Cichlid fishes of the Amazon River drainage of Peru

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INTRODUCTION

Peru is a western South American country with the northernmost tip just touching the equator and an area of fully 1,285,000 km^2. Besides a narrow lowland strip along the Pacific coast the area is divided about equally between Andean mountains (to 6,768 m) and Amazonian plains. The Amazon drainage of Peru covers some 750,000 km^2, including high altitude mountain source rivers and major lowland tributaries of the Amazon River, the central river of the world's largest fluvial hydrographic system (6.5 million km^2).

Fifty-five species of the fish family Cichlidae have been collected in the Peruvian part of the Amazon drainage. Cichlids are percoid or labroid (Kaufman & Liem 1982) perciforms, reasonably well diagnosed by characters in jaw musculature and gill-arch morphology (Stiassny 1981), otolith morphology (Gaemers 1984) and intestinal configuration (Zihler 1982).

Well over 1,000 cichlid species are known, including many not formally described. Most cichlid species occur in Africa. A few species are known peripherally from Madagascar, Sri Lanka, southern India and the Middle East. The neotropical portion of the family includes nearly a hundred species from the region of México, Central America and the Caribbean islands, and well over 250 species are estimated to occur in tropical and subtropical South America. Almost all cichlid species are limited to freshwater, only a few species are frequently taken in brackish environments.

The study of Peruvian cichlids presented here covers about 20 % of the known South American cichlid species, a group which has not been revised in its entirety since the cursory revision 80 years ago by Regan (1905-1906).

This paper is based on personal field work and review of most museum collections of Peruvian cichlids, encompassing a total of well over 4,000 specimens. Its principal aim is to serve as a basic treatise on the taxonomy and distribution of the western Amazonian cichlids, including also an analysis of distribution patterns in that area.

Peruvian Amazonía is not, and has never been proposed to be a faunistic region. The area is, however, considerable, and includes most of the major western tributaries of the Amazon drainage and a notable variation in biotopes. Even though the Peruvian ichthyofauna may have seemed so resonably well known as to have inspired syntheses such as monographs and check-lists by Eigenmann & Allen (1942), Fowler (1944, 1945*a*) and Ortega & Vari (1986), many new species (16) of cichlids were found in Peruvian collections, and the taxonomy for the remaining species was found to be in acute need of revision.

This paper complements the revision of the cichlids in Surinam (Kullander *et al.* 1986) and the continuous revision of the La Plata basin cichlids (Kullander 1981*a*, 1982*a*, *b*, 1983*a*, 1984*a*).

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HISTORY

Early naturalist travellers visiting Peru, like Humboldt (Humboldt & Valenciennes 1817) and von Tschudi (1845), did not report on cichlids. The first major work to include descriptions of Peruvian cichlids is that of Castelnau (1855) who made an eventful trip down the Ucayali and collected chiefly or only in lakes near Sarayacu in mid-October 1846. The expedition, however, descended the Amazon from Cuzco, stopping at Nauta, Iquitos and Pebas as well (Castelnau 1851, Papavero 1971). Locality data of Castelnau's Peruvian cichlids are either 'Sarayacu' or 'l'Ucayale'. Of the Peruvian species reported by Castelnau, *Chromys proxima* is here rehabilitated from the synonymy of *Geophagus surinamensis*; *Chromys ucayalensis* is here regarded as a synonym of *Chaetobranchus flavescens*; *Chromys uniocellata* is considered a synonym of *Aequidens tetramerus*; *Chromys appendiculata* represents a

valid species of *Heros*; *Chromys ocellata*, of which no material is preserved, apparently refers to *Astronotus ocellatus*; and the two species described from field drawings, *Cycla conibos* and *C. multifasciata*, are unrecognizable *Crenicichla* species (p. 45).

The Thayer expedition, 1865-1866, led by Louis Agassiz (Agassiz & Agassiz 1868), never reached Peru, but collected at nearby Brazilian localities, and some material from Tabatinga is used in this paper. Most of the cichlids from that expedition were reported on by Steindachner (1875).

Three papers by E D Cope (1870, 1872, 1878) report on the fishes collected by James Orton during voyages along the Ucayali in 1873 and 1877, and by James Hauxwell at Pebas. Locality data for these fishes are generally imprecise. Cope described several new species of cichlids. The type material of some of these is obviously lost or cannot be identified with certainty in the ANSP collection. The material was retained in Cope's home until his death in 1897, whereupon it was transported to the ANSP and sorted by H W Fowler (Fowler 1963). Obviously, many fishes were kept in the same jar and were not individually labelled. Sorting of the collection has thus been dependent on comparison with Cope's descriptions which are notoriously marred by obvious lapses. Although Fowler (1906, 1907, 1915) redescribed the characoids and siluroids, he obviously did very little with the cichlids and these have been examined by myself and Böhlke (1984).

Particular problems in the recognition of type materials are discussed in the species accounts. Böhlke (1984) and I differ in type nomenclature. Where she recognizes (holo-) types and paratypes, I distinguish only syntypes. Some of my identifications of Cope's species as given in Böhlke (1984) are different from those given here, because of subsequent nomenclatural updating.

Cope's new species are recognized in this paper as follows:

Cope's name	Current status
Acara compressus (1872)	*Astronotus ocellatus*
Acara flavilabris (1870)	*Laetacara flavilabris*
Acara freniferus (1872)	*Laetacara flavilabris*
Acara hyposticta (1878)	*Astronotus ocellatus*
Acara subocularis (1878)	*Acarichthys heckelti*
Acara syspilus (1872)	*Bujurquina syspilus*
Crenicichla anthurus (1872)	*Crenicichla anthurus*
Crenicichla cyanonotus (1870)	*Crenicichla cyanonotus*
Crenicichla lucius (1870)	*Crenicichla lucius*
Crenicichla proteus (1872)	*Crenicichla proteus*
Crenicichla proteus argynnis (1872)	*Crenicichla proteus*
Geophagus amoenus (1872)	not recognizable (p. 46)
Geophagus badiipinnis (1872)	*Chaetobranchus flavescens*
Uarus centrarchoides (1872)	*Heros appendiculatus*.

The expedition to Peru that has received the most attention is the Centennial Expedition of the Indiana University (Allen 1921*a*, *b*; Eigenmann & Allen 1942), which collected principally in the Pachitea drainage, at Contamana, in the R. Pacaya, R. Morona, at Yurimaguas and at Iquitos. The collection, now chiefly in CAS, with some duplicates in USNM, includes 18 cichlid species as listed in Eigenmann & Allen (1942). Only a portion of the collection was re-examined. Much of the cichlid material is misidentified. The two new species described by Allen, *Acaronia trimaculata* and *Aequidens hercules*, are synonyms of *Aequidens tetramerus* and *Crenicara punctulata*, respectively.

Another important report on a collection of Peruvian fishes is that of Fowler (1940*a*), listing 11 species of cichlids, 51 specimens, all taken at Contamana by W C Morrow and party. The two species described as new by Fowler, viz. *Apistogramma ambloplitoides* and *Batrachops nemopterus*, are redetermined in this paper as *Acaronia nassa* and *Crenicichla proteus*, respectively. Subsequently Fowler (1944, 1945*a*) catalogued the

Table 1. Chronology of ichthyological collecting in Peruvian Amazonía. Only collections including cichlid material and covered in this paper are considered.

Year(s)	Collector/Expedition	Principal collecting site(s)	Repository	Publications
1846	F. de Castelnau	Sarayacu	MNHN	Castelnau (1851, 1855)
1865	Thayer Expedition	R. Yavarí	MCZ, NMW	Agassiz & Agassiz (1868), Steindachner (1875)
c. 1870-1877	J. Hauxwell	Pebas	ANSP	Cope (1870, 1872, 1878)
1873, 1877	J. Orton	imprecise, lowlands	ANSP	Cope (1878)
1875	A. Stübel	lower R. Huallaga to Iquitos	MTD	Steindachner (1883)
c. 1910	H. & C. Watkins	R. Inambarí	BMNH	-
c. 1913	W. Mounsey	'R. Ucayali'	BMNH	Regan (1913a)
1920	Centennial Expedition of Indiana University (W.R. Allen)	R. Perené, R. Pachitea, Contamana, R. Pacaya, R. Morona, R. Huallaga, Iquitos	CAS, USNM	Eigenmann & Allen (1942)
1920	Cornell University Entomological Expedition	Iquitos	USNM	-
1922	P.S. Morris	Iquitos	CAS, USNM	Eigenmann & Allen (1942)
1933-1940	W.G. Scherer	Pebas	CAS, USNM	-
1937	W.C. Morrow	Contamana	ANSP	Fowler (1940a)
1949-1950	C. Kalinowski	Marcapata	FMNH	-
1953	N. Chirichigno F.	Tingo María, R. Aguaytía	ZMK	-
1955	Catherwood Expedition	Tingo María, Iquitos	ANSP	Patrick (1966)
1956	C. Kalinowski	R. Nanay	FMNH	-
1958	E.R. Blake	R. Inambarí	FMNH	-
1959-1960	K.H. Lüling	R. Pacaya, Iquitos	ZFMK	Lüling (1975)
1964	A.J. Klee	Tournavista, Pucallpa	ZMH	Klee (1965)
1965	J.-P. Gosse & Léopold III	R. Aguaytía	IRSNB	-
1966	K.H. Lüling	Tingo María, Azpusana, Yarina Cocha, R. Ucayali at Pucallpa	ZFMK	Lüling (1971a, 1975)
1968	Cambridge Veterinary Expedition	R. Pachitea	BMNH	-
1968	E.J. Hugghins	Iquitos, R. Pachitea, R. Colorado	ANSP	-
1970	K.H. Lüling	Yarina Cocha, Tingo María	?	Lüling (1971a, 1975)
1971	T. Hongslo	lower R. Yavarí	NRM	-
1972	K.H. Lüling	Iquitos	ZFMK	Lüling (1978a)
1973-1974	M. Chapman	Iquitos, R. Samiria	BMNH	-
1974	Spieler & Poncho	Mishana	MPM	-
1974	K.H. Lüling	Yarina Cocha, Iquitos, Tingo María	ZFMK	Lüling (1978a, 1979)
1975	H. Ortega T.	Pucallpa	MZUSP	-
1975	D.W. Greenfield & G.S. Glodek	Iquitos, Pucallpa, R. Aguaytía, R. Pachitea	FMNH	-
1976	T. Hongslo	lower R. Yavarí	NRM	-
1976	K.H. Lüling	Panguana	ZFMK	Lüling (1980a)
1977	R. Horwitz	R. Pilcopata, R. Manú, Puerto Maldonado	ANSP	-
1977	P. de Rham	Jenaro Herrera, R. Manú, R. Aguaytía	MHNG	-
1977	B. Jacobi	Quincemil	NRM	-
1978	K.H. Lüling	Campo Verde	ZFMK	Lüling (1981)
1978	P. de Rham	Jenaro Herrera, Yarina Cocha, R. Aguaytía	MHNG	-
1979	P. de Rham	Jenaro Herrera, R. Samiria, Nueva York, R. Aguaytía	MHNG, MZUSP	-
1980	C. Vaucher	lower R. Napo, R. Mazán	MHNG	-
1980	W. Staeck	Yarina Cocha, Iparia, R. Amaquiria	NRM	-
1980	P. de Rham	Jenaro Herrera, Iquitos, R. Pacaya	MHNG	-
1981	S.O. Kullander et al.	Jenaro Herrera, Iquitos, Yarina Cocha, Tournavista, Pebas	NRM	This paper
1981	P. Bayley	R. Palcazú	USNM	-
1981	W. Staeck	Yarina Cocha, Alto Aruya	NRM	-
1981	P. de Rham, H. Nijssen	Jenaro Herrera, Iquitos, Yarina Cocha, Tingo María, R. Aguaytía	MHNG, ZMA	-
1981	E. Lenkenhoff	Puerto Maldonado	ZFMK	-
1982	E.J. Hugghins	Iparia	ANSP	-
1982	J. Vierke	Yarina Cocha, Chicosa	Private	Vierke (1983a, b, c)
1983	W. Staeck & H. Linke	Jenaro Herrera, Chicosa, Atalaya, Rateri Yarina Cocha	NRM	Staeck & Linke (1975)
1983	S.O. Kullander et al.	Iquitos, Puerto Maldonado, Jenaro Herrera	NRM	This paper
1983	R.P. Vari et al.	R. Tambopata	USNM	-
1983	T. Iwamoto	Puerto Maldonado	CAS	-
1984	S.O. Kullander et al.	Iquitos, Colonia Angamos, R. Mazán	NRM	This paper
1984	P. de Rham & H. Ortega T.	R. Aguaytía, Pucallpa, Tarapoto, Moyobamba	MHNG	-
1984	W. Staeck	Monte Bello, Yarina Cocha, Requena, Jenaro Herrera, R. Pacaya	NRM	-
1985	W. Staeck & H. Linke	Iquitos, R. Maniti, R. Aguaytía, Yarina Cocha	NRM	-

fishes of Peru, listing 35 supposedly valid Amazonian cichlid species from a literature survey.

Aside from the basic contributions made by Castelnau, Cope, Eigenmann & Allen and Fowler, Peruvian cichlids are known chiefly from group revisions, particular species descriptions and, somewhat indirectly, through ecological studies. Various reports are listed in the next section where appropriate; and the collecting record is summarized in table 1, serving also as an index to the publications. Eigenmann and Allen (1942) present a history of Peruvian ichthyology in some respects fuller than that given here.

Group revisions of concern here are recent papers on the genera *Pterophyllum* (Schultz 1967), *Geophagus*, *Biotodoma* (Gosse 1976), *Apistogramma* (Kullander 1980*a*), and *Cichlasoma* (Kullander 1983*b*).

These report or describe as new species from Peruvian localities *Apistogramma agassizii*, *A. cacatuoides*, *A. bitaeniata*, *Biotodoma cupido*, *Cichlasoma amazonarum*, *C. boliviense*, *Pterophyllum scalare*, *Geophagus jurupari* (now *Satanoperca jurupari*), and *G. surinamensis* (here *G. proximus*).

New species described in shorter papers are mainly *Apistogramma* species described by Meinken (1961*a*, *A. sweglesi*; 1964, *A. kleei*; which both now considered as synonyms of *A. bitaeniata*) and Kullander (1979*a*, *A. nijsseni*; 1981*b*, *A. eunotus*).

Nakashima (1941) described a series of new species and subspecies of fishes from around Iquitos. The only cichlid that Nakashima dealt with is named *Cichla bilineatus*, and is here regarded as a synonym of *C. monoculus*. Meinken (1965*b*) described a new genus and species, *Apistogrammoides pucallpaensis* from Pucallpa. *Aequidens patricki* from the Aguaytía and Pachitea drainages was added by Kullander (1984*b*).

Ecological studies on Peruvian cichlids tend to be contained in limnological habitat parameter catalogues. Identifications of species in these reports are erroneous or imprecise. Papers by Lüling (1961 *et seq.*) and Patrick (1966) embody the ecological aspects; some personal field data are summarized in Koslowski (1985*a*); reports by aquarists travelling in the region may be as useful, see particularly Klee (1965), Linke & Staeck (1984), and Vierke (1983*a*, *b*, *c*, *d*).

COLLECTIONS AND HABITAT DATA

This chapter serves the several purposes of providing historical information, and general and particular habitat descriptions relating to Peruvian cichlids. Collecting sites covered by this paper are plotted in fig. 1, and plates 1-2 depict common biotopes. An idea of the altitudinal relief can be had from fig. 2.

General limnology

Limnologists in Brazil, building on the terminology of early naturalists and local people, have advanced a typification of Amazonian lotic waters, distinguishing between clear-water, black-water and white-water rivers (see especially Sioli 1984). Characteristic clear-water rivers are those of the Brazilian highlands, such as the Xingu, Tapajós and Tocantins. They have relatively transparent water, colourless to greenish, with variable pH (4.5-7.8; Sioli 1984). They are poor in nutrients. River beds are frequently made up of sand.

Black-water rivers, of which the R. Negro is the one classically studied, also have transparent water are but stained so as to look black when viewed from the shore, brownish in a cuvette. The colour is obtained from humic substances leached from flooded vegetation growing on white acid sands along the margin of the Guiana shield, limiting microbial activity. Black waters are very acid (pH *c.* 4-5) and contain almost no electrolytes. River beds are mostly made up of white sand. The floodplains have seasonally inundated forest. Aquatic macrophytes are reported for the R. Negro and R. Tefé, but may be relatively recent, historical, invaders (Goulding & Carvalho 1984).

White-water rivers such as the R. Amazonas are turbid, their water having a café-au-lait appearance. They are relatively rich in nutrients and pH is about neutral. Primary production is limited because of the reduced transparency, but calm areas support large crops of floating plants and grasses, commonly referred to as floating meadows, extending from the river bank. The silt of white-water rivers derives from erosion, and most rise in the Andes; silt is gradually deposited in and eroded from clayey river banks and extensive floodplains.

General descriptions of Amazonian waters may be found in reviews by Fink & Fink (1979) and Lowe-McConnell (1975) which consider the ichthyofauna as well, and limnological treatises such as Sioli (1984).

Peruvian limnology

All major, and most lesser rivers of Peruvian Amazonia are white-water rivers and are recognized as such locally. Only rivers which arise within the selva, below 200 masl, eg. the Nanay and Mazán, may be considered black-water rivers. There are no true clear-water rivers in Peru. Clear-water conditions exist, however. Mountain streams and tributaries of the large rivers at higher elevations carry little sediments during low water. Also the transparency of lowland streams fluctuates with rainfall. Black waters may be causally different from those of the Guiana shield. The sources of black-water forest streams remain uninvestigated, but swampy depressions, generally inhabited by aguaje palms, *Mauritia flexuosa*, and then known as aguajales, may provide conditions for extraction of colouring humic substances. Black-water rivers change in turbidity with water level, being more turbid at low water. Changes in optical qualities may be influenced by damming at confluence with a major river, leaking of humic substances from forest litter in flooded areas, greater influx of dark water from forest streams at high water, and increased velocity (bank erosion) paired with lessened influence from tributary streams and floodlands at low water.

Seasonal fluctuation in water level is considerable in the lowlands, amounting to 12 m in some places. Changes in water volume influence physico-chemical characteristics of water bodies and also affect much of the land along river channels by an annual cycle of flooding.

Seasonality is different in different parts of the country; northern rivers (eg. the Putumayo) are low November-February, whereas southern rivers (eg. the Ucayali) are lowest within the period May to October.

Cichlids are usually collected in smaller water bodies, being seemingly lentic fishes. Such habitats are not readily classified by water colour alone, but still the number of generalized low water biotopes is restricted. Most fishing has been done in forest streams, backwater pools, lakes, aguajales, floating meadows and along river playas. Virtually all collecting has been conducted during the low water period (*vaciante*) from which period the following generalizations are derived.

Forest streams are generally from one to 10 m wide, usually with steep banks and with variable water flow influenced by local rainfall. Limnological parameters vary, but usually they have relatively clear, slightly tinted or colourless water. There is no macrophyte vegetation, but trunks and, in calmer parts, heaps of leaf litter, are abundant. Shadowing can be nearly total for long stretches, but as a rule collecting is done near a crossing bridge where there is also usually a wide pool-like calm-water region facilitating collecting.

Aguajales are swampy depressions, which may cover several square kms. Only smaller aguajales and that bordering Quisto Cocha (easily accessible on a log path) are conveniently sampled. Aside from aguaje palms, which provide log litter, banks of pools are lined with mosses and other plants. The bottom substrate is soft mud. Aguajales have acid (pH about 5), brown stained water. Fishes seem generally not abundant in this habitat, but sampling inefficiency may bias the collecting record.

Backwater pools close to rivers, are extremely productive for fishing, par-

ticularly because of the ease of sampling. Such pools, or lakes, may be a few hundred meters long and have turbid water irrespective of the nature of the neighbouring river. The depth is generally not over 1 m and the bottom is made up of soft clay. Because of complete exposure to the sun, water temperature may be high, over 30°C along the shoreline. Many fishes die in the net, probably because of the elevated surface water temperature, and backwater pools generally do not provide well-preserved material.

Lakes are generally oxbow lakes which are under the influence of river water level and share physico-chemical characteristics with the adjacent river except for being stagnant. Yarina Cocha (described below) is a characteristic white water lake, with turbid water and abundant macrophyte vegetation (especially water hyacinths). Lakes near the Nanay have black water, turning turbid during low water, and contain no vegetation. In all lakes there is a considerable bottom layer of soft débris.

River playas collected are generally those of white or black sand; clay playas are difficult to walk on and the possibility of a sudden bank slide makes them dangerous. Playas along smaller rivers are usually of sand, whereas in the Amazon they are of clay. Stream velocity is slight near shore, and depressions provide accumulations of leaf-litter. At the lower end of a playa is usually a muddy backwater area.

Floating meadows, ie. fields of grasses extending from river or lake banks far out into shore water are productive fishing grounds. These meadows are found only along white waters, and always in calm places. Besides being obviously rich in fishes, collecting is easy as the fish hide inside the meadow. A portion of the meadow is encircled with the net and the grass is extracted from the water with the fish trapped within the net-encircled area. See Junk (1970, 1973) for an in-depth study of floating meadow conditions.

Local toponymy

Local terminology is highly useful as a conceptual basis for description of hydrographic conditions in the lowlands. The following glossary is based on local information and Villarrejo (1979).

Aguajal. Swamp, dominated by *Mauritia flexuosa* vegetation
Altura. Never-indundated land, generally hilly
Bajial. Seasonally flooded area
Caño. Stream draining a lake
Charco. Backwater pool
Cocha. Lake
Creciente. Season of high water level in rivers
Gramalotal. 'Floating meadow' vegetation
Monte. Forest
Playa. Exposed, gradually sloping river shore, bed of any composition
Pozo. Small lentic water body, not backwater
Quebrada. Stream, either from groundwater source or aguajal (may be combined); water volume fluctuates with local rainfall
Quebradita. Either a very small stream or synonymous with quebrada
Restinga. Land above flooding level, margined by tahuampa or bajial
Río (river). Major lotic waters of annual water level fluctuations
Sacarita. Stream connecting two river segments, of the same or different rivers
Selva. Rain forest. *Selva alta* c.400-1000 masl, *selva baja* <400 masl
Tahuampa. Floodplain forest
Tipishca. Oxbow lake, still largely in contact with river
Vaciante. Season of low water level in rivers.

Particular rivers and habitats

The following survey of rivers and habitats provides additional information on various habitat types, which generally can be assigned to one of the above outlined categories.

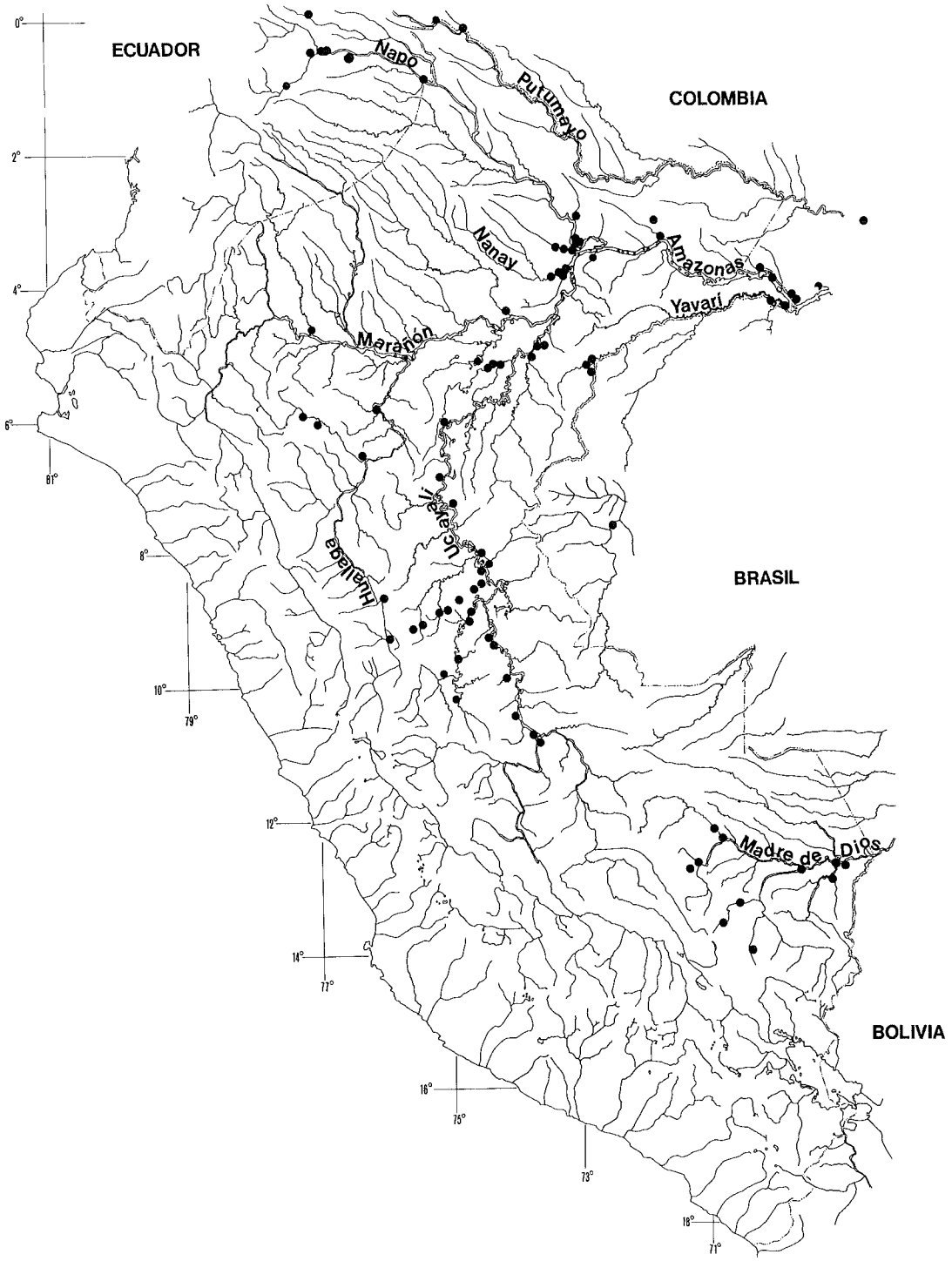


Figure 1. Map of western Amazonía with the majority of the cichlid localities covered in this paper. One dot may represent several adjacent collecting sites.

Río Caquetá - Río Japurá. The R. Caquetá is a major tributary of the Solimões, catching several rivers from the Andes from near Putumayo headwaters north and west to near R. Guayabero (upper R. Guaviare, an Orinoco tributary). Called Japurá in Brazil, it enters the middle Solimões through the many anastomoses north of the Fonte Boa-Coari stretch of that river.

There are scattered collections available from the upper Caquetá and lower Japurá. Fowler (1945*b*) reported on a collection from Morelia in which he identified the cichlid species *Aequidens vittatus* (here *Bujurquina cf. peregrinabunda*), *Geophagus pellegrini*, *Crenicichla saxatilis* (here *C. cf. anthurus*), and *Caquetaia amploris* (currently *C. myersi*).

Of these species *Geophagus pellegrini* is otherwise collected only in some Pacific and Caribbean drainages in NE Colombia and adjacent Panama. Gosse (1976) verified Fowler's determination, but I agree with him that the locality is doubtful.

From Florencia, Fowler (1945*c*) reported *Aequidens vittatus* (here *Bujurquina cf. peregrinabunda*), *Cichlasoma spectabilis* (redetermined as *Caquetaia myersi*) and *Crenicichla lugubris* (not seen).

A collection from the lower Japurá (Lago Amanã) is one of the easternmost collections covered in this paper.

Río Putumayo - Río Içá. Few collections are available from this long and important border river which rises in the Andes and reaches the Solimões well east of Peru. It parallels both the Napo and the Caquetá for long distances. The collections reported on here are chiefly that of Hongslo from Cuiabá (*c.* 2° 57'S 68° 14'W), an insignificant village on the Içá, and Saul's from Santa Cecilia (00°03'N 76°59'W, 340 masl).

Saul (1975) described habitats and stomach contents of his fishes. Determinations in this paper differ for all except one species. I have examined only ANSP material, and most of Saul's material is in the University of Kansas. The Santa Cecilia area is of particular interest because of the close proximity of Napo and Putumayo tributaries, and the considerable differences in limnological characteristics between waters collected by Saul.

The R. Conejo, less than 500 m distant from the Napo tributary Aguarico, is a tributary of the R. Putumayo, about 6 m wide at Santa Cecilia, draining swamps of the area. Average temperature was 22.5°C, pH was about 6.6, dissolved oxygen about 6.5 ppm. Beds varied, including mud, sand, gravel, rock, clay and vegetative debris. The Conejo had *Crenicichla lepidota* (not seen), *C. lucius* (here identified as a composite, of *C. sedentaria* and *C. anthurus*), and *Aequidens vittatus* (*Bujurquina* sp.?, not seen).

Lakes and swamps were also sampled; one called 'lower lake', was drained by the Conejo, with pH 7.1-8.2, temperature 23.8-27.8°C and dissolved oxygen 6-10 ppm. Saul identified three cichlid species from this lake: *Aequidens tetramerus* (determination verified), *A. vittatus* (not seen), and *Crenicichla lepidota* (here *C. proteus*). No cichlids were found in the rain pools and swamps. Creeks in the area yielded *Aequidens tetramerus*, *A. vittatus*, *Crenicichla lepidota*, *C. lucius* (none of which re-examined) and *Aequidens* sp. (redetermined as *Laetacara flavilabris*).

I get the impression that the Conejo and Aguarico (see account on R. Napo) have about the same cichlid species and that the variation in Saul's cichlid collections were due mainly to habitat variation, which was biased further because more cichlid habitats were sampled in the Conejo drainage.

Río Amazonas. Throughout this paper I use the name Amazon for that river which is the main system of the Amazon basin, called Solimões between Tabatinga and Manaus, Amazonas between Manaus and the Atlantic as well as between the Marañón-Ucayali confluence and the Peruvian-Colombian-Brazilian border. The upstream portion of the 'Amazon' is taken here to be the Ucayali-Ene-Tambo-Apurimac; although commonly the Amazon is considered to originate with Marañón headwaters (cf. Villarejo 1979). All component rivers and river stretches are recognized by their proper names. In some older literature (eg. Cope 1870) and occasionally today, the Peruvian Río Amazonas is called Marañón, which was once the name of the whole river here termed the Amazon. This

terminology is chosen to preserve the usefulness of a finer nominal subdivision (by local names) without risking confusion with an identical more general denomination (here to be in the English form), and to have a faunistically more uniform connotation for the general denomination (hence the Ucayali instead of the Marañón included). The drainage of the Amazon includes all rivers one way or another connected to the Brazilian Rio Amazonas (excepting occasional headwater connections with other major drainages, the Orinoco and the Paraguay). The Tocantins system is not to be regarded as a part of the hydrographic system of the Amazon drainage. The term Amazonía (Amazônia in Brazil) is reserved for the Amazon drainage and does not include adjacent drainages (cf. Fittkau 1974).

The R. Amazonas in Peru thus extends from the confluence of the rivers Ucayali and Marañón to the Brazilian border, a distance of about 700 km. Nearly all of this is flat-lying land of low elevation. The river width varies between 2 and 5 km, and there are several large islands in its course. Banks are generally clayey and steep, but black-sand playas as on the islands facing Iquitos are also common. Virtually no cichlids have been collected in the R. Amazonas itself, and only a few tributary rivers, such as the Nanay, Napo, Ampiyacu and Manití have been collected. A few collections are from islands in the Amazonas, such as Padre Isla outside Iquitos and Isla Santa Sofía in the Colombian section. The water level is lowest in August-October. The water is turbid, with a lesser tint, and swift-flowing. Swabey (in Patrick 1966) found pH 7.2, total hardness 73 ppm, and temperature 29°C at Iquitos during low water.

Río Ampiyacu. The R. Ampiyacu is a small tributary of the R. Amazonas which has been the subject of a surprising amount of collecting, first by J Hauxwell in the early 1870s, later by W G Scherer in the 1930s. The principal village, Pebas (3° 10'S 71° 46'W, *c.*100 masl), traces its history back to the 18th century and has been, and remains an important missionary, military and education center.

Cope (1872) wrote Ambyiacu, which is either an error in spelling or some anglicization. Many later authors have also used the spelling. The river is known locally as Ampiyacu. The spelling used by Lüling (in Meinken 1969*a*), Ambiyacu, may pass as an orthographic variant. Contrary to Lüling (*l.c.*), I consider the Ampiyacu as a white-water rather than a black-water river, but its appearance may vary seasonally.

Río Napo. The Napo is reasonably well investigated only along the Ecuadorian course and near the mouth into the R. Amazonas. It is 1,130 km long, with several large tributaries and with an altitudinal shift from nearly 4,300 m in the Monte Cotopaxi, it forms a significant portion of the western Amazonian watershed. Various Ecuadorian collections were consulted for this paper, chiefly from near Santa Cecilia on the Aguarico (leg. Saul, Hugghins, Touzet), near Coca (leg. Roberts *et al.*, Touzet), Hatún Cocha (Yatún Cocha) near Nuevo Rocafuerte, and R. Lagartococha.

Saul (1975) described R. Aguarico sites. It is a white-water Napo tributary, about 100 m wide at Santa Cecilia, where it flows swiftly over a bed of large rocks, and has steep shores or sandy beaches. pH varied from 6.3 to 8.0, temperature between 17 and 20°C, and dissolved oxygen was about 8 ppm. The cichlids reported by Saul were *Aequidens vittatus* (here *Bujurquina cf. moriorum*), *Caquetaia myersi* (not seen, probably correctly identified), *Crenicichla lepidota* (not re-examined), and *Crenicichla macrophthalma* (here *C. sedentaria*). (See also account on R. Putumayo, above.) From the Peruvian section are available only material from near the mouth and from the tributary R. Mazán.

The Napo itself is a white-water river, difficult to navigate because of huge banks of black sand as experienced during a visit in August 1984. At that time the river was still high, but the deslizador had trouble finding deep enough canals for passage upstream of Mazán. Fishing was done near Mazán, in a pool on a sand island covered by grasses and a backwater caño which obviously recently ceased to connect the pool with the river (Pl. I, fig. 2).

Tributaries of the lower Napo may be more often black than white-water. The R. Mazán, visited in 1984, was similar to the R. Nanay. The river and associated streams had soft, slightly acid water (<1°dGH, pH 5.5-6.0). Still water in the forest was clear and black, grading to turbid dark in the river. Playas were few and consisted of black rather than white sand; stretches of clayey beach were common. The only other Peruvian Napo collection studied (leg. Vaucher 1980) is also from near Mazán, including the lower R. Mazán and some left bank Napo localities.

Río Nanay. The lower part of the Nanay from Bella Vista near Iquitos (3°45'S 73°15'W, 106 masl) upstream to Mishana (3°52'S 73°28'W) is one of the ichthyologically best known river stretches in Peru. There are no collections from upstream of the Mishana area, and only one sample available from the major lower tributary, R. Momón.

The Nanay is a black-water river (Swabey, in Patrick 1966; pers.obs.), with long playas of white sand exposed along inner banks of meander curves during low water. The inundation zone is vast, and numerous temporary lakes form along both banks.

The optical aspect of the water varies with water level. During high water, the water is clearer and darker than during low water, when it is turbid although retaining a fair transparency. Patrick (1966) reported bottom visibility as 1.2 m in June (high water) and 0.48 m in September (low water). These observations agree with those I made in July (high water) of 1984, and August-September (low water) in 1981, 1983-1984, although no measurements of transparency were made.

The velocity was given by Patrick (1966) as 0.32-0.62 ms^{-1} in a transect. The current is stronger at the outer bend of meanders. The width of the main channel is somewhat variable, and has never been recorded, but is estimated to average 75-100 m. A few small floating meadows were observed on a trip to Mishana in July 1984, otherwise there is no aquatic vegetation along the river.

Water analysis data from a single October sample (Swabey, in Patrick 1966), show nutrient and bacteria contents low, excepting a relatively high iron content (0.070 ppm), pH 5.2, total hardness 3.00 ppm, dissolved oxygen 6.41 ppm and temperature 28.5°C. Personal observations from river playas indicate a pH of 5.5-6, temperatures 27-34°C in the surface, hardness 0-0.8 °dGH, dissolved oxygen 3.6-6.9 ppm (saturation 51-87 %) and iron 0.5 ppm.

Tributary quebradas carry clear, dark water and flow over sand bottom. They are well-shadowed by forest, but fishing was generally done in open areas. Leaf litter constitute a significant portion of the substrate. Quebradas were found to have pH 5.0-6.0, hardness 0.2-0.6°dGH and dissolved oxygen 4.5-6.4 ppm (saturation 56-77 %).

Different types of lakes at different water levels were fished. These had had generally darker and clearer water than the river, but turned turbid with lowering water level. Backwater pools, such as my station SOK 71, lacked transparency. Combined data give ranges of pH 5-5.5, oxygen 2.4-6.4 ppm (31-88 % saturation), hardness 0-0.6°dGH and temperature 27.5-32°C.

Quistococha. Lüling (1978*a*) collected in one of several streams along the road from San Juan to Quistococha (03°50'S 73°17'W, 150 masl) and gave some habitat data. The name of the quebrada studied by Lüling is Pucayacu, not Pacayacu. Clearing and roadside settlement has markedly changed the area since. Personal collecting was made in and near the fish ponds of the fish culture operation at Km 13 (IMARPE), including savage species. The only natural habitat studies in the area is, however, the lake Quisto Cocha.

Lüling (1963) published an inventory of the 'common' fishes of Quisto Cocha, supplemented by map, photos and water analysis data. The lake appears today similar to how it was in 1959 when visited by Lüling, although a zoological garden has been built around the concrete fish ponds on the steep western slope, and a log path circles most of the lake. The lake is used for recreation, but has probably not yet suffered pollution. Maximum depth measured by Lüling was 413 cm near the middle. The shores of the lake are very

steep, 2-3 m. Most of the lake is margined by an extensive aguajal extending to the R. Itaya about 1.5 km distant. There are no obvious affluents, excepting a few quebraditas bringing groundwater from the steep western slope, and no effluents. The only stream, Alcántara Caño, was found stagnant during low water in 1981, 1983, and 1984. The water is slightly turbid, pH 5.7-5.8 according to Lüling (1963). Only 3 cichlid species were reported by Lüling, viz. (names are those used in this paper) *Mesonauta festivus*, *Heros appendiculatus*, and *Cichla monoculus*.

Río Marañón. Although collections from this river are scarce, those existing indicate that cichlids may not be present in the Alto Marañón, ie. upstream of the Pongo de Manseriche (4°27'S 77°37'W, 180 masl), except in the Santiago-Zamora drainage coming from the north, and from which *Crenicichla* and *Bujurquina* species are recorded. Eigenmann & Allen (1942, p. 50) listed 34 species of fishes as occurring in the Marañón above the Manseriche rapids, of which less than one-third were not taken elsewhere. Allen (in Eigenmann & Allen 1942, p. 63) doubted the efficacy of the Pongo de Manseriche as a barrier to fish dispersal. Certainly, collections are insufficient for further discussion of the possibility. Collections from higher elevations (2,000-3,000 masl) in the Marañón and adjacent drainages and reported on by Fowler (1945*d*) and Pearson (1937*a*) include no cichlids but several small characids, siluriforms and a few other families represented also in the lowlands.

The lowland portion of the Marañón, the Bajo Marañón, is known chiefly from collections in two tributaries: The Tigre is a left bank tributary of the Bajo Marañón, with sources in the Ecuadorian Andes. There may exist only a single collection of cichlids from the Tigre, made by Patrick de Rham at Nueva York in 1979. The Morona, another left bank tributary with Andean origin, was visited by W R Allen in 1920; his collection is probably from very close to the mouth.

Río Huallaga. Lower Huallaga collections of cichlids are from the Rio Mayo (Moyobamba, 6° 04'S 76° 56'W, 860 masl), Tarapoto (6°31'S 76°23'W, 356 masl) and Yurimaguas. I have no habitat data for these. However, shortly before reaching Yurimaguas, at about 6°S, the Huallaga has made the transformation from an intercordilleran canyon river to a lowland floodplain river. Yurimaguas collections (5° 54'S 76°07'W, 182 masl) also include only lowland species of cichlids.

Tingo María (73°03'N 09°0.9'S, altitude 670 masl) collections reported here are chiefly from the Catherwood Expedition and Lüling's 1966 collection. Habitat data for the latter are given by Lüling (1971*a*, and see also Lüling 1971*b*). Huallaga highwaters had a pH of 7 and were relatively hard, with 6.2°dGH, as reported by Lüling (1971*a*).

Patrick (1966) has general and particular data on Catherwood expedition sites: The Tulumayo at Puerto Nuevo was a clear- to white-water river with varied bed composition and stream velocity in different parts of the study area, including rocky bottom riffles and a pool on a midriver island. Temperature was 23.7°C, pH 7.6 and hardness 247.20 ppm. Quebrada de Puente Perez had also hard (241.20 ppm) and alcaline (pH 7.2), but clear water; otherwise the habitat sampled was quite similar, temperature 23.6°C. The Río Rondo and its tributary the R. Bella, had clear, acid water, pH 5.0 and 5.5, respectively. Both had stretches of riffles, with the bed made up of sand, rubble and rocks. Temperature was 24.8°C, hardness 14.00 ppm in the Rondos. The Bella had 23.1°C, and 36.40 ppm, respectively.

Tingo María area waters thus seem to differ from selva baja waters in general in being somewhat cool, c. 23-25°C, and clear, with hard substrate beds and rapid sections. Hardness and pH are locally variable, but hard waters do not occur in the selva baja.

A collection of Peruvian fishes made by Alphons Stübel in 1875, was reported on by Steindachner (1883). It was deposited in the Museum für Tierkunde in Dresden, where some of the material is still preserved. Duplicates were deposited in NMW according to Steindachner, but none of the cichlids were located

with certainty. Stübel's itinerary includes stops at Rioja, Moyobamba, Tarapoto and Chasuta, from whence he proceeded by river to Iquitos (Papavero 1973). Collections labelled R. Huallaga thus are likely from the lower R. Huallaga.

Río Ucayali. The Ucayali upstream of Pucallpa is known chefly from collections of Staeck, Linke and Vierke, ranging from Iparia (9°17'S 74°29'W) to Rateri and the lower R. Tambo. No cichlids are known from more upstream in the Ucayali drainage. Vierke (1983*a*, *b*, *c*) has data and habitat photos from near Chicosa, including a study of *Bujurquina robusta* reviewed here on p. 276. Other portions of the Ucayali, a white-water river similar to the Amazonas, are best known from adjacent sites, see especially accounts of Yarina Cocha and Jenaro Herrera.

Río Aguaytía. There are many collections from along the road from Pucallpa to Huánuco, principally from the Aguaytía drainage. Easy accessibility to several tributaries and various biotopes has given a fairly good collecting record (bead of dots on map, fig. 1). There is little detailed information on the habitats, however. Most habitats are gravel bed river shores but include also aguajal-like conditions. Rivers of the region are clear-water. Data for the tributary R. Huacamayo range as follows: 26-27.6°C, pH 6.3-7.7, conductivity 48-52 µS and hardness 2.0-2.5°dGH (see p. 320).

Río Pachitea. The Pachitea is a white-water river, scattered tributaries of which are relatively well collected. The lower portion, at Tournavista (8°53'S 74°44'W), has partly gravel bed, and highland tributaries should be of mountain river character. There are no habitat data for Puerto Bermúdez (10° 14'S, 74°56'W, on R. Pichis) and R. Palcazú localities which are the most upstream, but the species taken there also occur in the lower section of the Pachitea.

Panguana (9°37'S 74°56'W) is a biological field station on the R. Llullapichis, a white-water river originating in the Cerro Sira. Lüling (1980*a*) gave water analysis data (pH 7.7, hardness 3.1°dGH). Most fishing has been made in backwaters of forest streams, as reported by Lüling (1980*a*).

Lüling (1981) reported on a collection made in 1978 in two streams near Campo Verde, a village where the side road to Tournavista starts. Two trips along the Tournavista road in 1981 failed to locate any of these collecting sites, but streams in the region are all more or less similar, and Lüling's photos may have been made some distance from the road. My station SOK 30 is an aguajal similar to Lüling's 'Dunkelwasserbach', for which was reported a pH of 6.3-6.4, total hardness 1.0°dGH and surface temperature 25-27°C.

Yarina Cocha (74°60'W, 08°40'S). This is an oxbow lake, close to the R. Ucayali, slightly north of Pucallpa (198 masl). Convenient hotel facilities have attracted several fish collectors. Lüling (1979 and especially 1975) has given detailed descriptions of observations during visits during both high and low water levels in 1966, 1970 and 1974. See also reports by travelling aquarists (Vierke 1983*d*).

The lake is about 17 km long, and 800-900 m wide during low water (Lüling 1975). Lüling (1975) measured a depth of 7.5 m at the middle of a single transect; near shore it is quite shallow and water hyacinths form large meadows or drifting islands along much of the shore (pers. obs. 1981; Lüling 1975). The surrounding forest was seen to be secondary in 1981. There is a small village, Puerto Callao, at the southern bank of the bend, and scattered buildings all around the lake.

The lake is flooded by the Ucayali at highwater and maintains contact with the river throughout the year by affluent and effluent caños. The water is white-water, which increases in transparency during the vaciante (to 95 cm measured by Lüling 1975). Lüling recorded high water pH values 5.8-7.1 ($\bar{x}$=6.6 from his 20 precise records), surface temperatures 25.4-34.5°C from 0930 h to 1230 h (Lüling 1975) and low water data: pH 7.2 (Lüling 1979). Fishes collected by Lüling were identified by Meinken and are deposited in the ZFMK.

Collections have been made in the lake proper as well as in caños, forest pools and smaller lakes near Yarina Cocha, especially in the caño between Yarina Cocha and Paca Cocha, which was described by Lüling (1979). In 1981 the

caño was choked by water hyacinths and some *Pistia* among which lived an abundance of fishes.

Río Pacaya. The Ucayali tributary R. Pacaya has been visited by several collectors, and Lüling (1975) has given accounts of fishes and habitats, but no detailed information is available. In the lower course is a lake, Yarina Cocha, which was visited by both Lüling and W R Allen. There is a potential risk of confusing this lake with the also well-collected Yarina Cocha near Pucallpa.

Jenaro Herrera. The Jenaro Herrera (4°55'S 73° 40'W, 140 masl) area has been subject to rather intensive collecting, with material available bearing dates almost continuously from years 1977 through 1984, and especially from expeditions in 1981 and 1983. Some data on general geography and particular habitats are given in de Rham & Kullander (1983).

Jenaro Herrera is a large village situated on the inner bend of a major curve of the Rio Ucayali, 140 km S from Iquitos. The annual precipitation is near 3 m, average air temperature about 26°C. The back regions are subject to agricultural activities, the chief result of which is the threatening devastation of a highly varied ichthyofauna encountered along an initiated road toward Colonia Angamos on the Brazilian frontier.

From about km 10 east, the topography is characterized by numerous low hills between which run quebradas of varying size. All are captured by the Sapuena or Carahuayte, draining to the Ucayali north of Jenaro Herrera. All waters in the region are soft, acid, and nutrient poor. The larger quebradas have rather clear water, the smaller vary in colour from yellowish to brown red.

About 4 km upstream from Jenaro Herrera is a system of lakes fed by two small rivers, the Aucayacu and Curiyacu but also within influence of water level of the Ucayali. This system is referred to here as the Supay system. Lakes and rivers are characteristically white-water, some of the smaller streams having transparent water, however.

Río Yavarí. Only two areas along the fully 1,000 km long R. Yavarí (Javari in Brazil) have been collected. Hongslo collected near the mouth in 1971 and 1976, obtaining several cichlid species. Personal collections from near Colonia Angamos (05°10'S 72°53'W, 250 masl), in several biotopes, did not yield many cichlids.

As observed at Angamos during low water in July-August 1984, the Yavarí is a narrow (*c.*80 m) white-water river, with long sand playas and lined by many lakes that dry up during the vaciante. Above the mouth of the black-water tributary R. Gálvez, the river is called Yaquerana (Jaquirana in Brazil). The most productive fishing was done in a small oblong backwater lake which was seined from one end to the other (Pl. I, fig. 1), whereas sand bank seining produced few cichlids. The river water had a pH of 6.5-7.0 and was somewhat soft, less than 2°dGH.

The Gálvez reminds one of the R. Nanay, but is much narrower and lacked long sand playas even at low water level. The water was turbid, but (early seen to be darker than that of the Yaquerana-Yavarí where the two rivers met. A few small forest quebradas were sampled, with clear, somewhat acid (pH 5.5-6.5) and soft (0-1.8°dGH) water. The river had soft (<0.6°dGH) and slightly acid (pH 6.5) water.

Quebradas sampled around and in Colonia Angamos were man influenced. Colonia Angamos, a colonization project, is situated on a hill overlooking the river; the hinterland is hilly altura, similar to the landscape around Jenaro Herrera on the Ucayali 100 km west.

Río Madre de Dios drainage. Lowlands just north of the Andean Altiplano are drained by the R. Madre de Dios, one of numerous major tributaries of the R. Madeira fanned out over Bolivia and knit together at the extreme northeastern corner of that country.

The Madre de Dios is a white-water river. At the time of my visit in 1983 it had very little water. Most Madre de Dios cichlids are from three expeditions made in close succession in 1983, collecting in the lower Tambopata and

nearby Madre de Dios. Personal collecting was done chiefly in a lake, Lago Túpac Amaru within flooding influence of the Madre de Dios, and various streams, all near Puerto Maldonado (12°37'N 69°11'W, 256 masl). Richard P Vari *et al.* (Hernán Ortega T., Susan L Jewett, R Crocroft) collected mainly near La Torre on the R. La Torre, a right bank tributary of the R. Tambopata, *c.*12°50'S 69°17'W, one sample from a Madre de Dios tributary 10 km downstream of the mouth of R. Tambopata. Tomio Iwamoto's material is from the Lago Sandoval on the right bank of the R. Madre de Dios little downstream of the mouth of R. Tambopata, and nearby.

There are several small collections including cichlids reported upon in this paper, mostly from the Inambarí area. Harry and Casimir Watkins collected fishes and other animals in the Madre de Dios drainage around 1910. The fish material was sent to W F H Rosenberg in London who sold it to BMNH and perhaps to other museums. There are three cichlid lots in the BMNH attributable to the Watkins brothers, labeled as from R. Mambarí (R. Inambarí), Uruhuasi, and Gahuarimayo (Yahuarmayo). Eigenmann & Allen (1942) located Uruhuasi to the R. San Gabian, and the Yahuarmayo as a R. Inambarí tributary, both localities slightly north of Macusani (14°05'S 70°24'W).

A major collection was obtained by Richard Horwitz, mainly from the Pilcopata, a tributary to the Alto Madre de Dios close to the departmental border between Cuzco and Madre de Dios, but also from the Manú, and from near Puerto Maldonado.

The Madeira is insufficiently surveyed. Bolivian Amazonía, in this paper understood as all the Madeira tributaries from the Guaporé (Itenez) west to the Madre de Dios drainage, has been surveyed by many expeditions. Particularly important are many types of cichlids collected in the Guaporé by J. Natterer and described by J Heckel (1840). Also J D Haseman travelled down the Guaporé and described cichlids from that trip (Haseman 1911*a-c*). Other Bolivian collections are from the Beni basin (Pearson 1925), central Bolivia (Trinidad, Chapare, etc.; Fowler 1940*b*, 1943*a*, Lüling 1969).

Recent collecting in Bolivia has been intense, but substantial collections in the IRSNB (leg. Gosse 1977), AMNH, UMMZ (leg. Bailey *et al.*, 1964), and NRM (leg. Loubens 1981-1985; Linke & Staeck 1983, 1985), have been worked up only partially and very little has been published.

Judging from Bolivian collections, it seems reasonable to assume that collecting in additional habitats in the Peruvian portion of the Madre de Dios system will show the existence of additional species, such as *Chaetobranchus flavescens, Acaronia nassa, Cichla monoculus,* the *Crenicichla* species called *C. simoni* by Pearson (1925), and a *Heros* species.

Lüling (1985) suggested that *Papiliochromis ramirezi* (Myers & Harry) and *P. altispinosa* (Haseman) might co-occur in the Madre de Dios. The former is presently known only from Orinocoan localities, the latter only from central Bolivia and the Guaporé drainage (Kullander 1981*c*). There is no obvious rationale for believing that they would both occur also in Peru.

Ecuador. Several Ecuadorian localities are used in this paper, including collections from the rivers Aguarico and Payamino (upper Napo). The numerous Amazon tributaries in eastern Ecuador are, however, quite insufficiently collected. It should be stressed that available Ecuadorian collections have not been made full use of, often because the specimens are old, juvenile or in bad condition; but also with reference to the scope of the paper (see p. 45 for reference to some Ecuadorian species). Existing collections indicate that lowland Ecuador has a cichlid fauna similar to that of Peru, whereas *Crenicichla* and *Bujurquina* species dominate collections from higher elevations.

Ovchynnyk (1967, 1968) has a checklist of the cichlids of Ecuador, based on literature and personal communications from Gustavo Orcés. It includes 14 cichlid species of which 9 are Amazonian. One of these records is for Pebas (*Aequidens flavilabris*), in this paper considered a Peruvian locality. Other original records need revision: *Aequidens tetramerus* (R. Conambo), *Apistogramma amoenus* (R. Panayacu, R. Lagartococha), *Cichlaurus festi-*

vus (R. Lagartococha), *Geophagus jurupari* (R. Lagartococha, R. Conambo (Aguarico tributary)).

Markets. Fish markets are a valuable source of material of some of the larger fish species not easily obtained by standard field techniques. Bérenz & Zelada (1975) studied cichlids of the markets and port of Iquitos. The fishes reported by Bérenz & Zelada have been identified on the basis of their descriptions and figures as *Astronotus ocellatus, Cichla monoculus, Heros severus, Hypselecara temporalis, Crenicichla cincta, Chaetobranchus flavescens, Cichlasoma amazonarum* and *Aequidens tetramerus*. There are two main markets in Iquitos, the principal at the edge of the settlement of Belén, which is continuous with Iquitos. In 1981, 1983, and 1984, *Cichla monoculus* and *Astronotus ocellatus* were seen on most visits to the Belén market. *Cichlasoma amazonarum, Chaetobranchus flavescens. Hypselecara temporalis, Satanoperca jurupari, Aequidens tetramerus*, and a *Crenicichla* species were occasionally present.

