
<i>Bunocephalus</i>	2	0	0	1	0&1	0	1	1
<i>Amaralia</i>	2	0	0	1	0	0	1	1
<i>Pterobunocephalus</i>	2	0	0	1	1	0	1	1
<i>Platystacus</i>	2	0	0	1	0	1	1	1
<i>Aspredo</i>	2	0	0	1	0	1	1	1
<i>Aspredinichthys</i>	2	0	0	1	0	1	1	1
<i>Xylipterus</i>	2	0	0	1	0	0	1	1
<i>Hoplomyzon</i>	0	1	3	1	0	0	1	1
<i>Dupouyichthys</i>	0	2	1	1	0	0	1	1
<i>Ernstichthys</i>	0	2	2	1	0	0	1	1

Table 1. Character x Taxon Matrix Cont.

	65	66	67	68	69	70	71	72	73			
	Abdominal vertebral connections		Interdigitating connections		Parapophyses for ribs		Ribs	Spinelet erector muscle canals	Anterior nuchal plate	Middle nuchal plate ornamentation	Posterior nuchal plate processes	Dorsal spinelet
DIPLOMYSTIDAE	0	0	0	0	0	0	0	0	0	0	0	0
HYPSIDORIDAE	0	0	0	0	?	0	0	0	0	0	0	?
AMBLYCIPITIDAE	0	0	0	1	1	1	0	0	0	0	0	0
SISORIDAE	0&1	0	0	1	1	1	0	0&1	1&2			
AKYSIDAE	0&1	0	0	1	1	1	0	0&1	1			
AMPHILIIDAE	0&1	0	0	1	0	1	0	0	0	2		
LORICARIODS	0&1&2	0	0&1	1	0	1	0	0	0	0&2		
PSEUDOPIMELODINES	0	0	0	1	0	0	0	0	0	0	0	0
DORADOIDS	0	0	0	1	0	0	0	0	0	0	0	1
ASPREDINIDAE ANC	2	0	1	1	0	1	0	0	0	0	0	0*2
<i>Pseudobunocephalus</i>	2	0	1	1	0	1	1	0	0	2		
<i>Acanthobunocephalus</i>	2	0	1	1	1	1	0	0	0	0	0	0
<i>Bunocephalus</i>	2	0	1	1	0	1	1	0	0	2		
<i>Amaralia</i>	2	0	1	1	0	1	1	0	0	2		
<i>Pterobunocephalus</i>	2	0	1	1	0	1	0	1	1	2		
<i>Platystacus</i>	2	0	1	1	0	1	0	1	1	2		
<i>Aspredo</i>	2	0	1	1	0	1	0	1	1	2		
<i>Aspredinichthys</i>	2	0	1	1	0	1	0	1	1	2		
<i>Xylipterus</i>	2	0	1	1	0	1	0	1	1	2		
<i>Hoplomyzon</i>	2	1	1	2	0	1	1	1	1	2		
<i>Dupouyichthys</i>	2	1	1	2	0	1	1	1	1	2		
<i>Ernstichthys</i>	2	1	1	2	0	1	1	1	1	2		

Table 1. Character x Taxon Matrix Cont.

	Dorsal spine	Dorsal spine length	Modal # of dorsal-fin rays (ordered)	Dorsal-fin adnate	Anal-fin adnate	Modal # of anal-fin rays (ordered)	Modal # of caudal-fin rays	Expanded bases on caudal-fin rays	Length of outermost caudal-fin rays	Procurrent caudal-fin rays
	74	75	76	77	78	79	80	81	82	83
DIPLOMYSIDAE	0	0	0	0	0	1	0	0	0	0
HYPSIDORIDAE	0	0	0	?	?	1	0	0	0	0
AMBLYCIPITIDAE	0	0	0	0	0	1	0	0	0	0
SISORIDAE	0&1	0	0&1	0	0	0&1	0&1	0&1	0	0
AKYSIDAE	0	0	1&2	0	0	0&1	0&1	0	0	0
AMPHILIIDAE	1	0	0	0	0	1	0	0	0	0
LORICARIODS	0&1	0	0	0	0	1	0	0&1	0	0
PSEUDOPIMELODINES	0	0	0&1	0	0	1	0	0	0	0
DORADOIDS	0	0	0&1	0	0	1	0	0	0	0
ASPREDINIDAE ANC	0*1	0	1	0	0	0	1	1	0*1	0
<i>Pseudobunocephalus</i>	1	0	1&2	0	0	0	1	1	1	0
<i>Acanthobunocephalus</i>	0	0	2	0	0	0	1	1	1	3
<i>Bunocephalus</i>	1	0	1	1	1	0	1&2	1	0	0
<i>Amaralia</i>	1	0	3	0	1	0	2	1	0	2
<i>Pterobunocephalus</i>	1	0	1	1	1	1	1	1	0	0
<i>Platystacus</i>	1	1	1	1	1	2	3	1	0	3
<i>Aspredo</i>	1	1	1	1	1	2	1	1	0	3
<i>Aspredinichthys</i>	1	2	1	1	1	2	1	1	0	3
<i>Xylipterus</i>	1	0	1	1	0&1	0	1	1	0	1
<i>Hoplomyzon</i>	1	0	0	1	1	0	2	1	0	1
<i>Dupouyichthys</i>	1	0	0	1	1	0	2	1	0	1
<i>Ernstichthys</i>	1	0	0	1	1	0	2	1	0	1

Table 1. Character x Taxon Matrix Cont.

	Hypuraphysis	Supracleithra-crana connection	Supracleithra ornamentation	Humeral process of cleithrum	Anterior margin of coracoid (ordered)	Coracoid processes	Mesocoracoid arch (ordered)	VAD process of pectoral spine	Pectoral spine shape
	84	85	86	87	88	89	90	91	92
DIPLOMYSIDAE	0	0	0	0	0	0	0	0	?
HYPSIDORIDAE	0	0	0	0	0	0	0	0	0
AMBLYCIPITIDAE	0	0	0	0	0	0	0	0	0
SISORIDAE	0	0&1	0	0	0&1	0&1	0	0	0
AKYSIDAE	0	0&1	0	0	0&1	0	1	0	0
AMPHILIIDAE	0&1	1	0	0	0	0	0	0	0
LORICARIODS	0	0&1	0	0&1	0&1	0&1	0&2	0	0&1
PSEUDOPIMELODINES	0	0	0	0	0	0	0	1	0
DORADOIDS	0	1	0	0	0	1	0&2	1	0&1
ASPREDINIDAE ANC	0	0	0	0	2	1	2	1	0
<i>Pseudobunocephalus</i>	0	0	0	0	2	1	2	1	0
<i>Acanthobunocephalus</i>	0	0	0	0	2	1	2	1	0
<i>Bunocephalus</i>	0	0	0	0	2	1	2	1	0
<i>Amaralia</i>	0	0	1	0	2	1	2	1	0
<i>Pterobunocephalus</i>	0	0	0	0	2	1	2	1	0
<i>Platystacus</i>	0	0	0	0	2	1	2	1	0
<i>Aspredo</i>	0	0	0	1	2	1	2	1	0
<i>Aspredinichthys</i>	0	0	0	0	2	1	2	1	0
<i>Xylipterus</i>	0	0	0	0	3	1	2	1	0
<i>Hoplomyzon</i>	1	1	0	0	3	1	2	1	0
<i>Dupouyichthys</i>	1	1	0	0	3	1	2	1	1
<i>Ernstichthys</i>	1	1	0	0	3	1	2	1	1

Table 1. Character x Taxon Matrix Cont.

	93	94	95	96	97	98	99
	Preaxial pectoral spine serrations		Modal # of pectoral-fin rays (ordered)		Anterior insertion of hypaxial musculature		Ventral pectoral musculature
DIPLOMYSIDAE	0	0	0	0	0	0	0
HYPSIDORIDAE	0	1	0	?	?	0	0
AMBLYCIPITIDAE	0	1&2&3	0	0	0	0	0
SISORIDAE	0&1	0&1&2&4	0	0	0	0	0
AKYSIDAE	0	2&3	0	0	0	0	0
AMPHILIIDAE	0	0&1	0	0	0	0	0
LORICARIODS	0	0&1&2&3&4	0	0	0&1&2	2	0&1
PSEUDOPIMELODINES	0&1	1&2&4	0	0	0	0	0
DORADOIDS	0&1	0&3&5	0	1	0&1&2	1	0
ASPREDINIDAE ANC	1	4	0	1	2	1	1
<i>Pseudobunocephalus</i>	1	4&5	0	1	2	1	1
<i>Acanthobunocephalus</i>	1	5	1	1	2	1	1
<i>Bunocephalus</i>	1	4	0	1	2	1	1
<i>Amaralia</i>	0	4	0	1	2	1	1
<i>Pterobunocephalus</i>	1	4	0	1	2	1	1
<i>Platystacus</i>	1	2	0	1	2	1	1
<i>Aspredo</i>	1	2	0	1	2	1	1
<i>Aspredinichthys</i>	1	1	0	1	2	1	1
<i>Xyliophius</i>	0	4	0	1	2	1	1
<i>Hoplomyzon</i>	0	3	0	1	1	1	1
<i>Dupouyichthys</i>	0	3	0	1	1	1	1
<i>Ernstichthys</i>	0&1	3	0	1	1	1	1

Table 1. Character x Taxon Matrix Cont.

	Basipterygia lateral cartilage	Basipterygia posterior cartilage	Posterior margin of basipterygia	Pelvic-pectoral girdle contact	Lateral line length	Lateral line ossicles	Infraorbital lateralis canal	Accessory nasal bones
	100	101	102	103	104	105	106	107
DIPLOMYSTIDAE	0	0	0	0	0	0	0	0
HYPSIDORIDAE	?	?	0	0	?	?	0	0
AMBLYCIPITIDAE	0	0	0	0	0	0	0	0
SISORIDAE	0	0	0	0&1	0&2	0	0	0
AKYSIDAE	0	0	0	0	0	0	0	0
AMPHILIIDAE	0	0	0	0	0	0	0	0
LORICARIOIDS	0	0	0	0	0&1	0	0&1	0
PSEUDOPIMELODINES	0	0	0	0	0&1	0	0	0
DORADOIDS	0	0	0	0&1	0&1	0&2	0	0
ASPREDINIDAE ANC	0	1	0	0	0*1	0	0	0
<i>Pseudobunocephalus</i>	0	1	0	0	1	0	0&1	0
<i>Acanthobunocephalus</i>	1	1	0	0	1	0	1	0
<i>Bunocephalus</i>	0	1	1	0	0	1	0	0
<i>Amaralia</i>	0	1	1	0	0	1	0	0
<i>Pterobunocephalus</i>	0	1	0	0	0	0	0	0
<i>Platystacus</i>	0	1	0	0	0	0	0	1
<i>Aspredo</i>	0	1	0	0	0	0	0	1
<i>Aspredinichthys</i>	0	1	0	0	0	0	0	1
<i>Xyliophius</i>	0	1	0	0	0&2	0	0	1
<i>Hoplomyzon</i>	1	2	0	1	0	3	0	0
<i>Dupouyichthys</i>	1	2	0	1	0	3	0	0
<i>Ernstichthys</i>	1	2	0	1	0	3	0	0

Table 1. Character x Taxon Matrix Cont.

	108	109	110	111	112	113	114	115
DIPLOMYSTIDAE	0	0	0	0	0	0	0	0
HYPSIDORIDAE	0	0	?	?	?	?	?	?
AMBLYCIPITIDAE	0	0	0	0	2	0	0	0
SISORIDAE	0	0	0	0	2	0	0	0
AKYSIDAE	0	0	0	0	2	0	0	0&1
AMPHILIIDAE	0	0	0	0	2	0	0	1
LORICARIOIDS	0	0	0	0	0&2	0	0	0
PSEUDOPIMELODINES	0	0	0	0	2	0	0	1
DORADOIDS	0	0	0	0&1	2	0&1	0	1
ASPREDINIDAE ANC	0	0	0	0	1	0	0	1
<i>Pseudobunocephalus</i>	0	0	0	0	1	0&1	0	1
<i>Acanthobunocephalus</i>	0	0	0	0	1	0	0	1
<i>Bunocephalus</i>	0	0	0	0	1	0	0	1
<i>Amaralia</i>	0	0	0	0	1	0	0	1
<i>Pterobunocephalus</i>	0	0	0	0	1	0	0	1
<i>Platystacus</i>	0	1	0	0	1	0	0	1
<i>Aspredo</i>	0	1	2	1	1	0	0	1
<i>Aspredinichthys</i>	1	1	0	1	1	0	1	1
<i>Xyliophius</i>	0	0	0	0	1	0	0	1
<i>Hoplomyzon</i>	0	0	2	0&1	1	0	0&1	1
<i>Dupouyichthys</i>	0	0	1	0	1	0	0	1
<i>Ernstichthys</i>	0	0	1	0&1	1	0	0&1	1

Table 1. Character x Taxon Matrix Cont.

	116	117	118	119	120	121	122	123
DIPLOMYSIDAE	0	0	0	0	0	0	0	0
HYPSIDORIDAE	?	?	0	?	?	?	?	?
AMBLYCIPITIDAE	0	0	0	0	0	0	0	0
SISORIDAE	0	0	0	0	0	0	3	0&1
AKYSIDAE	0	0	1	0	0	0	3	0&1
AMPHILIIDAE	0	0	0&1	0	0	0	1	0
LORICARIOIDS	0	0	0	0	0	0	1	0
PSEUDOPIMELODINES	0	0	0	0	0	0	1	0
DORADOIDS	0	0	0	0	0	0	1	0
ASPREDINIDAE ANC	0	0	0	0	0	0	1	1
<i>Pseudobunocephalus</i>	0	0	0	0	0	0	1	1
<i>Acanthobunocephalus</i>	0	0	0	0	0	0	1	1
<i>Bunocephalus</i>	0	0	1	0	0	0	1	1
<i>Amaralia</i>	0	0	1	0	0	0	1	1
<i>Pterobunocephalus</i>	0	0	1	1	1	0	1	1
<i>Platystacus</i>	0	0	1	1	1	1	1	1
<i>Aspredo</i>	0	0	1	1	1	1	1	1
<i>Aspredinichthys</i>	0	0	1	1	1	1	1	1
<i>Xylipterus</i>	1	1	1	0	0	0	2	1
<i>Hoplomyzon</i>	1	0	1	0	0	0	1	1
<i>Dupouyichthys</i>	1	0	1	0	0	0	1	1
<i>Ernstichthys</i>	1	0	1	0	0	0	1	1

Table 1. Character x Taxon Matrix Cont.

	124	125	126	127
DIPLOMYSTIDAE	0	?	0	0
HYPSIDORIDAE	?	?	0	?
AMBLYCIPITIDAE	0	?	0	0
SISORIDAE	0	0	0	0
AKYSIDAE	0&1	?	0&1	0
AMPHILIIDAE	0	0	0	0
LORICARIOIDS	0	0&1	0&1	0
PSEUDOPIMELODINES	1	0	0	0
DORADOIDS	0	0	0&1	0
ASPREDINIDAE ANC	1	1	1	0
<i>Pseudobunocephalus</i>	1	1	1	0
<i>Acanthobunocephalus</i>	1	1	1	0
<i>Bunocephalus</i>	1	1	1	0
<i>Amaralia</i>	1	1	1	1
<i>Pterobunocephalus</i>	1	1	1	0
<i>Platystacus</i>	1	1	1	0
<i>Aspredo</i>	0	1	1	0
<i>Aspredinichthys</i>	1	1	1	0
<i>Xylipterus</i>	0	1	1	0
<i>Hoplomyzon</i>	2	1	1	0
<i>Dupouyichthys</i>	2	1	1	0
<i>Ernstichthys</i>	2	1	1	0

Table 2. Character Diagnostics

	Character	States	Min	Steps	Max	CI	RI	RC
1	Mesethmoid medial notch	2	6	7	9	0.86	0.67	0.57
2	Mesethmoid dorsal processes	2	1	1	1	1.00	0.00	0.00
3	Ethmoid cartilage	2	1	2	5	0.50	0.75	0.38
4	Skull contact with eye	2	6	7	10	0.86	0.75	0.64
5	Epiphyseal bar	2	2	2	2	1.00	0.00	0.00
6	Supraoccipital-frontal contact	2	1	1	1	1.00	0.00	0.00
7	Posterior cranial fontanel	2	3	3	3	1.00	0.00	0.00
8	Pterotic laminar processes	5	5	5	13	1.00	1.00	1.00
9	Supraoccipital process	2	3	4	7	0.75	0.75	0.56
10	Knobby skull ornamentation	2	2	4	6	0.50	0.50	0.25
11	Vomer	2	3	3	9	1.00	1.00	1.00
12	Premaxillae shape	3	3	4	8	0.75	0.80	0.60
13	Premaxillae knobs	2	1	1	1	1.00	0.00	0.00
14	Premaxillae teeth	2	2	2	5	1.00	1.00	1.00
15	Premaxillae position	2	1	1	1	1.00	0.00	0.00
16	Dentary symphysis	2	2	2	5	1.00	1.00	1.00
17	Syphysis ossification	2	1	1	3	1.00	1.00	1.00
18	Mandibular lateralis canal	3	3	3	12	1.00	1.00	1.00
19	Dentary teeth	2	2	2	3	1.00	1.00	1.00
20	Ascending process of Meckel's cartilage	3	3	4	12	0.75	0.89	0.67
21	Coronomeckelian	2	4	6	9	0.67	0.60	0.40
22	Hyomandibula-skull contact	2	2	4	5	0.50	0.33	0.17
23	Anterior process of hyomandibula	2	1	1	3	1.00	1.00	1.00
24	Metapterygoid	4	3	3	7	1.00	1.00	1.00
25	Endopterygoid	2	1	1	3	1.00	1.00	1.00
26	Posterior palatine cartilage	2	2	3	4	0.67	0.50	0.33
27	Shape of posterior end of palatine	4	3	4	5	0.75	0.50	0.38
28	Suprapreopercles	2	5	6	9	0.83	0.75	0.63
29	Opercle shape (ordered)	3	7	7	18	1.00	1.00	1.00
30	Opercle-interopercle connection	3	2	2	11	1.00	1.00	1.00
31	Opercular apertures	2	1	1	8	1.00	1.00	1.00
32	Dorsohyal	2	4	5	6	0.80	0.50	0.40
33	Anterohyal lamina	2	3	4	9	0.75	0.83	0.63
34	Lateral end of anterohyal	2	1	1	4	1.00	1.00	1.00
35	Lateral end of posterothyial	2	2	2	2	1.00	0.00	0.00
36	Interhyal	2	6	7	9	0.86	0.67	0.57
37	Modal # of branchiostegal rays (ordered)	3	6	7	16	0.86	0.90	0.77
38	Urohyal shape	5	4	5	12	0.80	0.88	0.70
39	1st pharyngobranchial	2	1	1	1	1.00	0.00	0.00
40	2nd pharyngobranchial	3	3	4	4	0.75	0.00	0.00
41	4th pharyngobranchial	3	3	3	5	1.00	1.00	1.00
42	5th epibranchial	2	4	5	7	0.80	0.67	0.53
43	Gill rakers	2	4	4	4	1.00	0.00	0.00
44	1st hypobranchial	4	7	7	9	1.00	1.00	1.00
45	2nd hypobranchial	4	8	8	12	1.00	1.00	1.00
46	3rd hypobranchial	2	1	1	3	1.00	1.00	1.00
47	2nd basibranchial	2	2	2	4	1.00	1.00	1.00
48	3rd basibranchial	2	1	2	4	0.50	0.67	0.33
49	Lower pharyngeal toothplates	2	2	3	10	0.67	0.88	0.58
50	Weberian complex dorsal lamina	2	1	1	9	1.00	1.00	1.00
51	Os suspensorium	2	2	2	5	1.00	1.00	1.00
52	Contact between 4th & 5th parapophyses	2	2	3	8	0.67	0.83	0.56
53	Origin of 5th parapophysis	2	1	2	5	0.50	0.75	0.38

Table 2. Character Diagnostics Cont.

	Character	States	Min	Steps	Max	CI	RI	RC
54	Orientation of 5th parapophysis	2	1	1	1	1.00	0.00	0.00
55	Length of 5th parapophysis	2	2	2	9	1.00	1.00	1.00
56	Tip of 5th parapophysis	2	3	6	6	0.50	0.00	0.00
57	Horizontal lamina on centra (ordered)	3	5	7	18	0.71	0.85	0.60
58	Vertebral armor	3	3	3	4	1.00	1.00	1.00
59	Pre-anal-fin plates	5	4	4	4	1.00	0.00	0.00
60	Neural spine shape	2	6	6	9	1.00	1.00	1.00
61	Height of neural spines	2	2	3	3	0.67	0.00	0.00
62	Distal tips of neural spines	2	2	2	4	1.00	1.00	1.00
63	Bifid hemal spines	2	4	4	10	1.00	1.00	1.00
64	Hemal canal formation	2	2	2	9	1.00	1.00	1.00
65	Abdominal vertebral connections	3	6	6	13	1.00	1.00	1.00
66	Interdigitating connections	2	1	1	3	1.00	1.00	1.00
67	Parapophyses for ribs	2	2	2	9	1.00	1.00	1.00
68	Ribs	3	2	2	5	1.00	1.00	1.00
69	Spinelet erector muscle canals	2	1	2	4	0.50	0.67	0.33
70	Anterior nuchal plate	2	1	2	4	0.50	0.67	0.33
71	Middle nuchal plate ornamentation	2	1	3	6	0.33	0.60	0.20
72	Posterior nuchal plate processes	2	3	3	10	1.00	1.00	1.00
73	Dorsal spinelet	3	4	7	8	0.57	0.25	0.14
74	Dorsal spine	2	3	5	9	0.60	0.67	0.40
75	Dorsal spine length	3	2	2	3	1.00	1.00	1.00
76	Modal # of dorsal-fin rays (ordered)	4	8	11	16	0.73	0.63	0.45
77	Dorsal-fin adnate	2	1	2	9	0.50	0.88	0.44
78	Anal-fin adnate	2	2	2	10	1.00	1.00	1.00
79	Modal # of anal-fin rays (ordered)	3	4	5	13	0.80	0.89	0.71
80	Modal # of caudal-fin rays	4	6	7	15	0.86	0.89	0.76
81	Expanded bases on caudal-fin rays	2	3	3	9	1.00	1.00	1.00
82	Length of outermost caudal-fin rays	2	1	2	2	0.50	0.00	0.00
83	Procurent caudal-fin rays	4	3	4	9	0.75	0.83	0.63
84	Hypurapophysis	2	2	2	4	1.00	1.00	1.00
85	Supracleithra-crana connection	2	4	6	8	0.67	0.50	0.33
86	Supracleithra ornamentation	2	1	1	1	1.00	0.00	0.00
87	Humeral process of cleithrum	2	2	2	2	1.00	0.00	0.00
88	Anterior margin of coracoid (ordered)	4	6	6	22	1.00	1.00	1.00
89	Coracoid processes	2	3	3	8	1.00	1.00	1.00
90	Mesocoracoid arch (ordered)	3	6	7	17	0.86	0.91	0.78
91	VAD process of pectoral spine	2	1	1	7	1.00	1.00	1.00
92	Pectoral spine shape	2	3	3	4	1.00	1.00	1.00
93	Preaxial pectoral spine serrations	2	7	5	11	0.71	0.67	0.48
94	Modal # of pectoral-fin rays (ordered)	6	30	26	39	0.87	0.69	0.60
95	Modal # of pectoral radials	2	1	1	1	1.00	0.00	0.00
96	Anterior insertion of hypaxial musculature	2	1	1	7	1.00	1.00	1.00
97	Ventral pectoral musculature	3	6	6	13	1.00	1.00	1.00
98	Ventral division of arrector dorsalis (VAD)	3	2	2	7	1.00	1.00	1.00
99	Basipterygia anterior arms	2	2	2	9	1.00	1.00	1.00
100	Basipterygia lateral cartilage	2	1	2	4	0.50	0.67	0.33
101	Basipterygia posterior cartilage	3	2	2	11	1.00	1.00	1.00
102	Posterior margin of basipterygia	2	1	1	2	1.00	1.00	1.00
103	Pelvic-pectoral girdle contact	2	3	3	5	1.00	1.00	1.00
104	Lateral line length	3	6	7	7	0.86	0.00	0.00
105	Lateral line ossicles	4	3	3	6	1.00	1.00	1.00
106	Infraorbital lateralis canal	2	3	3	3	1.00	0.00	0.00

Table 2. Character Diagnostics Cont.

	Character	States	Min	Steps	Max	CI	RI	RC
107	Accessory nasal bones	2	1	2	4	0.50	0.67	0.33
108	Hooks on antorbital bone	2	1	1	1	1.00	0.00	0.00
109	Accessory canal in pterotic	2	1	1	3	1.00	1.00	1.00
110	Maxillary barbel adnate	3	2	3	4	0.67	0.50	0.33
111	Accessory maxillary barbels	2	4	4	5	1.00	1.00	1.00
112	Mental barbel bases	3	3	3	9	1.00	1.00	1.00
113	Bifid mental barbels	2	2	2	2	1.00	0.00	0.00
114	Accessory mental barbels	2	3	3	3	1.00	0.00	0.00
115	Anterior nares	2	2	3	5	0.67	0.67	0.44
116	Papillae on anterior nares	2	1	1	4	1.00	1.00	1.00
117	Papillae on lower jaw	2	1	1	1	1.00	0.00	0.00
118	Jaw occlusion	2	2	3	10	0.67	0.88	0.58
119	Testis morphology	2	1	1	4	1.00	1.00	1.00
120	Eggs carrying behavior	2	1	1	4	1.00	1.00	1.00
121	Cotylephores	2	1	1	3	1.00	1.00	1.00
122	Unculi shape	4	3	3	5	1.00	1.00	1.00
123	Unculiferous tubercle rows	2	3	3	8	1.00	1.00	1.00
124	Saddle pigmentation pattern	3	3	6	12	0.50	0.67	0.33
125	Alarm cells & fright reaction	2	2	2	5	1.00	1.00	1.00
126	Adipose fin	2	4	4	9	1.00	1.00	1.00
127	Oophagy specialization	2	1	1	1	1.00	0.00	0.00

Table 3. Synonymies of Aspredinidae Species

Original Name	Correct Designation
<i>Acanthobunocephalus nicoi</i> n. sp. Friel, 1994	<i>Acanthobunocephalus nicoi</i> n. sp.
<i>Agmus lyriformis</i> Eigenmann, 1912b	<i>Bunocephalus verrucosus</i>
<i>Aspredinichthys filamentosus</i> Valenciennes, 1840	<i>Aspredinichthys filamentosus</i>
<i>Aspredinichthys tibicen</i> Valenciennes, 1840	<i>Aspredinichthys tibicen</i>
<i>Aspredo aspredo</i> Linnaeus, 1758	<i>Aspredo aspredo</i>
<i>Aspredo batrachus</i> Gronovius, 1854	<i>Aspredo aspredo</i>
<i>Aspredo sexcirrhis</i> Valenciennes, 1840	<i>Platystacus cotylephorus</i>
<i>Aspredo sicuephorus</i> Bleeker, 1858	<i>Aspredo aspredo</i>
<i>Aspredo spectrum</i> Gronovius, 1854	<i>Platystacus cotylephorus</i>
<i>Bunocephalus albifasciatus</i> Fowler, 1943	<i>Pterobunocephalus depressus</i>
<i>Bunocephalus aleuropsis</i> Cope, 1870	<i>Bunocephalus aleuropsis</i>
<i>Bunocephalus amaurus</i> Eigenmann, 1912b	<i>Bunocephalus amaurus</i>
<i>Bunocephalus amaurus aloike</i> Hoedeman, 1961	<i>Bunocephalus amaurus</i>
<i>Bunocephalus amaurus sipaliwini</i> Hoedeman, 1961	<i>Bunocephalus amaurus</i>
<i>Bunocephalus bicolor</i> Steindachner, 1882	<i>Bunocephalus coracoideus</i>
<i>Bunocephalus bifidus</i> Eigenmann, 1942	<i>Pseudobunocephalus bifidus</i>
" <i>Bunocephalus boliviensis</i> " Ma, 1977	<i>Pseudobunocephalus amazonicus</i>
<i>Bunocephalus carvalhoi</i> Miranda Ribeiro, 1944	<i>Pseudobunocephalus iheringii</i>
<i>Bunocephalus chamaizelus</i> Eigenmann, 1912b	<i>Bunocephalus chamaizelus</i>
<i>Bunocephalus colombianus</i> Eigenmann, 1912a	<i>Bunocephalus colombianus</i>
<i>Bunocephalus coracoideus</i> Cope, 1874	<i>Bunocephalus coracoideus</i>
<i>Bunocephalus depressus</i> Haseman, 1911	<i>Pterobunocephalus depressus</i>
<i>Bunocephalus dolichurus</i> Delsman, 1941	<i>Pterobunocephalus dolichurus</i>
<i>Bunocephalus doriae</i> Boulenger, 1902	<i>Bunocephalus doriae</i>
" <i>Bunocephalus dorsolineatus</i> " Ma, 1977	<i>Pseudobunocephalus sp.?</i>
<i>Bunocephalus gronovii</i> Bleeker, 1858	<i>Bunocephalus verrucosus</i>
<i>Bunocephalus haggini</i> Eigenmann & Allen, 1942	<i>Bunocephalus coracoideus</i>
<i>Bunocephalus hysiurus</i> Kner, 1855	<i>Amaralia hypsiura</i>
<i>Bunocephalus iheringii</i> Boulenger, 1891	<i>Pseudobunocephalus iheringii</i>
<i>Bunocephalus kneri</i> Steindachner, 1882	<i>Bunocephalus kneri</i>
<i>Bunocephalus larai</i> von Ihering, 1930	<i>Bunocephalus larai</i>
<i>Bunocephalus melas</i> Cope, 1874	<i>Bunocephalus aleuropsis</i>
<i>Bunocephalus minutus</i> Güntert, 1942	<i>Pseudobunocephalus iheringii</i>
<i>Bunocephalus retropinnis</i> Eigenmann, 1942	<i>Bunocephalus doriae</i>
<i>Bunocephalus rugosus</i> Eigenmann & Kennedy, 1903	<i>Pseudobunocephalus rugosus</i>
<i>Bunocephalus salathei</i> Myers, 1927	<i>Pseudobunocephalus iheringii</i>
<i>Bunocephalus scabriceps</i> Eigenmann & Eigenmann, 1889	<i>Bunocephalus verrucosus</i>
" <i>Bunocephalus spelieri</i> " Ma, 1977	<i>Pseudobunocephalus sp.?</i>
<i>Cotylephorus blochii</i> Swainson, 1838	<i>Platystacus cotylephorus</i>
<i>Dupouichthys sapito</i> Schultz, 1944	<i>Dupouichthys sapito</i>
<i>Dysichthys amazonicus</i> Mees, 1989	<i>Pseudobunocephalus amazonicus</i>
<i>Dysichthys australis</i> Eigenmann & Ward, 1907	<i>Pseudobunocephalus rugosus</i>
<i>Dysichthys quadriradiatus</i> Mees, 1989	<i>Pseudobunocephalus quadriradiatus</i>
<i>Ernstichthys anduzei</i> Fernández-Yépez, 1953	<i>Ernstichthys anduzei</i>
<i>Ernstichthys intonsus</i> Stewart, 1985	<i>Ernstichthys intonsus</i>
<i>Hoplomyzon megistus</i> Orcés, 1961	<i>Ernstichthys megistus</i>

Table 3. Synonymies of Aspredinidae Species Cont.

Original Name	Correct Designation
<i>Hoplomyzon atrizona</i> Myers, 1942	<i>Hoplomyzon atrizona</i>
<i>Hoplomyzon atrizona petroleus</i> Schultz, 1944	<i>Hoplomyzon atrizona</i>
<i>Hoplomyzon papillatus</i> Stewart, 1985	<i>Hoplomyzon papillatus</i>
<i>Hoplomyzon sexpapillostoma</i> Taphorn & Marrero, 1990	<i>Hoplomyzon sexpapillostoma</i>
<i>Platystacus cotylephorus</i> Bloch, 1794	<i>Platystacus cotylephorus</i>
<i>Platystacus laevis</i> Bloch, 1794	<i>Aspredo aspredo</i>
<i>Platystacus nematophorus</i> Bleeker, 1862	<i>Platystacus cotylephorus</i>
<i>Platystacus verrucosus</i> Bloch, 1794	<i>Bunocephalus verrucosus</i>
<i>Pseudobuncephalus lundbergi</i> n. sp. Friel, 1994	<i>Pseudobuncephalus lundbergi</i> n. sp.
<i>Siluris hexdactylus</i> La Cepede, 1803	<i>Platystacus cotylephorus</i>
<i>Xyliphius barbatus</i> de Arámburu & Arámburu, 1962	<i>Xyliphius barbatus</i>
<i>Xyliphius kryptos</i> Taphorn & Lilyestrom, 1983	<i>Xyliphius kryptos</i>
<i>Xyliphius lepturus</i> Orcés, 1962	<i>Xyliphius lepturus</i>
<i>Xyliphius lombarderoi</i> Risso & Risso, 1964	<i>Xyliphius lombarderoi</i>
<i>Xyliphius magdalenaæ</i> Eigenmann, 1912a	<i>Xyliphius magdalenaæ</i>
<i>Xyliphius melanopterus</i> Orcés, 1962	<i>Xyliphius melanopterus</i>

Table 4. Comparative Materials Examined Cont.

Taxon	Catalog #	# of spec.	Prep.	SL in mm	Locality
Cypriniformes					
Cyprinidae					
<i>Barbus conchonius</i>	DU F1152	1	c&s	38	aquarium spec.
<i>Cyprinus carpio</i>	DU F1179	1	dry	270	North Carolina
<i>Notropis albeolus</i>	UNCAT	3	c&s	35-70	North Carolina
<i>Semotilus atromaculatus</i>	UNCAT	3	c&s	44-63	North Carolina
Catostomidae					
<i>Catostomus commersoni</i>	DU F1150	1	c&s	42	North Carolina
Characiformes					
Anostomidae					
<i>Leporinus sp.</i>	DU F1058	1	dry	180	Venezuela
Characidae					
<i>Charax sp.</i>	UNCAT	2	c&s	57-80	Venezuela
<i>Colossoma sp.</i>	UNCAT	1	c&s	125	aquarium spec.
<i>Mylossoma duriventris</i>	UNCAT	1	dry	163	Venezuela
<i>Pygocentrus sp.</i>	UNCAT	1	dry		Venezuela
<i>Roeboides affinis</i>	UNCAT	2	c&s	42-45	Venezuela
Ctenoluciidae					
<i>Ctenolucius sp.</i>	DU F1158	1	dry	165	Venezuela
Curimatidae					
<i>Curimata sp.</i>	UNCAT	1	dry	125	Venezuela
Cynodontidae					
<i>Cynodon gibbus</i>	DU F1159	1	dry		Venezuela
<i>Raphiodon vulpinus</i>	DU F1162	1	dry	250	Venezuela

Table 4. Comparative Materials Examined Cont.

Taxon	Catalog #	# of spec.	Prep.	SL in mm	Locality
Erythrinidae					
<i>Hoplias sp.</i>	DU F1159	1	dry	180	Venezuela
Prochilodontidae					
<i>Prochilodus mariae</i>	DU F1035	1	dry	230	Venezuela
Gymnotiformes					
Apteronotidae					
<i>Apteronotus albifrons</i>	DU F2016	1	c&s	123	Venezuela
<i>Apteronotus albifrons</i>	DU F1084	1	dry	280	Venezuela
<i>Sternarchorhyncus mormyrus</i>	DU F1089	1	dry	391	Venezuela
Electrophoridae					
<i>Electrophorus sp.</i>	UNCAT	1	dry	head only	Venezuela
Hypopomidae					
<i>Hypopomus brevirostris</i>	UNCAT	1	c&s		Venezuela
Rhamphichthyidae					
<i>Gymnorhamphichthys sp.</i>	UNCAT	1	c&s	210	Venezuela
<i>Rhamphichtys sp.</i>	DU F1087	1	dry	320+	Venezuela
Sternopygidae					
<i>Eigenmannia virescens</i>	DU F2015	1	c&s	150	Venezuela
<i>Sternopygus macrurus</i>	DU F1160	1	dry		Venezuela
Siluriformes					
Akysidae					
<i>Acrochordonichthys melanogaster</i>	FMNH 68010	1	c&s	38	Borneo
<i>Acrochordonichthys melanogaster</i>	FMNH 68949	1	alc	79	Sarawak
<i>Akysis leucorhynchus</i>	ANSP 59352	1	c&s	24	Thailand

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
<i>Akysis leucorhynchus</i>	ROM 51138	2	alc	22-23	
<i>Akysis</i> sp.	UMMZ 214905	1	c&s	36	Vietnam
<i>Akysis</i> sp.	UMMZ 214903	2	c&s	24-31	Vietnam
<i>Breitensteinia insignis</i>	USNM 230304	1	xr	190	Borneo
<i>Breitensteinia insignis</i>	AMNH 58378	2	c&s		aquarium spec.
<i>Parakysis verrucosa</i>	USNM 266589	1	xr	42	West Malaysia
<i>Parakysis verrucosa</i>	FMNH 51742	1	c&s		Malay
Amblycipitidae					
<i>Amblyceps laticeps</i>	UMMZ 208631	1	c&s	51	Bangladesh
<i>Amblyceps mangois</i>	CAS 50256	2	c&s	46-51	Nepal
<i>Amblyceps mangois</i>	UMMZ 208651	1	c&s	35	Bangladesh
<i>Amblyceps mangois</i>	CAS 44346	2	c&s	42-54	Thailand
<i>Liobagrus andersoni</i>	DU F1108	2	c&s	86-90	Korea
<i>Liobagrus anguillicauda</i>	SU 32398	1	c&s	43	China
<i>Liobagrus formosanus</i>	DU F1116	1	c&s	75	Taiwan
<i>Liobagrus formosanus</i>	DU F1117	1	c&s	78	Taiwan
<i>Liobagrus mediadiposalis</i>	DU F1109	1	c&s	82	Korea
<i>Liobagrus mediadiposalis</i>	DU F1111	1	c&s	83	Korea
<i>Liobagrus mediadiposalis</i>	SMWU 2538	1	dry	81	Korea
<i>Liobagrus obesus</i>	DUF1110	2	c&s	80-90	Korea
<i>Liobagrus reini</i>	UMMZ 183862	1	c&s	53	Japan
<i>Xiurenbagrus xiurenensis</i>	DU F1124	1	c&s	90	China
Amphiliidae					
<i>Amphilinus atesuensis</i>	MCZ 48068	1	c&s	27	Ghana
<i>Belonoglanis tenius</i>	MCZ 48354	1	c&s	57	Cent. African Rep.
<i>Doumea alula</i>	MCZ 50534	1	c&s	91	Zaire
<i>Phractura lindica</i>	MCZ 50535	1	c&s	78	Zaire
Ariidae					
<i>Ariopsis seemani</i>	DU F1017	1	dry	243	Panama
<i>Ariopsis seemani</i>	DU F1019	1	dry	130	Panama
<i>Arius felis</i>	UNCAT	2	c&s	73-75	Florida

Table 4. Comparative Materials Examined Cont.

Taxon	Catalog #	# of spec.	Prep.	SL in mm	Locality
<i>Arius felis</i>	DU F 995	1	dry	175	North Carolina
<i>Arius jordani</i>	DU F1020	1	dry	210	Panama
<i>Arius kessleri</i>	DU F1015	1	dry	320	Panama
<i>Arius kessleri</i>	DU F1016	1	dry	165	Panama
<i>Arius proops</i>	USNM 214860	1	dry		Colombia
<i>Bagre marinus</i>	UNCAT	2	c&s	99-105	Florida
<i>Bagre panamensis</i>	DU F1018	1	dry	210	Panama
<i>Sciadops trocheli</i>	USNM 214864	1	dry		Colombia
Aspredinidae					
<i>Acanthobunocephalus nicoi</i> n. sp	ANSP 160698	1 paratype	xr	12	Venezuela: AM: Pendare
<i>Acanthobunocephalus nicoi</i> n. sp	ANSP 168816	3 paratypes	xr	13	Venezuela: AM: Caño Casiquiare
<i>Acanthobunocephalus nicoi</i> n. sp	MCNG 21843	9 paratypes	c&s;xr	14.5-20	Venezuela: AM: Salto Remo
<i>Acanthobunocephalus nicoi</i> n. sp	MCNG 29000	holotype	alc	16	Venezuela: AM: Salto Remo
<i>Amaralia</i> n. sp.	MZSP 36383	1	xr	100	Brazil: MS: Corumbá
<i>Amaralia</i> n. sp.	MZSP 41099	1	alc	37	Brazil: MS: Corumbá
<i>Amaralia</i> n. sp.	MZSP 4423	1	xr	67.5	Brazil: MT: Santo Antonio do Leverger
<i>Amaralia</i> n. sp.	UMMZ 207818	3	c&s;xr	69-116	Paraguay: Concepcion: Paso Horqueta
<i>Amaralia</i> n. sp.	UMMZ 216543	1	xr	67	Paraguay: Central: Puerto de Asuncion
<i>Amaralia hypsiura</i>	CAS 76162	1	alc	50	NO DATA
<i>Amaralia hypsiura</i>	FMNH 70627	1	alc	95	Bolivia: Beni: San Joaquín
<i>Amaralia hypsiura</i>	FMNH 70871	1	alc	109	Ecuador: Napo: Río Cusuimi
<i>Amaralia hypsiura</i>	INPA 4396	2	xr	28-72	Brazil: PA
<i>Amaralia hypsiura</i>	INPA 4397	2	xr	22-32	Brazil: PA
<i>Amaralia hypsiura</i>	INPA 4448	1	xr	64	Brazil: AM
<i>Amaralia hypsiura</i>	INPA 6517	4	c&s;xr	49-71	Brazil: aquarium specimens
<i>Amaralia hypsiura</i>	MZSP 23997	2	alc	28-36	Brazil: PA?
<i>Amaralia hypsiura</i>	MZSP 24294	1	alc	45	Brazil: PA: São Luis
<i>Amaralia hypsiura</i>	USNM 121243	1	alc	125	Colombia: Caquetá: Río Orteguaza
<i>Amaralia hypsiura</i>	USNM 163896	1	alc	133	Ecuador: Napo: Río Suno
<i>Amaralia hypsiura</i>	USNM 301691	1	xr	79	Ecuador: Napo: Río Pindo
<i>Aspredinichthys filamentosus</i>	FMNH 76950	2	c&s		Suriname
<i>Aspredinichthys filamentosus</i>	ROM 41497	4	alc	99-144	Trinidad
<i>Aspredinichthys filamentosus</i>	SU 51775	2	alc	144-146	Brazil

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
<i>Aspredinichthys filamentosus</i>	USNM 207451	17	c&s	153-214	Brazil
<i>Aspredinichthys filamentosus</i>	USNM 292802	1	alc	150	Brazil
<i>Aspredinichthys filamentosus</i>	USNM 66132	1	alc	177	Guyana
<i>Aspredinichthys tibicen</i>	CAS 16020	13	alc	75-197	Guyana
<i>Aspredinichthys tibicen</i>	ROM 66326	3	alc		Guyana
<i>Aspredinichthys tibicen</i>	ROM 66329	5	alc		Guyana
<i>Aspredinichthys tibicen</i>	ROM 66330	2	alc		Guyana
<i>Aspredinichthys tibicen</i>	USNM 167844	3	c&s	158-85	Guyana
<i>Aspredinichthys tibicen</i>	USNM 292799	6	c&s	56-95	French Guiana
<i>Aspredo aspredo</i>	CAS 45725	2	alc	184-203	Brazil
<i>Aspredo aspredo</i>	FMNH 53117	10	c&s		Guyana
<i>Aspredo aspredo</i>	FMNH 70636	18	alc	160-195	Brazil
<i>Aspredo aspredo</i>	INPA 8418	3	c&s		Brazil: PA
<i>Aspredo aspredo</i>	MCZ 36517	3	alc	346-373	Suriname
<i>Aspredo aspredo</i>	MCZ 7976	6	c&s	131-176	Brazil
<i>Aspredo aspredo</i>	ROM 44760	1	alc	262	Trinidad
<i>Aspredo aspredo</i>	ROM 66327	2	alc		Guyana
<i>Aspredo aspredo</i>	UF 28330	2	alc	223-237	Suriname
<i>Aspredo aspredo</i>	USNM 226072	9	c&s	20-109	Suriname
<i>Aspredo aspredo</i>	USNM 41537	1	alc	121	Brazil
<i>Aspredo aspredo</i>	USNM 66099	1	alc	272	Guyana
<i>Bunocephalus aleuropis</i>	AMNH 12618	1	alc	54	Brazil: AM: Rio Envira
<i>Bunocephalus aleuropis</i>	ANSP 131471	4	alc	32-91	Colombia: Meta: Rio Negrito
<i>Bunocephalus aleuropis</i>	ANSP 131575	1	alc	77	Colombia: Meta: Rio Negrito
<i>Bunocephalus aleuropis</i>	CAS 6578	1	alc	67	Brazil: GO: Peixe
<i>Bunocephalus aleuropis</i>	FMNH 93743	7	alc	47-80	Colombia: AM: Leticia
<i>Bunocephalus aleuropis</i>	FMNH 93744	8	alc	40-83	Colombia: AM: Leticia
<i>Bunocephalus aleuropis</i>	FMNH 93745	4	alc	61-69	Colombia: AM: Leticia
<i>Bunocephalus aleuropis</i>	FMNH 96151	3	alc	57-76	Peru: Loreto: Iquitos
<i>Bunocephalus aleuropis</i>	FMNH 97001	1	alc	86	Peru: AM: Rio Santiago at La Poza
<i>Bunocephalus aleuropis</i>	INPA 6524	3	alc	55-74	Brazil: AM: Tabatinga
<i>Bunocephalus aleuropis</i>	MCNG 00378	2	alc	60-88	Venezuela: Apure: Rio Apure: Bruzual
<i>Bunocephalus aleuropis</i>	MZSP 26656	1	alc	56	Peru: Pucallpa-Huanco: Rio Neshuya
<i>Bunocephalus aleuropis</i>	MZSP 28389	1	alc	57	Brazil: AM: Puruzinio

Table 4. Comparative Materials Examined Cont.

Taxon	Catalog #	# of spec.	Prep.	SL in mm	Locality
<i>Bunocephalus aleuropensis</i>	MZSP 30704	2	alc	55-62	Brazil: RO
<i>Bunocephalus aleuropensis</i>	MZSP 30705	2	alc	70,70	Brazil: AM: Rio Japura
<i>Bunocephalus aleuropensis</i>	MZSP 43338	2	alc	58-63	Brazil: GO: Rio Araguaia: Aruaña
<i>Bunocephalus aleuropensis</i>	ROM 55820	1	alc		Peru
<i>Bunocephalus aleuropensis</i>	SU 36199	1	alc	54	Peru: Loreto: Pebas: Rio Ampiyacu
<i>Bunocephalus aleuropensis</i>	USNM 124912	2	alc	56-65	Peru: Shanshocano
<i>Bunocephalus aleuropensis</i>	USNM 190312	3	alc	48-51	Colombia: AM: Leticia
<i>Bunocephalus aleuropensis</i>	USNM 216858	1	alc	55	Colombia: AM: Leticia
<i>Bunocephalus amaurus</i>	FMNH 53121	holotype	xr	57.1	Guyana
<i>Bunocephalus amaurus</i>	FMNH 92826	2	alc		Suriname
<i>Bunocephalus amaurus</i>	MBUCV 16969	3	alc		Venezuela
<i>Bunocephalus amaurus</i>	MCNG 22419	2	alc		Venezuela
<i>Bunocephalus amaurus</i>	MCZ 48566	1	c&s		Guyana
<i>Bunocephalus amaurus</i>	MZSP 23615	2	alc		Brazil
<i>Bunocephalus amaurus</i>	ROM 62223	1	alc		Guyana
<i>Bunocephalus amaurus</i>	ROM 66331	1	alc		Guyana
<i>Bunocephalus amaurus</i>	ROM 66332	1	alc		Guyana
<i>Bunocephalus amaurus</i>	ROM 66333	2	alc		Guyana
<i>Bunocephalus amaurus</i>	USNM 226081	1	alc		Suriname
<i>Bunocephalus amaurus</i>	USNM 226082	1	alc		Suriname
<i>Bunocephalus chamaizelus</i>	CAS 35243	2 paratypes	xr		Guyana
<i>Bunocephalus chamaizelus</i>	CAS 35244	2 paratypes	xr		Guyana
<i>Bunocephalus chamaizelus</i>	FMNH 53123	2 paratypes	xr	24-40	Guyana
<i>Bunocephalus chamaizelus</i>	MCZ 30088	1 paratype	xr		Guyana
<i>Bunocephalus chamaizelus</i>	USNM 66122	1 paratype	xr		Guyana
<i>Bunocephalus colombianus</i>	FMNH 56038	holotype	xr	72	Colombia: Choco: Raspadura
<i>Bunocephalus colombianus</i>	FMNH 56666	1	alc		Colombia: Choco: Managru
<i>Bunocephalus colombianus</i>	FMNH 56668	1	alc		Columbia: Choco: Raspadura
<i>Bunocephalus colombianus</i>	FMNH 58073	3	alc		Colombia: Choco: Rio Truando
<i>Bunocephalus coracoideus</i>	AMNH 40163	1	alc		Bolivia: Beni: Guayaramerín
<i>Bunocephalus coracoideus</i>	AMNH 78086	19	c&s		Peru: Loreto: Rio Tahuayu
<i>Bunocephalus coracoideus</i>	CAS 35108	2	alc		Brazil: AL: Maceio
<i>Bunocephalus coracoideus</i>	CAS 35110	4	alc		Peru: Loreto: Iquitos
<i>Bunocephalus coracoideus</i>	FMNH 70633	2	alc		Bolivia: Berlin

Table 4. Comparative Materials Examined Cont.