Pacific coast cichlid fauna

This paper deals only with the Amazonian cichlids of the Peru. The existence of a few Pacific slope species needs to be pointed out, however. The cichlids of the Pacific slope of South America are covered by Eigenmann's (1922) monograph of the fishes in this area. Since then *Cichlasoma microlepis* Dahl (1960) from the R. Baudó in Colombia has been added. Two species occur in the Guayaquil drainage system, viz. *'Cichlasoma' festae* (Boulenger) and *'Aequidens' rivulatus* (Günther). Whereas *'C'. festae* may be endemic to this area, *'A'. rivulatus* occurs from the R. Chone south into Peru. The taxonomy of *'A'. rivulatus* is confused as there are only limited collections, several nominal species have been synonymized with *'A'. rivulatus*, and, as I have observed, there is considerable morphological variation between collections from different localities.

The southernmost major Pacific versant river system with steady water flow and rainforest conditions is the Tumbes which is little known ichthyologically except for Chirichigno's (1963) inventory. Chirichigno reported three cichlid species, viz. *'Cichlasoma' festae, 'Aequidens' rivulatus* and *Geophagus steindachneri* (a misidentified *Satanoperca* species?).

'Aequidens' rivulatus occurs further south as far as 40-45 km south of Lima (12° 06'S, 77°03'W) according to Lüling (1973). Further south along the Pacific coast, arid conditions obviously limit the freshwater fish fauna and no cichlids have been collected there, even though members of families of primarily cis-Andean range are found in Chile (Arratia 1981).

With the possible exception of the *Satanoperca* species, no cichlid species or genus has been collected in both Amazonian and Pacific versant rivers.

Annotated list of stations for expeditions to Peru in 1981, 1983 and 1984

The following is a list of collecting sites with habitat data for three expeditions in Peru, 1981-1984. Only stations at which cichlids were collected are included. Collectors (at one or more stations): Sven O Kullander, Anita Hogeborn-Kullander, Andrés Urteaga C., Teresa Townshend, Han Nijssen, Noé Buendia Y., Patrick de Rham, César Villanueva, Eusebio Carpio C., Hanns-Joachim Franke, Luis Mori P., Rodolfo Mori, Nestor Sarmiento R., José Cruz R., Bertha Guerola O., Pedro Cambero. Methods of collecting include nets, mostly with 2-5 mm mesh width, 3-14 m long, occasionally angling or rod-fishing with artificial bait. Fishes were killed and fixed in 10% formalin immediately upon capture and remained in formalin for up to one month before transferred to 80% ethanol.

SOK 19. Loreto, R. Nanay drainage, Km 13 on road Iquitos-Quistococha, IMARPE, stagnant pool remaining of quebrada effluent of fish ponds. 5 Aug 1981, 0830-0900 h. Stagnant backwater pool at margin of secondary forest, *c.*25X40 m; collecting depth *c.*10-20 cm; bottom soft mud and leaf litter; water brownish, turbid; 29°C, pH 6.3-6.9.

SOK 20. Loreto, R. Nanay drainage, Km 13 on road Iquitos-Quistococha, IMARPE, small quebrada effluent of fish ponds. 5 Aug 1981, 0930-1130 h. Spillwater ditch draining fish ponds; slight velocity, generally 15-25 cm wide; depth to *c.*25 cm; bottom clayey; margined by grass slope and secondary forest; water brownish, turbid; 29°C, pH 6.3-6.9.

SOK 21. Loreto, R. Nanay drainage, Km 13 on road Iquitos-Quistococha, IMARPE, water-filled depression between two fish ponds. 5 Aug 1981, 1200-1210 h. Depression, 80 cm in diameter, to 13 cm deep.

SOK 23a. Loreto, R. Itaya drainage, Quisto Cocha along shore at Parque Zoológico. 6 Aug 1981, 0930-1230 h. Steep and sloping lake margin along open shore; bottom sandy with some tree roots and leaf litter; collecting depth to *c.*30 cm; water colourless, turbid.

SOK 23c. Loreto, R. Itaya drainage, Quisto Cocha, shore between Parque Zoológico and Alcántara Caño. 27 Aug 1981.

SOK 24. Loreto, R. Nanay drainage, Zúngaro Cocha. 7 Aug 1981, 1000-1130 h. Small playa of white sand, *c.*30 m long; bottom sand and débris; collecting depth to 1 m; water brown, clear. 30°C, pH *c.* 5.

SOK 25b. Loreto, R. Ampiyacu drainage, just below the village Esperanza, mouth and lower course of small quebrada tributary to the R. Yaguasyacu. 12 Aug 1981, *c.*0930-1100 h. Slow flowing primary forest stream and small white sand playa in river; water colourless, turbid in river, clear in quebrada; 24°C, pH 6.9 in quebrada; 27°C, pH 6.3-6.9 in river.

SOK 26. Loreto, R. Ampiyacu drainage, Quebrada Sacarita, tributary to the R. Ampiyacu a few km upstream of Pebas. 12 Aug 1981, *c.*1500 h. Slow-flowing, small quebrada in primary forest but close to clearing, at most 2 m wide, depth to 0.5 m; bottom of clay, many tree trunks, little leaf litter; water clear.

SOK 26bis. Loreto, R. Ampiyacu left margin a few km upstream of Pebas. 12 Aug 1981, *c.*1430 h.

SOK 27a. Loreto, R. Ampiyacu drainage, little upstream of Pebas, Sacarita del Tuyé, right bank tributary of the R. Ampiyacu, floating meadow near mouth. 12 Aug 1981, *c.*1530-1630 h. Slow-flowing caño about 10 m wide at mouth, appearing shallow; banks of grass extending into water where forming a thick mass, some *Pistia* on the surface; about 15 m of floating meadow seined, to 0.5 m depth; bottom of clay and mud; 29°C, pH about 7.

SOK 27b. Loreto, R. Ampiyacu drainage, little upstream of Pebas, Sacarita del Tuyé, right bank tributary of the R. Ampiyacu, floating meadow near mouth. 12 Aug 1981, *c.*1700 h. As SOK 27a.

SOK 28b. Ucayali, R. Ucayali drainage, Yarina Cocha N Shore, just S 'La Cabaña'. 16 Aug 1981, 0800-1100 h. Lake margin within and just outside dense carpet of *Eichhornia* mixed with *Pistia*; bottom muddy; water yellowish, turbid; to 0.5-1 m depth at collecting site.

SOK 29a. Ucayali, R. Ucayali drainage, caño between Yarina Cocha and Paca Cocha. 16 Aug 1981, 1400-1600 h. Stagnant canal with steep shores, lined with secondary forest; *c.*1 m deep and 5 m wide, almost completely covered by *Eichhornia* mixed with *Pistia*; clay bottom, little mud; water turbid and slightly brownish.

SOK 29b. Ucayali, R. Ucayali drainage, caño between Yarina Cocha and Paca Cocha. 21 Aug 1981, 1200-1300 h. As SOK 29a.

SOK 30. Ucayali, R. Ucayali drainage, Km 6 on road Campo Verde-Tournavista, pool or quebrada in aguajal. 18 Aug 1981, 1000-1200 h. Swampy, stagnant stream, *c.*20 m wide, but with many palm islands; bottom of soft mud, some clay and sand near road; depth to 1 m; lined with mosses; some water lilies; water tea-coloured, turbid; 26°C, pH 5.7.

SOK 31. Huánuco, R. Pachitea drainage, *c.*1 km upstream from Tournavista, drying pool *c.*100 m from left bank of R. Pachitea. 19 Aug 1981, 1200-1300 h. Pool, about 300 m long and 20 m wide, knee-deep, in cattle pasture; water lilies; bottom clay; water colourless, turbid; 29°C, pH 6.9.

SOK 32. Huánuco, R. Pachitea drainage, near mouth of quebrada tributary to the R. Pachitea on the right bank, 2-3 km downstream of Tournavista. 19 Aug

1981, 1300-1400 h. Moderately flowing stream, *c.*2 m wide, to 1 m deep, margined by cattle pasture and secondary forest; bottom of alternating clay, sand, pebbles; some heaps of leaf litter; water colourless and clear; 26°C.

SOK 33. Ucayali, R. Ucayali drainage, Km 15 on road Campo Verde - Tournavista, quebrada. 19 Aug 1981, *c.* 1600 h. Moderately flowing stream, to *c.* 10 m wide, 1.5 m deep, through secondary forest and pasture; bottom clay; water colourless, turbid.

SOK 34. Ucayali, R. Ucayali drainage, caño and associated flooded forest between Yarina Cocha and Cashibo Cocha, *c.*8 km NW Puerto Callao. 20 Aug 1981, *c.*1500-1800 h. Slow-flowing caño about 10 m wide, apparently very deep; margined by secondary forest; bottom and shores thick layers of soft blackened mud with much leaf litter; water tea-coloured, clear.

SOK 35a. Loreto, R. Itaya drainage, Quisto Cocha, Alcántara Caño near mouth. 23 Aug 1981, 1000-1100 h. Stagnant stream, *c.*2 m wide, part of aguajal. Bottom of soft mud; depth to *c.*20 cm at collecting site; water slightly brownish, slightly turbid. Locality visited on several occasions for collecting rivulids; data from 24 Aug 1983, p.m., water clear, slightly brownish, 25°C, pH 6.0, <0.2°dGH, O_2 0.8 ppm.

SOK 35c. Loreto, R. Itaya drainage, Quisto Cocha, Alcántara Caño near mouth. 27 Aug 1981. Same site as SOK 35a.

SOK 36. Loreto, R. Nanay drainage, Vincente Cocha, just upstream of Bella Vista. 26 Aug 1981, 1100-1400 h. Tahuampa lake a few hundred m long; shores clayey, lake bottom of thick leaf litter; collecting depth to 1 m; water black, slightly turbid; 32°C, pH 5.1, 107 µS.

SOK 37. Loreto, R. Nanay drainage, temporarily isolated marginal cocha a few km upstream of Santa Clara. 28 Aug 1981, *c.*1100-1200 h. Tahuampa lake, about 100 m in dimeter, surrounded by inundation forest; depth less than 1 m; water turbid; bottom clay and mud.

SOK 38. Loreto, R. Nanay left bank sandy beach *c.*15 min by boat upstream of Santa Clara. 28 Aug 1981, *c.*1230-1300 h. White sand playa, about 100 m long, slope slight; bottom with thin layer of détritus; collecting depth to 0.5 m; current moderate; water slightly brownish, turbid.

SOK 39. Loreto, R. Ucayali drainage, mouth of Caño Supay into R. Ucayali, *c.*4 km upstream of Jenaro Herrera. 30 Aug 1981. Clayey river bank, in slow flowing caño mouth about 25-20 m wide; fishing depth to 1.5 m; white-water; 30°C, pH 6.9, 100 µS.

SOK 40. Loreto, R. Ucayali drainage, Quebrada Abrahancillo, left bank tributary of the R. Aucayacu, about 4 km S Supay Cocha. 30 Aug 1981, *c.* 1500-1700 h. Drying forest quebrada; water clear and colourless; bottom with leaf litter; at most *c.*1 m wide; collecting depth to *c.*0.5 m; 28°C, pH 6.5, 22 µS.

SOK 41. Loreto, R. Ucayali drainage, R. Aucayacu opposite mouth of Quebrada Abrahancillo. 30 Aug 1981, *c.*1700 h. Small river, about 20 m wide, to 1.5 m deep; bottom of clay and debris; white-water; current moderate.

SOK 42. Loreto, R. Ucayali drainage, small quebrada at km 3 on road Jenaro Herrera-Colonia Angamos. 31 Aug 1981. Small forest stream, generally about 1 m wide; tea-coloured clear water; bottom muddy.

SOK 43. Loreto, R. Ucayali drainage, unnamed quebrada tributary to the Quebrada Copal, *c.*200 m N road, *c.*14 km from Jenaro Herrera on road to Colonia Angamos. 1 Sep 1981. Streamlet marginal stream of forest quebrada, in secondary forest; at most 2 m wide, collecting depth to *c.*30 cm; well-shadowed; bottom mud; water clear, tea-coloured; 25°C, pH 5.6, 14 µS, O_2 6.45 ppm, CO_2 0.9 ppm, Ca^+ 0.5 ppm, Cl^-1.6 ppm. Figured in de Rham & Kullander (1983, Fig. 8) and Koslowski (1985*a*, p. 27, lower).

SOK 44. Loreto, R. Ucayali drainage, Quebrada Copal at Km 15 on road Jenaro Herrera - Colonia Angamos. 1 Sep 1981, *c.*1300-1700 h. Large quebrada, to *c.*8 m wide, through secondary forest and clearing; depth to 2 m; velocity moderate; bottom of clay and mud; water tea-coloured, clear; 22.5°C, pH 6.9, 18 µS, hardness 10 ppm. Figured reversed in Koslowski (1985*a*, p. 185).

SOK 45. Loreto, R. Ucayali drainage, Quebrada Sapuena at Km 10 on road Jenaro Herrera-Colonia Angamos. 2 Sep 1981, *c.*1200-1400 h. Slow-flowing forest quebrada, *c.*4 m wide, to *c.*1 m deep; slow-flowing; bottom of sand, some clay and mud, water tea-coloured, clear; 24°C, pH 5.5, 13 µS.

SOK 46a. Loreto, R. Ucayali drainage, Trueno Cocha, just S Supay Cocha. 3 Sep 1981, a.m. Floodplain lake, to 1 m deep; bottom of soft clay; water turbid; 31.5°C, pH 7.0, 19 uS.

SOK 47. Loreto, R. Ucayali drainage, near mouth of unnamed quebradita, small affluent of Supay Cocha. 3 Sep 1981, *c.*1600 h.

SOK 48. Loreto, R. Ucayali drainage, near mouth of Quebrada Espejo, small affluent of Supay Cocha. 3 Sep 1981, *c.*1700 h. Small clear-water stream.

SOK 49. Loreto, R. Ucayali drainage, Km 3 on road Jenaro Herrera-Colonia Angamos, quebrada behind the Centro Forestal de PARI. 3 Sep 1981. See 42.

SOK 50. Loreto, R. Itaya drainage, Quisto Cocha, pool close to lake on shore opposite the Parque Zoológico. 6 Sep 1981, a.m. Pool in aguajal along lake; shores lined with sphagnum; bottom muddy; water tea-coloured, clear.

SOK 51. Loreto, R. Nanay drainage, unnamed quebrada *c.*200 m to the left of the road from Iquitos, just before Santa Clara. 7 Sep 1981. Small forest quebrada, to 2-3 m wide; bottom sand, mud and leaf litter; water tea-coloured, clear. Figured in Koslowski (1985*a*, p. 31).

SOK 52. Loreto, R. Nanay drainage, Tinaja, left bank playa. 29 Jul 1983, 0945-1015 h. River bank, sand and clay playa; no current; depth to 0.5 m; 34°C at surface, 31-32°C at 86 cm, pH 6.0, 0.8°dGH, O_2 3.6 ppm.

SOK 53. Loreto, R. Nanay drainage, Caño Puñuisiqui. 29 Jul 1983, *c.* 1400 h. Slow-flowing, drying-up caño over sand, clay, leaf litter, trees; 2 m wide, 0.3-1 m deep, collecting depth to 0.2 m.

SOK 55. Loreto, R. Nanay, right bank playa near Shiriyana. 30 Jul 1983, 1015-1200 h. River bank sand playa; swimming velocity; water brownish, turbid; 28°C, pH 6.0, 0.8°dGH, O_2 4.9 ppm.

SOK 55bis. Loreto, R. Nanay, pool on right bank playa near Shiriyana. 30 Jul 1983, *c.*1100 h. Isolated pool on sand playa, 3X1 m, 0.4 m deep; stagnant; 32°C, pH 6.0.

SOK 58. Madre de Dios, R. Madre de Dios drainage, Lago Túpac Amaru. 11 Aug 1983, 1100-1230 h. Flood-plain lake at low water; fished along muddy, shallow shore, *c.*30 m long, depth to 0.5 m; lake otherwise with steep shores; water turbid; pH 7.5, 2.4°dGH, O_2 4.6 ppm.

SOK 60. Madre de Dios, R. Madre de Dios drainage, quebrada 8 km from airport road on road to Lago Túpac Amaru. 11 Aug 1983, 1430-1500 h. Forest quebrada, to *c.*3 m wide, collecting depth to 0.5 m; bottom of sand and thick mud alternating; current moderate; water brownish, clear.

SOK 61. Madre de Dios, R. Tambopata drainage, Quebrada San Roque at Km 11 on Puerto Maldonado - Cuzco road. 12 Aug 1983, 1000-1230 h. Quebrada where widened to a pool and adjacent aguajal; current moderate; bottom of sand and mud, near bridge shore gravel; water weakly tea-coloured, clear; pH 6.0, 0.15 °dGH, O_2 4.2 ppm.

SOK 64. Madre de Dios, R. Tambopata drainage, quebrada and roadside pools at km 14 on road Puerto Maldonado-Cuzco. 15 Aug 1983, 1000-1230 h. Quebrada 1-2 m wide, lined by grasses bottom of mud; collecting depth to 1 m; water of weak tea-colour, clear; pH 6.0, 0.1≤0.2°dGH, O_2 1.7 ppm. Pools 5X20 m and 10X50 m; shallow; clayey; water turbid. All in cattle pasture.

SOK 65. Loreto, R. Itaya drainage, Quebrada Guayabamba at Km 2 on Iquitos-Quistococha road. 17 Aug 1983, 1430-1530 h. Small stream, 0.8-1 m wide; depth to 0.5 m; bottom of sand and mud.

SOK 66. Loreto, R. Nanay drainage, Quebrada Shushuna on road Quistococha-Puerto Almendra, 16 km from Iquitos. 18 Aug 1983, 1300-1430 h. Stream, 4-6 m wide, 0-1 m deep; with brown clear water; sand bottom; moderate current; 25.5 °C, pH 5.5, 0.2°dGH, O_2 5.0 ppm.

SOK 67. Loreto, R. Nanay drainage, Quebrada Corrientillo, 20 km from Iquitos on road to Puerto Almendra. 18 Aug 1983, 1445-1700 h. Quebrada, 5 m

wide plus pool-like expansion 20-25 m wide; water clear, brown; pool with some aquatic vegetation; bottom of sand near bridge, otherwise soft mud; depth to 1 m; current moderate, stagnant in pool; 26°C, pH 5.0, 0.3°dGH, O_2 4.5 ppm.

SOK 68. Loreto, R. Nanay drainage, Quebrada Pampachica at ENTEL station, 6 km from Iquitos. 19 Aug 1983, 1000-1130 h. Pool, lined with grasses and floating plants; sand bottom; 20X40 m, to 1 m deep; stagnant; 24°C, pH 6.0, 0.6°dGH, O_2 6.4 ppm; rainy.

SOK 69a. Loreto, R. Nanay right bank at Puerto Almendra. 20 Aug 1983, 0900-0930 h. Clayey river playa.

SOK 70. Loreto, R. Nanay, both banks, near caño to Cocha Yarana, at second left bend above Mishana. 20-21 Aug 1983, 1700-2200/1200-1700 h. Sand playa and opposite steep clay bank, with fast current; fishing to 2-3 m depth; river rising; 27°C, pH 6.0, <0.2°dGH, O_2 6.9 ppm.

SOK 71. Loreto, R. Nanay drainage, small tahuampa cocha on left bank, second left bend above Mishana. 21 Aug 1983, 0800-1200 h. Isolated lake, 100X200 m, to 1 m deep; mud bottom; no transparency; stagnant; 32°C, pH 5.0, <0.2°dGH, O_2 6.4 ppm. Figured in Koslowski (1985*a*, p. 34).

SOK 72. Loreto, R. Itaya drainage, Quistococha, pond of UNAP fishfarm. 24 Aug 1983, p.m. Fish breeding pond; muddy bottom; fed by spring; pH 6.0.

SOK 73a. Loreto, R. Itaya drainage, Quisto Cocha, lake shore. 24 Aug 1983, p.m. Open shoreline, steep; pH 7.0, <2°dGH.

SOK 74. Loreto, R. Ucayali drainage, Quebrada Carahuayte at km 20 on road Jenaro Herrera-Colonia Angamos. 27-28 Aug 1983. Swift-flowing forest brook; *c.*10 m wide, depth to 2 m; bottom of clay and mud, many trunks; secondary forest and cleared; water turbid, no colour noted; 24.5°C; pH 6.0, <0.2°dGH, O_2 5.7 ppm.

SOK 75. Loreto, R. Ucayali drainage, isolated pool at left bank of Quebrada Carahuayte at km 20 on road Jenaro Herrera - Colonia Angamos. 28 Aug 1983, 0930-1030 h. Isolated marginal pool, 20X15 m, to 70 cm deep; on terrace in flooding ground; secondary forest; bottom of deep soft mud and leaf litter, tadpoles abundant; water clear, tinted; stagnant; 25°C, pH 6.5, 1.8 °dGH, O_2 1.6 ppm.

SOK 76. Loreto, R. Ucayali drainage, Quebrada Carahuayte, first bend downstream of Km 20 on road Jenaro Herrera - Colonia Angamos. 28 Aug 1983, 1100-1230 h. Same as SOK 75, but along steep shore of white sand, depth to 2.5 m.

SOK 77. Loreto, R. Ucayali drainage, quebrada tributary to Quebrada Carahuayte at Km 18 on road Jenaro Herrera - Colonia Angamos. 29 Aug 1983, 0900-1130 h. Small stream, 1-3 m wide; through clearing with many small, leaved trees in water and shadowing primary forest; depth to 0.5 m; bottom of sand and leaf litter; water clear, brownish; current moderate; 24.5°C, pH 5.0, 0°dGH, O_2 3.2 ppm.

SOK 78. Loreto, R. Ucayali drainage, Quebrada Copal at Km 15 on road Jenaro Herrera - Colonia Angamos. 29-30 Aug 1983, 1500-1700/0800-1100 h. Large stream, to 10 m wide, to 1.5 m deep; current moderately fast; bottom of sand, some mud, many trunks; in cleared area; water slightly turbid, slightly tinted; 24°C, pH 6.0, <0.2°dGH, O_2 4.5 ppm (30 Aug). (Pl. II, fig. 2.)

SOK 79. Loreto, R. Ucayali drainage, Quebrada Sapuena at Km 10 on road Jenaro Herrera - Colonia Angamos. 31 Aug 1983, 0900-1230 h. Stream, *c.*7 m wide, to 1.5 m deep; flow moderate; bottom of sand, sand/clay and mud; marginal grass extending out into water; water clear, brown; 25.5°C, pH 5.0, 0° dGH, O_2 3.2 ppm.

SOK 80. Loreto, R. Ucayali drainage, Quebrada Salomé, tributary to Quebrada Sapuena at Km 9 on road Jenaro Herrera - Colonia Angamos. 31 Aug 1983, 1300-1430 h. Small quebrada coming out of secondary forest; to 1 m wide, to 1 m deep; muddy bottom; grass extending out into water; moderate flow; water clear, brown.

SOK 81. Loreto, R. Ucayali drainage, Trueno Cocha. 1 Sep 1983, 0930-1200 h. As 46a. 32-38°C, pH 6.0, 0.4°dGH, O_2 3.2 ppm.

SOK 82. Loreto, R. Ucayali drainage, quebrada in arboretum at Km 3 on

road Jenaro Herrera - Colonia Angamos. 2 Sep 1983, 0800-1130 h. Small stream in modified forest; 1-3 m wide, to 1 m deep; bottom of mud and leaf litter; brownish, clear water; moderate flow; 25°C, pH 5.0, 0°dGH, O_2 3.2 ppm.

SOK 83. Loreto, R. Nanay drainage, Bella Vista, Vieja Cocha. 4 Sep 1983, 1400-1500 h. Tahuampa lake; shallow; mud bottom, much of trunks and branches; turbid, stagnant; 30°C, pH 5-5.5, 0°dGH, O_2 3.8 ppm.

SOK 84a. Loreto, R. Itaya drainage, Quisto Cocha, W lake margin. 22 Jul 1984, 1100-1400 h. Angled at lake margin.

SOK 85. Loreto, R. Yavarí drainage, Colonia Angamos, quebrada separating civil and military parts of village, behind school building. 27-28, 30 Jul, 2 Aug 1984. Turbid, colourless water; current moderate; stream 2-3 m wide, to 1 m deep; bottom mud-clay-sand mixture plus logs; shadowed but cleared area at collecting site; 24.5°C, pH 6.5, 1.2°dGH, O_2 5.0 ppm, Fe 0.5 ppm.

SOK 86. Loreto, R. Yavarí drainage, small cocha on left bank of R. Yaquerana, *c.*2 h upstream of Colonia Angamos, 30 min upstream of Cocha Palometal (30 hp deslizador). 29 Jul 1984, 1040-1330 h. Turbid, colourless water; drying flood-plain lake about 200 m long, about 20 m wide, depth to 0.5 m; bottom very soft, of mud-clay mixture; 27.5°C, pH 6.0, <0.2 °dGH, O_2 6.3 ppm; rainy. (Pl. I, fig. 1.)

SOK 87. Loreto, R. Yavarí drainage, Quebrada de la Piscigranja, at Km 2 on carretera Colonia Angamos - Jenaro Herrera, upstream and downstream of fish pond. 30 Jul 1984, p. m. Forest stream through plantations and secondary forest; depth to *c.*30 cm; bottom of leaf litter and mud, nearly stagnant; water colourless, clear upstream, turbid downstream of fish pond; 26°C, pH 5.5, 1.2°dGH, O_2 3.0 ppm, Fe 0.5 ppm.

SOK 89. Loreto, R. Yavarí drainage, quebrada left bank tributary to R. Galvez, *c.*25 min upstream of Colonia Angamos (30 hp deslizador). 31 Jul 1984, 1030-1200 h. About 100 m of small quebrada, completely dry on 2 Aug; 1-2 m wide; bed of leaf litter, clay, sand; depth to 0.5 m; water clear; current comparatively fast; shadowed by primary forest; 23°C, pH 5.5, 0°dGH, O_2 5.1 ppm, Fe 0.3 ppm.

SOK 90. Loreto, R. Yavarí drainage, quebrada left bank tributary to R. Gálvez, *c.*20 min upstream of Colonia Angamos (30 hp deslizador). 31 Jul 1984, *c.*1230 h. Incidental stop at small stream in shadowing primary forest; bottom clayey.

SOK 92. Loreto, R. Yavarí drainage, Colonia Angamos, quebrada in civil village intended for fish pond, close to source. 1 Aug 1984, *c.*1600 h. Dammed quebrada, choked with plants, frequented by cattle; turbid water; depth to 0.5 m; 28.5°C, pH 5.5, <1°dGH, O_2 5.0 ppm, Fe 1.0 ppm.

SOK 94. Loreto, R. Yavarí drainage, R. Gálvez right bank sand playa near mouth. 2 Aug 1984, 1145-1230 h. Strongly sloping sand playa; water turbid; current fast; collecting depth to *c.*3 m; 26 °C, pH 6.0, <0.6 °dGH, O_2 5.3 ppm, Fe 0.5 ppm (24.5°C, pH 6.5, <0.6°dGH, O_2 4.9 ppm, Fe 0.5 ppm at nearby SOK 88, 31 Jul).

SOK 95. Brasil, est. Amazonas, R. Javari, sand playa opposite civil village of Colonia Angamos. 5 Aug 1984, 1100-1200 h. Seined about 150 m; current fast; water turbid; collecting depth to 2 m; bottom of sand, little débris; 27°C, pH about 7, 1.8°dGH, O_2 5.6 ppm, Fe 1.0 ppm (26°C, pH 6.5, 1.2°dGH, O_2 6.0 ppm, Fe 0.5 ppm at nearby SOK 91, 31 Jul).

SOK 96. Loreto, R. Nanay, left bank sand playa opposite Llanchama Cocha. 9 Aug 1984, 1600-1700, 2200-2400 h. White sand playa, *c.* 50 m long; water turbid; current fast.

SOK 97. Loreto, R. Nanay drainage, Llanchama Cocha. 10 Aug 1984, 0800-1130 h. Tahuampa lake, surrounded by primary forest, bottom of mud; water slightly turbid, dark; collecting depth to 2 m.

SOK 98. Loreto, R. Nanay drainage, Puñuisiqui Cocha. 10-11 Aug 1984, 1600-1730 h, 0800-1200 h. Tahuampa lake, surrounded by primary forest; bottom of mud and leaf litter, abundant twigs and trunks of trees; water turbid, no definite colour; 27.5°C (0630 h), pH 5.5, $\leq$ 0.6°dGH, O_2 2.4 ppm, Fe 0.3 ppm.

SOK 99. Loreto, R. Nanay, left bank sand playa opposite mouth of Queb-

rada Agua Negra. 11 Aug 1984, 1300-1430 h. White sand playa, fished for about 100 m, to 2 m depth; bottom of sand with some mud and leaves, water turbid; current fast; 27.5°C, pH 5.5, 0°dGH, O_2 5.8 ppm, Fe 0.5 ppm. Figured in Koslowski (1985*a*, p. 35).

SOK 100. Loreto, R. Napo drainage, R. Mazán right bank cocha 2 h upstream of Puerto Alegre. 14 Aug 1984, 0900-1100 h. Tahuampa cocha with slightly turbid, dark water, in primary forest area; along slight-sloping shores with muddy bottom, to 2 m; 27°C, pH 5.5, 0.6°dGH, O_2 6.5 ppm, Fe 0.3 ppm.

SOK 102. Loreto, R. Napo drainage, lower course of quebrada right bank tributary to R. Mazán nearly 2 h upstream of Puerto Alegre. 14 Aug 1984, 1230-1400 h. Clay-lined mouth region of small quebrada with turbid, colourless water; current moderate; depth to 0.5 m; bed of clay and forest litter; in primary forest.

SOK 103. Loreto, R. Napo drainage, R. Mazán, boat-landing of Puerto Alegre. 14 Aug 1984, 1730-1800 h. Clayey, slow-sloping shoreline, *c.*25 m; along clearing. Data from more upstream, same day, 1130-1200 h (SOK 101), water turbid, current fast, 27°C, pH 6.0, 0.6°dGH, O_2 6.4 ppm, Fe 0.5 ppm.

SOK 104. Loreto, R. Napo, Cayapoza, small laguna on left bank island. 15 Aug 1984, 1000-1130 h. Black sand island covered with grasses (gramalote) extending into laguna, where also other floating plants; water turbid, colourless; collecting depth to *c.* 2 m over sand and mud bottom in vegetation; 31.5 °C, pH 7.0, 3.0°dGH, O_2 3.6 ppm, Fe 0.5 ppm (nearby river had 29°C, pH 7.0, 1.2°dGH, O_2 6.2 ppm, Fe 0.5 ppm, whitewater). (Pl. I, fig. 2.)

SOK 106. Loreto, R. Napo drainage, Aucapoza Cocha. 15 Aug 1984, 1500-1530 h. Long lateral lake on left bank, with dark water away from river; in shadowing forest; more turbid in open area near river; seined floating vegetation to 2 m depth; bottom muddy.

SOK 107. Loreto, R. Napo drainage, Yuto Cocha on right bank of R. Mazán. 16 Aug 1984, a.m. Tahuampa cocha, with darker clear water away from river, turbid close to river; gently sloping 25 m shoreline fished to 2 m depth; bottom of mud and some leaves.

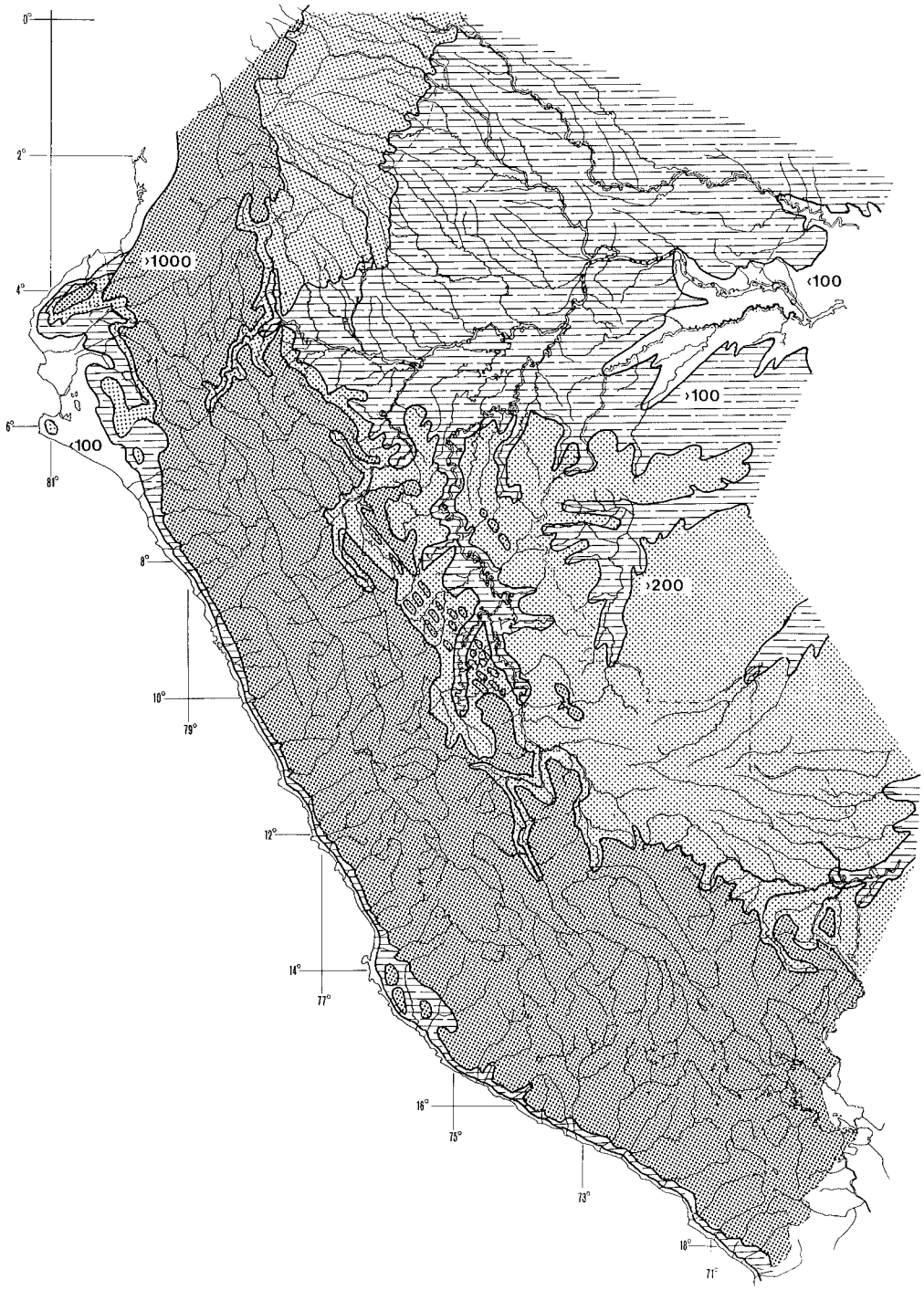
SOK 108. Loreto, R. Napo drainage, Quebrada de Yuto Cocha on right bank of R. Mazán. 16 Aug 1984, *c.*1000-1200 h. Shadowed stream in primary forest, without discernible current, about 10 m at the widest, depth to at least 2 m; water clear, dark; abundant leaf litter; 27.5°C, pH 6.0, 0.6°dGH, O_2 1.6 ppm, Fe 0.3 ppm.

SOK 109. Loreto, R. Napo drainage, quebrada left bank tributary to R. Mazán *c.*20 min upstream of Puerto Alegre. 16 Aug 1984, p.m. Wide stream mouth in primary forest; water turbid; to 2 m depth; little current; bottom of mud and clay.

SOK 112. Loreto, R. Itaya drainage, Quisto Cocha W margin. 21 Aug 1984, a.m. Same site as SOK 23a and SOK 23c.

SOK 113. Loreto, R. Nanay drainage, Quebrada Corrientillo at bridge on road Iquitos - Puerto Almendra. 23 Aug 1984, 1000-1100 h. Same site as SOK 67.

Figure 2. Gross altitudinal zonation of Peru, in <100 masl, 100-200 masl, 200-1000 masl (most selva), and >1000 masl (cordilleras and cerros) intervals. →


0°
2°
4°
6°
81°
8°
10°
79°
12°
14°
77°
16°
75°
73°
18°
71°
›1000
‹100
‹100
›100
›200

BIOGEOGRAPHY

For practical reasons the general discussion of distribution data precedes data presentation for each species (next section). Refer to plot maps for collecting records of particular species. Collecting bias can be checked against fig. 1.

The collecting record of western Amazonian cichlids is strongly biased in favour of the upper and lower Ucayali, and upper and lower Amazonas, with other regions subjected to spot-intensive or incidental collecting. Major lacunae in the collecting record include virtually all of the area north of Bajo Marañón-Amazonas up to the Meta, nearly all of the State of Amazonas in Brazil and Peru east of the Ucayali, and nearly all tributaries of the Ucayali (those collected showing apparent high endemicity) (cf. fig. 1). Nevertheless, for a South American region, Peru is as a whole well-collected. Few other regions of comparable size are better known, perhaps only the Guianas.

Two major western subdrainages of the Amazon basin are involved in the discussion, viz. the assembly collected into the R. Amazonas in Peru, and the Madeira tributaries collected to the Guajará-Mirim region. For the purpose of the present paper, these subdrainages are referred to as the Ucayali-Amazonas drainage and the Bolivian Amazon(ía), respectively. The only Peruvian drainage pertaining to the latter is the Madre de Dios.

Whereas a biogeographical analysis is best effected by the vicariance method (Nelson & Platnick 1981), data for Peruvian cichlids are not yet amenable to such a procedure. Phylogenetic information is insufficient and ranges poorly defined. An attempt will be made to distinguish areas of endemism, however, and these areas will be subjected to discussion that may be at best premature. Generalized Peruvian cichlid distribution falls into a restricted number of informative range categories as outlined below.

(1) Uncertain ranges

Poor taxonomic resolution of the species *Mesonauta insignis*, *Heros appendiculatus*, *Pterophyllum scalare*, *Crenicichla lucius*, and *Astronotus ocellatus* prevents characterization of their geographical ranges. Within Peru, these species are distributed mainly similar to widely distributed lowland species. Except in the case of *H. appendiculatus*, it is clear that none of these species occurs in Bolivia, but the eastern/northern limits of distribution are obscure.

(2) Wide range, including lowland Amazonía and Bolivian Amazonía

Aequidens tetramerus, *Cichla monoculus*, *Acaronia nassa*, *Crenicichla johanna*, *Biotodoma cupido*, *Satanoperca jurupari*, *Crenicara punctulatum*, and *Chaetobranchus flavescens* are widespread lowland species, mainly collected below 200 masl, only *A. tetramerus* ascending highland Madre de Dios, Napo and Ucayali streams.

Ecologically, these are either black/clear-water species or ubiquitous throughout. Extralimital distribution is poorly mapped for most of the species. Peruvian distributions are rather poorly known except for *Aequidens tetramerus*, *Satanoperca jurupari* and *Crenicara punctulatum*, the three species recorded from both the Ucayali-Amazonas and the Madre de Dios drainage. *Aequidens tetramerus*, *Acaronia nassa*, *Cichla monoculus*, *Crenicichla johanna*, *Crenicara punctulatum* and *Chaetobranchus flavescens* occur eastward to Guianan rivers, either the Essequibo or the Oyapock or they have a wider Guianan distribution. Probably only *A. tetramerus* and *C. flavescens* range into the Orinoco drainage.

The biogeographic significance of this group is obscure. The wide ranges indicate extensive dispersal.

(3) Wide range, excluding Bolivian Amazonía

Crenicichla reticulata, *C. cincta*, *Geophagus proximus*, *Acarichthys heckelii*, *Apistogramma agassizii*, *Symphysodon aequifasciatus*, *Cichlasoma amazonarum*,

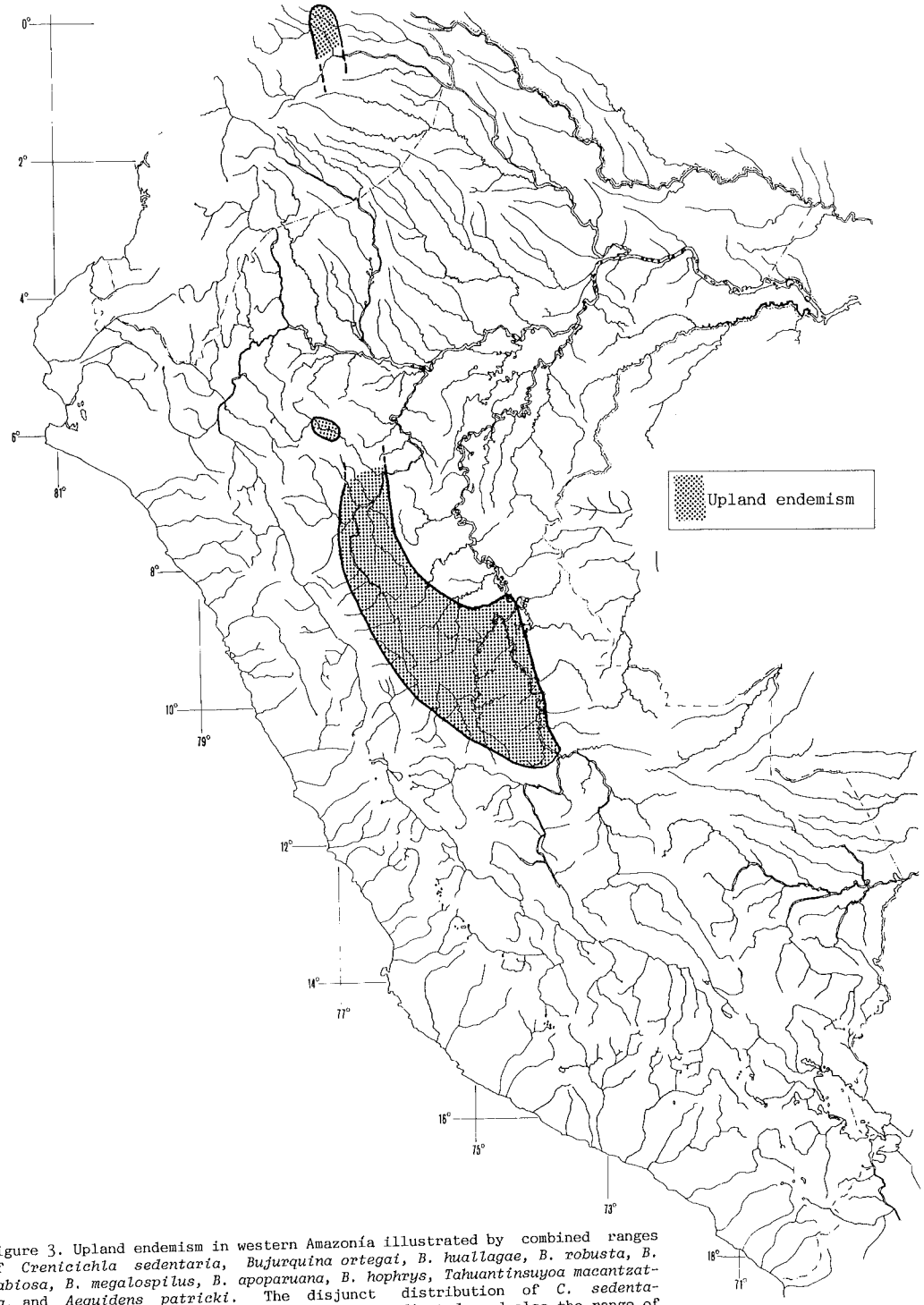


Figure 3. Upland endemism in western Amazonía illustrated by combined ranges of *Crenicichla sedentaria*, *Bujurquina ortegai*, *B. huallagae*, *B. robusta*, *B. labiosa*, *B. megalospilus*, *B. apoparuana*, *B. hophrys*, *Tahuantinsuyoa macantzatza*, and *Aequidens patricki*. The disjunct distribution of *C. sedentaria* in the upper Napo and southern Peru is indicated, and also the range of *B. ortegai* distinguished.

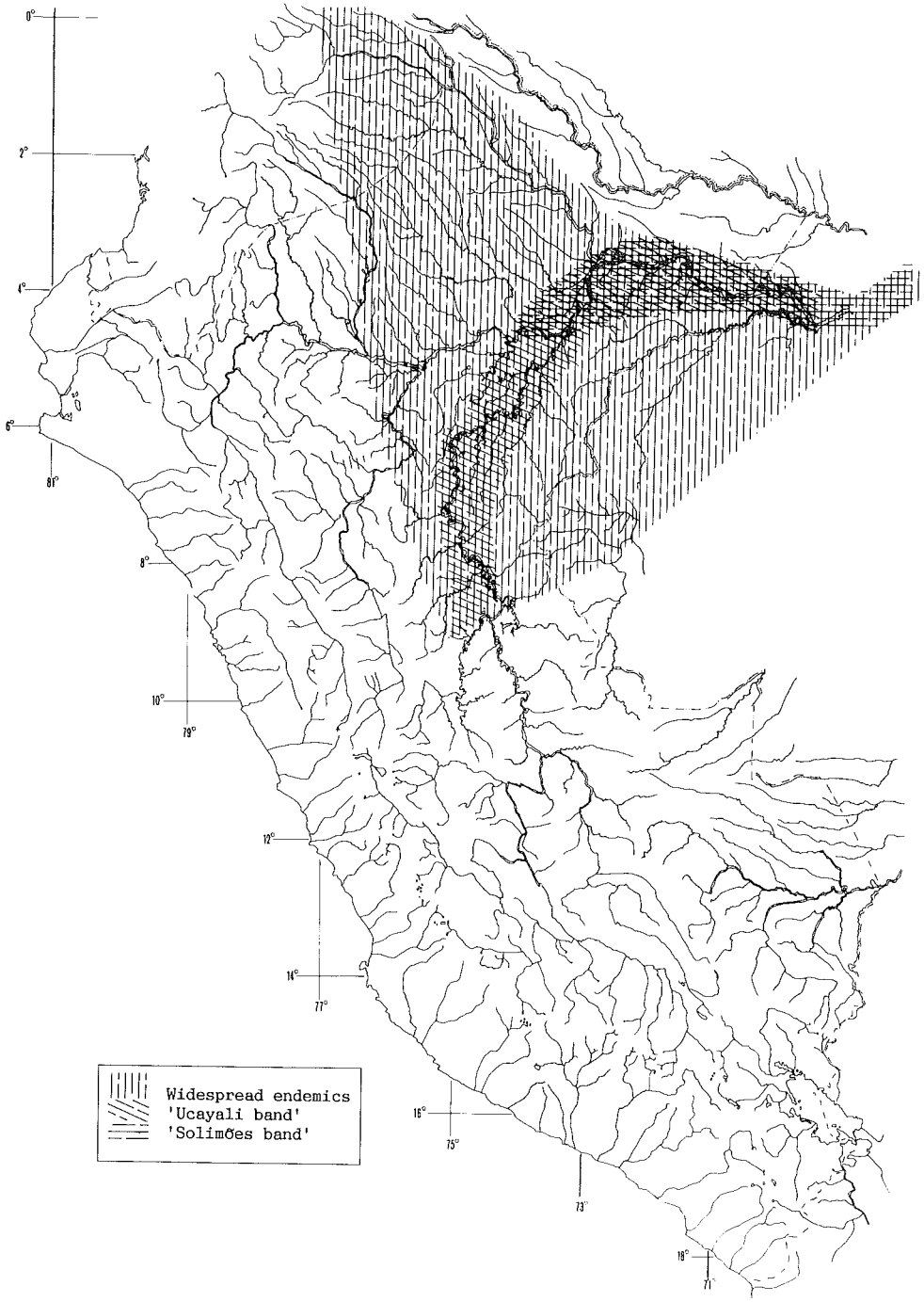


Figure 4. Lowland endemism in Peru. Three patterns illustrated by the ranges of *Apistogramma cacatuoides* ('Ucayali band'), *A. bitaeniata* ('Solimões band') and *Laetacara flavilabris* (widespread). The latter two extend eastward to Tefé, outside the map.

Laetacara thayeri and *Hypselecara temporalis* reach their western limit of mainly latitudinally extended east-west ranges in Peru-Ecuador. Only *Cichlasoma amazonarum* has an extensive distribution within Peru.

All of these are strictly lowland species, none ascending above 200 masl. Most, excepting *Hypselecara temporalis*, *Cichlasoma amazonarum* and *Apistogramma agassizii*, are probably or actually black/clear-water cichlids, and have few known localities in western Amazonía. *Crenicichla reticulata* and *C. cincta* are very rare in collections.

Crenicichla reticulata and *Acarichthys heckelii* occur in the R. Negro and R. Essequibo; the rest are notably absent from the Negro although they occur along the Amazon eastward well into Pará.

This group has little impact on the understanding of western Amazonian biogeography. Two species, *Geophagus proximus* and *C. amazonarum* have vicarying congenerics in Bolivian Amazonia (*G. megasema* and *C. boliviense*, respectively). Except for the very common *C. amazonarum* and *A. agassizii* these are rare species, either in Peru only or throughout their ranges. Whereas extinction of part range in Bolivia and much of Peru might be supported by relative rareness, this group may also be considered an alien element in the Peruvian fauna. None of the species occurs in the Orinoco. The group may qualify as a truly Amazonian faunal element in a strict sense. The biogeographic application of this element is not obvious, however.

(4) **Endemic species**

The following Ucayali-Amazonas species dealt with in this paper are endemic to western Amazonía (Peru in a wider sense): *Crenicichla sedentaria, C. cyanonotus, C. proteus, C. anthurus, Apistogramma eunotus, A. cruzi, A. payaminonis, A. nijsseni, A. cacatuoides, A. bitaeniata, Apistogrammoides pucallpaensis, Laetacara flavilabris, Tahuantinsuyoa macantzatza, Aequidens patricki*, and 10 *Burjurquina* species.

Two species not covered herein should be added for completeness: *Caquetaia myersi* and '*Cichlasoma*' Ecuador (notes on p. 45). The Ecuadorian cichlid fauna is still largely unstudied; this vacuum, however, does not add much to the problem of large uncollected adjacent Peruvian regions.

The range of *Crenicichla cyanonotus* is so vaguely defined, so as to be of little interest for further discussion. It is a lowland (<200 m) species corresponding to the Ucayali band recognized below, but if it is rare, a much wider range may have been overlooked. *Crenicichla anthurus* needs more study, but whether or not it should include Ecuadorian forms (see p. 120) it qualifies as a western Amazonian endemic.

Remaining endemic species fall taxonomically into four categories:

(1) endemic monotypic genera of uncertain relationships: *Apistogrammoides, Tahuantinsuyoa*

(2) species groups of uncertain relationships: *Apistogramma payaminonis-nijsseni, A. eunotus-moae-cruzi*

(3) species or species groups of suspected or definite relationship with Orinocoan or Bolivian Amazonian species/species groups: *Laetacara flavilabris, Crenicichla proteus, Apistogramma cacatuoides*

(4) single species of uncertain relationships: *Apistogramma bitaeniata.*

Bolivian Amazonian and Orinocoan tracks, and *Bujurquina* species will be discussed further under their own headings.

Geographically, endemics can be categorized into lowland or tributary species.

Tributary stream species have a strongly biased collecting record. They are chiefly from the Tingo María-Aguaytía-lower Pachitea-upper Ucayali area of intense collecting or from the upper Napo drainage (Coca-Santa Cecilia), ie. nearly the only upland regions collected. Positive data indicate that the upper Napo and upper Ucayali-Huallaga regions, despite the distance between are part of the same faunistic region, determined by endemism. This includes the occurrence in both areas of *Crenicichla sedentaria*, a tributary species, and the forms also occurring in the lowlands: *C. proteus, C. anthurus*

and *Laetacara flavilabris*. Nevertheless, the Napo, especially the upper portion, is characterized by endemics of its own, viz. *Apistogramma payaminonis* and an undescribed cichlasomine cichlid, and influence of Putumayo-Caquetá species not extending outside the Napo in Peru: *Apistogramma cruzi*, *Caquetaia myersi*.

Southern Peruvian rivers are well characterized by endemism. Excepting the ubiquitous *Cichlasoma amazonarum*, which may be an aggressive disperser and is a potential subject of human-caused dispersal, the Huallaga has only Peruvian-Ecuadorian endemics. These are two endemic Alto Huallaga *Bujurquina* species, the upper Napo-Huallaga-upper Ucayali *Crenicichla sedentaria*, and the widespread *C. anthurus*. Absence of other cichlids could be due to extinction, or long isolation. It is clear from the shared cichlid species that the Huallaga has had connections with the upper Napo and adjacent Ucayali.

The Pachitea-Aguaytía region is rich in species. It is open to the lowland species, and several lowland species occur here. Endemism involves 4 species (*Tahuantinsuyoa macantzatza, Bujurquina megalospilus, B. hophrys, Aequidens patricki*). Peruvian widespread endemics, *Crenicichla sedentaria* and widespread species like *Cichlasoma amazonarum* and *Crenicara punctulatum* also occur in the area. The mix of species in open upland areas have an ecological explanation, as habitat diversity is greater in the piedmont region, including both mountain-stream like conditions and lowland biotopes. The Huallaga may offer the same potential, but is not accessible to ready colonization by lowland species because of torrents along its course.

Little collecting in adjacent areas makes the Aguaytía-Pachitea endemic area a vaguely definable region. Most of the intensely collected areas in western Amazonía tend to include particular species. They are evidence of endemism, but the endemism remains largely uncharacterized.

In fig. 3 is outlined a loosely defined subandean western Amazonian endemic 'belt', with components. Compare with fig. 4 (lowland endemics), which shows the Pachitea-Aguaytía region shared by two lowland patterns ('Ucayali band' and widespread endemics), and the upper Napo area by one of these. With some overlap, there is a distinction between a highland area (>200 m) endemic belt and a lowland area (<200 m) widespread fauna (actual collecting localities are commonly below 200 m though). Comparing figs 3 and 4 it seems a bit unclear which pattern the Pachitea-Aguaytía-upper Ucayali species really belong to. Out of the 27 endemics considered herein there is remarkably little congruence in ranges.

Lowland endemism includes three partly overlapping patterns. There is a band that follows the Ucayali-Amazonas, consisting of *Apistogrammoides, Apistogramma cacatuoides, A. eunotus, A. bitaeniata, Bujurquina syspilus, B. moriorum, B. peregrinabunda* and perhaps *Crenicichla cyanonotus*. Several of these species penetrate the Solimões far eastward. Some sort of vicariance may exist between this pattern and the Napo-Putumayo region (*Apistogramma cruzi, A. payaminonis*), the Peruvian species not ascending the Putumayo or Napo.

There are two subsets of Ucayali-Solimões endemism. An 'Ucayali band', characterized by *Apistogrammoides pucallpaensis* and *Apistogramma cacatuoides*, and a 'Solimões band', of *Apistogramma bitaeniata* and *Bujurquina peregrinabunda*, whereas *Apistogramma eunotus* about covers both. Ranges of *Laetacara flavilabris, Crenicichla proteus*, and perhaps *C. anthurus* (status as lowland endemic questionable) expand either or both bands into the upper Napo, and suggest a third pattern.

All of these areas are completely covered by the ranges of widespread species. A Napo-Putumayo-Caquetá pattern may be recognized of the basis of the distribution of *Caquetaia myersi* and *Apistogramma cruzi*. Considering *Caquetaia* it may be part of a wider track involving eastern Amazonia (*Caquetaia spectabilis*), the Magdalena-Maracaibo (*Caquetaia kraussii*) and perhaps middle Central America (*Petenia splendida*, potential sister-group of *Caquetaia*).

It may be significant that two endemic species (*Crenicichla proteus,*

Apistogramma cacatuoides) in the Ucayali band vice Bolivian endemics (*C. semicincta*, *A. luelingi*), whereas Solimões band species trace non-Bolivian widespread forms.

An obvious similarity exists between the Ucayali and the Juruá, which rivers are intermediated by the Amazon. The Juruá has no known endemics other than *Apistogramma moae* and *A. juruensis*, the former most similar to *A. eunotus* and the latter to *A. cacatuoides*. Existing collections from the Juruá are, however, too small to allow characterization of this drainage. It includes several widespread Amazonian species, all shared with Peru except for a *Crenicichla* species.

Local endemism, ie. restriction to one or a few very close collecting sites, is different from range endemism considered above, because it is more apparent that only a single deme is involved. Range endemism may or may not involve distinct, geographically separate populations whether morphologically recognizable or not. It is doubtful whether the few cases of local endemism among western Amazonian cichlids are really local endemics. I believe that additional collecting will extend the ranges of *Apistogramma nijsseni* (Quebrada Carahuayte), *A. payaminonis* (near Coca), *A. moae* (near Cruzeiro do Sul), and particular *Bujurquina* species like *B. labiosa* and *B. robusta* (upper Ucayali). It is regular tendency in studies of South American fishes that widespread forms show up as species groups and local endemics are found to be widespread.

Altogether, attempts at identifying endemic centers in western Amazonía suggests chiefly that immense dispersal has taken place, even though the fauna is composed of rather distinct species, instead of largely sympatric closely related species.

(5) **The Orinocoan connection** (fig. 5)

Two of the Peruvian cichlid species show a marked tie between the Ucayali and upper Orinoco/upper Negro drainages. In one case, *Aequidens diadema*, species differentiation is not obvious. In western Amazonía this species has been collected only near Jenaro Herrera (Ucayali) and at Carauari (Juruá). There is also an old lot labelled 'Iquitos'. Black-water hill-streams like those near Jenaro Herrera are not extensively collected in Peru, and if *A. diadema* is a stenoic species, possibly wider distribution has remained undetected because of collecting bias. Upper Negro/Orinoco localities are assumedly also black/clear water streams. The region between Peru and the Negro/Orinoco is virtually unknown ichthyologically. It would be definitely wrong to assume vicariance between the Venezuelan/Colombian portion of the western Guianan highlands and the Serra do Divisor, although this is the apparent pattern (cf. fig. 5).

The other case (fig. 5) is different in two respects. Two species are involved and both species have a fairly good collecting record. *Laetacara flavilabris* is fairly wide-ranging in Peru and east to the R. Tefé and the upper R. Juruá. It is a characteristic black-water forest stream species. *Laetacara* sp. Orangeflossen (as it is named in Koslowski 1985a) is a black-water species occurring in the upper Orinoco and Negro. There is one locality near Manaus, in a region infested by escaped aquarium fishes collected elsewhere. The Manaus sample was actually taken in a stream used for water supply by at least one ornamental fish exporter. The Manaus locality is highly doubtful. As in the case of *A. diadema*, absence of collections from a huge intermediate area prevents any conclusion about opposing range limits. *Laetacara flavilabris* and *L.* sp. Orangeflossen are tentatively considered sister-species. A more detailed discussion will be given in the formal description of *L.* sp. Orangeflossen.

The range of *Laetacara thayeri* overlaps broadly that of *L. flavilabris* in western Amazonía, but the two species, with probably similar ecology, are never syntopic. *Laetacara thayeri* occurs eastward to the Trombetas, and may be the sister taxon of *L. flavilabris*+*L.* sp. Orangeflossen.

Another tentative case of Peruvian-Orinocoan connection is *Crenicichla*

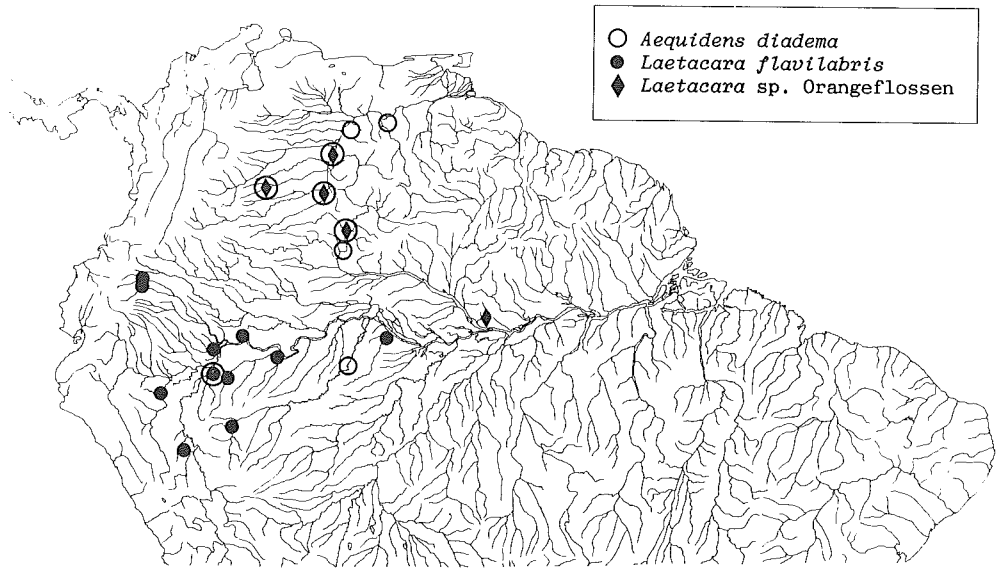


Figure 5. Collecting localities of *Aequidens diadema*, *Laetacara flavilabris* and *L.* sp. Orangeflossen, illustrating an Orinoco-Negro-Western Amazonian track.

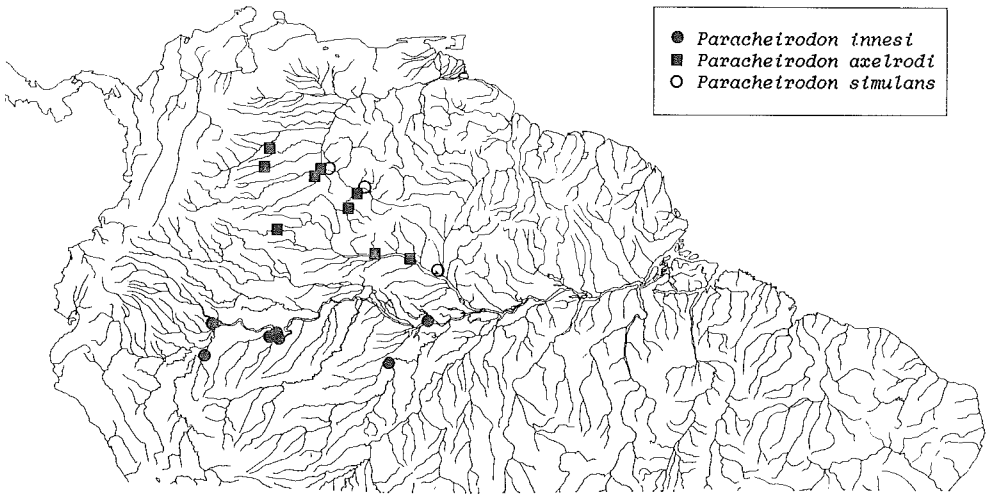


Figure 6. Collecting localities of *Paracheirodon* species (Characidae), based on Weitzman & Fink (1983) and personal collecting of *P. innesi* in the Mazán and Curiyacu in Peru, to illustrate a non-cichlid parallel to the Orinocoan-Peruvian distribution shown in fig. 5.

sedentaria and an Orinocoan, very similar species, of which I have seen material from the rivers Casanare and Caura. This species is under study by Stewart Reid. Whereas a close relationship seems clear between *C. sedentaria* and the Orinocoan form, they may belong to a larger group. Until the genus is better studied, *C. sedentaria* is not readily available for wider biogeographic analysis. The species is discussed further under 'endemic species'.

A Negro-Orinocoan + western Amazonian pattern is obvious in other fishes as well, although it is doubtful whether it is really characteristic for either region. The Negro has a decided discrete endemism and also a strong faunal relationship with eastern Amazonía (unpublished). Many localities are available for the Neon tetra group, *Paracheirodon* Géry (Characidae), and are plotted in fig. 6. Of the three species involved, two are parapatric in the Orinoco-Negro, and one is alone in western Amazonía. *Hyphessobryon socolofi* Weitzman and *H. erythrostigma* (Fowler) are two closely related characids, the former collected only in the mid-lower Rio Negro (Barcelos), the latter only in the upper Solimões-eastern Peru (Weitzman 1977; personal collections from the R. Gálvez, R. Nanay). I have no information on *H. socolofi*, but the other characids mentioned are all clear- to black-water species, like cichlids under discussion.

(6) *Bujurquina* species

The biogeographically most informative group of western Amazonian cichlids may be the genus *Bujurquina*, the distribution of which is shown in fig. 7. To some extent, species taxonomy is not fully resolved, especially not among non-Peruvian populations. The group has a sort of 3-legged distributional range, with major complexity (center of greatest taxonomic diversity) in Peru, particularly in the Amazonian subandean endemic belt. More work is required on intrageneric relationships, and distributional data are insufficient for eastern Amazonian species. The group indicates an extension of the subandean endemic belt well into the western Orinoco and well into the Paraguay-Parana basin.

Bujurquina species appear to be poor dispersalists. They differ from most co-ranging species in being forest stream fishes with a preference for clear to black water. Leaf carrying and mouth brooding habits may be of advantage in conditions of rapidly changing water levels, allowing exploitation of stream bank regimes. A few collections from river conditions are all correlatable to desiccation of quebradas in the area at times of low water. Whereas *Bujurquina* species have a distribution that may be conveniently ecologically characterized, there is no obvious limitation to range expansion through suboptimal habitats at times of low water level. *Bujurquina* differ from the black-water cichlids which are restricted to black-waters. Those are believed to disperse at times of highwater level, and the group does not include cases of extensive speciation as in Peruvian *Bujurquina*.

Overlapping distribution and lack of phylogenetic data precludes detailed analysis of *Bujurquina* distribution. Sympatry indicates dispersal, but it may be significant that syntopic occurrence of *Bujurquina* species is a rare phenomenon, recorded only for *B. labiosa* and *B. robusta*. These two species differ greatly in mouth structures, suggesting different feeding niches. Competitive interaction might be taken to be responsible for much of the habitat separation in *Bujurquina* species, and the group may be an example of allopatric speciation in similar environments. Morphological modifications and biotope selectivity may have been inforced rather by eventual sympatry than by isolation.

(7) Bolivian Amazonía

The Madre de Dios drainage has a cichlid fauna significantly different in species composition from that of the rest of Amazonian Peru. Of the 12 Madre de Dios species, three (*Aequidens tetramerus, Crenicara punctulatum* and *Satanoperca jurupari*) are shared with the Ucayali-Amazonas and also with a

Figure 7. Generic distribution of *Bujurquina*.

large portion of the rest of the Amazon basin. *Crenicara punctulatum* is not (yet) collected anywhere in the remaining portion of Bolivian Amazonía. The other two species are collected in Bolivian territory. In the Guaporé drainage *Satanoperca pappaterra* and an undescribed species of *Crenicara* replace *S. jurupari* and *C. punctulatum*, respectively.

Apistogramma urteagai, Bujurquina eurhinus, B. tambopatae and *B. cordemadi* are collected only in the Peruvian section of the Madre de Dios. Both *Bujurquina* and *Apistogramma* are genera including chiefly species with very restricted distribution. Other *Bujurquina* (one species) and *Apistogramma* (at least four species) in Bolivian Amazonía do not extend to the Madre de Dios.

Mesonauta festivus, Astronotus crassipinnis and *Cichlasoma boliviense* are widespread in Bolivian Amazonía and the first two even present in the Paraguay drainage.

The only interesting distribution patterns with relevance to Peru are those of *Apistogramma luelingi* and *Crenicichla semicincta*. The latter is hypothesized to be close to the Ucayali-Amazonas endemic *C. proteus* and *A. luelingi* forms a monophyletic group together with *A. cacatuoides* (Ucayali-Amazonas endemic) and *A. juruensis* (upper Juruá system). Both species have similar Bolivian distribution, neither reaching into the Guaporé drainage.

Bolivian biogeography as reflected in cichlid distribution is quite complex and will be dealt with elsewhere. A high level of endemism permits Bolivian Amazonía to be recognized as a biogeographic unit. It has two components, one Guaporéan and one comprising the rest of the drainage. Both extend into the Paraguay basin.

The distribution of *C. semicincta, C. proteus, A. luelingi, A. cacatuoides*, and *A. juruensis* may be taken as evidence of a relatively recent separation of the western portion of Bolivian Amazonía and the Ucayali-Amazonas drainage. Intermediate areas in western Brazil are virtually unknown ichthyologically.

Two characters suggest that *Apistogramma luelingi* is the sister species of *A. cacatuoides+A. juruensis*, meaning initial separation of the Madre de Dios from the Ucayali-Amazonas+Juruá, and subsequent separation of the Juruá from the Ucayali-Amazonas. Ucayali-Amazonas is more precisely the Ucayali band recognized above (p. 32). Both vicariance events are relatable to the last orogeny of the Andes.

Discussion

Peru, or even western Amazonía, has never been considered a biogeographic unit, but area endemism is notable in the region. Excepting some widespread species none of the Peruvian cichlids extend east of the Solimões drainage. Figure 9 shows the combined ranges of non-ubiquitous cichlids in western Amazonía. Within that area are discrete regions of endemism, and central Amazonian elements that do not range into Peru overlap along most of the Solimões. The triangle does not depict a real biogeographic unit also because adjacent areas are not collected. It serves to show, however, that for 27 Amazonian cichlid species, there is a common western area of distribution, meaning that parts of the Amazon basin have had significantly different histories. Other regions of the Amazon basin show corresponding endemism with much overlap of the widespread forms that also occur in eastern Peru. Coupled to the Bolivian Amazonian-Ucayali track and the Orinoco-Peru track, the suggestion is that western Amazonía likely acquired its distinct fauna before the Amazon basin came into existence.

Restricted ranges among western Amazonian cichlids are notable, as there are no obvious physical barriers to dispersal. Dispersal capacity appears to vary widely between South American cichlid species. Most of the Peruvian cichlid species have access to a major portion of the Amazon basin without having to cross land barriers or rapids. Yet, a minority have realized this potential, and those that have a wide range commonly also occur across obvious

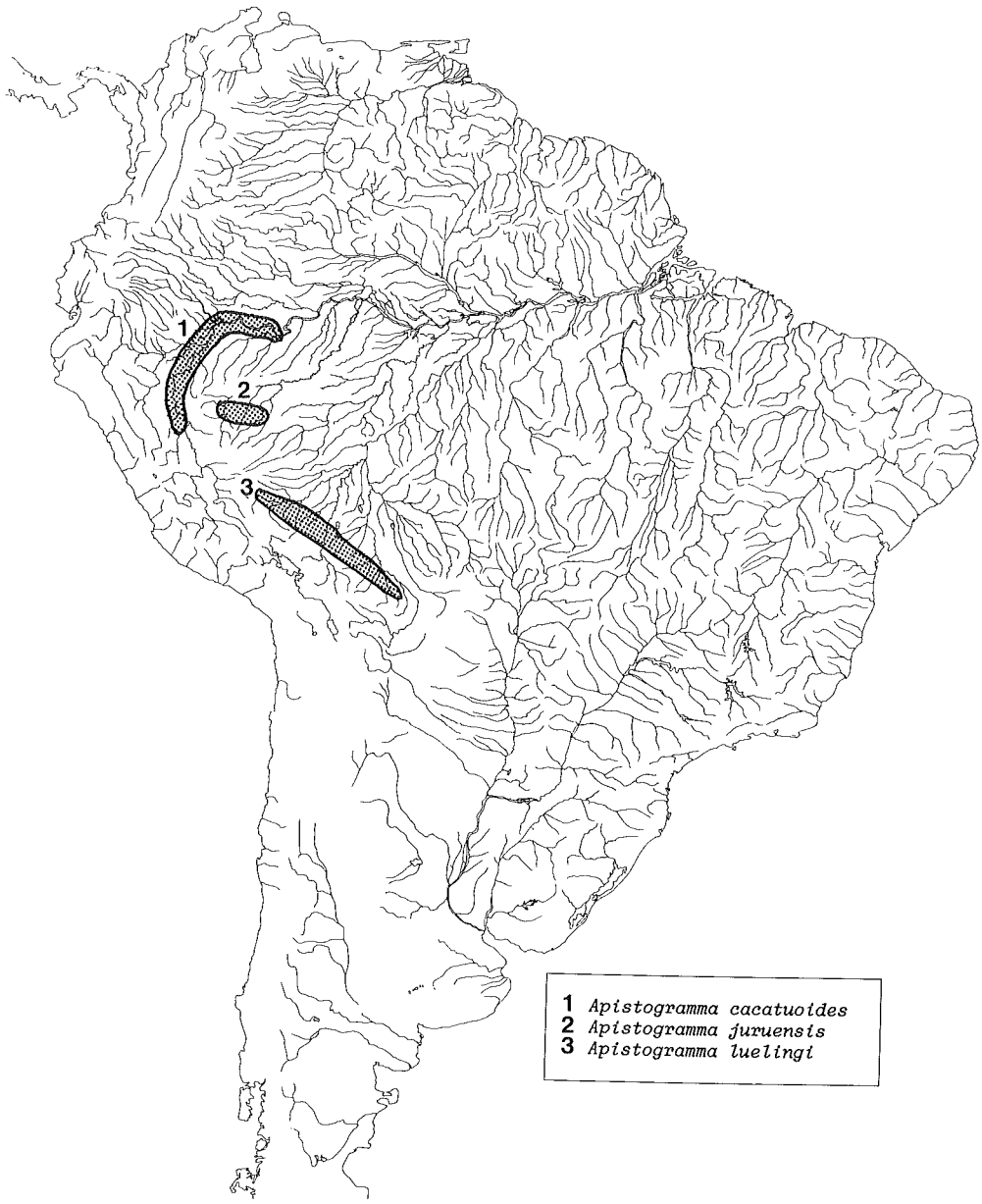


Figure 8. Ranges of *Apistogramma cacatuoides* group species, 1 *A. cacatuoides* (Ucayali-Amazonas), 2 *A. juruensis* (upper Juruá drainage) and 3 *A. luelingi* (Bolivian Amazonía), illustrating vicariance involving the Ucayali-Amazonas, Juruá and Bolivian Amazon drainages.

drainage divides (wide ranging species listed above). To some extent, range limits are ecologically determined. Many species, eg. *Tahuantinsuyoa* and *Bujurquina* species occur mainly in quebradas or upland streams subject to profound water level oscillations. Others, such as *Laetacara* species, *Aequidens diadema* and *Apistogramma bitaeniata*, with ample ranges, are black-water species. Black-water species have spotty distribution records, but do not necessarily reflect area fragmentation. During the creciente, floodlands may connect drainages and it is plausible that a mapping on floodlands (areas) rather than on river courses (lines) provides a more accurate, continuous instead of patchy distribution record. Widespread, ubiquitous forms likely use the same range expansion possibility, whereas white-water species may be handicapped in this regard.

Accidental dispersal by humans is little documented for South American fishes, and I believe has not been of importance in Peru. Major agents may be the aquarium trade and fish culture. Iquitos mainly, but also to some extent Pucallpa, are centers for the ornamental fish trade in Peru. In Colombia, Leticia is one of South America's most important centers for this business. Few fish are collected near these centers. Iquitos operations obtain much of their merchandise from the Putumayo and Napo, and even from adjacent Brazil (personal interviews with exporters). As the operations have water intake and outlet open to nearby drainages, and as handling from capture to export involves much sorting out of diseased fish and unattractive species, it is obvious that some contamination of waters around export centers does occur. So far, nothing unusual or unexpected has been observed among cichlids taken near Iquitos, but obviously collections of ornamental fishes from the lower R. Nanay, especially Morona Cocha, which receives all the spill-water from fish exporters, do not necessarily represent natural distributions. Dispersal by fish culturists is likely for at least one gregarious species, *Cichlasoma amazonarum*, which was observed to be extremely abundant in ponds in the Quistococha area. Populations of *C. amazonarum* were obviously by far greater than those of species intentionally kept in the ponds. Whenever stock of culture species is transferred, *C. amazonarum* are likely to be taken along, and spread from new ponds into open water systems.

Data from Peruvian cichlids are much too incomplete, as is geological information, to allow a detailed interpretation of the history of the region. Nevertheless, both geological history and cichlid distribution are compatible with a picture of a continuous western South American drainage that was eventually disrupted into the Orinoco, Solimões headwaters, and Bolivian Amazonía, and connected to the major drainage that is now the Amazon basin. The western Orinocoan and Amazonian watersheds may have become independent in the Upper Pliocene (Harrington 1962). The present Amazon basin developed in the Plio-Pleistocene following the latest major upheaval of the Andes. Grabert (1971) dated the origin of the R. Madeira to the closure of the Pacific outlet, forcing the Bolivian Amazonian drainage to a new entry in the Guajará-Mirim region.

Such a view is congruent with the current western Amazonian endemism and the extensive mixture of species in the Solimões area which was most altered by the drainage reversal. Western Amazonía would thus seem to be a relatively recent region both geologically and faunistically. If Pliocene drainage fracturing was responsible for speciation in the *Apistogramma cacatuoides* species group, and *Laetacara flavilabris-L.* sp. Orangeflossen, then Peruvian cichlid distribution may be an argument against refugium theory postulating Pleistocene speciation patterns caused by climatic oscillations (papers in Prance 1982). Speciation events are pushed back into the Tertiary, and their main agent may have been drainage fraction.

Whereas even a gross picture of the evolution of the hydrographic system of tropical South America must be highly conjectural from the geological data available (cf. Beurlen 1970) it is certain that the major event affecting South American topography in the Cenozoic was the formation and gradual uplift of the Andean cordilleras, and that the western South American orogeny which

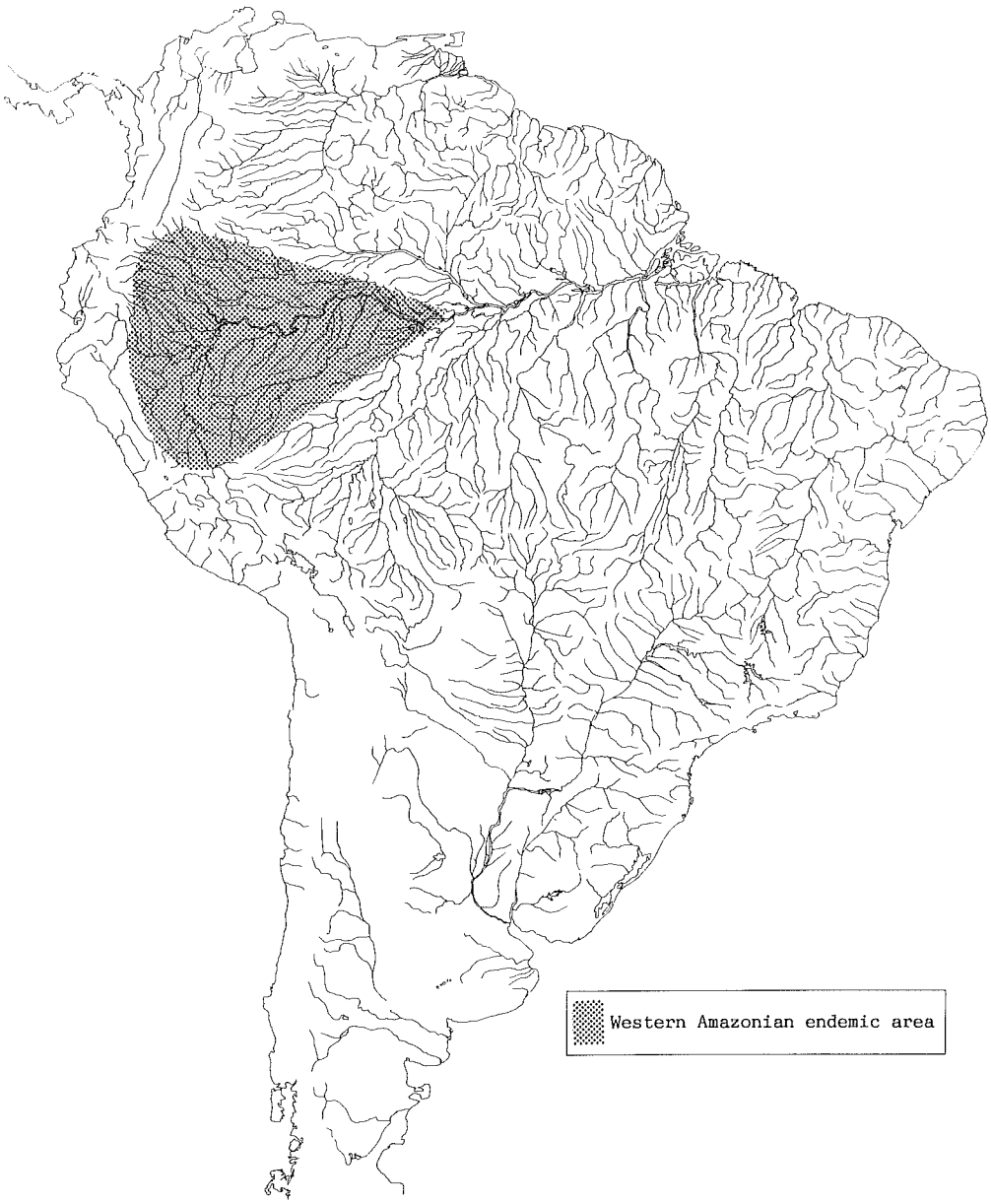


Figure 9. Western Amazonian endemism. Combined ranges of *Crenicichla sedentaria, C. cyanonotus, C. proteus, C. anthurus, Apistogrammoides pucallpaensis, Apistogramma bitaeniata, A. cacatuoides, A. eunotus, A. cruzi, A. payaminonis, A. nijsseni, A. juruensis, A. moae, Laetacara flavilabris, Aequidens patricki, Tahantinsuyoa macantzata* and *Bujurquina* species.

had a tremendeous impact on riverine systems of South America, was the causal agent of the present day fluvial network.

Virtually all of tropical South America was above sea level throughout the Cenozoic. During the Tertiary, the Guiana and Brazilian shields have been denudation areas, and most topographical change occurred in the northwestern part of the continent, including sediment deposition and mountain building. Up to the Upper Cretaceous, the portion now including Peru and most of the Andes was below sea level (Harrington 1962). Andean cordilleras emerged in the Upper Cretaceous, enclosing basins of continental deposits between them and the western shields (Harrington 1962, Simpson 1975). A gap in the region of the Peruvian-Ecuadorian border west of the major eastward bend of the present Marañón permitted marine or brackish deposition into western Amazonía up to the Middle Oligocene (Harrington 1962) or Miocene (Beurlen 1970, Putzer 1984). This meant the closure of a Pacific outlet for the cis-Andean drainage system.

Until then the intercratonic Amazon basin was a denudation area, and at least the region west of the Iquitos Arch, a Precambrian-based height joining the Guiana and Brazilian shields across the Peruvian-Brazilian-Colombian border (Putzer 1984) and possibly a large fraction of the area east to the Purús arch line (Beurlen 1970, Abb. 63) drained to the west. Initially, closure of the Pacific outlet of the eastern cis-Andean drainage area may have resulted only in a subandean damming with a marshy or generally lacustrine subandean region (cf. Fittkau 1974). Eastward draining may have been effected first in the Pliocene, following the major uplift of all the Andean cordilleras (cf. Simpson 1975). This uplift led both to increased sedimentation load in the rivers and to an increased west to east slope of the sub-Andean region.

In the Miocene-Pliocene interval, the subandean through may have drained to the north to the Caribbean. The Pliocene upheaval, however, forced rivers along the Andes from Bolivia to northern Venezuela to run west. At the borders of the Tertiary sedimentary zone and higher shield, marginal rivers like the Orinoco, Negro and Guaporé-Madeira formed.

The dividing impact of the transverse intershield arches (Iquitos, Purús, and Gurupá arches) was obliterated by the eastward directed drainage, which may have been largely preformed in the east.

However incomplete and uncertain Amazonian hydrological history may seem, it is evident that the pattern of western Amazonian fish distribution is mainly a Miocene to Recent one. Evolution of particular rivers in Peru appears unstudied. However, it is clear that Peruvian Amazonía is a young system.

All kinds of informations available are still to sketchy to allow detailed hypotheses about the history of the Peruvian cichlid fauna. The biogeographic integrity of western Amazonía seems established, but the patterns outlined above need confirmation from other taxa to exclude collection and selection bias. The lowland river system was formed from the Miocene on and with upland rivers must have been considerably modified by the uplift, volcanism and block faulting characterizing Andean history, as well as the rise of the Andean marginal regions. It seems likely that extensive connection with the Orinoco tributaries of Colombia and with Bolivian Amazonía existed up to the Pliocene upheaval of the Andes, but connection with drainages east of the Purús arch were established lately, and are recognizable only in extensive pan-Amazonian ranges of certain species.

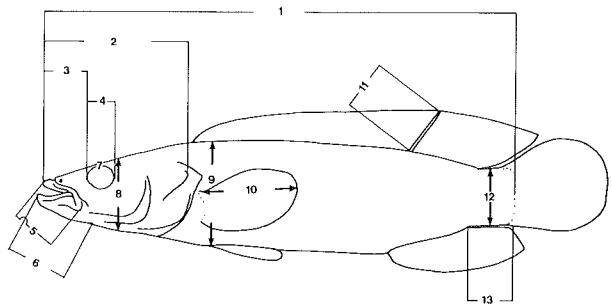


Figure 10. Measurements taken on *Crenicichla* specimens; 1, standard length, from upper jaw symphysis to middle of base of caudal fin; 2, head length, linear from level of upper jaw symphysis to level of posteriormost point of operculum (not including skin flap); 3, snout length, linear from level of upper jaw symphysis to level of osseous orbit margin; 4, orbital diameter, horizontal between osseous orbital margins; 5, upper jaw length, from symphysis of premaxillae to posterior end of maxilla; 6, lower jaw length, from symphysis to articulation with quadrate; 7, interorbital width, transverse at narrowest part of skull; 8, head depth, just posterior to orbit; 9, body depth, at level of origin of pelvic fins; 10, pectoral-fin length, from base of first ray to tip of longest ray; 11, length of last dorsal-fin spine; 12, depth of caudal peduncle, at approximate middle of peduncle; 13, length of caudal peduncle, from end of anal-fin base to level of caudal-fin base. See fig. 11 for principal measurements on other cichlids.

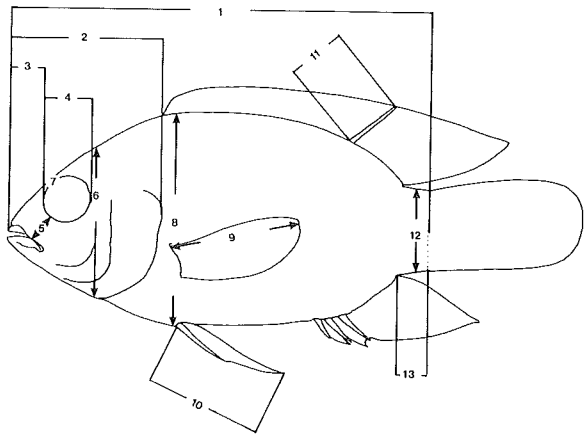


Figure 11. Principal measurements taken on cichlids other than *Crenicichla* (which illustrated in fig. 10). 1, standard length, from upper jaw symphysis to middle of base of caudal fin; 2, head length, linear from level of upper jaw symphysis to level of posteriormost point of operculum (not including skin flap); 3, snout length, linear from level of upper jaw symphysis to level of osseous orbit margin (generally lateral ethmoid lateral wing); 4, orbital diameter, horizontal between osseous orbital margins (generally lateral ethmoid to sphenotic); 5, preorbital depth, depth of lachrymal along imaginary line continuing radius of orbit; 6, head depth, just posterior to orbit, and head width taken at the position of '6'; 7, interorbital width, transverse at narrowest part of skull; 8, body depth, at level of origin of pelvic fins; 9, pectoral-fin length, from base of first ray to tip of longest ray; 10, pelvic-fin length, from base of spine to tip of longest ray; 11, length of last dorsal-fin spine; 12, depth of caudal peduncle, at approximate middle of peduncle; 13, length of caudal peduncle, from end of anal-fin base to level of caudal-fin base (occasionally, when longer, the dorsal edge of the peduncle is measured).

SYSTEMATIC SECTION

Fifty-five cichlid species known to occur in Peruvian territory, and three extralimital species appropriately dealt with in this context, are described below.

Because the geographical scope of this paper cuts rather drastically through genera and through ranges, it has not seemed adequate to attempt phylogenetic analyses of the taxa covered, and generic descriptions are made short. New genera are supposed to be adequately conceived by diagnoses given herein, though.

This paper includes descriptions of one or more species in 22 genera, representing about half the genera of South American cichlids.

Generic descriptions emphasize particulars of each genus and outline distribution and species coverage. Some species extensively described recently are dealt with only sketchily, otherwise species descriptions are intended to summarize taxonomic history (synonymies and bibliographies), superficial morphology, distribution, habitat data, local names, diagnostic characters and any other particulars of interest in the present context. It has not always been possible to fully resolve the taxonomic status of species considered, and names used herein may change following study of extralimital populations.

The ordering of taxa is quasi-phyletic, starting with hypothesized primitive groups, followed by the tentatively recognized geophagine (from *Geophagus*) and cichlasomine (from *Mesonauta*) lineages.

Material

Virtually all of this paper is based on study of ethanol (70-80 %) preserved specimens, in extremely varied states of preservation. The limited isopropanol material examined shows definite signs of clearing, as do some specimens killed and fixed in paraformaldehyde solution. Material examined is listed on p. 351 *et seq.* Osteological data is from study of radiographs and specimens macerated in trypsin, stained with Alizarin red S and Alcian blue NGS and cleared and maintained in glycerol. The clearing and staining procedures follow Taylor (1967) and Dingerkus & Uhler (1975). See p. 351 for explanation of museum abbreviations.

Methods

My methods for taking counts and measurements have been described in some detail (Kullander 1980*a*, *b*, 1983*b*); deviations are explained where appropriate. Principal measurements are illustrated in figs 10-11. Some special terms and particular procedures may require consideration:

Squ. long. is a count of the body scales in the horizontal series above that including the lower lateral line.

Jaw teeth are counted on one side of each jaw only, and only in the labiad series; inner series are counted near the symphysis.

Frequencies of counts are given in parentheses immediately succeeding each count.

Principal caudal-fin rays are numbered from 1 to 8 in each lobe, starting with the admedian, hypaxial and epaxial rays distinguished by the designators V and D respectively.

Procurrent caudal-fin rays are numbered i, ii, iii, etc., beginning with that closest to a principal ray.

Accessory lateral lines on the caudal fin are those lateral line sequences that run ventral and dorsal to the medial continuation of the lower flank lateral line on the caudal fin.

Vertebrae counts include data combined from both radiographed and cleared and stained specimens.

Scales between dorsal fin and upper lateral line scale series are counted in a caudad inclined vertical series. Scales much smaller than the rest and situated close to the dorsal fin may be recorded as 1/2 scale; this expression does not refer to surface size.

Colour pattern terminology varies slightly for each genus. It is convenient to number the vertical dark bars on the body, as has been done in, eg. *Cichla*, *Cichlasoma*, and *Apistogramma*. Identical numbering in different genera does not necessarily imply homology. A *midlateral spot* is a major dark blotch on about the middle of the side. In *Apistogramma* and *Apistogrammoides* it is referred to as *lateral spot*. *Caudal spot* refers to a dark blotch on the base of the caudal fin in most South American cichlids. Dark spots with light margin are referred to as *ocelli* (singular *ocellus*). Special terms have been invented for various markings whenever convenient. Use of identical term in different genera does not necessarily reflect an opinion of homology. Colour pattern descriptions are from specimens immersed in alcohol and with a white background.

Unless otherwise stated photographs are of specimens immersed in alcohol and illuminated both by flash and photo lamp. The film was developed for a soft grain and most prints are on soft paper.

Osteological terminology follows Kullander (1983*b*). Drawings were made using a drawing tube fitted on a Wild M5 stereomicroscope.

Taxonomy

The basic revision of South American cichlids is that of Regan (1905-1906). Subsequent attempts at genus group revisions have been variably successful and have not changed Regan's classification markedly. The number of described species has been considerably augmented, however, from 85 to nearly 200.

Regan's generic taxonomy is based on a restricted number of key characters that are used repeatedly and which resulted in two kinds of genera, catch-all groups without conspicuous specializations and small genera with one or another defining peculiarity.

The generic taxonomy used in this paper is basically similar, although the catch-all genera of Regan have been fragmented. Diagnostic characters are commonly new. Several new generic characters were introduced in Kullander (1983*b*), and some of them are described consistently in this paper, like cephalic lateralis system foramina, predorsal scale pattern and accessory caudal-fin lateral lines.

Local names

Peruvian Amazonía has two widely spoken languages, both introduced, Castellano and Quechua. Besides, there are several local languages, and both Portuguese and Tupi-Guarani are spoken along the Brazilian frontiers. The widely used and understood fish names in the selva derive from all these languages but are written in Spanish orthography. There are only four widely recognized names applied on cichlid fishes, reflecting economic importance of the species involved. Names on identified species are cited in the descriptions; but not group appellations as such.

Tucunaré is a Guarani name for *Cichla* species, employed throughout Brazilian Amazônia. In Peru it applies to *Cichla monoculus*, the only representative of the genus, and which is locally recognized as *tucunari*, or simply *tucu*.

Carahuazú, also *acarahuazú*, is the Peruvian spelling of the Guarani name for *Astronotus ocellatus*, written *acará-açu* in Brazil, and meaning big Acará, ie. big cichlid as *acará* is the Guarani name for all cichlids other than *Crenicichla* and *Cichla*.

Añashúa is applied to all *Crenicichla* species and is a truly local

name. The Brazilian counterpart is *jacundá*.

Bujurqui applies on all remaining cichlids, being the equivalent of *acará* in Brazil. The spellings *bufurqui, bufurque, bujurque* are local pronounciation variants, j and f as well as e and i freely interchanged in selva dialects.

The ornamental fish industry is the origin of some locally employed Castellano or Castellano-English names, like *pez disco* for *Symphysodon aequifasciatus*, and *pez ángel* and *escalar* for *Pterophyllum scalare*.

A species recently adopted for culture, *Chaetobranchus flavescens*, received then a distinguishing epithet for practical purposes, *bujurqui vaso*. *Satanoperca jurupari* is recognized around Iquitos as *punta shimi*.

Cichlid species potentially occurring in Peruvian Amazonía

This paper is not complete in species coverage. Large regions in the area are still uncollected and may yield new species. Others occurring in vicinal areas may eventually be collected in Peruvian territory:

Caquetaia myersi (Schultz 1944), type locality R. Dedo near Florencia, Colombia, referred material from Florencia (Fowler 1943*b*, as *Cichlasoma spectabile*), Morelia, upper Caquetá drainage (Fowler 1945*b*, as *C. amploris*, synonym of *C. myersi* fide Schultz (1949) and pers. obs.), R. Aguarico at Santa Cecilia (Saul 1975), 'Upper Amazon basin, Prov. Napo-Pastaza' (Orcés in Ovchynnyk 1967, 1968; not re-examined), near Missahualli (ANSP 146000), R. Payamino tributary (MCZ 49322).

'*Cichlasoma*' ECUADOR, an undescribed cichlasomine with long anal fin and unicuspid teeth, possibly close to *Heros* or *Hypselecara*, is known from collections near Coca, upper Napo system.

Bujurquina zamorensis (Regan 1905*b*), from the R. Zamora, a Marañón tributary, is possibly present in the R. Santiago in Peru. Some material of *Bujurquina*, both from Peru and adjacent Ecuador and Brazil is not further dealt with here, being either in very poor condition or single juveniles that cannot be identified with certainty. The distribution of this material can be had from comparison of fig. 7 with figs 111-112.

Several more Amazonian cichlid species may be expected to occur in the Madre de Dios drainage (p. 19), and in the Amazonas-Solimões junction, but species coverage of this paper for the Leticia-Tabatinga area is probably nonetheless relatively good.

Nomina dubia and misidentifications

Cycla multifasciata Castelnau (1855)

This species was described on the basis of a drawing of a specimen taken in a tributary of the Ucayali (Castelnau 1855, p. 18 and Pl. 10, fig. 2). It is shown on Castelnau's drawing as elongate, similar to a *Crenicichla* in body shape, but with a short, *Cichla*-like dorsal fin. The colour is described and figured as green with 11 oblique black bars. *Cycla* of Castelnau included both *Cichla* and *Crenicichla* species, and the drawing was most likely from a *Crenicichla* specimen. The species is, however, unidentifiable. *Cycla multifasciata* has been suggested to be a *Crenicichla* species by Machado (1971). It was listed as questionable synonym of *Cichla ocellaris* in Pellegrin (1904), and treated as a valid *Cichla* species (with *C. toucounarai* as a synonym) in Regan (1906*b*).

Cycla conibos Castelnau (1855)

This species is probably also based on a field drawing, although Castelnau did not say so. The description (Castelnau 1855, p. 18) is brief, mentioning green body and 7 black oblique vertical bars. The figure (Pl. 10, fig. 3) is similar to that of *Cycla multifasciata*, showing a *Crenicichla*-like fish with

short, *Cichla*-like dorsal fin, but with barred, emarginate caudal fin. I believe that this also represents a *Crenicichla* species, probably with a mutilated caudal fin. No more precise identification is possible.

There are no specimens in the MNHN which may be identified as either *C. conibos* or *C. multifasciata*. These nominal forms were regarded as valid *Cichla* species by Günther (1862), Eigenmann & Eigenmann (1891) and Eigenmann & Bray (1894), and as synonyms of *C. temensis* Humboldt by Fowler (1944, 1945*a*). *Cycla conibos* was considered a synonym or questionable synonym of *Cichla temensis* by Pellegrin (1904), Regan (1906*b*) and Machado (1971).

Geophagus amoenus **Cope (1872)**

No type material of this species has been located in the ANSP collection (Böhlke 1984, pers. obs.). Most authors agree in identifying it as an *Apistogramma* species on the basis of Cope's description. The type locality is given as R. Ambyiacu /=R. Ampiyacu/, and the following *Apistogramma* species are known from near Pebas: *A. agassizii, A. eunotus, A. cacatuoides*. None of these is fully compatible with the description of *G. amoenus*, neither is any other *Apistogramma* species in particular similar to the description.

In particular the caudal-fin colouration seems unique: 'brown; a black band from orbit to basis caudal. A black spot at base, and one at tip of caudal. Basis of dorsal and anal brown, rest yellow. A black band from orbit to angle of interoperculum. Cheeks and operculum with blue spots separated by yellow lines.' (Cope 1872). Otherwise the description is compatible with any elongate *Apistogramma* species.

Haseman (1911*c*) examined some of Cope's type material of cichlids. He remarked that '*Geophagus amoenus* is a synonym of this species /*Heterogramma taeniatum*/'. This does not with certainty imply that Haseman had seen material labeled as type(s) of *G. amoenus*. His conclusion is doubtful because his own material of *A. taeniata* is composite. The status of the species has been discussed in several papers (Kullander 1979*a*, 1980*a* with a sketch based on Cope's description, 1981*b*), as each new *Apistogramma* species described had to be compared with the insufficient description of *G. amoenus*.

Crenicara **sp.**

Tomey (1983) reported and illustrated an undescribed *Crenicara* species as being collected by himself in the Iquitos area. The description of the Iquitos region appears doubtfully authentic and the species I identify tentatively as one collected in the middle R. Negro and available as aquarium fish since about 1982, originally by Dutch importers (cf. Koslowski 1985*a*, p. 162, Rotflossen-*Crenicara*).

Key to cichlid genera of Peruvian Amazonía

A. A prominent flattened, lobe-like expansion on the first gill arch (figs 31, 36, 44, 52).....*R*
Upper limb of first gill arch slender, without lobe (eg. figs 17, 39).*B*

B. 7 preopercular foramina.....*C*
6 preopercular foramina.....*E*

C. Gill-rakers long and slender, more than 50 on first gill arch; American type lips (fig. 12B).....*Chaetobranchus*
Gill-rakers short, less than 20 on first gill arch; African type lips (fig. 12A).....*D*

D. Squ. long. more than 60; moderate fin squamation; A. III.10-12...*Cichla*
Squ. long. 40 or less; densely scaly fins; A. III.15-17.....*Astronotus*

E. Stochastic predorsal squamation (irregular, more than 10 on midline)..*F*
Uni- or triserial predorsal squamation (figs 136, 153).....*N*

F. Anal fin with three spines.....*G*
Anal fin with more than three spines.....*J*
G. Slender; squ. long. 45 or more.....*Crenicichla*
Moderately deep; squ. long. 30 or less.....*H*
H. Preoperculum strongly serrated.....*Crenicara*
Preoperculum smooth.....*I*
I. Squ. long. 22.....*Acaronia*
Squ. long. 29-30.....*Acarichthys*
J. Soft anal-fin rays 10-14.....*K*
Soft anal-fin rays 24-31.....*M*
K. Jaw teeth unicuspid; midlateral spot.....*Hypselecara*
Jaw teeth bicuspid; no midlateral spot.....*L*
L. Sides vertically barred, no lateral band or ocellated caudal spot.*Heros*
Bars faint, oblique lateral band, ocellated caudal spot.....*Mesonauta*
M. Preoperculum scaly.....*Pterophyllum*
Preoperculum naked.....*Symphysodon*
N. Triserial predorsal scale pattern (fig. 153).....*O*
Uniserial predorsal scale pattern (fig. 136).....*Q*
O. Preoperculum scaly (3-4 scales).....*Laetacara*
Preoperculum naked (rarely one scale).....*P*
P. Dorsal and anal fins scaly.....*Cichlasoma*
Dorsal and anal fins naked.....*Aequidens*
Q. Dark band from orbit running caudodorsad to nape.....*Tahuantinsuyoa*
Dark band continuing lateral band rostrodorsad across nape...*Bujurquina*
R. Dorsal and anal fins extensively scaly.....*Geophagus*
Dorsal and anal fins naked.....*S*
S. 13-17 gill-rakers externally on first ceratobranchial.....*Satanoperca*
0-6 gill-rakers externally on first ceratobranchial.....*T*
T. 6-9 anal-fin spines.....*Apistogrammoides*
3-4 anal-fin spines.....*U*
U. Squ. long. 27-29.....*Biotodoma*
Squ. long. less than 26.....*Apistogramma*

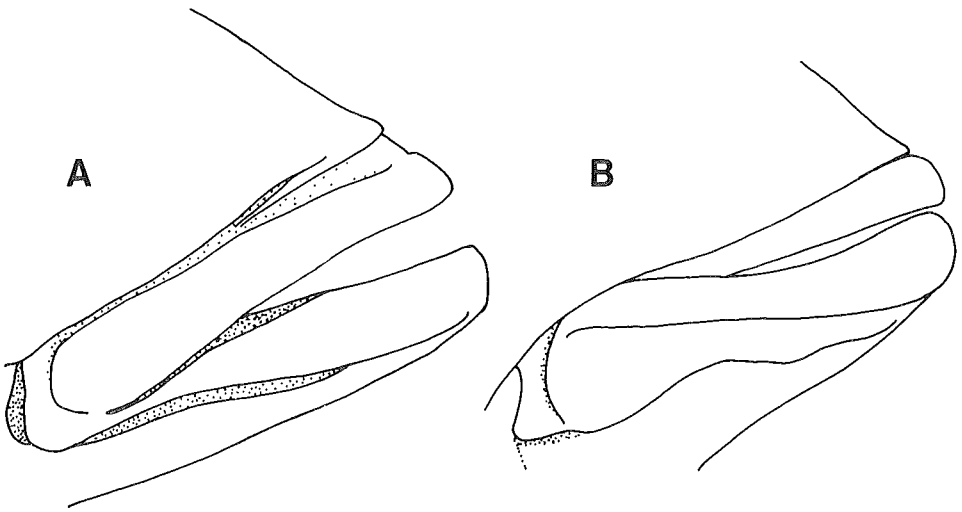


Figure 12. Lateral aspect of snout tip in A *Cichla ocellaris* and B *Chaetobranchus flavescens*, to illustrate 'African' (A) and 'American' (B) type lips; note that the posterior portion of the lower lip covers part of the upper lip in B but not in A.

Provisional list of South American cichlid genera

The following list provides a perspective to the coverage of this paper, references to complementary revisions and a provisional classification. Three groups of genera are distinguished: (1) Hypothesized phylogenetically primitive genera. (2) Geophagines (Kullander 1980*a*, *b*) include neotropical cichlids with a flat anteroventral expansion of epibranchial 1, which lined with connective tissue (epibranchial lobe; eg. figs 31-32), and genera with a general morphology like other geophagines though not featuring the epibranchial lobe. (3) Cichlasomines were reviewed by Kullander (1983*b*), though the name 'cichlasomines' is introduced here. Cichlasomines typically have only 4 dentary lateralis foramina (most other cichlids have 5). Neither cichlasomines nor geophagines can be shown to be monophyletic groups. Each, however, represents a useful reference to overall morphology and previous classification.