Taxon	Catalog #	# of spec.	Prep.	SL in mm	Locality
<i>Bunocephalus coracoideus</i>	FMNH 70634	4	alc		Brazil: PA: Santarem
<i>Bunocephalus coracoideus</i>	FMNH 70635	12	alc		Brazil: Ro: Rio Guapore: Maciel
<i>Bunocephalus coracoideus</i>	INPA 6512	2	alc		Brazil: AM
<i>Bunocephalus coracoideus</i>	INPA 6513	3	alc		Brazil: PA
<i>Bunocephalus coracoideus</i>	INPA 6525	2	alc		Brazil: Am: Rio Javari
<i>Bunocephalus coracoideus</i>	INPA 6531	13	alc		Brazil: PA: Itupiranga
<i>Bunocephalus coracoideus</i>	INPA 8386	1	alc		Brazil: PA: Ilha Itugui
<i>Bunocephalus coracoideus</i>	MCZ 36515	1	alc		Brazil: Rio Negro
<i>Bunocephalus coracoideus</i>	MCZ 46132	2	alc		Brazil: PA: Belem
<i>Bunocephalus coracoideus</i>	MCZ 46133	1	c&s		Brazil: PA: Ilha de Marajó
<i>Bunocephalus coracoideus</i>	MCZ 70980	1	alc		Brazil?
<i>Bunocephalus coracoideus</i>	MCZ 7966	1	alc		Brazil: AM: Rio Jutai
<i>Bunocephalus coracoideus</i>	MCZ 7968	2	alc		Brazil: AM: Lago Badajos
<i>Bunocephalus coracoideus</i>	MCZ 7969	1	alc		Brazil: AM: Lago Badajos
<i>Bunocephalus coracoideus</i>	MPM 30494	1	alc		Peru: Loreto: Mishana Cocha
<i>Bunocephalus coracoideus</i>	MZSP 30702	12	alc	32-77	Brazil: RR: Cachoeira do Bem-Querer
<i>Bunocephalus coracoideus</i>	SU 47825	1	alc		Peru: Loreto: Pebas
<i>Bunocephalus coracoideus</i>	UF 33074	1	alc		Peru: Loreto: Iquitos
<i>Bunocephalus coracoideus</i>	UMMZ 205056	2	alc		Bolivia: Beni: Guayaramerin
<i>Bunocephalus coracoideus</i>	UMMZ 205165	1	alc		Bolivia: Beni: Rio Itenez
<i>Bunocephalus coracoideus</i>	USNM 191562	2	alc		Brazil: Rio Araguaia: Aruana
<i>Bunocephalus coracoideus</i>	USNM 220857	2	alc		Peru: Shansho Caño
<i>Bunocephalus coracoideus</i>	USNM 284646	2	alc		Peru: Loreto: Rio Nanay
<i>Bunocephalus coracoideus</i>	USNM 284648	5	c&s		Peru: Loreto: Rio Itaya
<i>Bunocephalus coracoideus</i>	USNM 301686	7	alc		Bolivia: Beni: Ballivia: Rio Matos
<i>Bunocephalus coracoideus</i>	USNM 308332	1	alc		Brazil
<i>Bunocephalus doriae</i>	ANSP 124109	1	alc	53	Paraguay: Primavera: Rio Tapiricuay
<i>Bunocephalus doriae</i>	ANSP 54116	4	c&s	48-61	Uruguay: Paysandú
<i>Bunocephalus doriae</i>	CAS 31464	2	alc	55-62	Paraguay: Guaira: Villaricca
<i>Bunocephalus doriae</i>	CAS 35247	1	xr	72	Brazil: RS: Cacequi
<i>Bunocephalus doriae</i>	CAS 35248	1	alc	72	Brazil: RS: Uruguiana
<i>Bunocephalus doriae</i>	FMNH 70630	20	alc	39-77	Brazil: RS: Cacequi: Rio Ibicui
<i>Bunocephalus doriae</i>	FMNH 70632	1	alc		Paraguay: Sapucay
<i>Bunocephalus doriae</i>	MZSP 1941	1	alc	45	Brazil: RS

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
<i>Bunocephalus doriae</i>	MZSP 25155	2	alc	69-81	Brazil: RS: Taquara
<i>Bunocephalus doriae</i>	SU 4100	2	alc		Argentina: Buenos Aries
<i>Bunocephalus doriae</i>	UMMZ 203864	3	alc	30-69	Paraguay: Cordillera: Tobati
<i>Bunocephalus doriae</i>	UMMZ 205769	6	alc	38-70	Paraguay: Cordillera
<i>Bunocephalus doriae</i>	UMMZ 206288	2	alc	61	Paraguay: Canendiyu: Rio Jejui-Guazu
<i>Bunocephalus doriae</i>	UMMZ 206392	1	alc	70	Paraguay: Canendiyu
<i>Bunocephalus doriae</i>	UMMZ 206472	3	alc	60-63	Paraguay: Canendiyu
<i>Bunocephalus doriae</i>	UMMZ 206849	20	c&s; xr	34-71	Paraguay: San Pedro
<i>Bunocephalus knerii</i>	FMNH 99480	1	alc		Ecuador
<i>Bunocephalus knerii</i>	FMNH 99481	2	alc		Ecuador
<i>Bunocephalus knerii</i>	FMNH 99482	1	alc		Ecuador
<i>Bunocephalus knerii</i>	FMNH 99483	1	alc		Ecuador
<i>Bunocephalus knerii</i>	USNM 163897	1	alc		Ecuador: Rio Bobonaza
<i>Bunocephalus knerii</i>	USNM 177203	1	alc		Ecuador: Rio Suno
<i>Bunocephalus knerii</i>	USNM 177205	3	alc		Ecuador: Rio Suno
<i>Bunocephalus knerii</i>	USNM 177208	2	alc		Ecuador: Rio Suno
<i>Bunocephalus cf. knerii</i>	FMNH 70276	1	alc		Peru: Loreto
<i>Bunocephalus cf. knerii</i>	USNM 121244	1	alc		Colombia: Caqueta: Florencia
<i>Bunocephalus larai</i>	MZSP 22614	2	alc	36-39	Brazil: MS: Rio Panama
<i>Bunocephalus larai</i>	MZSP 23092	8	alc	27-32	Brazil: SP: Rio Panama
<i>Bunocephalus</i> n. sp. #1	AMNH 74438	1	alc	>150	Venezuela: AM: Rio Mawarinuma
<i>Bunocephalus</i> n. sp. #2	AMNH 74435	1	xr	55	Venezuela: AM: Rio Mawarinuma
<i>Bunocephalus</i> n. sp. #2	AMNH 74436	9	c&s;xr	44-70	Venezuela: AM: Rio Mawarinuma
<i>Bunocephalus</i> n. sp. #2	AMNH 74437	5	xr	50-64	Venezuela: AM: Rio Mawarinuma
<i>Bunocephalus</i> n. sp. #2	ANSP 163006	1	alc	44	Venezuela: AM: Rio Casiquiare
<i>Bunocephalus</i> n. sp. #2	MBUCV 14851	1	alc	69	Venezuela: AM: Rio Baria
<i>Bunocephalus</i> n. sp. #2	MBUCV 6295	1	alc	49	Venezuela: AM: Caño Pamoni
<i>Bunocephalus</i> n. sp. #2	USNM 269974	1	alc	35	Venezuela: AM: Caño Urami: Santa Lucia
<i>Bunocephalus</i> n. sp. #3	MZSP 39444	2	xr		Brazil: Minas Gerais: Rio Formoso
<i>Bunocephalus</i> n. sp. #4	ANSP 160693	1	xr	73.5	Venezuela: AM: Rio Sipapo: Pendare
<i>Bunocephalus</i> n. sp. #4	ANSP 160696	1	alc	26	Venezuela: AM: Rio Sipapo: Pendare
<i>Bunocephalus</i> n. sp. #4	MBUCV	1	alc	33	Venezuela: AM: Rio Mavaca
<i>Bunocephalus</i> n. sp. #4	MCNG 22419	2	alc	38-56	Venezuela: AM: Rio Putaco
<i>Bunocephalus</i> n. sp. #4	UF 77836	2	alc	26	Venezuela: Rio Ventuari

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
<i>Bunocephalus</i> n. sp. #5	CAS 53522		xr		Brazil: Rio São Franscisco
<i>Bunocephalus</i> n. sp. #5	MSZP39480		alc		Brazil: Rio São Franscisco
<i>Bunocephalus</i> n. sp. #5	MZSP 39443		alc		Brazil: Rio São Franscisco
<i>Bunocephalus</i> sp.	AMNH 78086	19	c&s	50-67	Peru: Loreto: Rio Tahuayo
<i>Bunocephalus</i> sp.	ANSP 128945	14	c&s;xr		Colombia: Caldas: Rio Miel
<i>Bunocephalus</i> sp.	CAS 59429	4	alc		Peru: Madre de Dios
<i>Bunocephalus</i> sp.	CAS 59445	1	alc		Peru: Madre de Dios
<i>Bunocephalus</i> sp.	FMNH 56667	1	xr		Colombia: Nariño: Rio Telembi
<i>Bunocephalus</i> sp.	FMNH 70277	1	alc		Peru: Loreto: Rio Nanay
<i>Bunocephalus</i> sp.	INPA 6516	1	alc		Brazil: PA: Jatobal
<i>Bunocephalus</i> sp.	INPA 6527	4	alc		Brazil: AP: San Antonio da Cachoeira
<i>Bunocephalus</i> sp.	INPA 6533	2	alc		Brazil: RR: Rio Uraricoera: Santa Rosa
<i>Bunocephalus</i> sp.	SU 49467	3	alc		Colombia: Cordoba
<i>Bunocephalus</i> sp.	UF 17213	1	xr		Colombia: Atlantico
<i>Bunocephalus</i> sp.	UF 26219	1	alc		Colombia: AM: Letcia
<i>Bunocephalus</i> sp.	UF 33074	1	alc		Peru: Loreto
<i>Bunocephalus</i> sp.	UF 33848	1	alc		Colombia: AM: Letcia
<i>Bunocephalus</i> sp.	UF 80214	1	alc		Bolivia: Beni
<i>Bunocephalus</i> sp.	USNM 121244	1	alc		Colombia: Caqueta: Rio Orteguaza
<i>Bunocephalus</i> sp.	USNM 175314	2	alc		Colombia: Cordonba
<i>Bunocephalus</i> sp.	USNM 220851	3	alc		Colombia: AM: Leticia
<i>Bunocephalus</i> sp.	USNM 263869	4	alc		Peru: Madre de Dios: Rio Tambopata
<i>Bunocephalus</i> sp.	USNM 301689	1	alc		Bolivia: Beni: Rio Curiraba
<i>Bunocephalus</i> sp.	AMNH 58454	3	alc	39-71	Venezuela: GU
<i>Bunocephalus</i> sp.	AMNH 58457	3	alc		Venezuela: PO
<i>Bunocephalus</i> sp.	ANSP 131470	1	alc		Colombia: Meta
<i>Bunocephalus</i> sp.	ANSP 131571	2	alc		Colombia: Meta: Rio Metica
<i>Bunocephalus</i> sp.	ANSP 131572	1	alc		Colombia: Meta: Rio Negritio
<i>Bunocephalus</i> sp.	ANSP 131573	2	alc		Colombia: Meta
<i>Bunocephalus</i> sp.	ANSP 131576	10	alc		Colombia: Meta
<i>Bunocephalus</i> sp.	ANSP 131577	1	alc		Venezuela
<i>Bunocephalus</i> sp.	ANSP 131578	1	alc		Venezuela: GU
<i>Bunocephalus</i> sp.	ANSP 133135	16	alc		Colombia: Meta
<i>Bunocephalus</i> sp.	ANSP 134444	19	alc		Colombia: Meta

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
<i>Bunocephalus</i> sp.	ANSP 135632	166	c&s		Venezuela: BO
<i>Bunocephalus</i> sp.	ANSP 160151	5	alc		Venezuela: BO
<i>Bunocephalus</i> sp.	ANSP 160161	1	alc		Venezuela: BO
<i>Bunocephalus</i> sp.	ANSP 160240	2	alc		Venezuela: BO
<i>Bunocephalus</i> sp.	ANSP 160855	1	alc		Venezuela: BO
<i>Bunocephalus</i> sp.	ANSP 163473	2	alc		Venezuela: GU
<i>Bunocephalus</i> sp.	ANSP 163505	5	alc		Venezuela: GU
<i>Bunocephalus</i> sp.	ANSP 165170	1	alc		Venezuela: GU: Rio Orituco
<i>Bunocephalus</i> sp.	ANSP 165306	1	alc		Venezuela: AP
<i>Bunocephalus</i> sp.	ANSP 165432	13	alc		Venezuela: AP
<i>Bunocephalus</i> sp.	ANSP 166610	2	alc		Venezuela: AN: Soledad
<i>Bunocephalus</i> sp.	ANSP 166611	5	alc		Venezuela: AN: Soledad
<i>Bunocephalus</i> sp.	ANSP 166612	7	alc		Venezuela: AN: Soledad
<i>Bunocephalus</i> sp.	ANSP 167920	8	alc		Venezuela: BO
<i>Bunocephalus</i> sp.	ANSP 167921	1	alc		Venezuela: BO: Rio Corumo
<i>Bunocephalus</i> sp.	ANSP 167922	3	alc		Venezuela: BO: Rio Macaruma
<i>Bunocephalus</i> sp.	FMNH 94758	1	alc		Colombia: Vaupes
<i>Bunocephalus</i> sp.	INPA 4117	2	alc		Brazil: PA:
<i>Bunocephalus</i> sp.	MBUCV 15255	148	c&s		Venezuela: AR
<i>Bunocephalus</i> sp.	MBUCV 15363	7	alc		Venezuela: AN
<i>Bunocephalus</i> sp.	MCNG 06038	63	alc		Venezuela: AP
<i>Bunocephalus</i> sp.	MCNG 14305	3	alc		Venezuela: MI
<i>Bunocephalus</i> sp.	UF 26051	2	alc		Venezuela: PO
<i>Bunocephalus</i> sp.	UF 32369	2	alc		Venezuela: PO
<i>Bunocephalus</i> sp.	UF 36150	4	alc		Venezuela: PO
<i>Bunocephalus</i> sp.	UF 77836	2	alc		Venezuela: AM
<i>Bunocephalus</i> sp.	UF 77901	32	alc		Venezuela: AP
<i>Bunocephalus</i> sp.	UF 78152	1	c&s		Venezuela: GU-CO
<i>Bunocephalus</i> sp.	UF 80215	5	alc		Venezuela: BA
<i>Bunocephalus</i> sp.	UF 80216	1	alc		Venezuela: PO-BA
<i>Bunocephalus</i> sp.	UF 80217	6	alc		Venezuela: BO
<i>Bunocephalus</i> sp.	USNM 220858	1	alc		Peru: Shanso Cano
<i>Bunocephalus</i> sp.	USNM 257967	1	alc		Venezuela: GU
<i>Bunocephalus</i> sp.	USNM 260191	22	c&s		Venezuela: AP

Table 4. Comparative Materials Examined Cont.

Taxon	Catalog #	# of spec.	Prep.	SL in mm	Locality
<i>Bunocephalus verrucosus</i>	AMNH 78043	2	alc		Peru: Loreto: Rio Tahauyo
<i>Bunocephalus verrucosus</i>	ANSP 165749	1	alc		Brazil: AM
<i>Bunocephalus verrucosus</i>	ANSP 167633	1	alc		Peru: Loreto
<i>Bunocephalus verrucosus</i>	FMNH 70626	1	alc		Brazil: AM: Manaus
<i>Bunocephalus verrucosus</i>	FMNH 99475	4	alc		Ecuador: Napo
<i>Bunocephalus verrucosus</i>	FMNH 99476	1	alc		Ecuador: Napo
<i>Bunocephalus verrucosus</i>	FMNH 99478	1	alc		Ecuador: Napo
<i>Bunocephalus verrucosus</i>	FMNH 99479	6	alc		Ecuador: Napo
<i>Bunocephalus verrucosus</i>	FMNH 99485	12	c&s		Ecuador: Napo
<i>Bunocephalus verrucosus</i>	INPA 4395	32	alc		Brazil: RR: Rio Uraricoera
<i>Bunocephalus verrucosus</i>	INPA 6521	2	alc		Brazil: AM
<i>Bunocephalus verrucosus</i>	INPA 6534	2	alc		Brazil: RR: Rio Uraricoera
<i>Bunocephalus verrucosus</i>	MCZ 36514	1	alc		Brazil: AM: Rio Jutahy
<i>Bunocephalus verrucosus</i>	MCZ 7967	1	alc		Brazil: AM: Rio Jutahy
<i>Bunocephalus verrucosus</i>	MPM 30584	1	alc		Peru
<i>Bunocephalus verrucosus</i>	MZSP 23349	7	alc	50-95	Brazil: AM: Fonte Boa
<i>Bunocephalus verrucosus</i>	MZSP 30698	3	alc	32-47	Brazil: AC: Rio Tarauacá
<i>Bunocephalus verrucosus</i>	MZSP 30700	3	alc	35-63	Brazil: RR: Caracaraí
<i>Bunocephalus verrucosus</i>	MZSP 30701	9	alc	28-93	Brazil: AC: Tarauacá
<i>Bunocephalus verrucosus</i>	MZSP 7362	15	alc	42-68	Brazil: AM: Maués
<i>Bunocephalus verrucosus</i>	ROM 62085	4	alc		Guyana
<i>Bunocephalus verrucosus</i>	ROM 62086	2	alc		Guyana
<i>Bunocephalus verrucosus</i>	ROM 62219	1	alc		Guyana
<i>Bunocephalus verrucosus</i>	ROM 62220	2	alc		Guyana
<i>Bunocephalus verrucosus</i>	ROM 62221	1	alc		Guyana
<i>Bunocephalus verrucosus</i>	ROM 62222	2	alc		Guyana
<i>Bunocephalus verrucosus</i>	ROM 62223	1	alc		Guyana
<i>Bunocephalus verrucosus</i>	USNM 197799	3	alc		Guyana: Demerara
<i>Bunocephalus verrucosus</i>	USNM 226079	52	c&s		Surinamee: Nickerie
<i>Bunocephalus verrucosus</i>	USNM 284548	3	c&s		Peru: Loreto: Iquitos
<i>Bunocephalus verrucosus</i>	USNM 305311	2	alc		Brazil: AM: Maués
<i>Dupouyichthys sapito</i>	FMNH 85938	1	xr		Venezuela: ZU: Rio Guasare: El Paso
<i>Dupouyichthys sapito</i>	MCNG 25015	8	c&s; xr	20-25	Venezuela: TR: Rio Yasa
<i>Dupouyichthys sapito</i>	MCZ 37295	1 paratype	alc		Venezuela: ZU: Rio San Juan

Table 4. Comparative Materials Examined Cont.

Taxon	Catalog #	# of spec.	Prep.	SL in mm	Locality
<i>Dupouyichthys sapito</i>	USNM 121073	3 paratypes	c&s; xr	21-22.7	Venezuela: TR: Rio Matatán
<i>Dupouyichthys sapito</i>	USNM 1323798	2	alc		Colombia: Santander: Rio Lebrija
<i>Ernstichthys anduzei</i>	FMNH 94441	1	xr	35.3	Venezuela: BA: Rio Bocono: La Veguita
<i>Ernstichthys anduzei</i>	MCNG 02762	2	c&s; xr	33	Venezuela: BA: Rio Bocono: La Veguita
<i>Ernstichthys anduzei</i>	UF 35393	1	xr	32.8	Venezuela: PO: Rio Tucupido: Guanare
<i>Ernstichthys intonsus</i>	FMNH 94603	holotype	xr	49.6	Ecuador: Napo: Añangu
<i>Ernstichthys megistus</i>	UNCAT	3	c&s; xr	15-24	Ecuador: Rio Tigrillo
<i>Ernstichthys. sp.</i>	MZSP 36180	1	xr	12	Brazil: PA: São Luis
<i>Ernstichthys. sp.</i>	MZSP 37814	8	xr	22-25	Brazil: MG: Aripuanã
<i>Ernstichthys. sp.</i>	USNM 303059	1	alc	28	Peru: Madre de Dios: Manu
<i>Hoplomyzon atrizona</i>	UF 30762	1	alc	19	Venezuela: TA: Rio Orope
<i>Hoplomyzon atrizona</i>	USNM 121071	1 paratype	xr	24.7	Venezuela: TR: Motatan
<i>Hoplomyzon atrizona</i>	USNM 130639	1 paratype	alc		Venezuela: TA: Rio Zulia
<i>Hoplomyzon n. sp.</i>	MCNG 00375	1	xr	17.8	Venezuela: ZU: Caño La Raya
<i>Hoplomyzon n. sp.</i>	MCNG 11560	1	xr	15.3	Venezuela: ZU: Rio Ariquaisa
<i>Hoplomyzon n. sp.</i>	MCNG 26955	1	alc	15.9	Venezuela: ZU: Rio Santa Ana
<i>Hoplomyzon papillatus</i>	FMNH 94908	holotype	xr	16.9	Ecuador: Napo: Rio Augarico
<i>Hoplomyzon cf. papillatus</i>	MCNG 24228	1	alc		Venezuela: C0
<i>Hoplomyzon sexpapilostoma</i>	UF 47525	5 paratypes	c&s; xr		Venezuela: BA: Rio Masperro at Dam
<i>Hoplomyzon sp.</i>	USNM 127073	1	c&s		Venezuela?
<i>Hoplomyzon sp.</i>	USNM 194160	2	alc		Venezuela: BA: Rio Corozo
<i>Platystacus cotylephorus</i>	FMNH 69824	6	alc	110-246	Brazil
<i>Platystacus cotylephorus</i>	MBUCV 12387	34	c&s	75-117	Venezuela
<i>Platystacus cotylephorus</i>	MBUCV 13068	2	alc	144-160	Venezuela
<i>Platystacus cotylephorus</i>	MCZ 7978	5	c&s	128-210	Brazil
<i>Platystacus cotylephorus</i>	MZSP 23998	3	alc	80-102	Brazil
<i>Platystacus cotylephorus</i>	RMNH66328	1	alc		Guyana
<i>Platystacus cotylephorus</i>	UF 28331	2	alc	250-252	Surinamee
<i>Platystacus cotylephorus</i>	USNM 159226	1	alc	298	Surinamee
<i>Platystacus cotylephorus</i>	USNM 226083	1	alc	75	Surinamee
<i>Platystacus cotylephorus</i>	USNM 87834	2	alc	161	Surinamee
<i>Pseudobunocephalus amazonicus</i>	AMNH 39880	1	alc	20	Bolivia: Beni: Rio Itenez
<i>Pseudobunocephalus amazonicus</i>	AMNH 78105	10	c&s	24-43	Peru: Loreto: Rio Yarapa
<i>Pseudobunocephalus amazonicus</i>	AMNH 78107	9	alc	28-44	Peru: Loreto: Rio Tahuayo

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
<i>Pseudobunocephalus amazonicus</i>	INPA 6522	3	alc	27.5-28	Brazil: AM: Rio Javari
<i>Pseudobunocephalus amazonicus</i>	INPA 6530	2	alc	24.5-31	Brazil: AM
<i>Pseudobunocephalus amazonicus</i>	MCZ 75986	1	alc	28	Brazil: AM: Lago Badajos
<i>Pseudobunocephalus amazonicus</i>	MCZ 7979	6	c&s	26.5-28	Brazil: AM: Rio Javari
<i>Pseudobunocephalus amazonicus</i>	MCZ 7980	1	alc	25.3	Brazil: AM: Tabatinga
<i>Pseudobunocephalus amazonicus</i>	MZSP 9678	3	alc	23-25	Brazil: AM: Codajás
<i>Pseudobunocephalus amazonicus</i>	UMMZ 204301	5	alc	20-20.5	Bolivia: Beni: Rio Itenez
<i>Pseudobunocephalus amazonicus</i>	UMMZ 205164	5	alc	19.5-26	Bolivia: Beni: Rio Itenez
<i>Pseudobunocephalus amazonicus</i>	USNM 220851	3	alc	37-44.5	Colombia: AM: Leticia
<i>Pseudobunocephalus amazonicus</i>	USNM 301686	11	alc	20-26	Bolivia: Beni
<i>Pseudobunocephalus bifidus</i>	AMNH 39837	5	alc	24.5-27	Bolivia: Beni: Rio Itenez
<i>Pseudobunocephalus bifidus</i>	AMNH 57016	1	alc	24.5	Bolivia: Beni: Rio Itenez
<i>Pseudobunocephalus bifidus</i>	AMNH 78102	5	c&s;xr	38-42.5	Peru: Loreto: Rio Tahuayo
<i>Pseudobunocephalus bifidus</i>	CAS 31466	1	alc	35.4	Bolivia: Beni: Lago Rogoagua
<i>Pseudobunocephalus bifidus</i>	CAS 31467	1	alc	28.8	Bolivia: Beni: Lago Rogoagua
<i>Pseudobunocephalus bifidus</i>	CAS 35106	4 paratypes	alc	33-43	Peru: Loreto: Yurimaguas
<i>Pseudobunocephalus bifidus</i>	FMNH 99484	1	alc	30.5	Ecuador: Napo: Rio Cuyabeno
<i>Pseudobunocephalus bifidus</i>	INPA 6522	3	alc	42.5	Brazil: AM: Rio Javari
<i>Pseudobunocephalus bifidus</i>	MZSP 30708	11	alc	24-50	Brazil: AC: Tarauacá
<i>Pseudobunocephalus bifidus</i>	UMMZ 204301	5	alc	25.5-36.5	Bolivia: Beni: Rio Itenez
<i>Pseudobunocephalus bifidus</i>	USNM 191561	1	alc	55.2	Brazil: GO: Aruana
<i>Pseudobunocephalus bifidus</i>	USNM 300984	1	alc	50.5	Peru: Madre de Dios: Manu
<i>Pseudobunocephalus bifidus</i>	USNM 302707	1	alc	26	Peru: Madre de Dios: Manu
<i>Pseudobunocephalus cf. bifidus</i>	INPA 6532	4	alc	23.5-25.2	Brazil: PA: Itupiranga
<i>Pseudobunocephalus cf. bifidus</i>	MZSP 22796	1	alc	30-32	Brazil: PA: Canindé
<i>Pseudobunocephalus cf. bifidus</i>	MZSP 30709	1	alc	25	Brazil: RO: Rio Machado
<i>Pseudobunocephalus cf. bifidus</i>	USNM 305861	42	alc	27-36	Bolivia: Beni: Rio Maniquí
<i>Pseudobunocephalus iheringii</i>	CAS 53521	1	alc	44	Brazil: RJ: Capivary
<i>Pseudobunocephalus iheringii</i>	FMNH 70628	23	alc	13-47	Brazil: RS: Cacequi
<i>Pseudobunocephalus iheringii</i>	FMNH 70629	8	alc	29-48	Uruguay: Treinta y Tres
<i>Pseudobunocephalus iheringii</i>	FMNH 88242	6	alc	34-47	Brazil: RS: Uruguaiana
<i>Pseudobunocephalus iheringii</i>	MCZ 31583	1	alc	39	Brazil: MG: Morro Agudo
<i>Pseudobunocephalus iheringii</i>	MZSP 23165	1	alc	28	Brazil: RS: São Leopoldo
<i>Pseudobunocephalus iheringii</i>	MZSP 23187	1	alc	28	Brazil: RS: São Leopoldo

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
<i>Pseudobunocephalus iheringii</i>	MZSP 23191	2	alc	41-44	Brazil: RS: São Leopoldo
<i>Pseudobunocephalus iheringii</i>	MZSP 40966	2	alc	22-25	Brazil: RS: Itaqui
<i>Pseudobunocephalus iheringii</i>	MZSP 43337	1	alc	44	Brazil: RS: Itaqui
<i>Pseudobunocephalus iheringii</i>	SU 24072	1	alc	25	Brazil: MG: Morro Agudo
<i>Pseudobunocephalus iheringii</i>	UMMZ 206226	2	alc	41-45	Paraguay: Alto Parana
<i>Pseudobunocephalus iheringii</i>	UMMZ 206289	4	alc	35-41	Paraguay: Canendiyu
<i>Pseudobunocephalus iheringii</i>	USNM 092975	2	alc	25-26	Brazil: MG: Morro Agudo
<i>Pseudobunocephalus iheringii</i>	USNM 181480	1	alc	23	Paraguay: Misiones: Florida
<i>Pseudobunocephalus iheringii</i>	USNM 301690	8	xr	41-48	Brazil: RJ: Rio Regane
<i>Pseudobunocephalus lundbergi</i> n. sp.	ANSP 131574	4	alc	19.5-22.5	Colombia: Meta: La Defensa
<i>Pseudobunocephalus lundbergi</i> n. sp.	ANSP 134530	1	alc	24.3	Colombia: Meta: La Siberia
<i>Pseudobunocephalus lundbergi</i> n. sp.	ANSP 168815	4	alc	22-23	Colombia: Meta: La Siberia
<i>Pseudobunocephalus lundbergi</i> n. sp.	ANSP 168817	holotype	alc	28	Venezuela: BO
<i>Pseudobunocephalus lundbergi</i> n. sp.	ANSP 172504	10 paratypes	xr; alc	20-29	Venezuela: BO
<i>Pseudobunocephalus lundbergi</i> n. sp.	ANSP 172505	425 paratypes	c&s; alc	20-30	Venezuela: BO
<i>Pseudobunocephalus lundbergi</i> n. sp.	MCNG 21122	3	alc	24.6-26.4	Venezuela: BO
<i>Pseudobunocephalus lundbergi</i> n. sp.	MCNG 23669	2	alc	22.5-23	Venezuela: BA
<i>Pseudobunocephalus lundbergi</i> n. sp.	MCNG 23671	13	c&s	20-23	Venezuela: AP
<i>Pseudobunocephalus rugosus</i>	AMNH 59797	9	alc	22-25	Paraguay: Pres. Hayes: Rio Confuso
<i>Pseudobunocephalus rugosus</i>	CAS 35241	3	alc	20.8-21.5	Brazil: MS: Corumbá
<i>Pseudobunocephalus rugosus</i>	FMNH 52615	1	alc	22	Brazil: MS: Corumbá
<i>Pseudobunocephalus rugosus</i>	MZSP 36433	2	alc	22-23	Brazil: MS: Corumbá
<i>Pseudobunocephalus rugosus</i>	MZSP 4461	2	alc	19-22	Brazil: MT: Santo Antonio do Leverger
<i>Pseudobunocephalus rugosus</i>	UMMZ 205514	1	alc	30	Paraguay: Central: Rio Salado
<i>Pseudobunocephalus rugosus</i>	UMMZ 205875	2	alc	17-20	Paraguay: Central
<i>Pseudobunocephalus rugosus</i>	UMMZ 206973	6	c&s	17-30	Paraguay: Pres. Hayes
<i>Pseudobunocephalus rugosus</i>	UMMZ 207567	3	alc	27-30	Paraguay: Pres. Hayes
<i>Pseudobunocephalus rugosus</i>	UMMZ 207820	8	alc	22-38	Paraguay: Conception
<i>Pseudobunocephalus rugosus</i>	UMMZ 207894	3	alc	15-25	Paraguay: Conception
<i>Pseudobunocephalus rugosus</i>	USNM 232383	3	alc	19-27	Paraguay: Pres. Hayes
<i>Pseudobunocephalus</i> sp.	FMNH 70635	12	alc	22	Brazil: RO: Rio Gaupore: Maciel
<i>Pseudobunocephalus</i> sp.	MZSP 28341	1	alc	17	Brazil: MT: Rio Pixaim
<i>Pseudobunocephalus</i> sp.	SU 36202	1	alc	24.5	Peru: Loreto: Pivas
<i>Pseudobunocephalus</i> sp.	UF 26219	1	alc	32.5	Colombia: AM: Leticia

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
<i>Pseudobunocephalus</i> sp.	UF 33848	1	alc	35	Colombia: AM: Leticia
<i>Pseudobunocephalus</i> sp.	UF 80214	1	alc	27.5	Bolivia: Beni
<i>Pseudobunocephalus</i> sp.	CAS 31470	3	alc	16-29	Brazil: RS
<i>Pseudobunocephalus</i> sp.	SU 40100	2	alc		Argentina: Buenos Aires
<i>Pseudobunocephalus</i> sp.	USNM 301687	1	alc	27.5	Brazil: AM: Manaus
<i>Pterobunocephalus depressus</i>	FMNH 54338	holotype	xr	53.3	Bolivia: Beni: San Joaquin: Rio Machupo
<i>Pterobunocephalus dolichurus</i>	ANSP 139244	4	xr	37.6-42.4	Brazil: AM: Moura
<i>Pterobunocephalus dolichurus</i>	ANSP 84943	4	xr	50.3-56.8	Peru: Loreto: Iquitos
<i>Pterobunocephalus dolichurus</i>	ANSP 84944	1	c&s		Peru: Loreto: Iquitos
<i>Pterobunocephalus</i> sp.	AMNH 37014	1	xr	46	Bolivia: Beni
<i>Pterobunocephalus</i> sp.	ANSP 130605	4	xr	47.4-64.2	Ecuador: Napo: Santa Cecilia
<i>Pterobunocephalus</i> sp.	ANSP 130606	1	c&s		Ecuador: Napo: Santa Cecilia
<i>Pterobunocephalus</i> sp.	CAS 59429	4	xr	38.6-86.3	Peru: Madre de Dios
<i>Pterobunocephalus</i> sp.	CAS 59945	1	xr	50.7	Peru: Madre de Dios
<i>Pterobunocephalus</i> sp.	FMNH 70625	1	xr	43.7	Brazil: RO: Maciél
<i>Pterobunocephalus</i> sp.	INPA 8395	1	alc	39.6	Brazil: PA: Ihla Itugui
<i>Pterobunocephalus</i> sp.	INPA 6526	2	alc	35.3-66.2	Brazil: aquarium fishes from Manaus
<i>Pterobunocephalus</i> sp.	INPA 6529	1	alc		Brazil: AM: Furo Paracuuba
<i>Pterobunocephalus</i> sp.	MCNG 01236	1	xr	30	Venezuela: AP
<i>Pterobunocephalus</i> sp.	MCNG 07404	1	xr	38.3	Venezuela: BA
<i>Pterobunocephalus</i> sp.	MZSP 43336	3	alc	38-88.7	Peru: Ucayali: Rio Neshuya
<i>Pterobunocephalus</i> sp.	UMMZ 206337	1	xr	40.4	Paraguay: Canendiyu: Ygatimi
<i>Pterobunocephalus</i> sp.	UMMZ 206796	1	xr	44.7	Paraguay: Amambay: Bella Vista
<i>Xyliophius kryptos</i>	MCNG 27310	3	alc		Venezuela: TR
<i>Xyliophius lepturus</i>	FMNH 99486	1	alc	18.3	Ecuador: Napo: San Pablo Kantesiya
<i>Xyliophius lepturus</i>	FMNH 99487	2	alc	100-101	Ecuador: Napo
<i>Xyliophius lepturus</i>	FMNH 99488	4	c&s	37-67	Ecuador: Napo: Anangu
<i>Xyliophius lepturus</i>	FMNH 99489	1	alc	107	Ecuador: Napo
<i>Xyliophius lepturus</i>	FMNH 99490	1	alc	61.5	Ecuador: Napo: Puerto Misahualli
<i>Xyliophius lepturus</i>	FMNH 99491	1	alc	114	Ecuador: Napo: Rio Coca
<i>Xyliophius lepturus</i>	MCZ 48678	2	alc	102-109	Ecuador: Napo-Pastaza: Montalvo
<i>Xyliophius lepturus</i>	ROM 47094	1	alc	106	Peru
<i>Xyliophius lepturus</i>	USNM 301688	1	alc	106	Ecuador: Napo: Conception
<i>Xyliophius cf. lepturus</i>	ANSP 128940	1	xr	76	Colombia: Meta: Rajote

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
<i>Xyliphius cf. lepturus</i>	ANSP 128941	1	alc	97	Colombia: Meta: Rio Guayuriba
<i>Xyliphius cf. lepturus</i>	MCNG 05547	33	c&s;xr	109	Venezuela: PO-BA: Rio Bocono
<i>Xyliphius cf. lepturus</i>	MCNG 23517	1	xr	102	Venezuela: TA: Rio Camburito
<i>Xyliphius magdalenae</i>	FMNH 56039	holotype	alc	25	Colombia: Cundinamarca: Giradot
<i>Xyliphius magdalenae</i>	SU 37075	1	alc	60	Colombia: Tolima: Honda
<i>Xyliphius magdalenae</i>	USNM 120224	2	xr	57-80	Colombia: Tolima: Honda
<i>Xyliphius melanopterus</i>	FMNH 99492	1	alc	103	Ecuador: Napo: Tiputini
<i>Xyliphius melanopterus</i>	FMNH 99493	2	c&s	105	Ecuador: Napo
<i>Xyliphius melanopterus</i>	FMNH 99494	2	xr	60-73	Ecuador: Napo
<i>Xyliphius melanopterus</i>	FMNH 99495	3	alc	59-123	Ecuador: Napo: Anangu
<i>Xyliphius melanopterus</i>	MZSP 38679	1	alc	66	Ecuador: Napo: Anangu
<i>Xyliphius cf. melanopterus</i>	DUF (T3179)	1	c&s		Venezuela
<i>Xyliphius cf. melanopterus</i>	DUF 999	1	sk		Venezuela
<i>Xyliphius cf. melanopterus</i>	MCNG 23518	2	alc	147	Venezuela: TA: Rio Camburito
Auchenipteridae					
<i>Ageneiosus brevifilis</i>	DU F927	1	dry	133	Venezuela
<i>Ageneiosus sp.</i>	DU 1145	1	c&s	60	Venezuela
<i>Ageneiosus ucayalensis</i>	DU F1068	1	dry	316	Venezuela
<i>Ageneiosus ucayalensis</i>	DU F1161	1	dry	162	Venezuela
<i>Ageneiosus ucayalensis</i>	DU F928	1	dry	226	Venezuela
<i>Auchenipterichthys thoracatus</i>	UNCAT	2	c&s	63-66	aquarium spec.
<i>Entomocorus benjamini</i>	DU F1146	2	c&s	50-52	Venezuela
<i>Entomocorus benjamini</i>	FMNH 97085	1	c&s	50	Venezuela
<i>Epapterus dispilurus</i>	USNM 263115	1	c&s	81	Peru
<i>Trachelyopterus galeatus</i>	ANSP 167889	1	c&s	90	Venezuela
<i>Trachelyopterus sp.</i>	DU F1171	1	c&s	80	Venezuela
Bagridae					
Auchenoglaninae					
<i>Auchenoglanis occidentalis</i>	UMMZ 200182	1	c&s	113	Zambia
<i>Parauchenoglanis sp.</i>	USNM 303328	1	c&s	49	Cameroon

Table 4. Comparative Materials Examined Cont.

Taxon	Catalog #	# of spec.	Prep.	SL in mm	Locality
Bagrinae					
<i>Aorichthys</i> sp.	DUF?	1	c&s	83	
<i>Bagroides malapterus</i>	UMMZ 155695	1	c&s	87	Sumatra
<i>Hemibagrus macropterus</i>	AMNH 10261	1	c&s	83	China
<i>Liocassis siamensis</i>	UMMZ 186730	1	c&s	42-56	Thailand
<i>Mystus cavasius</i>	UMMZ 186731	1	c&s	59	Thailand
<i>Mystus gulio</i>	UMMZ 186724	1	c&s	55	Thailand
<i>Mystus nemurus</i>	UMMZ 186685	1	c&s	50	Thailand
<i>Mystus nemurus</i>	AMNH 58309	1	c&s	113	aquarium spec.
<i>Mystus vittatus</i>	UMMZ 186780	1	c&s	63	Thailand
<i>Pelteobagrus nudiceps</i>	UMMZ 187592-S	1	dry	166	Japan
<i>Pseudobagrus adiposalis</i>	DU F1121	1	c&s	115	China
<i>Pseudobagrus aurantiacus</i>	UMMZ 183870	1	c&s	65	Japan
Claroteinae					
<i>Chrysichthys walkeri</i>	UMMZ 187901	3	c&s	57-65	Sierra Leone
Callichthyidae					
<i>Corydoras barbatus</i>	UNCAT	1	c&s	35	aquarium spec.
<i>Corydoras</i> sp.	DU F1147	2	c&s	38	aquarium spec.
<i>Hoplosternum thoracatum</i>	DU F1061	1	dry	169	Venezuela
<i>Hoplosternum thoracatum</i>	DU F1062	1	dry	152	Venezuela
<i>Hoplosternum thoracatum</i>	DU F1171	1	dry		Venezuela
Centromochlidae					
<i>Centromochlus</i> sp.	ANSP160989	1	c&s	47	Venezuela
Cetopsidae					
<i>Bathycetopsis oliverai</i>	DU F1170	1	c&s	25	Brazil
<i>Cetopsis coecutiens</i>	DU F843	1	c&s	134	Brazil
<i>Cetopsis</i> sp.	ANSP 165734	2	c&s	34-36	Venezuela
<i>Cetopsogiton</i> sp.	MCZ 48769	1	c&s	93	Ecuador
<i>Hemicetopsis candiru</i>	MCZ 8138	1	c&s	90	Brazil
<i>Pseudocetopsis amphioxia</i>	USNM 305348	1	c&s	73	Colombia

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
Chacidae					
<i>Chaca bankanensis</i>	DU F1148	1	dry	80	aquarium spec.
<i>Chaca bankanensis</i>	UNCAT	1	c&s	102	aquarium spec.
Clariidae					
<i>Clarias batrachus</i>	UNCAT	1	c&s	103	Florida
Cranoglanididae					
<i>Cranoglanis multiradiatus</i>	DU F917	1	c&s	56	P. R. of China
Diplomystidae					
<i>Olivaicichthys viedmensis</i>	DU F913	1	c&s	115	Argentina
Doradidae					
<i>Amblydoras sp.</i>	FMNH 96571	1	c&s	59	Ecuador
<i>Hemidoras carinatus</i>	FMNH 53192	1	c&s	105	Guyana
<i>Leptodoras sp.</i>	DU F847	1	c&s	105	Venezuela
<i>Megalodoras iriwini</i>	DU F1041	1	dry	430	Venezuela
<i>Megalodoras iriwini</i>	DU F1045	1	dry	440	Venezuela
<i>Megalodoras iriwini</i>	DU F1069	1	dry	345	Venezuela
<i>Megalodoras iriwini</i>	DU F1126	1	dry	345	Venezuela
<i>Megalodoras iriwini</i>	DU F925	1	dry	133	Venezuela
<i>Megalodoras iriwini</i>	DU F996	1	dry		Venezuela
<i>Orinocodoras eigenmanni</i>	DU F926	1	dry	198	Venezuela
<i>Oxydoras niger</i>	DU F1092	1	dry		Venezuela
<i>Platydoras costatus</i>	DU F1105	1	dry	198	Venezuela
<i>Platydoras costatus</i>	DU F1106	1	dry	111	Venezuela
<i>Platydoras costatus</i>	FMNH 85829	1	c&s	56	Venezuela
<i>Pterodoras angeli</i>	DU F1128	1	dry	83	Venezuela
Helogenidae					
<i>Helogenes marmoratus</i>	USNM 264030	1	c&s	51	Peru
<i>Helogenes marmoratus</i>	ANSP 165748	2	c&s	38-44	Brazil
<i>Helogenes marmoratus</i>	UF 16283	1	c&s	45	Suriname

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
Heteropneustidae					
<i>Heteropneustes fossilis</i>	USNM 274063	1	c&s	85	Thailand
†Hypsidoridae					
<i>†Hypsidoris farsonensis</i>	FMNH PF10453	1	cast	160	Wyoming
Ictaluridae					
<i>Ameiurus brunneus</i>	DU F1137	1	c&s	59	North Carolina
<i>Ameiurus natalis</i>	DU F916	2	c&s	77-85	North Carolina
<i>Ameiurus natalis</i>	DU F1135	1	c&s	35	North Carolina
<i>Ameiurus nebulosus</i>	UNCAT	1	c&s	91	Florida
<i>Ameiurus nebulosus</i>	DU F1133	1	c&s	32	North Carolina
<i>Ameiurus nebulosus</i>	DU F1138	1	c&s	63	North Carolina
<i>Ameiurus platycephalus</i>	DU F1192	1	dry	41	North Carolina
<i>Ictalurus punctatus</i>	DU F930	2	c&s	50-51	North Carolina
<i>Ictalurus punctatus</i>	DU F1018	1	c&s	197	North Carolina
<i>Ictalurus punctatus</i>	DU F1131	1	c&s	43	North Carolina
<i>Ictalurus punctatus</i>	DU F1134	1	c&s	42	North Carolina
<i>Noturus furiosus</i>	DU F1136	2	c&s	46	North Carolina
<i>Noturus furiosus</i>	DU F1139	1	c&s	62	North Carolina
<i>Noturus gyrinus</i>	DU F1132	1	c&s	50	North Carolina
<i>Noturus insignis</i>	DU F1130	2	c&s	40-45	North Carolina
<i>Noturus insignis</i>	DU F1143	5	c&s	94-110	North Carolina
<i>Pylodictis olivaris</i>	FMNH 6549	1	c&s	101	Kentucky
Loricariidae					
<i>Acanthicus histrix</i>	DU F1093	1	dry	420	Venezuela
<i>Chaetostoma sp.</i>	UNCAT	1	c&s	47	Venezuela
<i>Loricariinae sp.</i>	DU F934	1	diss	107	aquarium spec.
<i>Loricaria sp.</i>	DU F1066	1	dry	263	Venezuela
<i>Loricaria sp.</i>	DU F1127	2	dry	175-195	Venezuela
<i>Panaque sp.</i>	DU F1067	1	dry	242	Venezuela
<i>Liposarcus sp.</i>	DU F1191	1	dry	242	Venezuela

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
<i>Liposarcus</i> sp.	DU F2009	1	dry	239	Venezuela
<i>Sturisoma</i> sp.	DU F1064	1	dry	294	Venezuela
<i>Sturisoma</i> sp.	DU F1065	1	dry	215	Venezuela
Malapteruridae					
<i>Malapterurus electricus</i>	USNM 303492	1	c&s	63	Cameroon
Mochokidae					
<i>Chiloglanis disneyi</i>	USNM 303583	1	c&s	55	Cameroon
<i>Chiloglanis neumanni</i>	UMMZ 199975	1	c&s	39	Zambia
<i>Synodontis acanthomias</i>	MCZ 50152	1	c&s	77	Zaire
<i>Synodontis njassae</i>	USNM 266765	1	c&s	55	Lake Malawi
<i>Synodontis schalli</i>	USNM 229806	1	c&s	61	Nigeria
<i>Synodontis</i> sp.	UNCAT	1	c&s	90	aquarium spec.
<i>Synodontis</i> sp.	UNCAT	1	dry	120	Lake Malawi
Nematogenyidae					
<i>Nematogenys inermis</i>	UNCAT	1	c&s	47	Chile
Olyridae					
<i>Olyra longicaudata</i>	UMMZ 208811	1	c&s	85	Bangladesh
<i>Olyra</i> sp.	CAS 54502	1	c&s	54	Thailand
Pangasiidae					
<i>Pangasius hypophthalmus</i>	UNCAT	2	c&s		aquarium spec..
<i>Pangasius</i> sp.	DU F907	1	dry	250	Thailand
Pimelodidae					
Pimelodinae					
<i>Brachyplatystoma filamentosum</i>	DU F1052	1	dry	220 skull	Venezuela
<i>Brachyplatystoma juruense</i>	DU F983	1	dry	185	Venezuela
<i>Brachyplatystoma juruense</i>	DU F981	1	dry	650	Venezuela
<i>Brachyplatystoma vaillanti</i>	DU F1034	1	dry	370	Venezuela

Table 4. Comparative Materials Examined Cont.

Taxon	Catalog #	# of spec.	Prep.	SL in mm	Locality
<i>Calophysus macropterus</i>	DU F1199	1	dry	236	Venezuela
<i>Duopalatinus peruanus</i>	DU F2004	1	dry	88	Venezuela
<i>Exallodontus aguanai</i>	DU F977	1	dry	166	Venezuela
<i>Exallodontus aguanai</i>	DU F865	1	dry	82	Venezuela
<i>Goslinia platynema</i>	DU F992	1	dry	415	Venezuela
<i>Hemisorubim platyrhynchos</i>	UNCAT	1	dry	290	Venezuela
<i>Hypophthalmus edentatus</i>	DU F1044	1	dry	390	Venezuela
<i>Leiarius marmoratus</i>	DU F1036	1	dry	240	Venezuela
<i>Zungaro lutkeni</i>	DU F982	1	dry	375	Venezuela
<i>Phractocephalus hemiliopterus</i>	DU F925	1	dry	265	Venezuela
<i>Pimelodus blochi</i>	UNCAT	1	dry	225	Venezuela
<i>Pimelodus grosskopfii</i>	DU F919	1	dry	220	Colombia
<i>Pimelodus ornatus</i>	DU F1193	1	dry	160	Venezuela
<i>Pimelodus pictus</i>	DU F1012	1	c&s	65	Venezuela
<i>Pimelodus clarias</i>	DU F922	1	dry	212	Colombia
<i>Pimelodus groskopfii</i>	DU F919	1	dry	220	Colombia
<i>Pinirampus pirinampu</i>	UNCAT	11	c&s	10-56	Venezuela
<i>Pseudoplatystoma fasciatum</i>	DU F991	1	dry	258	Venezuela
<i>Sorubim sp.</i>	DU F1095	1	dry	195	Venezuela
Pseudopimelodinae					
<i>Lophiosilurus alexandri</i>	FMNH 95987	1	c&s	83	Brazil
<i>Microglanis poecilus</i>	DU F1014	3	c&s	26-27	Venezuela
<i>Pseudopimelodus apurensis</i>	DU F1040	1	dry	285	Venezuela
<i>Pseudopimelodus sp.</i>	DU F2013	1	c&s	60	Guyana
<i>Pseudopimelodus zungaro</i>	DU F920	1	dry	207	Colombia
<i>Pseudopimelodus zungaro</i>	MCNG 5307	1	c&s	125	Venezuela
Rhamdiinae					
<i>Brachyrhamdia imitator</i>	ANSP 139850	2	c&s	40	Venezuela
<i>Brachyrhamdia sp.</i>	UNCAT	1	c&s	55	aquarium spec.
<i>Cetopsorhamdia sp.</i>	DU F2010	1	c&s	30	Venezuela
<i>Heptapterus sp.</i>	DU F2014	1	c&s	47	Venezuela
<i>Rhamdia sebae</i>	DU F1000	1	c&s	57	Venezuela

Table 4. Comparative Materials Examined Cont.

TAXON	CATALOG #	# OF SPEC.	PREP.	SL IN MM	LOCALITY
Plotosidae					
<i>Plotosus lineatus</i>	USNM 309546	1	c&s	50	Philippines
Schilbeidae					
<i>Schilbe mystus</i>	USNM 80213	1	c&s	68	Zambia
Scolopacidae					
<i>Scolopax dicra</i>	UF 80213	1	alc	16	Bolivia
<i>Scolopax distolothrix</i>	USNM 232408	1	c&s	13.5	Brazil
Siluridae					
<i>Belodontichthys dinema</i>	DU F906	1	dry	370	Thailand
<i>Hemisilurus mekongensis</i>	DU F904	1	dry	422	Thailand
<i>Kryptopterus sp.</i>	USNM 268725	1	c&s	124	Thailand
<i>Ompok bimaculatus</i>	SU 34864	1	c&s	130	India
<i>Parasilurus asotus</i>	UMMZ 214490	1	c&s	58	P. R. of China
<i>Parasilurus asotus</i>	DU F908	1	dry	320	P. R. of China
<i>Silurodes hypophthalmus</i>	UMMZ 155798	1	c&s	133	Java
<i>Silurus mento</i>	DU F911	1	dry	382	P. R. of China
<i>Wallafo attu</i>	DU F905	1	dry	506	Pakistan
Sisoridae					
<i>Bagarius bagarius</i>	UMMZ 186793	1	c&s	90	Thailand
<i>Conta conta</i>	UMMZ 208808	1	c&s	48	Bangladesh
<i>Erethistes pusillus</i>	UMMZ 208697	1	c&s	36	Bangladesh
<i>Euchiloglanis hodgarti</i>	ANSP 159668	1	c&s	49	Nepal
<i>Exostoma labiatum</i>	DU F973	1	c&s	140	P. R. of China
<i>Gagata cenia</i>	UMMZ 208281	1	c&s	41	Bangladesh
<i>Gagata cenia</i>	UMMZ 208356	1	c&s	46	Bangladesh
<i>Gagata nangra</i>	UMMZ 208357	2	c&s	35	Bangladesh
<i>Glyptothorax laosensis</i>	ANSP 76834	3	c&s	39-51	Thailand
<i>Glyptothorax ribeiroi</i>	UMMZ 208955	1	c&s	25	Bangladesh
<i>Glyptothorax shawi</i>	UMMZ 208967	1	c&s	24	Bangladesh

Table 4. Comparative Materials Examined Cont.

Taxon	Catalog #	# of spec.	Prep.	SL in mm	Locality
<i>Glyptothorax sp.</i>	MCZ 47232	1	c&s	55	Thailand
<i>Glyptothorax sp.</i>	UMMZ 214929	1	c&s	38	Thailand
<i>Hara hara</i>	UMMZ 208748	1	c&s	50	Bangladesh
<i>Hara jordoni</i>	UMMZ 208401	1	c&s	20	Bangladesh
<i>Laguvia shawi</i>	UMMZ 208967	1	c&s	24	Bangladesh
<i>Nangra nangra</i>	UMMZ 208357	2	c&s	35	Bangladesh
<i>Oreoglanis labiatum</i>	DU F973	1	c&s	46	P. R. of China
<i>Pseudecheneis sulcatus</i>	DU F975	1	c&s	62	P. R. of China
Trichomycteridae					
<i>Bullockia maldonadoi</i>	UNCAT	1	c&s	53	Chile
<i>Trichomycterus areolatus</i>	UNCAT	1	c&s	58	Chile
<i>Vandellia sp.</i>	UNCAT	3	c&s	45-57	Venezuela

Table 5. Morphometric data for holotype and 10 syntopic paratypes of *Pseudobunocephalus lundbergi* new gen. & sp. Standard length in mm, all other measurements expressed as thousandths of standard length.

Measurement	Holotype ANSP 168817	Mean	Range
Standard length (mm)	28.4	24.6	20.5-29.1
Snout length	53	50	40-55
Eye diameter	25	23	19-29
Interorbital width	77	83	77-93
Maxillary barbel length	194	170	145-203
Prepectoral length	151	163	151-180
Width at pectoral fin insertion	285	292	274-307
Maximum head depth	134	131	119-138
Pectoral spine length	165	177	165-186
Cleithral process length	109	115	105-124
Coracoid process length	92	91	81-98
Predorsal length	394	397	383-411
Depth at dorsal fin insertion	130	122	102-130
Dorsal spine length	134	126	112-139
Prepelvic length	433	439	421-454
Pelvic fin length	141	148	141-158
Preanal length	637	639	613-663
Anal fin base length	137	134	113-151
Caudal peduncle length	236	233	224-242
Caudal peduncle depth	56	57	52-59
Caudal-fin length	229	226	214-239

Table 6. Morphometric data for holotype and 8 syntopic paratypes of *Acanthobunocephalus nicoi* new gen. & sp. Standard length in mm, all other measurements expressed as thousandths of standard length.

Measurement	Holotype MCNG 29000	Mean	Range
Standard length (mm)	16.1	16.8	14.5-19.7
Snout length	56	61	55-69
Eye diameter	31	27	22-34
Interorbital width	93	96	93-98
Maxillary barbel length	255	243	221-268
Prepectoral length	199	210	197-248
Width at pectoral fin insertion	335	321	302-348
Maximum head depth	149	146	134-158
Pectoral spine length	199	207	188-234
Cleithral process length	124	120	107-128
Coracoid process length	112	114	102-124
Predorsal length	441	434	404-462
Depth at dorsal fin insertion	180	174	162-197
Dorsal spine length	161	148	112-166
Prepelvic length	466	471	457-490
Pelvic fin length	186	174	153-186
Preanal length	652	648	629-665
Anal-fin base length	106	107	94-126
Caudal peduncle length	211	230	211-249
Caudal peduncle depth	56	59	51-69
Caudal-fin length	242	253	242-268

Abbreviations for Figures

ACF = anterior cranial fontanel	PNP = posterior nuchal plate
ACHY = anterior ceratohyal	POPR = preopercle
BRR = branchiostegal rays	PTO = pterotic
CLEp = humeral process of cleithrum	QUA = quadrate
CORp = coracoid process	RIB = pleural rib
DEN = dentary	SCL = supracleithrum
DR1 = dorsal spinelet	SOC = supraoccipital
DR2 = dorsal spine	SPO = sphenotic
EDT = endopterygoid	V4pp = parapophysis of forth vertebra
EPO = epioccipital	V5pp = parapophysis of fifth vertebra
FRT = frontal	VADp = ventral arrector dorsalis process
HC = hemal canal	
HP = humeral process	
HS = hemal spine	
HYO = hyomandibular	
IOPR = interopercle	
LET = lateral ethmoid	
MET = mesethmoid	
MNP = middle nuchal plate	
MTPT = metapterygoid	
NS = neural spine	
OPR = opercle	
PCF = posterior cranial fontanel	
PCFR = procurent caudal-fin ray	

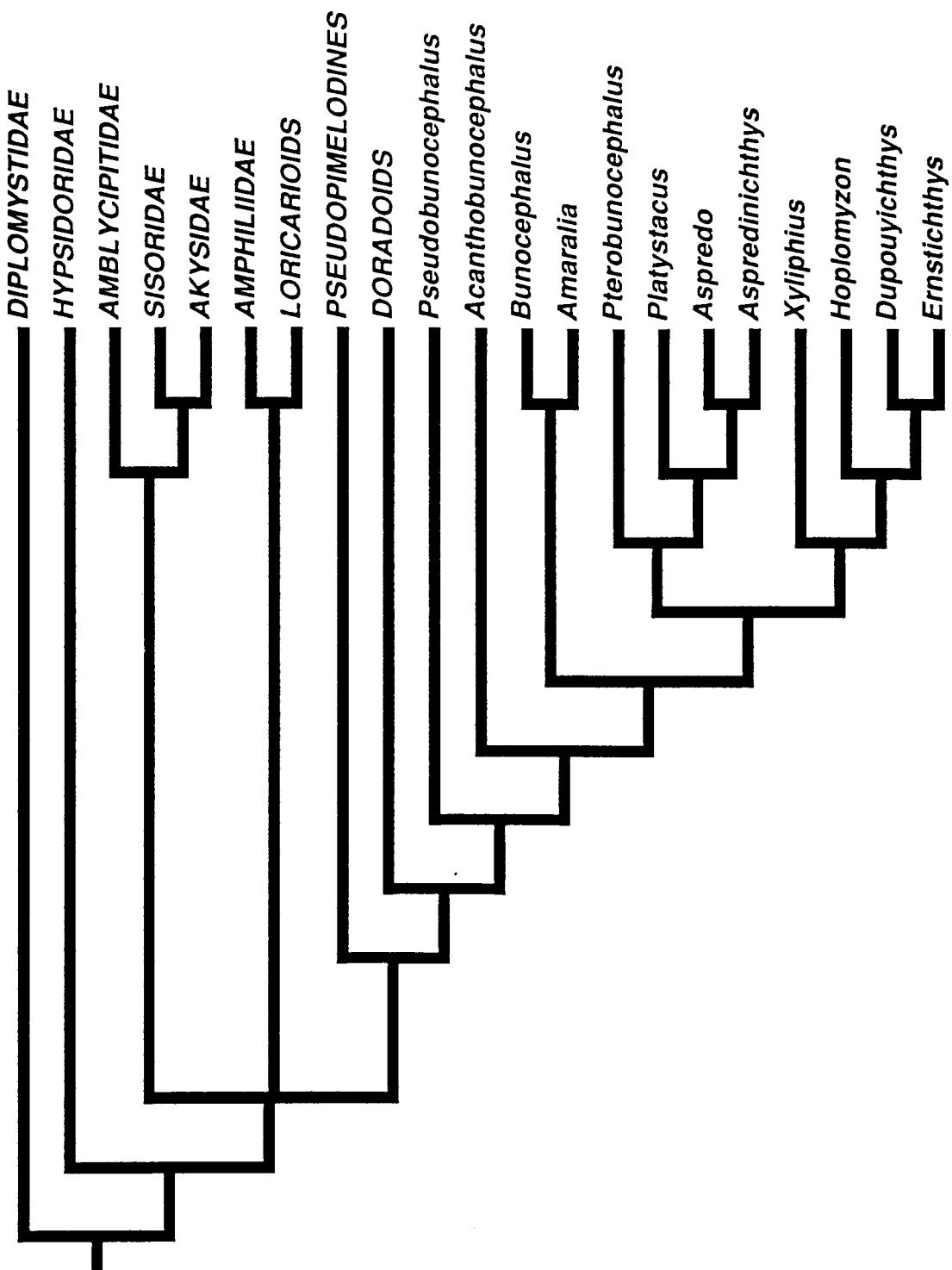


Figure 1. Consensus tree of two most parsimonious trees (438 steps) from analysis #1.

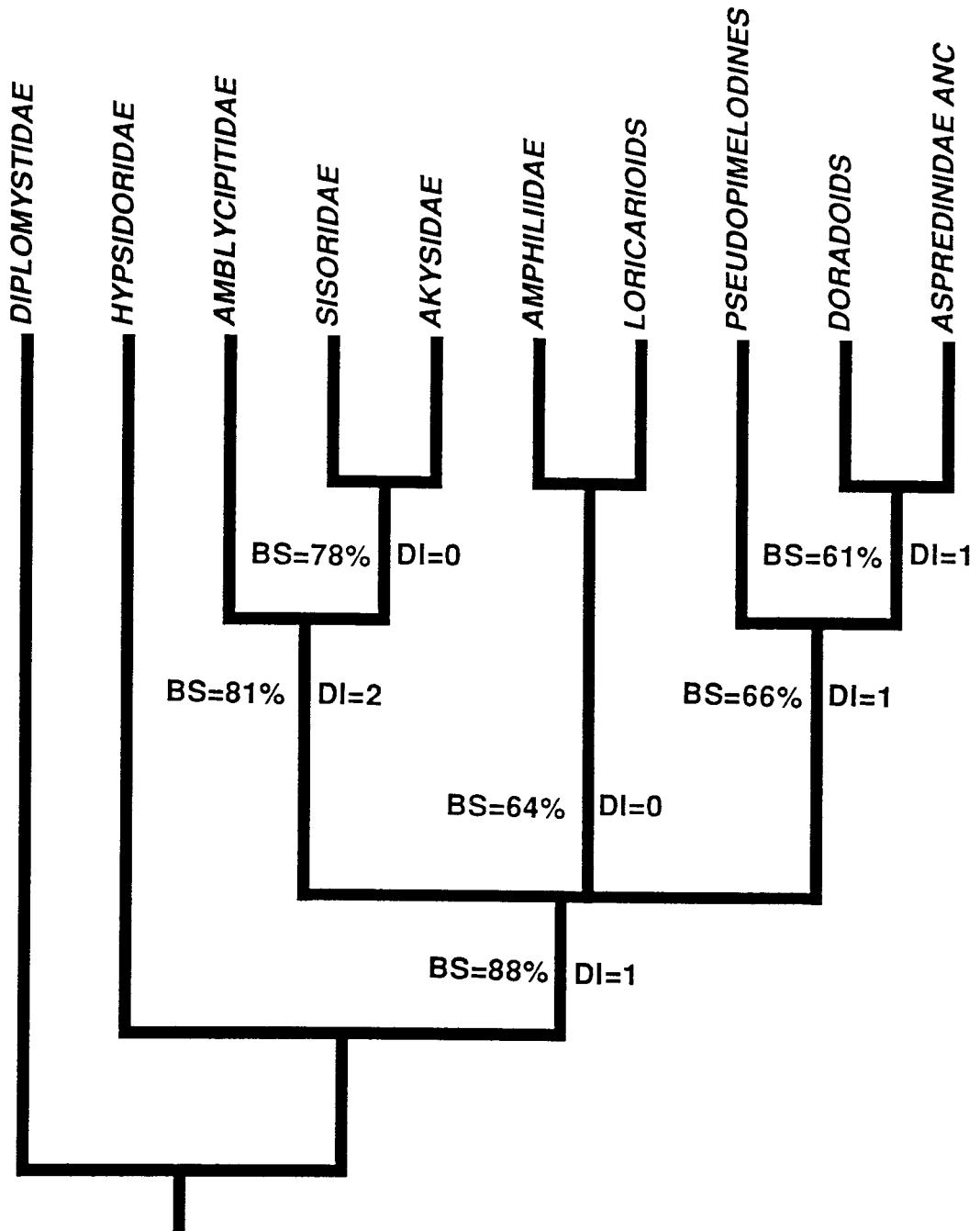


Figure 2. Consensus tree of two most parsimonious trees (271 steps) from analysis #2 with bootstrap frequencies (BS) and decay indices (DI).

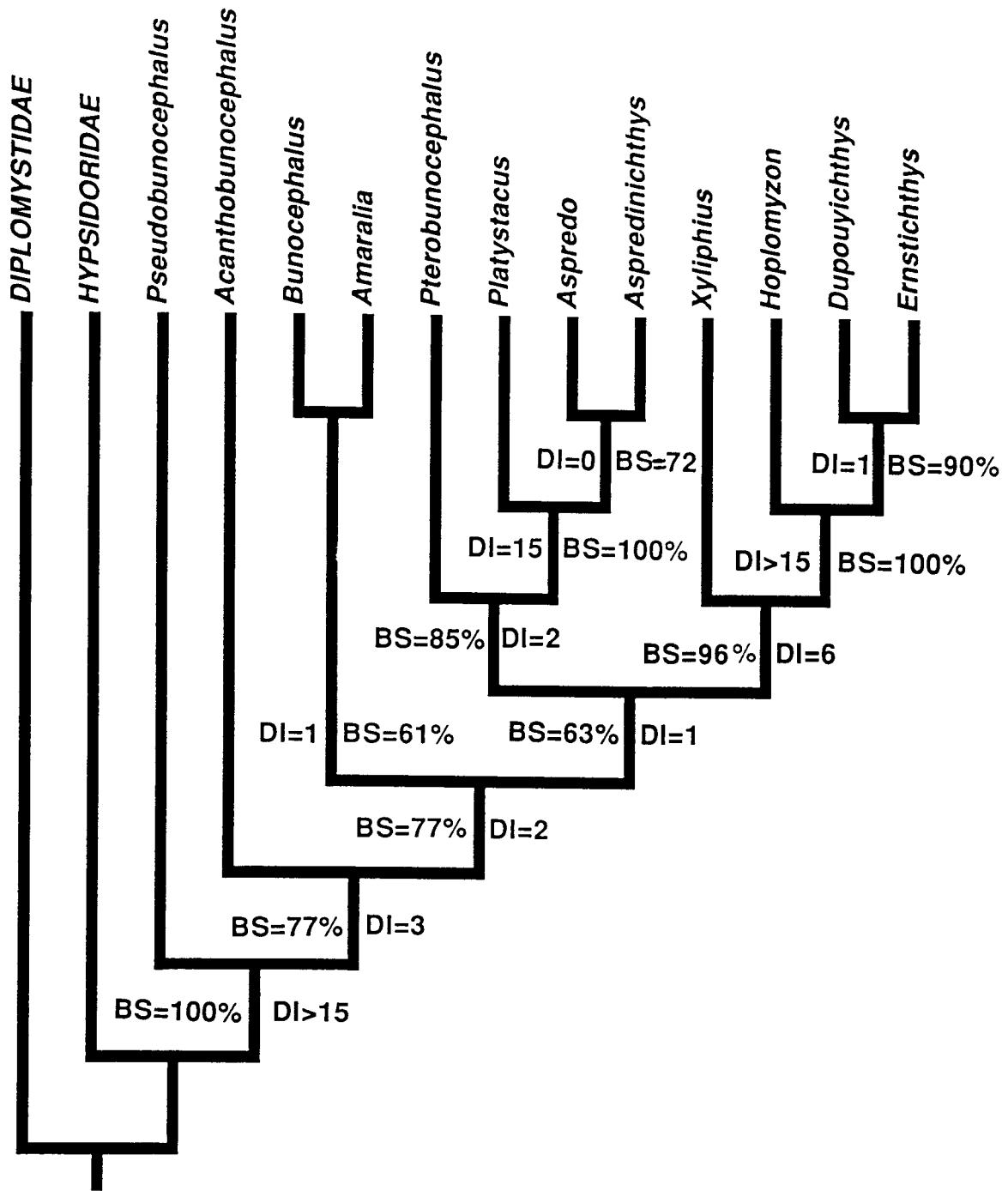


Figure 3. Single most parsimonious tree (226 steps) from analysis #3 with bootstrap frequencies (BS) and decay indices (DI).

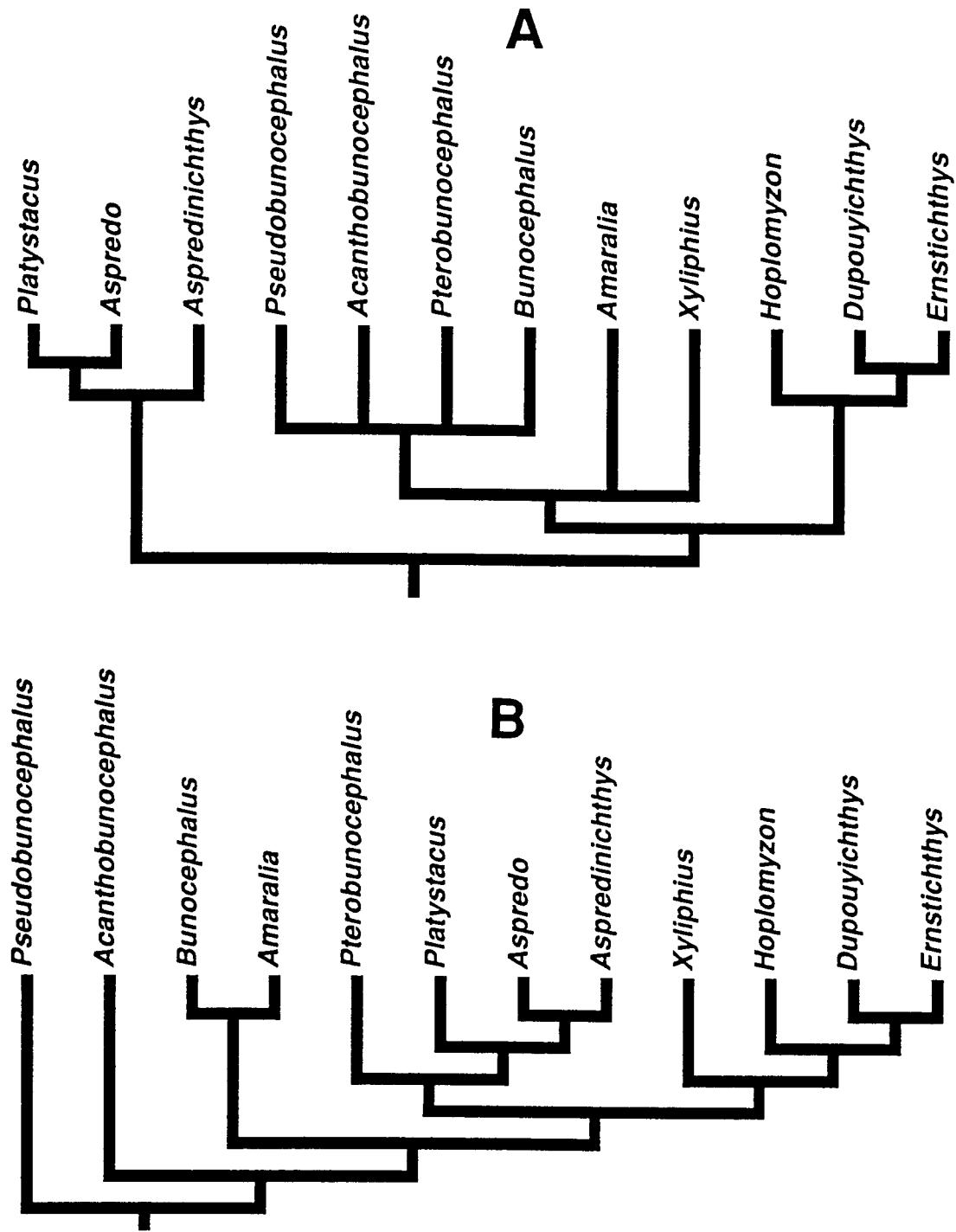


Figure 4. Competing hypotheses on relationships within the Aspredinidae. A. Phylogeny inferred by previous classification of the Aspredinidae vs. B. Phylogeny produced in this study.

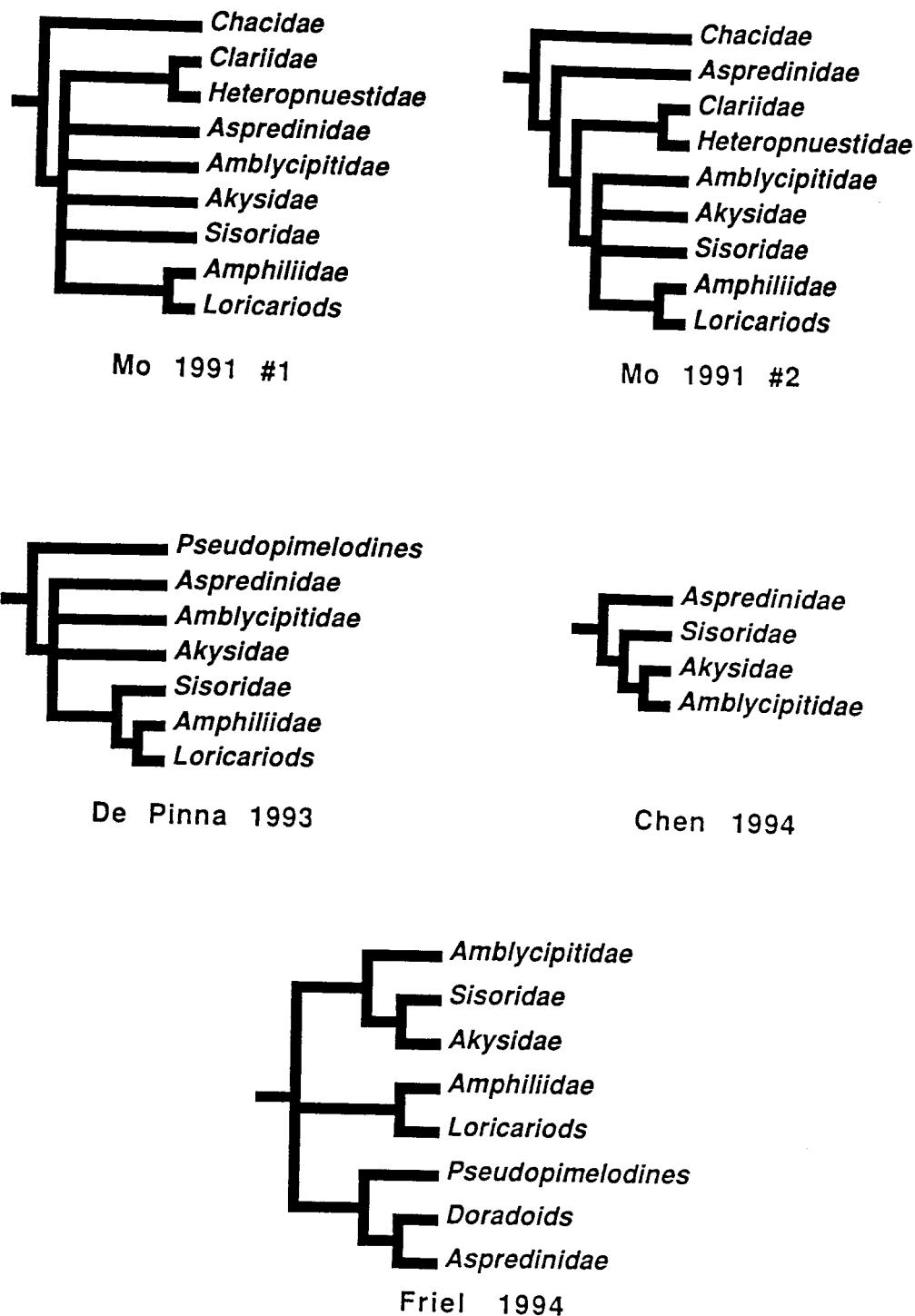


Figure 5. Competing hypotheses on relationships of the Aspredinidae to other families of catfishes.

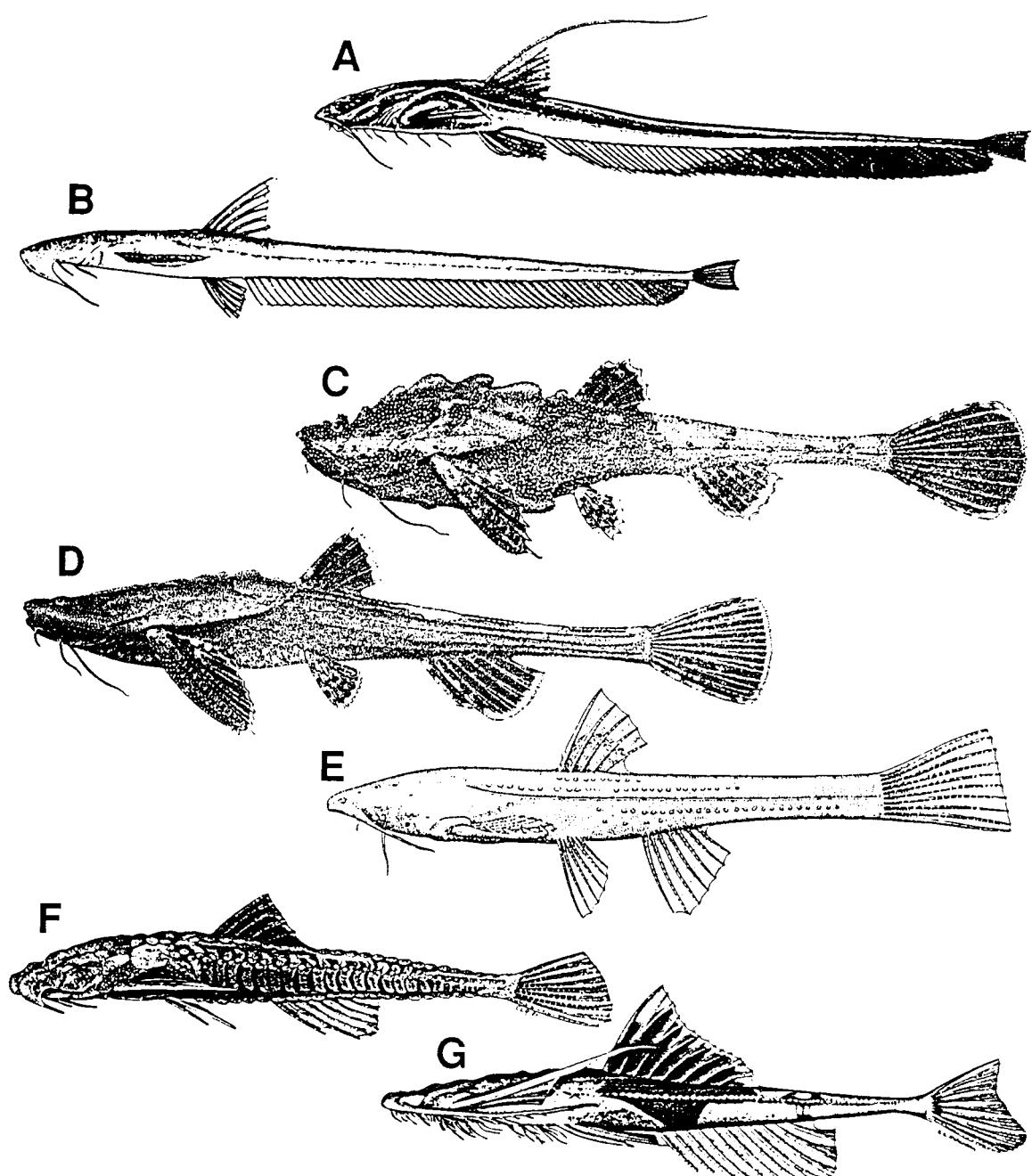


Figure 6. Figure of representative genera of Aspredinidae. A. *Aspredinichthys filamentosus* (from Taylor, 1977); B. *Asredo asredo* (from Taylor, 1977); C. *Bunocephalus verrucosus* (from Eigenmann, 1912b); D. *Bunocephalus amaurus* (from Eigenmann, 1912b); E. *Xylipterus magdalena* (from Eigenmann, 1923); F. *Hoplomyzon papillatus* (from Stewart, 1985); G. *Ernstichthys intonsus* (from Stewart, 1985).

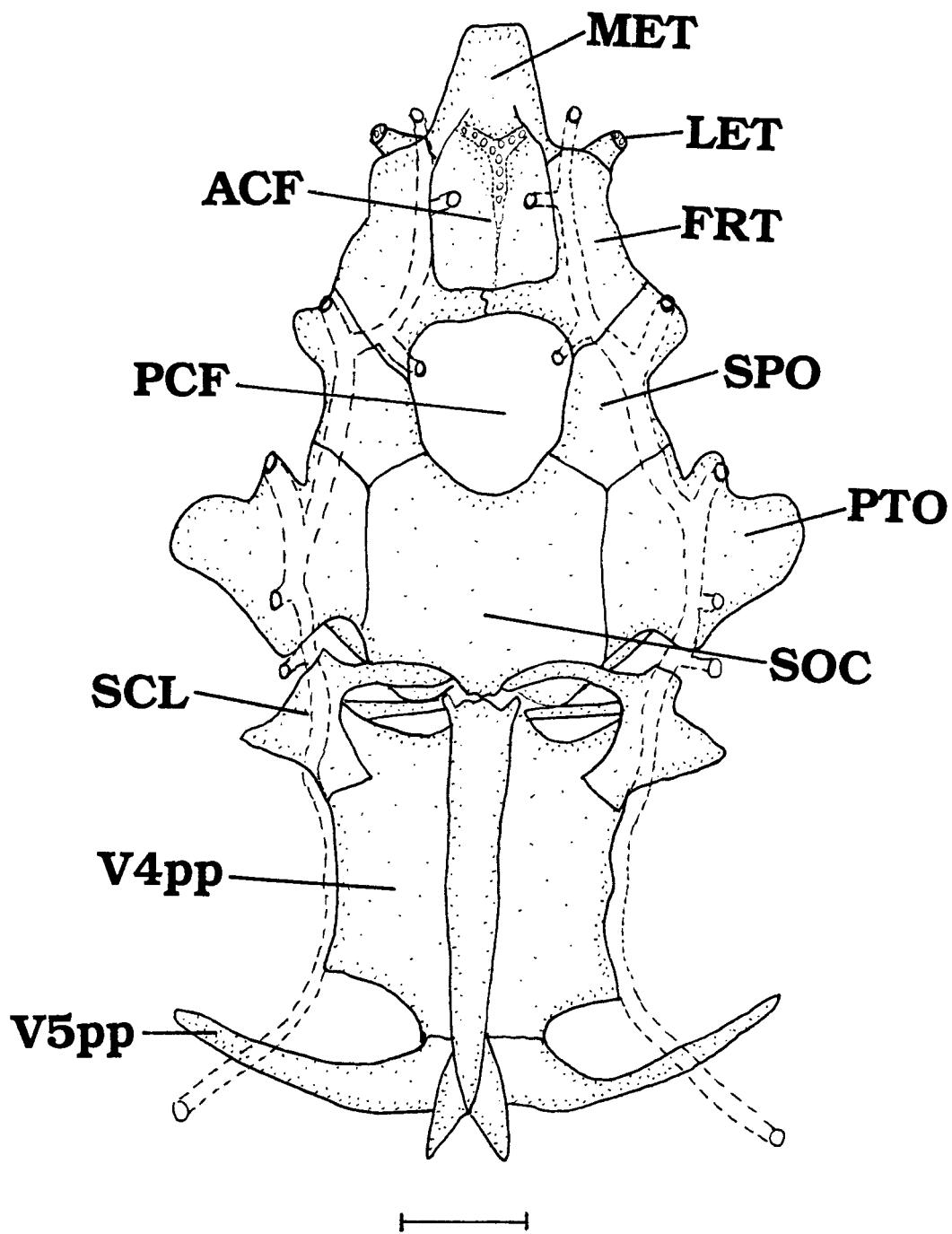


Figure 7. Dorsal view of neurocranium & Weberian complex of *Pseudobunocephalus lundbergi* new gen. & sp., ANSP 172505.

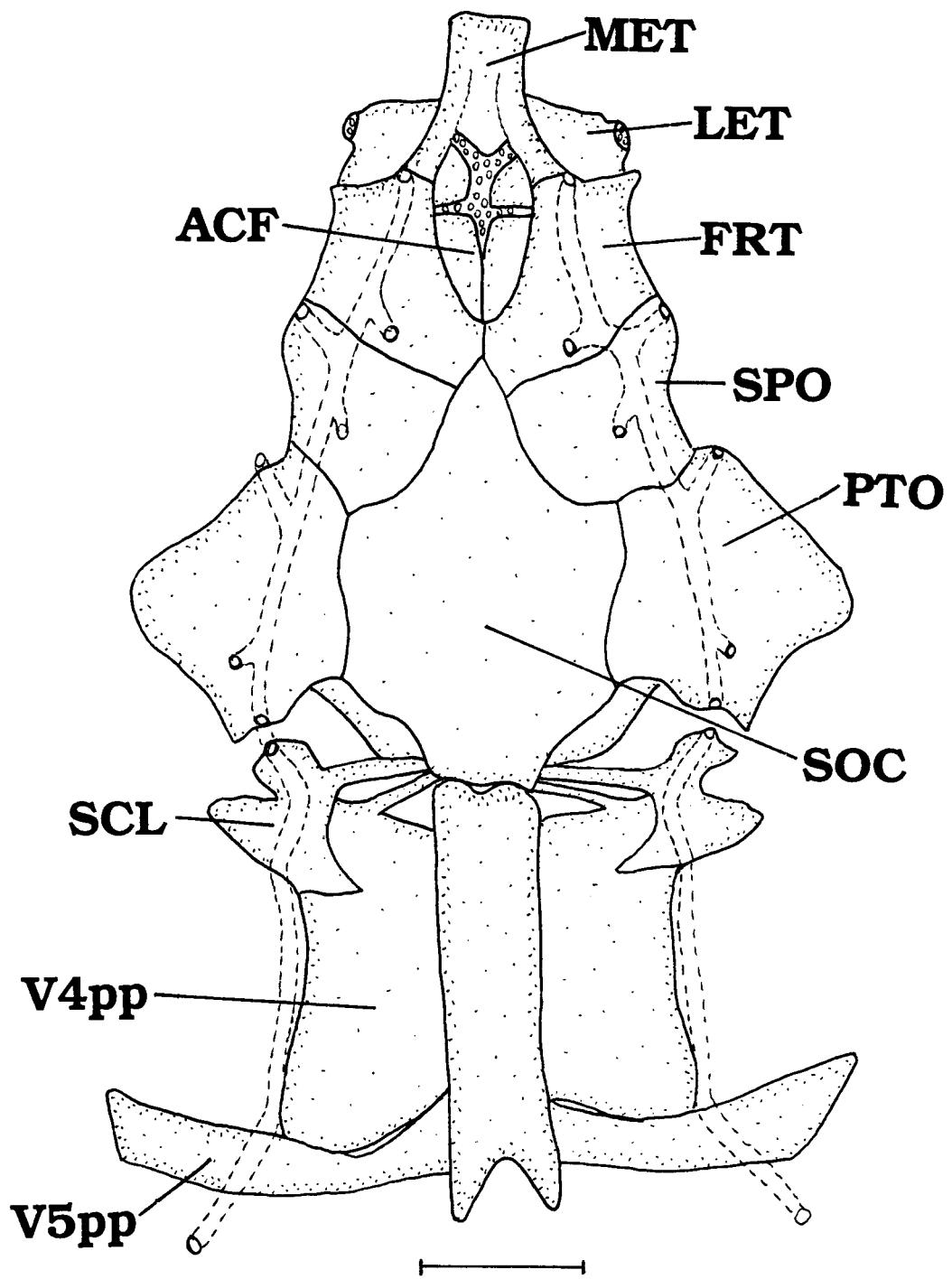


Figure 8. Dorsal view of neurocranium & Weberian complex of *Acanthobunocephalus nicoi* new gen. & sp., MCNG 21843.

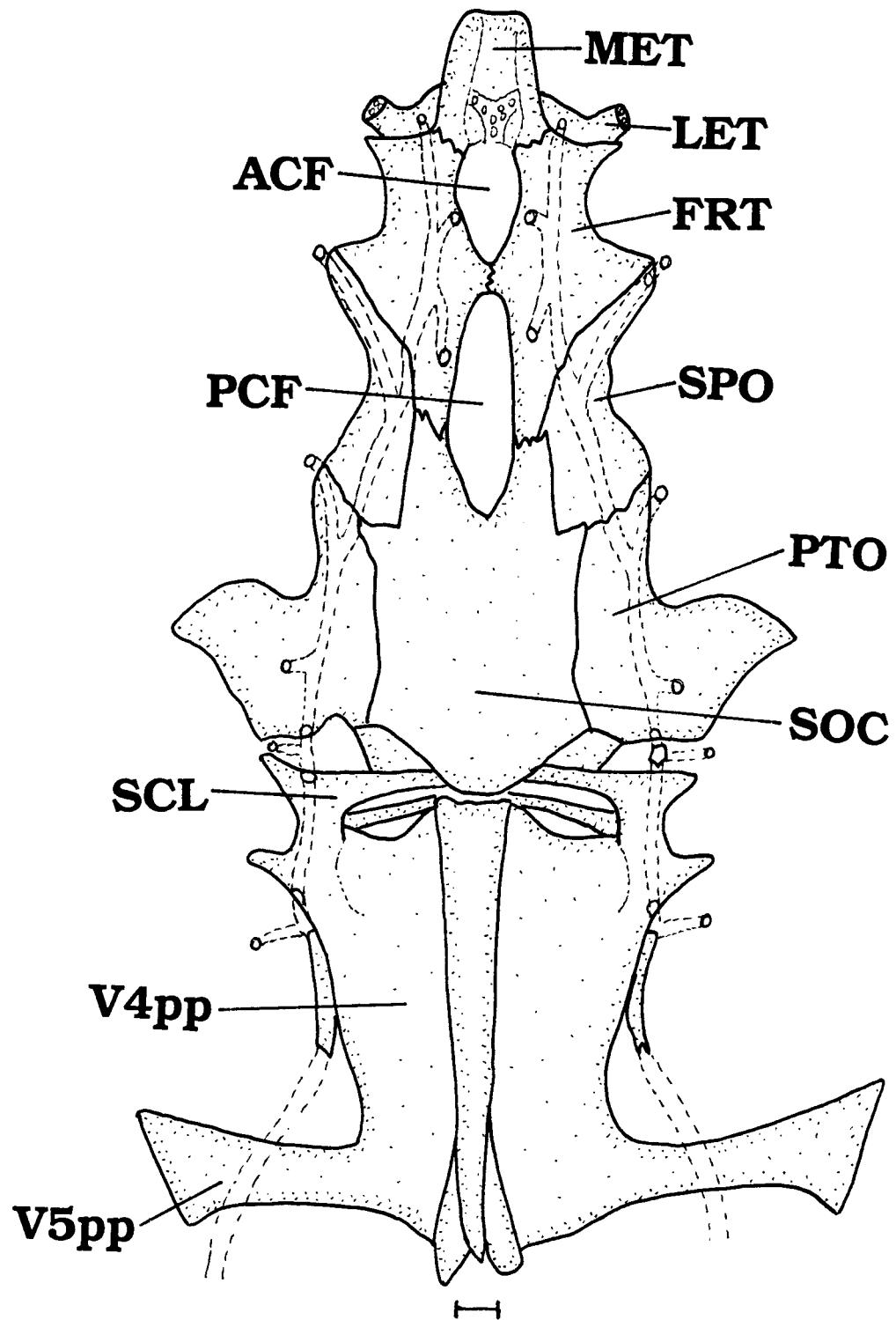


Figure 9. Dorsal view of neurocranium & Weberian complex of *Bunocephalus amaurus*, MCZ 48566.

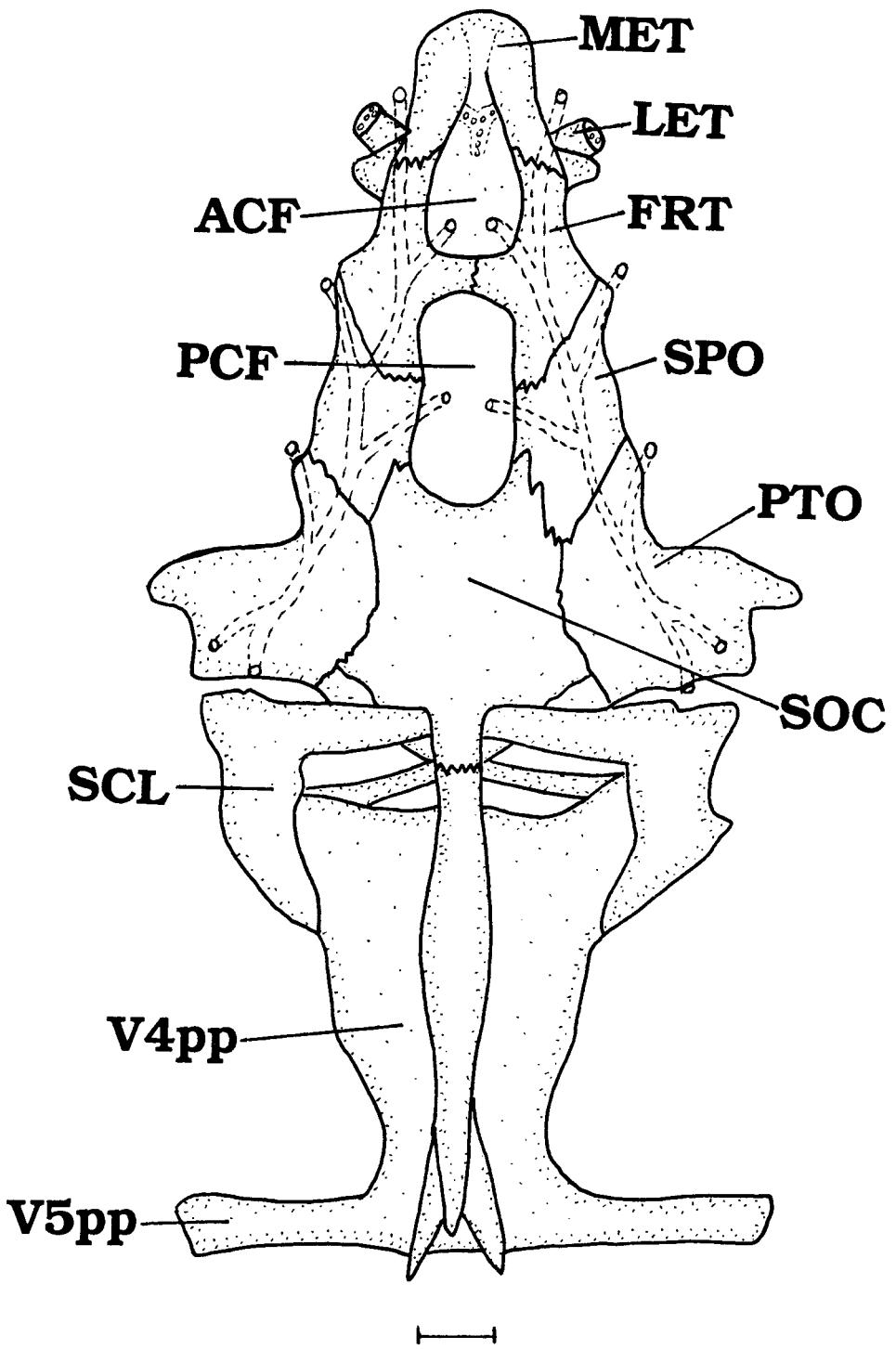


Figure 10. Dorsal view of neurocranium & Weberian complex of *Amaralia* n. sp., UMMZ 207818.

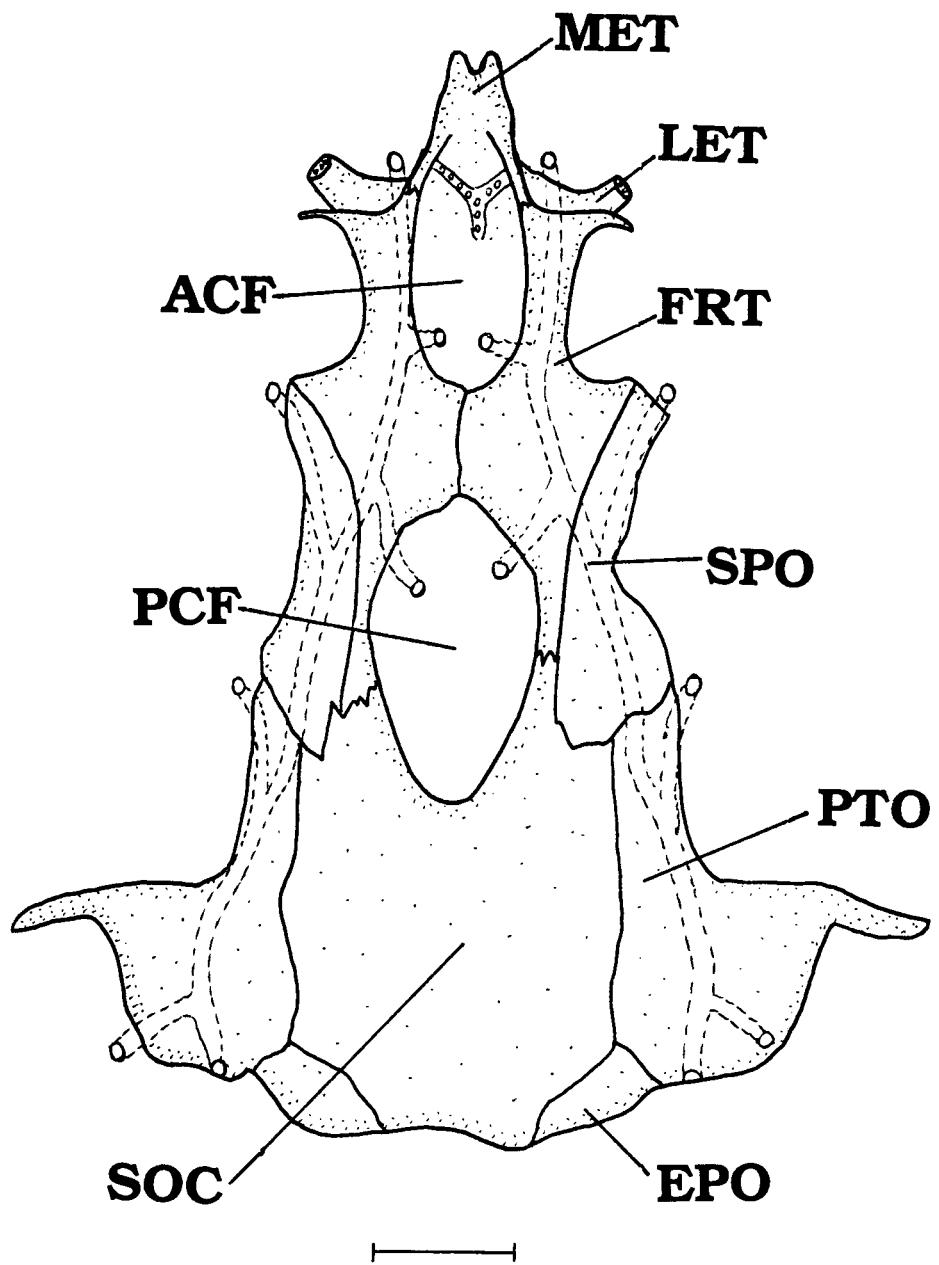


Figure 11. Dorsal view of neurocranium of *Pterobunocephalus dolichurus*, ANSP 84944.

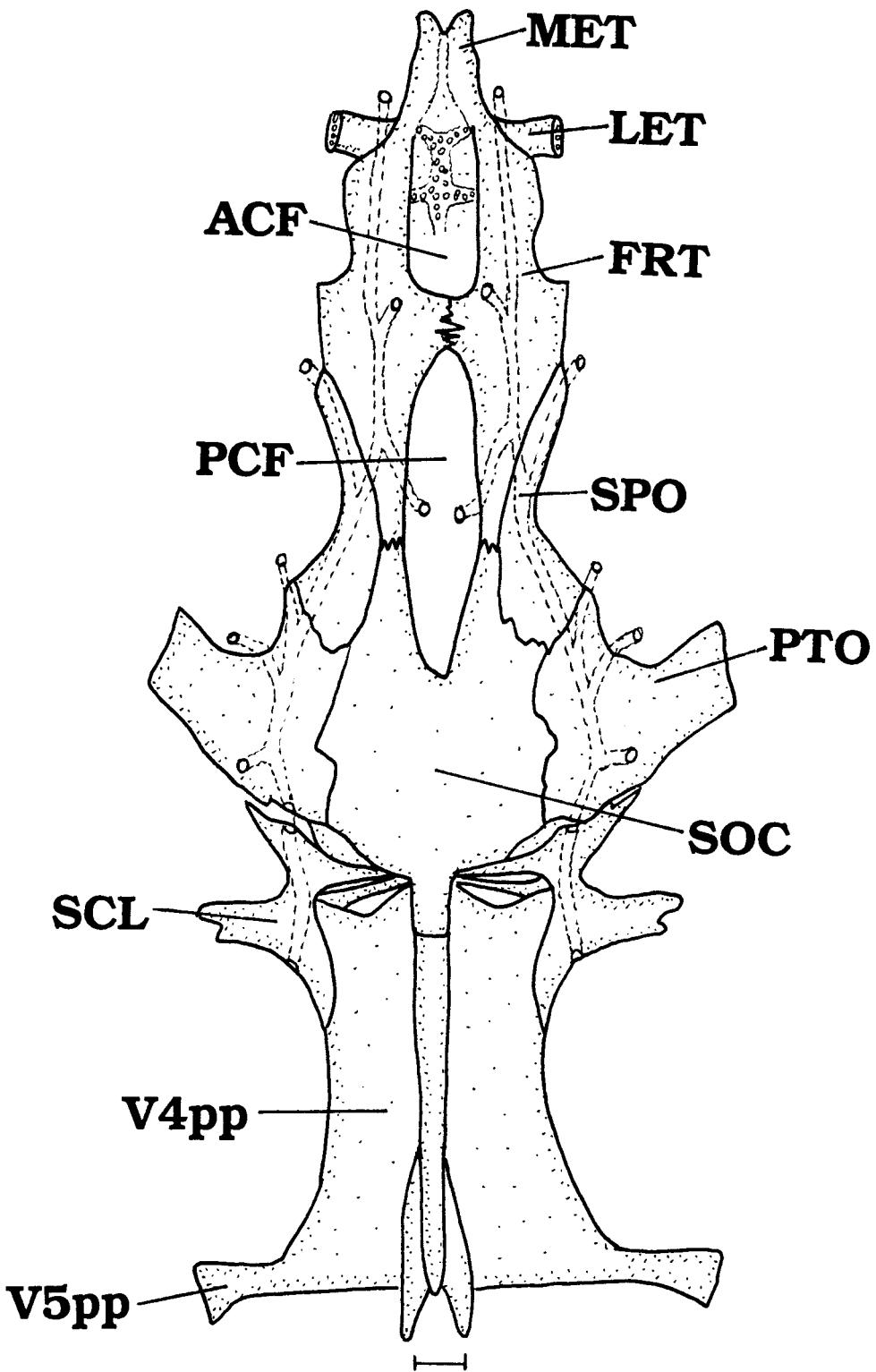


Figure 12. Dorsal view of neurocranium & Weberian complex of *Platystacus cotylephorus*, MBUCV 12387.