GROUP, Genus	Species	Most recent review
INCERTAE SEDIS		
Acaronia Myers	2	This paper
Astronotus Swainson	2-3	Kullander 1981*a*
Chaetobranchopsis Steindachner	1	Regan 1906*b*
Chaetobranchus Heckel	2	This paper
Cichla Schneider	8	Machado 1971,1972, Stiassny 1982
Crenicichla Heckel	>50	Regan 1913*a*, Stiassny 1982
Genus undescribed	6	
GEOPHAGINES		
Acarichthys Eigenmann	1	This paper
'Acarichthys'	6	Kullander *et al.* 1986
Apistogramma Regan	60	Kullander 1980*a*
Apistogrammoides Meinken	1	This paper
Biotodoma Eigenmann & Kennedy	>2	This paper
Biotoecus Eigenmann & Kennedy	1-2	Regan 1906*a*
Crenicara Steindachner	6	Kullander 1978
Geophagus Heckel	15	This paper
'Geophagus'	7-8	
Gymnogeophagus Ribeiro	6	Gosse 1976, Kullander 1981*a*
Papiliochromis Kullander	2	Kullander 1980*b*
Retroculus Eigenmann & Bray	3	Gosse 1971
Satanoperca Günther	>7	This paper
Taeniacara Myers	1	Kullander 1980*a*
Genus undescribed	1	
CICHLASOMINES		
Aequidens Eigenmann & Bray	10	Kullander 1983*b*, 1984*a*, *b*
'Aequidens'	13	Kullander 1983*b*
Bujurquina n. gen.	>20	This paper
Caquetaia Fowler	3	Kullander 1983*b*
Cichlasoma Swainson	12	Kullander 1983*b*
'Cichlasoma'	1	Kullander 1983*b*
Heros Heckel	>2	This paper
Hoplarchus Kaup	1	Kullander 1983*b*
Hypselecara n. gen.	2	This paper
Laetacara n. gen.	6	This paper
Mesonauta Günther	4	This paper
Nannacara Regan	2	Kullander *et al.* 1986
'Nannacara'	1	
Pterophyllum Heckel	3	This paper
Symphysodon Heckel	2	This paper
Tahuantinsuyoa n. gen.	1	This paper
Uaru Heckel	1	Regan 1905*d*
Genus undescribed	1	
Total species (low estimate):	275	

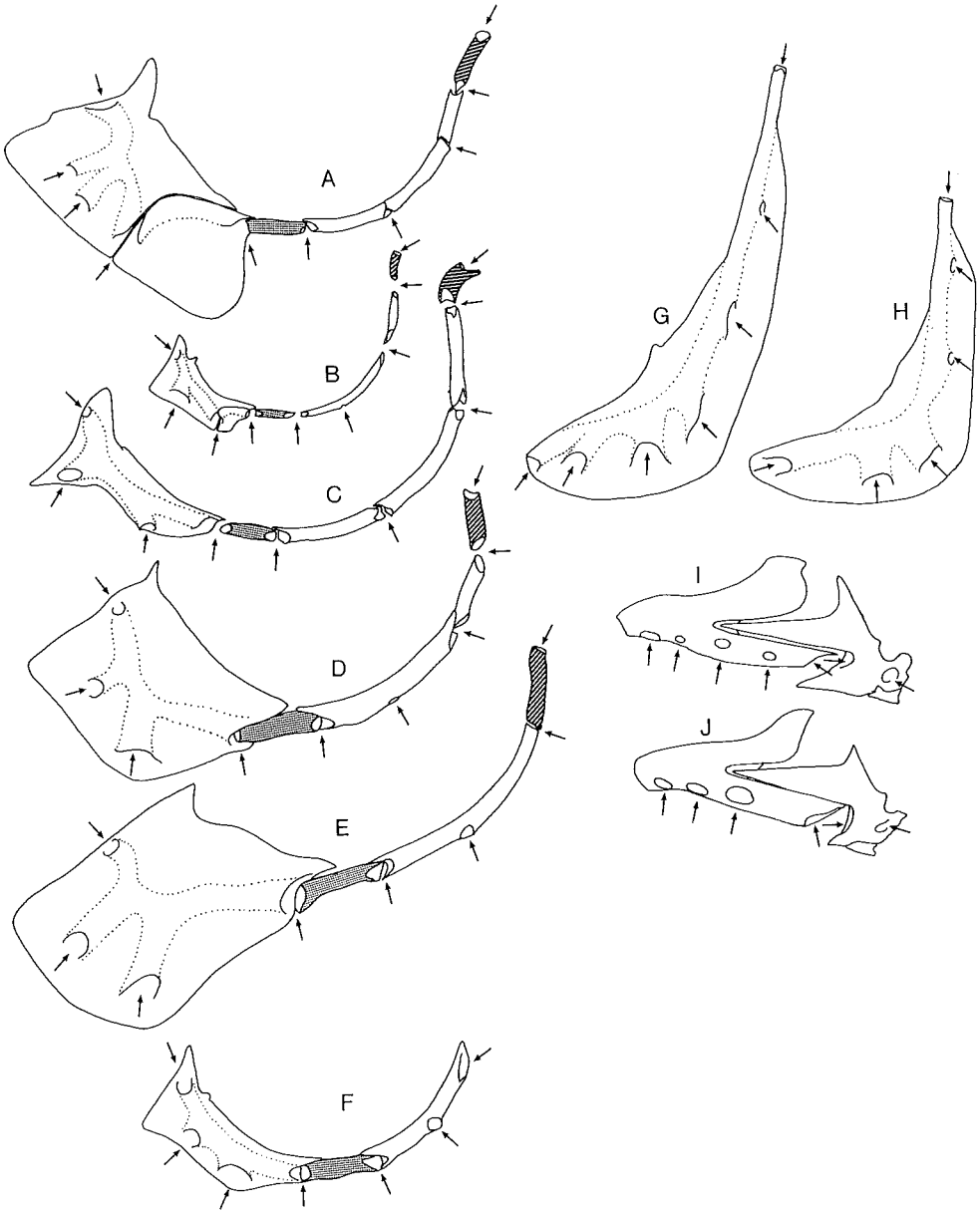


Figure 13. Some lateralis canal bearing bones showing variation in cichlids. Not drawn to scale.
A and G from *Cichla* B from *Astronotus* C from *Crenicichla*
D from *Geophagus* E from *Satanoperca* J from *Tahuantinsuyoa*
F, H and Ifrom *Apistogramma*.
A-F show reductions in the suborbital series from the *Cichla* condition (A). Arrow points to lateralis openings, presumably homologous elements identically shaded. In B lachrymal foraminal number is reduced from 4 to 3, 4th and 5th suborbitals co-ossified. In C-F first two suborbitals (lachrymal and adjacent infraorbital) co-ossified. C-E shows reductions by co-ossification of the 4th to 6th elements of *Cichla*. In F also the posteriormost element is lost. The condition in D is characteristic of cichlasomines.
G shows lateralis canal configuration of preoperculum characterizing *Cichla, Astronotus, Chaetobranchus, Chaetobranchopsis, Retroculus* and most African cichlids; H is characteristic of all other American cichlids, with a reduction of foraminal number from 7 to 6.
I and J show lower jaws with the common African and American cichlid dentary foraminal number 5 (I) and that characteristic of cichlasomines with the next to posteriormost dentary foramen lost (J).

Cichla Schneider

Cichla Schneider 1801, p. 336 (type species *C. ocellaris* Schneider, by subsequent designation in Eigenmann & Bray 1894, p. 611).
Acharnes Müller & Troschel in Schomburgk 1849, p. 622 (type species *A. speciosus* Müller & Troschel, by monotypy).

Cichla species are found all over the Amazon basin, in the Tocantins drainage, the Orinoco basin, and the Guianas, but not on Trinidad, west of the Andes or in southern drainages such as the São Francisco or Paraguay. There is only one species of *Cichla* known from Peru, *C. monoculus*, although several more species have been reported (pp. 45 and 60).

Cichla taxonomy is somewhat difficult because of a large number of nominal species (15), most of which lack either type material or a reliable type-locality or both, and the paucity of fresh material from critical regions. I distinguish tentatively at least eight species in the genus.

Cichla ocellaris is re-described elsewhere (Kullander *et al.* 1986). That species appears confined to the Guianas west from the Marowijne drainage.

Amazonian *Cichla* are identified in current literature as either *C. ocellaris* or *C. temensis* Humboldt. The status of the latter requires further studies, but it does indeed seem to be a wide-spread species in clear and black water of the Negro and Orinoco and rivers of Central Brazilian Amazônia. Most *C. ocellaris* reported from outside the Guianas appear to be *C. monoculus*, but for the purpose of the present paper only selected material will be referred to (material list, p. 352). There are other similar species in the eastern part of the Amazon drainage still awaiting study.

Cichla has been the subject of several recent reviews dealing with phyletic position (Stiassny 1982), life history (Zaret 1980), and particular species (Machado 1971, 1973; Kullander *et al.* 1986).

Cichla species grow very large: *C. monoculus* to at least 34 cm, *C. temensis* to 46 cm (Machado 1971), *C. intermedia* to 42 cm (Machado 1973), *C. orinocensis* to 62 cm (Machado 1973, as *C. ocellaris*), and *C. ocellaris* to at least 41 cm (Kullander *et al.* 1986).

Distinguishing characteristics of the genus include the notched dorsal fin (spines increasing in length to 5th, posteriorly decreasing to penultimate, last spine again longer and tightly joined to soft portion, which as high as anterior spinous portion); scaly fins (except occasionally pectoral fin); large laminar first infraorbital tightly joined to lachrymal; microgill-rakers on both sides of all arches, with spines on exposed surface (fig. 14); long gill-rakers; large mouth with lower jaw projecting.

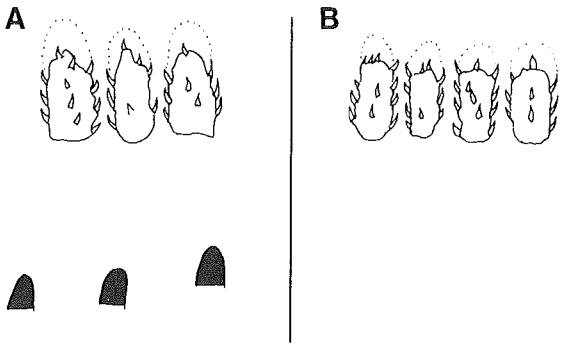


Figure 14. Microgill-rakers of *Cichla monoculus*, NRM SOK/1983354.3680, 175.0 mm SL, as they appear at *c.* 50X magnification, both shown from exposed side; A from external side of 1st epibranchial, gill-filament interspace bases below in black, B, from external side of 4th ceratobranchial; soft tissue cap outlined by dotted line; vertical scale 1 mm.

Stiassny (1982) diagnosed the genus by four autapomorphic features, viz. (1) bilateral elements of lower pharyngeal jaw united anteriorly, posteriorly diverging before sweeping laterad to form posteriorly directed muscular processes; dentigerous area covering almost all of dorsal face; (2) a dorsomedial part of the sternohyoideus muscle originating by a long tendon from the cleithrum and inserting musculously on the urohyal; (3) a flat anteroventral aponeurosis of the pars A1 of the adductor mandibularis, extending caudad over the anteromedial face of the A1, the tendon linking maxilla and A1 inserted nearer the neurocraniad condyle of the maxilla than in other cichlids, (4) a cartilaginous plate uniting hypurals 2 and 3.

A hypural cartilage is present also in *Geophagus* (Kullander *et al.* 1986) and *Biotodoma* (p. 128), and it is doubtful whether the appearance of the lower pharyngeal jaw should be considered apomorphic, resembling the modal percoid condition. A suite of character states suggest that *Cichla* may be a phylogenetically primitive group of cichlids, among which the following may be ranked (see Stiassny 1982 for others).

Lip morphology of *Cichla* is similar to that of most African cichlids and percoids in general, the upper and lower lips attaching to the maxilla without the lower covering a portion of the upper.

Astronotus and *Retroculus* Eigenmann & Bray are the only other American cichlids with such lip morphology, referred to as 'African' lip shape. In all other American cichlids the lower lip attaches to the caudal or medial side of the ventral portion of the upper lip, laterally covering its maxillary attachment ('American type' lips) (fig. 12).

Cichla, Astronotus, Chaetobranchus, Chaetobranchopsis, and *Retroculus* are similar to African cichlids, differing from all other American cichlids in having 7 instead of 6 preopercular lateralis foramina. *Cichla* also has a very wide first post-lachrymal infraorbital which forms a unit together with the lachrymal (Günther 1862); posterior to these are 5 tubular infraorbitals with terminal openings only. A similar arrangement, but with much smaller first infraorbital is found in *Retroculus* and *Astronotus*. The lateralis canal configuration (4+2 foramina) of the lachrymal+first infraorbital is similar in *Cichla, Retroculus* and Old World cichlids except *Hemichromis* Gill. In African cichlids the lachrymal+infraorbital 1 are obviously completely coossified. In *Astronotus* the lachrymal has 3 lateralis foramina, and the lachrymal+infraorbital 1 pattern resembles that of other American cichlids (4 foramina on what appears to be coossified lachrymal+infraorbital 1). Figure 13 shows some of the variation in the lateralis canal system of the preoperculum and suborbital series among American cichlids

Other parts of the lateralis system in *Cichla* is similar to other cichlids. There are 5 dentary foramina, as in African, and most American cichlids.

The flank lateral line continues on the caudal fin by a few scales mainly beween rays V1 and V2. On the dorsal and ventral lobes of the caudal fin are long sequences of tubed scales, between rays D3-D4 and V4-V5, respectively.

Cichla species have 2 supraneurals, the common number among South American cichlids.

Cichla monoculus Spix

Figs 14-16, Pls III (figs 1-4), IV (fig. 1), Table 2

Synonymy

Cychla Monoculus Spix in Spix & Agassiz 1831, p. 100 (descr.; mari Brasiliae), Pl. LXIII (as *Cichla Monoculus*; coloured drawing, habitus).

Cycla toucounarai (pt.) Castelnau 1855, p. 17 (descr.; l'Amazone /not observations in Goyaz and Tocantins/, Pl. 10, fig. 1 (coloured drawing, habitus).

Cichla bilineatus Nakashima 1941, p. 73 (diagn.; descr.; en los lagos y ríos de Sudamérica tropical; behaviour), Figs 2-3 on p. 75 (sketches, habitus, young and adult).

Selected bibliography

Cichla ocellaris; Cope 1878, p. 697 (listed; probably Nauta /specimen not found in ANSP/). -- (*pt.*) Steindachner 1883, p.3 (note; descr. in part; not fig.; Rio Huallaga). -- Eigenmann & Bray 1894, p. 611 (*C. monoculus* new syn.). -- (*pt.*) Fowler 1940*a*, p. 283 (listed; Contamana; bibliogr. only in part). -- Eigenmann & Allen 1942, p. 401 (bibliogr. in part; listed: Peruvian Amazon; Contamana; Yarinacocha; local name; *Cichla bilineatus* new synon.). -- (*pt.*) Fowler 1944, p.261 (Peruvian bibliogr.). -- (*pt.*) Fowler 1945*a*, p. 242 (Peruvian bibliogr.). -- Lüling 1961*a*, p. 176 (listed; Quisto Cocha). -- Lüling 1963, p. 52 (habitat; Quisto Cocha; local name), Abb. 8 (sketch, habitus). -- Tovar Serpa 1967, p. 210 (listed; Uchpa-Caño "caño" (Río Itaya)). -- Bérenz & Zelada 1975, p. 51 (descr.; local name; markets of Iquitos), Fig. 2 (sketch, habitus). -- Lüling 1975, p. 50 (recorded: Yarina Cocha), Abb. 12*pt.* (monochrome photo, habitus), Abb. 14 (sketch, habitus).

Cichla temensis; (?) Steindachner 1883, p. 3 (note; descr. in part; not fig.; Rio Amazonas, Iquitos). -- (?, *pt.*) Fowler 1944, p. 262 (bibliogr. in part, ref. to Steindachner 1883). -- (?, *pt.*) Fowler 1945*a*, p. 243 (bibliogr. in part, ref. to Steindachner 1883).

Cychla monoculus; Whitehead & Myers 1971, p. 495 (authorship).

Material

19 Peruvian specimens, 44.3-295.5 mm SL, discarded specimens to 305 mm SL also consulted, and Brazilian and Ecuadorian material to 343.9 mm SL.

Description

Based on 210.8 mm SL specimen (Pl. III, fig. 1), followed by notes on variation, emphasizing ontogenetic changes, from all NRM specimens (44.3-295.5 mm SL). Counts are from NRM (n=10) or NRM+USNM specimens (n=13); counts from additional, not preserved specimens given separately. Measurements are summarized in Table 2.

Shape. Elongate, laterally compressed, nape edge keeled, abdominal edge rounded, chest flattened; dorsal and ventral edges of caudal peduncle broad and wide. Outline of chest and abdomen straight and about horizontal, lower jaw profile slightly convex, slope of ventral head outline not as strong as frontal profile; frontal outline straight ascending to just in advance of dorsal-fin origin where ascend levelled ut; back outline straight, horizontal along spinous dorsal-fin base, slightly curved, descending along soft dorsal fin; caudal peduncle gradually narrower caudally.

Interorbital convex; orbit below frontal outline and about in middle of head length. Mouth large, oblique, posteriorly as wide as head, much wider than interorbital space; lower jaw prognathous; maxillary tip well exposed, reaching to vertical from 1/3 of orbit; lower jaw articulation below hind margin of orbit. Young (44.3, 46.6 mm) similar to adults, but slenderer; lower jaw distinctly prognathous; maxilla reaching to below anterior 1/3 of orbit, lower jaw articulation below middle of orbit; orbit tangented by forehead outline. Orbit below frontal contour from 138.0 mm specimen; only 295.5 mm specimen with indication of elevated nape. Maxilla reaching 1/3 or middle of orbit.

Scales. Scales ctenoid on body; predorsally, to extrascapulars, cycloid or weakly ctenoid; predorsal midline naked, anterior half with smooth skin, posterior half with papillose skin and thick mucus layer. Chest scales ctenoid except area covered by gill-cover; prepelvic area scales cycloid except naked pit at cleithral symphysis, and posterior 1/3 with ctenoid scales. Squ. long. 68 (2), 69 (1), 71 (1), 72 (1), 73 (2), 74 (3), 75 (2), 77 (1); 74 (2), 76 (1), 77 (1) in discarded specimens. Body scales ctenoid in all specimens available; predorsal scales cycloid back to extrascapulars, except in 175 mm specimen and larger, in which distinctly ctenoid; predorsal midline naked along half to entire extent; prepelvic scales cycloid except posteriorly and in 114.2 and 175.0 mm specimen in which mainly ctenoid; precleithral scales

deeply embedded in skin in the two smallest specimens.

Cheek with about 9 irregular scale-series; scales smaller ventrally, and ventral 1/5 of cheek naked; chiefly cycloid, but ctenoid in about 5 vertical postorbital series; a few scales on posterior margin of infraorbital 1. Preoperculum naked. Opercular scales mostly ctenoid, subopercular scales in 4-5 series mostly ctenoid; 5 cycloid scales posteriorly on interoperculum. Cheek scales cycloid in all specimens, in 8-11 series, but ctenoid in the 4-5 vertical series behind orbit. All head scales cycloid in the two smallest specimens; most or all gill-cover scales ctenoid from 114.2 mm specimen; subopercular scales in about 5-7 series; infraorbital 1 with scales on posterior margin in 114.2, 175.0 and 295.5 mm specimens. Between dorsal fin and upper lateral line anteriorly 12 scale series; 4 scale series between lateral lines where overlapping (by about 6 scales); 18 (dorsally) +1+16 (ventrally) +1 = 36 circumpeduncular scale series. Lateral lines disjunct, parallel where overlapping, in all specimens; counts individual: 35/34, 37/33, 39/32, 40/31, 41/32, 43/33, 43/34, 43/35, 47/35, 49/34, with a tendency for increase correlated with size in count of anterior section; posterior section continued on caudal fin by 2-4 scales.

Fins. First dorsal-fin spine above hind edge of operculum, shorter than succeeding spines which increasing in length to 4th, succeeding gradually shorter to penultimate which a little longer than half length of 5th but shorter than last spine. Lappets pointed, reaching little beyond spine tips. Height of soft dorsal fin about equal to greatest height of spinous dorsal fin; dorsal margin straight, posterodorsal corner rounded, not reaching back to caudal-fin base. D. XV.16 (1), XV.17 (11), XVI.16 (1); XI.16 (1; anterior spinous portion not developed), XV.17 (3) in discarded specimens. Anal-fin origin opposite 6th dorsal-fin ray; first spine very short; soft part damaged. A. III.10 (2), III.11 (10), III.12 (1). Caudal-fin hind edge very little convex, anterior dorsal and ventral margins keeled. Pectoral fin acuminate, 4th ray longest, not reaching to above vent. P. 14 (13). Pelvic fin short, with rounded tip of subequal 1st and 2nd (longest) rays, remaining rays forming straight edge; spine inserted directly below pectoral axilla.

Dorsal-fin spines increasing in length to 4th, 4th to 6th equal in length, succeeding spines shorter to penultimate, last spine longer than preceding and little longer than half length of 4th. Soft dorsal-and anal-fins with rounded-off posterior corners, never extending to caudal-fin base. Caudal fin in two young specimens slightly emarginate, with squared dorsal and rounded ventral hind corner, in the others hind margin very slighty and evenly convex. Pelvic fin with tip formed by subequally long 1st and 2nd rays, inner branch of 1st usually slightly the longest.

Fin scales. All fins scaly. Dorsal fin from behind last spine to behind 11th or 12th ray with small cycloid scales in 1-2 series close behind preceding spine or ray and in deeper ray branches, anterior 5 series pairs basally in contact with body squamation, remaining slightly separated. Anal fin naked between first 2 spines, otherwise a thick basal layer and most of fin except distal parts of posterior rays covered by scales. Pectoral fin with small cycloid scales proximally between 6th-11th rays, ray bases naked, axilla densely covered by cycloid scales. Pelvic-fin lateral side with dense pluriserial layer of cycloid scales between spine and 2nd ray, extending to near fin tip; medial side with 1-2 series of cycloid interradial scales between spine and first ray, 1st and 2nd ray, and basally between 2nd and 3rd ray; dense layer of scales over base of fin; also scales between mayor branches of outer rays. Caudal fin densely scaled, cycloid scales in series on and between rays; distal 2/3 of median portion of central membrane and, narrowly, hind margin of fin naked. Lateral line branched on caudal fin, including short sequence between rays V1 and V2, and long sequences between rays D3-D4 and D4-D5, reaching hind edge of fin and proximally curved to converge with median sequence.

Dorsal, pectoral and pelvic fins naked in two smallest specimens, almost half of caudal fin scaled, anal fin with basal scale layer and 46.6 mm specimen also with a few interradial scales anteriorly. Dorsal fin scaly from

114.2 mm specimen; single series of interradial scales marking middle or basal 3rd of fin, not extending proximad to fin base, from behind last spine to behind 10th ray; double series anteriorly in 146.2 mm specimen; in 295.5 mm specimen also double series along anterior ray edges (ie. 4 series of interradial scales) and scales between major branches of rays 6-12, interradial squamation contiguous with body squamation; posterior part of fin, behind ray 11, invariably naked. Caudal fin scaled to near hind margin from 74.5 mm, but distal about half of middle membrane remains naked at least along middle. Anal fin remaining naked on about 2 posterior membranes and distally on immediately preceding portion, otherwise single interradial scale series in 74.5 mm specimen develop into a thick cover enveloping spines and most of the rays in large specimens. Pectoral-fin base scaly from 175.0 mm specimen. Pelvic fin scaly from 93.6 mm specimen, in which ventral (exposed when fin laid back) surface with single series of scales along all membranes, between spine and first ray along half of spine and gradually shorter on inner rays, dorsal surface with only interradial scales between spine and first ray (to middle of spine) and between 1st and 2nd rays (much shorter); pelvic-fin squamation gradually denser in larger specimens, with double series along outer rays, addition of a series between rays 2-3 on dorsal surface, and in largest specimen ventral surface scales more or less embedded in thick skin. Of caudal fin lateral line sequences, dorsalmost usually straight, not joined to the other, ventralmost proximally dorsad curved and connecting with median sequence; occasionally median continuous with ventral sequence, sequences all separate or in a trifurcate arrangement.

Gill-rakers. Externally on first arch 7-8 epibranchial, 1 in angle, and 13 (9), 14 (2), 15 (1), 18 (1) projecting lower limb rakers; 1-5 plate-like cerato- and hypobranchial rostral difficult to count without dissection, but total cerato+hypobranchial rakers 17 (1), 18(5), 19(1) in 7 specimens in which count possible. Two smallest specimens with 18 projecting + 1 plate-like and 15+3 respectively, so an ontogenic modification of rostral rakers from projecting to plate-like is indicated. Microgill-rakers on both sides of all gill-arches except in two smallest specimens in which absent from internal side of all arches; small, close-set, with rounded-off top and subtruncate or rounded ventral end, appearing massive, with 3-4 spines on each margin and a few on exposed surface and top; a pad of soft tissue capping top (fig. 14).

Jaw teeth minute, strongly recurved, depressible; specimens with open mouths with 4-5 series anteriorly in upper jaw and one less correspondingly in lower jaw arranged in narrow bands; in upper jaw tooth-band slightly widened close to symphysis, in lower jaw rather narrowed close to symphysis.

Vertebrae. 18+17 (1), 18+18 (2).

Colouration. Ground colour grey, light on flanks, dark on back, nape and dorsally on caudal peduncle; most flank scales with light center and dark edge. Lower regions, including prepelvic area and abdomen back along ventral surface of caudal peduncle pure yellowish white. Head sides grey-brown, lower jaw smoky, whitish branchiostegal membrane duskied dorsally, intermandibular region whitish with some dark pigment. Blackish stripe along anterior edge of cheek. Lips dark grey, like preorbital area, snout and forehead. Chest and pectoral axilla dirty greyish; pectoral axilla internally dark grey. Black blotch, including light scale centra, over extrascapulars. Black, not contrasted vertical bar across nape between levels of orbit and preoperculum. Three blackish bars on side, from back close to dorsal-fin base down to below (2 anterior) or to (3rd bar) lower lateral line level, none ocellated. Dark scattered spots between bars give a mottled appearance to flanks.

Spinous dorsal fin black, immaculate; soft dorsal fin dark grey, with about 7 vertical series of white spots. Anal fin dark grey. Caudal-fin ventral lobe uniformly grey, dorsal lobe lighter and with about 6 vertical series of silvery or white spots. Caudal fin ocellus of about diameter of orbit; black nucleus on and above lower lateral line level, ring silvery. Pelvic fin dorsally with rays and scale layer blackish; ventral side unpigmented but dorsal side pigment showing through.

Variation: Ucayali specimens, from white-water, much lighter in overall colour than remainder, which from black-water areas. Coloration otherwise showing marked ontogenic change. In the following, vertical bars are numbered 1-4, beginning with the anteriormost, Bar 4, apparently an individual variant, is on the caudal peduncle.

Young, 44.3-46.6 mm, whitish; back, nape and dorsal part of caudal peduncle greyish, sides dusky down to about level of horizontal band. Snout, preorbital, projecting part of lower jaw dark grey. Pectoral axilla light on both sides. Bars (1-3) dark grey, extending from back at dorsal-fin base onto abdominal sides; each including a black vertically extended spot on middle of side, that in Bar 2 less intense than the other two. Wide black band from caudal spot rostrad to Bar 3, and fainter to Bar 2. Caudal fin smoky except white horizontally elongate spots on each side of proximal half of black band continuing band on body to hind edge of fin; band pigmentation more intense basally on fin. Anal and pelvic fins white or clear. Spinous dorsal fin with some dark pigment basally and along edge, but no pattern formed; larger specimen with horizontal dark stripe along middle of soft dorsal fin.

In 74.5-74.6 mm specimens, which not well-preserved, bars without spots excepting a spot-like widening of Bar 3 in one specimen; horizontal band only faint, to Bar 4 or Bar 3; dark stripe from mouth angle along cheek margin indicated, better expressed in larger specimens; flanks duskied; caudal spot on level of lower lateral line, margined by light spots or semicircles above and below; caudal fin grey, turning black along hind edge; pelvic and anal fin with dark margins; spinous dorsal fin grey, lappet tips blackish, two horizontal series of white spots; soft dorsal fin hyaline, with two dark horizontal stripes.

93.6 mm specimen with dorsum blackish; greyish sides contrasting against white ventral areas; pectoral axilla inside dusky, in larger specimens blackish; horizontal band remaining, dark grey, from caudal spot to Bar 4 position; anal fin and dorsal part of pelvic fin greyish; spinous and soft dorsal fin blackish, with 2 and 3 series of white spots, respectively; caudal fin dark grey with indistinct light spots in dorsal lobe, generally better expressed in larger specimens; caudal ocellus fully formed, in dorsal rather than mid-axial position, black nuclear part of pupil diameter, with white, ventrally incomplete ring of eye diameter.

114.2 mm specimen retaining, as largest specimen, a trace of the horizontal band; differing from smaller specimens in two blackish bars across nape just anterior to dorsal fin and in blackish spot over proximal extrascapular; also in indistinct scattered small light spots along middle of side, which shown also by 138.0 mm specimen but not by larger specimens.

Light dorsal-fin spots retained in 146.2 mm specimen, apparently lost from spinous portion in those larger. Ucayali specimens with dark spot in Bar 3 above lateral line level, with some silvery spots adjacent in the larger specimen; a single nape bar in 175.0 mm specimen and those larger. 295.5 mm specimen uniquely distinguished by numerous black, light-ringed small spots behind pectoral axilla posteriorly to Bar 3. Of large non-NRM specimens ($\geq$200 mm) ocellated spot dorsally in Bar 3 noted in one Nanay (ANSP 139117) and Contamana specimen.

Adult *C. monoculus* from Jatún Cocha, R. Tefé, R. Oyapock and Manaus are either similar to the lighter Peruvian *C. monoculus* or have black bars short, blotch-like and contrasting against light sides (Pl. IV, fig. 1). The blotches may be narrowly ocellated and usually there are scattered small dark spots on the back. The spinous dorsal fin is contrastingly black. Such specimens are found among both sexes, and I tentatively regard it as breeding colour pattern as males with this pattern have a distinct nuchal protuberance. Among Peruvian specimens not preserved (Trueno Cocha, Belém market, port of Jenaro Herrera, Llanchama Cocha), *c.* 300 mm SL, many had the bars similarly reduced.

Life colours. Adults from the very turbid Trueno Cocha were yellowish on sides, white ventrally. A narrow orange (anteriorly) to yellow (posterior-

ly) band ran from the mouth angle to the lower caudal-fin base. The caudal ocellus was ringed with golden, the pelvic, anal, and lower half of caudal fin were dark red, the irish yellowish red. Adults from the Nanay were either olive green to yellowish, with contrasted white ventrum and grey fins, or similar to Jenaro Herrera fish with orange-yellow ventral band and reddish lower fins. Black vertical bars were deep black and much more contrasted in living than in preserved specimens. Juveniles from the Napo were olivaceous with faint brassy sheen, ventrally white, the caudal-fin base dull yellowish.

Tefé material. Ten R. Tefé specimens measured (Table 2) agree with Peruvian material in shape features. A higher frequency of 16-spined specimens and higher squ. long. count average is notable among counts: D. XV.15 (1), XV.16 (1), XV.17 (2), XVI.15 (3), XVI.16 (2), XVI.17 (1); A. III.10 (3), III.11 (6), III.12 (1); P. 14 (8), 15 (2); squ.long. 72 (2), 73 (1), 74 (1), 76 (2), 77 (2), 81 (1), 83 (1); lateral lines 41/33 (1), 41/36 (1), 43/36 (2), 44/35 (3), 44/36 (1), 46/34 (1), 51/34 (1); gill-rakers - (2), 14 (4), 15 (2), 16 (2), discounting plates.

Ecuadorian material. Two BMNH specimens from Jatún Cocha (presumably that near the Peruvian border, in the Napo drainage) are not well preserved. Counts are: D. XV.16 (1), XV.17 (1); A. III.10 (1), III.11 (1); P. 13 (1), 14 (1); squ. long. 73 (1), 76 (1); lateral lines 38/39 (1), 45/35 (1); gill-rakers 13 (1), 14 (1), discounting plates. The smaller specimen, in reasonable state of preservation has 3 contrasting dark blotches on the back and one anteriorly on the caudal peduncle, and numerous small dark spots scattered over the dorsal sides.

Distribution (figs 15-16)
Peruvian localities are scattered from Yarina Cocha to the lower Napo along the Ucayali-Amazonas. Extralimital material consulted for this paper is from the Napo in Ecuador, the lower R. Tefé, Codajás, Manaus, R. Oyapock and Bolivian Amazonía (Beni, Guaporé and Madre de Dios drainages). The species is much more widespread in the Amazon basin, and may be expected to be much more widely dispersed in Peruvian Amazonía.

Ecology
Cichla monoculus has been collected in a number of different biotopes. Adults were caught on artificial bait along the shoreline of Nanay tahuampa lakes (SOK 96, 97; blackwater), and by seining in the cut-off Trueno Cocha (SOK 81, white-water). Large numbers of adults were obtained in Trueno Cocha in 1981 (SOK 46a) but not preserved. Seining in open systems, such as along lake shores and playas of the Nanay and Mazán produced only a few young specimens.

Local names
Tucunaré (Iquitos, Puerto Alegre; Lüling 1963: Quisto Cocha), occasionally Tucunari (Jenaro Herrera), familiarly 'Tucu' (Iquitos). Tucunaré, Tucunari (Bérenz & Zelada 1975: markets of Iquitos), Tucunari (Steindachner 1883: Rio Huallaga; Eigenmann & Allen 1942: E Peru).

Notes
Material here regarded as *C. monoculus* is identified with reference to the description and, particularly, the figure in Spix & Agassiz (1831). The description was made by Agassiz, the plate under Spix's supervision (Kottelat, in press).

Agassiz cites as reference for his description of *Cychla monoculus* a 13" long specimen in spirit of wine, with the locality 'mari Brasiliae'. The Spix and von Martius collection was destroyed when the Munich Museum was bombed in 1944. Kottelat (1984), however, recognized some material from that collection in the Museum d'Histoire naturelle de Neuchâtel (MHNN), where it was brought by Agassiz. One stuffed *Cichla* specimen, MHNN 2188, was identified by Kottelat (1984) as potential holotype of *C. monoculus*. I have

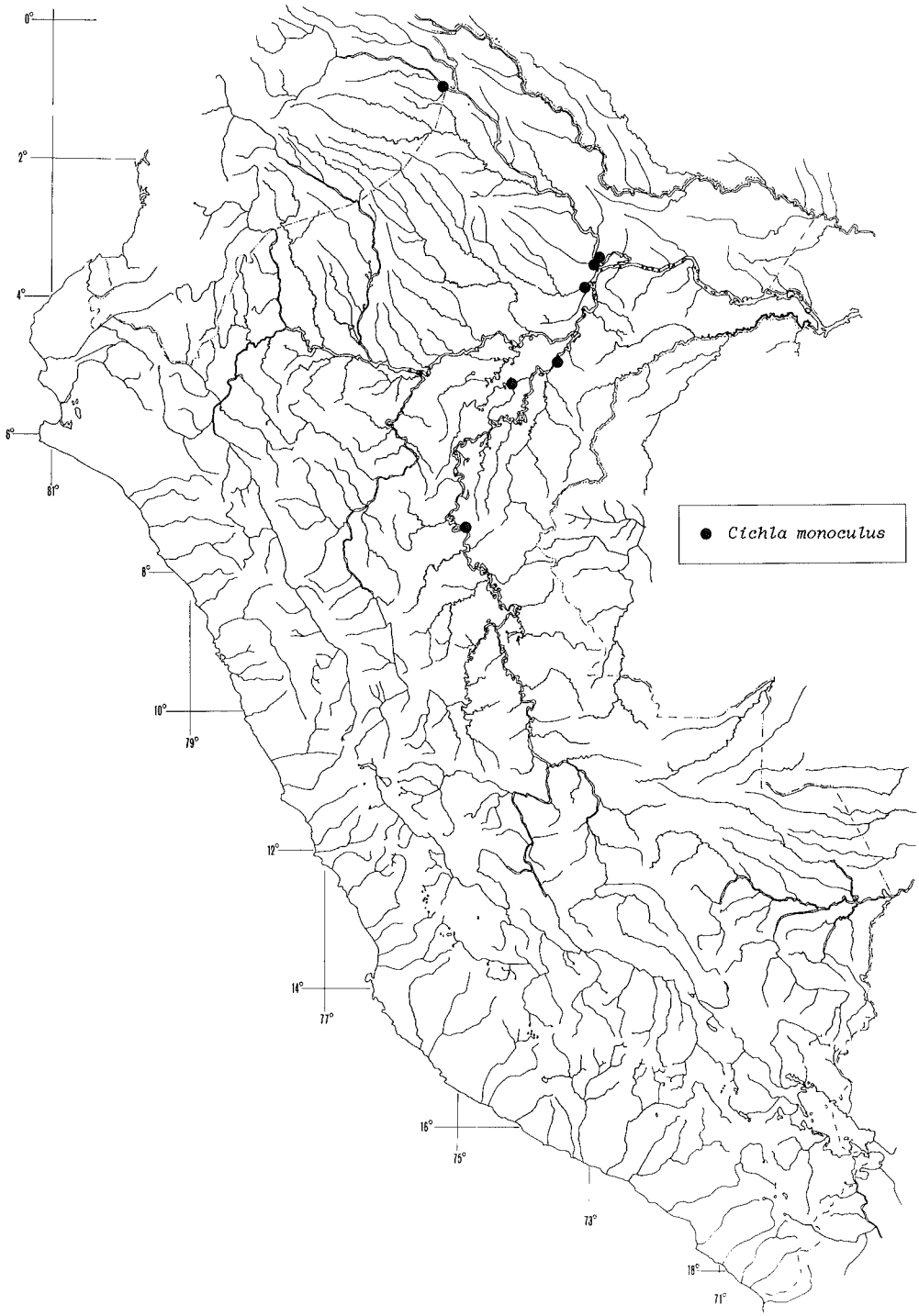


Figure 15. Collecting localities of *Cichla monoculus* in western Amazonía. A dot may represent more than one collecting site.

seen a colour photograph of it and Kottelat (*in litt.* 1984) has also taken some counts and measurements. The specimen is mounted on a wood plate with the left side toward the plate. It is 365 mm TL.

I think there is good reason to doubt that the MHNN specimen is the holotype of *C. monoculus*, both because it is stuffed, not alcohol-preserved as stated by Agassiz, and because it does not agree in length with the 13" measured by Agassiz. I do not know what duodecimal system was used but assumedly total length is intended. 365 mm corresponds to 13"6'" in the Parisian system, nearly 15"4'" in the Hamburg system, and about 13"11'" in the Viennese system (calculated on the basis of the conversion table in Isbrücker 1980). It is 15" with the Bavarian system, which most likely was that applied by Agassiz (1" = 24.32 mm, M. Kottelat, pers. comm.). The figure (Spix & Agassiz 1831, Pl. LXIII), measures *c.* 258 mm, and is not supposed to be natural size.

As it appears on the slide, MHNN 2188 is not much dissimilar from the specimen on Spix's plate, which is, I think, a very well-executed drawing. However, whereas MHNN 2188 (which has been painted) has 3 blackish blotches on the back between the dorsal fin and lateral line, the Spix drawing shows 3 dark grey ventrad narrower bars from the dorsal fin to below the middle of the side. The description says 'Back dark, marked by black bands and spots /small scattered spots as shown on the plate/. Yellowish side ornated by large black white-margined ocelli, such ocellus on caudal-fin base. Dorsal fin blackish. */Dorsum fuscum, fasciis et maculis nigris notatum. Latera flavicantia ocellis majoribus nigris albo cinctis ornata; talis ocellus ad basin pinnae caudalis. Pinna dorsalis nigricans./* The two specimens apparently represent two different colour phases recognized for *C. monoculus*, viz. breeding (MHNN 2188) and non-breeding (plate). On the slide (showing the right side) it looks like the lower lateral line is upcurved anteriorly to contact the upper lateral line shortly anterior to the end of the latter. Agassiz's description and Spix's figure (of the left side) are of a discontinuous lateral line, the upper with a slight ventral shift of the posterior portion.

Whereas it seems unlikely that MHNN 2188 was used for the description or figure of *C. monoculus* it is still likely that the specimen originates from the Spix and von Martius collection. As the figure is sufficiently informative for identification of the species, no type material is required at present. Authorship citation for Spix & Agassix (1829-1831) here follows Whitehead & Myers (1971), for both book and taxa. Maurice Kottelat has reexamined the authorship problem and will propose changed taxon-author combinations in several cases (Kottelat, in press).

Among *Cichla* species so far named, *C. monoculus* is most similar to *C. ocellaris*, in being comparatively deep-bodied and with a squ. long. count range between about 70 and 80. It differs from *C. ocellaris* as rediagnosed by Kullander *et al.* (1986) in:

(1) discontinuous lateral line - usually continuous in *C. ocellaris*;

(2) early lower jaw prognathy - jaws isognath at about 50 mm SL in *C. ocellaris*, lower prognath in smaller *C. monoculus*;

(3) lacking fainter vertical bars (Bars 1a, 2a in *C. ocellaris*) between the three principal dark bars (Bars 1, 2, 3) on the side, Bars 1-3 much wider than in *C. ocellaris* and extending ventrad from the dorsal-fin base instead of well removed from the dorsal-fin base, bars in breeding fish reduced and intensified to 3 black spots dorsal to the lateral line instead of faint;

(4) shallower caudal peduncle in large specimens (depth 12.0-13.2 % of SL, $\bar{x}$ = 12.5±0.12 in 11 *C. ocellaris*, 138.6-324.1 mm SL; 10.3-12.3 %, $\bar{x}$ = 11.2±0.15 in 14 *C. monoculus*, 138.0-324.5 mm SL; in young comparably shallow in the two species).

Cichla temensis is slenderer (depth 24.0-27.3 % of SL, $\bar{x}$ = 25.5±0.30 in 12 specimens, 158.4-315.0 mm SL) and has much smaller scales (squ. long. 108-127). *Cichla orinocensis* as it was described by Machado (1971, as *C. ocellaris*) has 3 large ocelli along the middle of the side. *Cichla intermedia* as described by Machado (1971) has numerous short bars along a narrow

TABLE 2. *Morphometry of* **Cichla monoculus** *from Peru and Rio Tefé. Measurements in per cent of SL except SL (in mm). Measurements are as explained in fig. 10, except that head and snout lengths direct, and 5th (about longest) rather than last dorsal-fin spine measured.*

	Peru			*R. Tefé*		
	n	Range	$\bar{x} \pm S(\bar{x})$	n	Range	$\bar{x} \pm s(\bar{x})$
SL (mm)	11	44.3-295.5	128.5±23.02	10	156.9-335.4	252.8±25.09
Head length	11	31.8- 35.3	33.8± 0.31	10	32.5- 34.5	33.7± 0.19
Head depth	11	21.2- 25.8	23.6± 0.38	10	22.2- 25.5	24.0± 0.32
Body depth	11	27.1- 34.6	30.3± 0.69	10	29.4- 32.1	30.8± 0.25
Snout length	11	9.2- 13.0	11.1± 0.32	10	11.2- 12.6	11.9± 0.17
Orbital diameter	11	7.3- 11.3	9.2± 0.40	10	7.5- 8.6	8.3± 0.12
Interorbital width	11	7.7- 9.3	8.6± 0.18	10	17.8- 9.9	8.9± 0.24
Pectoral-fin length	9	22.6- 26.5	24.3± 0.47	10	23.3- 28.9	25.3± 0.47
Upper jaw length	11	13.8- 16.0	14.6± 0.20	10	14.5- 16.8	15.7± 0.30
Lower jaw length	11	18.7- 21.0	19.4± 0.25	10	18.8- 21.2	19.6± 0.27
Caudal peduncle depth	11	9.9- 12.3	10.9± 0.22	10	10.7- 11.8	11.1± 0.13
Caudal peduncle length	11	17.1- 20.2	18.5± 0.30	10	16.6- 20.1	18.4± 0.40
Length of 5th dorsal-fin spine	11	12.7- 15.8	14.3± 0.26	10	11.7- 14.3	13.3± 0.29

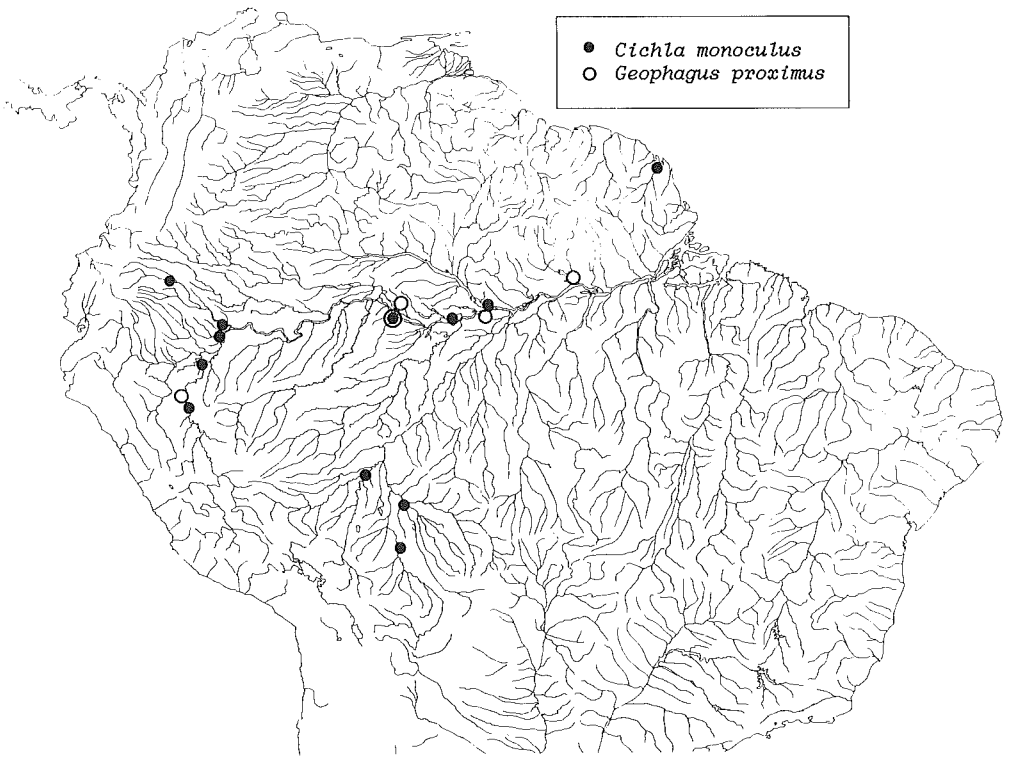


Figure 16. Collecting localities of *Cichla monoculus* and *Geophagus proximus*. A symbol may represent more than one, adjacent collecting sites.

lateral band.

Bolivian material appears indistinguishable from *C. monoculus* from elsewhere, but the 4 specimens consulted do have high metameric counts (D. XV.18, XVI.17, squ.long. 81-87).

Cycla toucounarai Castelnau was described on the basis of two specimens of *C. monoculus* (MNHN A.9490), unfortunately lacking precise locality data. They are labeled simply as coming from the 'Amazone', although Castelnau mentioned having obtained his species in the 'lac des Perles' in Goias, the Tocantins and the 'Amazone'. Castelnau's description is not quite in accordance with my data from the syntypes. He gives D. XV.17 (actually XVI.17), A. II.11 (actually III.11). I count *c.*71 and *c.*79 squ. long. scales, instead of 72-75 as given by Castelnau. The larger syntype (Pl. IV, fig. 1) is a male with nuchal hump, the smaller specimen a female. The male is brassy with contrasted wide brown bars, one across nape over nuchal hump, two below spinous dorsal fin and one below soft dorsal fin, reaching little ventral to upper lateral line, and one less distinct anteriorly on caudal peduncle. A few brown spots scattered on side under adpressed pectoral fin. Caudal spot black, ringed with silver. The smaller specimen is similar, but faded.

Castelnau compared *C. toucounarai* with *C. monoculus*, referring to Spix & Agassiz, and put forth the constant absence, in 'an immense quantity' of *C. toucounarai*, of spots on the belly as a distinguishing character. Both syntypes of *C. toucounarai*, however, have abdominal side spots.

Nakashima's (1941) *C. bilineatus* was compared by its author with *C. ocellaris*, probably with reference chiefly to Eigenmann (1912), and distinguished expressly by separate lateral line from young age instead of continuous in young and divided in adult, nearly completely scaly caudal fin, and 'genealogy' of spot pattern. The description is probably based on specimens taken near Iquitos. There may be type material preserved at some local museum or at the Universidad Mayor de San Marcos in Lima, but it has not been searched for. The description and figures are in agreement with *C. monoculus* reported from Peru in the present paper.

Steindachner (1883) reported a 22 cm SL specimen of *C. ocellaris* from the R. Huallaga, and a 26 cm SL specimen of *C. temensis* from Iquitos. They were obviously in a poor state of preservation. Steindachner figured (Pl. I, figs 2,3) both species, but the figures are based on young specimens not identical with the Peruvian material reported on. The figure of a young *C. temensis* (Pl. I, fig. 3) thus cannot be taken as evidence of the existence of *C. temensis* in Peru. I am uncertain of the identity of the specimen figured as *C. ocellaris*. The '*C. temensis*' from Iquitos was discarded in 1909, and the '*C. ocellaris*' (Museum für Tierkunde, Dresden, MTD F348) is presently in such a bad state of preservation that a loan has been deemed inadvisable (W. Hebig *in litt.* 25 Nov 1985). Photographs of the side and back confirm the poor condition of the specimen; it is a *Cichla* specimen and judging from the large scales and narrow caudal peduncle, is probably a *C. monoculus*.

Astronotus Swainson

Crenilabrus (Astronotus) Swainson 1839, p. 229 (type species *Lobotes ocellatus* Agassiz, by monotypy).

Acara Heckel, 1840, p. 338 (type species *A. crassipinnis* Heckel, by subsequent designation in Eigenmann & Bray 1894, p. 616).

Hygrogonus Günther 1862, p. 303 (type species *Lobotes ocellatus* Agassiz, by monotypy).

Astronotus are relatively large cichlids, common in the fish markets in Amazonía. The largest *Astronotus* specimen measured, from the Paraguay drainage, is 240 mm SL (Kullander 1981*a*). Kullander (1981*a*) reviewed the taxonomy of *Astronotus*, in particular the variation in meristics.

There are obviously several species in the genus, distributed over the Amazon basin, the Orinoco basin, French Guiana and the northern part of the Paraguay drainage. Pond culture use has led to more extensive dispersal of one or more species.

Astronotus, *Chaetobranchus* and *Chaetobranchopsis* have large microgill-rakers that bear numerous spines on the exposed surface (fig. 18), quite unlike those of other cichlids in which microgill-rakers are comparatively small and, except in *Cichla* (p. 54), spines are few and restricted to lateral margins. Unlike *Chaetobranchus* and *Chaetobranchopsis*, *Astronotus* has 'African type' lips (fig. 12A) like *Cichla* and stout, medianly contiguous lower pharyngeal tooth-plate like most other cichlids. There are 7 preopercular and 5 dentary lateralis foramina. The lachrymal has only 3 foramina and there are six infraorbitals, the third with a middle foramen. Two supraneurals. *Astronotus* species are readily identified in the field with reference to colour pattern and the long, extensively scale-sheathed dorsal- and anal-fin bases.

Some controversy surrounds the application of the generic name *Acara*, which is here regarded as a synonym of *Astronotus*. *Lobotes ocellatus* is type species of *Astronotus* by monotypy. The genus *Acara* originally included 20 species, currently assigned to 9 different genera (*Aequidens*, *Laetacara*, *Bujurquina*, *Cichlasoma*, *Acaronia*, *Astronotus*, *Geophagus*, *Oreochromis* Günther, *Astatotilapia* Pellegrin).

Gill (1858) conditionally ('if...really distinct from *Astronotus*') and by restriction reduced *Acara* to contain only *A. crassipinnis* (spelt *crassispinis*).

Eigenmann & Bray (1894) and Eigenmann (1910) considered Gill's restriction as a designation of *A. crassipinnis* as type species of *Acara*. Regan (1905*b*), however, considered Gill's action invalid because it would make one species (*A. crassipinnis* regarded as synonym of *L. ocellatus*) type species of two synonymous genera, and he thus used *Acara* in place of *Aequidens*.

Gill's designation would seem actually to be invalid with reference to ICZN article 67c3, which does not accept designations made 'in an ambiguous or conditional manner'. Article 69b does not seem to apply. Eigenmann & Bray's citation of Gill's type designation of *A. crassipinnis* has validity under the ICZN article 69aiv, which accepts as type designation any statement indicating a type species provided that the species was originally included and that the author accepts it as type species, even if the rationale be wrong (eg. contrary to ICZN ruling). Thus, *A. crassipinnis* is the type species of *Acara* by subsequent designation in Eigenmann & Bray (1894), and all support (Eigenmann & Bray 1894, Eigenmann 1910) or objections (Regan 1905*b*) concerned with Gill's conditional restriction are irrelevant.

Astronotus ocellatus (Agassiz)

Figs 17-20, Pl. IV (figs 2-3), Table 3

Synonymy

Lobotes ocellatus Agassiz in Spix & Agassiz 1831, p. 129 (diagn.; descr.; Oceano Atlantico), Pl. LXVIII (coloured drawing, habitus).
Acara compressus Cope 1872, p. 256 (descr.; the Ambyiacu).
Acara hyposticta Cope 1878, p. 697 (descr.; Peruvian Amazon).

Peruvian bibliography

Chromys ocellata; Castelnau 1855, p. 16 (note; l'Amazone et...l'Ucayale). -- Eigenmann & Eigenmann 1891, p. 73 (listed as incertae sedis species).
Hygrogonus ocellatus; Cope 1872, p. 256 (listed; Ambyiacu River).
Acara (Acara) ocellata; (*pt.*) Steindachner 1875, p.77 (status of *Acara compressus* discussed).
Acara ocellata; Cope 1878, p. 697 (listed; Peruvian Amazon).

Acara (Hydrogonus) ocellata; Steindachner 1883, p. 2 (note; Rio Huallaga).
Astronotus (Astronotus) ocellata; (*pt.*) Eigenmann & Eigenmann 1891, p. 68 (*A. compressus* in synonymy).
Astronotus (Acara) hypostictus; Eigenmann & Eigenmann 1891, p.68 (listed).
Astronotus ocellatus; Pellegrin 1904, p. 182 (*Acara compressus* in synonymy). -- (*pt.*) Fowler 1940*a*, p. 284 (listed; Contamana; bibliogr. only in part; local name). -- Fowler 1944, p. 271 (Peruvian bibliogr.). -- Fowler, 1945*a*, p. 252 (Peruvian bibliogr.). -- Tovar Sepa 1967, p. 210 (listed; Uchpa-Caño "Caño" (Río Itaya)). -- Bérenz & Zelada 1975, p. 50 (descr.; local name; markets of Iquitos), Fig. 1 (sketch, habitus). -- Lüling 1975, p.50 (listed; Yarina Cocha; mittleren Ucayali), Abb. 12*pt.* (monochrome photo, habitus). -- (*pt.*) Kullander 1981*a*, p.681 (geographical variability, status of nominal species). -- Vierke 1983*d*, p. 440 (recorded; Yarinacocha).
Astronotus hypostictus; Pellegrin 1904, p. 183 (bibliogr.; descr. abstr. Cope). -- Fowler 1944, p. 272 (bibliogr.). -- Fowler 1945*a*, p. 253 (bibliogr.). -- Fowler 1954, p. 279 (bibliogr.), Fig. 867 (sketch; holotype, habitus)
Lobotes ocellatus; Whitehead & Myers 1971, p. 495 (authorship).
Acara compressus; Böhlke 1984, p. 57 (type material listed).
Acara hypostícta ; Böhlke 1984, p. 58 (holotype listed).

Material
50 specimens from Peru, 28.4-*c.*213 mm SL, including type series of *Acara hypostícta* and *A. compressus*; also consulted extralimital material from the Solimões drainage.

Description
From 4 adults, 157.2-169.9 mm SL, with observation of juvenile characteristics from NRM SOK/1983343.3697; measurements from 14 specimens summarized in Table 3, counts from these only or include also other NRM, ZMA, USNM and ANSP specimens (n = 46 or less). Refer to Pl. IV, figs 2-3 for general aspect.