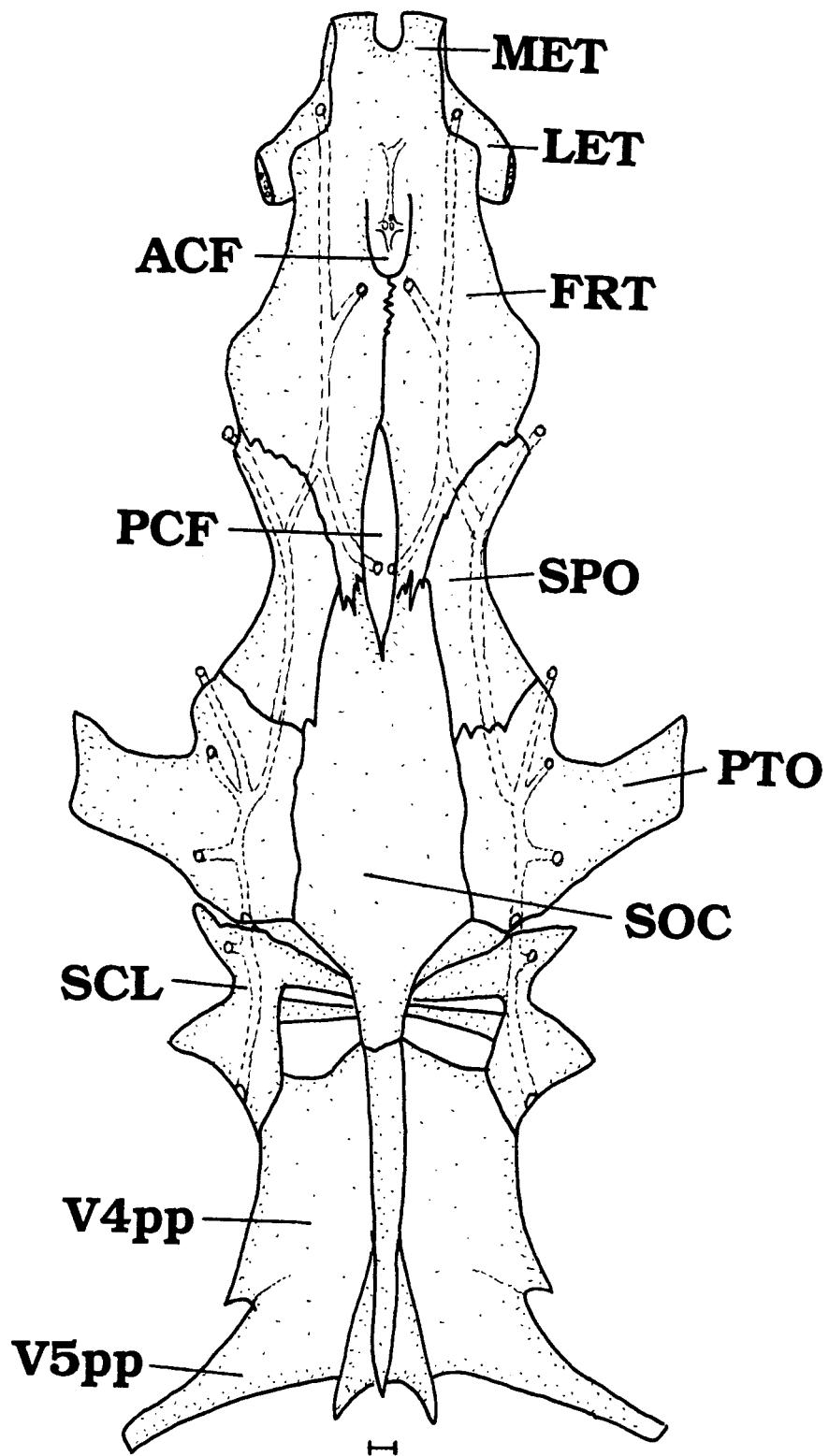


Figure 13. Dorsal view of neurocranium & Weberian complex of *Aspredo aspredo*, FMNH 53117.

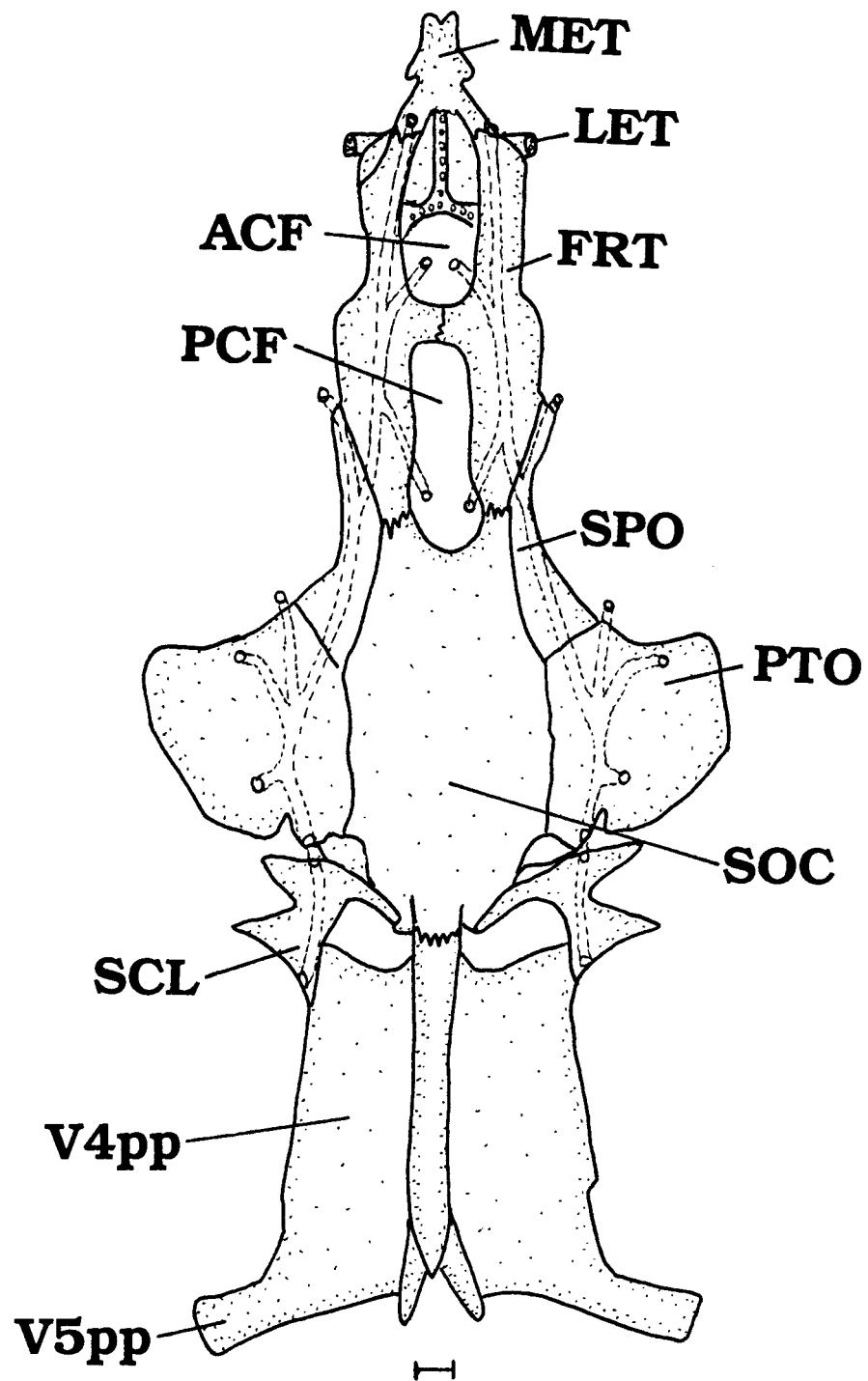


Figure 14. Dorsal view of neurocranium & Weberian complex of *Aspredinichthys filamentosus*, FMNH 76950.

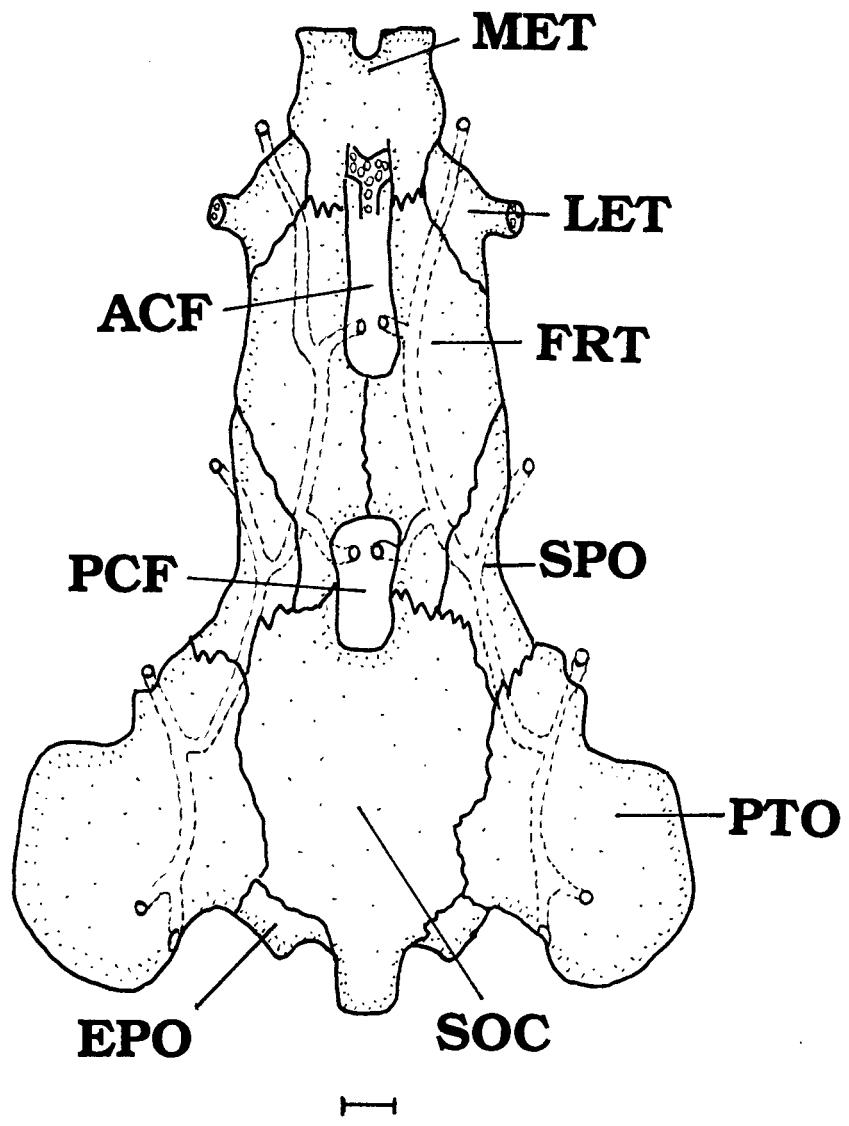


Figure 15. Dorsal view of neurocranium of *Xylipterus melanopterus*. FMNH 99493.

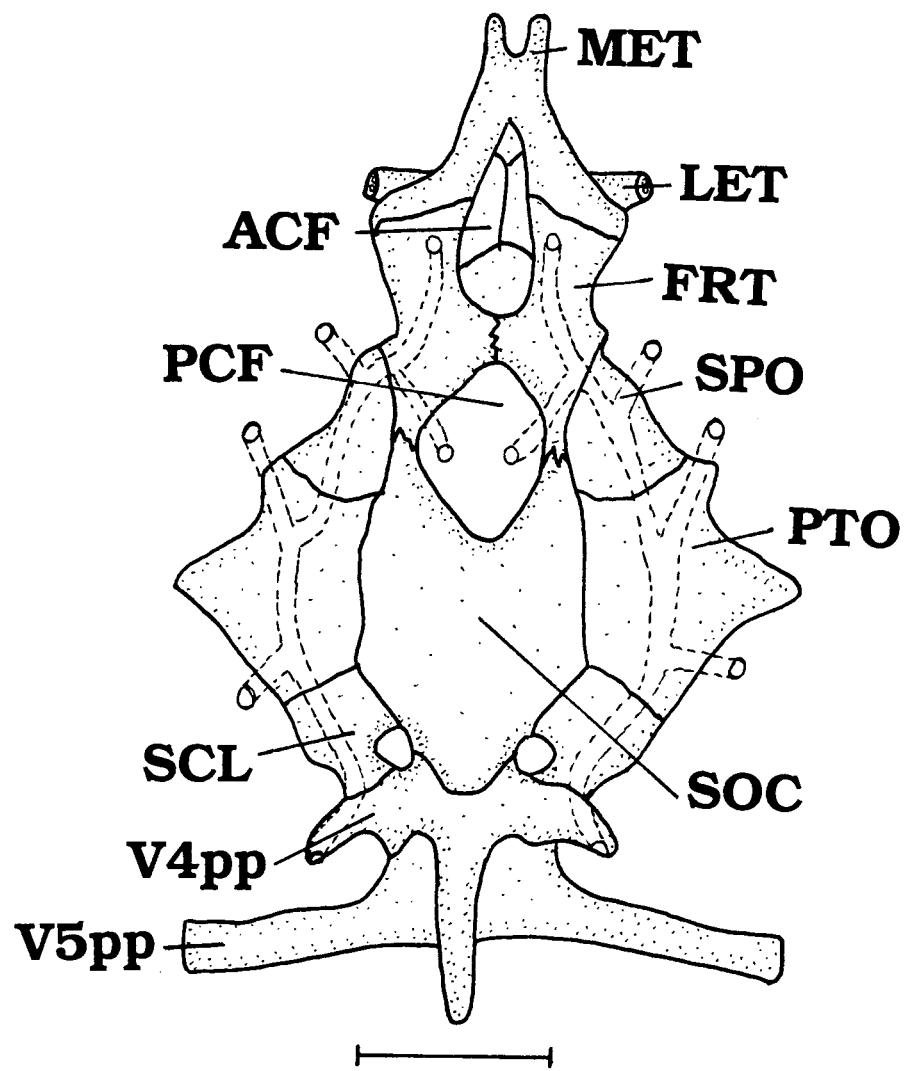


Figure 16. Dorsal view of neurocranium & Weberian complex of *Hoplomyzon atrizona*, MCNG 24796.

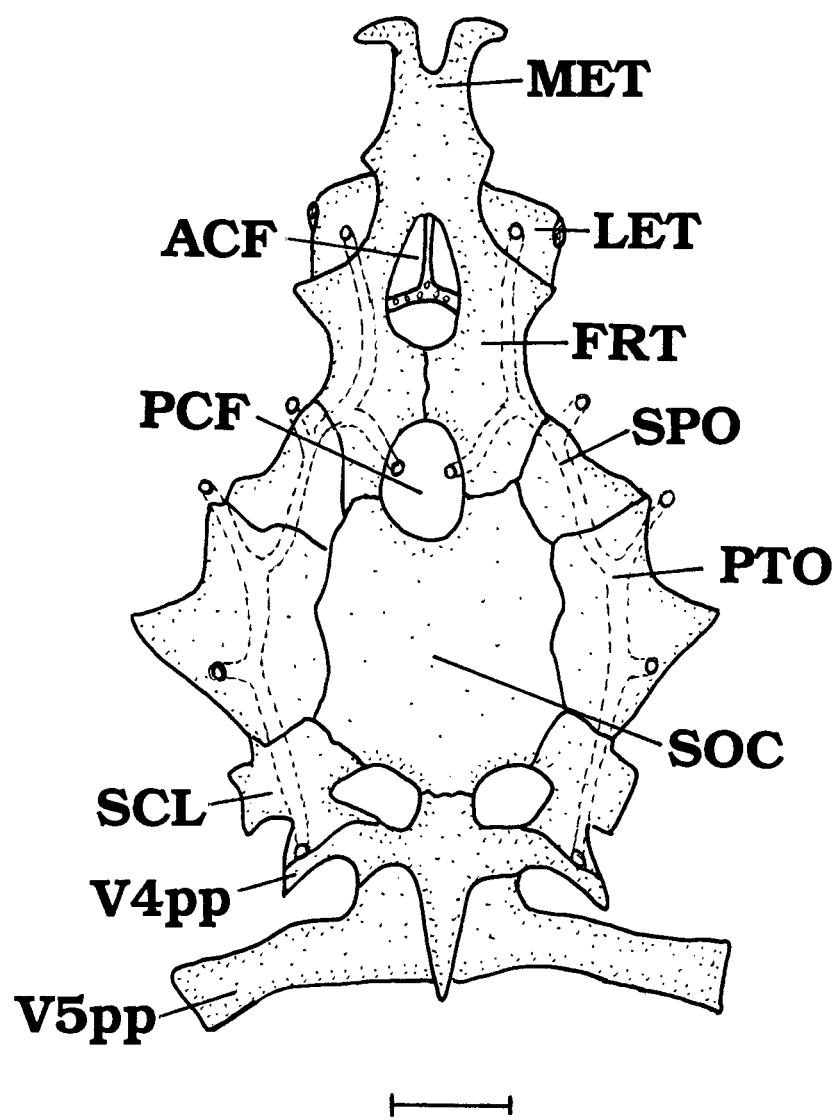


Figure 17. Dorsal view of neurocranium & Weberian complex of *Dupouyichthys sapito*, USNM 121073.

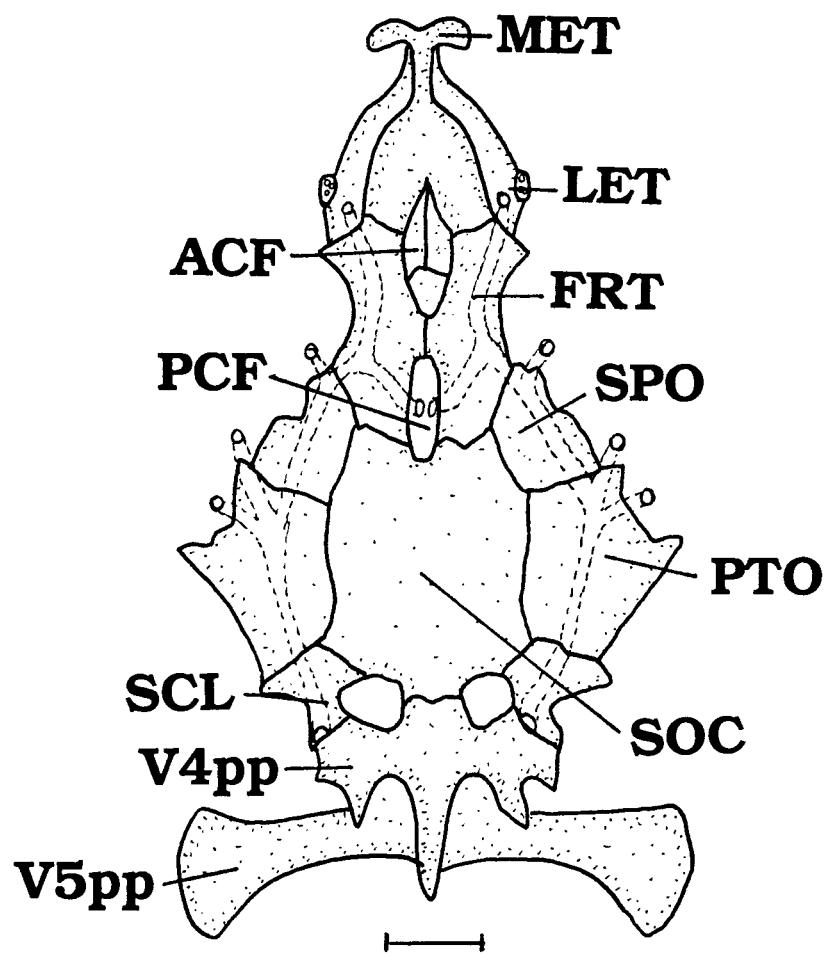


Figure 18. Dorsal view of neurocranium & Weberian complex of *Ernstichthys megistus*, UNCAT.

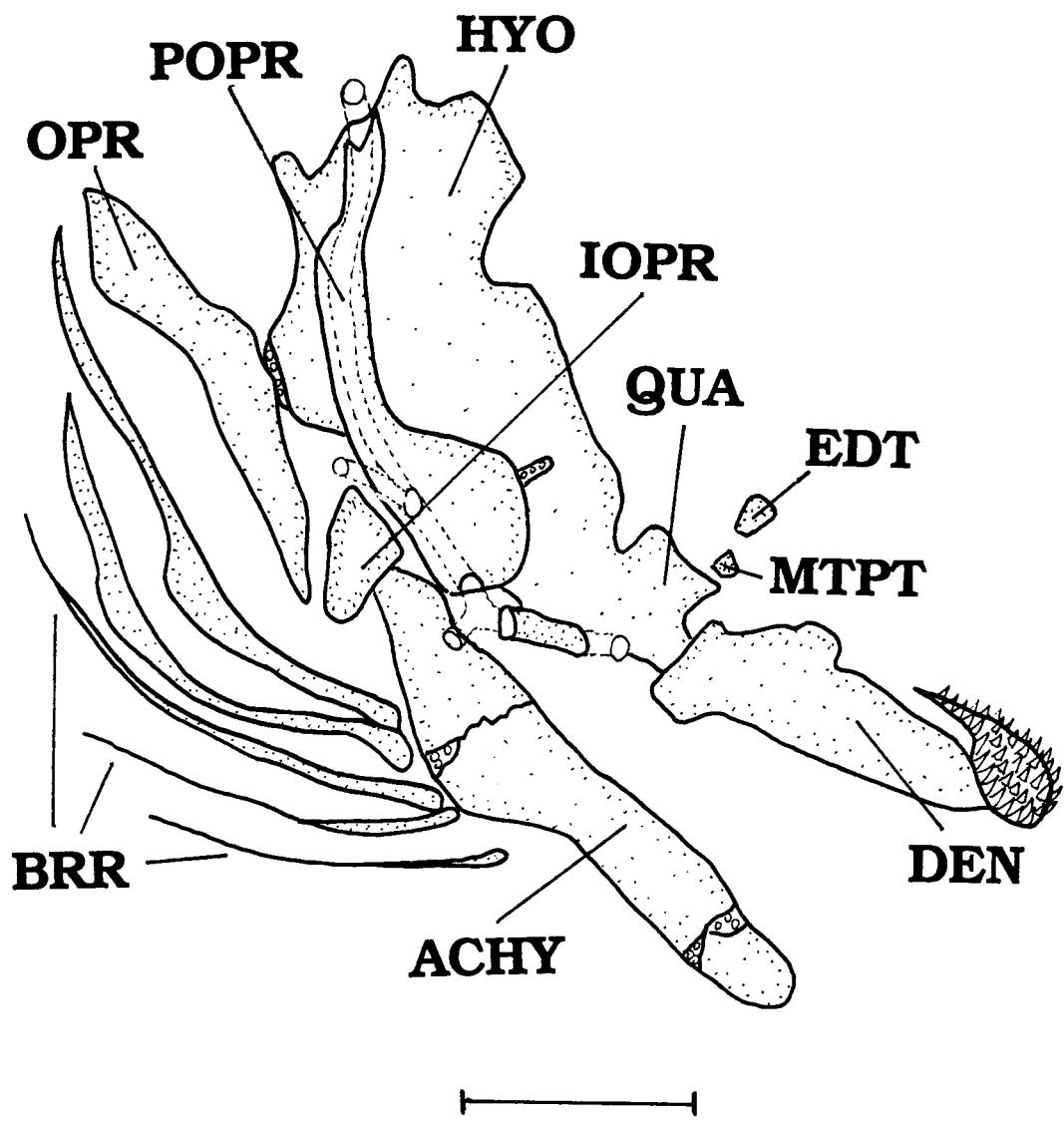


Figure 19. Lateral view of suspensorium of *Pseudobunocephalus lundbergi* new gen & sp.,
ANSP 172505.

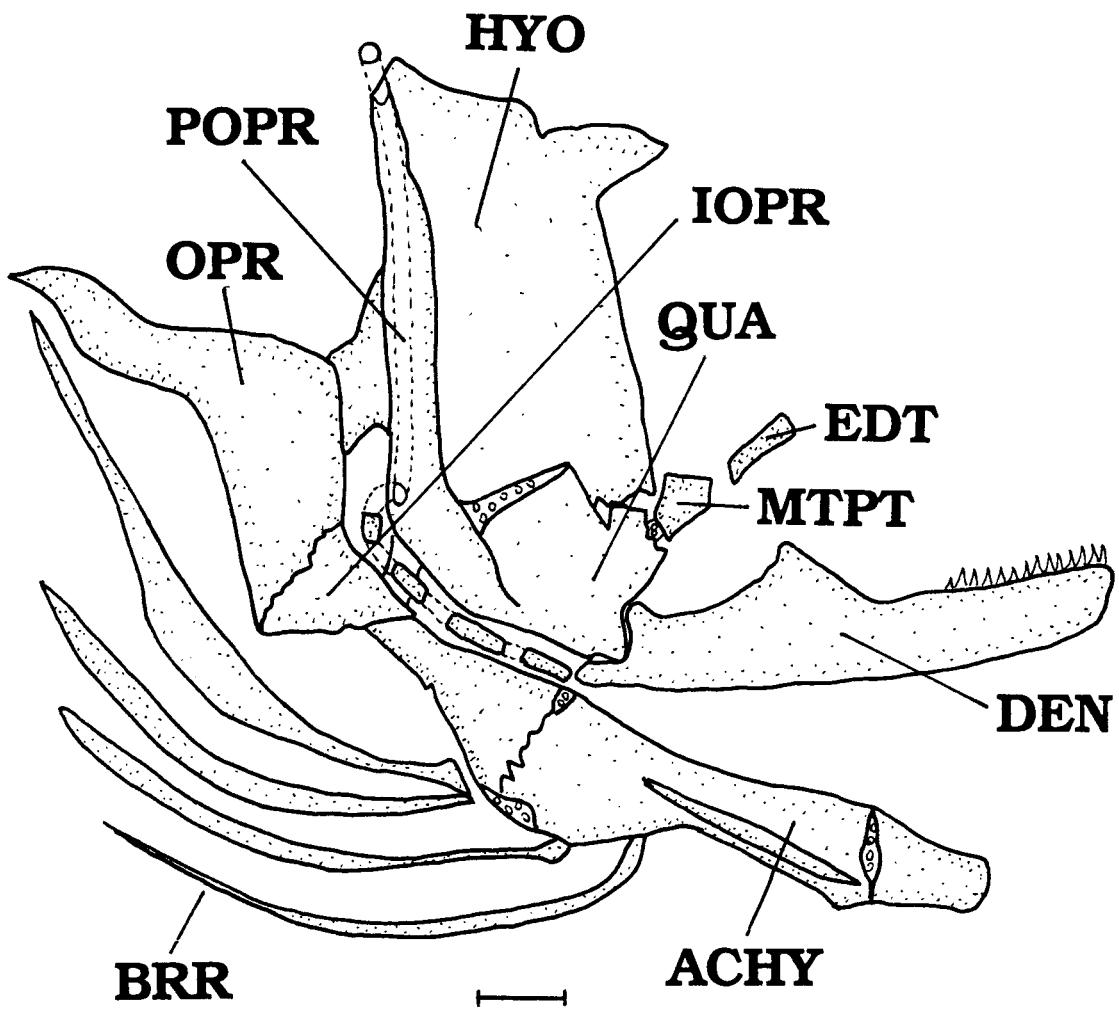


Figure 20. Lateral view of suspensorium of *Amaralia* n. sp., UMMZ 207818.

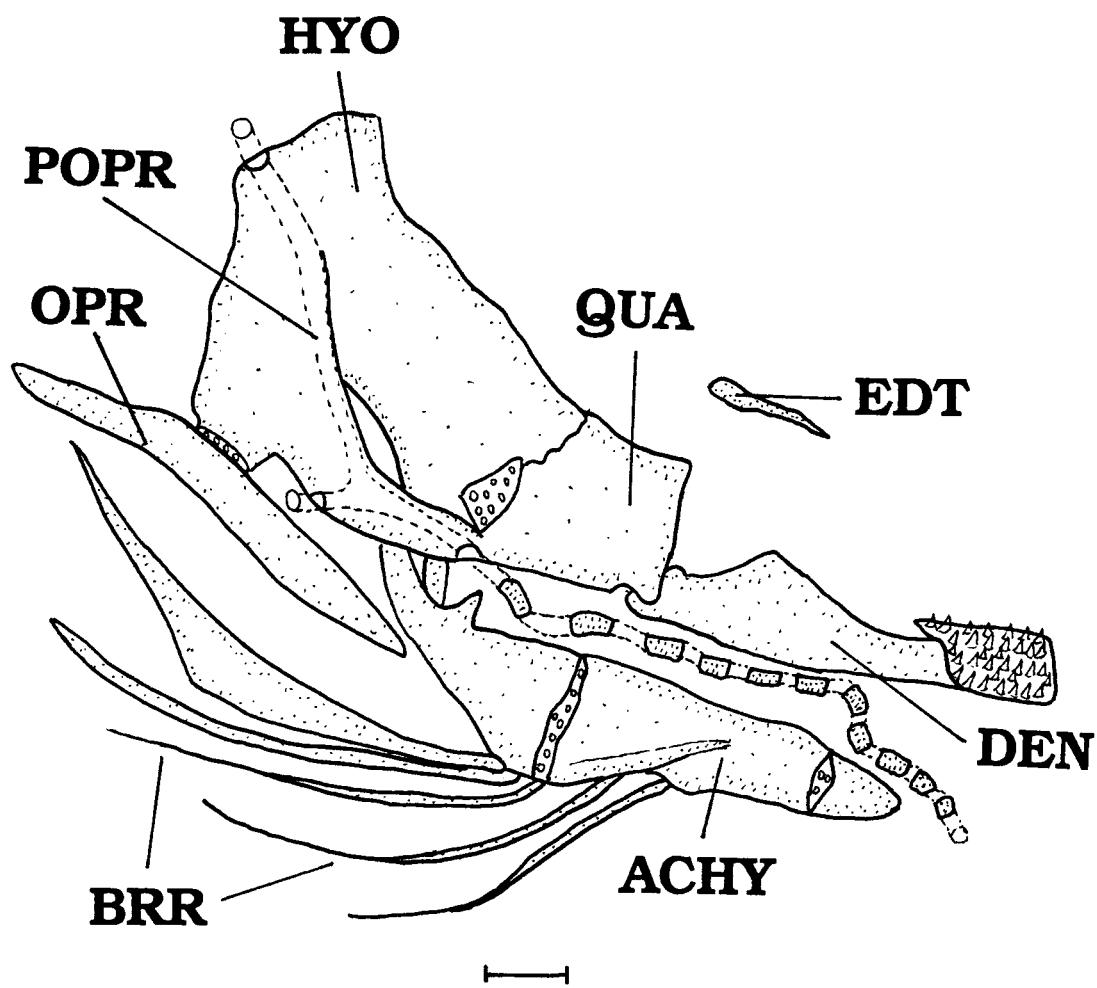


Figure 21. Lateral view of suspensorium of *Platystacus cotylephorus*, MBUCV 12387.

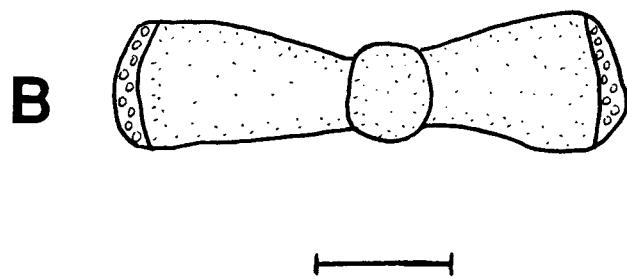
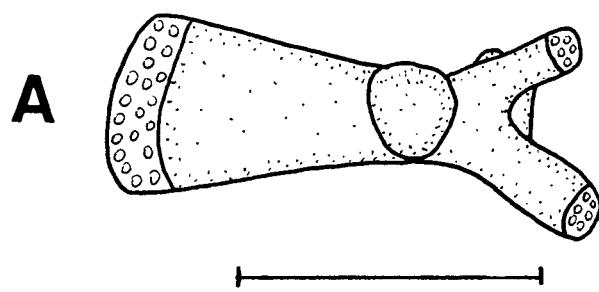


Figure 22. Medial view of palatine. A. *Pseudobunocephalus lundbergi* new gen. & sp., ANSP 172505; B. *Bunocephalus amaurus* MCZ 48566.

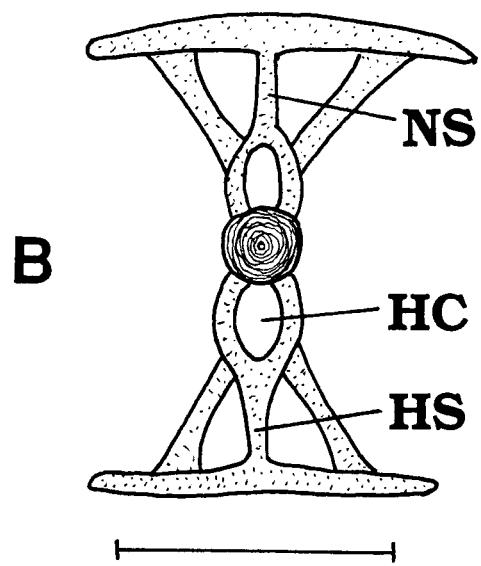
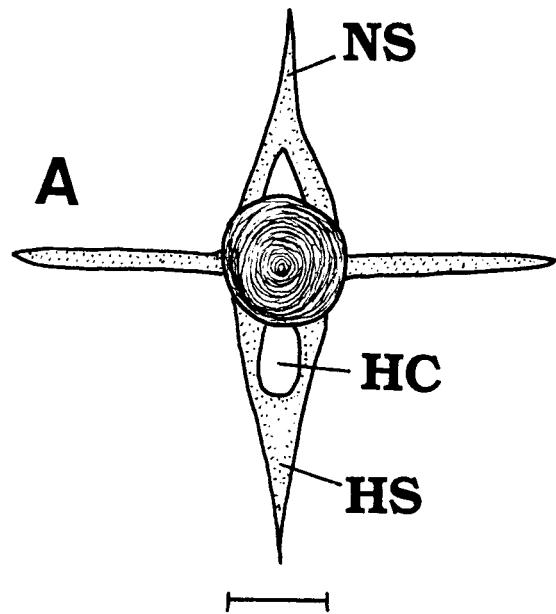


Figure 23. Transverse section of vertebrae. A. *Bunocephalus coracoideus*, UNCAT; B. *Dupouyichthys sapito*, USNM 121073.

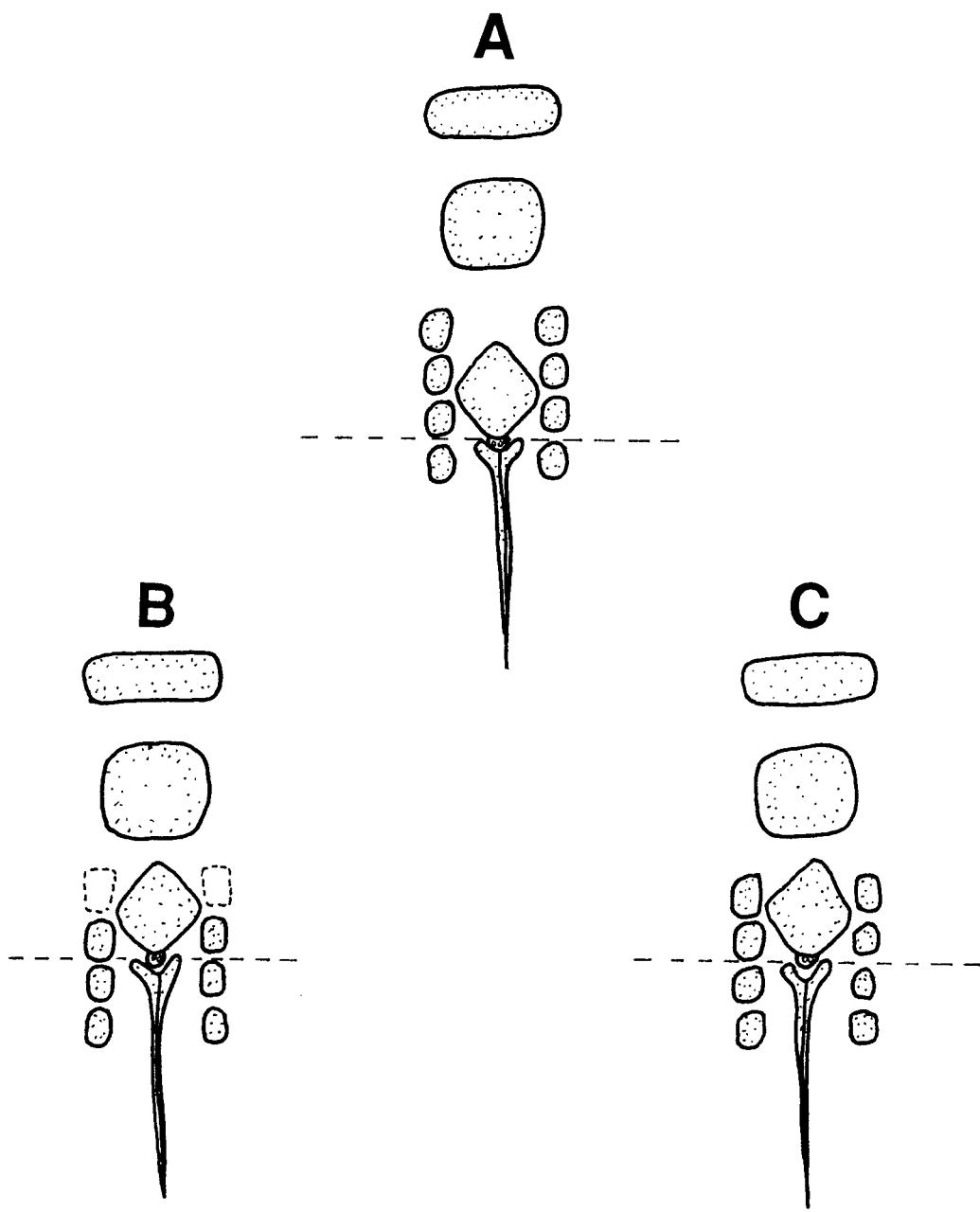


Figure 24. Pattern of pre-anal-fin plates. A. *Hoplomyzon*; B. *Dupouyichthys*; C. *Ernstichthys*.

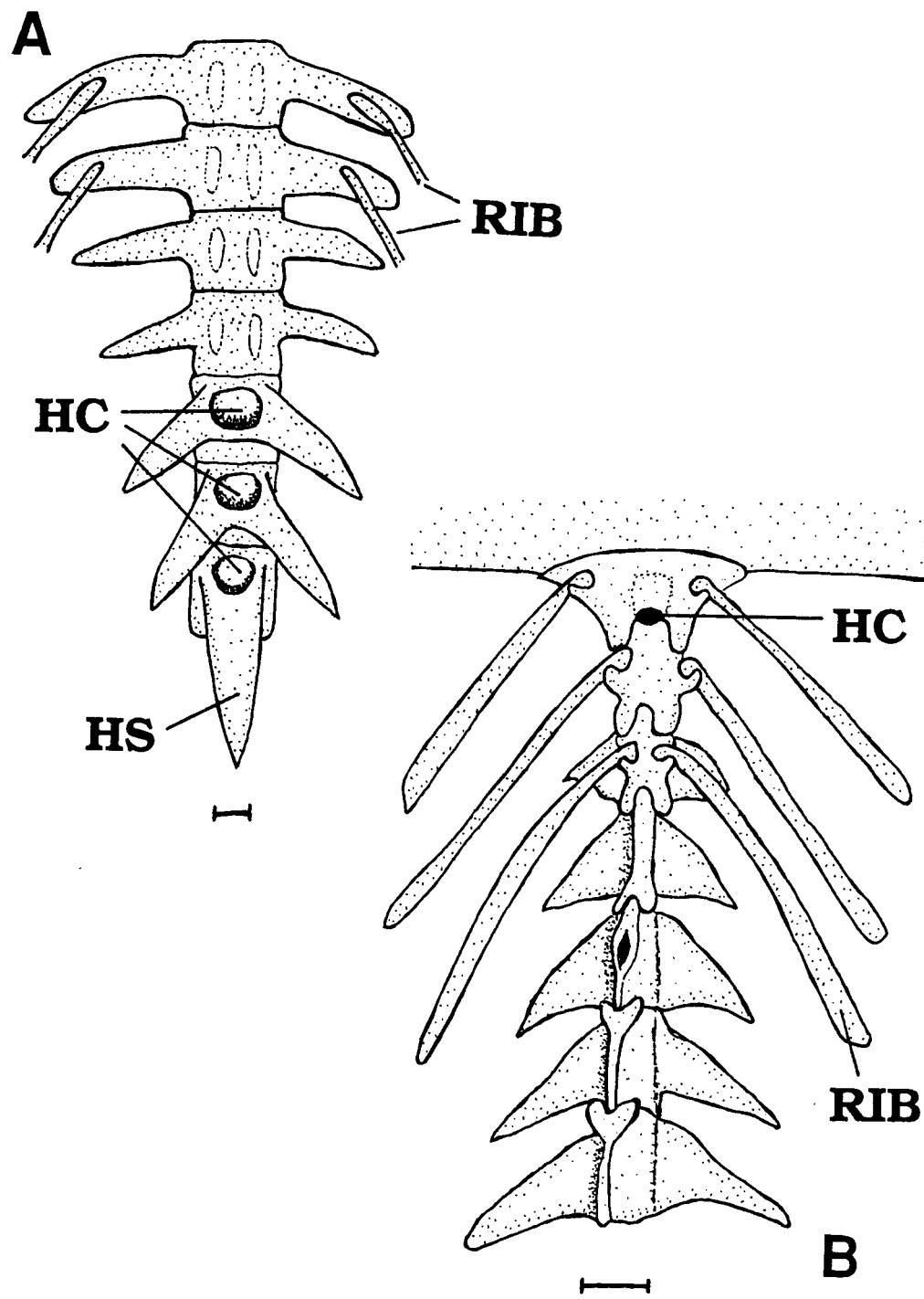


Figure 25. Ventral view of abdominal vertebrae. A. *Ictalurus punctatus*, UNCAT; B. *Bunocephalus coracoideus*, UNCAT.

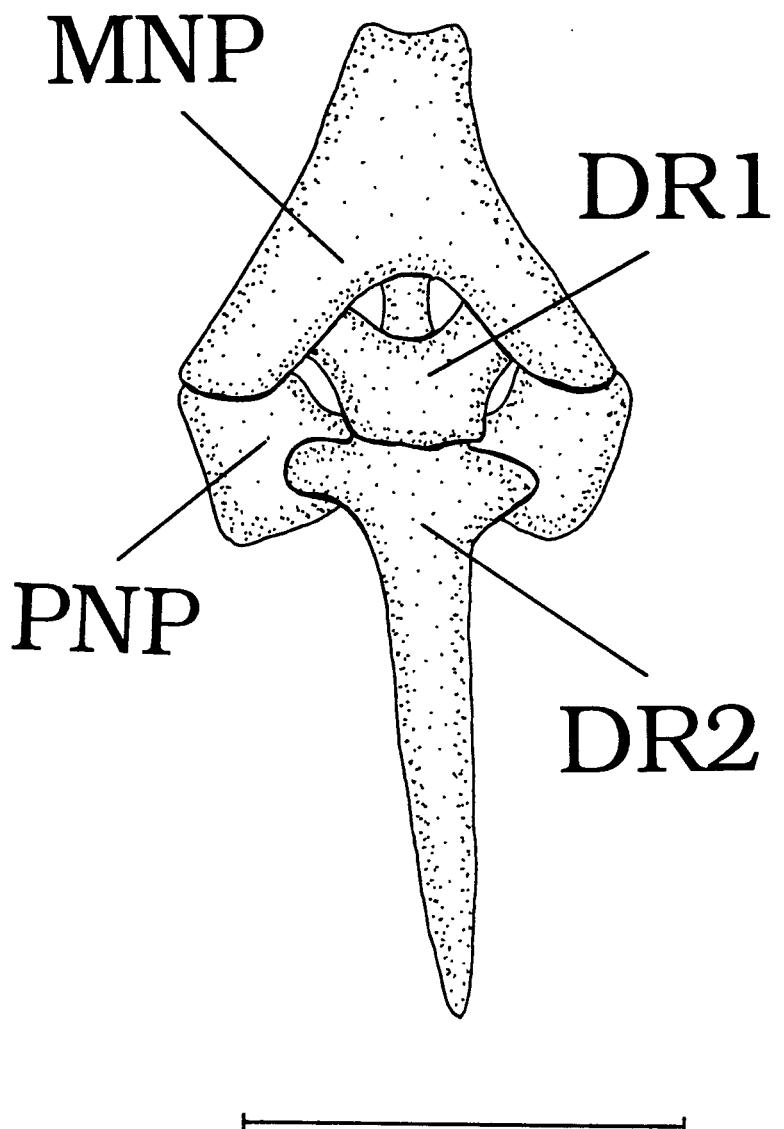


Figure 26. Dorsal view of dorsal fin of *Acanthobunocephalus nicoi* new gen. & sp.,
MCNG 21843.

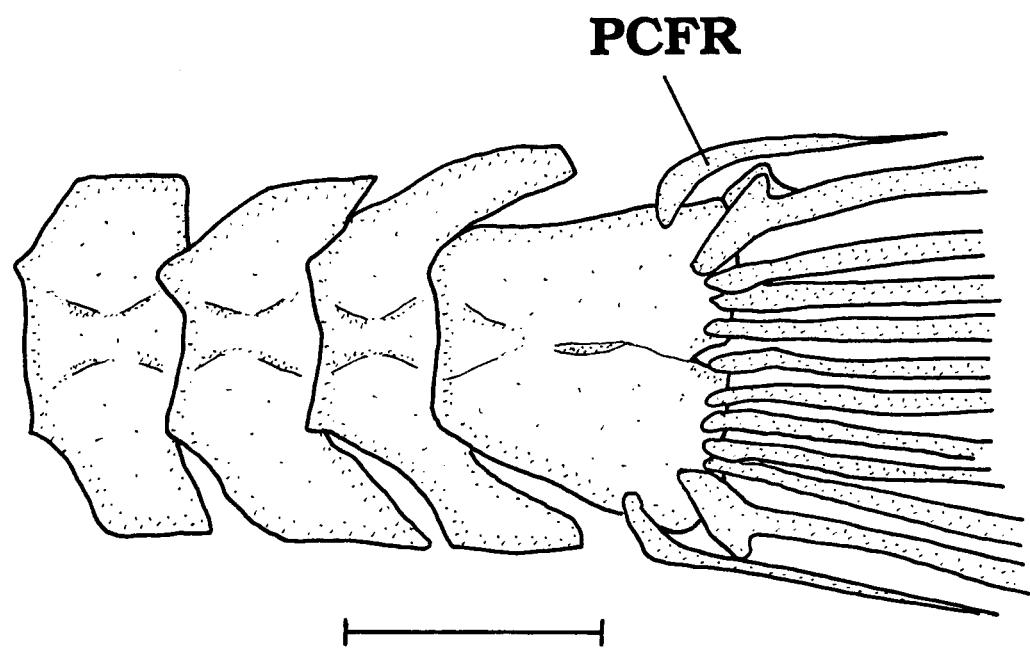


Figure 27. Lateral view of caudal skeleton *Pseudobunocephalus lundbergi* new gen. & sp., ANSP 172505.

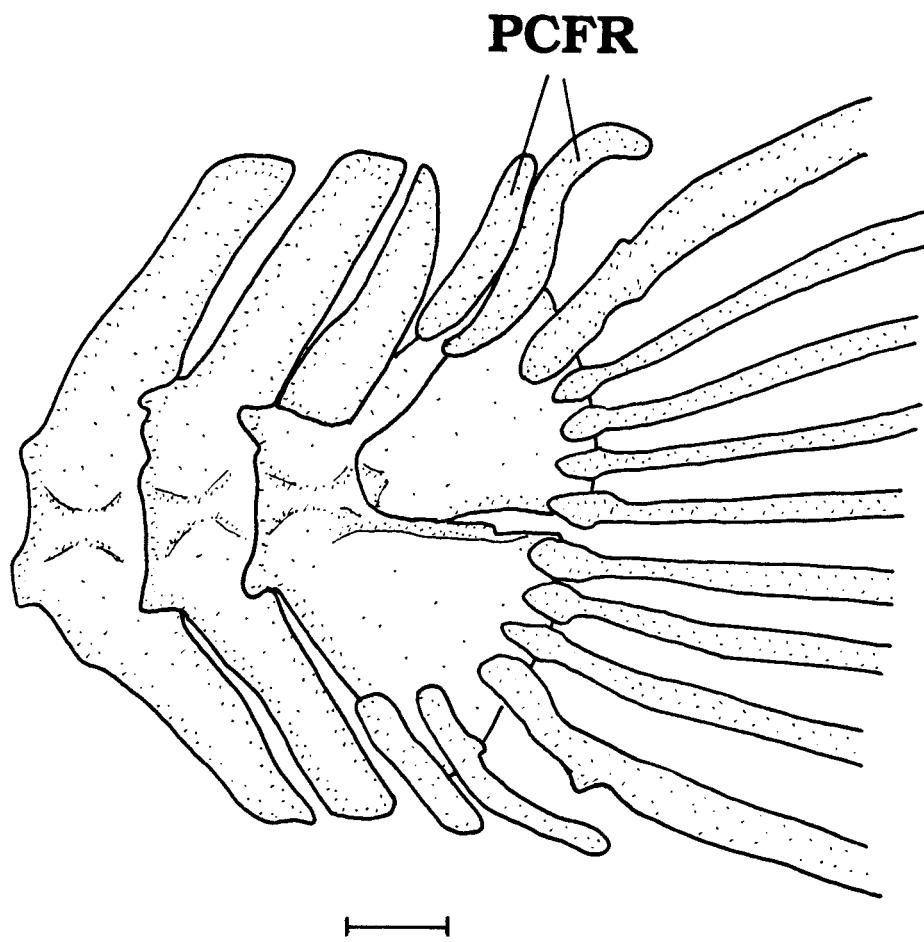


Figure 28. Lateral view of caudal skeleton of *Amaralia* n. sp., UMMZ 207818.

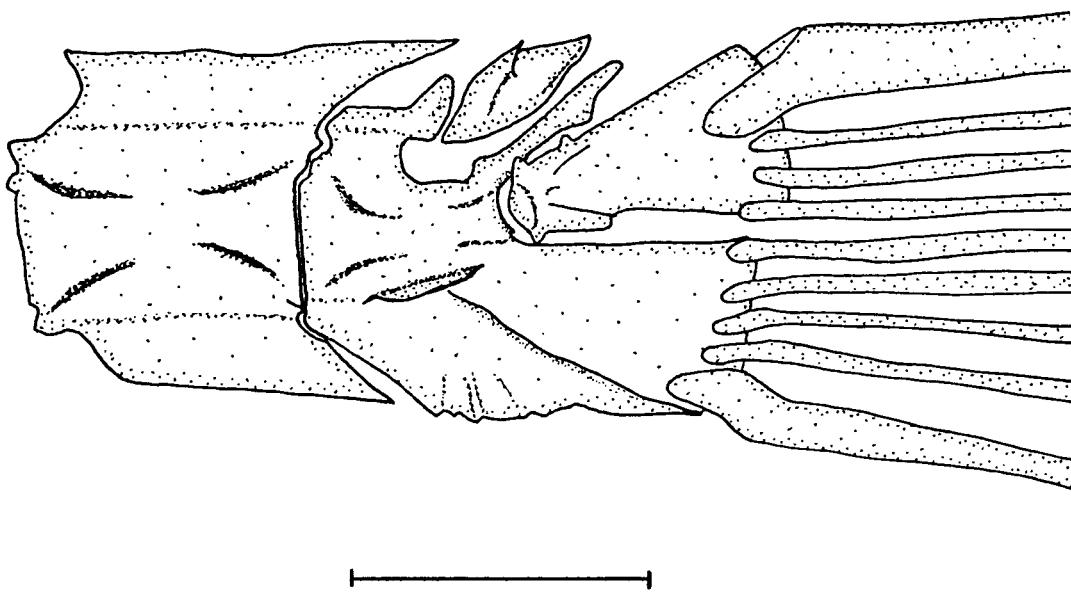


Figure 29. Lateral view of caudal skeleton of *Platystacus cotylephorus*, MBUCV 12387.

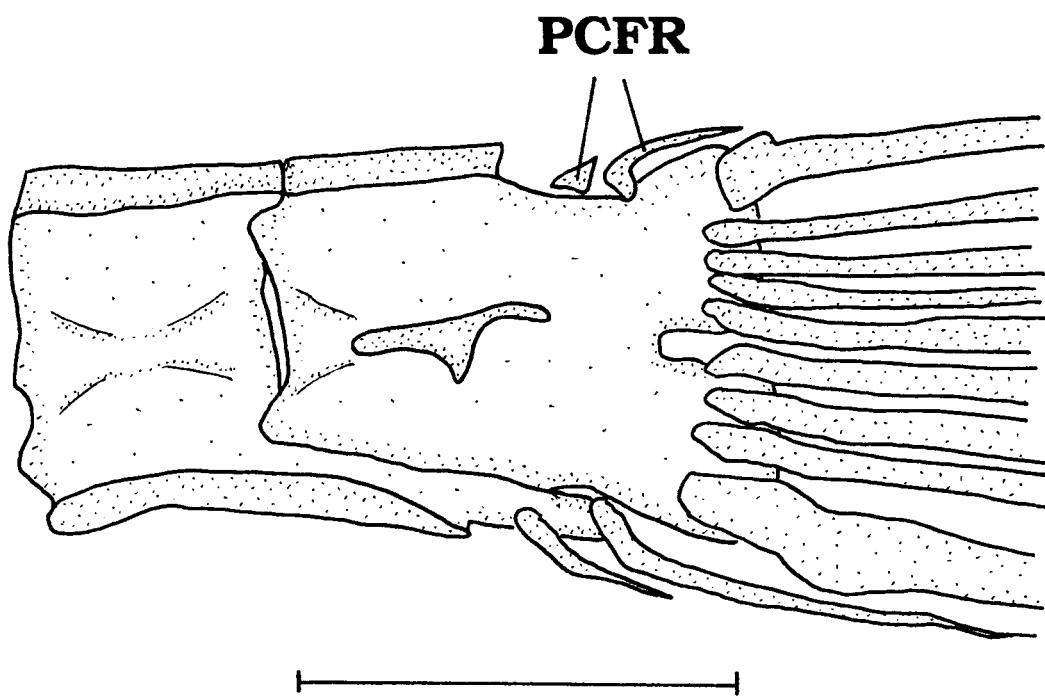


Figure 30. Lateral view of caudal skeleton of *Hoplomyzon sexpilosoma*, UF 47525.

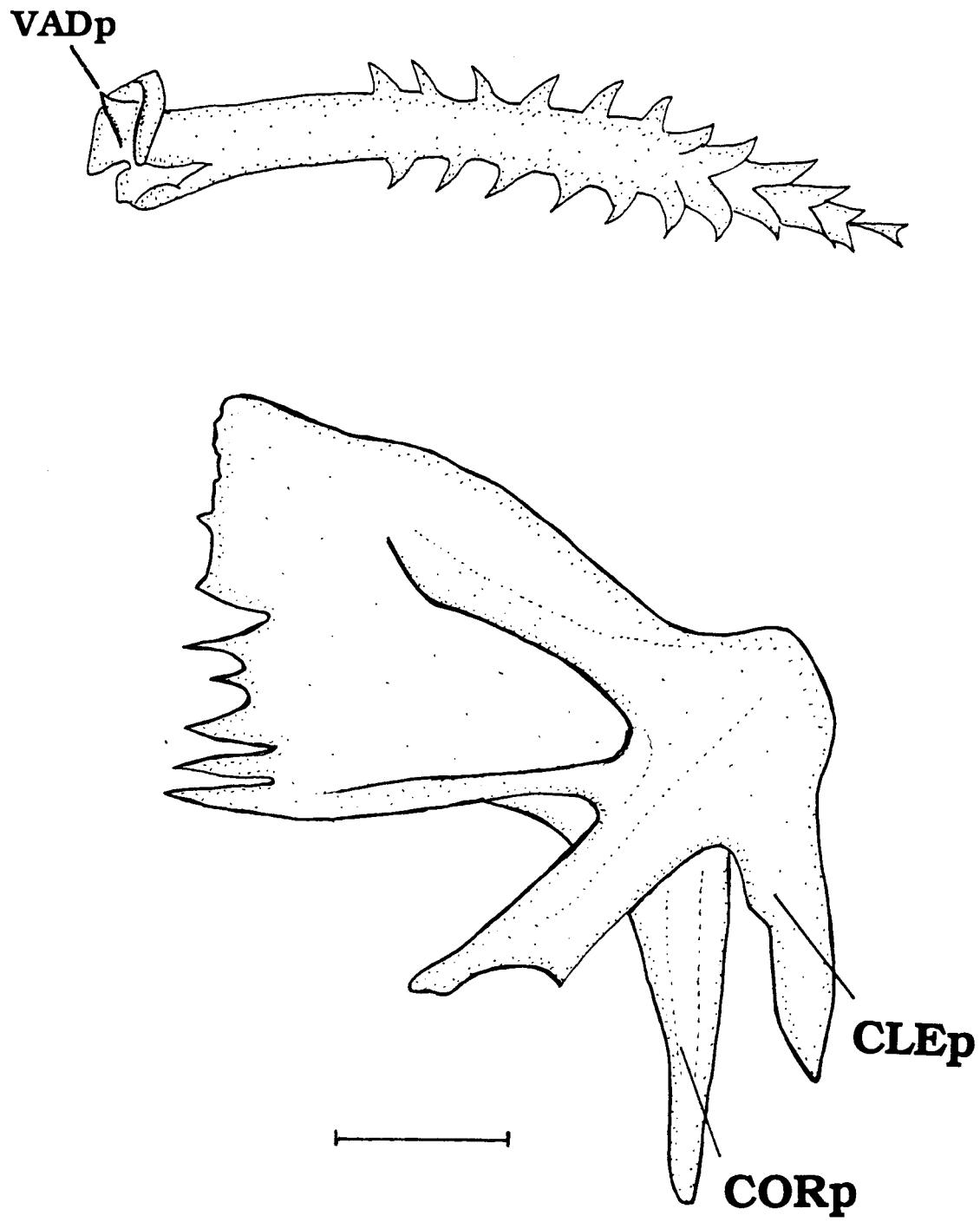


Figure 31. Dorsal view of pectoral spine and girdle of *Acanthobunocephalus nicoi* new gen. & sp., MCNG 21843.



A. *Peckoltia*

B. *Ictalurus*

C. *Breitensteinia*

D. *Arius*

E. *Synodontis*

F. *Trachelyopterus*

G. *Bunocephalus*

Figure 32. Anterior view of the bases of pectoral spines. A. *Peckoltia*, UNCAT; B. *Ictalurus*, UNCAT; C. *Breitensteinia*, AMNH 58378; D. *Arius*, DU F995; E. *Synodontis*, UNCAT; F. *Trachelyopterus*, UNCAT; G. *Bunocephalus*, UNCAT.

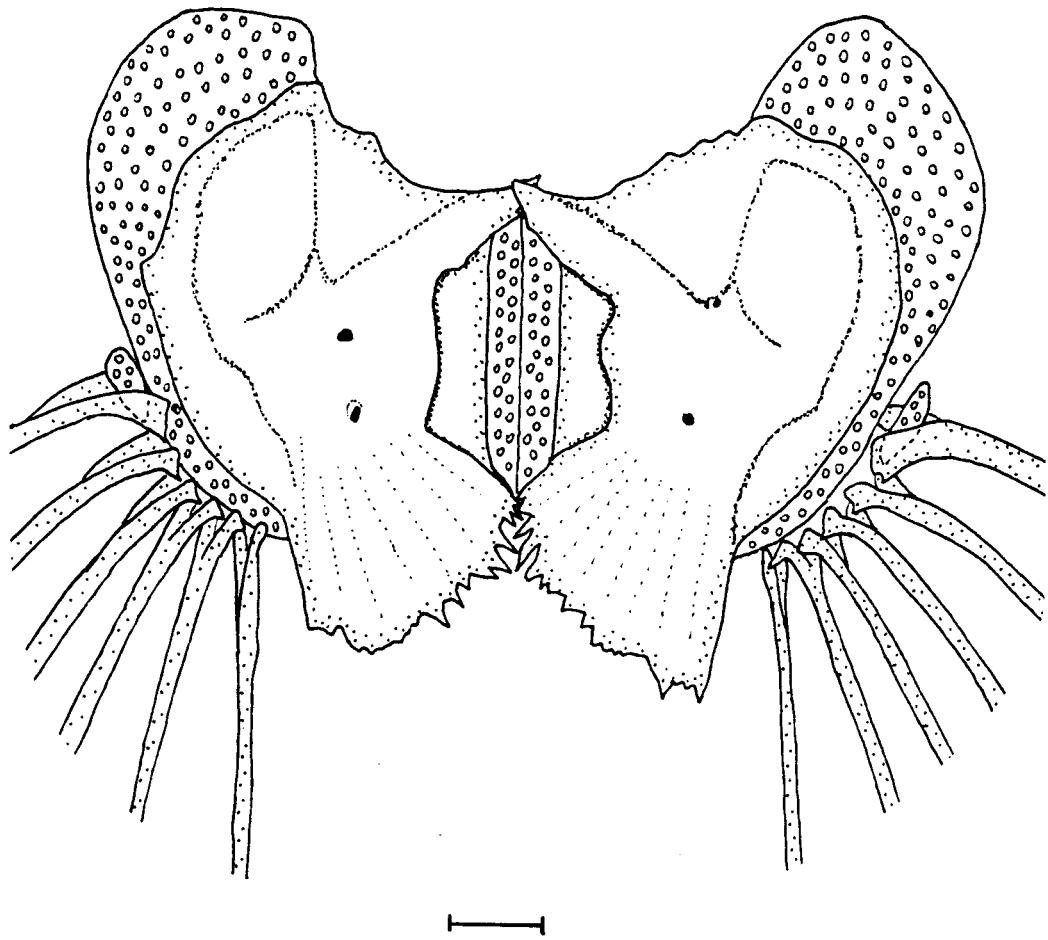


Figure 33. Ventral view of basipterygia of *Amaralia* n. sp., UMMZ 207818

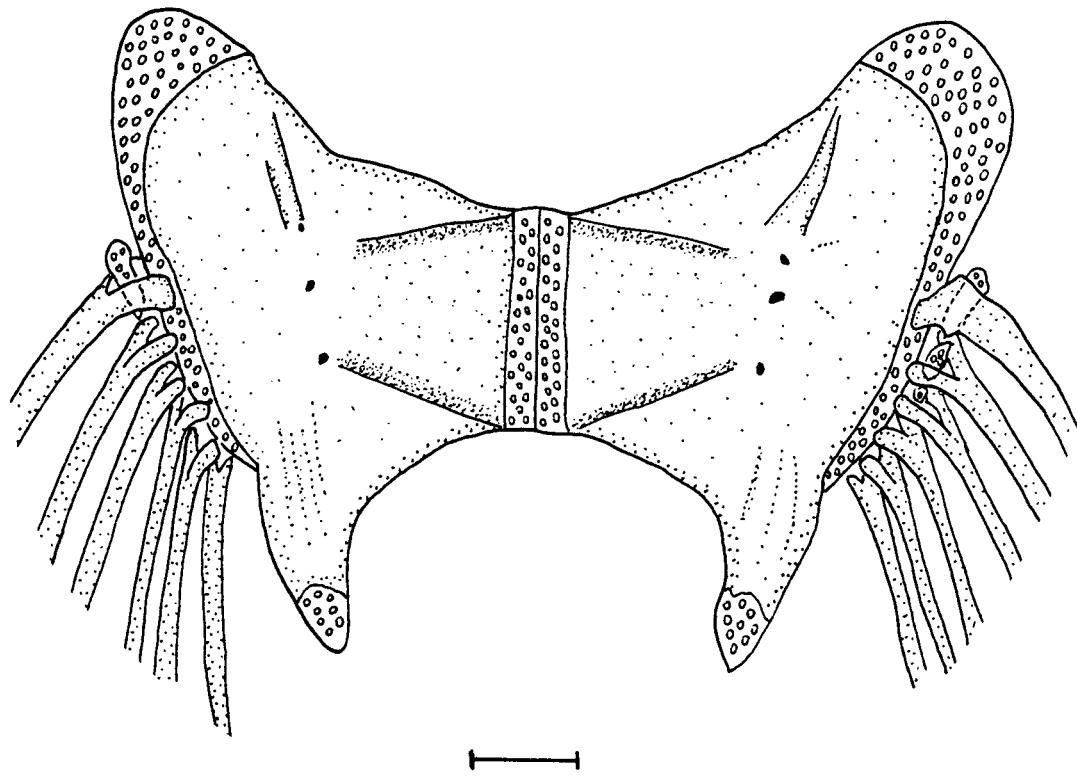


Figure 34. Ventral view of basipterygia of *Platystacus cotylephorus*, MBUCV 12387

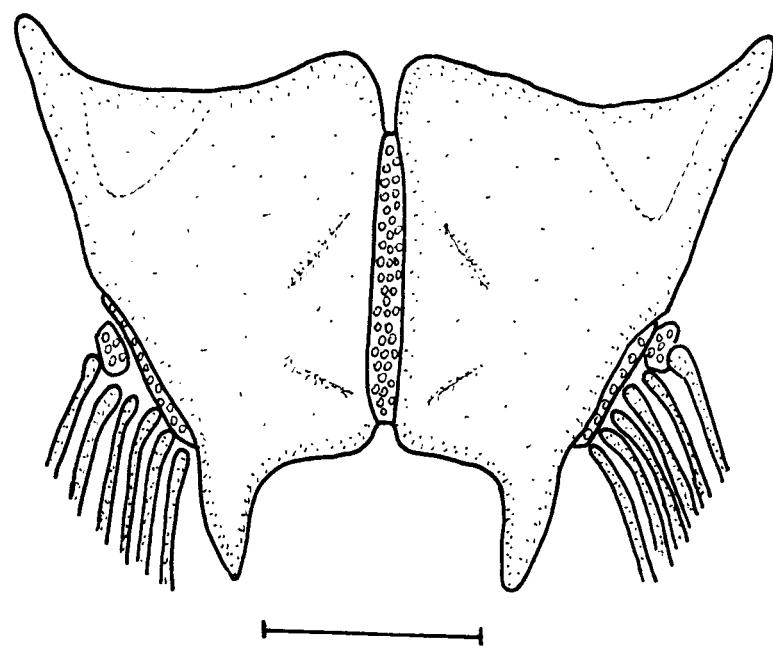
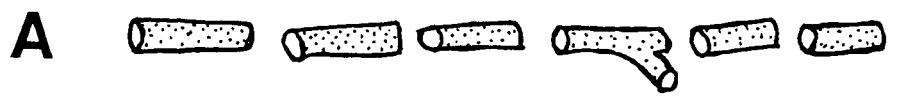
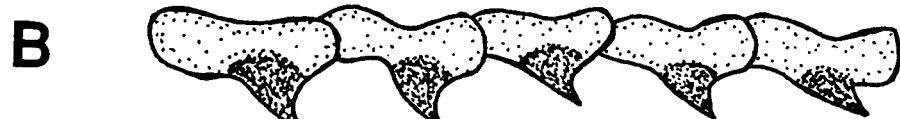


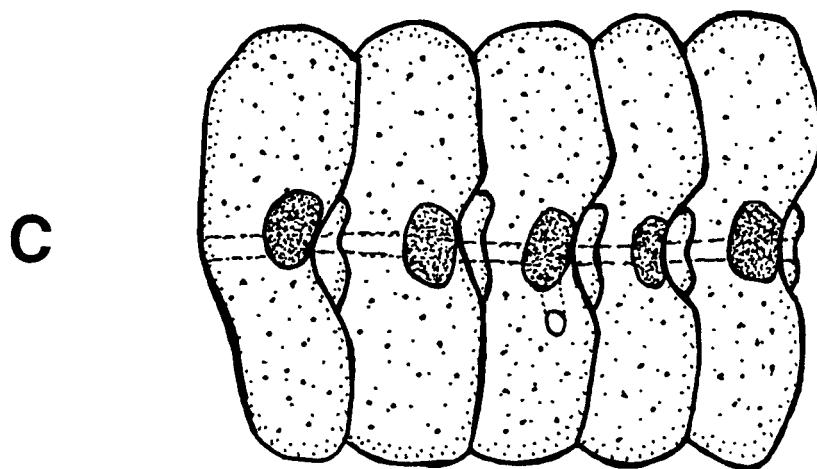
Figure 35. Ventral view of basipterygia of *Hoplomyzon sexpilosoma*, UF 47525



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Figure 36. Lateral view of lateral-line ossicles. A. *Pterobunocephalus depressus*, ANSP 130606; B. *Bunocephalus coracoideus*, UNCAT; C. *Dupouyichthys sapito*, USNM 121073.

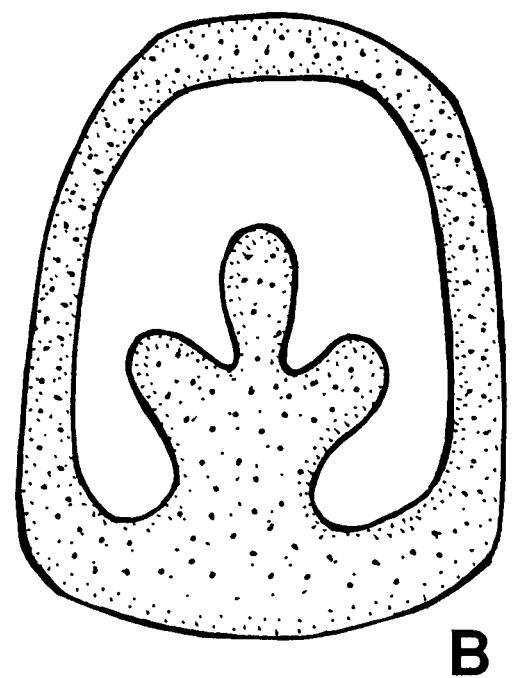
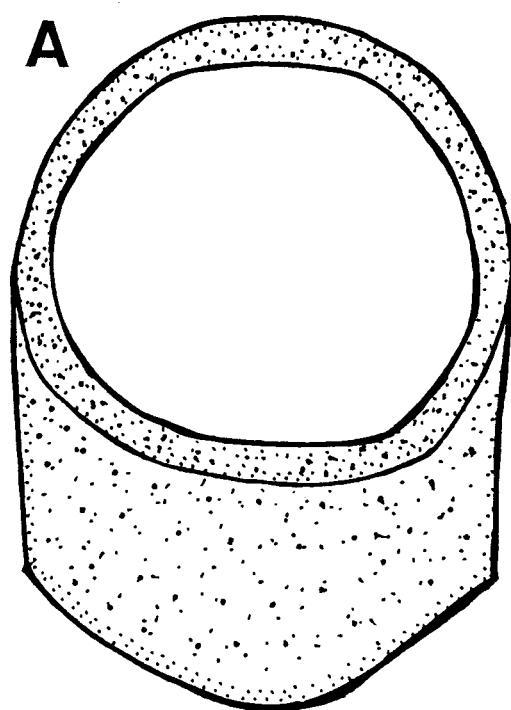


Figure 37. Anterior nares. A. *Bunocephalus*; B. *Xyliphius*.

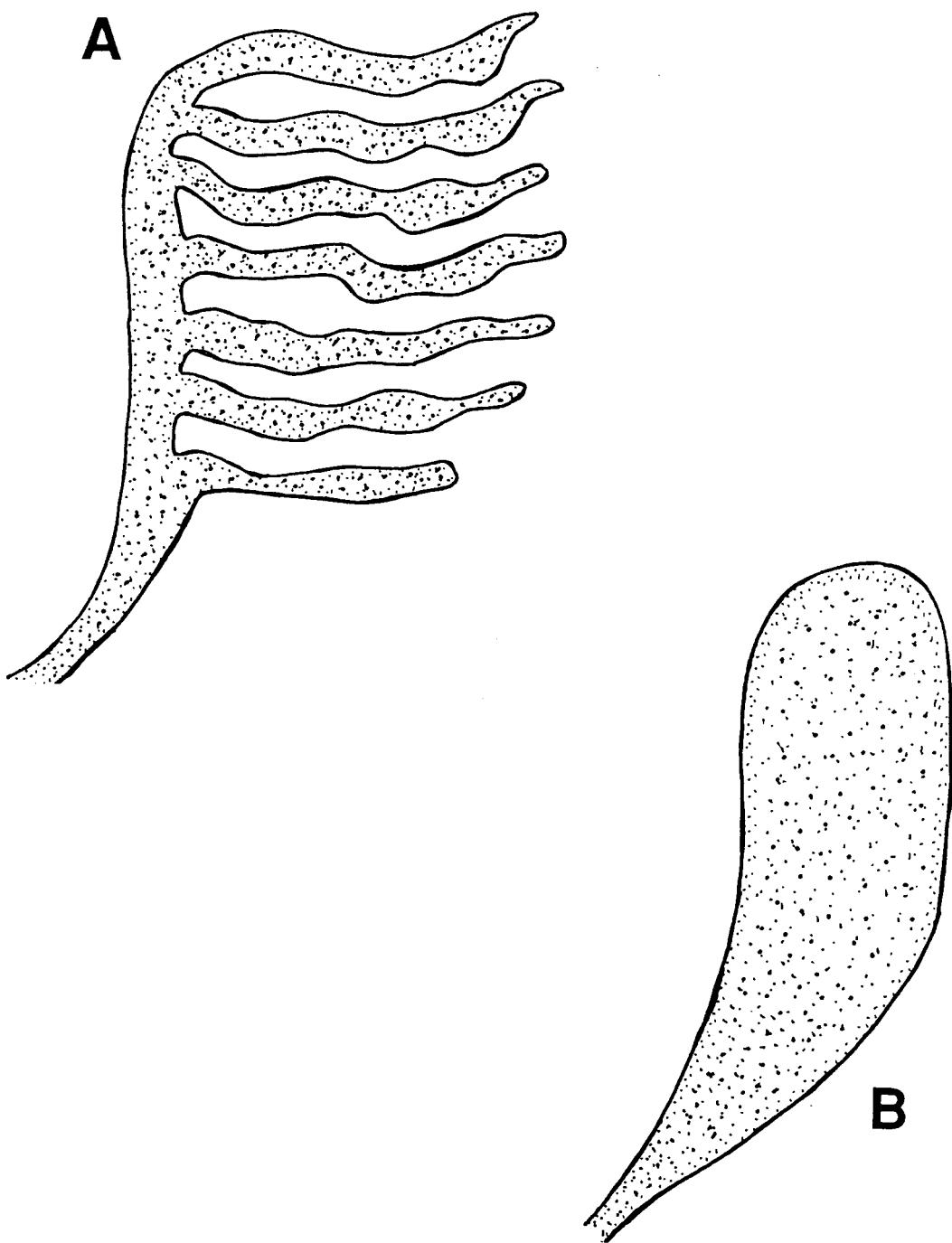
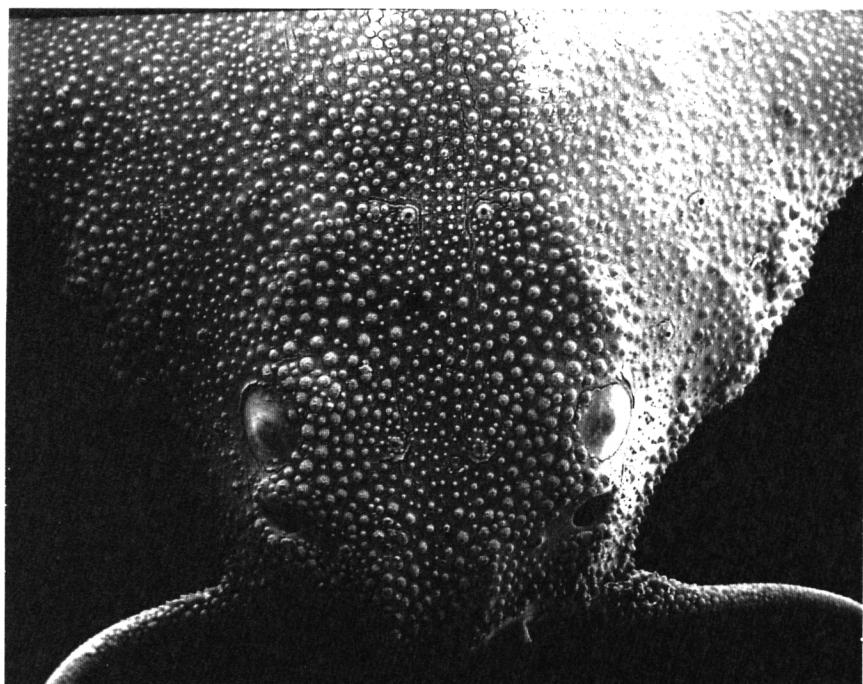


Figure 38. Testis morphology. A. *Bunocephalus*; B. *Pterobunocephalus*.

A

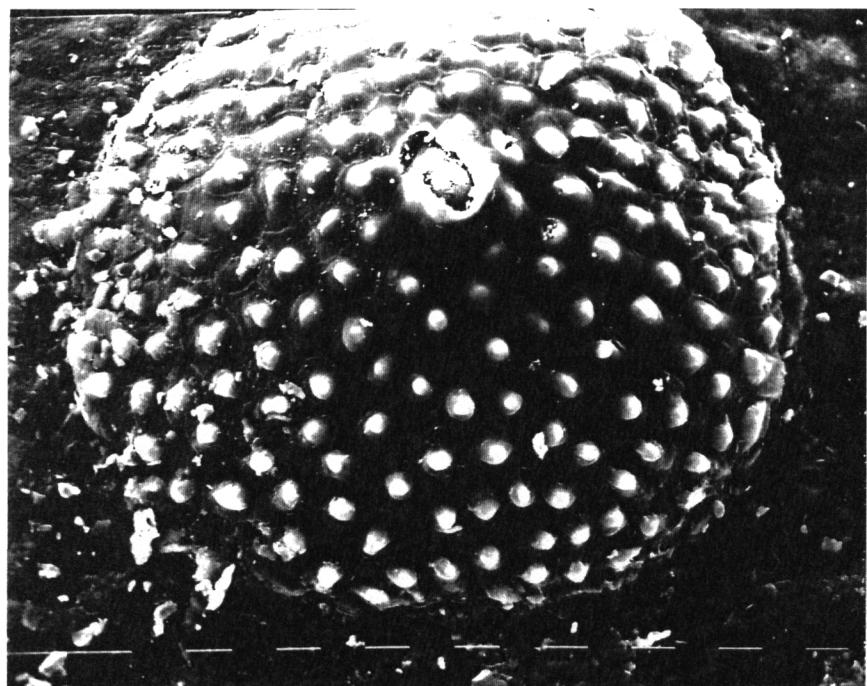


B



Figure 39. SEM micrographs. A. Head of *Bunocephalus* specimen, UNCAT; B. *Bunocephalus*, UNCAT, skin with rows of unculiferous tubercles.

A



B

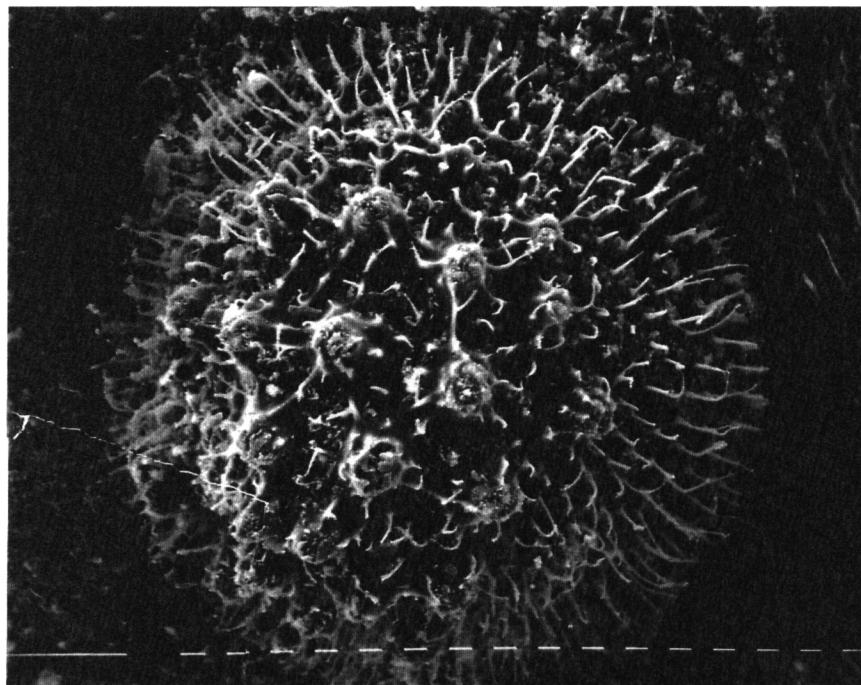
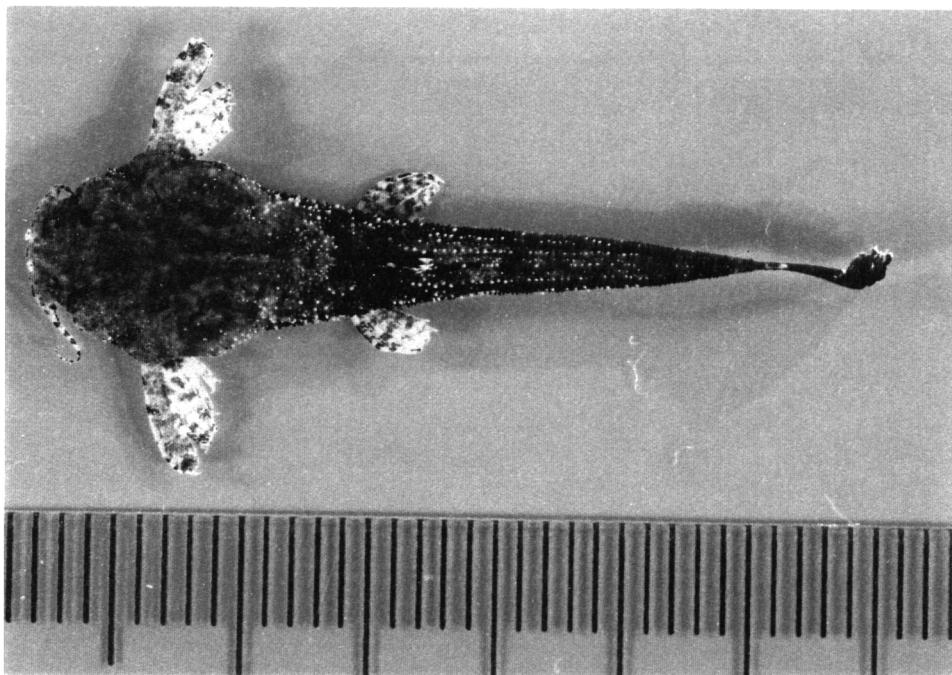


Figure 40. SEM micrographs. A. Unculiferous tubercle from *Pterodoras*, UNCAT; B. Unculiferous tubercle from *Breitensteinia*, USNM 230304.

A



B

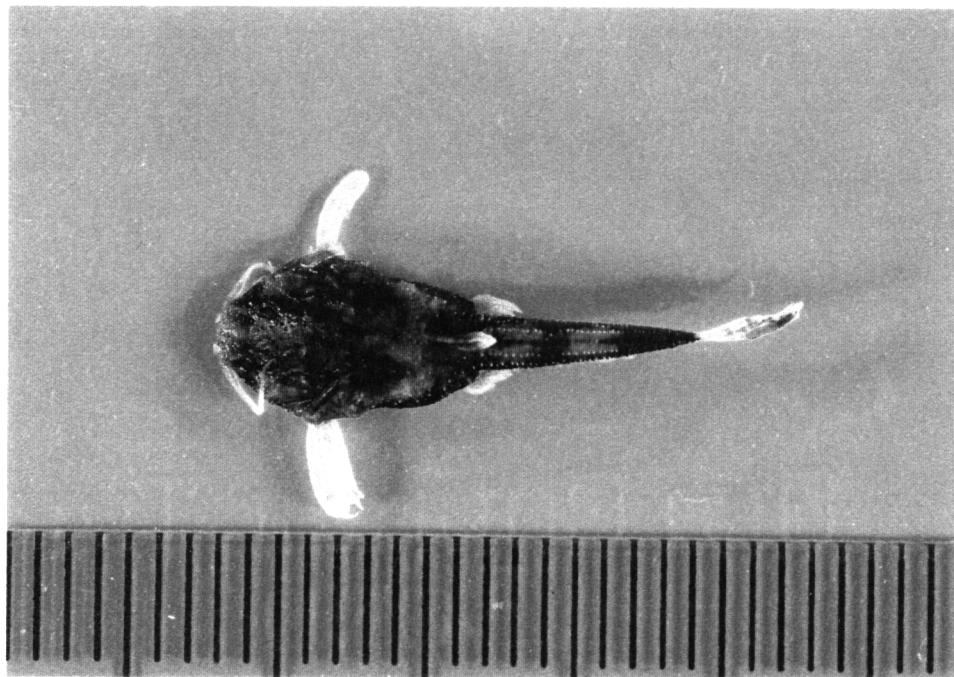


Figure 41. A. Photograph of *Pseudobunocephalus lundbergi* new gen. & sp., ANSP 16887.

B. Photograph of *Acanthobunocephalus nicoi* new gen. & sp., MCNG 29000.

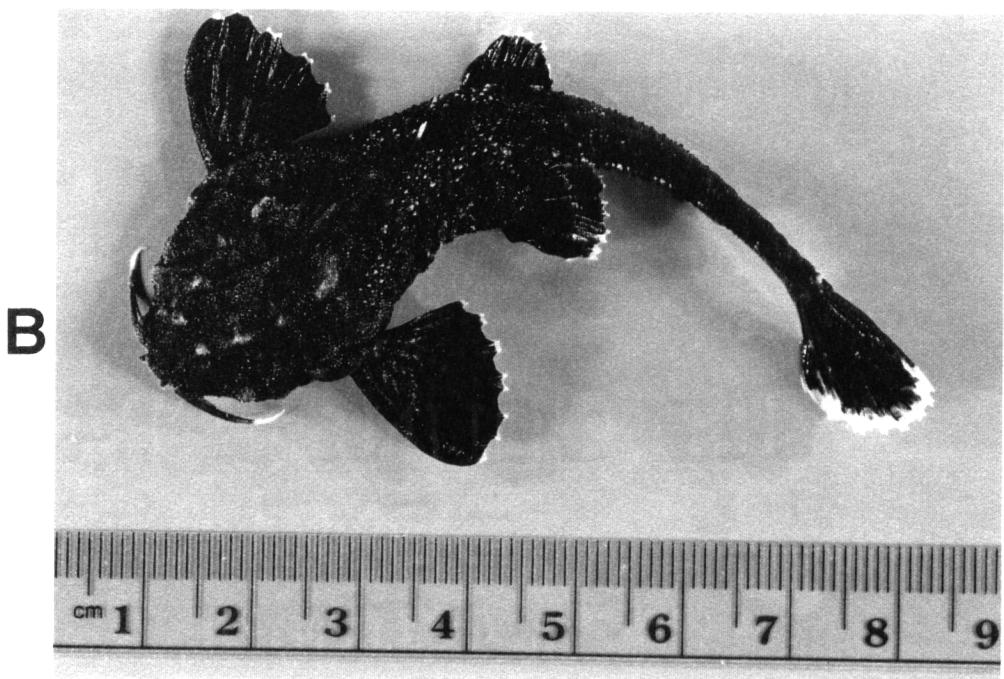
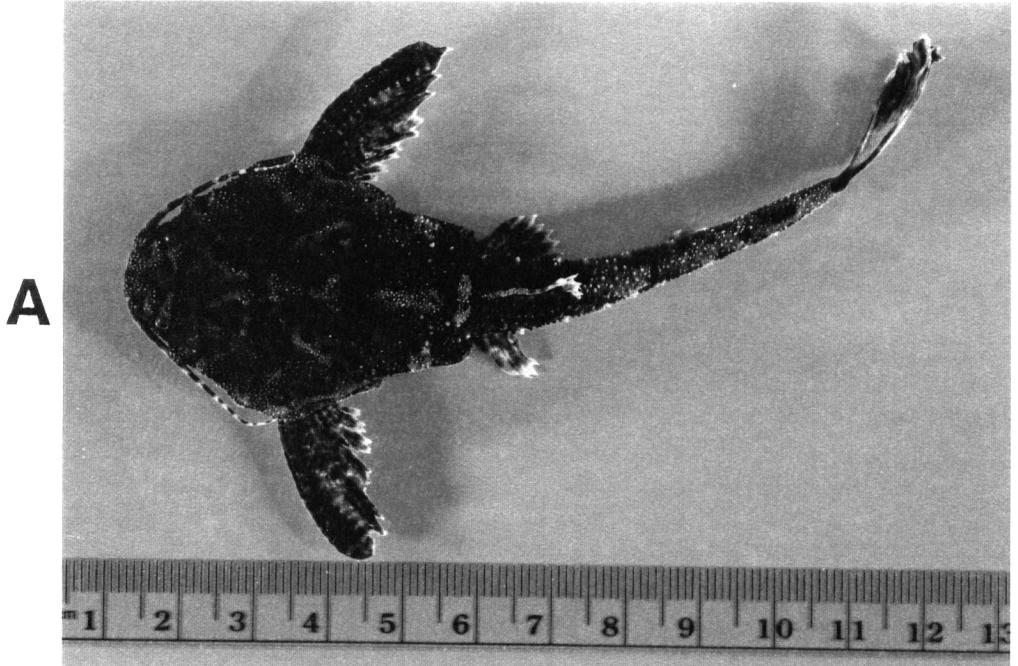


Figure 42. A. Photograph of *Bunocephalus verrucosus*, MZSP 23349; B. Photograph of *Amaralia hypsiura*, INPA 6517.

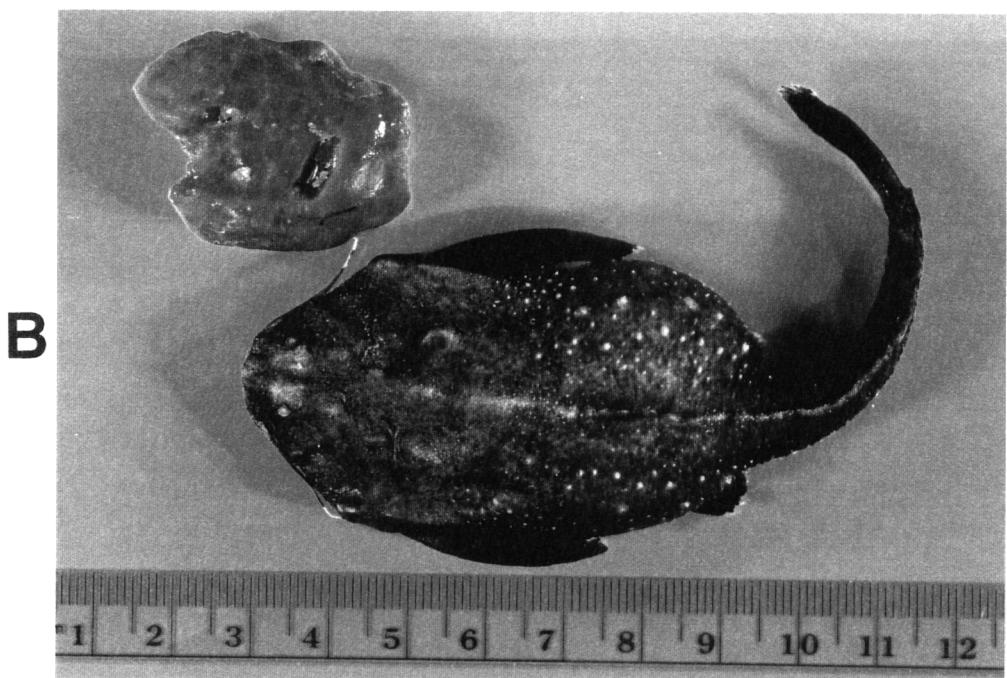
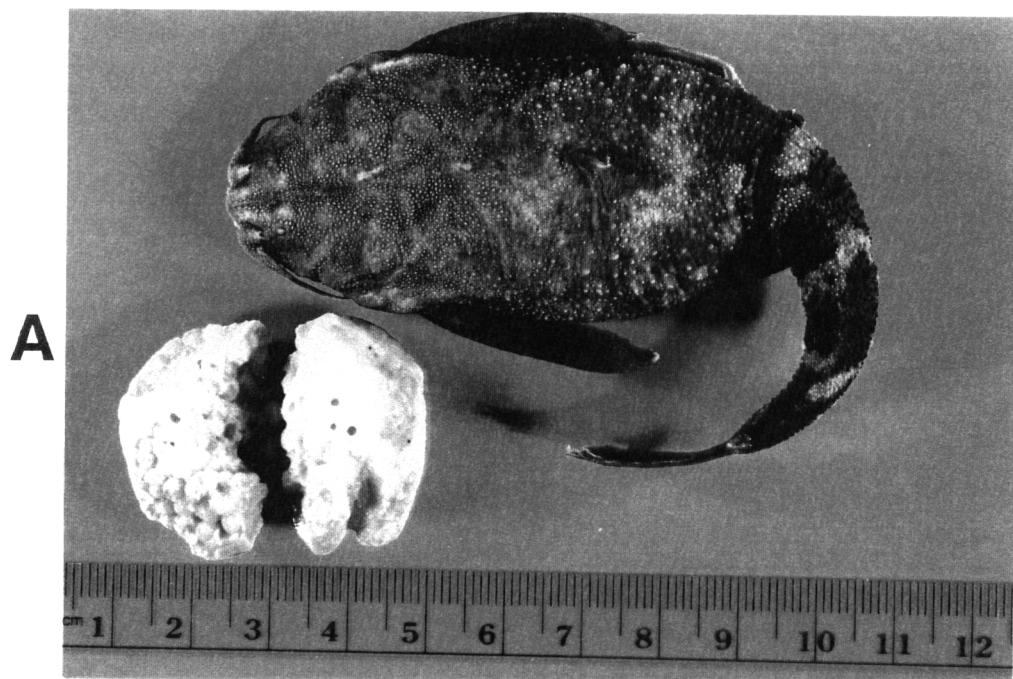


Figure 43. A. Photograph of egg mass removed from stomach of *Amaralia hypsiura*, FMNH 70871; B. Photograph of egg mass removed from stomach of *Amaralia* n. sp., MZSP 36383.

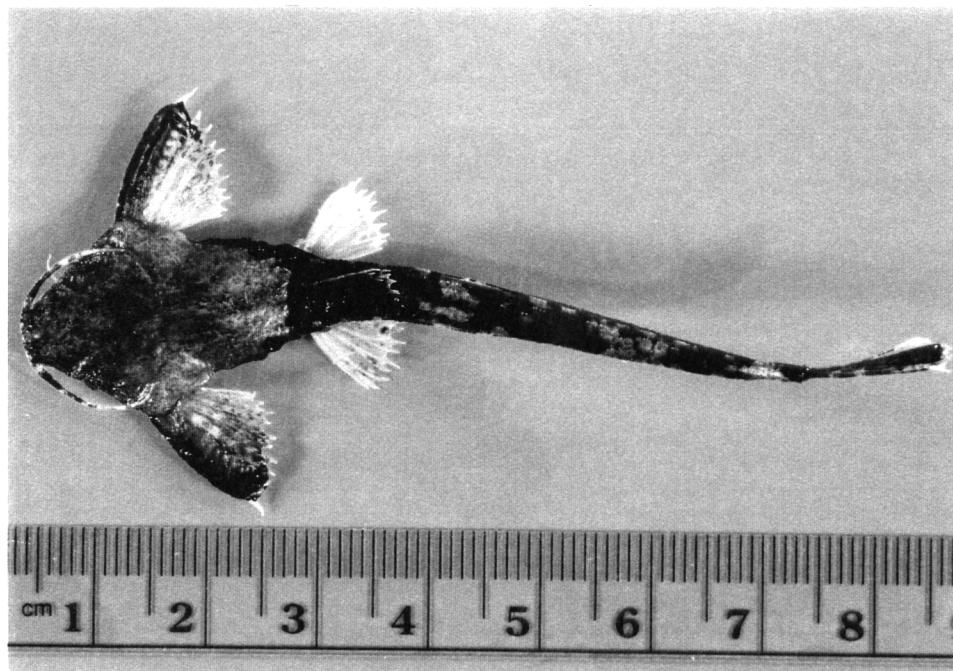
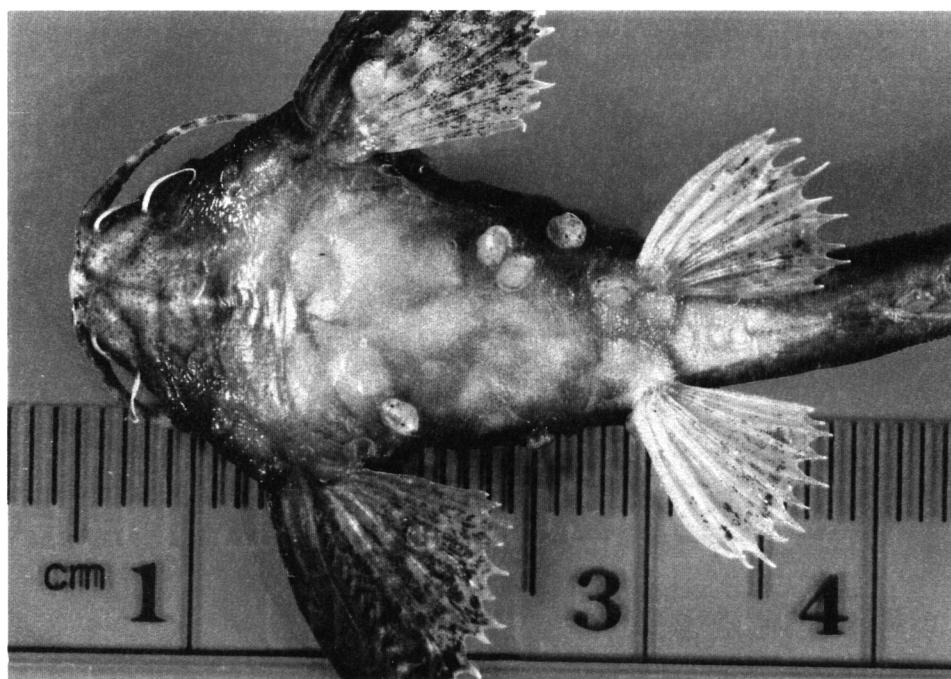
A**B**

Figure 44. A. Photograph of *Pterobunocephalus* sp., UNCAT; B. Photograph of embryos attached to ventral surface of *Pterobunocephalus* sp., UNCAT.

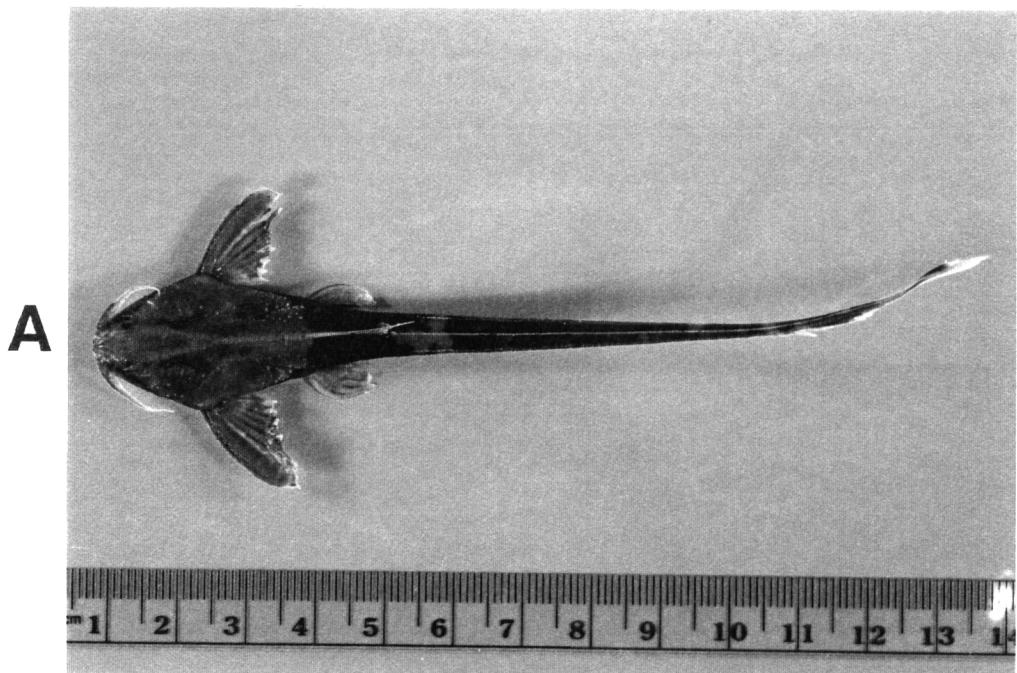
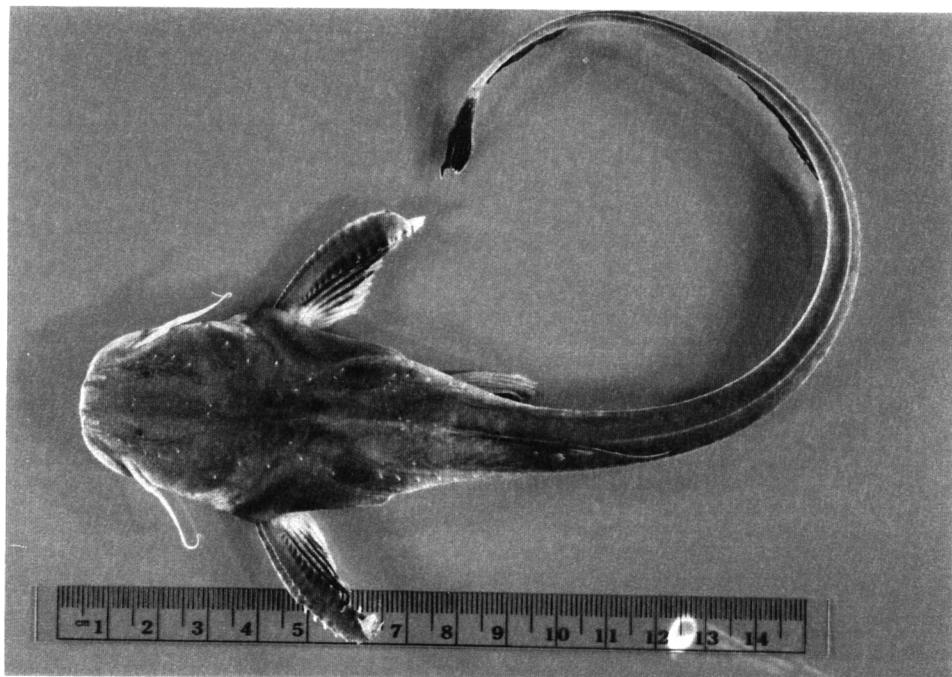


Figure 45. A. Photograph of *Platystacus cotylephorus*, MBUCV 12387; B. Photograph of cotylephores on ventral surface of *Platystacus cotylephorus*, MBUCV 13068.

A



B

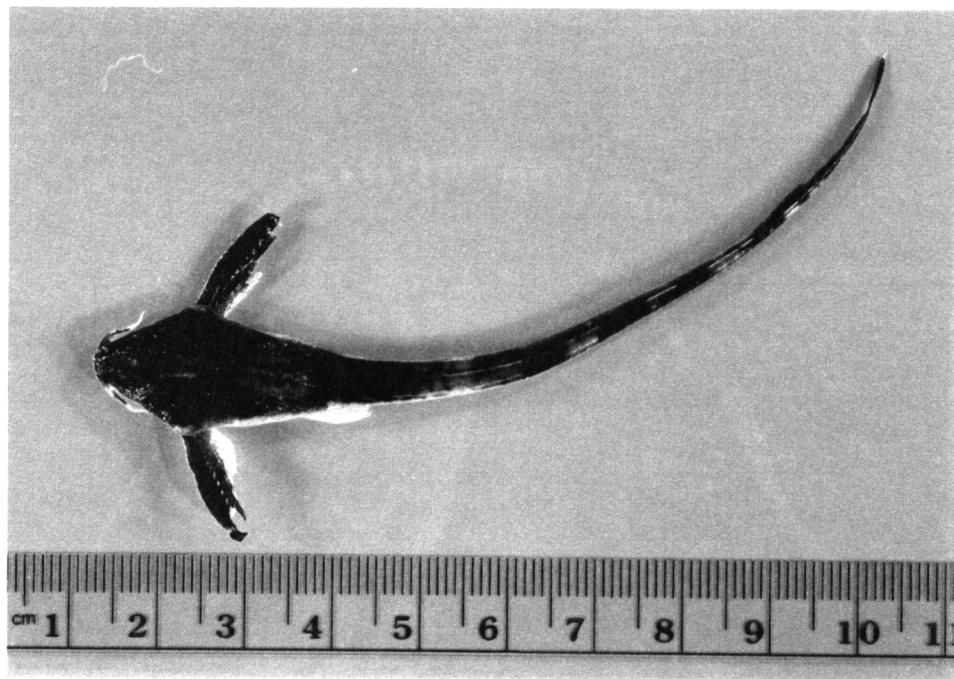


Figure 46. A. Photograph of *Aspredo aspredo*, ROM 66327; B. Photograph of *Aspredinichthys tibicen*, ROM 66330.