Shape. Moderately elongate; laterally compressed, widest in region of anterior of flank and posterior part of head; in anterior view body outline a narrow oval. Anterior half of predorsal contour straight ascending, posteriorly less steeply, gradually ascending through edge of dorsal-fin scale sheath to soft dorsal fin; dorsal-fin base contour sloping from about middle of spinous portion. Prepelvic contour little convex, nearly as steep as predorsal contour, abdominal edge straight, slightly sloping, deeper at anal-fin origin than just posterior to pelvic-fin bases. Caudal peduncle edges about horizontal; ventral longer than dorsal. Head short; snout short, a blunt triangle in lateral aspect, narowly rounded off in dorsal aspect. Interorbital wide, slightly curved, as wide as or wider than mouth. Orbit slightly below forehead contour, entirely in upper and anterior halves of head. Tip of maxilla exposed, reaching to vertical from anterior 1/3 of orbit; lower jaw articulation below middle of orbit. Lower jaw slightly prognathous. Both lip folds interrupted, but upper thick and wide across symphysis; junction of upper and lower lips of African type. Opercular and pectoral girdle bones smooth. Young (*c.* 30 mm) with relatively longer head than adults; interorbital flat; predorsal contour straight to above middle of orbit, thence slope rapidly less; dorsal-fin base contour gently sloping; prepelvic contour straight, distinctly less steep than predorsal; greatest depth at pelvic-fin bases; mouth large, maxilla reaching 1/4 of orbit; upper lip narrowly continuous symphysially, narrowly interrupted in 44.2 mm specimen.

Scales. Cycloid predorsally, on head, on back below spinous dorsal fin ventrally to upper lateral line or 3 scale series below, anteriorly on flank dorsal to pectoral axilla, on chest and prepelvic area. Predorsal midline scales irregularly arranged, about 15-17 along midline, of varying size, largest size of anterior flank scales. Chest scales half size of anterior flank scales. Prepelvic scales posteriorly of about half flank scale size,

slightly smaller anteriorly, in about 7 horizontal series. Squ. long. 34 (7), 35 (9), 36 (6), 37 (1), - (2). About 27-29 circumpeduncular scale series (12-13 above, 13-14 below lateral lines). Upper lateral line at 7 (anteriorly) to 4-5 (posteriorly) scale series distance from dorsal-fin base; overlapping lower, on 4th scale-series below, by 3-4 scales. Lateral lines of 20/12 (3), 21/11 (1), 21/12 (2), 21/13 (1), 22/12 (3), 23/12 (4) scales; the ultimate in each or both may be pored in juveniles.

Cheek scales in about 6 series which ventrally are shorter; wide naked line continuing preorbital margin to preoperculum; bordering anterior part of horizontal limb of preoperculum a series of 6-9 small scales, occasionally one below and/or above that series; 2 vertical scale series behind orbit. Opercular scales in about 4 vertical series, subopercular scales in 2-3 series; interoperculum with 1-2 scales close to preopercular corner and 6-7 scales in principal series leaving lower half of exposed part of bone naked. Preoperculum naked.

Young (*c.* 30 mm) scaled like adults, but all scales cycloid and ventro-rostral cheek scale series missing; ctenoid scales on abdomen, close above anal-fin base posteriorly and on edges of caudal peduncle in 44.2 mm specimen, in which also ventral cheek scale series appearing, of 6 scales.

Fin scales. Most of soft unpaired fins covered by dense scale layer. Spinous dorsal fin bordered by posteriorly progressively wider scale layer with straight margin, caudally covering about half of last spine; no structural difference between flank and fin squamation, but scales gradually smaller dorsally. This basal scale layer continued onto basal 1/3 of soft dorsal fin but interradial scales distal to it widening the scaly layer to basal 1/2 of fin medially (relatively wider anteriorly where rays shorter), last membrane only with basal scales; interradial scales in 2-3 series between rays, also some scales between branches of longer rays. Save some basal scales all dorsal-fin scales cycloid. Anal fin similarly scaled, last 3 membranes, however, scaly only basally, most scales ctenoid, and only narrowly naked along ventral margin.

Pectoral fin naked except that 169.9 mm specimen with a small cycloid scale between rays 6 and 7 on right side. Anterior (medial) side of pelvic fin naked except in 169.9 mm specimen in which 4 outer membranes with single short series of cycloid scales basally and another between branches of 1st ray; posterior (lateral) side with a short scale series basally, but not reaching proximad to base, on first ray, in 162.5 mm specimen a similar series also on 2nd ray. All pelvic fin scales cycloid. Interpelvic squamation extended laterad to cover bases of pelvic-fin-rays. Caudal fin completely scaled save for narrow zone along hind margin; basally ctenoid scales; interradial cycloid scales in 3-4 series between rays, distally irregularly arranged. Lower lateral line continued by 2 (as in juveniles) or, usually, 3 scales in slightly ventrad directed series to ray V1; short additional sequences between rays D3-D4 (absent in young and on one side in 169.9 mm specimen; otherwise of 1-8 tubed scales, usually with gaps between them, continued to hind edge of fin by pored scales) and V4-V5 (absent or a single tubed scale in specimens about 30 mm; 4 tubed scales in 44.2 mm specimen; 7-13 tubed scales in adults, behind middle of fin pored scales to near fin edge; no gaps between tubes; sequence not or only slightly upturned proximally).

Young, *c.* 30 mm, with scaly basal skin cover of spinous dorsal fin, on soft fin only narrow basal scale layer and 4 last membranes naked; anal fin anteriorly with scales to middle of rays, less posteriorly; basal 1/3 of caudal fin scaled. 44.2 mm specimen has added a narrow zone of interradial scales, in single series, distal to basal scale-layer of soft dorsal fin; the scaly zone of the anal fin is slightly wider as compared to smaller fish; half of caudal fin scaly.

Fins. First dorsal-fin spine inserted slightly in advance of vertical from hind margin of operculum; relative length of spines increasing to 4th from which subequal, but last again slightly longer, twice length of first or slightly longer. Lappets reaching little beyond spine tips, anterior

with rounded margin, posterior with truncate margin. Soft dorsal fin with rounded tip, reaching to not quite middle of caudal fin or to 3/4 of caudal fin. D. XII.21 (2), XIII.19 (7), XIII.20 (33), XIII.21 (3), XIV.20 (2). Anal-fin origin opposite soft dorsal-fin origin; soft portion similar to soft dorsal fin, but not reaching beyond middle of caudal fin. A. III.6 (1; abnormal), III.15 (3), III.16 (25), III.17 (9), III.- (3).

Pectoral-fin with blunt dorsal tip, 4th ray longest, hind margin truncate or slightly curved; reaching to above 1st or 2nd anal-fin spine. P. 15 (16), - (1). Pelvic-fin spine inserted below pectoral axilla; fin pointed, with outer branch of first ray longest, reaching to first anal-fin spine to 1/3 of soft-anal fin base, inner rays gradually shorter. Caudal fin with hind edge rounded in 157.2 mm specimen, damaged in the others but was probably rounded in these as well.

Rays of soft unpaired fins are generally not movable because of dense scale cover, only naked tips of rays and posterior rays in dorsal and anal fins flexible.

Young, *c.* 30 mm similar to adults in finnage, but pectoral fin rounded; pelvic fin pointed, but first ray not prolonged although of extension as in adults; caudal fin rounded; dorsal and anal fins with rounded tips reaching to 1/3 of caudal fin.

Gill-rakers. 2 epibranchial, 1 in angle, and 8 (1), 9 (15), 10 (2) ceratobranchial rakers externally on first gill-arch. Gill-rakers externally on first gill-arch (fig. 17) short, compressed, heavily denticulate on medial side, 3 anterior rudimentary and denticuli exposed to lateral aspect, anteriormost raker in figured specimen a mere ossified plate. Microgill-rakers, externally on 2nd and 3rd gill-arches, and on both sides of 4th arch, elongate thin plates with narrowly rounded top and subtruncate ventral end, slightly arched (convex abbranchially) in lateral aspect, with marginal projections along ventral half and numerous close-set minute spines on exposed surface (fig. 18). In some juveniles inner 4th arch microgill-rakers rudimentary and few.

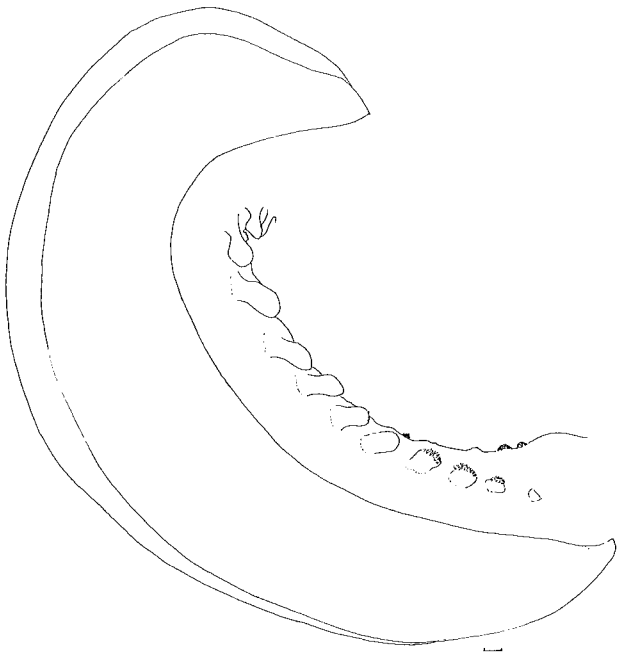


Figure 17. Lateral aspect of first gill-arch of *Astronotus ocellatus*, NRM SOK/1983354.3691, 166.0 mm SL. Scale 1 mm.

Teeth. Teeth in outer series stout, conical, pointed, little recurved; anterior 3-4 in each jaw half stronger than the rest, *c.* 2 mm long, in upper jaw a more gradual size difference between these and posterior teeth than in lower jaw; outer series to near end of upper jaw and of corresponding length in lower jaw; inner band of very small weak teeth, less than 0.5 mm long, only anteriorly in jaws, in 2 series, occasionally 3 series in lower jaw. 12-17/12-15 teeth in upper/lower jaw outer hemiseries in specimens *c.*30-*c.*200 mm SL, with tendency for increased number in upper jaw with increasing SL. Teeth smaller in juveniles, but otherwise dentition as in adults.

Tooth-plates. Dissected 166.0 mm specimen with 6 teeth on small tooth-plate on left side of 4th ceratobranchial, right side 4th ceratobranchial edentulous. Lower pharyngeal tooth-plate (fig. 19) with rather few but strong teeth, all stout and firmly attached; along lateral margin subconical, inner teeth gradually larger mediad and caudad, those in posterior series laterally compressed, with antrorse posterior cusp and anterior shelf. Bicuspid shape gradually transformed to mammiform along middle; posterior admedian teeth slightly compressed anteriorly and posteriorly. Most inner teeth showing signs of wear or abrasion.

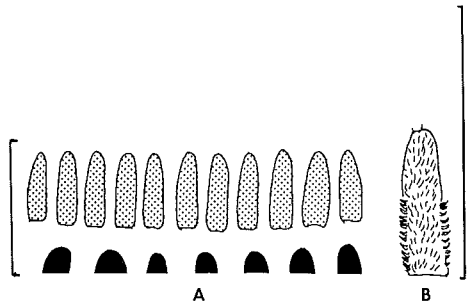


Figure 18. Microgill-rakers from medial side of 4th ceratobranchial of *Astronotus ocellatus*, NRM SOK/1983354.3691, 166.0 mm SL. A, diagrammatic, showing regular alignment, microgill-rakers shaded, gill-filament interspaces black, scale 1 mm; B, semidiagrammatic, exposed surface of microgillraker to show appearance at low magnification *in toto*, scale 1 mm.

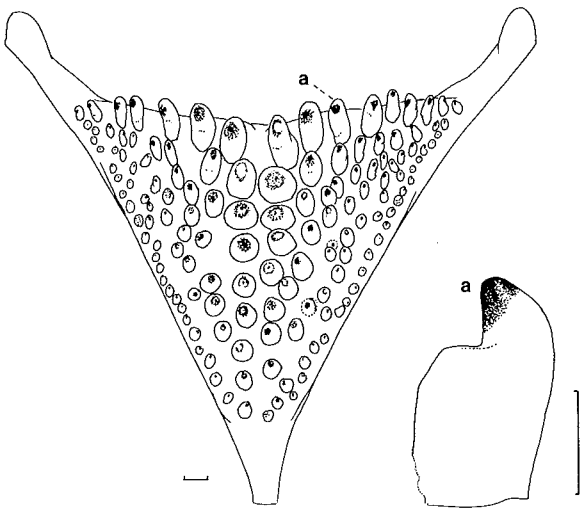


Figure 19. Occlusal aspect of lower pharyngeal tooth-plate, and posterior tooth in lateral aspect of *Astronotus ocellatus*, NRM SOK/1983354.3691, 166.0 mm SL. Scales 1 mm.

Vertebrae. 15+17 (3).

Colouration. Ground colour light greyish, chest dirty silvery, abdominal midline whitish; operculum and cheek grey-brown, snout and forehead brown; lower head silvery overlayered with grey-brown. Blackish stripe continuing free preorbital margin on cheek vanishing before reaching preopercular corner. Minute dark brown dots marginally on gill-cover and adjacent pectoral girdle dorsal to pectoral axilla.

Sides adorned with dark (brown or grey brown) vertical bars and fields of different width and courses in each specimen and on the both sides of each specimen. The following is a generalization from the 8 sides of the 4 large Trueno Cocha specimens: A wide vertical bar of ground colour across side above vent and spinous anal fin; anterior to that bar dark except for light band from light vertical bar at level of lower lateral line forwards across anterior two lateral line scales and around nape where, however, usually drowned in dark nape colour. Midflank light vertical bar usually divided on abdominal sides, lambda-shaped, legs of bar separated by wedge-shaped dark blotch, but anterior leg, extending to anterior part of abdomen, may be isolated. From dark field ventral to light horizontal band, a dark band running to pelvic-fin base; faintly continous with identical bar on opposite side. Faint dark band across throat between posterior part of interoperculae. Behind light vertical midflank bar 1-2 wide dark bars above anal fin, more or less divided or otherwise of irregular shape, another relatively constant between ends of bases of soft vertical fins, and a dark vertical blotch or bar over end of caudal peduncle. Black scale edges more or less evident, chiefly in dark markings.

Fins greyish. Scaly basal part of dorsal fin with a series of black silver-ringed spots of varying irregular appearance, different on each side of each specimen. Anteriormost ocellus, or group of ocelli posteriorly above brown field anterior to light vertical midflank bar; posteriorly in series, last spot the most constant in presence and position, over beginning of caudal peduncle, usually similar to caudal-fin ocellus. Caudal-fin ocellus constant, deep black with silvery ring that touches median caudal-fin lateral line and marginally also extends onto caudal peduncle; diameter of complete ocellus equal to that of eye (iris). Pectoral fin with black or, usually, grey large spot over bases of middle rays externally; internally a much more intense, deep black blotch covering bases of rays except about 5 ventral and a greater or lesser part of axilla.

Juveniles whitish with dominating light brown or brown blotches; fin markings brown or dark brown. Considerable individual variation in flank markings, but fin and head pattern rather constant.

If body regarded as brown, the following light markings may be generalized: (1) An X-marking over middle of side, composed of light stripe from just posterior to pelvic-fin base obliquely dorsad and caudad, continuous or narrowly separated from stripe obliquely ventrad and rostrad from over upper lateral line to level of lower lateral line; from lower end of latter stripe slightly dorsad inclined stripe craniad to trifurcate head stripe (see below) often separated from it over upper lateral line; posterior leg of X dorsad and craniad from white spot on anal-fin base; (2) often 2 white spots above anterior arm of X above lateral line; (3) spot on caudal peduncle below lower lateral line and often 1-2 spots on dorsal margin of peduncle; (4) spot on back just posterior to end of upper lateral line, extended by stripe dorsad onto dorsal fin; (5) spot similar to preceding above anal-fin base usually isolated; (6) white around and between pelvic-fin bases; (7) stripe across throat below suboperculae; (8) prepelvic area light rostrally (ie. a dark stripe separating anterior prepelvic area and preceding light stripe); (9) spot on base of pectoral axilla; (10) small spot on side dorsal to pectoral axilla; (11) belly midline white.

If head regarded as dark, the following are principal light markings: (1) stripe marking extrascapulars, ventrally divided with one branch to rostral arm of X-marking on body, the other branch continued ventrally on anterior edge of operculum and on vertical limb of preoperculum onto interoperculum;

(2) stripe with intensified dark edges from cheek just posterior to mouth across throat, the dorsal end of this stripe interpreted as the early phase of the dark stripe back from the mouth seen in adults; (3) underside of lower jaw anteriorly white with intensified dark edges, especially noticeable dark margin of lower jaw along lower lip; (4) spot on junction of lips at maxilla and adjacent lip parts; (5) stripe along posterior margin of orbit, often segregated into spots, one posterior to orbit, the other posteroventral to orbit and often extended as stripe down to the cheek; (6) spot on infraorbital 1; (7) many minute spots on nape and forehead (8) narrow stripe along head midline from between eyes to upper lip.

Blackish spot over bases of median pectoral-fin rays on exposed side of fin; on medial side a corresponding spot expanded over axilla.

Fins except hyaline pectoral fin marbled dark and light. If fins regarded as basically dark, the following light markings appear: spinous dorsal fin with some light dots and often a wavy line along base; 2-3 light stripes over soft portion; dark spot on base of posterior soft portion appearing constant and intensified. Anal fin much like dorsal fin plus a prominent white spot over base of spinous portion and adjacent body. Pelvic fin with white spots. Caudal fin with blackish spot basally close above lower lateral line level; prominent white vertical spot on each lobe slightly distal to base and narrowly separated by brown at caudal spot level; 1-2 uneven light cross-bands or spot-series distal to dark bar succeeding basal light spots.

44.2 mm specimen not showing contrast-rich juvenile pattern, but tending to uniform brownish with light markings only indicated; light head markings lost, instead distinct stripe back from mouth angle and many small dark dots on cheek, preorbital and preoperculum, and behind orbit. Dorsal and anal fins greyish with few clear dots distally on soft parts. Two small blackish spots on scale-cover margin at middle of dorsal fin. Pelvic fin dark brown, edge of inner rays clear. Pectoral fin lateral spot faint, medial spot strong. Caudal-fin spot ocellated with white (not silvery), ocellar diameter slightly less than that of eye; caudal fin otherwise greybrown with indistinct light cross-stripes of dots.

Life colours. Adults from Trueno Cocha were similar to preserved fish, though the soft dorsal- and caudal-fin margins were narrowly red, and the large dorsal- and caudal-fin ocelli brick red.

Distribution (fig. 20)

Astronotus ocellatus is recorded from along the Ucayali (Iparia, Yarina Cocha, Contamana, Supay system) and Amazonas (near Iquitos, Pebas) in Peru. It occurs also in the Solimões (lower R. Tefé; Codajás), and Içá (Cuiabá). Uncertainty about species taxonomy in this genus prevents characterization of the possibly wider distribution.

Ecology

Personal collections of adults are from the white-water floodplain lake Trueno Cocha in the Supay lake system near Jenaro Herrera (SOK 46a and SOK 81). These collections actually yielded large numbers of 15-20 cm *Astronotus* but only the smaller were preserved. Trueno Cocha was, on both occasions, nearly dried up, with an average radius of less than 100 m, yet very rich in large fishes. The water was turbid and very warm in the surface (to 38°C in 1983). *Astronotus ocellatus* is probably much more abundant and widespread in Peru than current collections indicate.

Local name

Acarahuazú/carahuazú (Iquitos, Jenaro Herrera; Bérenz & Zelada 1975: markets of Iquitos); variant spelling 'Acarahugsu' recorded by Fowler (1940*a*) for Contamana material.

Notes

The genus *Astronotus* is widely distributed in South America, with many

localities along the Amazon River, a few in the Oyapock, Approuague, Negro, Branco, Orinoco, and Paraguay drainages, and in Bolivian Amazonía. As indicated in recent reviews of the genus (Burgess 1974; Kullander 1981*a*), the status of nominal species of *Astronotus* is not clear. The above description serves the purpose of providing basic data on *A. ocellatus*, with consideration of variation. The possible distinction of additional species of *Astronotus* from other parts of the generic range is still a subject requiring more investigation. Geographically correlated variation, recorded so far chiefly in colouration and dorsal-fin counts (Kullander 1981*a*), should be more carefully studied, but indicates that *Astronotus* includes more than one species. *Astronotus crassipinnis*, synonymized with *A. ocellatus* since Günther (1862) is recognized herein, p. 70.

No type material of *A. ocellatus* exists (Kullander 1981*a*), and the type locality (Atlantic Ocean) is obviously incorrect. Nevertheless, Spix & Agassiz's plate (1829-1831, Pl. LXVIII) shows a series of black, white-margined spots along the base of the dorsal fin. Such spot series are characteristic, as far as known, only for adult *Astronotus* of the Ucayali-Amazonas and Solimões, which may have up to 12 of these ocelli. *Astronotus* from elsewhere either lack these ocelli or have only one or two. I thus identify the Ucayali-Amazonas-Solimões *Astronotus* as *A. ocellatus*, the only extra-Peruvian localities being Tefé, Codajás and Cuiabá. I see no immediate need for a neotype of *A. ocellatus*.

Agassiz's plate shows the fish green dorsally, yellowish on lower flanks, brownish on head, chest and ventrally, not overall green as on Burgess's (1974) reproduction.

Two nominal species are obviously junior synonyms of *A. ocellatus*, viz. the Peruvian *Acara compressus* and *A. hyposticta*. The type materials of *A. hyposticta* (ANSP 21286, about 69.1 mm SL) and *A. compressus* (ANSP 9180, about 57.4 mm SL, ANSP 9136, about 50.5 mm SL) are presently in a very bad state of preservation. Of the former, Cope (1878) wrote 'in rather bad condition', of the latter (1872) 'Color, injured by the alcohol...'.

Both were described as *Acara* species, although at the time removal of *A. ocellatus* to a separate genus, *Hygrogonus*, had already been proposed by Günther (1862) (Günther, for some reason, did not consider Swainson's (1839) names).

The *A. compressus* description (Cope 1872) includes no reference to particular diagnostic traits; perhaps Cope considered the description as sufficient. In the same paper, *A. ocellatus* is listed, as a *Hygrogonus* species. This specimen (ANSP 9041, 180 mm; but possibly also ANSP 9040, *c.* 117 mm SL) is correctly identified, and large as it is, it is somehow understandable that the small *A. compressus* were described as a different species in a different genus.

The *A. hyposticta* description (Cope 1878) points out the numerous soft radii of median fins and the 'peculiar' colouration as particularly diagnostic. The next entry in that paper lists *Acara ocellata*, signifying a change in Cope's opinion of the validity of *Hygrogonus*, obviously following Steindachner (1875). Again, the *A. ocellatus* (probably ANSP 22009, *c.* 200 mm SL) is correctly identfied, and much larger, explaining the reference to colouration in the diagnosis of *A. hyposticta*, whereas the reference to fin counts would seem to be in comparison with other *Acara* species.

About the same fin counts are given for *A. hyposticta* (D. XIII.19, A. III.15) and *A. compressus* (D. XIII.19, A. III.15 1/2), however. I count D. XIII.20 in all three, and A. III.16 in *hyposticta*, A. III.15 and A. III.16 in the *compressus*. There is nothing in Cope's description or on the actual specimens to indicate that *hyposticta* or *compressus* would be specifically different from *A. ocellatus*. The holotype of A. *hyposticta* has a trace of the caudal spot, which was not mentioned by Cope, but the types of *A. compressus* are now completely discoloured. The specimens are too small to show diagnostic dorsal ocelli. One of the *A. compressus* syntypes (ANSP

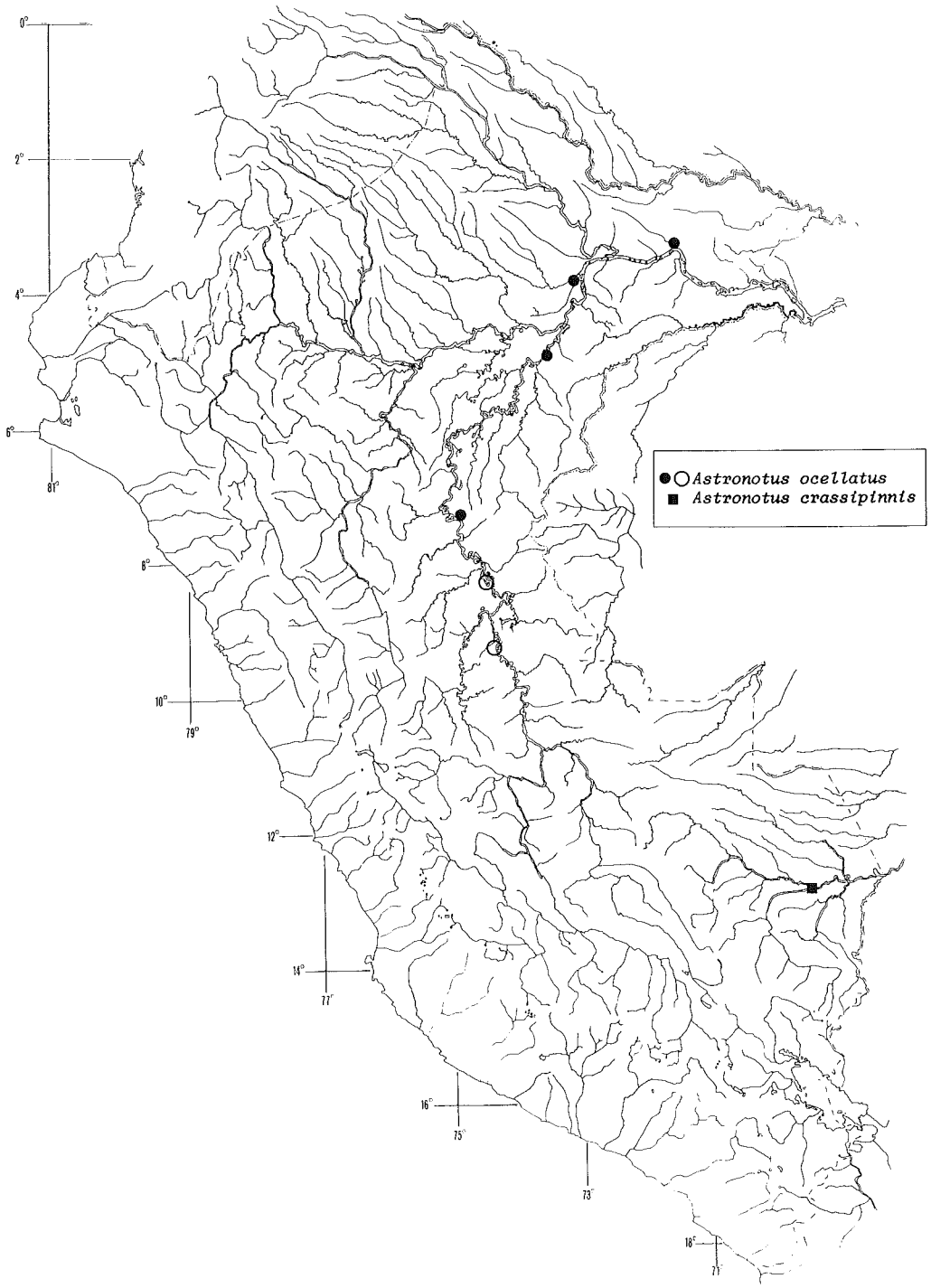


Figure 20. Collecting localities of *Astronotus* species in western Amazonía. Open circles designate literature records.

9180) was labeled holotype by Böhlke (1984) and is thus the lectotype (ICZN article 74a).

Astronotus zebra Pellegrin (1904) and *Astronotus orbiculatus* Haseman (1911c) were both described from Santarém, on the basis of material lacking dorsal ocelli. *Cychla rubroocellata* Jardine (1843) was described from the Rio Negro, and is both described and figured with an ocellus on the base of the soft dorsal as well as one on the caudal fin. The status of these names is unclear.

The colour pattern of juvenile *A. ocellatus*, as described above (and Pl. IV, fig. 3) is certainly different from that figured for much smaller Paraguayan *Astronotus* (Kullander 1981a), but the two patterns might very well represent ontogenetic phases. Peruvian *Astronotus* differ from Paraguayan *Astronotus* in possessing ocelli along the dorsal-fin base, and in different dorsal-fin count frequencies (D. XI.- (2), XII.- (14), XII.20 (1), XII.21 (28), XII.22 (9), XIII.- (3), XIII.20 (11), XIII.21 (4) in Paraguayan material, from Kullander 1981a). The Paraguayan *Astronotus* is referable to *A. crassipinnis* (below).

Astronotus crassipinnis (Heckel)
Pl. V (fig. 1), Table 3

Acara crassipinnis (*pt.?*) Heckel 1840, p. 357 (diagn.; descr.; Villa Maria, Caiçara; Matogrosso; Rio-negro; Rio-branco).

Description

Only a single Peruvian specimen is available, 159.4 mm SL, not well-preserved. It agrees in most characters with adult *A. ocellatus* as described above, so the following description emphasizes individual features; measurements are given in Table 3.

Shape. Relatively slender in comparison with Ucayali *Astronotus*; contours, see Pl. V, fig. 1.

Scales. As in *A. ocellatus*, but cycloid on back only to below middle of spinous dorsal fin and in more restricted anterodorsal flank area. Cheek scales in 9 series, plus 2 series of 9 and 6 scales respectively in ventral division of cheek squamation. Interoperculum well-scaled; 2 series, upper of 9, lower of 6 scales. Squ. long. 40. Lateral lines: 23/16; upper at 8 anteriorly, 4 1/2 posteriorly scales distance from dorsal-fin base, posteriorly in 4th scale-series dorsal to lower line which it overlaps by 6 scales.

Fin scales. Right side pectoral fin with 2 basal scales. Pelvic fins naked. Dorsal, anal and caudal fin scaly as in *A. ocellatus*, but most scales, except distal interradial, ctenoid.

Fins. Both spinous and soft dorsal fin mutilated. Soft anal fin with rounded tip reaching nearly to middle of caudal fin. Caudal fin mutilated distally. Pectoral fins mutilated, partly regenerated, reaching to at least nearly anal-fin origin. Pelvic fin pointed, reaching to first anal-fin ray. D. XIII.22. A. III.c.16. P. 15. No dorsal lobe lateral line tube sequence on caudal fin; 4 scales in median sequence.

Gill-rakers. 2+1+9 externally on first arch. Microgill-rakers externally on 2nd and 3rd arches, on both sides of 4th arch; also internally dorsally on right side 3rd arch.

Teeth. As in Ucayali *Astronotus*. 3 inner series in lower jaw, 2 in upper.

Vertebrae. 15+18 (1).

Colouration. Not well-preserved. Yellowish whitish with brown bars and blotches, caudal-fin ocellus, pectoral axilla spots and cheek stripe as in *A. ocellatus*, but no ocelli on dorsal-fin base, and first light flank bar slightly more anterior in position. Probably only one dark bar in position of first light bar of *A. ocellatus*.

Distribution

A single specimen from the R. Inambarí. Bolivian material of *A. crassipinnis* comes from the Beni, Mamoré and Guaporé drainages, and in the Paraguay drainage the species is collected southward to Puerto Max, Paraguay.

Notes

Assignation of the single, poorly preserved *Astronotus* specimen from the Madre de Dios drainage to *A. crassipinnis* is somewhat provisional, pending improved material availability. I have examined 24 specimens from the Guaporé (including types of *A. crassipinnis*), Beni, and Mamoré drainages that are referred to *A. crassipinnis* in addition to the Madre de Dios specimen.

Astronotus crassipinnis is recognized on the basis of the following character states in comparison with *A. ocellatus*.

(1) Colouration. The absence of ocelli along the dorsal-fin base. Such are invariably present in *A. ocellatus* from western Amazonia. The bar pattern is variable in both species, but *A. crassipinnis* is overall darker, and recognized in particular by having the anteriormost light vertical bar more anterior than in *A. ocellatus* (well in advance of the tip of the pectoral fin) and two more or less well-separated dark vertical bars in the position of the first light bar in *A. ocellatus*.

(2) Dorsal fin count. The 25 Amazonian *A. crassipinnis* have XII.21 (11), XII.22 (7), XIII.19 (1), XIII.20 (1), XIII.21 (4), XIII.22 (1). These soft ray counts average high compared to *A. ocellatus* (Peruvian material modal count XIII.20; XIII.21 is rare, no specimen with 22 rays available of *A. ocellatus*), and the frequency of 12-spined specimens is comparatively high (cf. 2 of 47 Peruvian *A. ocellatus*). D. XII.21 is modal count among Paraguayan *Astronotus*, which also have a high frequency of 22-rayed dorsal fins.

(3) Scale count range which higher than in *A. ocellatus*. This character shows much variation among *Astronotus* material. Squ.long. counts vary from 35 to 40 among *A. crassipinnis*; larger series are needed to show if higher counts are aberrant or more frequent than in *A. ocellatus* (34-37 in Peruvian material, 33-39 species range, but 35 modal).

As the Paraguayan *Astronotus* agree in colouration and counts with *A. crassipinnis* it is consequently referred to that species (see Kullander 1981*a* for review).

Only two syntypes of *A. crassipinnis* have been located in NMW, although five localities were given by Heckel. These two specimens (NMW 58776, 24261) are both labeled 'Rio Guapore'. An eventual lectotype designation would restrict the type-locality to the Guaporé, validating the present restriction of the name *crassipinnis* to Bolivian-Paraguayan *Astronotus*, but it should be noted that such a restriction is formally still not quite correct.

Table 3. *Morphometry of* Astronotus *species in Peru. Measurements are in per cent of SL, except SL (in mm).*

	A. ocellatus Young			*A. ocellatus* Adult			*A. crassipinnis*
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}$	(n=1)
SL (mm)	10	29.0-44.2	31.5±1.45	4	157.2-169.9	163.9	159.4
Head length	10	36.5-38.9	38.0±0.23	4	33.1- 34.5	33.6	32.7
Snout length	10	6.4- 7.1	6.7±0.09	4	6.4- 8.1	7.0	6.9
Body depth	10	43.3-49.5	45.6±0.53	4	46.5- 49.6	47.8	44.7
Orbit diameter	10	14.8-16.0	15.3±0.11	4	9.2- 9.3	9.3	8.9
Head width	10	20.1-20.9	20.5±0.08	4	20.3- 21.0	20.7	19.1
Interorbital width	10	10.9-12.4	11.7±0.17	4	14.2- 15.4	14.9	13.2
Preorbital depth	10	2.4- 3.1	2.6±0.06	4	3.9- 4.3	4.1	3.4
Caudal peduncle depth	10	14.3-16.2	15.4±0.17	4	17.5- 18.2	17.8	17.3
Caudal peduncle length	10	7.9-10.1	9.3±0.20	4	6.8- 8.0	7.5	7.3
Pectoral-fin length	10	27.8-31.2	28.9±0.35	4	33.0- 34.5	33.7	--
Pelvic-fin length	10	28.0-37.1	30.9±0.79	4	32.0- 41.9	36.1	29.6
Length of last dorsal-fin spine	10	16.7-19.9	18.0±0.28	4	12.7- 13.6	13.2	11.9

Chaetobranchus Heckel

Chaetobranchus Heckel 1840, p. 401 (type species *C. flavescens* Heckel, by subsequent designation in Eigenmann 1910, p. 469).

This genus is composed of two very different species, *C. flavescens* and *C. semifasciatus* Steindachner, characterized by the very long and numerous gill-rakers. These species are distinguished from *Chaetobranchopsis* Steindachner (one or two species) with similar gill-rakers, by anal-fin spine number: 3 spines in *Chaetobranchus*, 5-6, rarely 4, in *Chaetobranchopsis*. The taxonomy of these genera is not clear. Microgill-rakers are of the same shape as in *Astronotus*, but found also, uniquely among cichlids, on the lower pharyngeal tooth-plate. In other characters, *Chaetobranchus* is very different from *Astronotus*, eg. in having 'American type' lips, a basibranchial tooth-plate (unique for cichlids), and lacking separate infraorbital 1 (lachrymal with 4 pores). Although one of the Peruvian specimens radiographed has only one supraneural, 2 is characteristic for the species (and genus). The most recent revision of the genus is that of Regan (1906*b*).

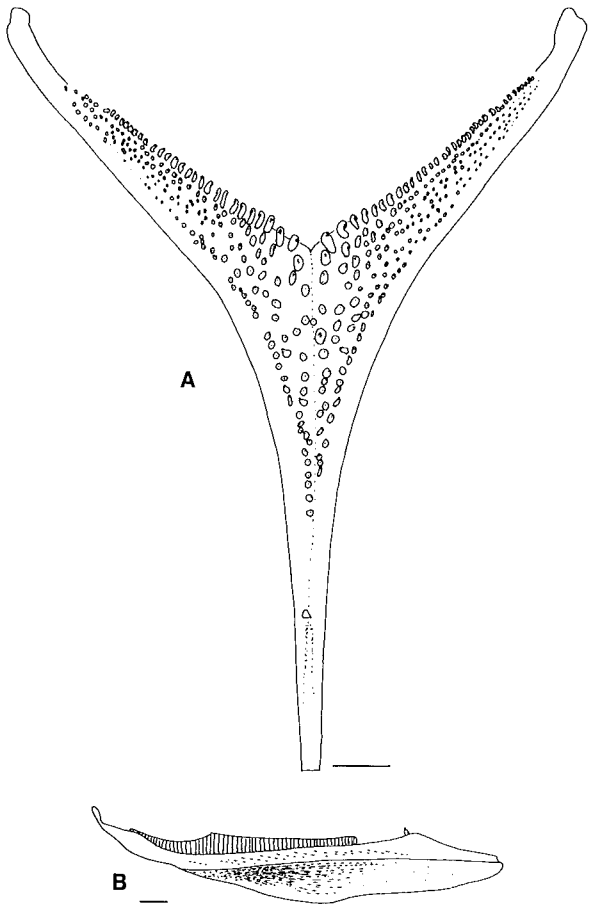


Figure 21. A occlusal and B lateral aspect of lower pharyngeal tooth-plate in *Chaetobranchus flavescens*, NRM SOK/1981353.3498, 88.3 mm SL. Scales 1 mm.

Chaetobranchus flavescens Heckel
Figs 21-22, Pl. V (fig. 2), Table 4

Synonymy
Chaetobranchus flavescens Heckel 1840, p. 402 (diagn.; descr.; Fluss Guapore und in der Nähe seiner Ufer gelegenen Moräste; Ausflusse des Rio-negro).
Chaetobranchus bruneus Heckel 1840, p. 405 (diagn.; descr.; Rio-negro, unweit von seiner Mündung).
Centrarchus cyanopterus Jardine 1843, p. 165 (descr.; Essequibo), Pl. 16 (coloured drawing, habitus).
Chromys ucayalensis Castelnau 1855, p. 15 (descr.; Sarayacu (Pérou)), Pl. 6, fig. 3 (coloured drawing, habitus).
Chaetobranchus robustus Günther 1862, p. 310 (descr.; Guiana).
Geophagus badiipinnis Cope 1872, p. 251 (descr.; Ambyiacu River), Pl. XI, fig. 1 (sketch, habitus, holotype).

Peruvian bibliography
Acara (?) *ucayalensis*; Günther 1862, p.281 (bibliogr.; diagn.; data from Castelnau 1855).
Geophagus badiipinnis; Cope 1878, p.697 (note on type material). -- Pellegrin 1904, p. 190 (bibliogr.; descr. abstr. Cope). -- Böhlke 1984, p. 57 (holotype listed; synonym of *Chaetobranchus flavescens*).
Chaetobranchus flavescens; Steindachner 1875, pp. 122 (*Geophagus badiipinnis* a synonym), 129 (*Geophagus badiipinnis* and *Chromys ucayalensis* questionable synonyms). -- Eigenmann & Eigenmann 1891, p. 70 (*Geophagus badiipinnis* and *Chromys ucayalensis* as questionable synonyms). -- Eigenmann & Bray 1894, p. 610 (*Geophagus badiipinnis* and *Chromys ucayalensis* in synonymy). -- Pellegrin 1904, p. 200 (holotype of *Chromys ucayalensis* included in descr.). -- Regan 1906*b*, p. 51 (*Geophagus badiipinnis* and *Chromys ucayalensis* in synonymy). -- Eigenmann 1912, p. 483 (*Geophagus badiipinnis* and *Chromys ucayalensis* in synonymy). -- Fowler 1940*a*, p. 280 (bibliogr.; listed; Contamana). -- Eigenmann & Allen 1942, p. 387 (bibliogr.; distr.; listed: Lago Cashiboya; Iquitos; Rio Itaya; Contamana; Yarinacocha; Maranon). -- Fowler 1944, p. 260 (Peruvian bibliogr.). -- Fowler 1945*a*, p. 242 (Peruvian bibliogr.). -- Fowler 1954, p. 285 (bibliogr.; *Geophagus badiipinnis* in synonymy), Fig. 872 (sketch, holotype of *G. badiipinnis*).
Geophagus (Mesops) badiipinnis; Eigenmann & Eigenmann 1891, p. 70 (listed).
Chromys ucayalensis; Blanc 1962, p. 206 (holotype listed).
Aequidens sp. Bérenz & Zelada 1975, p. 53 (descr.; local name; markets of Iquitos), Fig. 8 (sketch, habitus).

Material
16 Peruvian specimens, 82.9-186.1 mm SL, including holotypes of *Chromys ucayalensis* and *Geophagus badiipinnis*; also consulted Brazilian, Guianan and Bolivian material, including type materials of *C. flavescens*, *C. bruneus* and *C. robustus*.

Description
From large adults, with comparative notes on young. Measurements are summarized in Table 4. Counts from measured specimens (n=15).

Shape. Deep; laterally compressed, widest in scapulo-thoracal region. In anterior view oval, chest slightly broader than nape. Predorsal contour straight, ascending to dorsal-fin origin; dorsal-fin base contour horizontal or slightly ascending anteriorly, descending from posterior spinous portion through soft portion. Prepelvic contour slightly convex, not as steep as predorsal; in slender specimens depth gradually increasing to anal-fin origin; deep specimens equally deep at pelvic-fin bases. Anal-fin base contour steeply ascending, slightly convex; dorsal and ventral margins of caudal peduncle of equal length, straight horizontal. Head deep; snout wide, broadly rounded off

in dorsal view, broadly triangular in lateral aspect. Orbit tangential in young, up to about 150 mm SL, in middle of head length and in upper half of head depth. Interorbital wide, width of mouth or slightly greater; rather flat to about 150 mm SL, vaulted in larger specimens. Lips of American type, fold of both continuous. Jaws equal or lower slightly prognathous; maxilla concealed or slightly exposed, extending caudad to, or slightly beyond, vertical from anterior margin of orbit; lower jaw articulation below middle of orbit; ascending processes of premaxilla reaching slightly beyond anterior margin of orbit, length equal to or slightly less than that of alveolar processes. Opercular entire.

Scales. Squ.long. 25 (5), 26 (9), - (1). Weakly ctenoid except predorsally, anteriorly on back close to dorsal fin, cheek except commonly some ctenoid scales posterodorsally, gill-cover, occasionally (Yaquerana specimens) anteriorly on throat. Predorsal scales irregularly arranged, of varying size, most about 1/2-2/3 size of anterior flank scales. Prepelvic scales posteriorly of about 1/2 size of anterior flank scales, smaller rostrally; throat sides scaly. Preoperculum naked. Cheek scales in 5-7 not well defined series of which 1-2 lower separated anteriorly by a naked line extending back from free preorbital margin, totals 5(2), 6(12), 7(1). Opercular scales numerous, in about 5 straight vertical series. 2 series of subopercular scales and 1 over margin of suboperculum and operculum, free edge of suboperculum broadly naked. 5-6 interopercular scales in single series ventral to preoperculum. A short vertical series of scales on rostral process of preoperculum onto interoperculum. 16 horizontal scale series on caudal peduncle. Between upper lateral line and dorsal fin 3 1/2-4 1/2 scale series anteriorly and 1 1/2-2 posteriorly. 2 horizontal scale series between lateral lines, which overlapping by 3 or 4 scales; counts: 17/9 (1), 17/10 (2), 17/11 (2), 18/9 (4), 18/10 (4), 19/9 (1), -/13 (1).

Fin scales. Fins naked except caudal fin, which scaled to about middle in young, to near hind edge and then also between ray branches in large specimens; interradial scales mostly cycloid in young, ctenoid in adults. Lower lateral line continued on caudal fin usually in continuation with one of ventral lobe tubed scale sequences. Configuration of accessory lateral lines very variable, especially in ventral lobe; a sequence between rays D1-D2 (absent on one side in one specimen) not connecting with median sequence and ventral lobe sequence between rays V3-V4 usually continuous with lower lateral line; ventral lobe variants in 13 specimens (both sides): V2-V3 sequence only (5); V3-V4 sequence only (8), V2-V3 and V3-V4 sequences (6); V1-V2 sequence only (1); V1-V2 (short) and V3-V4 sequences (3); V1-V2 (long), V2-V3 and V3-V4 sequences (1); V1-V2 (short), V2-V3, V3-V4 sequences (1); D1-V1, V1-V2 (long) and V2-V3 sequences (1). Caudal fin lateral lines extending to or beyond scale cover of fin, including over 20 scales in large specimens.

Table 4. *Morphometry of* Chaetobranchus flavescens *and* Acaronia nassa *from Peru. Measurements are in per cent of SL, except SL (in mm).*

	Chaetobranchus flavescens			*Acaronia nassa*		
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$
SL (mm)	15	82.9-186.1	138.9±8.97	23	38.4-121.8	69.8±5.33
Head length	15	34.1- 38.7	35.6±0.35	23	35.4- 40.1	38.1±0.28
Snout length	15	9.3- 10.6	9.8±0.10	23	7.3- 10.1	8.8±0.18
Body depth	15	43.0- 49.0	46.5±0.44	23	43.4- 49.7	45.5±0.31
Orbital diameter	15	10.5- 13.4	11.6±0.24	23	12.2- 17.6	15.3±0.32
Head width	15	18.2- 20.2	19.5±0.15	23	18.2- 22.0	19.8±0.20
Interorbital width	15	12.9- 14.9	14.2±0.14	23	8.4- 11.1	9.7±0.14
Preorbital depth	15	5.9- 8.6	7.6±0.19	23	2.6- 4.2	3.3±0.10
Caudal peduncle depth	15	15.6- 17.7	16.8±0.15	23	16.3- 19.4	17.3±0.14
Caudal peduncle length	15	7.8- 10.2	9.4±0.21	23	7.3- 9.6	8.6±0.12
Pectoral-fin length	14	41.5- 47.0	44.0±0.51	23	34.4- 41.9	37.9±0.38
Pelvic-fin length	14	29.5- 42.8	35.3±0.86	23	36.0- 58.2	43.6±1.15
Last dorsal-fin spine length	14	17.2- 23.3	19.8±0.43	21	18.8- 24.0	21.8±0.27

Fins. First dorsal-fin spine inserted well in advance of vertical from hind margin of operculum, about 1/3 length of last spine; spines increasing in length to last; anterior lappets pointed, posterior with straight dorsal margin and posterior point, reaching little beyond spine tips. Soft dorsal fin damaged in most specimens, but in Supay specimens rays 4-7 with long filaments from above about middle of caudal fin to end or beyond of caudal fin; roundish fin edge in 96.8 mm specimen with incipient filament extensions. D. XIII.13 (13), XIII.14 (2). Anal fin in posterior third of body, first spine opposite last dorsal-fin spine. Soft fin damaged in most specimens; bluntly pointed and reaching to middle of caudal fin in 96.8 mm specimen; in 150.9 mm Supay specimen with long filaments of rays 4, 5 and particularly 6, from about middle to about end of caudal fin. A. III.10i (1), III.11 (13), III.12 (1). Pectoral fin long, pointed 4th ray longest, reaching to above 3rd to 7th anal-fin ray. P. 14 (9), 15 (6). Pelvic-fin, below pectoral fin, frequently damaged, otherwise pointed, outer branch of first ray prolonged, reaching to 3rd spine or 3rd ray of anal fin. Caudal fin damaged in all specimens, but in 148.0 and 151.8 mm specimens with long filaments of produced rays, in 96.8 mm specimen subtruncate.

Gill-rakers. 52 (1), 54 (2), 55 (1), 56 (2), 58 (3), 59 (1), 60 (1), - (4) rakers exernally on lower limb of first arch. Microgill-rakers externally on 2nd-4th arches, internally on 4th and, rudimentary, along margin of lower pharyngeal tooth-plate.

In dissected 88.3 mm specimen, 20 epibranchial, 1 in angle, 50 ceratobranchial, 1 in joint and 7 hypobranchial rakers externally on first gill arch; dorsal ceratobranchial rakers longest, 7.7 mm, gradually smaller, to less than 0.5 mm, toward ends of arch; other rakers shorter (25 mm externally on second arch) otherwise similar, slender, each edge bearing a row of blunt projections. A single tooth on basibranchial 3 tooth-plate; in other specimens 0-4 teeth in this position. 2 pharyngobranchial 2 teeth.

Jaw teeth. In both jaws slender, conical, slightly recurved, outer and anterior slightly larger than posterior and inner; in young (82.9-96.8 mm SL) 17-24 in upper and 19-20 in lower jaw outer hemiseries, posterior 1/3 of each upper jaw half and corresponding portion of lower jaw edentulous, a single inner series of only a few teeth anteriorly in each jaw; larger specimens with 36-48/33-39 teeth in upper/lower jaw outer hemiseries, upper jaw outer series advancing to jaw end and lower jaw outer series correspondingly prolonged, tooth-band remaining narrow, with 1-3, usually 2 inner series in upper jaw, one of which as long as outer series in largest specimens, and 1-3, usually 1, inner series in lower jaw, one of which may extend nearly as far back as outer series. Some of the outer teeth with distinctly worn, blunt tips in a few large specimens.

Tooth-plates. Lower pharyngeal tooth-plate Y-shaped, slender (fig. 21). Teeth small, numerous, about 70 along posterior margin; anteriorly and along lateral margin simple, conical, along posterior margin and medianly compressed laterally, with posterior slightly antrorse cusp and low anterior blunt cusp; a single tooth on medial rostral elevation.

Vertebrae. 13+13 (2); supraneurals 1 (1), 2 (1) in radiographed specimens (NRM SOK/1984307.3896).

Colouration. Ground colour white or yellowish white, pure on abdomen, chest and lower head, duskied on sides; back nape, forehead and dorsal margin of caudal peduncle grey. Flank scales below upper lateral line level with silvery or brassy center and more or less evident dusky or blackish margin; reflecting colour may extend also onto abdominal and head sides, but is not shown in young (to 96.8 mm). Two thin dark lines occasionally evident below eye: one along adbuccal margin of preorbital and succeeding infraorbitals, another about parallel on preorbital. Dark, sometimes very faint, stripe continuing preorbital margin to corner of preoperculum (absent in young), and another along labian edge of lower jaw (absent in 3 of 4 young specimens). Side markings very faint except black, round or slightly elongate blotch below lateral line tubes 8-10 (usually) or 9-11, extending above lateral line tubes

only in Yaquerana specimens. Shades of 5 vertical bars below dorsal fin in some specimens, the lateral spot on 2nd from anteriormost of these; bars extending ventrad to a broad, faint greyish band from behind opercular flap obliquely dorsad through lateral spot and ending on posterior scales of upper lateral line. Pectoral axilla not dark on inside.

Dorsal fin whitish with blackish lappet tips, large dark spots on spinous portion, and about 10 cross-series of dark spots with narrow interspaces over soft portion. Anal fin greyish, base narrowly white, about 10 cross-series of spots as in dorsal fin, but not as contrasting. Caudal-fin without base spot; in young 7 vertical stripes of dark spots and margin dark, stripes not well-defined in adults in which caudal fin tending to overall dusky with blackish hind edge. Pelvic fin whitish basally, spine and distal 2/3 grey to blackish with lighter or white spots.

Life colours. Adults from Trueno Cocha (SOK 46a) had silvery bluish flanks and dorsal gill-cover region, a brassy sheen on the nape and anterior back. Cheek and anterior chest yellowish, turning orange on ventral gill cover and posterior chest and abdomen, also a reddish spot on the base of each scale on the lower half of flanks. Mandibular stripe and midlateral spot blackish, halter stripe in mouth angle greyish. Two faint icy blue lines on preorbital. Pelvic fin with bright red and iridescent blue ray-parallel stripes. Dorsal fin with large blackish spots separated by narrow white lines; same pattern in anal fin but dark spots maroon. Scaly base of caudal fin silvery/bluish; upper lobe otherwise greyish and lower dark red.

Distribution (fig. 22)
Collected in Peru along the Ucayali-Amazonas from Yarina Cocha to Leticia and in the Yaquerana near Colonia Angamos. Widely distributed in the Amazon basin east of Peru and also collected in Guyana (Eigenmann 1912), Surinam (Kullander *et al.* 1986) and French Guiana; reported from the Apuré in Venezuela by Fernández-Yépez (1951).

Ecology
Personal collections are exclusively from turbid floodplain lakes during the vaciante (SOK 36, 46a, 86; a few specimens from SOK 81 not preserved).

Local name
Bujurqui vaso at Jenaro Herrera, a recent construction.

Notes
Chaetobranchus flavescens is easily distinguished from the other species in the genus, *C. semifasciatus*, by naked instead of scaly vertical fins, lacking a prominent ocellus on the caudal-fin base, and in having a midlateral spot. *Chaetobranchus semifasciatus* has been collected near Manaus, Tefé, Óbidos and Itacoatiara.

Chaetobranchus flavescens has many synonyms. I have examined the type materials and limited material from the Amazon basin and the Guianas and find no geographical variation suggesting that more than one species would be involved.

Chaetobranchus bruneus is next in priority to *C. flavescens* by action of the first reviser (Steindachner 1875). The holotype of *C. bruneus* is somewhat slender (depth 40.5 % of SL), and would have had cheek stripes different from those of *C. flavescens* (cf. Heckel 1840). As body depth may be quite variable among *C. flavescens* from the same locality, and as the cheek stripe pattern, specifically a stripe from the mouth angle to the middle of the vertical limb of the preoperculum cannot be verified either in the holotype of *C. bruneus* or in other *Chaetobranchus* material, I consider, like most previous authors, that *C. bruneus* is a synonym of *C. flavescens*. See also Steindachner (1875).

Chaetobranchus robustus was distinguished with reference chiefly to intermediate depth (44.7 % of SL) and short maxilla, not reaching orbit.