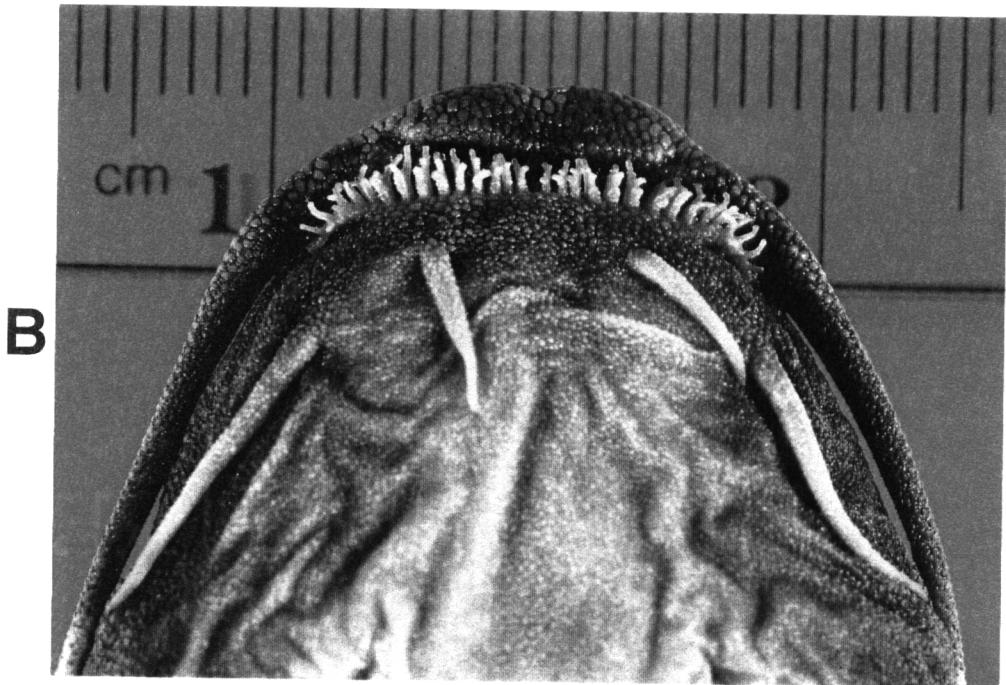
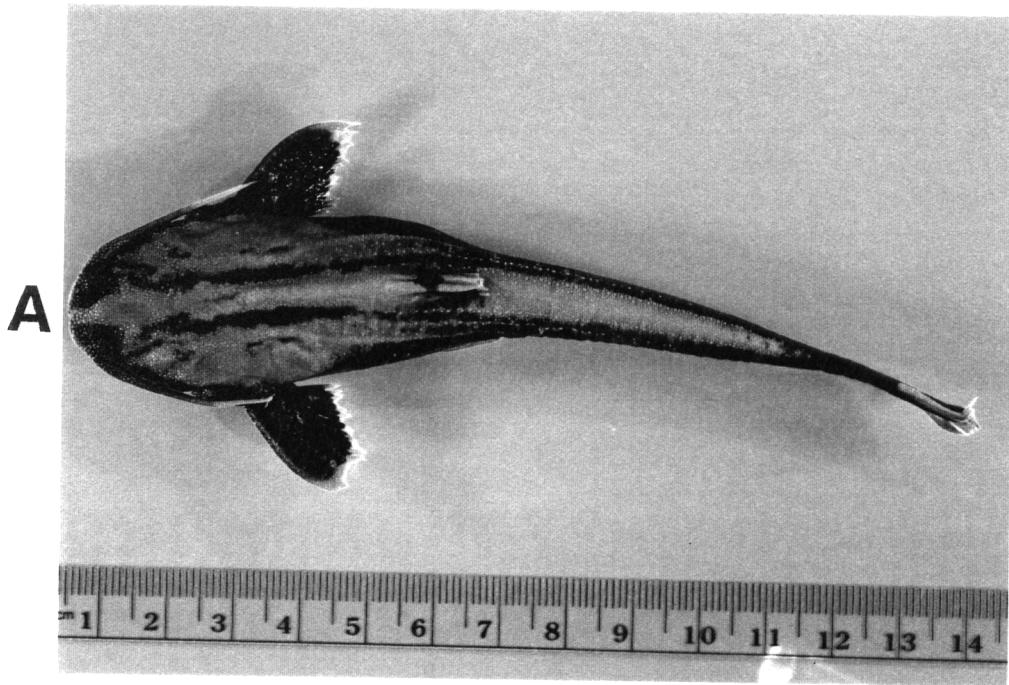
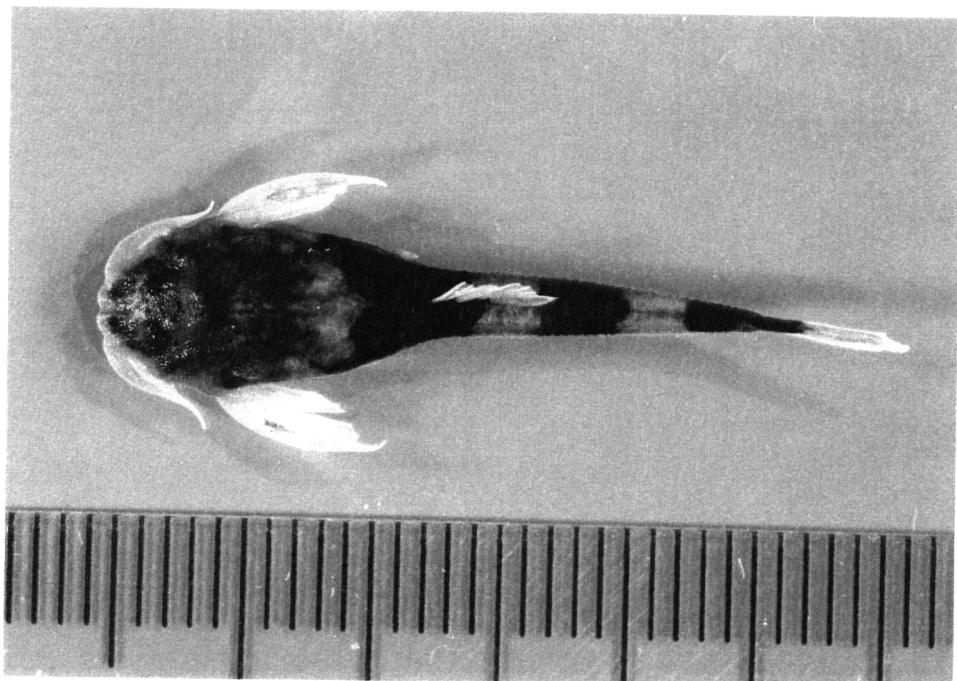


Figure 47. A. Photograph of *Xylipterus kryptos*, MCNG 27310; B. Photograph of ventral view of lower lip of *Xylipterus kryptos*, MCNG 27310.

A



B

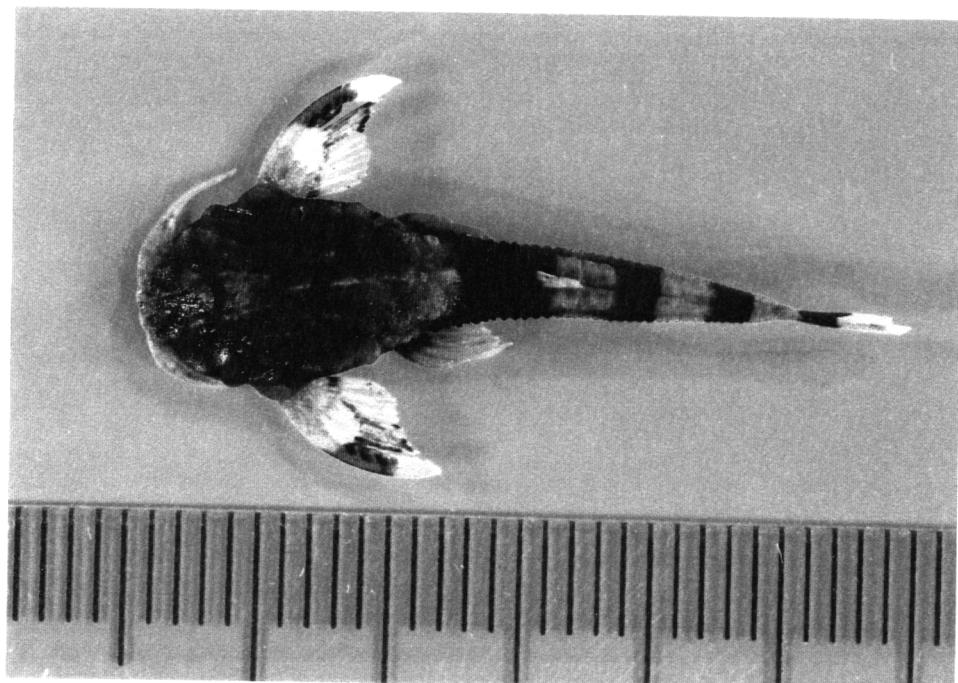


Figure 48. A. Photograph of *Hoplomyzon atrizona*, MCNG 24796; B. Photograph of *Dupouyichthys sapito*, MCNG 25015.

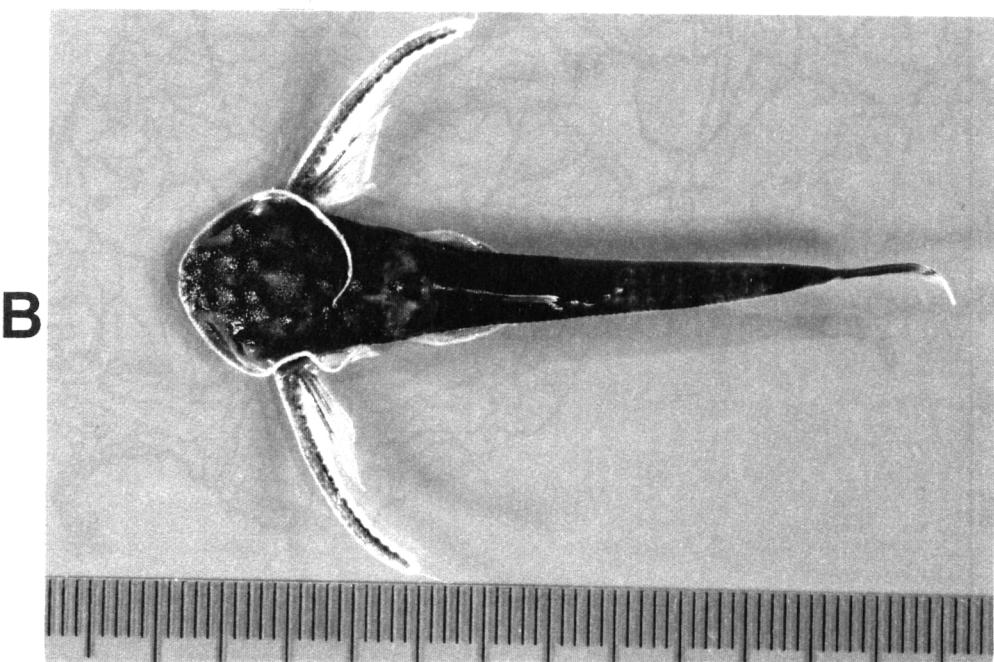
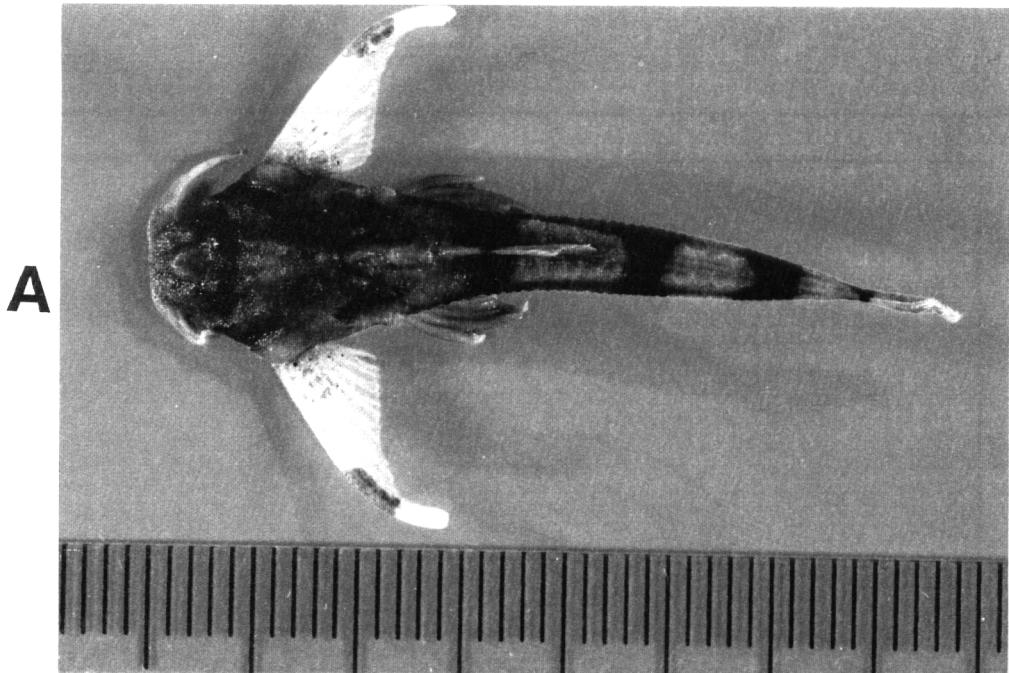


Figure 49. A. Photograph of *Ernstichthys anduzei*, UF 35393; B. Photograph of *Ernstichthys intonsus*, FMNH 94603

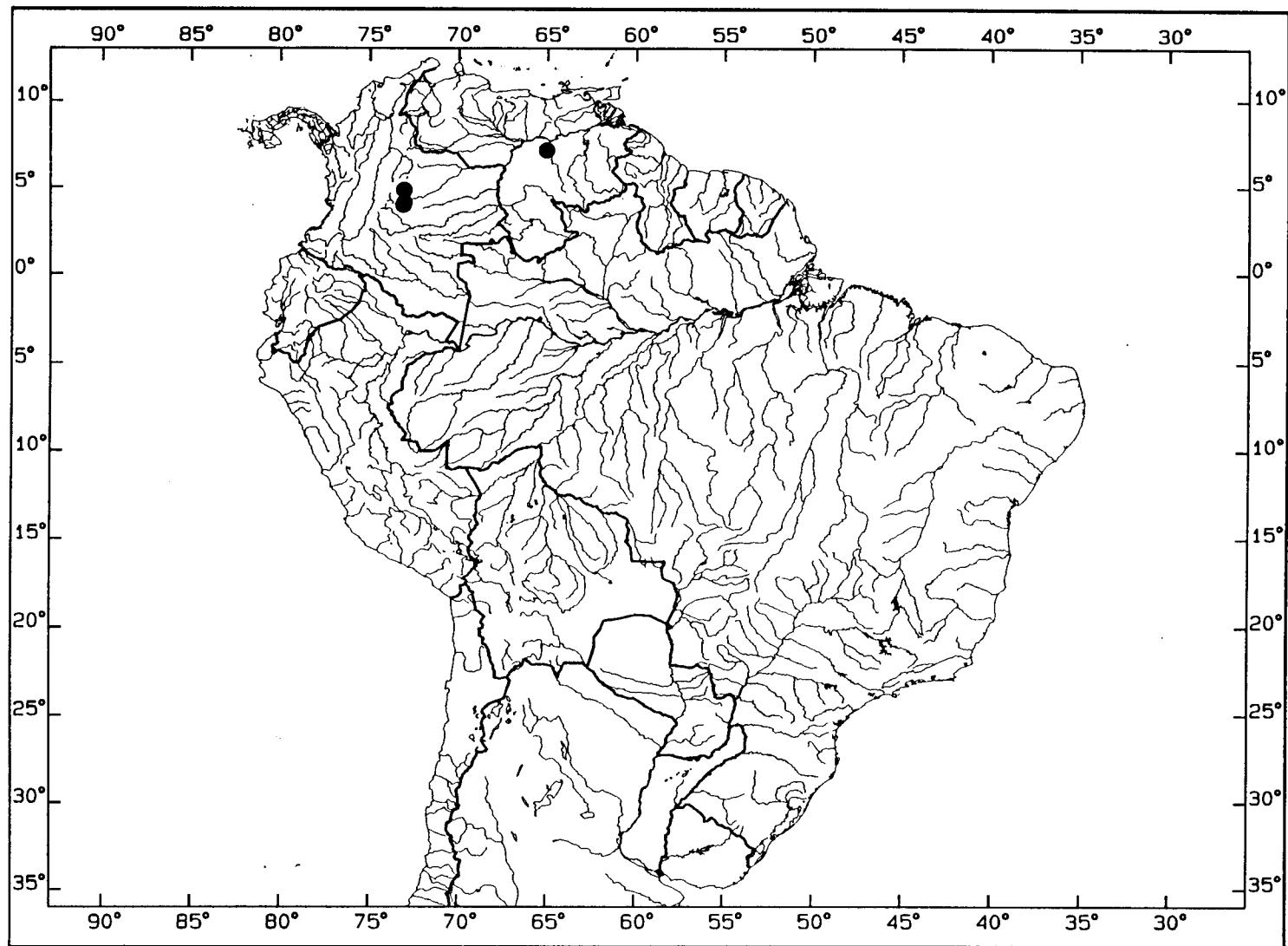


Figure 50. Geographic distribution of *Pseudobunocephalus lundbergi* n. gen. & sp.

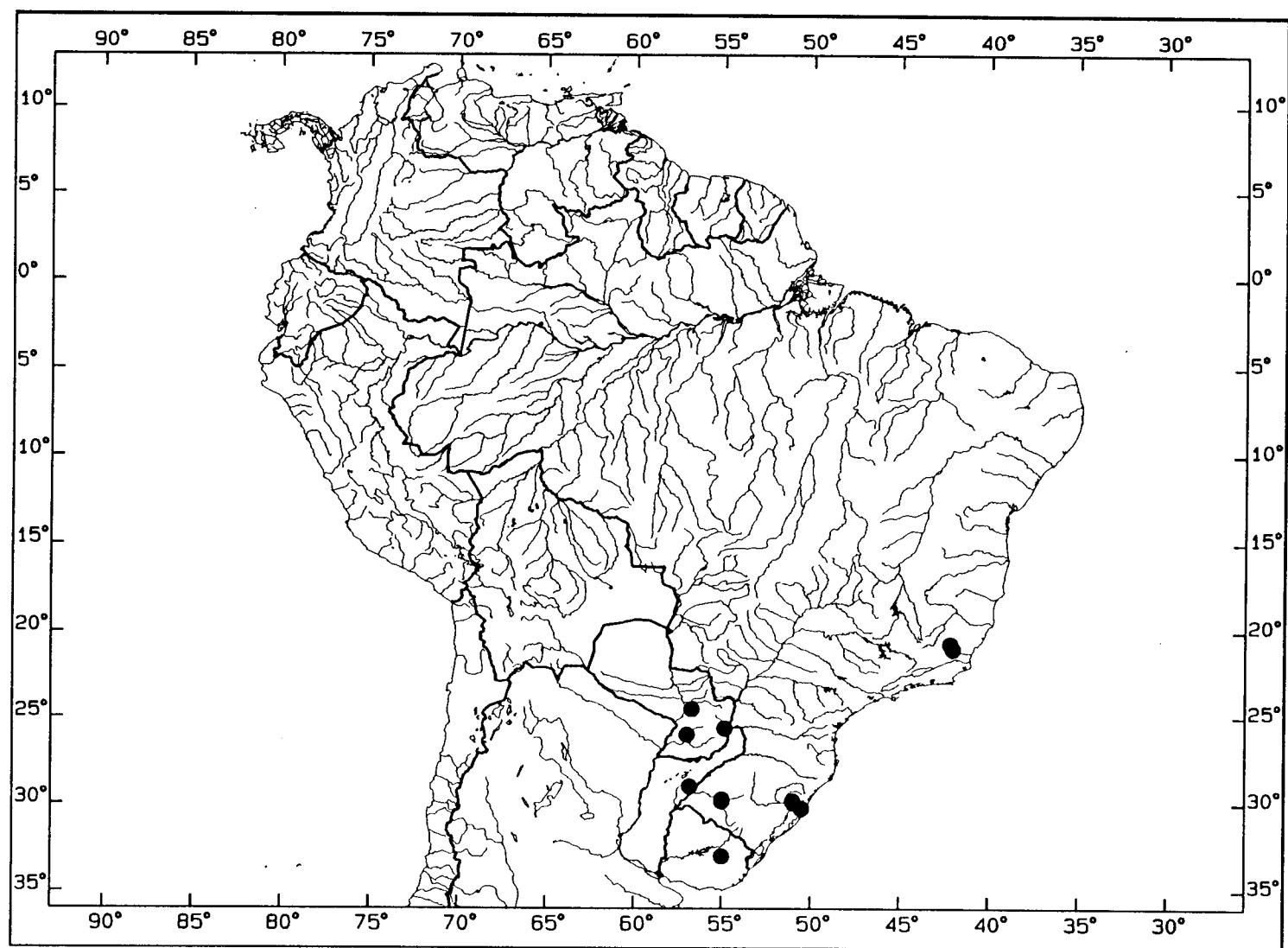


Figure 51. Geographic distribution of *Pseudobunocephalus iheringii*.

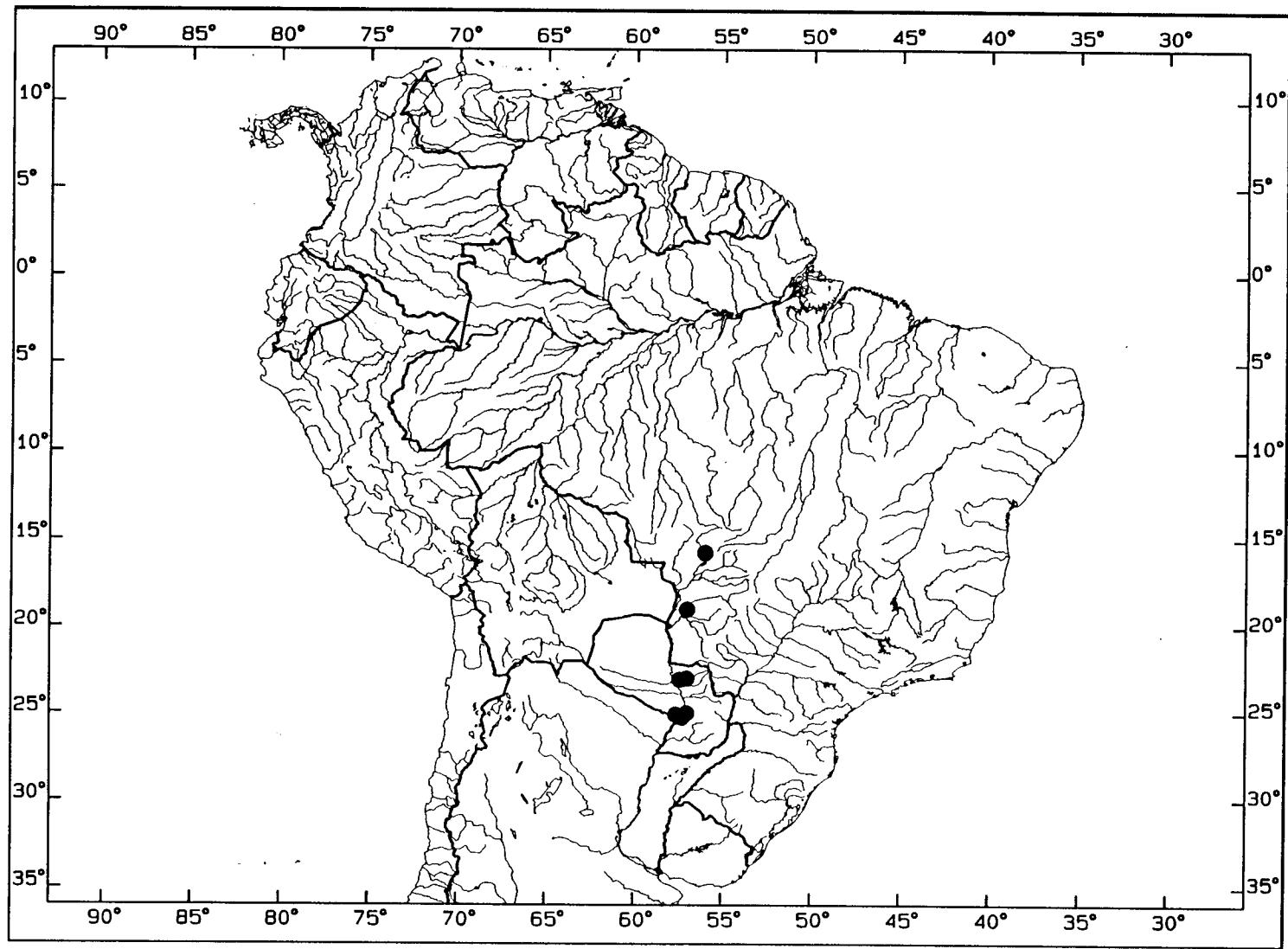


Figure 52. Geographic distribution of *Pseudobunocephalus rugosus*.

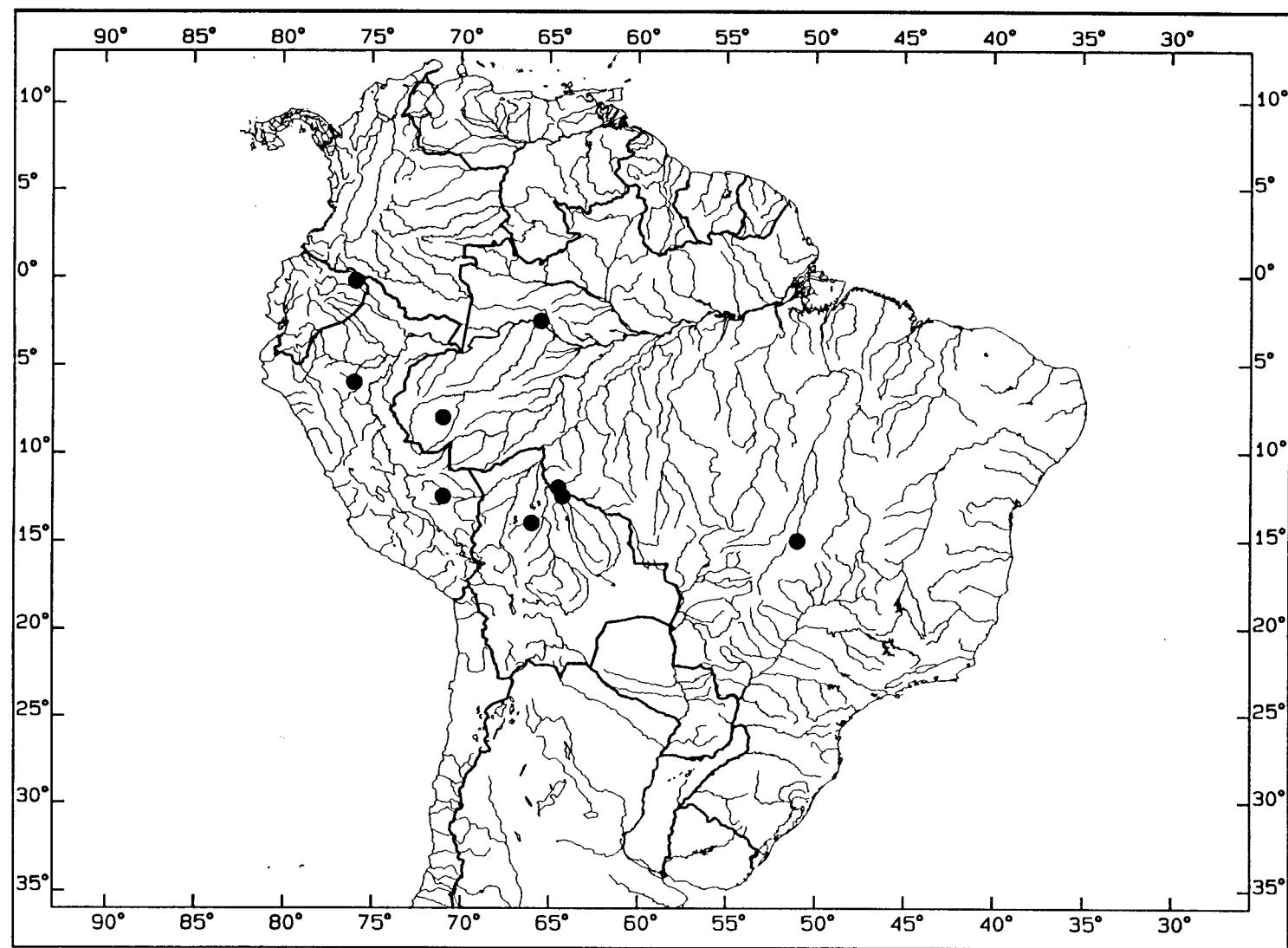


Figure 53. Geographic distribution of *Pseudobunocephalus bifidus*.

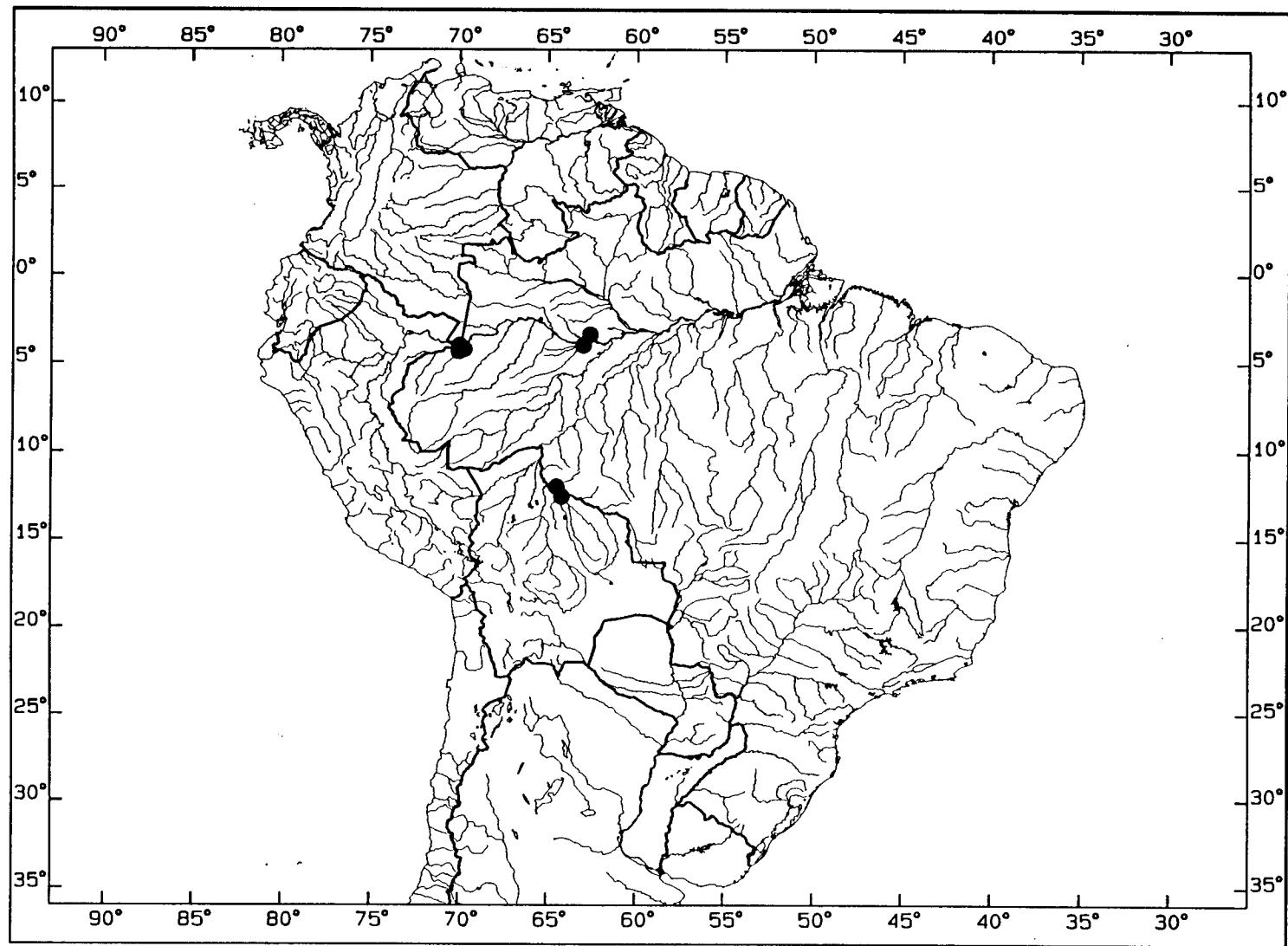


Figure 54. Geographic distribution of *Pseudobunocephalus amazonicus*.

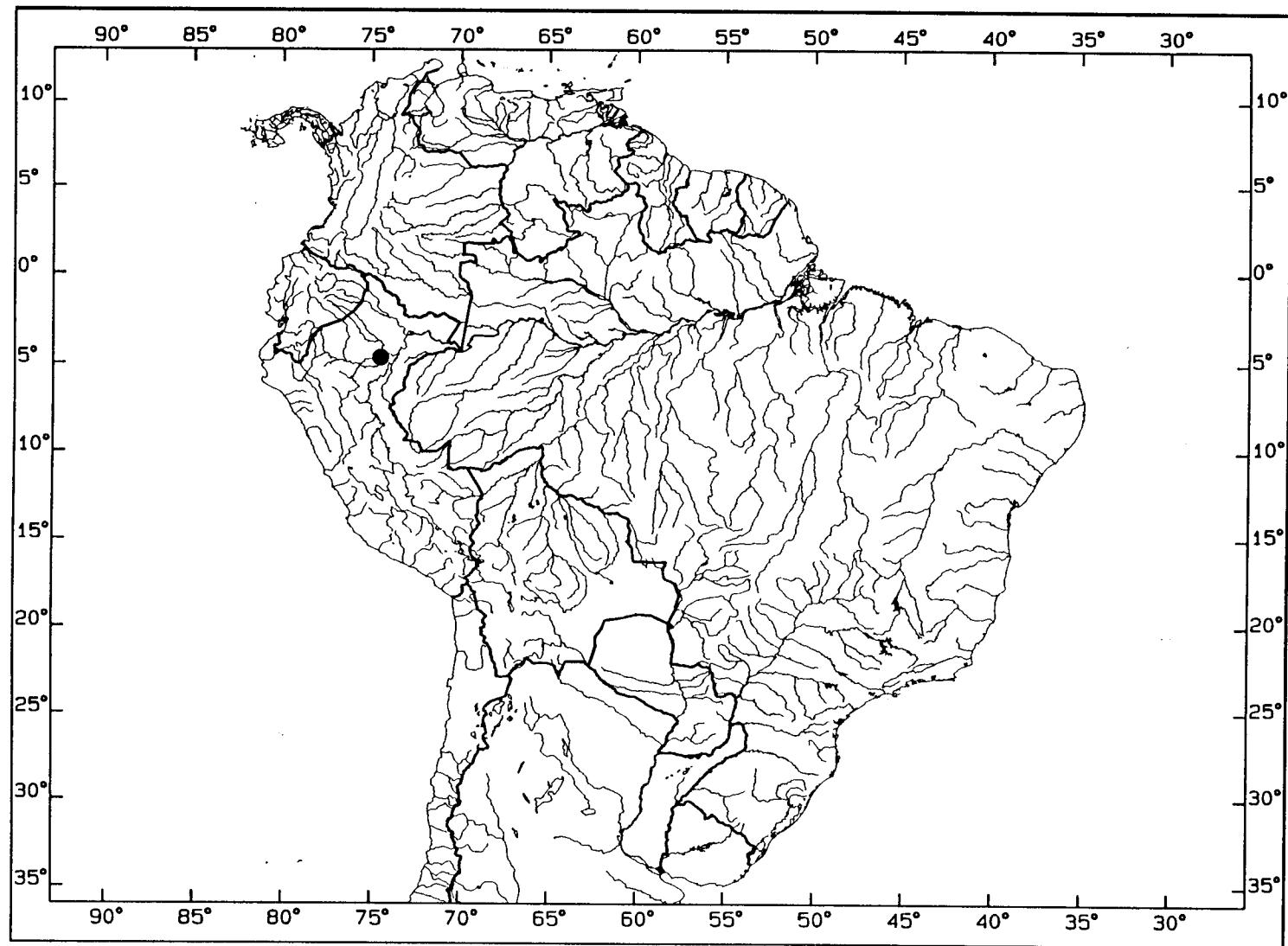


Figure 55. Geographic distribution of *Pseudobunocephalus quadriradiatus*.

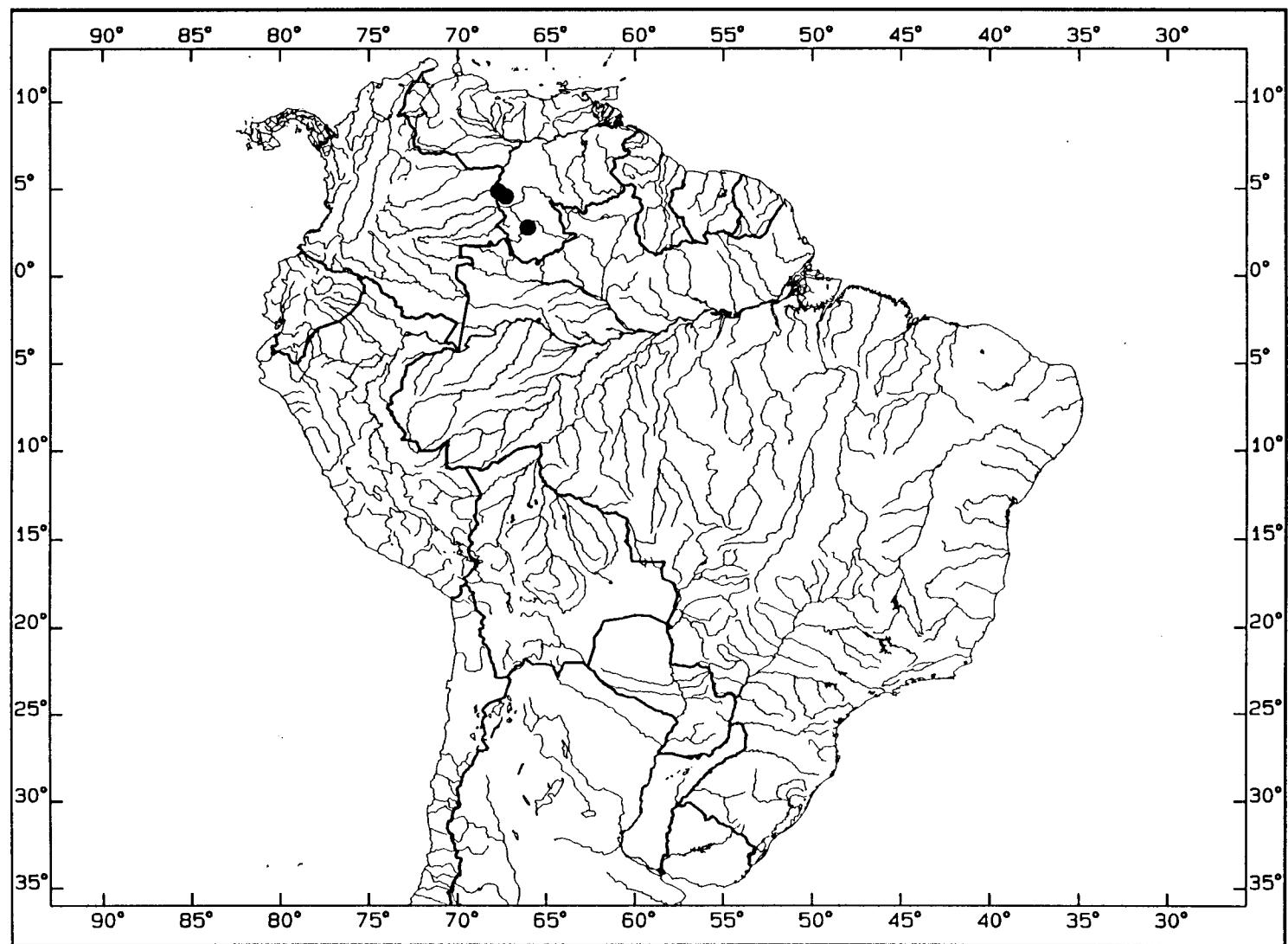


Figure 56. Geographic distribution of *Acanthobunocephalus nicoi* n. gen. & sp.

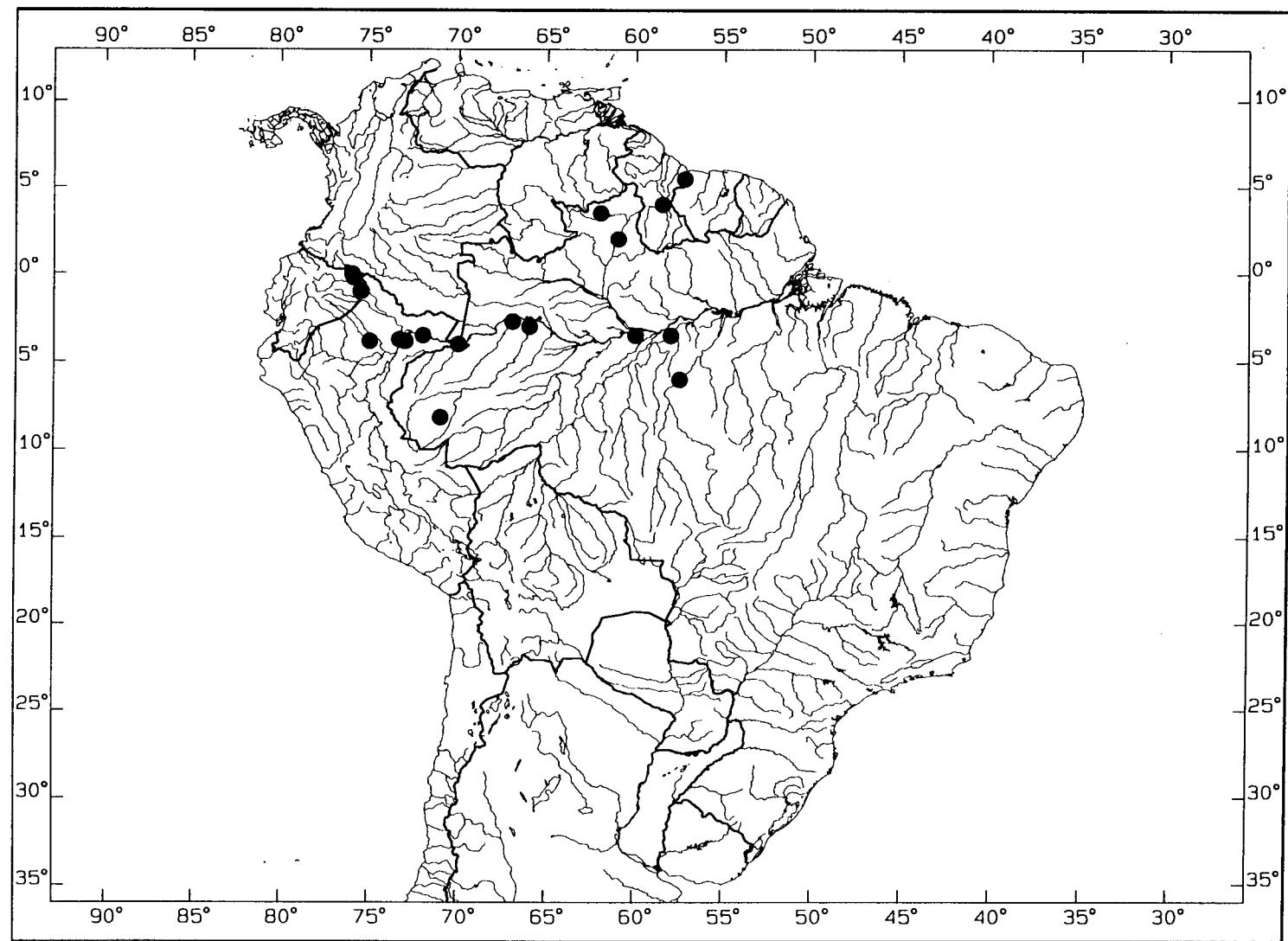


Figure 57. Geographic distribution of *Bunocephalus verrucosus*.

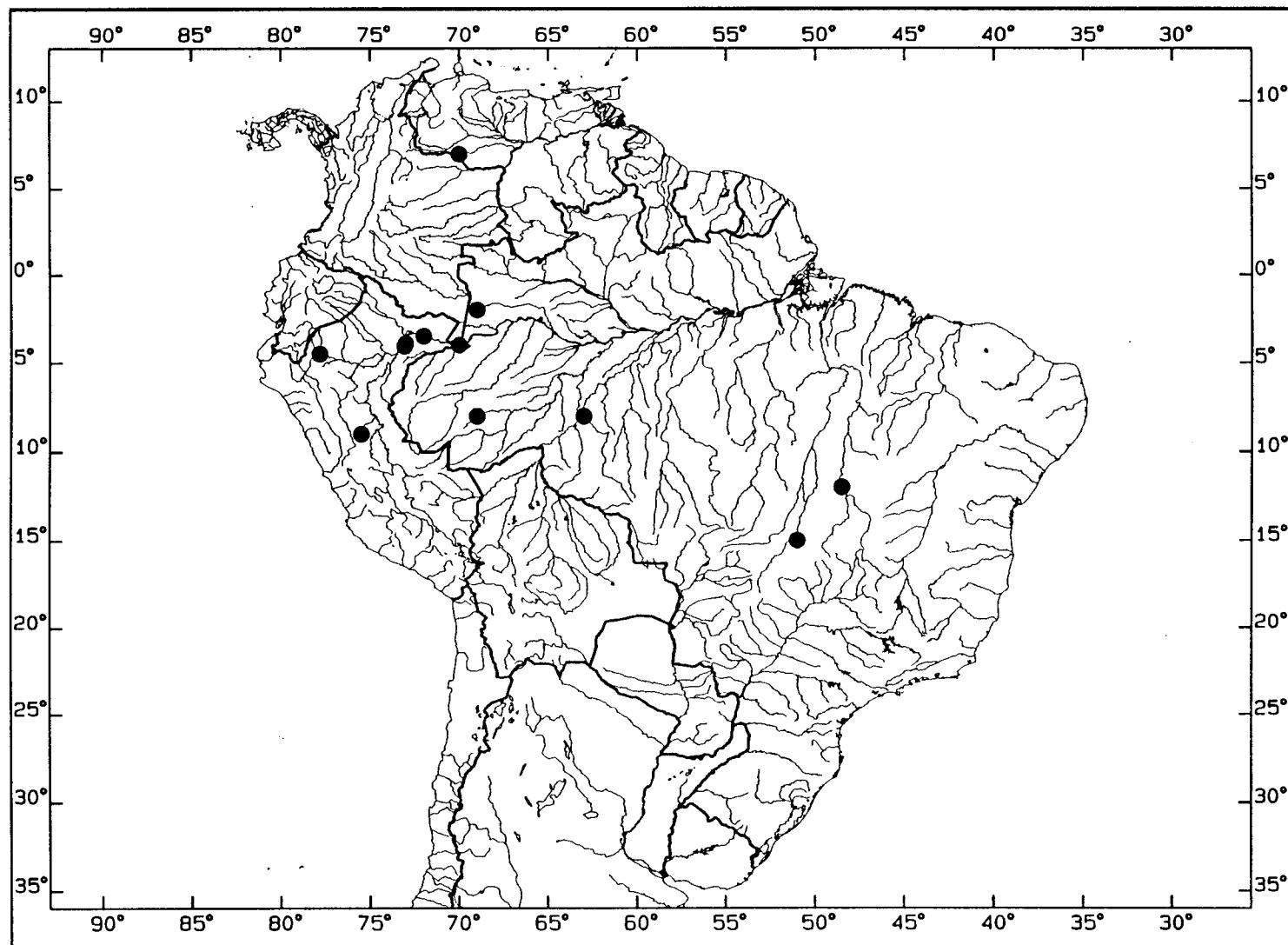


Figure 58. Geographic distribution of *Bunocephalus aleuropsis*.

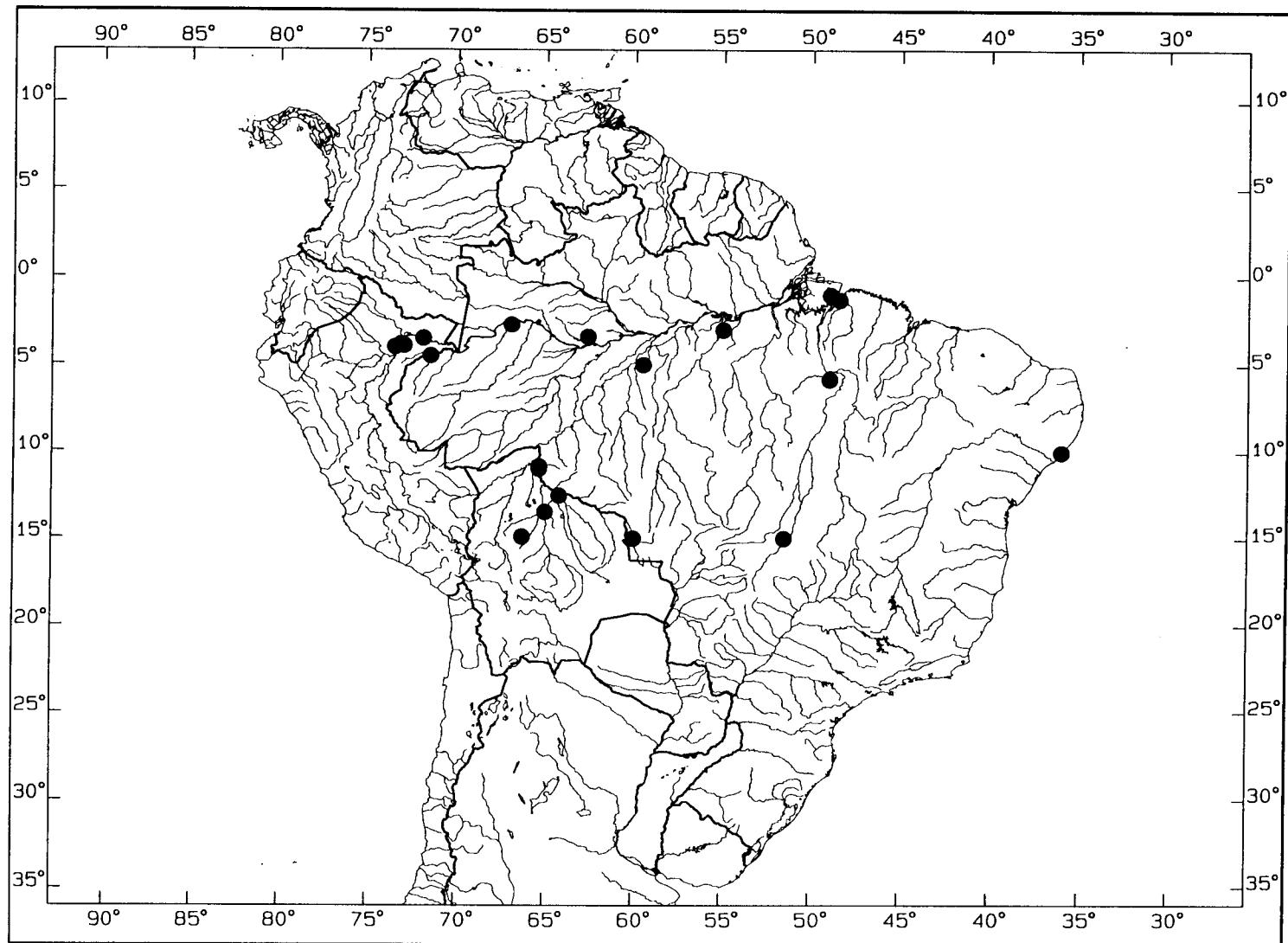


Figure 59. Geographic distribution of *Bunocephalus coracoideus*.

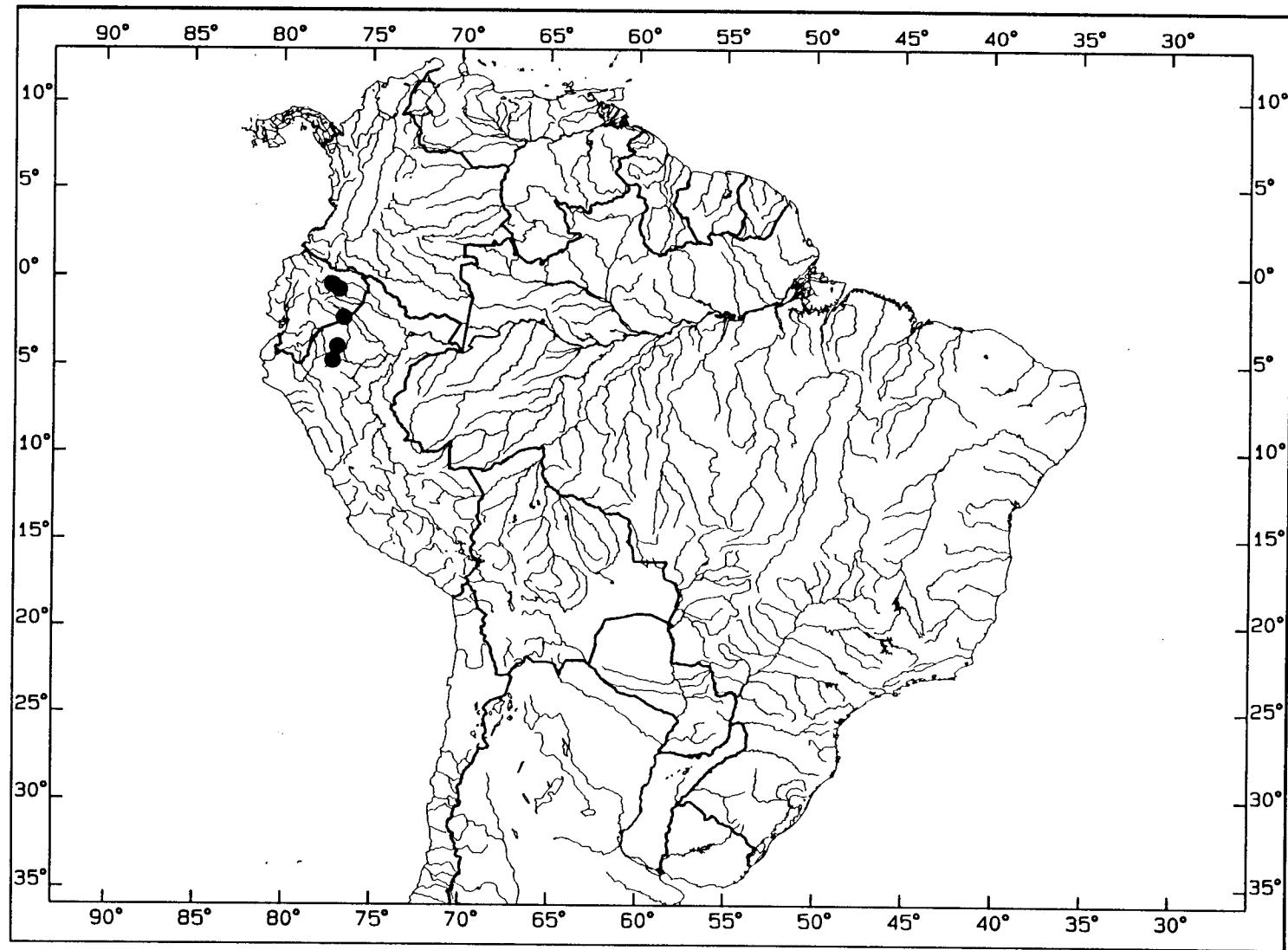


Figure 60. Geographic distribution of *Bunocephalus knerii*.

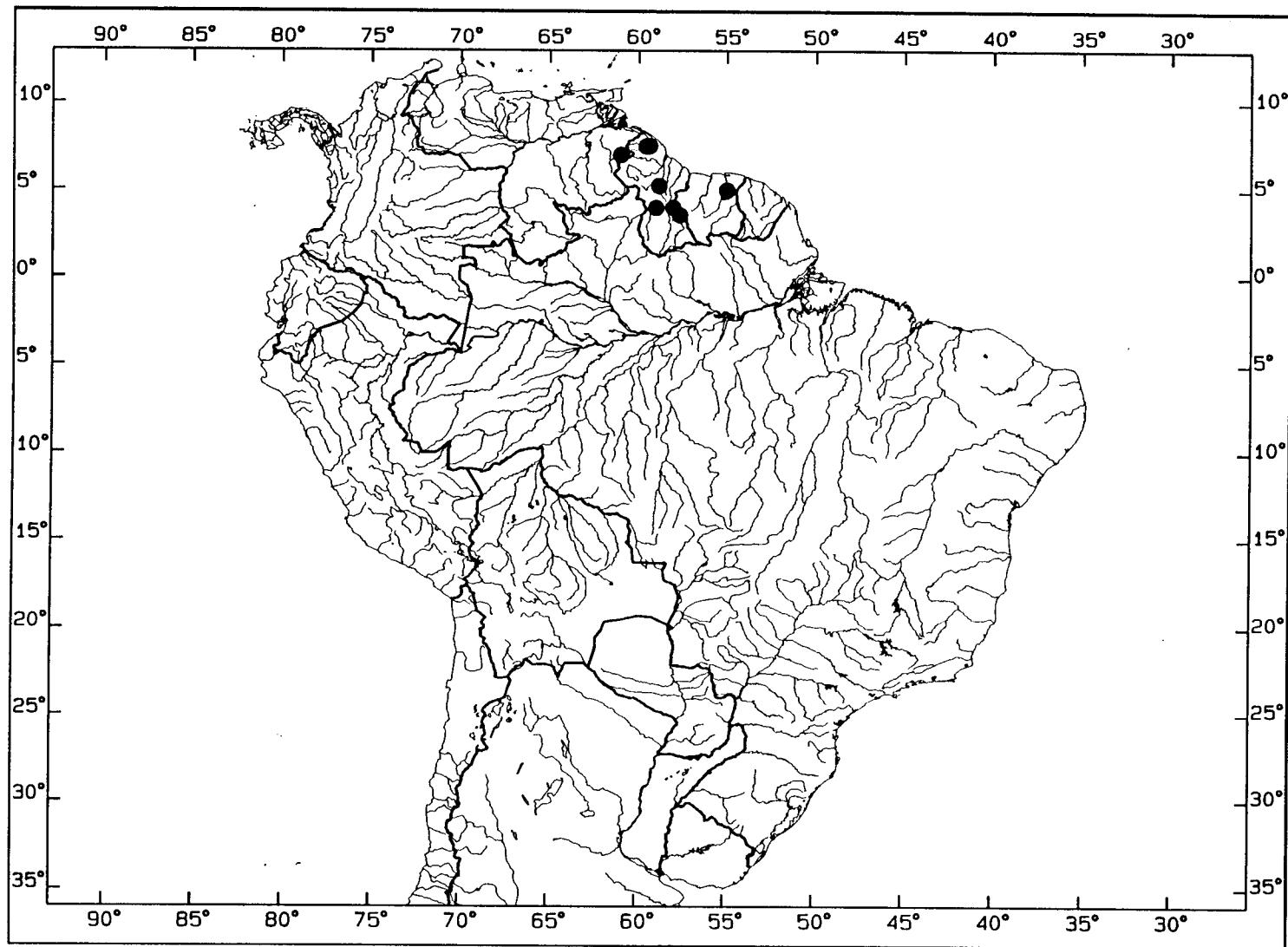


Figure 61. Geographic distribution of *Bunocephalus amaurus*.

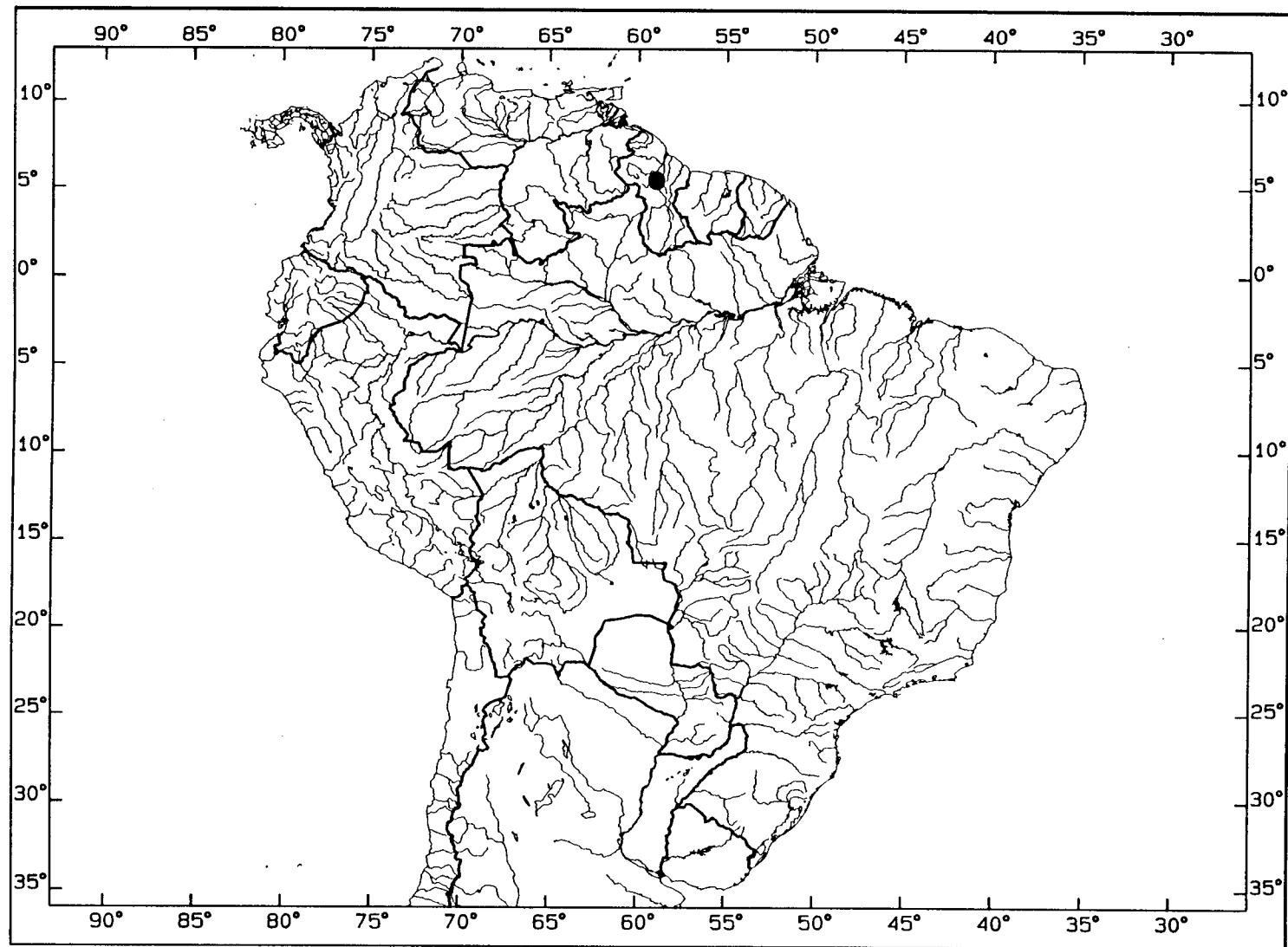


Figure 62. Geographic distribution of *Bunocephalus chamaizelus*.

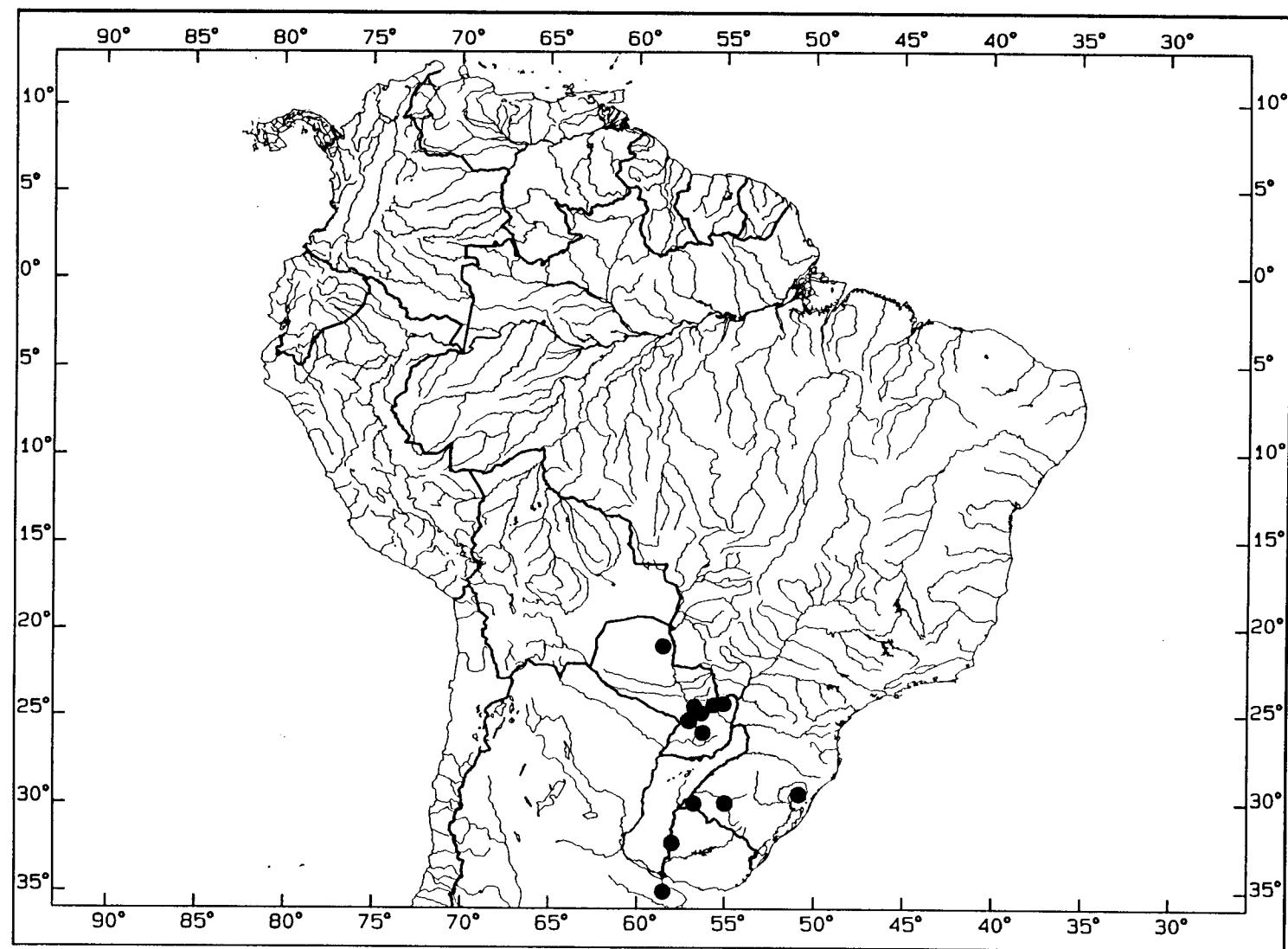


Figure 63. Geographic distribution of *Bunocephalus doriae*.

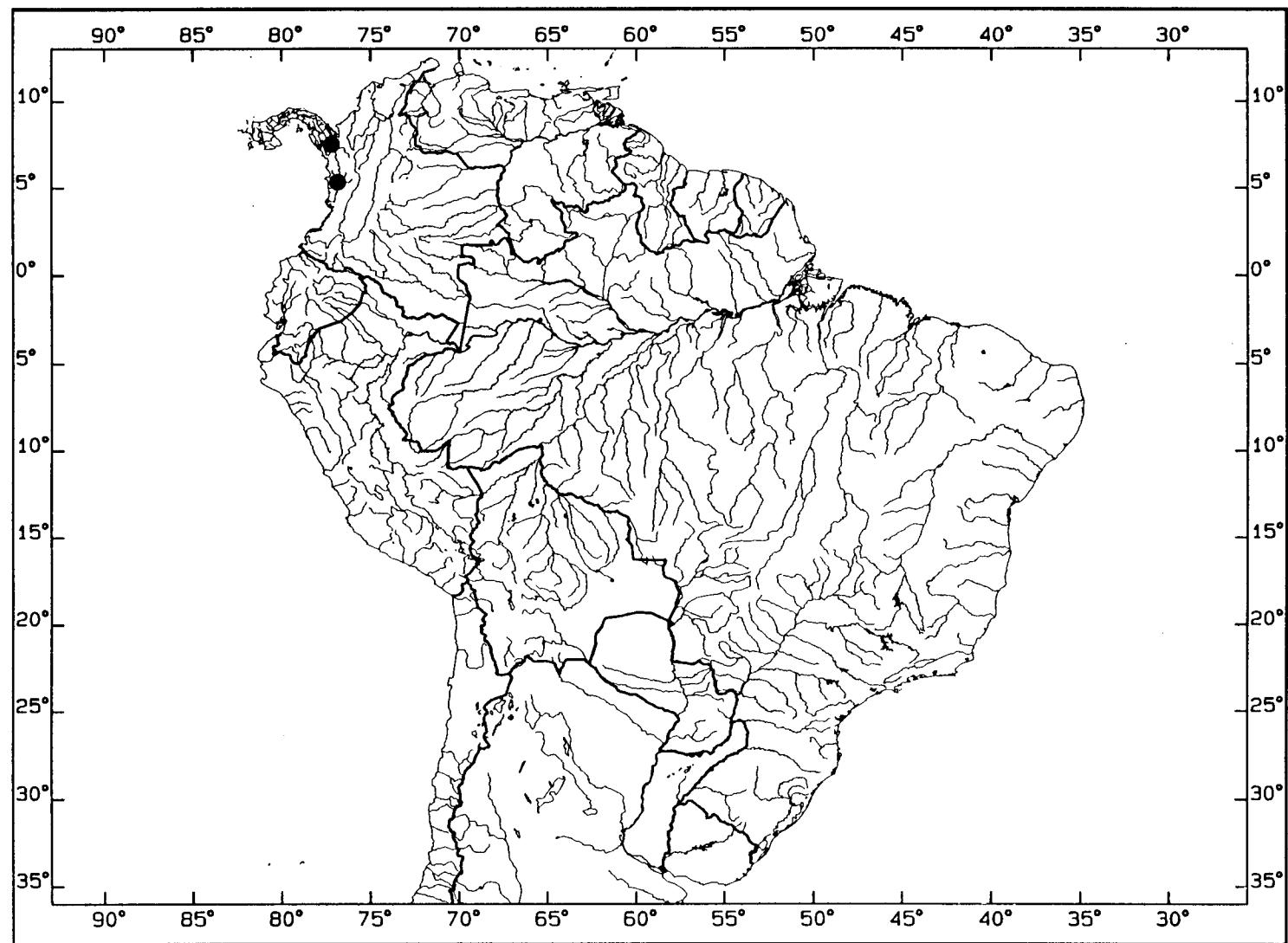


Figure 64. Geographic distribution of *Bunocephalus colombianus*.

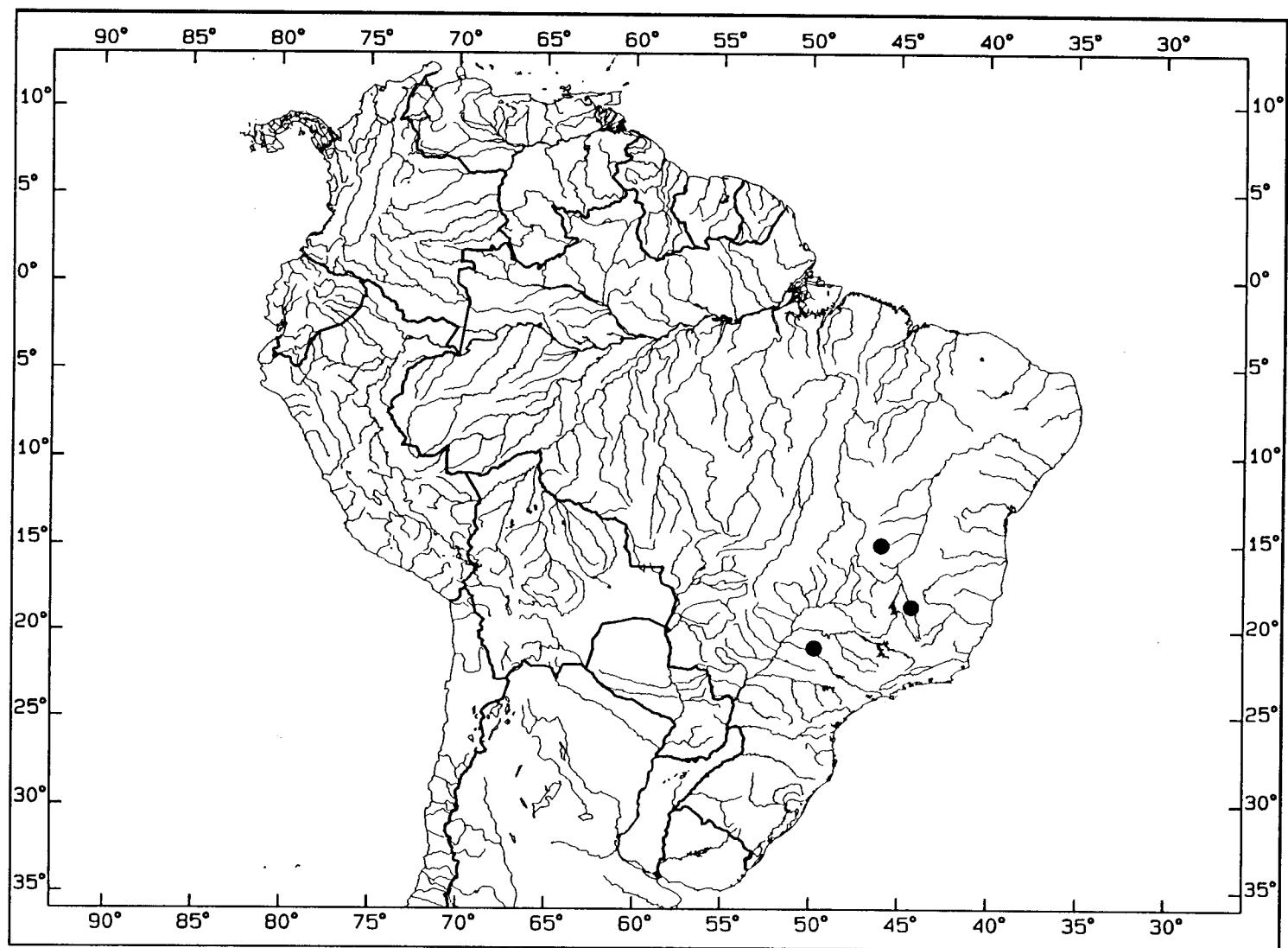


Figure 65. Geographic distribution of *Bunocephalus larai*.

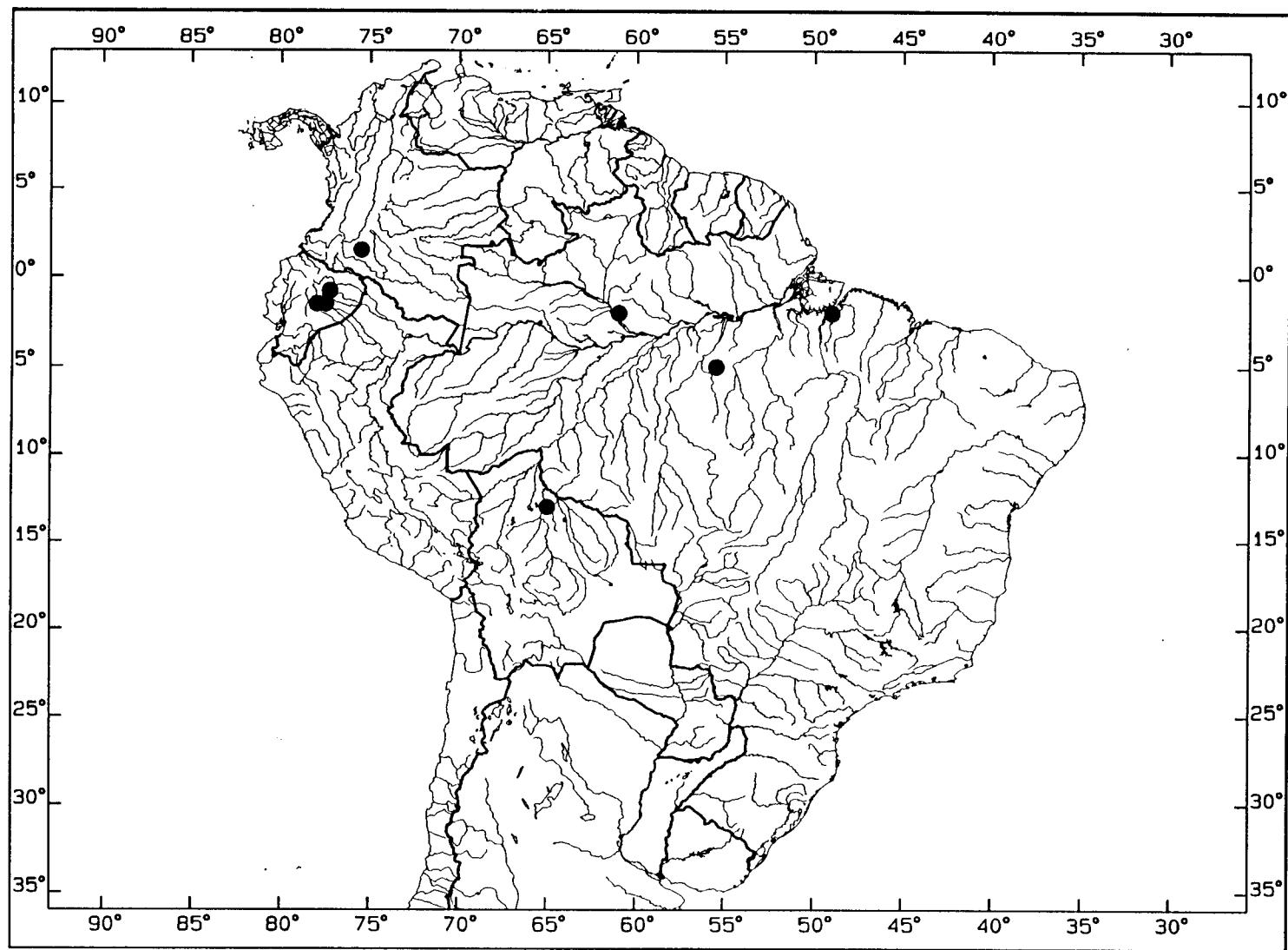


Figure 66. Geographic distribution of *Amaralia hypsiura*.

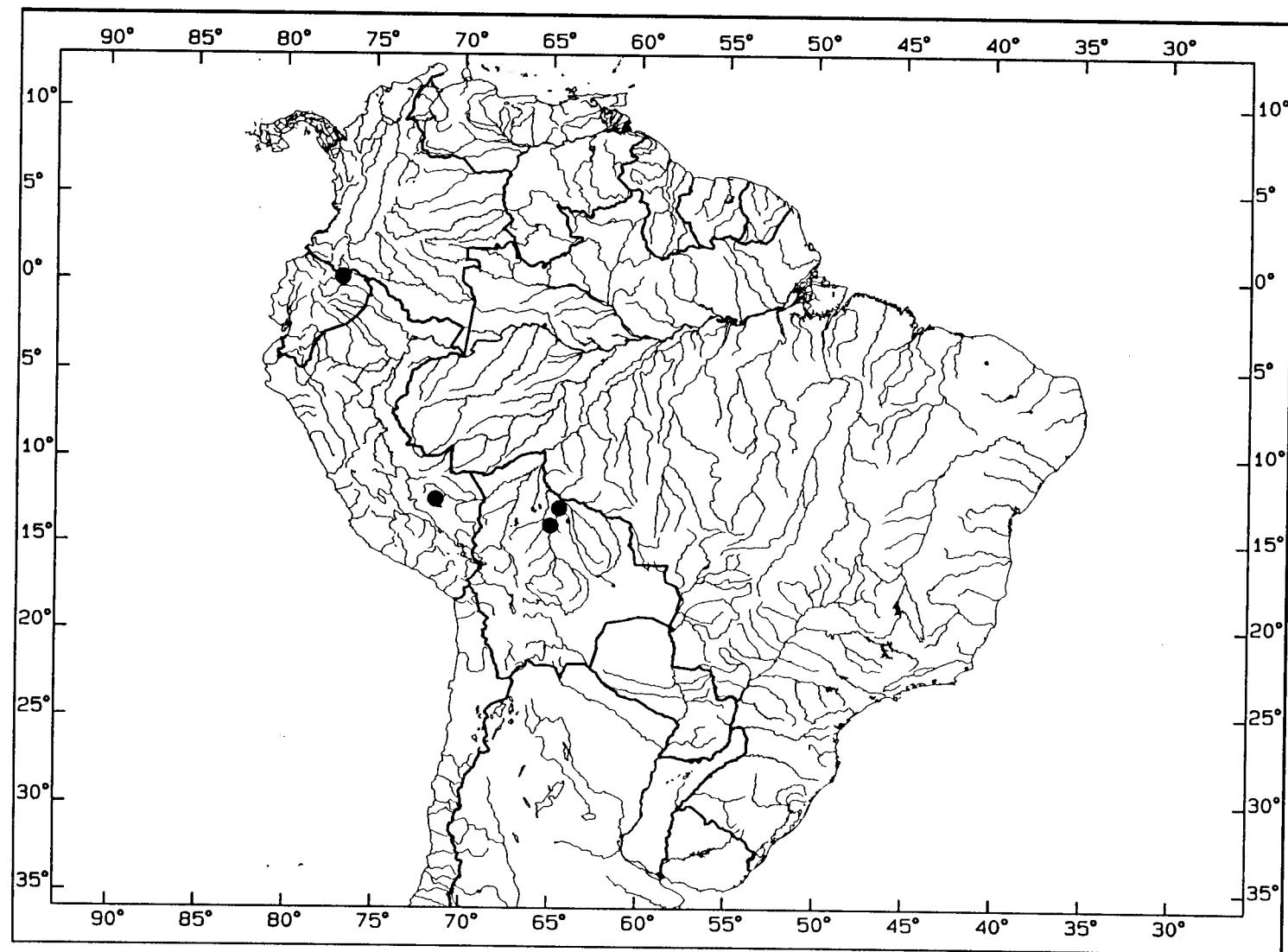


Figure 67. Geographic distribution of *Pterobunocephalus depressus*.

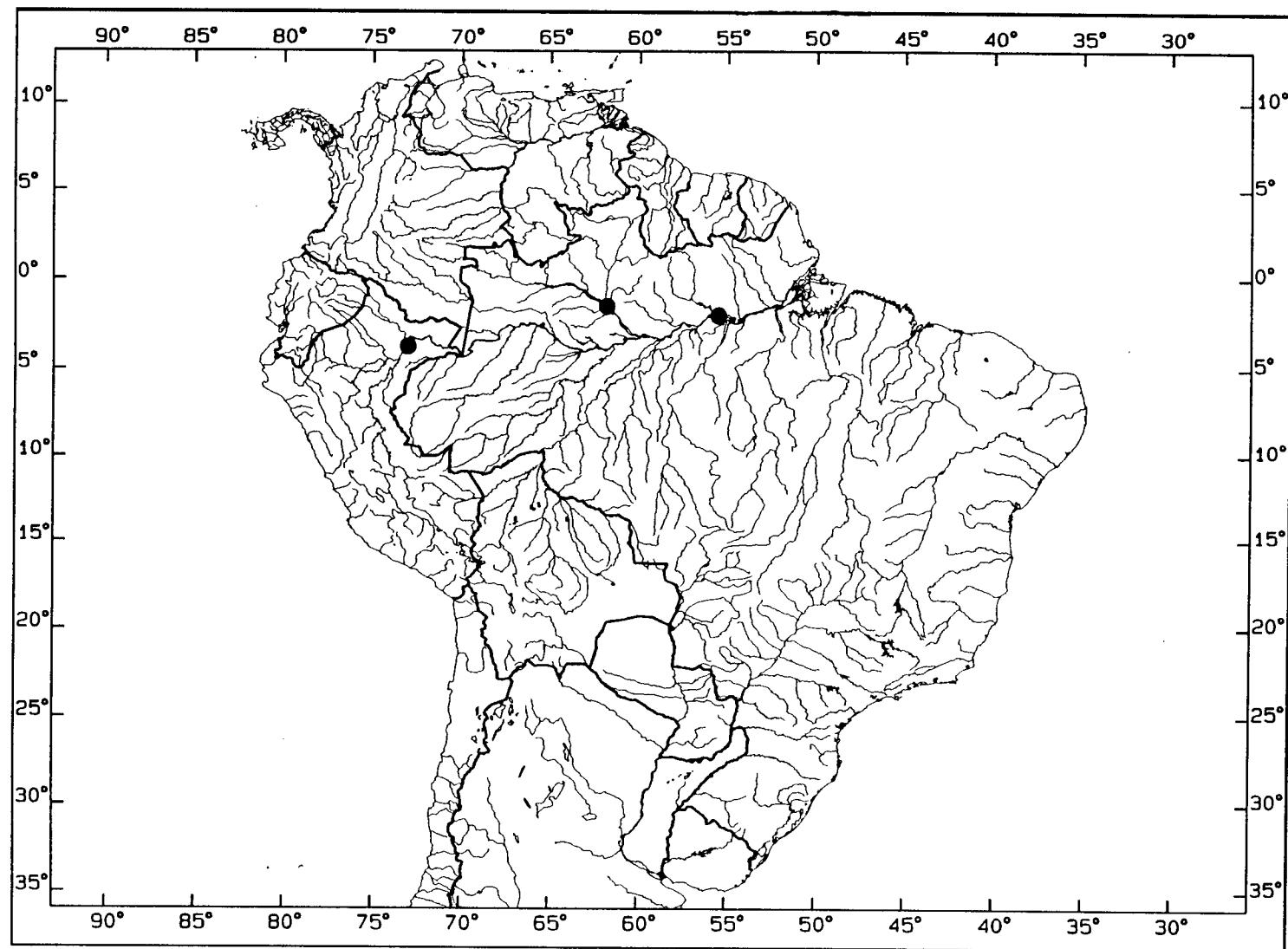


Figure 68. Geographic distribution of *Pterobunocephalus dolichurus*.

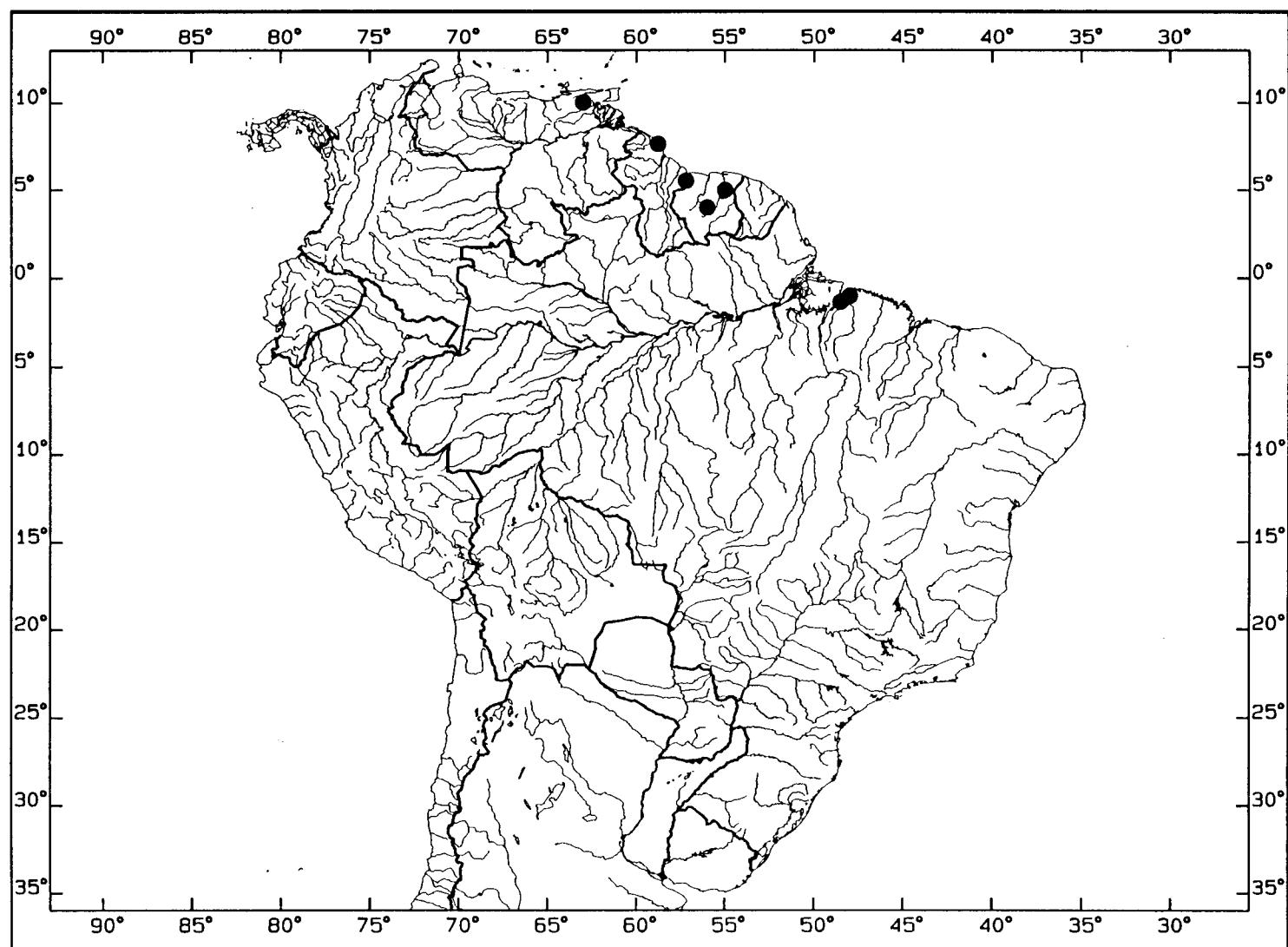


Figure 69. Geographic distribution of *Platystacus cotylephorus*.

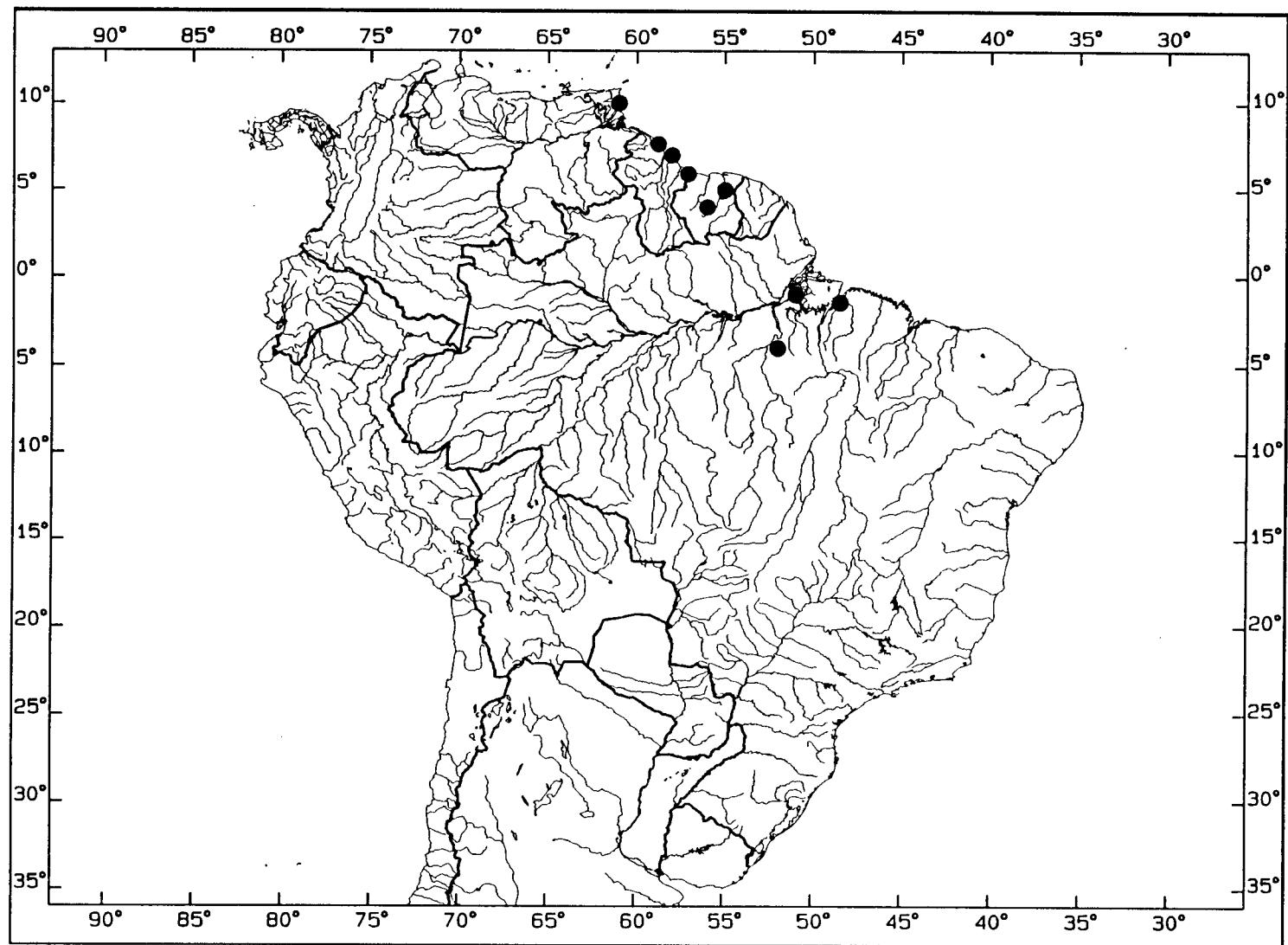


Figure 70. Geographic distribution of *Aspredo aspredo*.

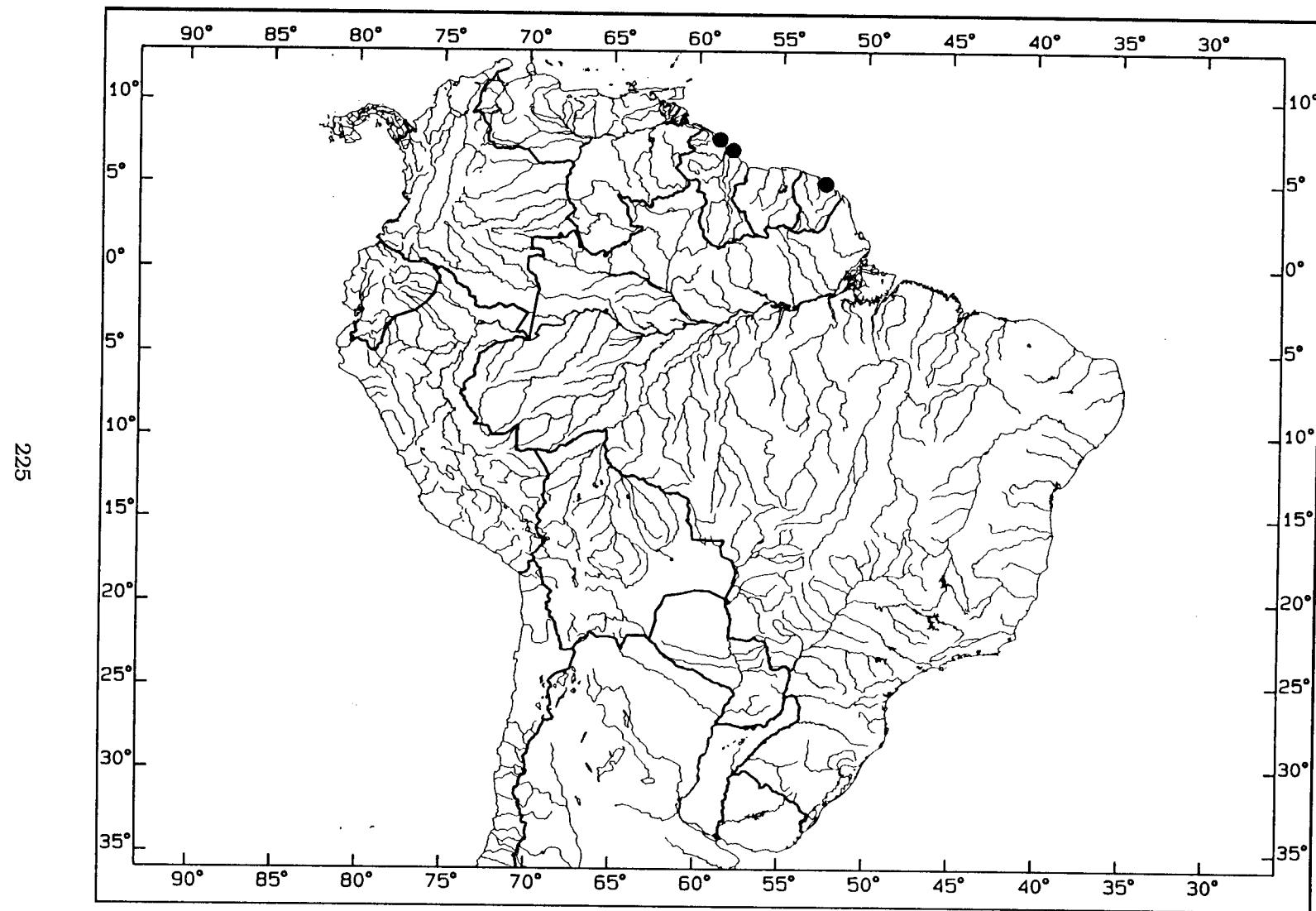


Figure 71. Geographic distribution of *Aspredinichthys tibicen*.

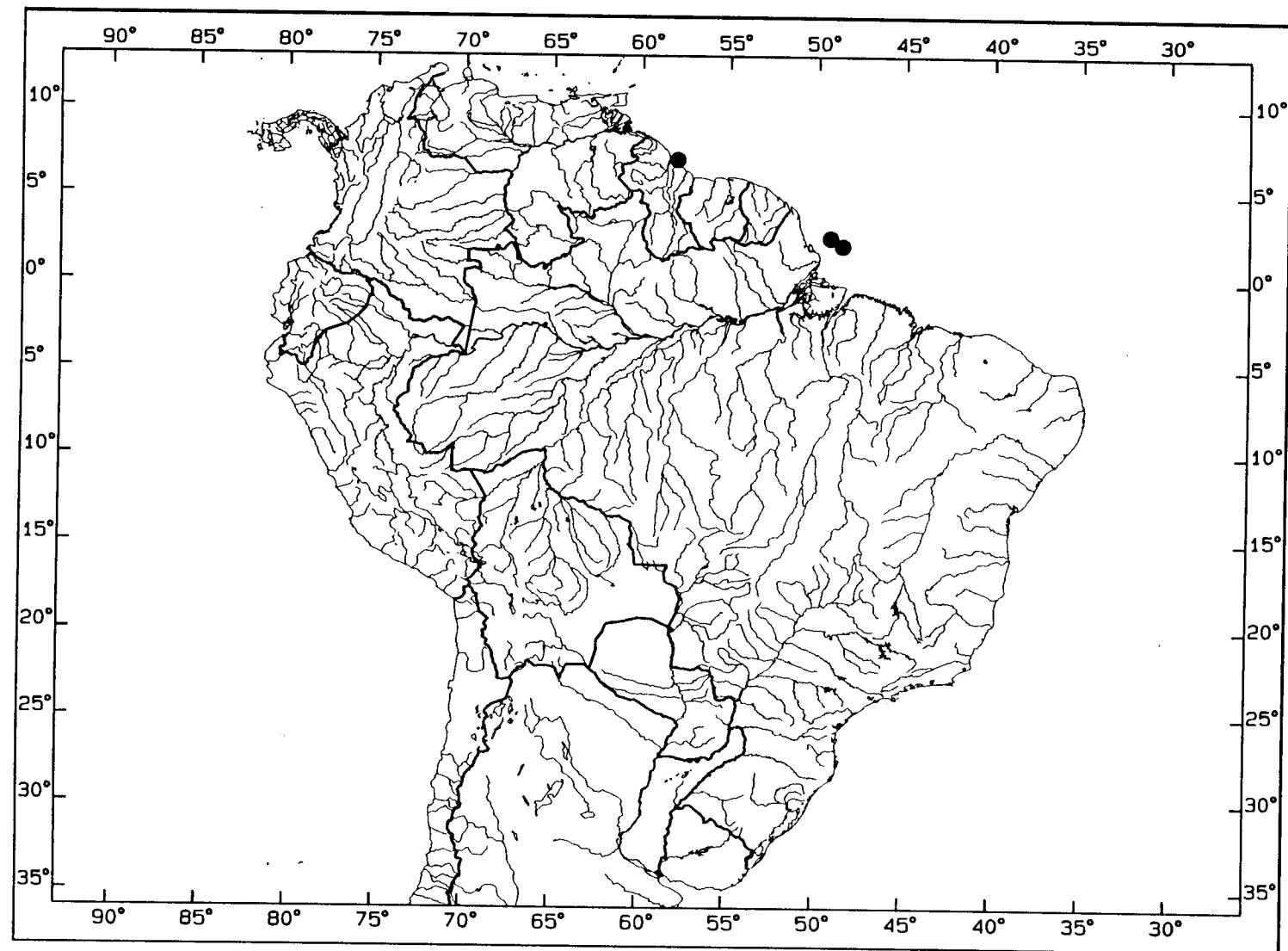


Figure 72. Geographic distribution of *Aspredinichthys filamentosus*.