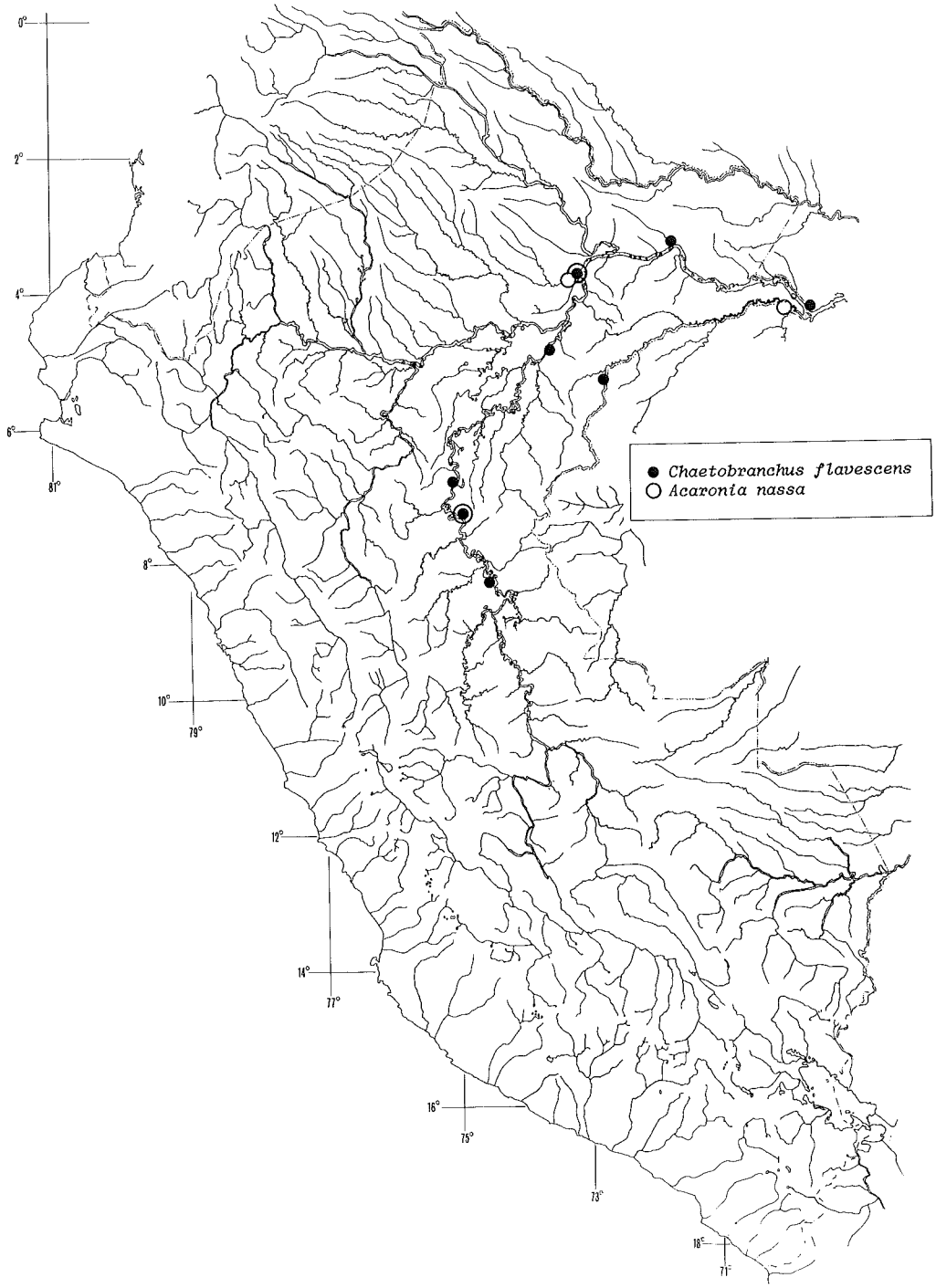


Figure 22. Collecting localities of *Chaetobranchus flavescens* and *Acaronia nassa* in western Amazonía. A symbol may represent more than one, adjacent collecting sites.

Günther was comparing only with Heckel's *Chaetobranchus* descriptions. As the maxilla reaches beyond the anterior margin of the orbit in the holotype of *robustus* as well as in other *Chaetobranchus*, and as body depth is quite variable within *C. flavescens*, there is no character by which to identify *C. robustus*. Other data given by Günther also fall within variation of *C. flavescens*.

No type specimen of *Centrarchus cyanopterus* has been identified, and there is nothing in the description or figure to support status as a potentially valid species. Eigenmann (1912) included *cyanopterus* in the synonymy of *Cichlasoma bimaculatum*, Eigenmann & Bray (1894) regarded it as a synonym of *Acaronia nassa*, Steindachner (1875) and Pellegrin (1904) as a questionable synonym of *A. nassa*.

There are several specimens of *C. flavescens* in NMW, labeled as being from R. Negro, Mato Grosso and R. Guaporé. They may all be regarded as syntypes, even if the description is probably based on one or more of 3 alcohol-preserved specimens, 138.4-151.7 mm SL, in NMW 21931-32933 from R. Guaporé. These are relatively deep-bodied (depth 46.9 % of SL in the largest). Heckel's description is, on the whole, quite accurate.

Chaetobranchus ucayalensis is based on a large specimen now in very bad condition. Many scales are lost, the fins are severely frayed, and there is a deep transverse (knife?) cut through the head dividing it down to the orbits, and a hole through the abdomen. The figure in Castelnau (1855) is better than the description (eg., D. XI.13 in the description, XIII.*c*.12 on figure, actually XIII.13) but, eg. the cheek scales shown are too few and too large, and the interoperculum is actually scaly.

The holotype of *Geophagus badiipinnis* is likewise in poor condition. All authors, except Cope, have recognized it as a *Chaetobranchus* as is very clear from the figure (Cope 1872, Pl. XI, fig. 1). The gill-rakers are as in *Chaetobranchus*, numbering about 58 on the lower limb of the first gill-arch. I count D. XIII.13, not XIII.12 as given by Cope. Cope (1872) compared *G. badiipinnis* only with *Geophagus* species, and responded to Steindachner's (1875) synonymization with the assertion that 'it has...the branchial structure of the genus to which I referred it' (Cope 1878).

Acaronia Myers

Acara (Acara: Acaropsis) Steindachner 1875, p. 80 (type species *Acara nassa* Heckel, by monotypy).

Acaronia Myers 1940, p. 170 (nom. nov. subst. *Acaropsis* Steindachner, preoccupied in Arachnida).

Acaronia is similar in shape to *Chaetobranchus* and young resemble *Bujurquina* in colouration. The genus is distinguished by the large gape, correlating with long ascending premaxillary processes reaching beyond middle of orbit; large scales (squ. long. 22 very low for a large cichlid species); few vertebrae (12+12); prominent flank lateral line tubes and large cephalic lateralis foramina (4 mandibular, 6 preopercular). The lachrymal is narrow and has 4 foramina; infraorbitals are tubular, the second with a middle foramen. *Acaronia* is distinguished from the otherwise most similar group, *Chaetobranchus*, especially by the comparatively strong and not as numerous gill-rakers: 1-2 epibranchial, one in angle and to 13 cerato- and hypobranchial rakers, lower limb rakers contiguous to form a long tooth-plate in large specimens. *Acaronia* has two supraneurals like similar genera.

The most recent revision of *Acaronia* is that of Regan (1905*b*; then *Acaropsis*), recognizing only one species, *A. nassa*. Since then two more nominal species have been referred to the genus: *Acaronia trimaculata* Allen, is here, p. 346, considered a synonym of *Aequidens tetramerus*. *Acaropsis rondoni* Ribeiro (1918), of which I examined the holotype (single

known specimen), obviously belongs rather among *Aequidens*-like cichlids, but its proper generic allocation is uncertain.

Only one *Acaronia* species is encountered in Peru.

Acaronia nassa (Heckel)

Figs 22-24, Pls V (fig. 3), VI (figs 1-2), Table 4

Synonymy

Acara nassa Heckel 1840, p. 353 (diagn.; descr.; Mottogrosso).
Acara cognatus Heckel 1840, p. 356 (diagn.; descr.; Barra do Rio-negro).
Acara unicolor Heckel 1840, p. 357 (diagn.; descr.; Barra do Rio-negro).
Centrarchus ?? rostratus Jardine 1843, p. 163 (descr.; Rio Negro), Pl. 15 (coloured drawing, habitus).
Apistogramma ambloplitoides Fowler 1940*a*, p. 281 (descr.; Ucayali River basin, Contamana, Peru), Fig. 63 (sketch, habitus).

Peruvian bibliography

Apistogramma ambloplitoides; Fowler 1944, p. 270 (bibliogr.). -- Fowler 1945*a*, p. 251 (bibliogr.). -- Fowler 1954, p. 274 (bibliogr.), Fig. 861 (sketch, from Fowler 1940*a*). -- Böhlke 1984, p. 56 (type material listed).
Acaronia nassa Kullander 1980*a*, p. 144 (*Apistogramma ambloplitoides* a synonym).

Material

37 specimens, 25.5-121.8 mm SL, including type-series of *Apistogramma ambloplitoides*; also consulted type material of *Acara nassa, A. cognatus*, and *A. unicolor*, and other extralimital material.

Description

From specimens over 100 mm; counts from 23 specimens measured; measurements summarized in Table 4. Refer to Pls V-VI for general aspect.

Shape. Moderately elongate, moderately compressed laterally; long head, large eye and large mouth notable. Predorsal contour ascending about straight to middle of orbit, nape slightly curved; dorsal-fin base either slightly curved or about straight descending, with strong terminal decurvature; prepelvic contour with straight sloping head and nearly horizontal chest; abdominal contour straight; anal-fin base ascending, slightly curved; dorsal edge of caudal peduncle straight, horizontal, as long as or little shorter than ventral edge, which straight, slightly sloping. Orbit in upper, and chiefly in anterior half of head, nearly tangented by predorsal outline; narrow interorbital little curved, narrower than mouth. Snout triangular in lateral, narrowly rounded in dorsal aspect. Lip folds relatively thin, moderately wide, both continuous. Sub- and interoperculars separated by a groove. Ascending premaxillary processes reaching beyond vertical from middle of orbit; maxilla reaching to near vertical from middle of orbit; lower jaw slighthly prognathous, articulating below posterior 2/3 of orbit.

Scales. Large, squ. long. 22 (23); 16 circumpeduncular scale series. Predorsal squamation irregular, chiefly scales overlapping along midline, 7-9 along midline. Cheek scales in 2 (6), 3 (17) series; anteroventral triangular area naked; all cycloid or posterodorsal ctenoid. Gill-cover scales cycloid or ctenoid; 2 series on operculum, 1 on sub- and interoperculum. Prepelvic scales cycloid in median and one parallel series or ctenoid except on anterior half of thorax.

Upper lateral line at 3 (anteriorly) to 1/2 (posteriorly) scales distance from dorsal-fin base; 2 horizontal scale-series between lateral lines at free ends. Lateral line counts: 15/4 (2), 15/6 (1), 16/4 (4), 16/5 (3), 16/6 (7), 16/7 (1), 17/5 (3), 17/6 (2), plus 1-2 (4 in 90.3 mm specimen) tubed scales on caudal fin; accessory lateral lines rare, 1-2 tubed scales between rays D3-D4

and/or one between rays V4-V5, in 121.8, 105.1, 120.0 and 69.8 mm specimen. Lateral line tubes and lateralis foramina on head very large.

Fins naked, except caudal fin, with slightly concave basal squamation, to 2/5 marginally, 2/7 medianly; and 121.8 mm specimens with 2 interradial scales basally on each membrane between rays 3 and 4, and 4 and 5 of dorsal fin.

Fins. First dorsal-fin spine inserted above first lateral line scale, about 1/3 length of last spine, spines graduated in length to last; lappets short, anteriorly rounded, posteriorly truncate. Soft fin often damaged; in 120.0 mm specimen (Pl. X, fig. 00) with long point formed by rays 3-5, 4th longest, reaching little beyond caudal fin; in young rounded. D. XIII.9 (22), XIV.9 (1). Anal-fin origin opposite penultimate dorsal-fin spine; soft fin often damaged, in 120.0 mm specimen with long point formed by rays 4-6, 5th longest, reaching to end of caudal fin; rounded in young. A. III.8 (14), III.9 (9). Pectoral fin with rounded tip, 5th ray longest, reaching to above 3rd spine to 2nd ray of anal fin; P. 13 (16), 14 (7). Pelvic fin inserted below pectoral axilla; pointed, first ray produced, reaching usually to somewhere along soft anal-fin base, at most to near caudal-fin base. Caudal fin with rounded hind edge.

Gill-rakers. 1-2 epibranchial, 1 in angle and 5-13 lower limb rakers externally on first arch, latter number decreasing with increasing SL as anterior rakers combine to form a long tooth-plate; all gill-rakers with heavily toothed crown, short, knob-like (fig. 23), also those internally on 4th arch. Microgill-rakers externally on 1st to 4th and internally on 4th arch; on first arch a hiatus in microgill-rakers series where posterior end of ceratohyal pressing against gill-arch.

Tooth-plates (fig. 24). 90.3 mm specimen dissected with lower pharyngeal teeth all firmly attached, tooth-plate halves slightly sloping away from median; anterior teeth unicuspid with retrorse tip or with minute cusp on posterior edge below main cusp, caudad gradually more compressed, enlarged, bicuspid with antrorse posterior cusp and rostral edge bulge (posterior teeth) or cusp (others). No tooth-plates on 4th ceratobranchial.

Jaw teeth. Small, close-set, recurved, unicuspid, pointed; those of outer series inclinable, little larger than those in inner band of 3-4 series of depressible teeth.

Vertebrae. 12+12 (6); last half-centrum within caudal peduncle.

Colouration. Slightly variable with habitat and size. 120.0 mm specimen (Pl. V, fig. 3), from a black-water stream: dark grey-brown, back and nape darker, lighter medially on chest and belly; anterior and lower scales of sides with whitish center. Two large dark brown spots on cheek, one close to orbit, second posteroventrally and over corner of preoperculum; dark brown spot close to superoposterior margin of orbit; dark brown spot on exposed posttemporal and scale behind; indistinct dark brown band from orbit caudad on dorsal edge of gill-cover. Dark lateral band indistinct, in squ. long. scales to midlateral spot which dark brown, elongate, on upper halves of squ. long. scales 8-9, parts of 7 and 10, and onto ventral parts of scales above. No vertical bars discernible.

Dorsal fin dark grey; 2, posteriorly 3, horizontal series of whitish spots distinct from middle of spinous portion posteriorly onto soft portion, which also with about 6 cross-series of white spots posteriorly; lappets and dorsal edge of soft portion with narrow white seam. Anal fin blackish with small white spots in about 3 horizontal series. Pelvic fin blackish, slightly lighter inwardly. Caudal-fin base spot black, rectangular, in dorsal lobe, not reaching dorsal edge of fin; margined by yellowish white line on caudal peduncle anteriorly and whitish line posteriorly; rest of fin blackish, lighter distally, with white spots in about 8 irregular cross-series.

Mishana specimens from turbid water (Pl. VI, fig. 1) much lighter, pale greyish, chest, belly and underside of head whitish; sides, cheek and gill-cover with silvery sheen. Head and posttemporal spots fainter greyish to brown. Fins lighter; anal fin covered by white spots; pelvic fin with white leading edge, rest grey with white spots; caudal spot rather indistinct.

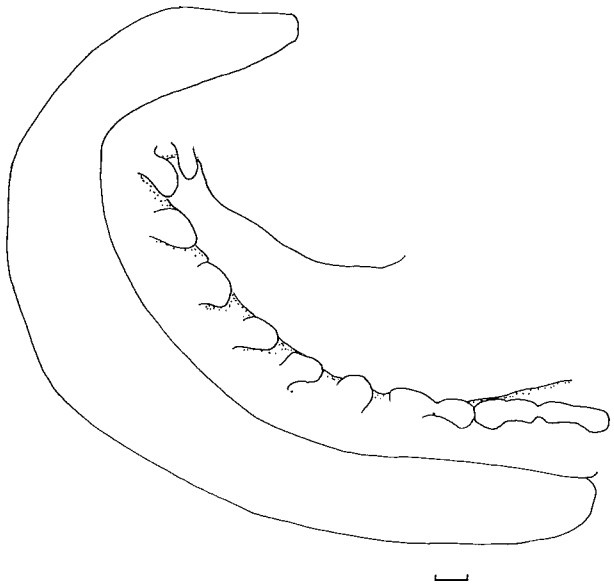


Figure 23. First gill-arch of *Acaronia nassa*, NRM SOK/1983337.3677, 90.3 mm SL. Semidiagrammatic, scale 1 mm; note anterior rakers forming continuous elongate plates anteriorly; dorsal limb somewhat laterad turned as compared to normal *in situ* position.

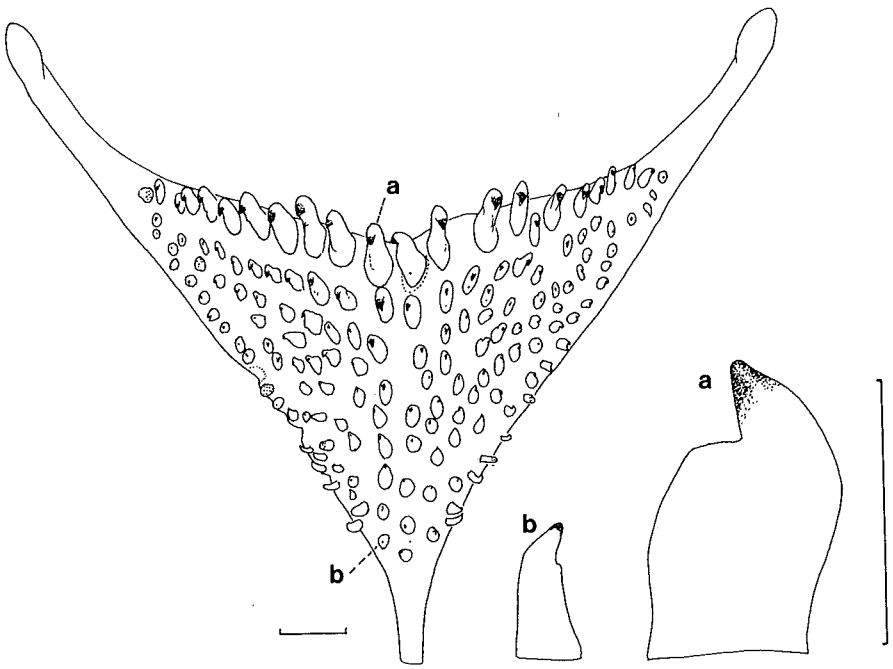


Figure 24. Occlusal view of lower pharyngeal tooth-plate and posterior (a) and anterior (b) teeth in medial aspect, in *Acaronia nassa*, NRM SOK/ 1983337.3677, 90.3 mm SL. Scales 1 mm.

Young (Pl. VI, fig. 2) have distinct lateral band, vertical bars and less richly spotted fins. Suborbital spots develop out of continuous stripe from orbit to preopercular corner. Forehead with 2 narrow dark stripes, posterior straight between orbits, anterior little curved across posterior nasal lateralis pores. Midlateral spot more rounded than in adults, covering upper halves of squ. long. scales and lower halves of those above. Lateral band distinct, brownish, from eye caudad to penultimate vertical bar anteriorly in squ. long. scales, posteriorly shifting to slightly more dorsad course (directed toward angle of dorsal-fin base with caudal peduncle), antepenultimate vertical bar dorsally commonly of same colour. Vertical bars faint, with narrow interspaces; one on caudal peduncle, one between ends of dorsal and anal fin bases, two above anal fin, one above vent containing midlateral spot, sides anteriorly of same colour (light brownish, darkening dorsally).

Life colours. Quebrada Corrientillo specimen (Pl. V, fig. 3) blackish with bluish scale centers and silvery marginal stripes associated with black humeral and cheek markings, and silvery spots scattered on back. White-water specimens overall silvery grey.

Distribution (fig. 22)
Acaronia nassa appears to be a widespread species in the Amazon drainage, but it has been collected in only three regions in Peru, at Contamana, in the Nanay drainage and in the lower Yavarí.

Ecology
Personal collections are all from the Nanay drainage where most specimens were taken in backwater tahuampa lakes, two in a pool in a stream (SOK 67) and one at a sand playa.

Notes
Acaronia nassa is described from the R. Guaporé. I find the syntypes (NMW 10538-10540) very similar to Peruvian *Acaronia* and consider them to be the same species. *Acaronia cognatus* and *A. unicolor*, from Manaus, cannot be distinguished from *A. nassa*. Orinocoan and upper R. Negro *Acaronia* material, however, represent a second, undescribed species with the midlateral spot reaching dorsally to the lateral line.

Fowler's assignation of *A. amboplitoides* to *Apistogramma* may have been suggested by the close approximation of the lateral line and dorsal fin, or may have been the result of some *lapsus calami*. The type specimens definitely belong to the species here identified as *A. nassa*, and there should normally be no possibility of confusing *Acaronia* and *Apistogramma* specimens.

Acaronia nassa may be widespread in the Amazon basin, collected along the Amazon east to Gurupá, in the Branco, Rupununi, Essequibo, Oyapock, lower R. Negro, Guaporé and Madeira. No taxonomic analysis of material from all over the range of the species has been made yet, however.

Crenicichla Heckel

Crenicichla Heckel 1840, p. 416 (type species *C. macrophthalma* Heckel, by subsequent designation in Eigenmann & Bray 1894, p. 620).
Batrachops Heckel, 1840, p. 432 (type species *B. reticulatus* Heckel, by subsequent designation in Eigenmann & Bray 1894, p. 620).
Boggiania Perugia 1897, p. 148 (type species *B. ocellata* Perugia, by monotypy).

Regan revised this genus twice (1905*a*, 1913*b*), and distinguished some species as constituting a separate genus, *Batrachops*, characterized by (1) non-depressible oral teeth in 2-3 series, in contrast to *Crenicichla* with 'several' series of teeth in each jaw and teeth of inner series depressible,

and (2) body little compressed, *vs.* more or less compressed, as apparent from comparison of the generic diagnoses in Regan (1905*a*). Other reviewers of *Crenicichla* have varied in treatment of *Batrachops*, including total suppression (Günther 1862) and subgeneric distinction (Pellegrin 1904). Here, *Batrachops* is tentatively synonymized with *Crenicichla*.

In two papers (Kullander 1981*a*, 1982*b*) I have attempted to distinguish species groups among *Crenicichla* species. The validity of the *C. lacustris* group, of predominantly southern species, is not confirmed by unpublished studies of component species. The *lepidota* group has not been shown to be monophyletic. It is defined chiefly by low meristics compared to most other *Crenicichla* species, the possession of humeral ocellus between the pectoral fin and lateral line, and relatively short snout (maxilla reaching to below middle of orbit). Similar species with higher meristics, were not labeled by a group name but referred to as *C. saxatilis* auctt., and *C. saxatilis*-like forms (Kullander 1982*b*). The Peruvian species *C. anthurus*, *C. lucius*, *C. proteus*, and *C. semicincta* would belong to this latter assemblage, comprising also Guianan, Orinocoan and Trinidadian forms.

The small-scaled (squ. long. >100), blunt-snouted group is represented in Peru by *C. johanna* and *C. cincta*.

A third group, *Batrachops* in a wide sense, is represented by *C. sedentaria*, *C. cyanonotus* and *C. reticulata*. These have large mouth, squ. long. counts largely between 60 and 70 and a pattern of oblique bars on the sides. These two last-mentioned groups also are in great need of further study and refined diagnosis.

Altogether there may be over 50 species in this genus, which has a vast distribution including most of cis-Andean South America.

Crenicichla are more elongate than most other cichlids. The jaws are long, the lower usually projecting before the upper. Most species, including all Peruvian, have the preoperculum denticulated. Stiassny (1981) proposed some *Cichla-Crenicichla* synapomorphies. Autapomorphies include the absence of supraneurals combined with a spinous posterior process of the supraoccipital; long ectopterygoid connecting with the vomer head by a short ligament; and cartilaginous first pharyngobranchial. Little has been published on the anatomy of *Crenicichla* (Stiassny 1981, Vandewalle 1971), and studies in progress indicate many unique specializations. Microgill-rakers are similar to those of most cichlids, ie. without surface spines, and are present on the external face of the three posterior gill arches. There are 6 preopercular and 5 dentary lateralis foramina; lachrymal with 4 foramina, succeeded by 5 short tubular infraorbitals.

Crenicichla sedentaria n. sp.

Fig. 25, Pls VI (fig. 3), VII (figs 1-2), Table 5

Bibliography

Crenicichla geayi; (*pt.*) Eigenmann & Allen 1942, p. 405 (listed: Pto. Bermudez, R. Pichis).

Crenichla lacustris; Lüling 1971*a*, p. 212 (habitat), Abb. 13 (monochrome photo, habitus /ZFMK 2142-2143, *c.* 160 mm SL/; Aspusana).

Crenicichla simoni; Lüling 1971*a*, p. 212 (habitat), Abb. 13 (monochrome photo, habitus; Aspusana /ZFMK 2141/).

Crenicichla macrophthalma; Saul 1975, p. 121 (habitat; stomach contents; Rio Aguarico /ANSP 130460, 130461 verified/).

Crenicichla lucius; (*pt.*) Saul 1975, p. 122 (habitat; stomach contents; Rio Conejo /ANSP 158168/).

Crenicichla spec. (*pt.*) Lüling 1980*a*, p.181 (listed; habitat; Panguana /ZFMK unreg/; not specimen on Abb. 9). -- Staeck & Linke 1985, p. 122 (popular account; colour descr.; habitat descr.; Rio Chinipo), figs pp. 122, 123 (colour photos, aquarium and underwater).

Diagnosis

An elongate species with head wider than deep; outer teeth fixed, inner inclinable but not depressible; squ. long. (55-56) 58-64 (66-68); without humeral blotch and suborbital stripe. *Crenicichla sedentaria* is distinctive in the genus (see notes), and readily separated from other Peruvian *Crenicichla* species, by large flank scales (over 100 in *C. johanna* and *C. cincta*), dental, shape and colour features (inner teeth depressible, head compressed, humeral blotch and suborbital stripe in *C. saxatilis* group species).

Holotype

USNM 229057. Probable male, 104.4 mm SL. Perú, departamento Pasco, Río Pachitea drainage system, in Río Yamushimas, tributary to Río Palcazú, near San Pedro de Longín. 24 July 1981. Leg. P. Bayley.

Material

Holotype and 83 paratypes, 27.5-221.0 mm SL, from Peru and Ecuador.

Description

Based on the holotype, with notes on variation; counts from 26 specimens measured, measurements summarized in Table 5. Refer to Pls VI-VII for general aspect.

Shape. Elongate, trunk compressed; head depressed, wider than deep posterior to orbit. Ventral outline very little curved; predorsal contour straight ascending, dorsal fin base contour straight descending; caudal peduncle always longer than deep, edges straight (concave in larger specimens), ventral longer than dorsal. Lower jaw prognathous, articulating below middle of orbit; maxilla reaching 1/4 of orbit; ascending processes of premaxilla reaching slightly beyond middle of orbit. Lips thick; fold of anterior ending anteriorly at level of anterior end of mandibular cartilage; upper discontinuous, a median fleshy pad fitting truncate (or slightly concave) edge of postlabial skin. Interorbital narrower than mouth. Nostril edges slightly elevated; nostrils about halfway between orbit and postlabial skin fold. Vertical margin of preoperculum serrated.

Scales. Squ. long. - (1), 55 (1), 56 (1), 58 (1), 59 (1), 60 (4), 61 (7), 62 (2), 63 (5), 64 (1), 66 (1; 60 on left side), 68 (1, 63 on left side). Scales ctenoid except on cheek and gill-cover, predorsally and anteriorly on back, abdominally below line between pectoral axilla and anal-fin origin and on chest; basal caudal-fin scales ctenoid, other fin scales cycloid. Predorsal and prepelvic scales very small and embedded in skin. Cheek completely scaly, with 7 (-9) horizontal series below, 7 (-8) vertical series behind orbit. Naked on lateralis canal from supratemporal to orbit. Group of scales posteriorly on interoperculum. About 28 horizontal scale-series around caudal peduncle.

Upper lateral line at 10 (anteriorly) to 4 (posteriorly) scales distance from dorsal fin (11-12 and 5, respectively, in Huallaga specimens); anteriorly on flank 3, posteriorly 2 scales impinging on each lateral line scale; 3, occasionally 2 horizontal scale series passing between opposing ends of lateral lines. Lateral lines of -/- (1), 23/13 (1), 24/12 (4), 24/13 (1), 24/14 (1), 25/11 (1), 25/12 (6), 25/13 (3), 26/10 (1), 26/11 (2), 26/12 (3), 27/10 (1), 27/11 (1) scales, plus 3, rarely 2 on caudal fin; accessory caudal-fin lateral line in 2 specimens (2 tubed scales between rays V3-V4 and 1 tubed scale between rays V2 and V3, respectively).

About half of caudal fin scaly in holotype, in larger specimens scales between branches of rays and in largest specimen only hind margin of fin narrowly without scales. Thick skin covering bases of pectoral, dorsal and anal fins usually with minute embedded scales in large specimens (*c.* 130 mm and larger).

Fins. First dorsal-fin spine 1/5-1/3 length of last, inserted at vertical from opercular tip; spines subequal in length from 7th; lappets pointed;

Table 5. *Morphometry of western Amazonian* Crenicichla *species. Measurements are in per cent of SL, except SL (in mm).*

	C. sedentaria			*C. cincta*			*C. johanna*			*C. cyanonotus*			*C. reticulata*			
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}$	n	Range	$\bar{x}$	n	Range	$\bar{x}\pm s(\bar{x})$				
SL (mm)	26	45.3-221.0	109.9±9.30	4	127.7-194.6	162.7	4	141.7-240.9	191.7	7	81.2-147.5	125.6±8.12	72.5	89.9	160.0	172.9
Head length	26	27.6- 31.9	29.3±0.19	4	30.8- 34.6	32.0	4	28.6- 30.4	29.4	7	24.0- 30.9	26.7±0.98	27.6	26.9	29.7	29.6
Head depth	26	12.2- 15.5	13.4±0.16	4	15.1- 15.8	15.6	4	12.4- 19.5	15.8	7	13.5- 16.2	14.8±0.34	13.9	15.0	19.3	17.4
Body depth	26	17.2- 23.5	20.0±0.34	4	22.2- 23.3	22.7	4	20.0- 25.9	22.1	6	18.7- 22.9	20.9±0.59	19.2	18.5	23.8	22.8
Snout length	26	6.3- 9.6	7.6±0.17	4	8.7- 9.9	9.2	4	7.1- 9.4	8.0	7	5.7- 7.1	6.2±0.22	5.4	5.9	8.5	8.0
Orbital diameter	26	5.8- 9.1	7.4±0.18	4	6.7- 7.7	7.3	4	6.6- 6.9	6.8	7	6.4- 9.1	7.6±0.38	9.1	8.2	7.9	7.8
Interorbital width	26	4.9- 10.7	6.7±0.28	4	8.5- 9.2	8.9	4	7.6- 9.9	8.7	7	7.5- 10.4	8.5±0.45	7.3	8.5	11.8	12.4
Pectoral-fin length	23	19.0- 22.3	20.6±0.16	4	18.1- 20.0	19.2	3	20.7- 21.3	20.9	7	17.9- 22.0	19.9±0.60	21.4	20.2	21.3	19.4
Upper jaw length	26	8.8- 14.4	10.9±0.30	4	13.1- 13.4	13.3	4	10.5- 12.5	11.5	7	9.8- 12.3	10.9±0.36	10.2	9.9	13.6	13.8
Lower jaw length	26	13.7- 17.5	15.0±0.20	4	16.4- 18.2	17.0	4	14.7- 15.3	15.0	7	13.2- 15.4	14.1±0.34	14.2	14.1	15.0	17.6
Caudal peduncle depth	26	10.8- 12.6	11.7±0.12	4	9.9- 10.8	10.3	3	10.4- 12.4	11.6	7	11.6- 12.7	12.1±0.13	11.6	11.3	13.3	12.7
Caudal peduncle length	26	13.0- 16.4	14.3±0.16	4	12.9- 13.9	13.5	3	10.1- 11.6	11.0	7	13.4- 14.4	13.9±0.12	13.8	15.0	12.0	12.0
Last dorsal-fin spine length	25	10.9- 14.0	12.3±0.17	4	10.8- 12.2	11.5	4	10.1- 12.1	11.0	6	11.0- 12.9	12.0±0.29	14.1	11.8	12.0	12.2

soft fin with about rounded tip in holotype, reaching 1/4 of caudal fin, in larger specimens generally pointed, with 8th ray produced, to middle of caudal fin. D. XXI.12 (1), XXII.11 (5), XXII.12 (10), XXII.13 (1), XXIII.11 (3), XXIII.12 (6). Anal-fin origin below penultimate dorsal-fin spine (or 3rd-4th from last); soft fin rounded, 5th-6th ray longest, not reaching caudal-fin base in holotype, in larger specimens rounded or pointed, but not reaching beyond caudal-fin base. A. III.8 (5), III.9 (19), III.10 (2). Pectoral fin rounded, 7th ray longest, reaching about halfway to vertical from 3rd anal-fin spine; P. 16 (3), 17 (21), 18 (2). Pelvic-fin origin behind vertical from pectoral-fin base; with broad rounded tip, 2nd ray longest, 3rd ray nearly as long (longer in one specimen), 1st ray shorter than 2nd and 3rd; reaching about halfway to anal-fin origin; outer edge, from spine tip to 2nd ray thickened. Caudal fin rounded.

Gill-rakers. 1-2 epibranchial, 1 in angle and 8 (15) or 9 (11) lower limb rakers externally on first gill-arch. Microgill-rakers externally on 2nd to 4th arches. Rakers on lower pharyngeal tooth-plate 8 (1), 9 (1), 10 (3), 11 (6), 12 (3), 13 (2) in 16 specimens examined.

Jaw teeth. Simple, conical, recurved; those of outer series larger than those of inner series and larger anteriorly than posteriorly; outer slightly movable or fixed, inner movable, but not completely depressible. Young anteriorly with 4 teeth series in upper, 3 in lower jaw, large specimens with 5 (-6) upper, 4 (-5) lower jaw series anteriorly, only one inner series posteriorly.

Vertebrae. 19+17 (1), 19+18 (5), 20+17 (1), 20+18 (1), 21+17 (1); 5-6 vertebrae within caudal peduncle.

Colouration. Holotype: Ventral surfaces dirty whitish; lower flank scales centrally whitish, marginally brownish, above lateral band centers yellowish, margins dark brown; cheek yellow-brown; snout grey dorsally; gill-cover pale brownish. No suborbital stripe. Preorbital stripe indistinct. Wide dark brown postorbital stripe most intense close to orbit. Vertical bars dark brown with lighter scale centra: one, wide, from pectoral axilla across nape through and anterior to first dorsal-fin spine, narrowly separated from dark brown anterior half of scaly predorsal area; 5 bars below dorsal fin and 2 dorsally on caudal peduncle; bars anteriorly slanting (ventral end posterior to dorsal end) and much wider than interspaces, posteriorly gradually narrower and vertical; continuous with lateral band which slightly darker, anteriorly 4 scales broad, posteriorly 2 scales broad, discontinuous in some bar interspaces. Dorsal fin semitransparent, brown-grey, with darker brown dot proximal to each lappet and in series submarginally on soft portion; posterior membranes hyaline with scattered brown dots. Anal fin greyish, shading to brownish distally on soft portion; posterior 3 membranes hyaline with brown dots. Caudal fin brown-grey with 4 vertical series across middle of distal 2/3, dorsal lobe with wide oblique hyaline stripe with a few brown dots, a black dot distally remaining of distal caudal ocellus; caudal spot black, between rays D1 and D4, white-margined dorsally, less contrasted light margin ventrally. Pelvic fin hyaline with some dark peppering.

Most other large specimens poorly preserved. Variation mainly in: (1) Appearance of bars: narrow bars (to 9 bars below dorsal fin) more or less separate or fused, holotype apparently representing extreme of fused bars. (2) Lateral band: usually as a series of round or oval blotches; more or less contiguous. (3) Dorsal-fin colour-pattern: females with a whitish median band which widening posteriorly, or basal half (anteriorly) to 2/3 (posteriorly) light, in some with a darker area in distal dark seam, or blotch covering most of height of fin, between spines 13-16, 14-16, 12-14, 12-16, or 13-17, centrally still darker, occasionally with indistinct lighter marginal dorsal zone; soft dorsal and anal fins immaculate. Holotype representing males, with series of dark spots submarginally in dorsal-fin and spotted posterior soft dorsal and anal-fin membranes.

Suborbital stripe invariably absent; ocellated caudal-fin spot well-evident at all sizes; margined by silvery dots in 172.0 mm female.

Smallest specimens available (*c.*30 mm) not well preserved, though apparently light with dark, contrasting band from snout tip to caudal fin, and indistinct dorsal stripes, caudal ocellus well-formed.

Slightly larger young variable in appearance, but as in 45.3 mm specimen (Pl. VII, fig. 2) with continuous lateral band; dark vertical bars continued faintly on abdominal sides, and as the back is dusky above lateral line conspicuous light spots form dorsally and ventrally along anterior about half of band. Two young (69.1 and 75.0 mm SL) from near Chicosa unusually dark, with bars well evident on abdominal sides, each hypaxially inclined at slight angle with epaxial portion and split ventrally; like other young of comparable size with anteriorly one, posteriorly 2 horizontal series of dark spots on spinous dorsal fin and more dark spots on soft dorsal fin than in adults.

Distribution

Collected in Peru in the Pachitea and Aguaytía drainages, near Chicosa and Alto Aruya on the upper Ucayali, and in the vicinity of Tingo María; in Ecuador near Coca and Santa Cecilia in the upper R. Napo system, and in R. Conejo which is a tributary to the R. Putumayo near Santa Cecilia.

Ecology

Saul (1975) collected juvenile and young *C. sedentaria* (as *C. macrophthalma*) in shallow, quiet inlets and backwaters of the R. Aguarico at Santa Cecilia and found insects, insect larvae, fish larvae and fish eggs in stomachs, and in the nearby R. Conejo (mixed with *C. anthurus*, identified by him as *C. lucius*). Some data on the Panguana site is given by Lüling (1980*a*), who collected a specimen in a backwater pool. Staeck & Linke (1985) described briefly the R. Chinipo locality, a clear water river with pH 7.9, hardness 4°dGH, conductivity 116 µS, 26°C, and swift current. Large individuals were observed in strong current, young in calm backwaters, brooding pairs (photographed) in slow-flowing bays and side-arms.

Etymology

The species name is from the Latin adjective *sedentarius*, sitting, in reference to habits of tentatively identified aquarium material. I have observed occasional resting behaviour in other *Crenicichla* species.

Notes

Distribution, habitat information, morphology and observation of living aquarium specimens tentatively identified as *C. sedentaria* (pers. obs.; Uwe Werner, pers. comm. and photos), jointly suggest that this is a benthic, moderately rheophilic species.

Morphological traits indicating benthic rheophily include the broad pelvic fins with thickened anterior distal edge, minute nape and thoracic scales compared to body scales, and the unusually slender body and depressed head. Aquarium specimens observed rested on the bottom substrate, but swam like 'normal' *Crenicichla* although never far above substrate. All localities so far reported in higher elevations are insofar data are available, clear-water streams with rocky bottom. At times of collecting, stream velocity seems to have been low or moderate, but is probably greater during high-water conditions. None of the localities are rapids, however.

Crenicichla sedentaria differs greatly from other Peruvian as well as extralimital *Crenicichla* species, and appears to be similar only to an undescribed species in Colombia and Venezuela under study by S. Reid.

Crenicichla sedentaria challenges the traditional view of a *Crenicichla* species, having the teeth more rigid than 'typical' *Crenicichla*, but not fixed as in *Crenicichla reticulata*. Aside from teeth and rheophilic traits, it is notable for (1) the lack of a suborbital stripe, (2) long spinous dorsal-fin, (3) 3 tubed lateral-line scales on caudal-fin instead of the usual 2, (4) extensive scale-cover of caudal fin; none of these characters unique, however. Scaly pectoral-, anal- and dorsal-fin bases are uncommon

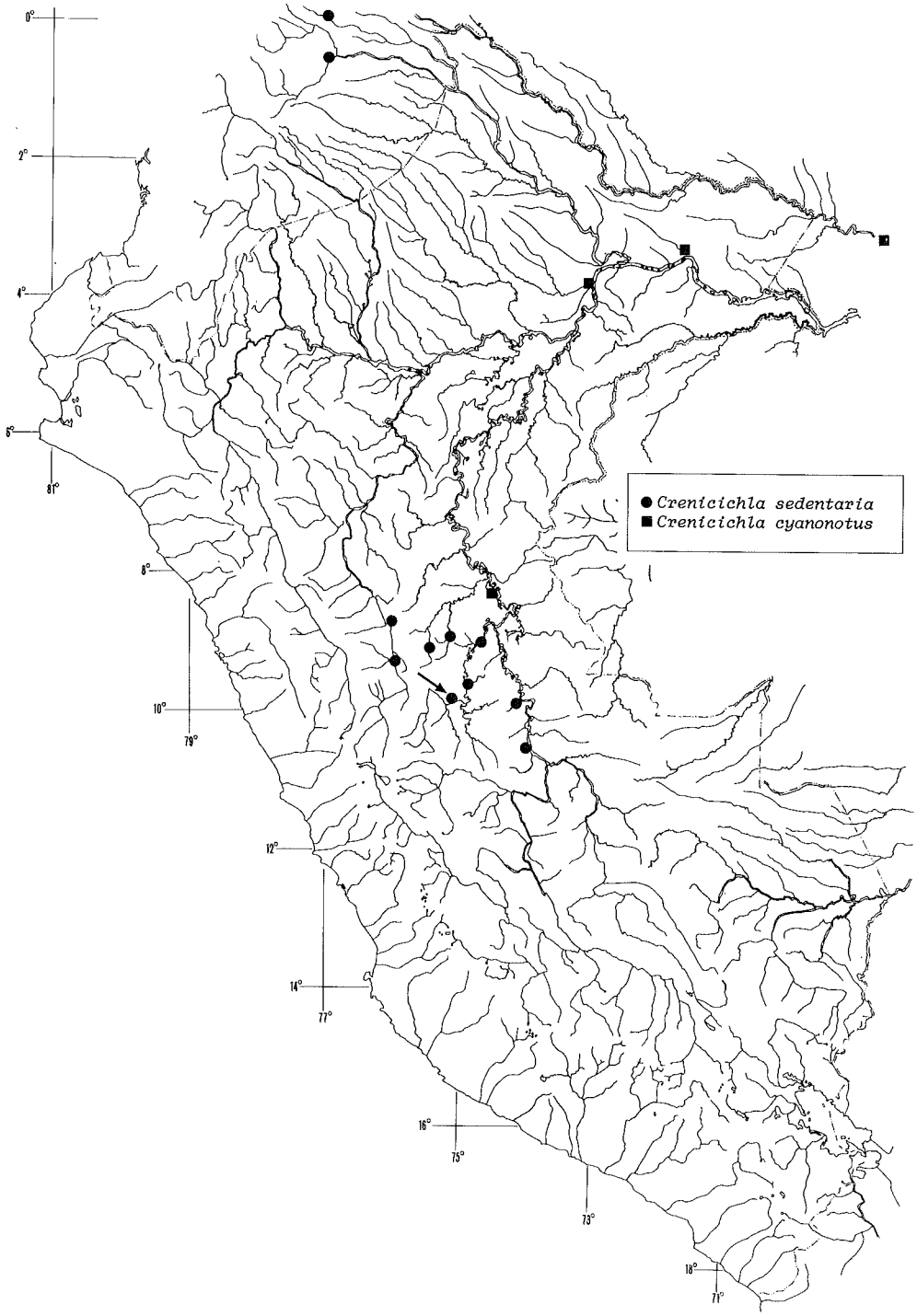


Figure 25. Collecting localities of *Crenicichla sedentaria* (a dot may represent more than one collecting site; arrow points to type locality) and *C. cyanonotus*.

in *Crenicichla*, but, as reported elsewhere in this paper, such appear in thick basal skin of large specimens of a number of species.

Using Regan's (1913*b*) key, *C. sedentaria* would key out as *C. geayi*. That species is known solely from the holotype, MNHN 98-47, 131.1 mm SL, with no other locality data than 'Venezuela'. Comparison with *C. sedentaria* shows that the type of *C. geayi* is well distinguished by comparatively longer (30.8 % of SL) and deeper (14.4 % of SL) head, wider interorbital (9.1 % of SL), and longer jaws (upper 13.9 %, lower 17.4 % of SL). The scales are rather large (squ.long. 53 on right side, 55 on left side, lateral lines 24/10). The cheek is incompletely scaly, with scattered scales below middle, and widely naked ventrally along the preoperculum. The jaw teeth are, compared with similar-sized *C. sedentaria*, considerably stouter and fewer.

Eigenmann & Allen (1942) identified a R. Pichis specimen as *C. geayi*. However, they included in that species material of *C. cyanonotus* and perhaps yet another species of which material was recorded for Yurimaguas.

Crenicichla cyanonotus Cope

Figs 25-26, Pl. VII (figs 3-4), Table 5

Crenicichla cyanonotus Cope 1870, p. 569 (descr.; upper Marañon, near Pebas).

Bibliography

Crenicichla cyanonotus; Eigenmann & Eigenmann 1891, p. 70 (listed). -- Böhlke 1984, p. 57 (holotype listed).

Crenicichla (Batrachops) cyanonotus; Pellegrin 1904, p. 378 (bibliogr.; descr. abstr. Cope).

Batrachops cyanonotus; Regan 1905*a*, pp.154 (key), 156 (bibliogr.; descr. cop. Cope 1870). -- Fowler 1940*a*, p. 284 (compared with *Batrachops nemopterus* = *Crenicichla proteus*). -- Fowler 1944, p.268 (bibliogr.), Fig. 85 (outline sketch of holotype, restored). -- Fowler 1945*a*, p. 248 (bibliogr.), Fig. 85 (outline sketch of holotype, restored). -- Fowler 1954, p. 281 (bibliogr.).

Crenicichla geayi; (*pt.*) Eigenmann & Allen 1942, p. 405 (material only: Iquitos).

Batrachops reticulatus; Lüling 1975, p. 50 (listed; Yarina Cocha; mittleren Ucayali; habitat), Abb. 12*pt.* (monochrome photo, habitus; /ZFMK 2251-2254*pt.*, 133.4 mm SL/).

Material

Holotype, ANSP 9078, 117.5 mm SL, and 7 referred specimens, 81.2-147.5 mm SL, all in poor state of preservation (faded, distorted and/or shrunken).

Description

Composite; refer to Pl. VII, for general aspect; counts from all specimens available; measurements summarized in Table 5.

Shape. Elongate, moderately compressed laterally; predorsal and prepelvic contours slightly curved. Head short, depressed, wider than deep, or, in Yarina Cocha specimens, very short, about as wide as deep. Snout short, rounded in dorsal aspect, bluntly triangular in lateral aspect. Lower jaw slightly prognathous, articulating below posterior half of orbit; ascending processes of premaxilla reaching 1/3 of orbit; maxilla slightly beyond 1/4 or 1/3 of orbit; lower lip fold widely discontinuous, upper lip fold subcontinuous. Preoperculum serrated. Nostril closer to postlabial skinfold than to orbit, but not overlying lower lip.

Scales. Squ. long. 59 (1), 61 (1), 62 (2), 64 (1), 65 (1), 66 (1), 67 (1). Scales cycloid on cheek, gill-cover, top of head and anterior dorsal side (ctenoid scales next dorsal to lateral line), belly ventral to line between

pectoral axilla and anal-fin origin, chest, and fins except proximal caudal-fin scales. Cheek completely scaly, about 6-7 horizontal series below, 4-5 vertical behind orbit. Group of scales posteriorly on interoperculum. Naked line from posttemporal to orbit. 24-25 horizontal circumpeduncular scale series. Upper lateral line at 9-10 (anteriorly) to 3-4 (posteriorly) scales distance from dorsal-fin; 2-3 horizontal scale series passing between lateral lines at free ends. Lateral lines of 24/12 (1), 25/11 (1), 25/12 (2), 25/15 (1), 27/11 (1), 27/12 (1), 28/13 (1) scales, plus 3 on caudal-fin base. One specimen with tubed scale between rays V2 and V3 on right side of caudal fin. Little more than half of caudal fin scaly in young, only narrowly naked posteriorly in large specimens; pectoral-fin base scaly in Yarina Cocha and Iquitos specimens; other fins naked.

Fins. First dorsal-fin spine above tip of operculum; soft part rounded or pointed, to 1/4-1/2 of caudal-fin; D. XXIII.10 (1), XXIII.11 (3), XXIV.11 (2), XXIV.12 (1), XXV.11 (1). Anal-fin origin below end of spinous dorsal fin; soft part rounded or pointed, reaching to or not quite to caudal-fin base; A. III.7 (2), III.8 (3), III.9 (1). Pectoral fin rounded, 7th ray longest, reaching halfway to 2nd anal-fin spine or, in Yarina Cocha specimen, halfway or not quite halfway to vent; P. 16 (3), 17 (5). Pelvic fin slightly posterior to vertical from pectoral-fin base, with rounded tip; 2nd ray longest and 3rd ray longer than 1st; reaching halfway to anal-fin origin or, in Yarina Cocha and Iquitos specimens, shorter. Caudal fin rounded.

Gill-rakers. 1-2 epibranchial, one in angle and 6 (1), 7 (3), 8 (4) lower limb rakers externally on first gill-arch. 7 (1), 9 (2), 10 (2), 11 (1) rakers on lower pharyngeal tooth-plate in 6 specimens checked. Microgill-rakers externally on 2nd to 4th arches.

Jaw teeth. In both jaws an outer series of strong, firmly attached, conical, recurved teeth (*c.* 18-21/18-23 in a hemiseries in upper/lower jaw), and anteriorly 3 inner series of inclinable but not depressible smaller teeth, one series continued posteriorly.

Vertebrae. 81.2 mm specimen with 20+16 vertebrae.

Colouration. None of the specimens seems to have a well-preserved colouration. It is best preserved in Içá specimens, although they appear to be slightly faded. 81.2 mm specimen, a female: Belly midline white, chest, lower trunk sides, underside of head pale yellowish-whitish; cheek brownish yellowish; gill-cover light greyish; snout and forehead grey. Brownish preorbital stripe on preorbital only. Postorbital stripe in three discrete dark brown blotches, one between orbit at preoperculum, one on upper half of operculum, one on posterodorsal soft subopercular flap fading out ventrally along posterior edge of suboperculum. Flank pattern indistinct, of faint brownish bars on back ventrally to middle of side where slightly intensified to form series of blotches (or discontinuous lateral band) from pectoral girdle to caudal fin, passing between lateral lines; 1st spot much darker than remainder, above pectoral axilla, continuous with narrow oblique bar across nape in advance of dorsal fin; another brownish stripe across nape above preoperculae; 4 wide bars below dorsal-fin, 1 below dorsal-fin-caudal peduncle junction, caudad slanting. Dorsal fin greyish, semitransparent; black elongately oval spot distally between spines 14 and 16 surrounded by clear ring about 1 membrane wide; otherwise fin immaculate. Anal fin greyisyh, semitransparent, with wide grey lower seam. Caudal fin brownish yellowish with wide greyish posterior border; caudal spot round, not ocellated, between rays D1 and D4. Pelvic fin dirty whitish.

Specimen *c.* 87 mm similar, but dorsal fin immaculate, lighter ring around caudal spot indicated, and flank blotches except the first tending to be constricted at middle. ZFMK specimens very obviously faded; trunk colour pattern doubtful, may have been lines of dark dots on scale centers, but at least one specimen with traces of vertical bars. Postorbital spots pronounced. CAS specimens darkened; colour pattern consisting of pronounced postorbital spots, indistinct oblique vertical bars on back ending in ill-defined lateral band or spot series, above lower lateral line level; caudal spot brown,

ocellated with silver.

Holotype according to Cope 'olive, with seven indistinct cross-bands directed obliquely to the middle line of the side. A dark band from orbit to axilla. A black, white (?) edged spot on the upper caudal radii. Dorsal and anal fins without spots, blue at the base'. Presently, the specimen is olivaceous with bars indicated on back; 3 dark postorbital spots as described above still evident; caudal spot ringed with silvery.

Distribution (fig. 25)
Holotype said to come from near Pebas; referred specimens here are from Yarina Cocha, Iquitos, and Cuiabá on the R. Içá.

Ecology
Lüling (1975) reported the species, as *Batrachops reticulatus*, from Yarina Cocha and gave some general habitat information, see p. 17.

Notes
Regan (1905*a*), relying on Cope's description only, regarded *Crenicichla cyanonotus* as a *Batrachops* species, a generic assignation supported by the broad head and short snout by which *C. cyanonotus* resembles *C. reticulata* and *C. semifasciata*, the two species that originally were included in *Batrachops*. That genus is herein considered a synonym of *Crenicichla*, see p. 94.

Crenicichla cyanonotus resembles 'traditional' *Crenicichla* in pluriserial jaw dentition, and the slightly inclinable inner teeth. Amongst 'traditional' *Crenicichla* species it is similar to *C. sedentaria*, and an undescribed form in Bolivia. From *C. sedentaria*, *C. cyanonotus* can be distinguished by the shorter snout, which longer than orbit in all *C. sedentaria* over 100 mm SL, and shorter than orbit in all *C. cyanonotus*.

The most similar species is *C. reticulata*. The only certain differences observed are in the jaw dentition (biserial in *C. reticulata*) and the more obtuse snout of *C. reticulata*, whereby the nostrils come to have a more anterior position (fig. 26). Too few specimens are available of either species to allow judgement on possible differences in colouration or proportions. It seems, however, that *C. cyanonotus* may lack the dark scale-base spots so prominent in *C. reticulata*.