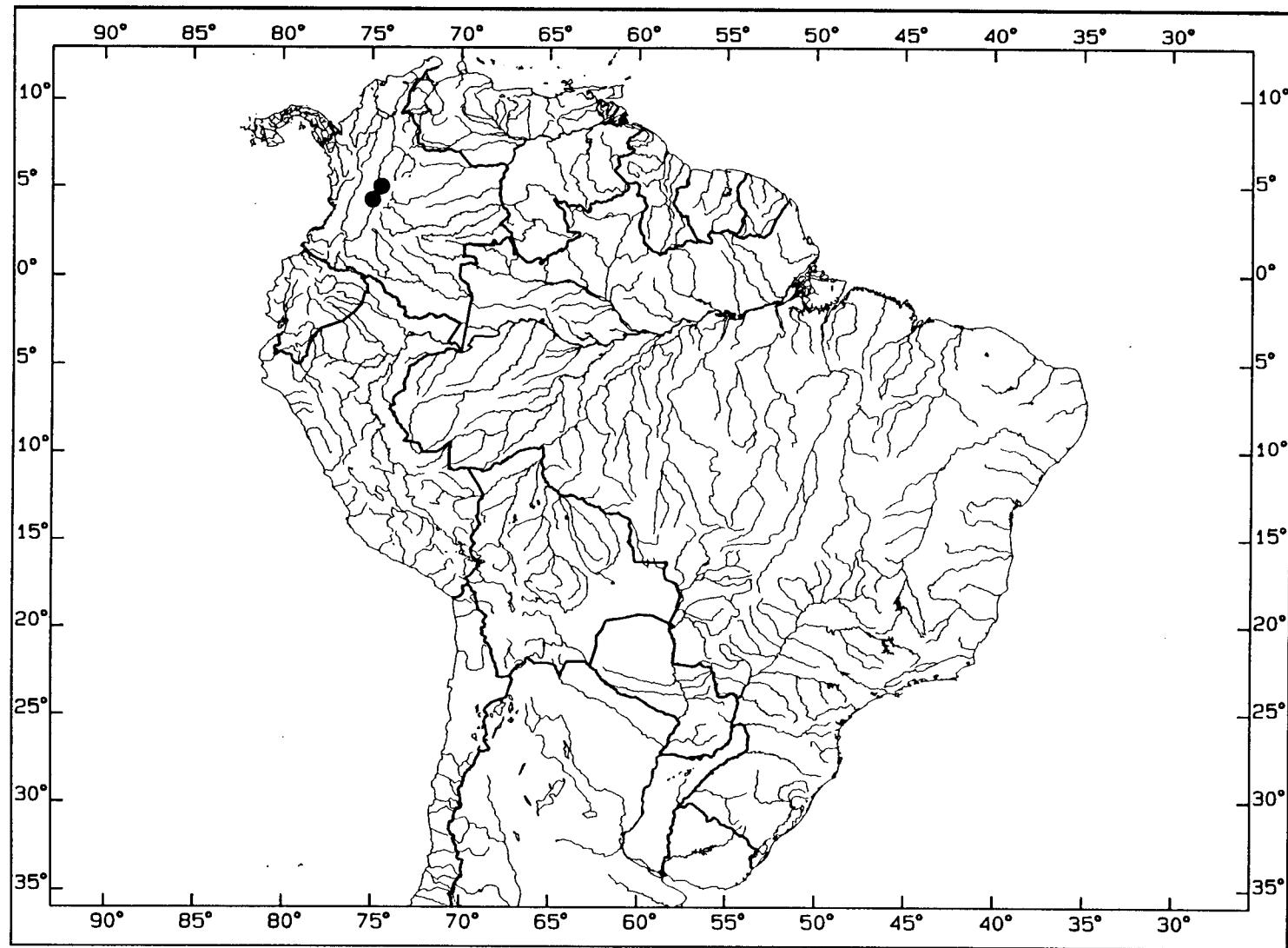


Figure 73. Geographic distribution of *Xyliphius magdalena*e.

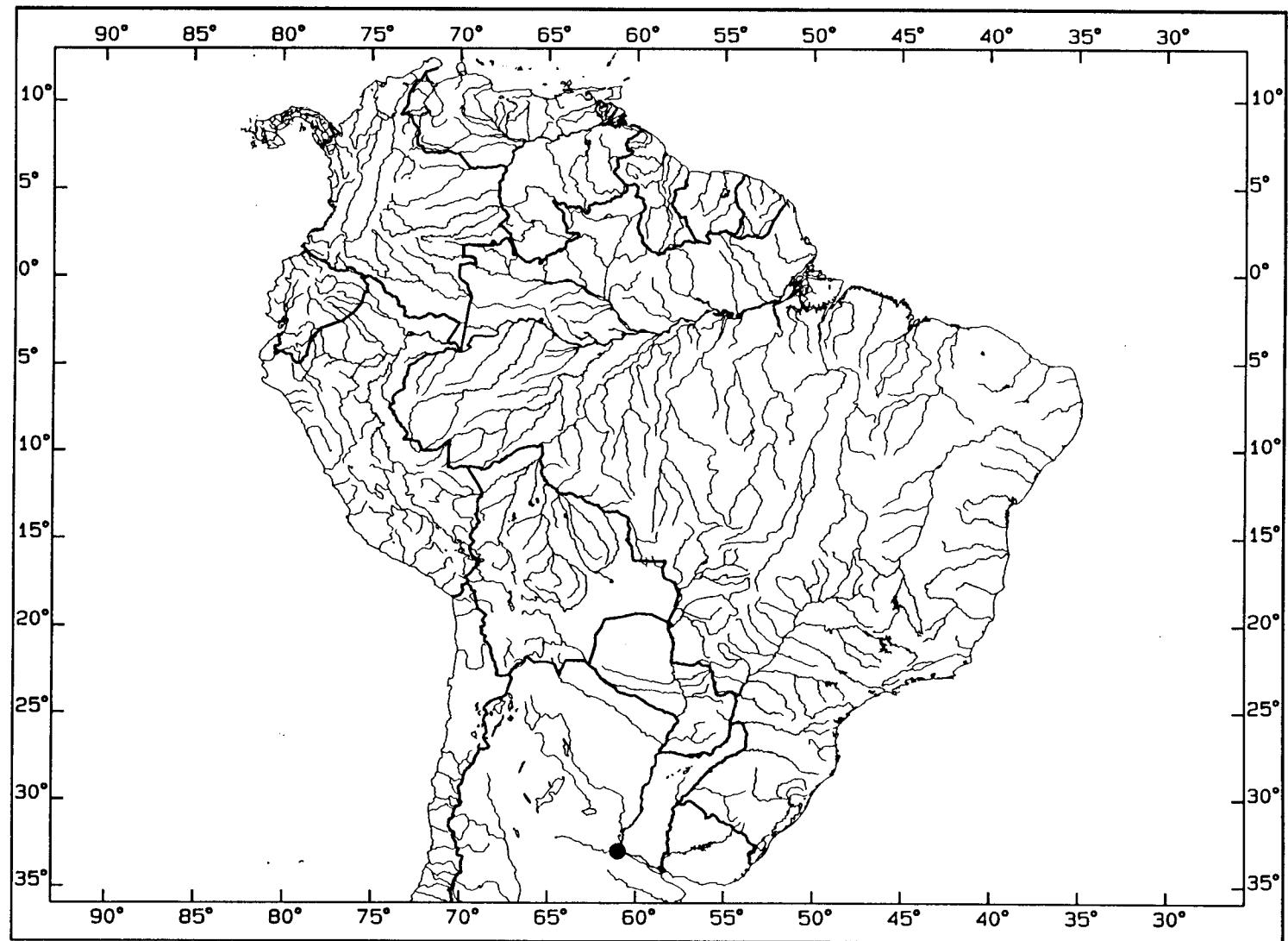


Figure 74. Geographic distribution of *Xyliphius barbatus*.

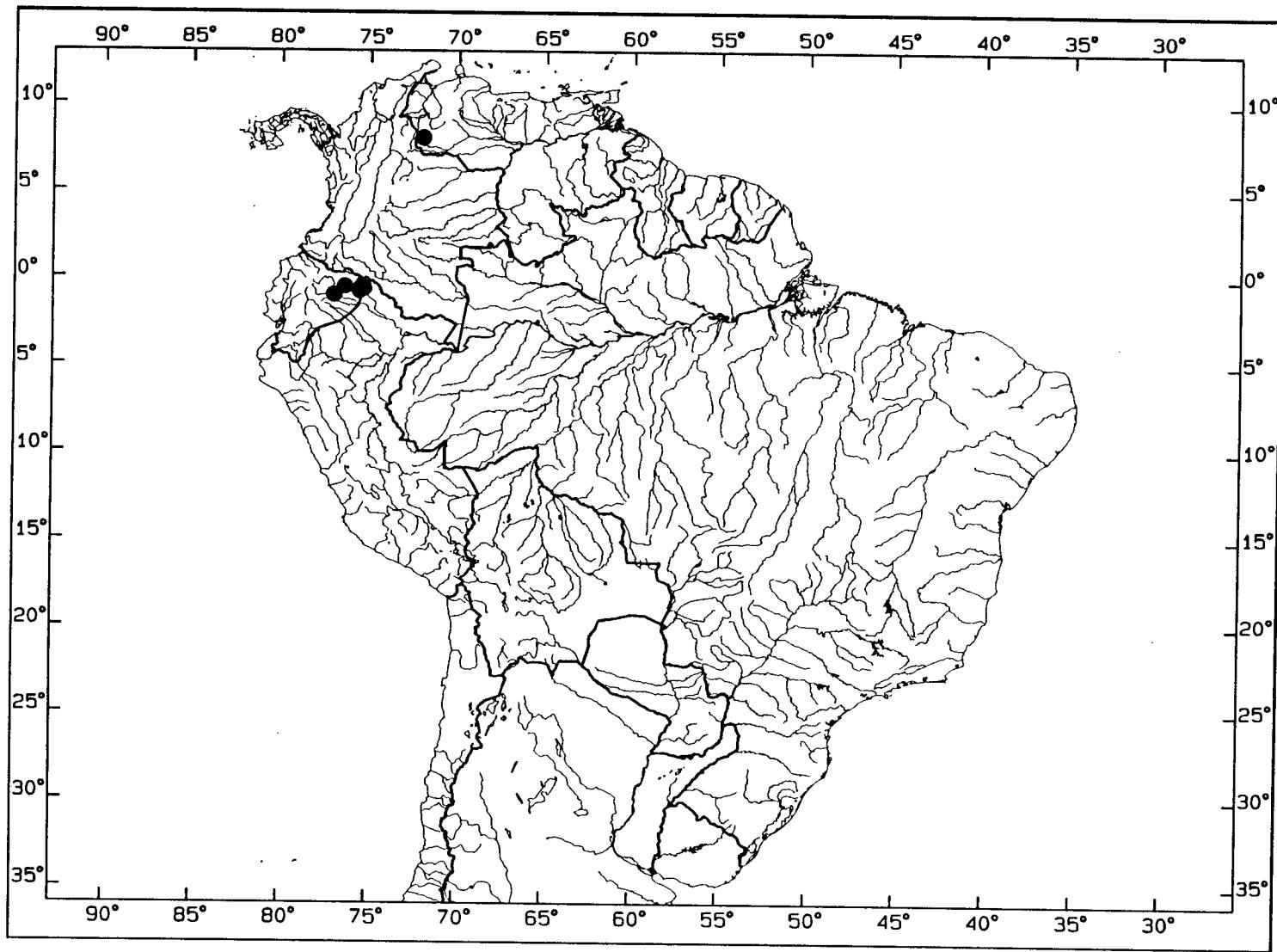


Figure 75. Geographic distribution of *Xyliphius melanopterus*.

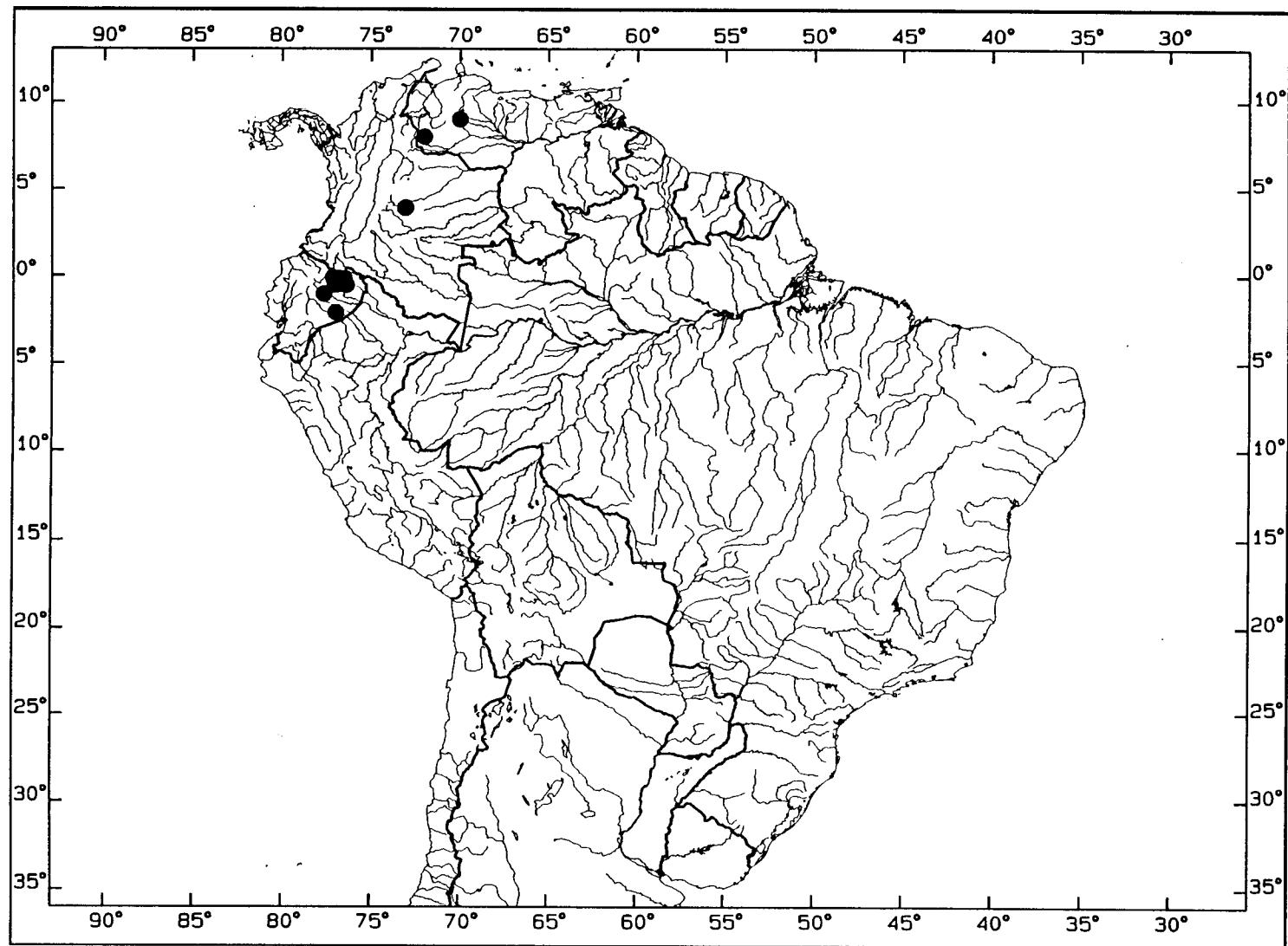


Figure 76. Geographic distribution of *Xylipterus lepturus*.

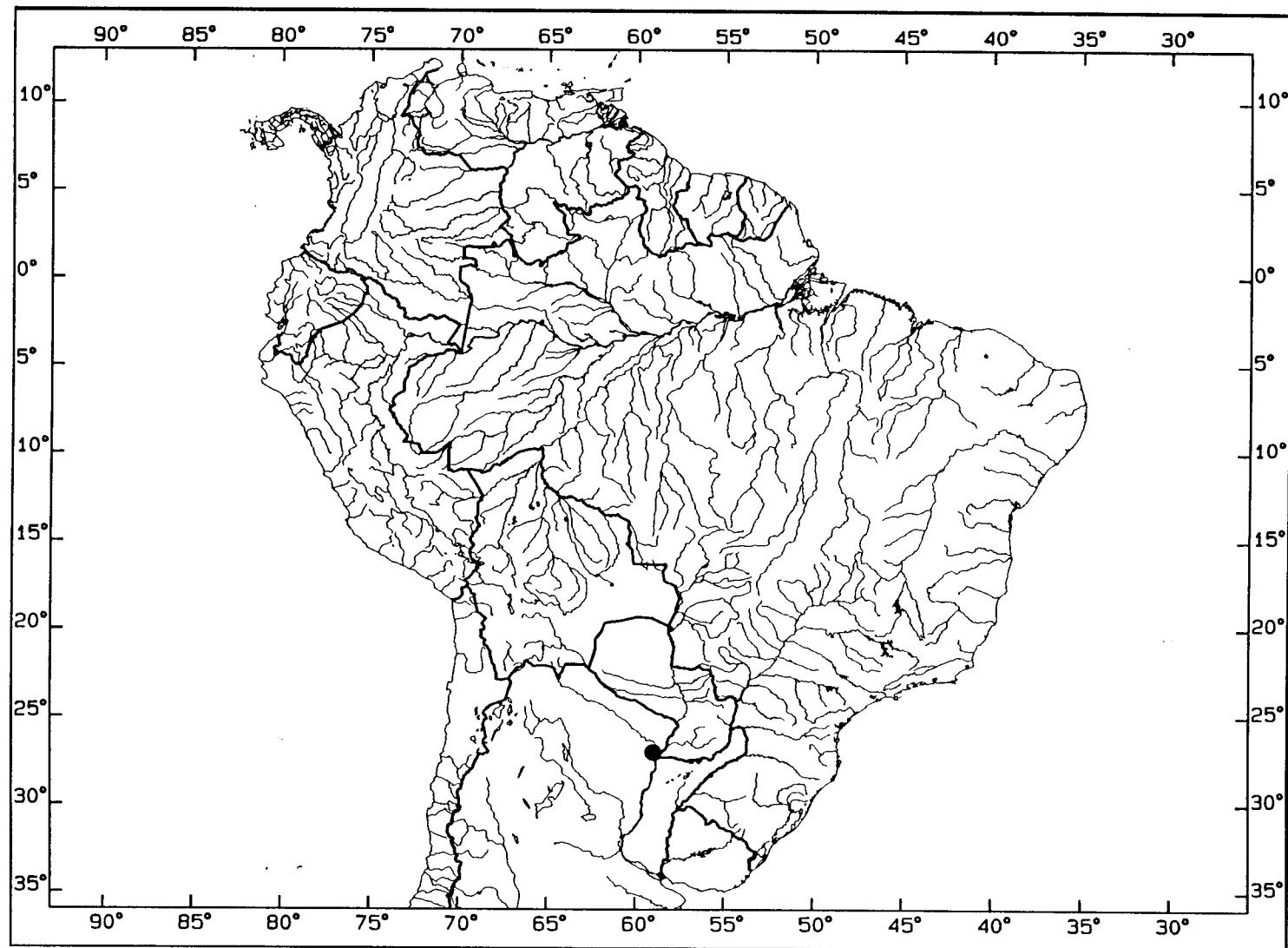


Figure 77. Geographic distribution of *Xyliphius lombarderoi*.

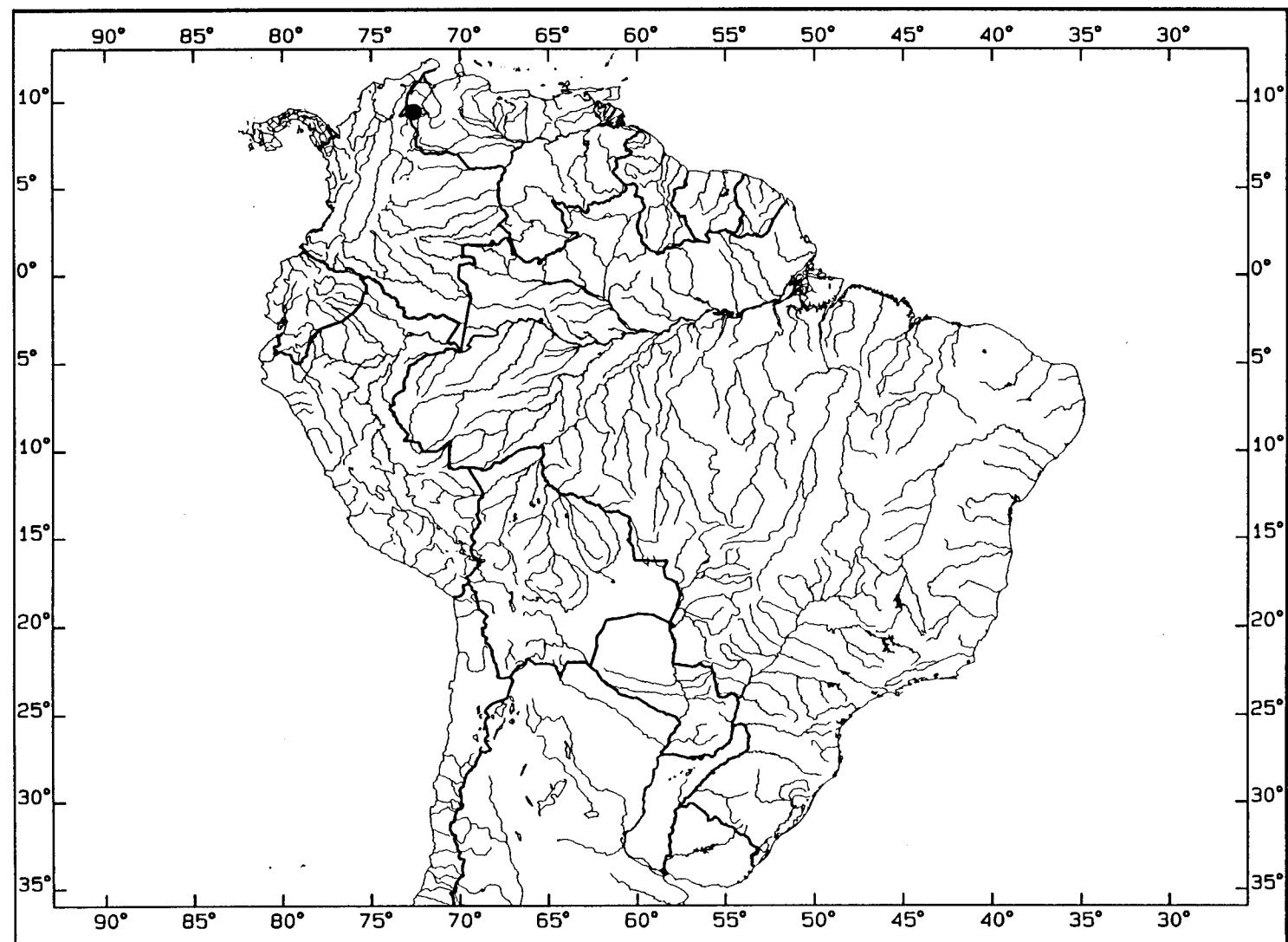


Figure 78. Geographic distribution of *Xyliphius kryptos*.

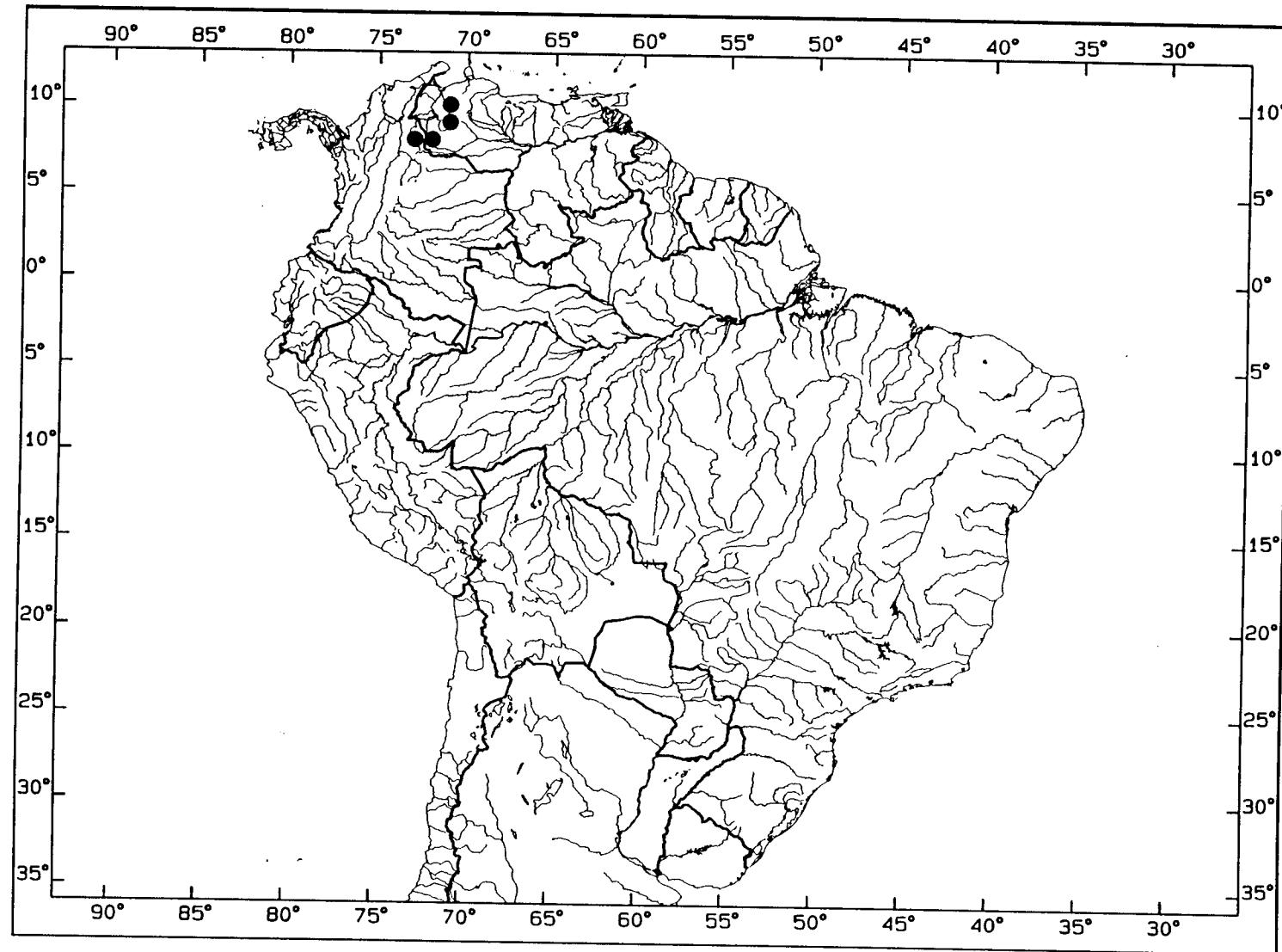


Figure 79. Geographic distribution of *Hoplomyzon atrizona*.

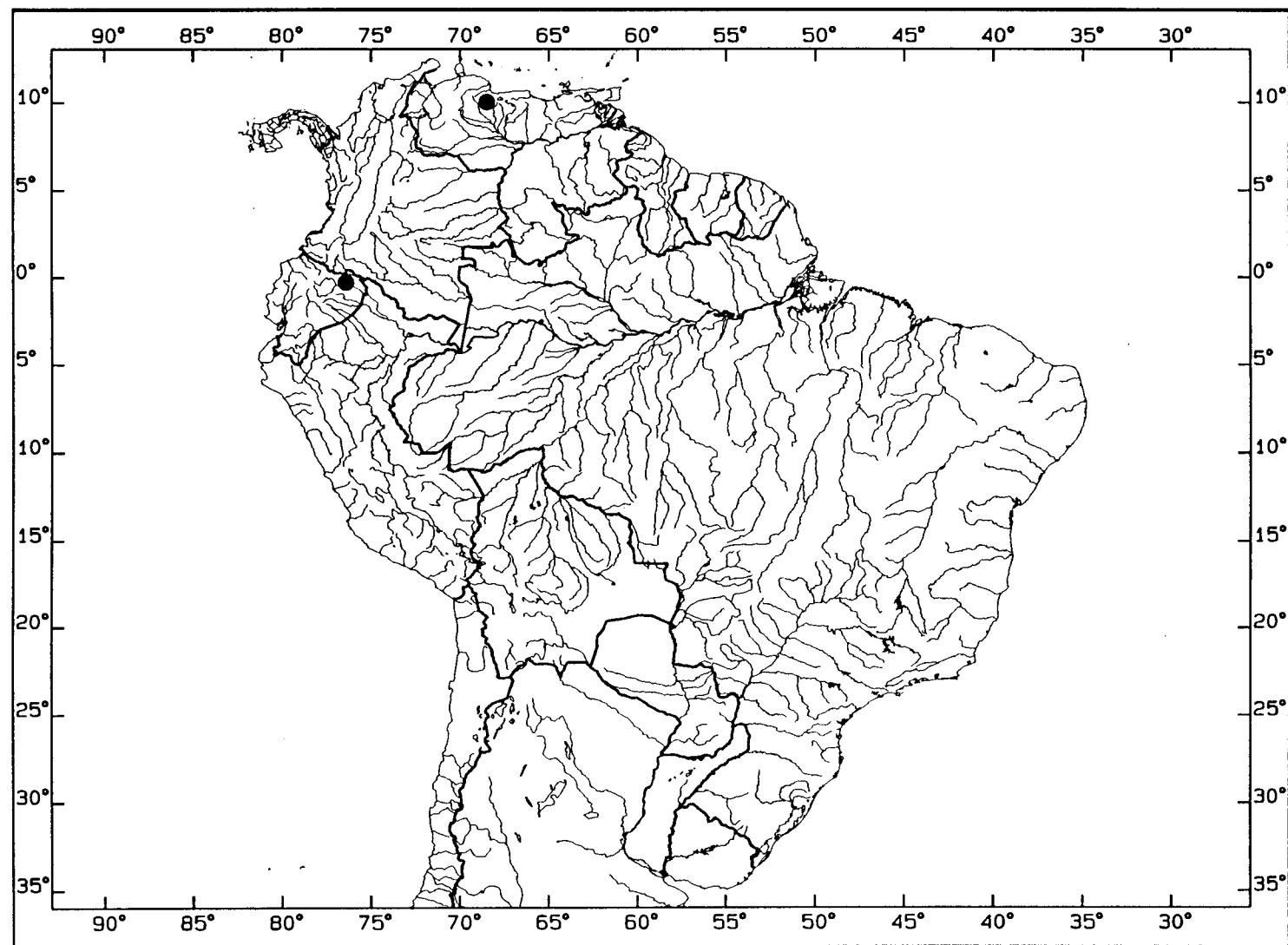


Figure 80. Geographic distribution of *Hoplomyzon papillatus*.

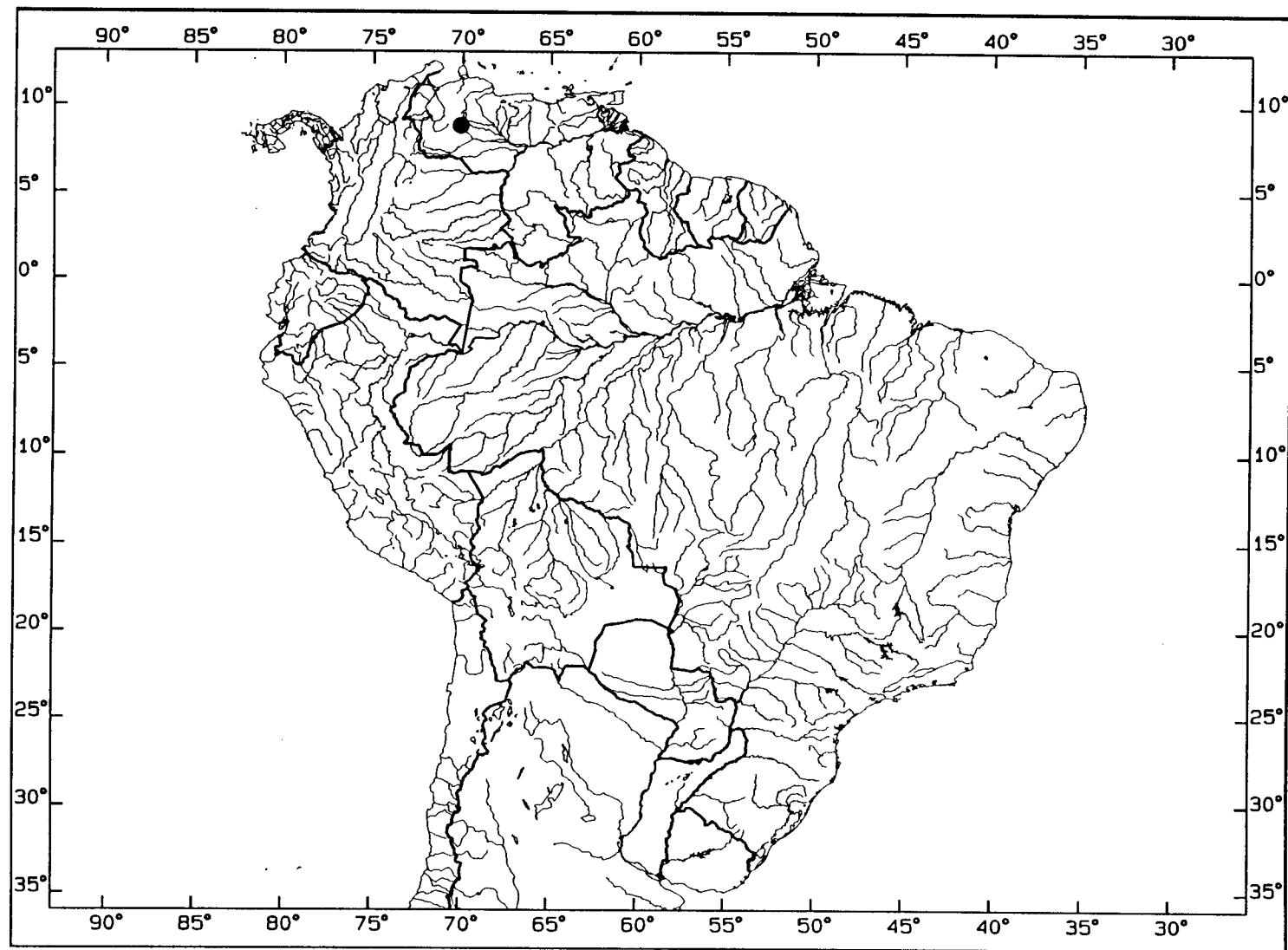


Figure 81. Geographic distribution of *Hoplomyzon sexpilosoma*.

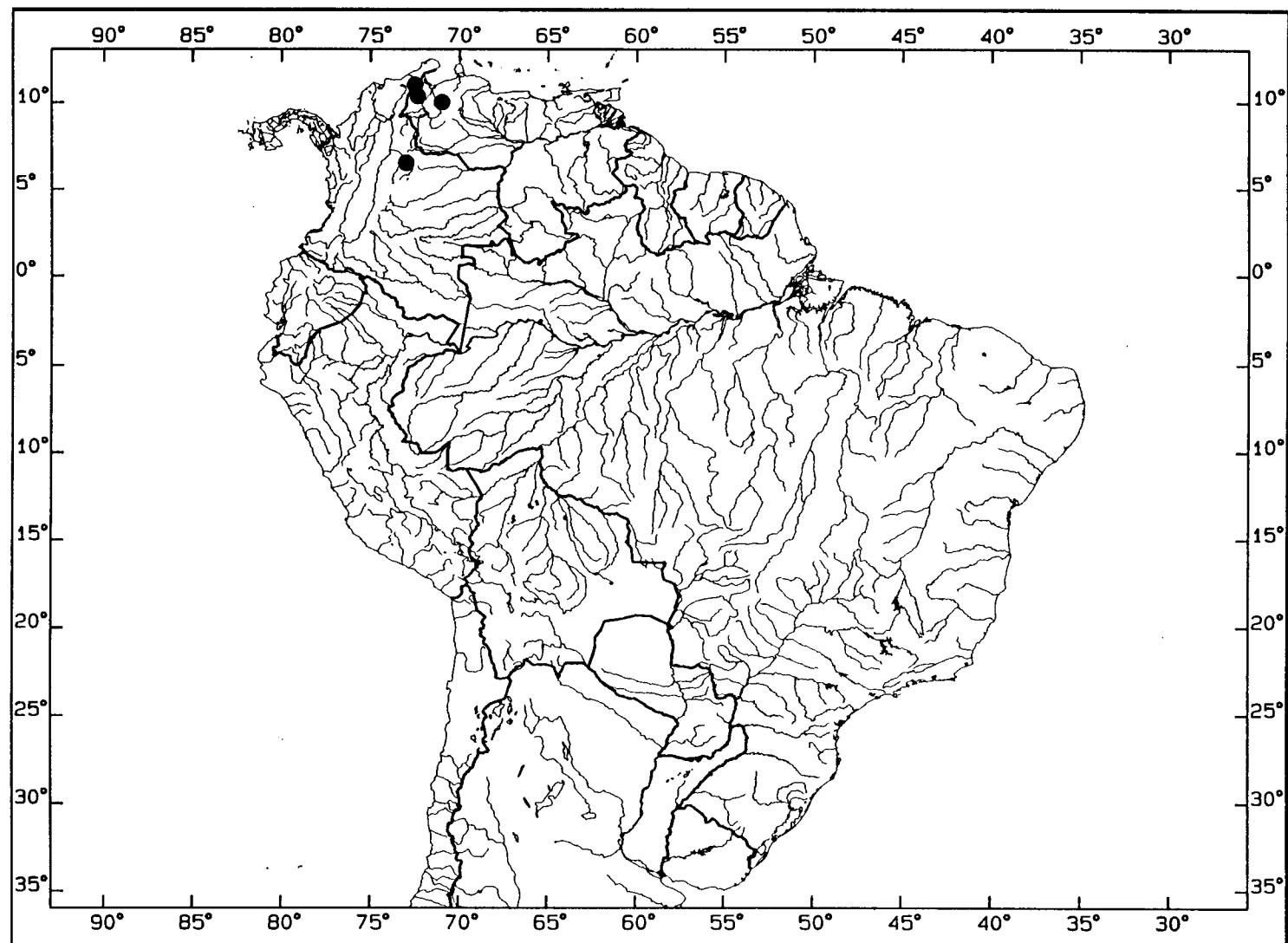


Figure 82. Geographic distribution of *Dupouyichthys sapito*.

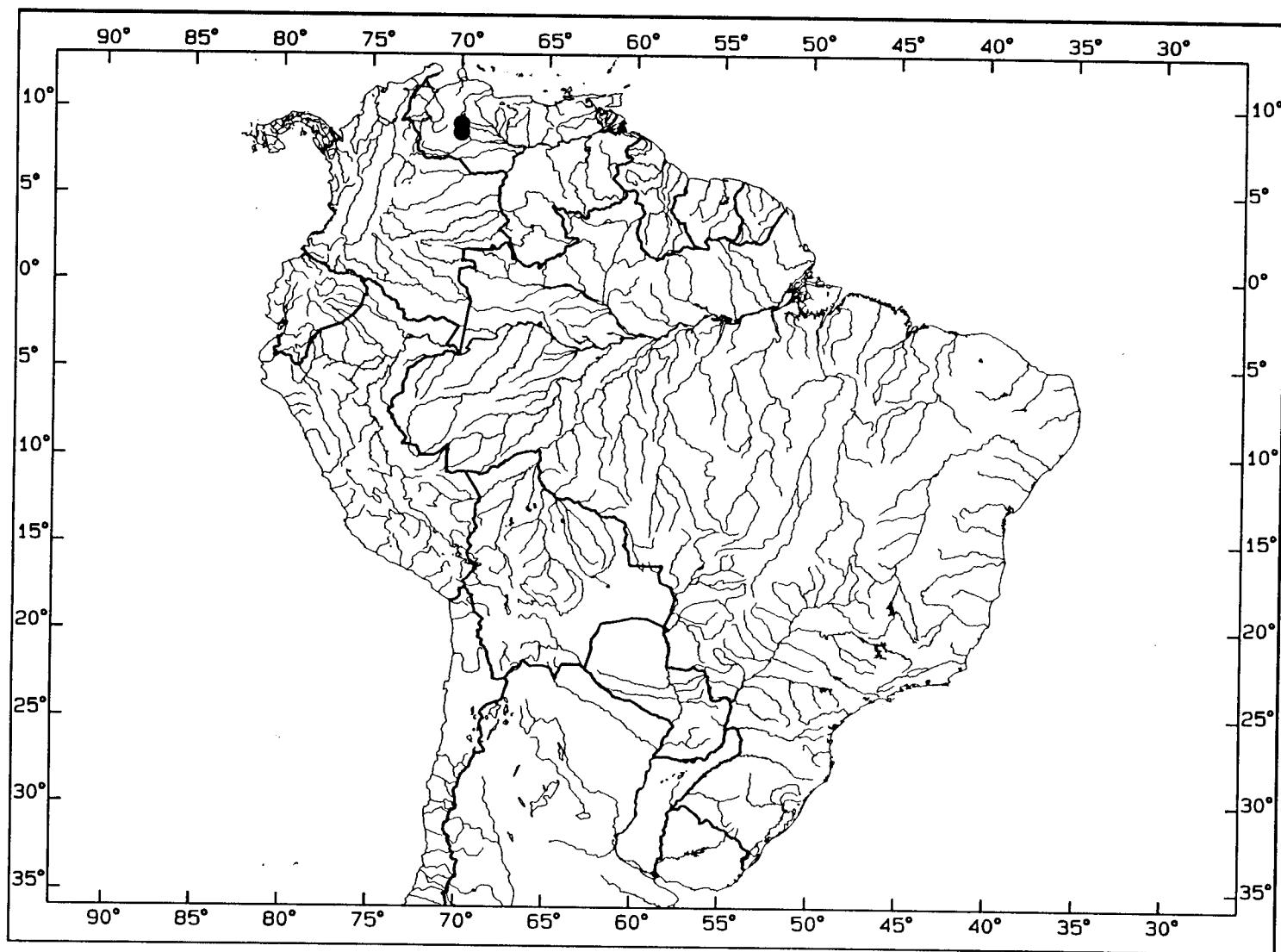


Figure 83. Geographic distribution of *Ernstichthys anduzei*.

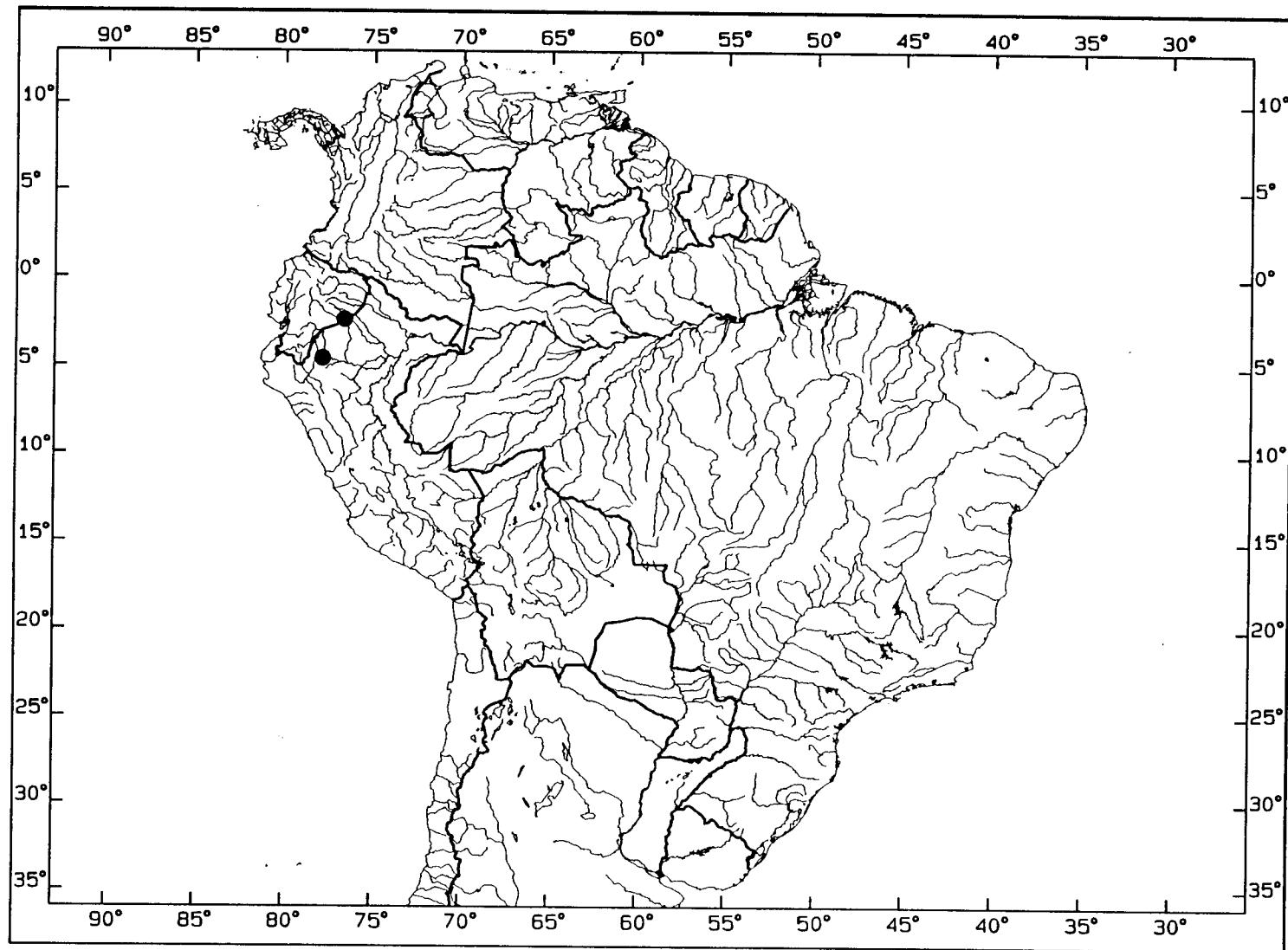


Figure 84. Geographic distribution of *Ernstichthys megistus*.

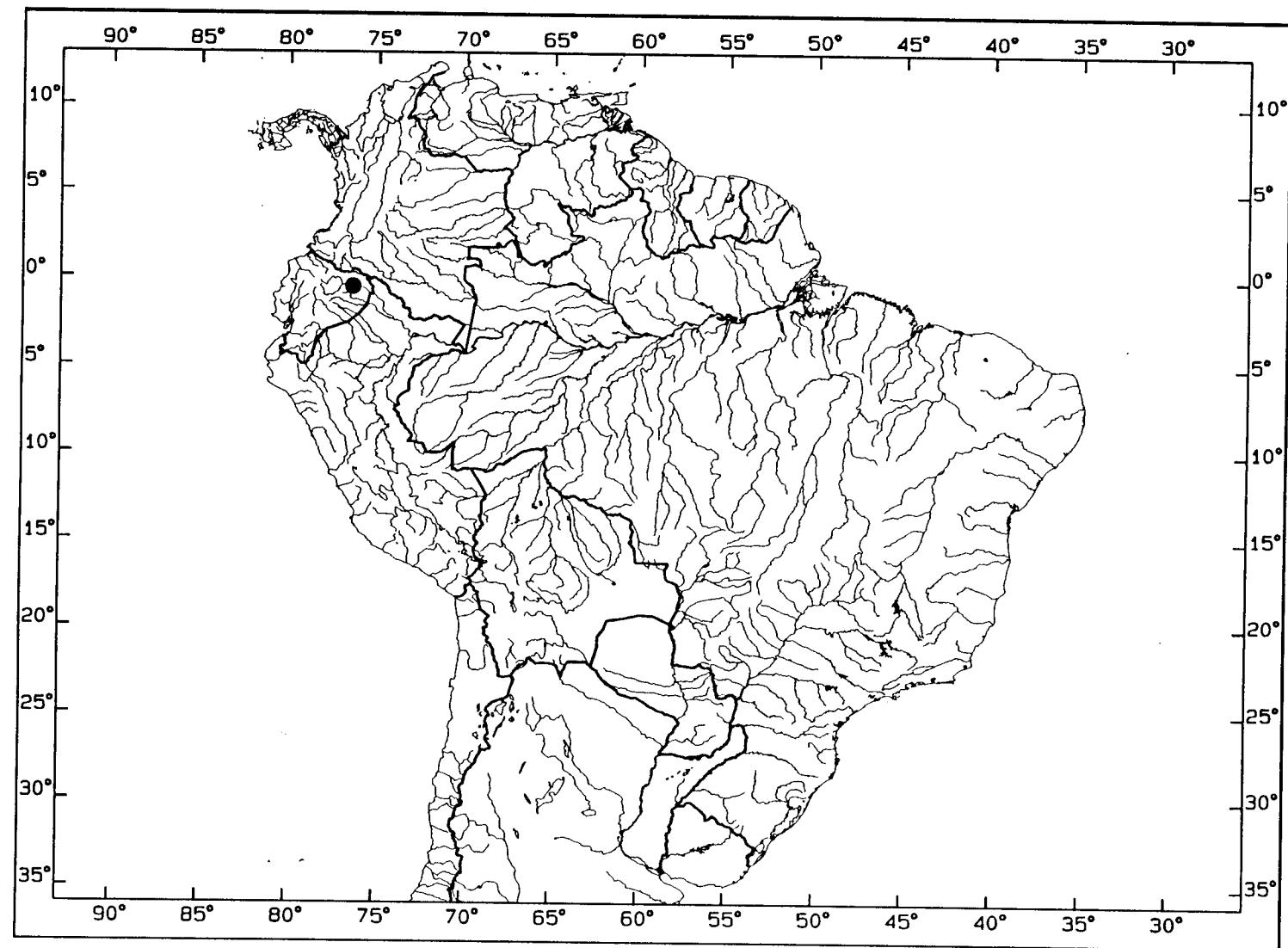


Figure 85. Geographic distribution of *Ernstichthys intonsus*.

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Biography

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BIRTH

Born September 22, 1964 to Jack and Eileen Friel in the town of Oyster Bay, NY.

EDUCATION

Ph.D., Zoology, 1994, Duke University
B.S., Zoology, 1986, University of Central Florida, Magna Cum Laude.

POSITIONS

Instructor, Comparative Vertebrate Anatomy, Duke University, 1/94 - 5/95.
Cocos Fellow in Morphology, Dept. of Zoology, Duke University, 9/92 - 7/93.
Graduate Teaching Assistant, Duke University, 8/87 - 8/92.
Representative on the Duke University Graduate Student Council, 1990-1992.

FELLOWSHIPS, GRANTS, AND AWARDS

1993, Stoye Award for best student paper in general ichthyology at ASIH meeting.
1993, 1989 Conference Travel Award, Duke University Graduate School.
1992, Cocos Foundation Morphology Fellowship.
1991, Collection Study Grant, American Museum of Natural History.
1991, Böhlke Fund Award, Philadelphia Academy of Natural Sciences.
1991, Dissertation Travel Grant, Duke University Graduate School.
1990, Dee Fellowship, Field Museum of Natural History, Chicago.
1990, Travel Grant, Duke-UNC Program in Latin American Studies.

PROFESSIONAL SOCIETIES

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CONTRIBUTED PRESENTATIONS AND ABSTRACTS

Phylogenetic relationships of the banjo catfishes (Siluriformes: Aspredinidae).
A.S.I.H annual meeting, Austin, TX, 1993.
A phylogenetic revision of *Amaralia*, a genus of oophagous banjo catfishes.
A.S.I.H. annual meeting, Urbana-Champaign, IL, 1992.
Epidermal keratinization and molting in the banjo catfishes (Siluriformes:
Aspredinidae), A.S.I.H. annual meeting, San Francisco, CA, 1989.

PUBLICATIONS

Friel, J. In Press *Acanthobunocephalus nicoi*, a new genus and species of miniature
banjo catfish from the Upper Orinoco River System (Siluriformes: Aspredinidae).
Ichthyological Explorations of Freshwaters.