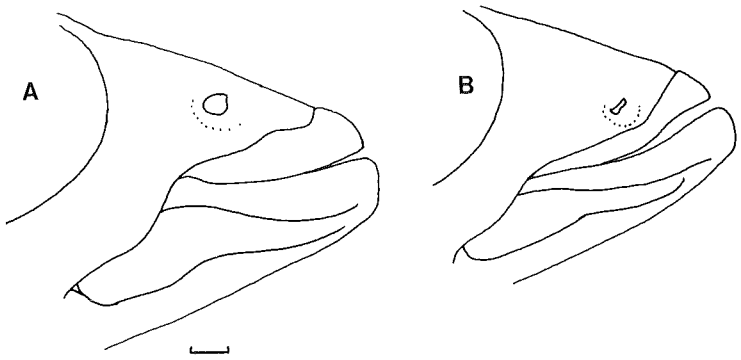


Figure 26. Comparison of snout appearance in A *Crenicichla cyanonotus* (81.2 mm SL, NRM THO/1971508.3264) and B *C. reticulata* (72.5 mm SL, NMW 32835); note more anteroventral nostril on postlabial projection in *C. reticulata* compared to more 'normal' *Crenicichla* condition in *C. cyanonotus*. Scale 1 mm.

The holotype of *C. cyanonotus*, ANSP 9078, appears identified with certainty. It does not bear an original label, but agrees in length (144.7 mm TL; 6 inches according to Cope, which is 152 mm), and other data with Cope's description. I count only 59 squ. long. scales instead of 66, but Cope's count may have included scales on the caudal-fin base.

Three ZFMK specimens from Yarina Cocha, one of which was figured as *Batrachops reticulatus* by Lüling (1975), seem to be *C. cyanonotus*, but differ from other *C. cyanonotus* in the peculiarly short head, much shorter than in any other *Crenicichla* species. Head length is 24.0, 24.0 and 24.9 % of SL in these specimens, to be compared with 27.1 and 30.9 % in the other two specimens measured. As the head length is not only proportionately but also absolutely shorter than in the holotype of *C. cyanonotus*, allometry is out of the question. The condition appears correlated with rounded-off instead of acuminate posterodorsal opercular projection and may reflect different growth conditions in dissimilar habitats. Additional material of *C. cyanonotus* is needed for a better characterization of the species.

One of the Yarina Cocha specimens identified by Meinken as *B. reticulatus* is actually a *Crenicichla proteus*.

Eigenmann & Allen (1942) reported 6 specimens of *C. geayi* from Iquitos as IUM 15986. The same reg. no. is given to '*C. anthurus*' material with the same data. CAS 57454 probably represents one-third of the *C. geayi* lot; unfortunately the other 4 specimens have not been located.

Crenicichla reticulata (Heckel)

Figs 26-27, Pls VII (fig. 5), VIII (fig. 1), Table 5

Synonymy

Batrachops reticulatus Heckel 1840, p. 433 (diagn.; descr.; Rio-negro).
Crenicichla elegans Steindachner 1882, p. 15 (descr.; Hoch-Peru).

Peruvian bibliography

Crenicichla elegans; Eigenmann & Eigenmann 1891, p. 70 (listed).
Crenicichla (Batrachops) elegans; Pellegrin 1904, p. 378 (bibliogr.; descr. abstr. Steindachner).
Batrachops reticulatus; Regan 1905*a*, p. 155 (bibliogr.; descr. abstr. Heckel (1840), Steindachner (1882); *Crenicichla elegans* new synonym). -- Fowler 1944, p. 266 (bibliogr.). -- Fowler 1945*a*, p.248 (bibliogr.).

Material

Syntypes of *C. elegans*, NMW 32835, 72.5-89.9 mm SL, and 2 referred specimens, 160.0-172.9 mm SL, from upper R. Putumayo; holotype of *Batrachops reticulatus* also consulted.

Description

Composite, based on *C. elegans* syntypes, with notes on GNHM specimens; measurements summarized in Table 5; refer to Pls VII-VIII for general aspect.

Shape. Elongate, moderately compressed laterally; predorsal and prepelvic contours slightly curved. Head short, depressed, as wide as deep or slightly wider. Snout short, rounded in dorsal aspect, bluntly triangular in lateral aspect. Lower jaw slightly prognathous, articulating below posterior half of orbit; ascending processes of premaxilla reaching to anterior margin of orbit; maxilla to 1/3 of orbit; lower lip fold widely discontinous, upper lip fold subcontinuous. Preoperculum serrated. Nostril at edge of postlabial skin, which projecting to roof part of upper lip (fig. 26).

Scales. Squ. long. 60 (1), 64 (1), 65 (1), 68 (1). Cycloid on cheek, gill-cover, top of head and anteriorly on back above about 7-8 lateral line scales, on chest, and abdomen ventrally to line connecting pectoral and anal-fin bases, and fin scales. Cheek with 9-11 horizontal scale series below orbit, 6 vertical series behind orbit. 27 horizontal scale series around

caudal peduncle. Naked line from posttemporal to orbit. Group of scales posteriorly on interoperculum. Upper lateral line at 10-11 (anteriorly) to 3-4 (posteriorly) scales distance from dorsal-fin base; 3 horizontal scale-series passing between lateral lines at free ends. Lateral line on 25/12 (2), 26/11 (1), 27/12 (1) scales, plus 3 on caudal fin, and 72.5 mm specimen with tubed scale beween rays D2 and D3. About half (young) to nearly entire (adult) caudal fin scaly; 172.9 mm specimen with pectoral-fin base scaly, both GNHM specimens with small scales in thick basal skin cover of posterior spinous to anterior soft dorsal fin.

Fins. Dorsal-fin origin above opercular tip, 1st spine 1/3 length of last, subequal from 6th, last few again longer; soft fin pointed, 8th ray reaching beyond caudal-fin base (to 1/3 of caudal fin in GNHM specimens). D. XXII.12 (1), XXIII.10 (1), XXIII.12 (1), XXIV.10 (1). Anal-fin origin below last dorsal-fin spine; soft part with rounded tip, not reaching caudal-fin base in young, slightly beyond in adults; A. III.8 (4). Pectoral fin rounded, reaching halfway to anal-fin origin; P. 17 (4). Pelvic fin slightly posterior to pectoral fin; subacuminate, 2nd ray longest, 3rd ray longer or shorter than 1st; reaching almost halfway to anal-fin origin. Caudal fin rounded.

Gill-rakers. 1-2 epibranchial, 1 in angle and 8 (3), 9 (1) lower limb rakers externally on first arch; 6 and 8 rakers on lower pharyngeal toothplate in GNHM specimens. Microgill-rakers externally on 2nd to 4th arches.

Jaw teeth. In both jaws 2 series of stout, conical, slightly recurved teeth, except in smallest specimen with a few teeth forming one additional series anteriorly; outer teeth (19-22/21-24 in upper/lower jaw hemiseries) firmly attached, inner slightly movable, short inner series in lower jaw, almost as long as outer series in upper jaw.

Vertebrae. 20+16 (1), 20+17 (3).

Colouration. Syntypes of *C. elegans* faded from age, ground colour whitish, scales of sides with brown central dot and light edge. Brownish markings still distinct: postorbital spots, one between eye and preoperculum, one on upper half of operculum, one on posterodorsal soft flap of suboperculum; no sub- or preorbital stripes; vertical bars including one above pectoral axilla, spotlike below lateral line, narrower and fainter obliquely dorsally to just in advance of dorsal fin; 5 wide, slanting bars from dorsal fin ventrally to middle of side where each divided into two extending much fainter onto lower sides, 1 wide bar from junction of dorsal-fin base and caudal peduncle to lower lateral line level; bars more intense in a wide longitudinal field passing between lateral lines. Dorsal fin opaque with two parallel series of dark spots, increasingly intense from about middle of spinous dorsal fin caudad, also lappets darkened; anal fin similar, immaculate. Caudal fin yellowish with brownish hind edge, narrow clear posterodorsal edge and wide light submarginal stripe obliquely over dorsal lobe; caudal spot between rays D1-D4, dark brown, ringed with light. Pelvic fin hyaline.

Fresh Putumayo specimens similar. Ground colour slightly greyish yellow on ventral parts. Dark brown postorbital spots as described, posterior extended fainter along posterior edge of suboperculum. Sides with oblique bars as described, 5 below dorsal fin but anterior divided also on back, and an additional spot on caudal peduncle in series with preceding spot-like bar intensifications. Female with greyish yellow, opaque dorsal fin with indicated lighter band along middle and slightly darker inframarginal band; traces of scattered light dots on soft portion. Dorsal fin of male with dark oblique elongate spot on each membrane proximal to lappet, lappets darkened, colour of basal portion uncertain, but probably including additional 1-2 series of dark spots; submarginal spot series continuing onto soft portion, basal part of which also dark-spotted.

Distribution (fig. 27)

Only one precise western Amazonian locality, in the upper Putumayo. The types of *C. elegans* were reported to come from 'Hoch-Peru', which is reasonably in the Marañón or Ucayali drainages, since at the time much of the present

northern Peru was Ecuadorian.

Notes

The holotype of *Crenicichla reticulata* is a 215.6 mm SL specimen, NMW 35783, collected in the R. Negro, Brazil. Few specimens are known that are referable to *C. reticulata* and the status of *Batrachops punctulatus* Regan (1905*a*) from the Essequibo is uncertain. I regard it tentatively as distinct, however, differing in a continuous instead of maculate postorbital stripe, but the quality of this marking is unfortunately not apparent in the old type of *C. reticulatus*. Otherwise, colouration, shape, and meristics of Guyanan '*Batrachops*' agrees with *C. reticulata* from western Amazonía.

The locality of the syntypes of *C. elegans* unfortunately seems to remain a mystery; there is no clue to either locality or collector in Steindachner's (1882) paper containing the description of *C. elegans*, and the register entry '1874.I' is of little help. Material brought by Steindachner from MCZ, chiefly from the Thayer collection, was registered at the same time, and one possibility is that the specimens stem from an American collector.

Although *Crenicichla* is a catch-all group, including several distinct lineages, it appears nevertheless to be a monophyletic group at a higher level than genus. Some species have been excluded from *Crenicichla* and placed together in *Batrachops* Heckel (1840), originally distinguished by stouter shape and stronger teeth in two rather than more series in each jaw, and including *B. semifasciatus* and *B. reticulatus*. Later authors have varied in opinion of the status of *Batrachops* (synonymized with *Crenicichla* by Günther 1862, regarded as subgenus for large-scaled species by Pellegrin, 1904), current literature, however, following Regan (1905*a*) who distinguished *Batrachops* as having 'none of the teeth depressible' in contrast to *Crenicichla*, with 'teeth of the inner series depressible'.

As I find considerable variability in degree of firmness in attachment of teeth in Peruvian species, and as there appears to exist no character otherwise indicative of generic distinctness of *C. reticulata*, the type species, I cannot see any advantage in preserving separate treatment of this species. A future splitting may revalidate the name, but currently it seems to lack meaning, and it obfuscates the evident monophyly of *Crenicichla s.l.*

In shape, squamation and colour pattern, *C. reticulata* strongly resembles several other *Crenicichla* species, like *C. sedentaria, C. semifasciata*, and undescribed forms, which have 3 inner series of movable teeth. It resembles *C. johanna* and *C. semifasciata* in the short, wide head, and especially *C. johanna* in very forwards positioned nostrils. It is distinguished from all other *Crenicichla* species by the biserial jaw dentition and the relatively greater rigidity in attachment of inner teeth.

Among Peruvian species, *C. cyanonotus* appears to be most similar. This species has also been considered as a *Batrachops* (Regan 1905*a*). The material available of both species is very limited, altogether 12 specimens, most of them in poor shape. Separation here is based on: (1) teeth in 4 series in *C. cyanonotus*, 2 series in *C. reticulata*, (2) 2 scale-series separating lateral lines in *C. cyanonotus*, 3 in *C. reticulata*, (3) nostril slightly removed from postlabial skin margin in *C. cyanonotus*, on a projection of the postlabial snout margin in *C. reticulata* (Fig. 26).

Crenicichla cincta Regan

Fig. 27, Pl. VIII (fig. 2), Table 5

Synonymy

Crenicichla brasiliensis Var. *fasciata* Pellegrin 1904, p. 383 (descr.; Marajo (Brésil)), Fig. 42-3 (sketch, colour pattern). (Not *Cychla fasciata* Jardine.)

Crenicichla cincta Regan 1905*a*, p. 166 (descr.; bibliogr.; Para).

Western Amazonian bibliography

Crenicichla cincta; Ovchynnyk 1971, p. 116 (descr.; bibliogr.; comparison with literature data; Ecuador, Prov. Napo, Lake Jatun Cocha (100'S, 75026'W)), Fig. 17 (habitus, monochrome photo).

Crenicichla sp. Bérenz & Zelada 1975, p. 52 (descr.; local name; markets of Iquitos), Fig. 6 (sketch, habitus).

Material

Six specimens, *c.* 120-194.6 mm SL; also Brazilian material consulted (see notes).

Description

From 181.0 mm specimen, variation as noted in ANSP and BMNH specimens (all ANSP specimens females); some counts also include USNM material; measurements in Table 5. Refer to Pl. VIII for general aspect.

Shape. Elongate, moderately compressed laterally; predorsal contour straight ascending to dorsal-fin origin, dorsal-fin base descending about straight; prepelvic contour sloping, straight except anterior curvature. Head depressed, width and depth about equal behind orbit. Snout broad, rounded in dorsal aspect, bluntly triangular in lateral aspect. Preoperculum serrated. Orbit tangential, in dorsal and rostral halves of head. Interorbital narrower than mouth. Lower jaw prognathous, articulated below posterior half of orbit; maxilla reaching to vertical from 1/3 of orbit; ascending processes of premaxilla reaching to 1/4 of orbit. Upper lip folds discontinuous, medianly connected by fleshy pad with convex hind margin fitting concave postlabial skin; lower lip fold along 2/3 of lower jaw margin. Nostril halfway between orbit and postlabial skin margin.

Scales. Squ. long. 108 (1), 110 (1), 112 (2), 113 (1), 116 (1). Scales ctenoid except on cheek and gill-cover, chest, abdominally below line connecting pectoral axilla and anal-fin origin, anteriorly on back (but ctenoid just dorsal to lateral line), and on fins (except basal caudal-fin scales); head, chest, and median abdominal scales smaller than flank scales. Cheek completely scaly, scales not in regular series, about 15-17 horizontal series below and about 12 vertical series behind orbit; posterior half of interoperculum densely scaly. 40-43 horizontal scale-series around caudal peduncle.

Upper lateral line at 18-21 (anteriorly) to 9-10 (posteriorly) scales distance from dorsal-fin base; 5 horizontal scale-series passing between free ends of lateral lines; 4 (anteriorly) to 3 (posteriorly) scales impinging on each lateral line scale. Lateral lines of 25/19 (1), 26/16 (1), 28/16 (1), 28/17 (1) scales, plus 2-3 on caudal-fin base; tubed scale representing caudal-fin accessory lateral line on left side between rays V3 and V4 in MHNG specimen.

Pelvic fin naked; pectoral-fin base with many small scales; caudal fin densely scaly to near hind margin. Dorsal fin with narrow scaly sheath basally from about posterior 1/3 of spinous fin, last 6 membranes naked and those preceding with only one or a few grouped interradial scales; anal fin with narrow basal scaly sheath anteriorly ending on 5th soft part membrane. BMNH specimen with naked soft vertical fins and less wide scaly sheath of spinous fins.

Fins. First dorsal-fin spine, in advance of vertical from opercular tip, about 1/3 length of last spine; spines subequal in length from about 6th; anterior lappets pointed, gradually changing to truncate posteriorly; soft part with short point, 11th ray longest, reaching slightly beyond caudal-fin base. D. XXI.16 (2), XXI.17 (1), XXII.16 (2), XXIII.15 (1). Anal-fin origin below last spine or first two rays of dorsal fin; soft part with rounded or subacuminate tip, not reaching to caudal-fin base. A. III.10 (2), III.11 (4). Pectoral fin rounded, 7th ray longest, reaching halfway to vent or anal-fin origin; P. 17 (2), 18 (2). Pelvic fin inserted posterior to vertical from pectoral axilla; tip rounded-off; 2nd ray longest, 1st ray longer than 3rd; reaching about halfway to anal-fin origin. Caudal fin damaged in all specimens.

Gill-rakers. 1-2 epibranchial, 1 in angle and 10 (1), 11 (4), 12 (1), lower limb rakers externally on first gill-arch. 10 (1), 11 (2), 12 (1) rakers

on lower pharyngeal tooth-plate. Microgill-rakers externally on 2nd to 4th arches.

Jaw teeth. Simple, conical, little recurved. Those of outer series movable, those of inner 4-6 (upper) or 2-3 (lower jaw) series depressible, 1-2 inner series posteriorly in each jaw; outer teeth equal to or larger than inner except inner teeth anteriorly in upper jaw longer than those anteriorly in outer series.

Vertebrae. 23+19 in MHNG 2233.15.

Colouration. Honey-yellow, shaded with brownish on back, whitish along middle of abdomen, chest and branchiostegal membrane; cheek and gill-cover pale yellowish; snout grey dorsally, nape light brownish. Preorbital stripe grey brown, from lower jaw tip to orbit; postorbital stripe brown, distinct on gill-cover. Lateral band grey-brown, narrow, even-edged, continuing postorbital stripe on level of lower lateral line to caudal ocellus, 4 scales deep on middle of side; intensified between origin and 1st bar below dorsal-fin. In others, band faint or absent caudal to intense portion just posterior to head. Contrasted brown vertical bars, as wide as interspaces or slightly narrower; 1 across nape just in advance of dorsal fin, not reaching quite to 1st lateral line scale, 8 (in others 7-9; number and precise positions not bilaterally symmetrical) from dorsal-fin base ventrally to lateral band and as shades slightly below, anterior oblique, posteriorly gradually becoming vertical; 2 across dorsal half of caudal peduncle. Young BMNH specimen with dark brown band from around lower jaw tip to end of caudal fin much more intense than vertical bars; narrow uneven brown horizontal lines on each side of head: one between eye and gill-cleft faint, one from dorsal margin of orbit to about 8th lateral line scale, one from anterior nasal pore faint to above middle of upper lateral line, one from middle of upper lip (where joined to opposite side line) caudad along back to above middle of upper lateral line. No suborbital stripe or pectoral axilla spot.

Dorsal fin light grey, turning brownish on soft portion which also narrowly edged with dark brown dorsally and with a few large yellowish spots and cross-stripes. Anal fin light greyish with brown ventral seam and narrow white ventral edge; 4 indistinct yellowish cross-stripes posteriorly on soft portion. Pelvic fin yellowish white. Caudal fin grey brown, lighter basally, with 3 cross-rows of large yellowish spots, and a posterior irregular stripe of same colour; 2 proximal spot-series interrupted by large ocellus, comprising black roundish spot from ray D1 to D3 and wide yellowish surrounding ring. Young BMNH specimen with dark band along middle of caudal fin and caudal spot little rising from it, light-ringed dorsally.

Distribution (fig. 27)

Peruvian localities are near Iquitos and Pebas, and on the lower Napo. The species has also been collected in Ecuador (L. Jatún Cocha) (Ovchynnyk 1971), and in Brazil (Manaus, near Belém, Ilha Marajó).

Local name

Añashua (Bérenz & Zelada 1975: markets of Iquitos; label of BMNH specimen).

Notes

Crenicichla cincta was described first by Pellegrin as *C. brasiliensis* var. *fasciata*, based on a specimen from the Ilha Marajó (MNHN 02-95). Regan (1905a) recognized it as a distinct species and proposed the name *C. cincta*, considering *fasciata* to be preoccupied in the genus by *Cychla fasciata* Jardine, which he regarded as a synonym of *C. johanna*. As Regan described *C. cincta* as a new species (sp.n.) and listed as 'type of the species' a specimen from 'Para' (BMNH 1895.3.29:32) not identical with Pellegrin's type of *fasciata*, it seems like Regan instead of substituting the name *fasciata* produced a junior synonym. In accordance with ICZN Article 60b *C. cincta* must be adopted as replacement name for *C. fasciata* Pellegrin, and following Article 72e Pellegrin's specimen (MNHN 02-95) is

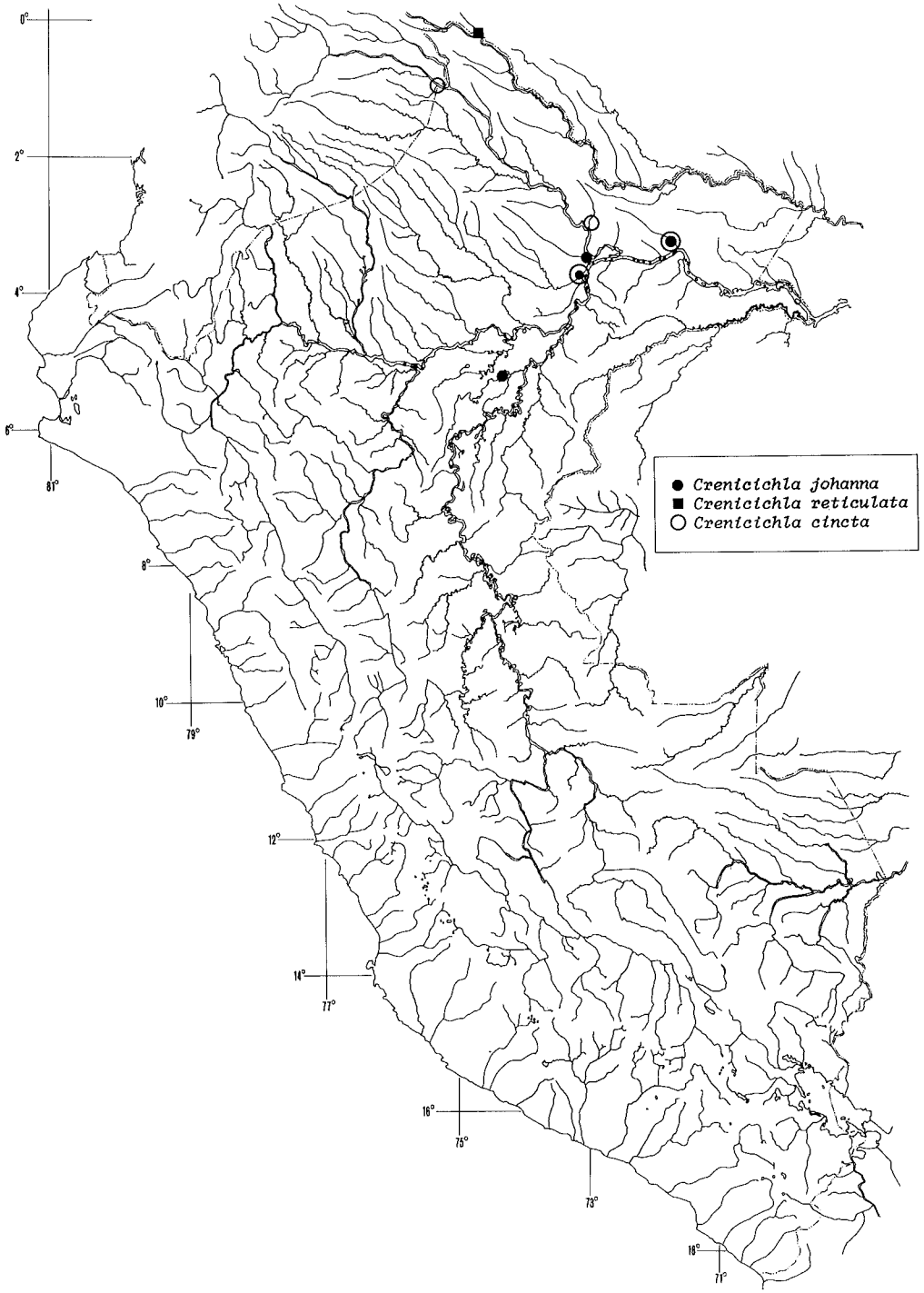


Figure 27. Collecting localities of *Crenicichla johanna*, *C. reticulata* and *C. cincta* in western Amazonía.

the holotype of *C. cincta*. As Jardine's name is not, and virtually never has been used as a senior synonym, the change from *fasciata* to *cincta* is not really required to prevent confusion; a change back now to *fasciata* would, however, be confusing, as *cincta* has been used in several important papers (eg. Regan's revisions).

Few additional specimens have been collected in Brazil. I am aware of NMW 32859, 219.3 mm SL from 'Para', NRM unreg., 238.0 mm SL, from Manaus, Haseman's (1911c) specimen from Belém and Stark's (1913) specimen from Para (=Belém). Eastern Brazilian material appears slenderer in general aspect, with less depressed head compared to Peruvian material. The available material is, however, much too limited to allow any decision about the significance of variation in shape. East Brazilian specimens do not show a lateral band, but the band in Peruvian specimens appears to be a preadult feature, as in many other *Crenicichla*. In other respects, the description of Peruvian specimens appears valid also for Brazilian material.

Crenicichla cincta differs from all other *Crenicichla* species in the scaly sheath of the dorsal and anal fins. The scales cover rather than are embedded in thick skin along fin bases and are much more numerous than in large specimens of other *Crenicichla* species which regularly feature scales in the basal skin cover of vertical fins (eg. *C. sedentaria*). The species also has a relatively long snout compared to many other small-scaled *Crenicichla* species, with the nostril well removed from the anterior edge of the snout (cf. *C. johanna*). The colour pattern, light with contrasting dark bars across the sides, and a prominent caudal ocellus, is distinctive, and especially helpful in the field to distinguish *C. cincta* from other western Amazonian *Crenicichla* which are all dark-coloured, with or without prominent lateral band, and with much smaller caudal ocellus.

Crenicichla johanna Heckel

Fig. 27, Pl. VIII (figs 3-4), Table 5

Synonymy

Crenicichla johanna Heckel 1840, p. 425 (diagn.; descr.; Rio-Guaporè).
Crenicichla obtusirostris Günther 1862, p. 305 (descr.; River Capin).
Crenicichla Johanna var. *carsevennensis* Pellegrin 1905, p. 168 (bibliogr.; descr.; Entre les rivières Carsevenne et Cachipour (contesté franco-brésilien)).

Peruvian bibliography

Crenicichla joanna (sic); Cope 1878, p. 697 (listed; Peruvian Amazon).
Crenicichla Johanna; Steindachner 1883, p. 3 (note; Rio Huallaga).
Crenicichla johanna; Fowler 1944, p. 269 (Peruvian bibliogr.). -- Fowler 1945a, p. 250 (Peruvian bibliogr.). -- Fowler 1954, p. 301 (bibliogr.), Fig. 885 (sketch, specimen from Peru, /ANSP 21279/).

Material

Six Peruvian specimens, 125.5-240.9 mm SL; also the holotype of *C. johanna* and other extralimital material consulted.

Description

Compound, but chiefly from 146.5 mm specimen (Pl. VIII, fig. 3), comparative notes on two more NRM specimens; counts are from these and FMNH specimen, some also from ANSP and USNM specimens (n=6); measurements are given in Table 5.

Shape. Elongate; rostrally wider than deep, depth and width about equal posteriorly on head, flanks compressed, gradually more so caudad. Predorsal contour ascending, straight in 146.5 mm specimen, very little curved in the others; prepelvic contour sloping; dorsal-fin base contour about horizontal, slightly descending posteriorly; caudal peduncle edges straight, ventral much longer than dorsal.

Head wide, snout wide, bluntly rounded in dorsal aspect. Orbit entirely in rostral and dorsal halves of head. Mouth wider than flat (146.5 mm specimen) or very little vaulted interorbital area. Lower jaw prognathous, its articulation below middle of orbit. Maxillary tip exposed; reaching to or slightly beyond vertical from anterior margin of orbit. Preorbital concave where receiving lower lip. Nostril close to edge of postlabial skin, a wide skin flap on anterior edge. Lower lip fold extending 2/3 of distance from attachment on upper lip to lower jaw tip; upper lip fold curled laterally, symphysially interrupted by fleshy caudad convex pad fitting concave postlabial skin margin. Preoperculum with well-formed pointed serrae along vertical margin above corner pore, 31 in 146.5 mm specimen; all covered by thick skin.

Scales. Squ. long. 89 (1), 90 (1), 100 (1), 103 (1), 110 (1), - (1). All scales cycloid, small, especially on head and anterior to pelvic fins, but lateral line scales much larger than the rest, 3 scales impinging on each. In 146.5 mm specimen about 18 (anteriorly) and 9 (posteriorly) scales between upper lateral line and dorsal fin; 4 scale series between lateral lines. Naked pit at tip of cleithral symphysis. Cheek completely scaled (about 15 horizontal scale series); naked line over posttemporal lateralis canal section from dorsal tip of preoperculum to naked circumorbital area. Preoperculum naked. A group of scales posterodorsally on interoperculum.

Lateral lines of 24/13 (1), 26/13 (1), 27/13 (1), 28/12 (1) scales, and 2 scales continuing lower on caudal fin between rays D1 and V1; no accessory lateral lines on caudal fin.

Fins naked except caudal fin, with a short basal layer to 1/4 length of fin, posteriorly interradial scales in 2-3 series on each membrane, not extending over rays, to over 2/3 of fin length (146.5 mm specimen) or nearly distal end (larger fish, which also with scales between ray branches). Pectoral axilla naked.

Fins. First dorsal-fin spine inserted above tip of operculum, its length 1/3 (146.5 mm specimen) to 1/4 length of last; spines increasing in length from first to last; lappets pointed, moderately long; soft dorsal fin anteriorly higher than spinous, margin slightly convex, ending posteriorly in blunt or (240.9 mm specimen) pointed tip, not reaching to middle of caudal fin. D. XX.16 (1), XX.17 (2), XX.18 (1), XXI.16 (1), XXI.17 (1). Anal-fin origin below anterior dorsal-fin rays; soft portion with posterior rounded-off tip, reaching almost to or to slightly beyond caudal-fin base. A. III.10 (3), III.11 (2), III.12 (1).

Pectoral fin rounded, about 7th ray longest, reaching halfway to vertical from anal-fin origin. P. 17 (3), 18 (1). Pelvic fin with rounded tip, 1st and 2nd rays subequal in length (146.5 mm specimen only) or pointed, 2nd ray slightly the longest; reaching halfway to vent or genital papilla; inserted well posterior to vertical from pectoral axilla. Caudal fin mutilated in all, appearing to have had a rounded edge.

Gill-rakers. 2 epibranchial, 1 in angle and 9 (5) ceratobranchial rakers externally on first gill-arch; short or knob-like, well-denticulated; 9? (1), 11 (1), 12 (1), 15 (1) rakers on lower pharyngeal tooth-plate. Microgill-rakers externally on 2nd-4th arches.

Teeth. Simple, conical, slightly recurved; those in outer series stout and fixed, inner comparatively slender, completely depressible, but upper jaw outer teeth in 146.5 mm specimen slightly movable. Outer, and one of inner series extending back to jaw end, except that in 146.5 mm specimen outer series about 5 teeth shorter than accompanying inner series (only 19 outer hemiseries teeth). NRM specimens with 26/19, 27/26, 26/23 teeth in outer upper/lower jaw hemiseries, 2-3 inner series in lower jaw, 3 in upper jaw. Inner anterior teeth slightly longer than anterior outer, otherwise inner and outer adjacent teeth of about same length.

Vertebrae. 22+17 (1), 22+18 (1).

Colouration. From 146.5 mm specimen (Pl. VIII, fig.3): Sand-coloured, shading to greyish on back; snout and operculum greyish. Pattern of dark markings very indistinct. No suborbital stripe or humeral ocellus. A brownish

sharply defined stripe from orbit forward to preorbital edge ventral to nostril. Dark brown spot close to posterosuperior edge of orbit. Indistinct wide horizontal brown band from orbit back to preoperculum. 10 (right side) or 11 (left side) grey brown vertical bars; those behind head not symmetrical bilaterally; anterior bars about as wide as interspaces or narrower, posterior wider than their interspaces; (1) across nape above preoperculum; (2) across nape just in advance of dorsal fin; (3)-(10) below dorsal fin down to upper lateral line or its level, anterior bars backwards inclined, posterior bars straight vertical; (11) on left side at origin of caudal peduncle virtually a part of dark margin of peduncle, on right side a short bar at end of dorsal-fin base representing bars 10 and 11 of left side. A wide, very faint but sharp-edged horizontal band from pectoral girdle to caudal-fin base, dorsal margin along upper lateral line canals (or same level), reaching ventrally about 3 scales below lower lateral line level. Along abdominal side a very few indistinct curved vertical stripes, convex caudad. Inside of pectoral axilla and side just above, dark brown. Minute scattered dark dots on dorsal side of head, and back in a line parallel to upper lateral line between it and dorsal fin. A similar, but smaller, dark dot at base of each scale in upper lateral line.

Dorsal fin greyish; whitish submarginal stripe, dark marginal band with lighter median zone. Anal fin light grey, lower edge slightly darker. Pelvic fin whitish. Caudal fin grey-brownish; no caudal spot; dorsal lobe corner with wide submarginal band and clear edge, ventral lobe with light zonation indicated.

237.5 mm specimen grey dorsally; lighter, to dirty whitish on ventral surfaces. About 9 vertical bars can be traced below dorsal fin; pectoral axilla spot as in specimen described above, but no other head or flank markings evident. Dorsal, anal and caudal fins uniformly grey. Pelvic fin white or clear with grey anterior margin. 240.9 mm specimen grey, yellowish white on ventral surfaces; about 9 bars below, 1 bar anterior to dorsal fin and horizontal band indicated. Postorbital stripe and spot above eye not well distinguished from dark head colour otherwise. Pectoral axilla spot as in other specimens. Dorsal fin grey, marginally somewhat lighter, edge narrowly black. Anal fin grey with darker edge. Caudal fin grey. Pelvic fin as in 237.5 mm specimen.

141.7 mm specimen (Pl. VIII, fig. 3) showing characteristic colour pattern of young; specimen darkened in preservation but pattern of dark markings still distinct: Dorsally on head numerous small brown dots, seemingly scattered anteriorly but chiefly forming anterior portion of dotty horizontal lines: (1) running close along dorsal-fin base, dots well spaced; (2) running anteriorly at about middistance dorsal-fin lateral line straight to end of dorsal-fin base and onto dorsal edge of caudal peduncle, converging with (1) along soft dorsal-fin base; (3) dotty from nostril over dorsal orbital margin and along frontal-pterotic lateralis canal, a few dots anteriorly on lateral line scales. Wide brown preorbital stripe from lower jaw to eye, undulated postorbital stripe and lateral band, with dark brown uneven edges; lateral band 9 scales deep on middle of side, dorsal margin touching end of upper lateral line, ventral margin well below lower lateral line level, narrowing to end in blunt point distally on scaly portion of caudal fin. Scattered brown dots dorsally on operculum and suboperculum, on orbital rim and on cheek close to orbit. Traces of vertical bars; 8 or 9 from dorsal fin, ventrally to below lateral band. Dorsal edge of pectoral axilla dark brown. No humeral or caudal spots. Caudal fin with white corner edges, and dark wide submarginal band posteriorly; colouration of other fins uncertain, not well preserved.

Life colours. Ampiyacu specimen blue-grey, with numerous narrow myocommata-like vertical stripes on side. Dorsal- and upper caudal-fin margin red, inframarginal stripes white. Adult from Puñuisiqui Cocha with posterior cheek, lower operculum, suboperculum and adjacent branchiostegal membrane yellowish, darkening to red on head and anterior dorsal flanks; anterior margin of pelvic fin red. Yuto Cocha adult simply grey with white underside and light myocomma-

ta-like vertical stripes on side.

Distribution (fig. 27)
Only 5 Peruvian localities known: near Pebas, Mazán and Iquitos, and 'R. Pacaya' (apparently near Bretaña, cf. Eigenmann & Allen 1942). The species is wide-spread in the Amazonas drainage basin, and taken also in marginal Guianas rivers and the Orinoco basin.

Ecology
In 1981 and 1984 single specimens of *C. johanna* were obtained from river and lake shores. Like other large *Crenicichla* species, *C. johanna* is rare in collections, and may have solitary habits.

Local name
Añashúa (Iquitos).

Notes
Like the other large *Crenicichla* species with small scales, *C. johanna* is uncommon in museum collections. The colour pattern of young (Pl. VIII, fig. 4) has never been described previously, but juveniles still remain to be collected. The ontogenetic change in coloration, from a rather bold pattern to simply countershaded dark is striking. It parallels that of *C. strigata* (Günther) which has a colouration basically similar to that of *C. johanna* both as young and as adult, but with a large, conspicuous caudal-fin spot. The cycloid scales, absence of caudal spot, and very rostrally positioned nostril make *C. johanna* a distinctive species among western Amazonian *Crenicichla*. No other *Crenicichla* species has exclusively cycloid scales.

The holotype (NMW 16431, 28.3 cm SL) is a stuffed specimen from the R. Guaporé. No *C. johanna* have since been collected in the Guaporé. Because of limited material availability from other localities within the vast range of *C. johanna*, it is not possible at this moment, to try an analysis of geographical variability.

Crenicichla semicincta Steindachner
Figs 28-29, Pl. IX (figs 1-3), Table 6

Crenicichla saxatilis (Var. *semicincta*) Steindachner 1892, p. 376 (descr.; Bolivia, Provinz Yuracares, im oberen Chaparé bei Puerto de San Mateo).

Bibliography
Crenicichla saxatilis; (*pt.*) Regan 1905*a*, p. 159 (*C. saxatilis var. semicincta* in synonymy; not material). -- (*pt.*) Lüling 1975, Abb. 12*pt.* (monochrome photo, habitus /ZFMK 2137-2138*pt.*/).

Material
36 Peruvian specimens, 27.3-171.2 mm SL; also syntypes and smaller series from Bolivia (see notes).

Description
Based on specimens over 100 mm SL from Lago Túpac Amaru and lower R. Tambopata, unless otherwise specified; counts from all specimens available, measurements summarized in Table 6. Refer to Pl. IX for general aspect.

Shape. Elongate; laterally compressed, gradually more so posteriorly; head deeper than wide behind orbit, anteriorly wider than deep; predorsal contour about straight ascending; dorsal-fin base contour slowly descending; prepelvic contour sloping, straight. Orbit tangented by frontal contour, in anterior and upper half of head. Snout rounded in dorsal aspect; round-tipped

triangular in lateral aspect; with curved dorsal and ventral surfaces. Interorbital narrower than mouth. Lower jaw prognathous, articulating below hind edge of orbit; maxilla reaching to vertical from 1/3 or, exceptionally, middle of orbit or slightly beyond; both lip folds narrowly interrupted anteriorly. Nostril at about middistance eye-postlabial skin edge. Preoperculum with regular serrations, not reaching ventrally to corner pore.

Scales. Squ. long. - (4), 47 (1), 48 (4), 49 (2), 50 (4), 51 (6), 52 (6), 53 (4), 54 (1), 55 (2), 57 (1), 59 (1). Scales ctenoid except predorsally, anteriorly on back (scales in series dorsal to lateral line usually ctenoid, or ctenoid from above about 7th lateral line scale), cheek, operculum, chest, along middle of abdomen and side of abdomen near pectoral fin, and interradial scales on fins. Naked line along lateral line canal from posttemporal to orbit. Cheek completely scaly or naked anteroventrally and next to lachrymal; with about 5 horizontal scales-series below, 5-6 vertical series behind orbit. Interoperculum naked, or with a group of scales posteriorly. 24 horizontal scale-series around caudal peduncle.

Upper lateral line at 6-7 (anteriorly) to 3-4 (posteriorly) scales distance from dorsal fin; 2 scale-series passing between lateral lines at free ends; 2 scales impinging on each lateral line scale. Lateral lines of -/- (1), -/10 (1), 22/- (1), 22/10 (5), 22/11 (2), 22/13 (1), 23/8 (2), 23/9 (4), 23/10 (8), 23/11 (3), 23/12 (1), 24/8 (1), 24/9 (2), 24/10 (2), 24/11 (1), 25/9 (1) scales, plus 2 on caudal fin; no accessory caudal-fin lateral lines observed.

Fins, except caudal fin, which scaly on inner 1/3 to 1/2, generally naked. Pectoral-fin base scaly in 142.1 and 158.6 mm specimens; dorsal and anal fins with 1-2 scales on each membrane in thick basal skin in 142.1 mm (right side: between rays 8 and 10; left side: rays 4-5, 6-7) and 158.6 mm (right side only, between rays 1-8) specimens.

Fins. Dorsal-fin origin at or slightly in advance of vertical from opercular tip; 1st spine 1/3 length of last; spines increasing in length to last, but little posteriorly from 5th-7th; lappets pointed; soft fin pointed, 9th ray long or with short filament to near middle or 3/4 of caudal fin. D. XVII.15 (6), XVII.16 (1), XVIII.14 (6), XVIII.15 (10), XIX.13 (2), XIX.14 (6), XIX.15 (4), XX.14 (1). Anal-fin origin below soft dorsal-fin origin; soft fin pointed, 5th or 6th ray longest, reaching to at most 1/3 of caudal fin. A. III.9 (11), III.10 (24), III.11 (1). Pectoral fin rounded, 6th ray longest, reaching halfway to origin of spinous or soft dorsal fin; P. - (1), 15 (8), 16 (21), 17 (6). Pelvic fin with rounded tip, 2nd ray longest or 1st and 2nd rays subequal; reaching halfway to vent or anal-fin origin. Caudal fin rounded.

Gill-rakers. Two epibranchial, one in angle, and 9 (11), 10 (21), 11 (4) on lower limb externally on first arch. Microgill-rakers externally on 2nd-4th arches. - (4), 9 (4), 10 (6), 11 (7), 12 (8), 13 (3), 14 (2), 15 (2) rakers on lower pharyngeal tooth-plate.

Teeth. As in *C. proteus*; 4-5 series anteriorly in upper jaw in adults, 3 in some young, in large specimens 1-2 inner series posteriorly; 3-4, 2 in some young, series anteriorly in lower jaw.

Vertebrae. 18+16 (1), 19+15 (2), 19+16 (6), 20+16 (3).

Local variation. Scales apparently slightly smaller in Inambari than in other material, and dorsal-fin count lower in Puerto Maldonado area + Tambopata material than in other material.

Colouration. Large males, over 140 mm SL: Ventrally whitish, head more greyish; lower flanks greyish whitish, back brown-grey; cheek yellowish thinly overlayered with brown; gill-cover grey; snout above grey, nape brown-grey. Preorbital stripe brownish, faint; postorbital stripe brown, fading on gill-cover tip; dark brown suborbital stripe to middle of cheek. Lateral band, about 2 scales deep, on and above lower lateral line level, very indistinct, greyish. Centers of lower lateral line scales with light dot; upper lateral line canal tubes light. Humeral spot unocellated, entirely within lateral band, about 4-5 scales long, 2-2 1/2 scales deep, elongate and fading out posteriorly or roundish. Dark brown spot dorsally on pectoral axilla and adjacent side. Traces of vertical bars on back and nape, rarely countable, 2 ante-

rior to, 7 below dorsal fin, and 2 on caudal peduncle. Dorsal fin grey with lighter horizontal stripe along middle of spinous dorsal fin; posterior inner soft portion with light interradial spots, which form cross-stripes or, commonly, rather irregularly distributed. Anal fin greyish with blackish lower edge and light spotting on proximal posterior part. Caudal fin greyish with about 8 indistinct light interradial spots in cross-series along middle; edges narrowly darkened, white distal edge superoposteriorly. Caudal spot black, round or rectangular, between rays D1 and D4, not or indistinctly ocellated. Pelvic fin white. Two males, 158.6 and 146.0 mm SL (USNM 264098) much darker than other, brownish with subdued markings and also ventral parts pigmented.

Adult females, over 100 mm: Like males, differing in fin colouration. Dorsal fin with light stripe anteriorly marking proximal 1/3 of spinous dorsal fin, posteriorly widening and gradually more dorsally positioned; black spots with wide hyaline borders variable in number and cohesiveness, interradially on outer half of membranes from about middle of spinous dorsal fin, and fainter, smaller and unocellated on anterior half of soft dorsal fin (examples: 3 continuous spots with shared light border from 14th to 17th spine; series of contiguous spots with shared light border from 11th to 17th spine, posteriorly fainter and smaller spots; 5 separate ocelli, between 10th-11th, 12th-15th, 16th-18th spines, and 1st-2nd, 4th-5th rays, posteriorly 1 or 2 fainter and smaller ocelli); black dorsal border posteriorly from commencement of ocelli-series, inframarginally white or hyaline stripe, bordered below by black stripe or spot series representing continuation of ocelli series. Soft unpaired fins without light spots (cf. males); caudal fin with narrow black posterior border except on central portion, posterodorsal corner with white edge and white stripe proximal to black border. Smallest female with dorsal-fin ocelli 99.8 mm SL.

Young (less than 100 mm) have the lateral band emphasized, especially at smaller sizes, and light dorsal margin to humeral spot makes it more contrasted than in larger fish. Young of both sexes with light spots forming cross-stripes on unpaired fins as in adult males, but fewer stripes, and caudal spot ocellated. At 43 mm, caudal fin with light and dark marginal stripes dorsally on caudal fin relatively much wider than in adults.

Specimens 102.0-135.8 mm from the upper Madre de Dios are notable for the contrasting lateral band which obscures the humeral spot, ocellated caudal spot, and comparatively short suborbital stripe, resembling thus young from the Puerto Maldonado-Tambopata region.

Among Inambarí material, the Marcapata specimens are overall brown due to preservation, but otherwise appear similar to upper Madre de Dios material, but in these the lateral band tends to have an uneven dorsal margin, with short projections where much fainter vertical bars meet.

Distribution (fig. 28)
Peruvian localities are near the Cuzco/Madre de Dios departmental border on the Pilcopata, along the lower Tambopata and adjacent Madre de Dios, and near Macusani and Marcapata. The Inambarí locality for one BMNH sample is imprecise.

Ecology
Crenicichla semicincta has been collected in lakes, streams and swamps in both Bolivia and Peru.

Notes
Crenicichla semicincta is based on 3 specimens (NMW 33482-33484, 76.0-132.5 mm SL) from Puerto de San Mateo on the upper Chapare in Bolivia. The species appears widely distributed in Amazonian Bolivia, but replaced in the Guaporé by *C. lepidota* Heckel.

Crenicichla proteus and *C. semicincta* are more similar to each other than either to any other *Crenicichla* species. Like *C. lucius* they have the humeral spot unocellated and on the body midaxis, but they differ from *C. lucius* in relatively low scale count and in the colour pattern of

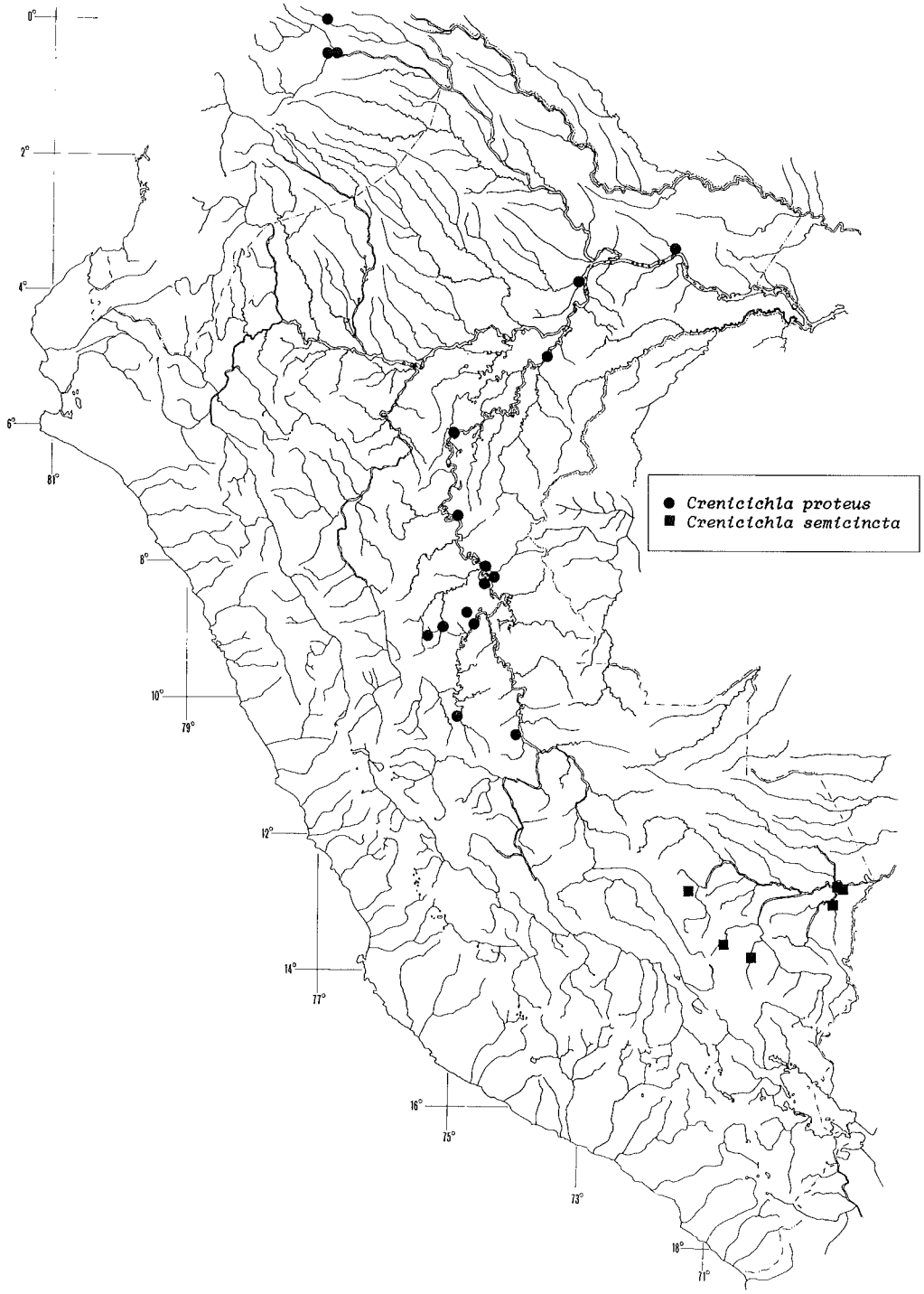


Figure 28. Collecting localities of *Crenicichla proteus* (total known range) and *C. semicincta* in Peru.. A symbol may represent more than one, adjacent collecting sites.

unpaired fins in adult females. The single ocellus, or series of ocelli, on the dorsal fin is not a unique feature among *Crenicichla* species and scale-counts overlap with those of other species.

Crenicichla semicincta is distinguished from *C. proteus* by having a stripe-like suborbital stripe which commonly pointed ventrally, instead of a roughly triangular suborbital stripe with rounded ventral end, and by overall slenderer aspect, which is best illustrated by the narrower interorbital width.

Crenicichla semicincta was recently (Kullander 1982*b*) resurrected from the synonymy of *C. saxatilis* (Regan 1905*a*), with a query concerning its status *visavi C. lepidota*. I had then seen neither the types of *C. semicincta* or other Amazonian material of *C. lepidota*. Examination of the syntypes and topotypes of *C. semicincta*, a topotype and other Guaporéan material of *C. lepidota*, shows, however, that there are two *C. lepidota* group species in Bolivian Amazonía to which material from other localities can be referred. The specimen on which the description of *C. lepidota* was based, cannot be located in NMW, but a smaller specimen from the same collection (NMW 33109) agrees with material labelled '*C. lepidota* Paraguay' in Kullander (1982*b*). Referred material examined is from Santo Antonio de Guaporé and R. Blanco (FMNH 54116, NRM A85/1984357.3084, together 9 specimens, 42.2-85.2 mm SL). This species, referred to as *C. lepidota* despite the vacant holotype, has a large, ocellated humeral spot that may transcend the lateral line, low scale counts (34) 37-45 in Paraguayan material, 42-46 ($\bar{x}$=44.2, n=10) in Guaporéan material), and breeding females have a black dorsal fin with or without a submarginal series of white spots. None of the syntypes or topotypes of *C. semicincta* have dorsal-fin ocelli, at least the larger specimens apparently being males, but they have an axial, unocellated humeral spot, as described for Madre de Dios material, and more squ. long. scales than *C. lepidota* (49-54, $\bar{x}$=50.7, n= 6). Other lots from

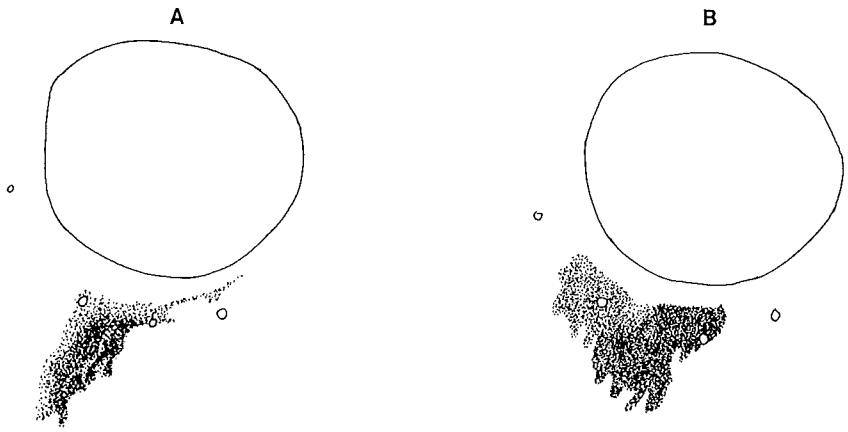


Figure 29. Comparison of cheek markings (suborbital stripe) in A *Crenicichla semicincta* (99.8 mm SL) and B *C. proteus* (101.0 mm SL); note broader, more blotch-like appearance in *C. proteus*, but individual variation notable in both species.

Table 6. *Morphometry of* **Crenicichla semicincta** *from Peru. Measurements are in per cent of SL, except SL (in mm). Data for material from the R. Tambopata-Puerto Maldonado, R. Inambari and R. Pilcopata regions based on specimens about 100 mm SL and larger (actual range as specified).*

	All *C. semicincta* n = 34		Pto Maldonado + Tambopata n = 10		Inambari n = 6		Pilcopata n = 5	
	Range	$\bar{x}\pm s(\bar{x})$	Range	$\bar{x}\pm s(\bar{x})$	Range	$\bar{x}\pm s(\bar{x})$	Range	$\bar{x}\pm s(\bar{x})$
SL (mm)	38.6-161.5	105.2±6.67	99.8-158.6	133.9±7.44	100.2-161.5	137.3±9.96	102.9-135.8	116.9±5.73
Head length	29.5- 33.5	31.2±0.18	29.8- 33.1	31.5±0.28	29.5- 31.9	30.4±0.37	29.6- 31.3	30.6±0.30
Head depth	14.0- 17.6	15.5±0.14	14.6- 17.6	16.0±0.28	14.2- 15.2	14.8±0.15	14.7- 15.3	15.0±0.11
Body depth	20.4- 27.5	23.1±0.28	22.2- 27.5	24.6±0.52	21.2- 24.9	22.6±0.55	20.6- 23.5	22.3±0.50
Snout length	6.0- 9.0	8.0±0.14	7.4- 9.0	8.5±0.16	8.1- 8.8	8.5±0.13	7.7- 9.0	8.4±0.26
Orbital diameter	6.7- 11.5	8.3±0.22	7.1- 8.3	7.6±0.16	6.7- 8.6	7.3±0.30	7.0- 7.9	7.6±0.19
Interorbital width	5.4- 8.4	6.9±0.14	6.7- 8.4	7.7±0.21	6.4- 7.4	6.9±0.17	6.8- 7.7	7.2±0.15
Pectoral-fin length	18.3- 24.1	21.4±0.23	20.3- 22.8	21.6±0.25	18.3- 21.6	19.8±0.53	20.0- 22.0	20.8±0.34
Upper jaw length	9.8- 14.6	12.3±0.16	12.3- 14.6	13.2±0.22	11.9- 12.5	12.2±0.11	11.4- 12.8	12.3±0.29
Lower jaw length	14.8- 18.9	16.9±0.16	16.8- 18.9	17.8±0.19	16.4- 17.5	17.1±0.17	15.8- 17.9	17.0±0.38
Caudal peduncle depth	10.4- 14.0	11.6±0.14	11.1- 14.0	12.3±0.27	10.7- 12.3	11.5±0.27	10.6- 11.5	11.1±0.17
Caudal peduncle length	10.8- 14.8	12.5±0.14	11.3- 12.6	12.0±0.14	10.8- 13.1	12.2±0.32	12.2- 13.7	12.7±0.28
Last dorsal-fin spine length	10.9- 14.8	12.4±0.18	11.1- 14.2	12.9±0.35	11.0- 12.3	11.6±0.20	10.9- 12.1	11.5±0.24

Bolivian Amazonía west of the principal Guaporé drainage agree in colour pattern and scale count, and females have ocelli in the dorsal fin as described for Peruvian material. Conclusively, *C. lepidota* and *C. semicincta* are different and allopatric species. *Crenicichla lepidota* is also widely distributed in the La Plata basin, where distinct forms have been recognized (Kullander 1983*b*). *Crenicichla semicincta* occurs in the Mamoré, Beni and Madre de Dios drainages only. A form of *C. lepidota* from the upper R. Alto Paraná approaches rather *C. semicincta* in meristics and female dorsal-fin colour pattern (cf. Kullander 1982*b*), but has the ocellated humeral spot as in *C. lepidota*.

At small sizes (<50 mm), the head shape is similar in both species, and similar to that of other *Crenicichla* young, and interorbital width shows positive size allometry compared to both SL and head length. The difference in head shape is obvious by direct observation comparing large specimens; in specimens 100 mm and larger, interorbital width 27.9-33.2 % of head length, $\bar{x}$ = 29.5±0.59, n = 8, 100.6-146.1 mm SL in *C. proteus*, 20.0-27.0 %, $\bar{x}$ = 23.8±0.42, n = 21, 99.8-161.5 mm SL in *C. semicincta*.

Material from the Tambopata and Puerto Maldonado area tends to be more stout-bodied than Pilcopata and Inambarí series, and there are also minor differences in count frequencies and colouration. These dissimilarities are minor, and although calling for investigation using larger samples than those now at hand, may reflect only habitat differences. Morphometric data of specimens grouped into three geographical regions are given in Table 6, indicating chiefly shallower bodies of Pilcopata and Inambarí material. This phenotype distribution pattern approximately parallels distribution of *Bujurquina tambopatae* + *B. cordemadi* and *B. eurhinus*.

Crenicichla proteus Cope

Figs 28-29, Pls IX (fig. 1), X (figs 1-2), Table 7

Synonymy

Crenicichla proteus Cope 1872, p. 252 (descr.; Ambyiacu River).

Crenicichla proteus Var. *γ (argynnis)* Cope 1872, p. 253 (descr.; Ambyiacu River).

Batrachops nemopterus Fowler 1940*a*, p. 283 (descr.; Ucayali River basin, Contamana, Peru), Fig. 64 (outline drawing, habitus /holotype/).

Selected bibliography

Crenicichla lacustris; Cope 1870, p. 570 (notes; the tributaries of the Upper Maranon, in Equador).

Crenicichla proteus; Cope 1878, p. 697 (listed; Peruvian Amazon). -- Eigenmann & Eigenmann 1891, p. 70 (listed, twice). -- Kullander 1982*b*, p. 654 (listed). -- Böhlke 1984, p. 59 (type material listed; *C. proteus argynnis* a synonym).

Crenicichla proteus argynnis; Eigenmann & Eigenmann 1891, p. 70 (listed). -- Kullander 1982*b*, p. 654 (listed). -- Böhlke 1984, p. 56 (syntypes listed; synonym of *C. proteus*).

Crenicichla (Batrachops) argynnis; Pellegrin 1904, p. 373 (bibliogr.; descr. abstr. Cope).

Crenicichla (Batrachops) proteus; Pellegrin 1904, p. 373 (bibliogr.; descr. abstr. Cope).

Crenicichla saxatilis; (*pt.*) Regan 1905*a*, p. 159 (*C. proteus*, *C. argynnis* in synonymy; not material). -- (*pt.*) Haseman 1911*c*, p. 351 (*C. proteus* a synonym; not material).-- (*pt.*) Eigenmann & Allen 1942, p. 404 (bibliogr. in part; material listed, in part: Puerto Bermudez, R. Pichis). -- (*pt.*) Fowler 1944, p.268 (*C. proteus*, *C. argynnis* in synonymy). -- (pt.) Fowler 1945*a*, p. 248 (*C. proteus*, *C. argynnis* in synonymy). -- (*pt.*) Fowler 1954, p. 306 (bibliogr., in part), Fig. 893 (sketch, syntype of *C. proteus*). -- (*pt.*) Lüling 1975, p. 50

(listed; Yarina Cocha; R. Ucayali).
Crenicichla anthurus; (*pt.*) Eigenmann & Allen 1942, p. 405 (listed; material in part; Iquitos).
Batrachops nemopterus; Eigenmann & Allen 1942, p. 403 (bibliogr.; listed). -- Fowler 1944, p. 268 (bibliogr.). -- Fowler 1945*a*, p.248 (bibliogr.). -- Fowler 1954, p. 282 (bibliogr.), Fig. 869 (sketch, from Fowler 1940). -- Kullander 1982*b*, p. 654 (listed; referred to *Crenicichla*).
Crenicichla lepidota; Saul 1975, p. 121 (habitats; reproduction; food; only ANSP 130450 re-examined; Santa Cecilia).

Material
98 specimens, 26.0-*c*.155 mm SL from Peru and Ecuadorian Napo drainage, including the type-series of *C. proteus*, *C. proteus argynnis* and *Batrachops nemopterus*.

Description
From fresh material over 100 mm SL, unless otherwise stated; counts from measured specimens (n=25), or (D, A, squ. long.) from those and various other specimens; measurements are summarized in Table 7. Refer to Pl. X, figs 2-3, for general aspect.

Shape. Elongate; laterally compressed, gradually more so posteriorly; head deeper than wide behind orbit, anteriorly wider than deep; predorsal contour straight or very slightly convex; ascending; prepelvic contour sloping, straight or very slightly convex; dorsal-fin base contour about straight, very little sloping; caudal peduncle edges about straight, ventral longer than dorsal. Orbit tangented by frontal outline, situated in anterior and upper halves of head. Snout rounded in dorsal aspect, triangular in lateral outline; with curved dorsal and ventral surfaces. Interorbital narrower than mouth. Lower jaw prognathous, articulated below posterior half of orbit; maxilla reaching vertical from 1/4-1/3 orbit; ascending processes of premaxilla reaching to middle of orbit. Lip folds narrowly interrupted anteriorly. Nostril about halfway between eye and postlabial skin edge. Preoperculum with regular serrations, not reaching ventrally to corner pore.

Scales. Squ. long. - (2), 45 (2), 46 (1), 47 (3), 48 (3), 49 (4), 50 (4), 51 (5), 52 (2), 53 (3). Scales ctenoid except predorsally and anteriorly on back close to dorsal fin (scales margining lateral line ctenoid or only a few cycloid), cheek, gill-cover, thoracally, narrowly along abdominal midline, and interradial scales. Naked line along lateralis canal from posttemporal to orbit. Cheek completely scaly or naked anteroventrally and close to lacrimal; 5-6 horizontal series below orbit. A group of scales posteriorly on interopercerculum. 20-23 horizontal scale series around caudal peduncle.

Upper lateral line at 6 (anteriorly) to 3 (posteriorly) scales distance from dorsal-fin base; 2 horizontal scale series passing between free ends of lateral lines; 2 scales impinging on each lateral line scale. Lateral line counts -/- (1), -/10 (1), -/11 (1), 22/8 (1), 22/10 (4), 22/11 (1), 22/12 (1), 23/9 (2), 23/10 (7), 23/11 (2), 24/9 (1), 24/10 (1), plus 2 on caudal fin; accessory caudal-fin lateral lines rare, represented by single scale between rays V3 and V4.

Pectoral fin with group of cycloid scales basally on left side in holotype of *B. nemopterus* and 119.4 mm paratype of *C. proteus*; otherwise fins naked except caudal fin, basal half of which densely scaly.

Fins. Dorsal-fin origin at vertical from opercular tip; first spine about 1/3 length of last; spines increasing in length to about 6th-7th from which subequal, last longest; lappets pointed; soft fin pointed, 8th or 9th ray slightly prolonged, reaching at least middle of caudal fin. D. XVII.15 (1), XVIII.13 (7), XVIII.14 (12), XVIII.15 (2), XIX.12 (2), XIX.13 (9), XIX.14 (3), XX.12 (1). Anal-fin origin below soft dorsal-fin origin; soft fin pointed, 4th or 5th ray longest, reaching to or slightly beyond caudal-fin base. A. III.7 (1), III.8 (13), III.9 (21), III.10 (1). Pectoral fin rounded, 6th or 7th ray longest; reaching halfway to spinous or soft anal fin; P. 15

(10), 16 (14), 17 (2). Pelvic fin inserted posterior to vertical from pectoral-fin base; tip pointed (1st ray longest) or rounded (2nd ray longest), reaching about halfway to soft anal-fin origin. Caudal fin rounded.

Teeth. Simple, conical, recurved, those of outer series slightly movable, those of inner series depressible. Outer series teeth a trifle larger than inner, or size uniform, but anterior innermost teeth in upper jaw appearing longer than outer in large specimens. 4 series anteriorly in upper jaw, 3 in lower jaw, or 5 and 4 respectively in large specimens; one inner series extending posteriorly in both jaws or, in large specimens, two inner series posteriorly in upper jaw.

Gill-rakers. Two epibranchial, one in angle and 9 (2), 10 (20), 11 (14) lower limb rakers, all short, lower knob-like in adults, upper ceratobranchial long (reaching base of next raker) in young. 11 (1), 13 (1), 14 (1), 15 (3), 16 (2), 17 (4), 18 (1) rakers on lower pharyngeal tooth-plate in 13 specimens counted. Microgill-rakers externally on 2nd to 4th arches.

Vertebrae. 18+15 (1), 19+14 (3), 19+15 (3), 20+15 (1).

Colouration. 101.0 mm male (NRM SOK/1981337.3431): Ground colour whitish on chest and along belly midline, slightly shaded on lower side of head; cheek yellowish thinly powdered with brown; gill-cover greyish; snout above grey, nape pale brown; lower sides greyish white. Brown preorbital stripe hardly evident on jaws; postorbital stripe dark brown anteriorly, fading on gill-cover tip. Intense, about triangular, brown suborbital stripe reaching about middle of cheek. Dark brown humeral spot, on lateral band, or very slightly higher, irregularly round, about 3 scales long. Lateral band diffuse, grey-brown, *c.* 3 scales deep anteriorly, *c.* 1 1/2 scales deep posteriorly, on and above lower lateral line level. Scale centers of lower lateral line scales light, tubes of upper lateral line light. Back side light grey, darkening dorsally. Grey brown vertical bars about as wide as interspaces, 2 preceding dorsal fin, 8 below dorsal fin, 2 on caudal peduncle. Dorsal edge of pectoral axilla and adjacent side covered by dark brown spot.

Dorsal fin grey, semitransparent, with slightly darker horizontal band below lappets; soft fin with about 3 series of lighter dots basally on posterior portion. Anal fin greyish, semitransparent, lower edge darker; 4 light spot-stripes as on dorsal fin. Caudal-fin greyish; black caudal spot between rays D4 and D1 or V1, narrowly ocellated. Pelvic fins whitish.

Variation: Females 41.8 mm SL and larger with blackish spot or series of spots ocellated with hyaline, submarginally on dorsal fin, of varying intensity in pigmentation; 1-3, but usually only one (examples: between dorsal-fin spines 12-13, 14-15, 15-16; 11-16; 12-15; 11-14; 12-15, 16-18; 12-18; 13-15, 16-18; 12-16; 12-13, 14-15; 13-15), positions, size and shapes of ocelli individual characteristics; at least MCZ Napo material females with distinct or indicated zonation of soft dorsal fin (from edge proximad: hyaline, dark, hyaline, dark). Large females with immaculate vertical fins save dorsal and caudal-fin ocelli; young females and all males with light cross-stripes on dorsal and anal fins as described, and also light-dark indistinct transverse caudal-fin stripes in young. I find no clear example of dark-light zonation on caudal fin, except in juveniles (below). Suborbital stripe distinct from at least 41.8 mm SL, indicated at 34.1 mm SL. Young, to at least 43.2 mm SL, with semiocellus distally on caudal-fin.

Juveniles, *c.* 26-29 mm SL light, with contrasting, sharp-edged brown band from lower jaw tip to caudal-fin end, including humeral spot; vertical bars present in the larger, absent in the smaller, which have dark line from above orbit caudad to along dorsal-fin base; caudal fin with hyaline corner margin and dark submarginal band, otherwise hyaline except dark median band, caudal ocellus and dark pigment surrounding caudal ocellus.

Life colours. Label for MCZ 49320 says 'Overall colour dark, almost black, males (?) /more likely females/ with carmine red band in dorsal fin'. Young Yarina Cocha female, from a colour slide, greyish with dark grey to black markings, ventrally whitish; dorsal-fin margin narrowly red; dorsal-fin ocellus ringed with white; caudal ocellus ring pinkish.

Table 7. *Morphometry of* Crenicichla saxatilis *group species in Peru. Measurements are in per cent of SL, except SL (in mm).*

	C. anthurus			*C. lucius*			*C. proteus*		
	n	Range	$\bar{x}\pm s(x)$	n	Range	$\bar{x}\pm s(x)$	n	Range	$\bar{x}\pm s(x)$
SL (mm)	17	50.5-128.5	77.1±6.07	29	50.2-167.9	92.5±6.17	23	46.5-146.1	90.3±5.73
Head length	17	29.3- 32.9	31.4±0.25	29	29.8- 33.7	31.9±0.18	23	28.7- 33.5	30.9±0.21
Head depth	14	13.1- 15.3	14.3±0.22	29	13.7- 16.3	15.1±0.14	23	14.8- 17.7	16.1±0.15
Body depth	14	18.4- 23.5	20.3±0.41	29	18.9- 25.0	21.2±0.27	23	21.1- 27.4	23.9±0.36
Snout length	17	6.3- 8.8	7.2±0.16	29	6.7- 9.8	8.2±0.16	22	6.4- 9.3	7.4±0.15
Orbital diameter	17	6.6- 10.4	8.8±0.25	29	6.8- 10.8	9.0±0.19	23	7.1- 10.5	8.8±0.21
Interorbital width	17	4.7- 7.7	6.0±0.21	29	4.9- 9.2	6.5±0.23	23	6.3- 9.5	7.9±0.20
Pectoral-fin length	17	18.2- 23.2	21.0±0.34	28	19.1- 22.7	20.8±0.22	23	20.2- 26.1	22.8±0.28
Upper jaw length	17	10.1- 12.8	11.3±0.16	29	11.3- 14.3	12.4±0.15	23	10.3- 13.4	11.9±0.16
Lower jaw length	17	15.1- 16.9	16.0±0.14	29	16.2- 18.9	17.1±0.11	23	15.4- 18.0	16.5±0.15
Caudal peduncle depth	17	10.1- 12.0	10.8±0.14	29	10.0- 11.9	10.9±0.10	23	10.8- 13.6	12.2±0.14
Caudal peduncle length	17	11.9- 13.9	12.8±0.18	29	11.7- 13.9	12.6±0.10	23	11.2- 13.5	12.3±0.14
Last dorsal-fin spine length	16	10.7- 13.6	12.4±0.20	28	11.2- 13.5	12.3±0.12	20	12.0- 14.8	13.1±0.17

Distribution (fig. 28)

Crenicichla proteus is widely distributed, having been collected in the upper Napo drainage near Coca and upper Putumayo drainage at Santa Cecilia, in the upper Ucayali drainage at Chicosa, around Pucallpa in the Pachitea, Aguaytía, Ucayali, Callaria drainages, and in the selva baja at Pebas, Jenaro Herrera, Monte Bello and Contamana.

Ecology

Saul's (1975) material from Santa Cecilia had insects, insect larvae, molluscs, shrimp, fish eggs and fish in stomachs. At Santa Cecilia the species was found in shallow, quiet waters associated with abundant aquatic and shoreline vegetation. Peruvian collections include material from lakes, especially much material from Yarina Cocha, but also a few specimens from streams.

Notes

Cope (1870) first recorded this species as *C. lacustris* (ANSP 9077), which is a very different eastern Brazilian species. The identification was based on comparison with Caselnau's description and figure, and probably derived in particular from the shared possession of a dark spot in the spinous dorsal fin. Cope never corrected the identification but with a larger series at hand, he (Cope 1872) described this series as *C. proteus*, distinguished as being deeper than *C. lacustris* and lacking spots and stripes ('*vittae*'). A 'typical' form and three varieties (α,β,γ) were distinguished, with reference to slight differences in overall form, counts and colour. One of the varieties, named 'Var. γ (*argynnis*)' represents a nominal species group taxon, being designated by a trinomial.

All or most of the original series of *C. proteus* appears preserved. With the aid of pencil notes on labels made by Fowler, the following identification of particular specimens appears:

ANSP 9050-9059. 10 specimens 90.3-135.1 mm SL. 119.4 mm specimen with label in mouth remarking 'Type *C. proteus*', 90.3 mm specimen with similar label '*C. proteus* γ'. The 90.3 mm specimen has dorsal-fin spots between spines 12-13, 14-15, and 16-17, and represents *C. argynnis*. The remainder are either of the 'typical form' or 'Var. α'. The 135.1 mm specimen is here regarded as lectotype of *C. proteus* as it comes nearest in total length (>165 mm) to the 0.17 m given by Cope. It was distinguished as holotype of *C. proteus* and separated as ANSP 9050 by Böhlke (1984), but since Cope gave variation in both counts and proportions of his 'typical form', it must have been based on a syntype series. ANSP 9050 is therefore strictly a lectotype.

I could not distinguish the 'Var.α' in Cope's material. ANSP 9051-9058 likely includes both 'typical form' and 'Var.α' material. The *argynnis* specimen is separated as ANSP 9059, and considered as syntype of *argynnis*, because Cope explicitly provided data from 2 specimens.

ANSP 9060-9061. 2 specimens, 85.6-90.8 mm SL. A note on a label in the mouth of the larger specimen indicates '*C. proteus B*'. This specimen has a dark spot posteriorly on spinous dorsal fin and D. XVIII.14, hence agreeing with Cope's description of 'Var.β'. The smaller specimen may be of the same variety but has no dorsal-fin spot, and D. XVIII.13.

ANSP 14375. 1 specimen, 95.7 mm SL, agrees with the *argynnis* description, including 3 spots on spinous dorsal fin, and is regarded as a syntype of that form. It was identified by Fowler as *C. proteus* γ by a small label in the mouth.

All of the above listed ANSP *C. proteus* material is in bad condition. Whereas the *argynnis* and 'Var.β' obviously are female *C. proteus*, the remainder are overall uninformative. Squ. long. in the lectotype of *C. proteus* is estimated as 53 on the right side, 49 on the left side, in a paralectotype the count is 51; one of the *argynnis* syntypes has squ. long. 48. These estimates fall well below the ranges for *C. anthurus* and *C. lucius*.

Fowler (1940α) compared his new species *Batrachops nemopterus* with *B. cyanonotus* and separated them by colouration and proportions. Re-examination of the type series of *B. nemopterus* shows that neither dentition (teeth movable or depressible instead of fixed), snout shape (somewhat short, but not truncated as in *Batrachops*) or colouration, in which are criteria by which *Batrachops* might be diagnosed (p. 94), supports the original generic allocation. Furthermore, *B. nemopterus* falls neatly within the variation of *C. proteus* as here understood. The holotype is a large male, the paratypes are two males, 98.9-101.5 mm, and a female, 109.8 mm SL. The female has dark spots between dorsal-fin spines 11-12, and 13-16, but no distinct ocelli.

Comparing with other Peruvian *Crenicichla* species, *C. proteus* is evidently most similar to *C. lucius*, from which it is readily recognized in squamation (squ. long. 45-53 in *C. proteus*, 58-63 in *C. lucius*, former with 3, latter with 4 scales between lateral line termination and dorsal fin), colouration (*C. lucius* females with dark-light zonation in dorsal fin, *C. proteus* females with ocelli in dorsal fin; no apparent dark-light zonation of caudal fin in *C. proteus*, more or less prominent in *C. lucius*; band from snout tip to caudal fin straight horizontal in *C. lucius*, but in *C. proteus* ascending from snout tip to opercular tip, leaving only trunk section horizontal). The low scale count and the dorsal-fin colouration rather suggest that *C. proteus* is closely related to *C. semicincta*; see further p. 105.

ZFMK 2137-2138, labelled by Hermann Meinken, as coming from Yarina Cocha, are excluded from the above description. The larger specimen, 139.5 mm SL, is a female, probably the one figured by Lüling (1975) as *C. saxatilis*, with a series of ocelli in the dorsal fin. It has a long snout (8.5 % of SL), narrow interorbital (7.9 % of SL, 25.4 % of head length), a lateral band with short dorsal extensions as in some *C. semicincta*; the suborbital stripe is not well-preserved, but resembles that of *C. semicincta*. Whereas this specimen is most likely a *C. semicincta*, it seems probable also that the locality information is incorrect. Lüling collected in both Bolivia and Peru in 1966. The fishes were sent to Hermann Meinken for identification. Meinken wrote ink labels with collecting data. From personal experience, collaborating with Lüling, I believe that the pencil labels, with ZFMK register number and number of specimens were written by Lüling upon the return of the identified fishes. The ink label is sewn through the tail of the smaller specimen, a *C. proteus* (99.9 mm SL), and this label bears the remark 'Achtung: Abweichende Form. 14 Kiemenrechen, D. XX.12; A. III.7; ziemlich hoher Schwanzstiel; Fleck im weicher Dorsale'. The counts cannot be verified, but the soft dorsal fin

has a stripe-like marking which atypical (melanoma) for both *C. proteus* and *C. semicincta*. As other material in Lüling's 1966 collection is incorrectly labelled, it appears likely that some confusion has occurred also with the ZFMK 2137-2138 lot, considering especially the labelling procedure. Rather than considering the 139.5 mm specimen as representing Ucayali distribution of *C. semicincta*, or as an atypical *C. proteus*, I believe it was collected in Bolivia but somehow dropped in the same bottle as a Yarina Cocha specimen of *C. proteus* by mistake. Haseman (1911*c*) noted briefly that '*Crenicichla proteus* (Cope) is a synonym of *C. saxatilis*', possibly on the basis of examination of type material of *C. proteus*. His *C. saxatilis* material has not been re-examined, but is probably incorrectly identified.

Crenicichla lucius Cope

Fig. 30, Pl. X (figs 3-4), Table 7

Crenicichla lucius Cope 1870, p. 570 (descr.; the tributaries of the Upper Maranon, in Equador).

Bibliography

Crenicichla lucius; Eigenmann & Eigenmann 1891, p. 70 (listed). -- (*pt.*) Regan 1905*a*, p.161 (*C. anthurus* new synonym; not material). -- Eigenmann & Allen 1942, p. 405 (bibliogr.). -- (*pt.*) Fowler 1944, p. 269 (bibliogr. in part, only original ref.). -- (*pt.*) Fowler 1945*a*, p. 250 (bibliogr. in part, only original ref.). -- (*pt.*) Fowler 1954, p. 304 (bibliogr. in part, only original ref.). -- Kullander 1982*b*, p. 654 (listed).

Crenicichla (Batrachops) lucius; Pellegrin 1904, p. 377 (bibliogr.; descr. abstr. Cope).

Crenicichla saxatilis; (*pt.*) Eigenmann & Allen 1942, p. 404 (not bibliogr.; material listed: creek, Rio Morona).

Crenicichla anthurus; (*pt.*) Eigenmann & Allen 1942, p. 405 (not bibliogr.; material listed, in part; Iquitos).

Material

61 specimens, 33.9-167.9 mm SL, including neotype, NRM SOK/1984333.4085, a 146.0 mm male.

Description

Based on the neotype and 5 specimens collected with it (NRM SOK/1984333.4079, 33.9-141.9 mm SL), unless otherwise noted. Counts are from specimens measured; measurements are summarized in Table 7. Refer to Pl. X for general aspect.

Shape. Elongate; laterally compressed, gradually more so posteriorly; head deeper than wide behind orbit, anteriorly wider than deep; predorsal contour abut straight ascending; dorsal-fin base contour straight, nearly horizontal; prepelvic contour sloping, very slightly curved; caudal peduncle edges straight, ventral longer than dorsal. Orbit tangented by frontal outline, in anterior half of head. Snout rounded in dorsal aspect, triangular in lateral aspect, with curved dorsal and ventral surfaces. Interorbital narrower than mouth. Lower jaw distinctly prognathous, articulated behind vertical from middle of orbit; maxilla reaching to 1/4 of orbit, ascending premaxillary processes to middle of orbit; both lip folds narrowly interrupted anteriorly. Nostril at about middistance eye - postlabial skin edge. Preoperculum with regular serrations, not reaching ventrally to corner pore.

Scales. Squ. long. 58 (7), 59 (6), 60 (5), 61 (7), 62 (3), 63 (1). Scales ctenoid except along abdomen, thoracally, on cheek and gill-cover, predorsally and a short distance on back close to dorsal fin (scales close above anterior lateral line ctenoid or cycloid only above 2-3 anterior), and interradial scales. Naked line along lateral line canal from posttemporal to orbit.

Cheek completely scaly, with about 7-9 horizontal scale series below, about 6 vertical scale series behind orbit. A group of scales posteriorly on interoperculum. 24 horizontal scale series around caudal peduncle.

Upper lateral line at 7-8 (anteriorly) to 4 (posteriorly) scales distance from dorsal fin; 2 (occasionally 3) horizontal scale series passing between lateral lines at region of free ends; 2 scales impinging on each lateral line scale. Lateral line counts 21/11 (3), 21/13 (1), 22/10 (6), 22/11 (8), 22/12 (3), 23/10 (3), 23/11 (2), 23/12 (1), 24/10 (1), 24/11 (1), plus 2 (1 in one, 4 in one) scales on caudal fin; accessory lateral lines on caudal fin in 4 specimens, 2 with a tubed scale between rays D3 and D4, one with a tubed scale between rays V4 and V5, and one with a tubed scale between rays V3 and V4.

Pectoral fin with cycloid scales basally in 141.9 mm specimen; otherwise fins naked, except caudal fin, over 1/3 of which scaly.

Fins. Dorsal-fin origin at vertical from opercular tip; first spine about 1/3 length of last, spines only little increasing in length from 6th; lappets pointed; soft dorsal-fin pointed, median ray with short filament reaching to middle or 3/4 of caudal fin in large specimens; D. -.- (1), XVIII.12 (1), XVIII.13 (1), XVIII.14 (10), XIX.13 (13), XX.12 (3). Anal-fin origin opposite soft dorsal-fin origin; soft anal fin pointed, median ray reaching at most little beyond caudal-fin base. A. III.8 (2), III.9 (19), III.10 (8). Pectoral fin rounded, 6th or 7th ray longest, reaching about halfway to anal-fin origin; P.15 (11), 16 (17), 17 (1). Pelvic fin inserted well posterior to vertical from pectoral-fin base, with rounded-subacuminate tip, 2nd, occasionally 1st ray slightly the longest, reaching about halfway to soft anal-fin origin. Caudal fin rounded (damaged in many specimens).

Gill-rakers. Two epibranchial, one in angle and 9 (6), 10 (16), 11 (6), 12 (1) lower limb rakers externally on first gill-arch, all denticulate, short anteriormost knob-like. Microgill-rakers externally on 2nd to 4th arch. Gill-rakers on lower pharyngeal tooth-plate 6 (1), 7 (1), 8 (2), 9 (4), 10 (9), 11 (5), 12 (1) in 23 specimens checked.

Teeth. Simple, conical, recurved, those of outer series slightly movable, those of inner series depressible; 2, in large specimens 3 inner series anteriorly in lower jaw; 2-4 inner series anteriorly in upper jaw, band widened with increasing SL; in both jaws one inner series extending posteriorly, except in specimens over 140 mm SL in which two inner series posteriorly; teeth of about uniform size in lower jaw, in upper jaw anterior innermost teeth appearing longer than outer teeth.

Vertebrae. 19+15 (3), 19+16 (3).

Colouration. Neotype, representing adult male: Ground colour whitish medially on chest and belly, shading to greyish laterally on belly and chest and on lower head parts and jaws; lower sides pale greyish, operculum and subоperculum darker greyish; cheek yellowish overlayered with grey; preorbital light grey; dorsal part of head and narrowly along dorsal-fin base grey turning grey-brown posteriorly. Indistinct, wide, grey-brown lateral band about 3 scales deep from humeral spot to caudal-fin base, on and above lower lateral line level; above band light grey brown. Tubes of upper lateral line light, lower lateral-line scales with light basal spot. Suborbital stripe indistinct, small. Dark brown to blackish horizontal band on head, faint on upper lip and lower jaw tip, stronger between mouth and eye below nostril, continued behind orbit, fading on gill-cover tip. Humeral spot dark brown to blackish, below 3rd-5th lateral line scales, in and slightly above lateral band, form irregular, not extending onto lateral line scales, not ocellated. Dark brown spot on side immediately dorsal to pectoral axilla. Chest anterior to pectoral-fin base grey. Traces of vertical bars on sides, so indistinct that no count possible. Dorsal fin semitransparently grey, with about 6 vertical series of light spots across ventral half of soft part. Anal fin greyish with blackish ventral edge and soft portion spotted like soft dorsal fin. Caudal fin greyish with about 5 cross-bars of alternating light and darker spots over median portion; caudal spot black, not ocellated, between rays D1 and D4. Pelvic fin white.

Adult females, 106.3 and 116.9 mm SL taken with the neotype basically similar; triangular suborbital spot more evident; vertical bars distinct, 2 across nape, 9-10 on back below dorsal fin. Fins, however, reflecting sexual dimorphism: Dorsal fin blackish, lappets dark grey turning into black dorsal edge of soft fin, proximal to lappets a wide hyaline band commencing as interradial spots anteriorly on dorsal fin and bordered proximally by black band from anterior 1/3 of spinous dorsal-fin. Unpaired fins all lacking stripes of light spots, shown by neotype and other large males. Anal fin grey with black ventral margin. Pelvic fin clear with dark leading edge. Caudal fin dark grey with black unocellated caudal spot; distal ventral portion damaged but dorsal lobe with wide black superoposterior margin proximally bordered by series of hyaline spots.

Young, 55.5 mm SL, taken with neotype, resembling adults but lateral band with sharper edges, suborbital stripe indistinct, humeral spot round and reaching little dorsal to lateral band, caudal spot ocellated, distal caudal-fin half-ocellus present. Fins, see below.

Juvenile, 33.9 mm SL, taken together with neotype, with belly, chest and lower head parts whitish, sides otherwise greyish on whitish ground; lower jaw tip blackish, making beginning of well-defined lateral band extending to caudal-fin base, dark brown on flanks; slightly darker spot contained in band just posterior to head; back slightly darker than side, with traces of 7 narrow vertical bars below dorsal fin; horizontal dark stripes bordering dorsal-fin base and rostrad onto nape, indicated; no suborbital stripe; dorsal fin greyish, immaculate; anal fin dusky, lower edge slightly darker; caudal spot black, ocellated dorsally; caudal fin damaged, but dorsal lobe apparently with dark-light zonation.

Considering all available material, the humeral spot may appear elongately rounded or slightly irregular in shape. It is never light-ringed, although contrasted in overall light coloured specimens (from Nanay sand playas). Two specimens (NRM SOK/1981364.3607) have 1-4 silvery dots associated with the dorsal margin of the spot. The humeral spot extends dorsal to the lateral band, but never reaches the lateral line. Dorsal- and caudal-fin zonation and striping not as well developed in young as in adults. Caudal-fin zonation appears characteristic in dorsal lobe, involving a wide black seam, proximally margined by hyaline spot series and usually margined distally by hyaline edge. Ventral lobe simply with darkened seam, large males with barred soft vertical fins, zonation suppressed or absent, females vice versa. Young, and some adults, with caudal-fin half-ocellus. Barring of dorsal sides variably evident, usually not distinct.

Life colours. Young Nanay specimens dull coloured, though dorsal-fin lappet tips red, dorsal margin of soft dorsal fin reddish, caudal-fin ocellus with yellowish ring. Body olivaceous or greyish above, greyish on flanks; very thin vertical lines resembling myocommata on sides blue or green; red to yellow hues dominate in caudal and anal fins and basally on dorsal fin. Pelvic fin white.

Distribution (fig. 30)
Peruvian material comes from the lower Morona, Napo, Nanay, Ampiyacu and Mazán, and the Jenaro Herrera area on the Ucayali. Extralimital material is tentatively identified from the Içá near Peru; see discussion for possibly wide Brazilian range of the species.

Ecology
The neotype and other specimens came from a gramalotal in a pool on an island in the Napo (SOK 104), a white-water habitat. Elsewhere, *C. lucius* is usually taken in streams, and mostly in black waters, much of the material coming from the Nanay and streams near Jenaro Herrera.

Notes
The present application of the name *lucius* differs from that of earlier

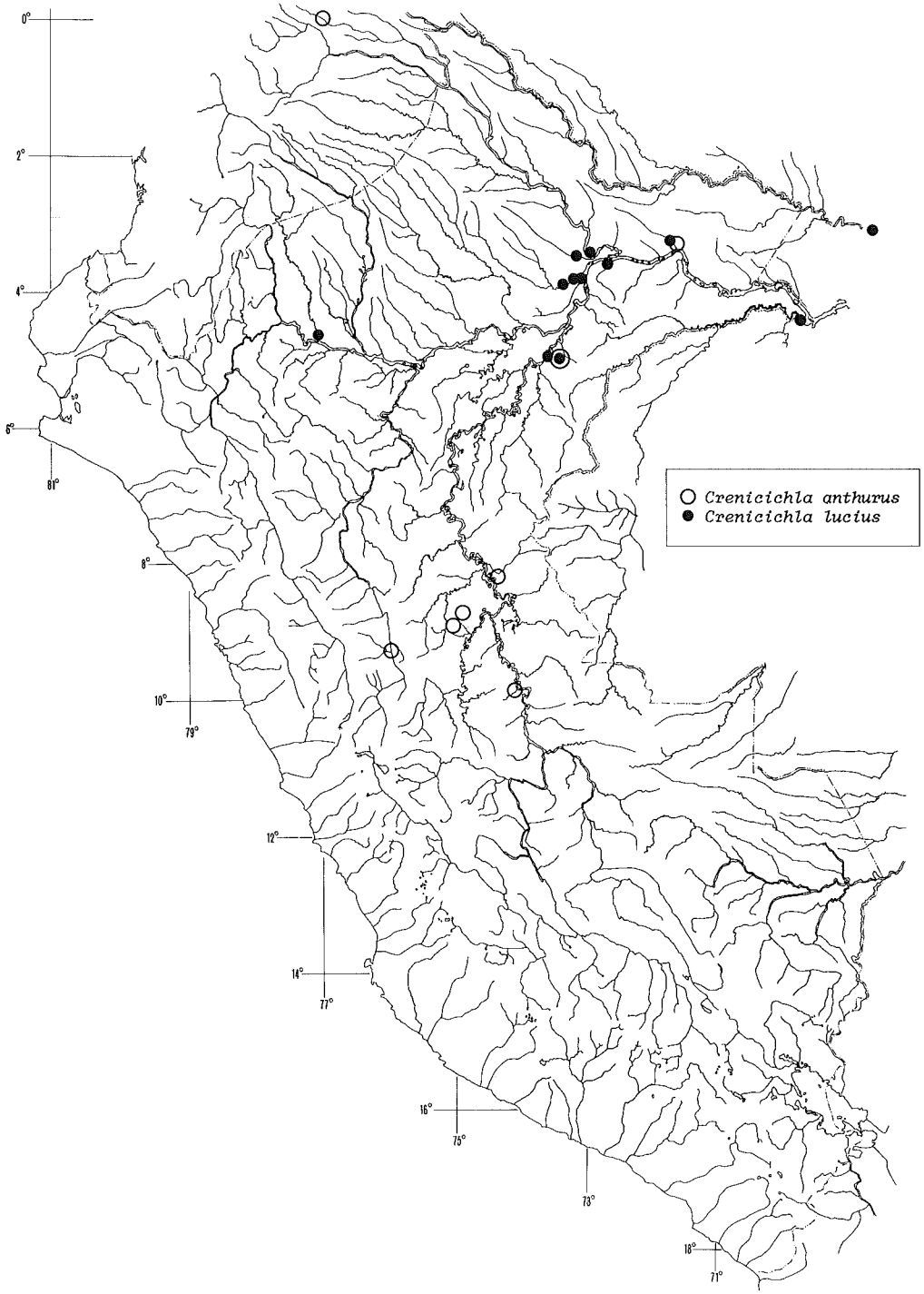


Figure 30. Collecting localities of *Crenicichla anthurus* (total known range) and *Crenicichla lucius* in western Amazonía. A symbol may represent more than one, adjacent collecting sites.

authors (Regan 1905*a*, Fowler 1944) who synonymized *C. anthurus* with *C. lucius* and appear to have referred to species with the humeral spot on the upper lateral line (see also p. 120). The type-material of *C. lucius* cannot now be found in the ANSP (Böhlke 1984; pers. obs.). Identification of the species must be based on Cope's (1870) description, which is brief and contains only indications that the lost type of *C. lucius* and the species identified in this paper as *lucius* may be the same species.

Counts and proportions given by Cope for his material, probably only one specimen, 6 inches TL, agree more or less with all *Crenicichla saxatilis* group species in Peru and Ecuador. But the scale count, 64 transverse series, is compared by Cope with that of *C. lacustris* (actually a *C. proteus*, ANSP 9077) having 51. Thus it seems reasonable that the type of *C. lucius* indeed had a significantly larger number of scales than has *C. proteus*. The colour description includes mention of 'a darker band from muzzle to opercular angle', but not of a humeral spot. At about 15 cm TL, the dorsally placed ocellated humeral blotch of *C. anthurus* would have been a conspicuous feature, difficult to overlook and likely to have been mentioned. Considering the brevity of the description, disregard of the less conspicuous, unocellated blotch in *C. lucius* and *C. proteus*, appears more understandable. The name *C. lucius* is consequently given here to the Peruvian *Crenicichla* species with 58-63 squ. long. scales and axially positioned humeral spot and the identity is fixed by designation of a neotype.

A neotype of *C. lucius* is clearly warranted because the name is in active use, and obviously the original description alone is insufficient for characterization of the species. The taxonomy of the *C. saxatilis* group is difficult and a stable nomenclature is dependent on reference material for names. The neotype designation is qualified in accordance with ICZN Article 75d by the following statements.

(1) *Crenicichla lucius* is a *C. saxatilis* group species with 58-63 squ. long. scales, distinguished from all other *C. saxatilis* group species with similar scale count frequency by unocellated humeral spot situated below the upper lateral line and by dorsal-fin pattern of adult females: hyaline submarginal line, bordered by black line proximally and grey, black tipped lappets distally.

(2) The neotype, NRM SOK/1984333.4085, is an adult male, 146.0 mm SL, of which particular data is given above, see also Pl. X, fig. 3.

(3) Loss of original type material is inferred from unsuccessful search by Böhlke (1984) and myself through all that remains of Cope's South American cichlid collections in ANSP. Some other material in that collection is also missing.

(4) Cope's description of *C. lucius* is compatible with many *Crenicichla* species, but as outlined above, scale counts, colour pattern and locality data in combination suggest that *C. lucius* of Cope is of the same species as the neotype.

(5) The type of *C. lucius* was said to come from 'the tributaries of the Upper Maranon, in Equador', collected by J. Hauxwell. Other Hauxwell material reported in the same paper (Cope 1870) have the locality Pebas or near Pebas, and that may have been the more precise locality also of the *C. lucius* material. Although Ampiyacu material is available, the neotype, an adult male from the lower R. Napo, is chosen for being well preserved (except mutilated caudal fin) and taken in association with specimens representing young and female of the same species. The neotype locality is nevertheless rather near Pebas and compatible with Cope's original locality description (the Amazonas then named Marañón, and Ecuador at that time encompassing both the Napo and Pebas).

(6) The neotype is already deposited in the research collection of the Department of Vertebrate Zoology, Swedish Museum of Natural History, Stockholm, Sweden, a Swedish authority and research institution with permanent facilities for the preservation of name-bearing types, which are available for study to anyone qualified.

Crenicichla lucius belongs to the group of relatively large-scaled species usually referred to the species *C. saxatilis* by authors. It seems now clear that *C. saxatilis* is a Guianan endemic with about 50-55 squ. long. scales (Kullander *et al.* 1986). The characterization and nomenclature of non-Guianese '*saxatilis*' is a problem still requiring investigation. Such cichlids occur throughout collected parts of the Amazon basin. The oldest available name for Amazonian *saxatilis*-like *Crenicichla*, may be *C. labrina* (Spix, 1831). The description and figure of *C. labrina* are not sufficiently detailed for identification, and the type locality is stated as 'mare Brasiliae'. A syntype is preserved in Muséum d'Histoire naturelle de Neuchâtel (Kottelat 1984), but has not been compared with fresh material.

As the collectors of the type of *C. labrina*, Spix and von Martius, did ascend the Solimões and apparently collected fishes there since their *A. ocellatus* has a colour pattern typical of upper Solimões-Peruvian Amazonian *A. ocellatus* but less common among more eastern *Astronotus* populations (p. 68) and because detailed comparisons with *C. saxatilis*-like material from more easterly Amazonian localities remain to be made, I consider it an open question whether the Peruvian species here named *C. lucius* should rather bear the name *C. labrina* and whether it is geographically restricted to the western Amazonian lowlands.

Among Peruvian *Crenicichla* species, *C. lucius* is most similar to *C. anthurus*, differing in the humeral spot position below rather than on the lateral line and averaging longer snout and jaws. The humeral spot is invariably ocellated in *C. anthurus*, but never in *C. lucius*. Both species occur near Jenaro Herrera, but never syntopic; otherwise *C. anthurus* appears to replace *C. lucius* to the west and south within the area considered in this paper. *Crenicichla proteus* has much larger scales than *C. lucius*, squ. long. 45-53 (58-63 in *C. lucius*).

Crenicichla anthurus Cope

Fig. 30, Pl. XI (figs 1-3), Table 7

Crenicichla anthurus Cope 1872, p. 252 (descr.; the Ambyiacu), Pl. X, fig. 1 (woodcut, habitus, lateral aspect).

Selected bibliography

Crenicichla lucius; (?) Cope 1878, p. 697 (listed; Cachyiacu, an affluent of the Huallaga, near Moyabamba). -- (*pt.*) Regan 1905*a*, p.160 (*C. anthurus* in synonymy, not material). -- (cf.; *pt.*) Regan 1905*a*, p. 160 (descr.; Canelos; R. Zamora). -- (*pt.*) Fowler 1944, p. 269 (*C. anthurus* in synonymy). -- (*pt.*) Fowler 1945*a*, p. 250 (*C. anthurus* in synonymy). -- (*pt.*) Fowler 1954, p. 305 (bibliogr. in part), Fig. 890 (sketch, ANSP 21103, restored). -- (*pt.*) Saul 1975, p. 122 (habitats; food; Santa Cecilia). -- Kullander 1982*b*, p. 654 (listed).

Crenicichla anthurus; Eigenmann & Eigenmann 1891, p. 70 (listed). -- Böhlke 1984, p. 56 (syntypes listed).

Crenicichla (Batrachops) anthurus; Pellegrin 1904, p. 377 (bibliogr., descr. abstr. Cope).

Crenicichla saxatilis; (?) Fowler 1945*b*, p. 132 (note; Morelia, Rio Caqueta drainage).

Material

Described from 20 specimens 32.4-223.8 mm SL, including syntypes, ANSP 9074-9076, 78.4-118.4 mm SL; juveniles, poorly preserved specimens tentatively referred.

Description

Composite, based on NRM unreg., NRM SOK/1981363.3577, MHNG 2205.12, ANSP

139123, ANSP 130453, 50.5-128.5 mm SL, unless otherwise stated; counts from measured specimens, measurements in Table 7. Refer to Pl. XI for general aspect.

Shape. Elongate, flanks laterally compressed, caudally gradually more so. Predorsal contour ascending, straight; prepelvic contour sloping, slightly curved. Head moderately long, about as wide as deep posterior to orbit. Dorsal-fin base contour about straight, little sloping. Ventral edge of caudal peduncle longer than dorsal, both edges about straight. Interorbital and snout slightly convex, ventral head side flat or slightly curved. Snout moderately long, rounded off in dorsal aspect, triangular in lateral aspect, wider than deep. Orbit tangented by frontal contour, situated in dorsal and anterior halves of head. Nostril about halway between orbit and postlabial skin edge. Preoperculum with regular serrations, not reaching ventrally to corner pore. Lower jaw distinctly prognathous, articulated below posterior half of orbit; ascending processes of premaxilla reaching to above middle of orbit; maxilla reaching about 1/3 of orbit; both lip folds interrupted anteriorly.

Scales. Squ. long. - (1), 59 (1), 60 (6), 61 (5), 62 (3), 64 (1). Scales ctenoid, except on belly below line connecting pectoral- and anal-fin bases, on chest, gill-cover and cheek, on top of head and above upper lateral line back to above 8th-12th lateral line scale and interradial caudal-fin scales, which cycloid; nape and prepelvic scales much reduced in size. Cheek completely scaled; scales in about 7-8 horizontal series below orbit, about 6-7 vertical series behind orbit. A group of 3-6 scales posteriorly on interoperculum. Line marking lateral line canal from supratemporal rostrad to eye, naked. 24 scale series around caudal peduncle.

Upper lateral line at 8-11 (anteriorly) to 4-5 (posteriorly) scales distance from dorsal fin; 2 scales impinging on each lateral line scale, except anteriorly where adjacent scales smaller (3 impinging); 2, occasionally 3, horizontal scale-series passing between free ends of lateral lines. Lateral line scales -/9 (1), 20/13 (1), 21/11 (2), 21/12 (3), 22/10 (1), 22/11 (3), 22/12 (1), 23/10 (2), 23/11 (1), 24/9 (1), 24/10 (1), plus 2 scales on caudal fin, no accessory caudal-fin lateral lines. Fins naked, except caudal fin, which scaly basally for between 1/3 and 1/2.

Fins. First dorsal-fin spine inserted at vertical from tip of operculum, its length about 1/3 that of last, spines increasing in length to 6th or 7th, from which subequal; lappets pointed, moderately long; soft dorsal-fin rounded, with 7th-8th ray longest and reaching to base or 1/4 of caudal fin, or pointed (117.7 and 223.8 specimens), with 9th ray produced, with filamentous tip reaching to about 2/3 of caudal fin. D. XIX.12 (3), XIX.13 (8), XIX.14 (1), XX.12 (1), XX.13 (4). Anal-fin origin opposite about origin of soft dorsal-fin; soft fin rounded, 5th ray reaching to or not quite to caudal-fin base, or (117.7 and 223.8 mm specimens) pointed, 6th ray reaching to 1/4 or 1/2 of caudal-fin. A. III.8 (1), III.9 (8), III.10 (8). Pectoral fin rounded, 7th ray longest, reaching about halfway to vertical from spinous or soft anal-fin origin. P. 15 (5), 16 (11), 17 (1). Pelvic fin inserted well behind pectoral-fin base, tip rounded, 2nd ray little the longest, reaching about halfway to anal-fin orign. Caudal fin roundish except in 223.8 mm specimen in which sublanceolate (median portion prolonged, but damaged).

Gill-rakers. 1 or, usually, 2 epibranchial, 1 in angle, and 8 (4), 9 (8), 10 (3), 11 (2) lower limb rakers externally on first gill-arch, all short, denticulate, knoblike anteriorly. About 8 (1), 9 (1), 10 (1), 11 (3), 12 (4), 13 (1), 15 (1) rakers on lower pharyngeal tooth-plate in 12 specimens examined. Microgill-rakers externally on 2nd-4th arches; appearing rudimentary and distribution not certain in 128.5 mm specimen.

Teeth. Simple, conical, recurved. Generally 4 series anteriorly in upper jaw, but inner band irregular and tending to more series in large specimens (total 5-6), outer series of slightly movable teeth, inner teeth depressible, one inner series laterally along outer; anteriorly, posterior teeth appearing slightly longer than anterior teeth, otherwise of about uniform size. Lower jaw teeth of about uniform size, 2 inner series anteriorly (3 in

128.5 mm specimen), one inner series continued laterally; outer series teeth slightly movable, inner teeth depressible.

Vertebrae. 19+14 (1), 19+15 (4) in Ucayali specimens (NRM unreg., MHNG 2205.22); 19+17 (2) in Huallaga (ANSP 139123) and Aguarico (ANSP 130453) specimens.

Colouration. From female MHNG 2205.22, 111.7 mm SL (Pl. XI, fig. 1), slightly faded, with notes on variation: Chest, abdomen, lower part of head, lower jaw whitish; sides pale, light greyish, dorsum grey-whitish; cheek yellowish white, snout dorsally grey; gill-cover greyish. Blackish to black stripe from lower jaw tip passing under nostril to orbit, continued posterior to orbit, fading on gill-cover tip. Suborbital stripe very faintly indicated, shape uncertain. Indicated wide lateral band along flanks. Light spot on each lateral line scale. 12 vertical bars, of about same colour as middle sides; 2 across nape, 8 below dorsal fin, 2 on caudal peduncle, those on sides reaching little ventral to upper lateral line. Humeral ocellus, roundish, dark grey with silvery ring, transected by lateral line scales 3-5, in 3rd vertical bar; diameter approximately equal to orbital diameter. Dorsal edge of pectoral axilla grey. Dorsal fin grey with whitish spot submarginally on each membrane of spinous dorsal fin, and whitish submarginal stripe on soft portion, dorsal edge blackish on soft and posterior spinous portion. Anal fin pale greyish with blackish ventral border. Pelvic fin white. Caudal fin grey, lighter marginally, dorsal and ventral edges black-seamed, whitish submarginal stripes formed by more or less confluent light spots except in inner 1/4 of fin; hind margin of central portion not patterned. Caudal spot between rays D1 and D3 blackish, not ocellated.

Large male, MHNG 2205.12, 223.8 mm SL, similar, but colour pattern less distinct, humeral ocellus small (over lateral line scales 4 and 5), and fins richly spotted: Dorsal fin grey, each membrane of spinous portion with large white spot at about middle, and from posterior spinous portion also a submarginal spot at each membrane, continued as more or less continuous submarginal stripe on soft portion; soft dorsal fin otherwise with black dorsal margin and about 14 cross-series of whitish spots which denser posteriorly. Anal fin grey, with black ventral margin and 12 light cross-stripes of spots as in dorsal fin. Caudal fin grey, with black margin, and wide light submarginal stripe in dorsal lobe, hind margin not patterned; about 12 cross-series of light, indistinct spots except over posterior 1/3 of fin; caudal spot small, not ocellated.

Other samples preserved with brown rather than grey colours. Shahuaya and Aguarico material with brown, even lateral band on and above lower lateral line level, Huallaga and Jenaro Herrera specimens with uniform sides; number of vertical bars variable, 8-12, as those below dorsal fin may be wider and fewer or appear as being incompletely split. Humeral spot in 32.4 mm specimen a simple spot, in slightly larger specimens, vertical and extending across lateral line, in adult position, roundish and ocellated from 81.2 mm SL. Suborbital stripe generally indistinct; incipient in 50.5-51.0 mm specimens, in those larger appearing as a wide, short, oblique (caudad slanting) bar. Fins variably patterned, anal fin uniform or with a few light spots posteriorly; dorsal fin uniform, with or without light submarginal spot-series posteriorly, with or without a few light cross-stripes posteriorly on soft portion; caudal spot ocellated or not; half-ocellus at tip of caudal fin remaining in 81.2 mm specimen; caudal fin with or without 4-5 indistinct cross-stripes of light spots.

Single juvenile with some confidence referable to *C. anthurus*, 32.4 mm SL, yellow-whitish with even, contrasting grey band from snout tip to caudal-fin base; round brown spot in lateral band just posterior to head; 12 vertical narrow bars on back as in adults; no suborbital stripe; caudal spot horizontally elongate, light-ringed, caudal fin otherwise with wide dark margin, dark median portion and dark margin to ocellus; dorsal-fin hyaline with smoky dorsal margin; other fins hyaline.

Distribution (fig. 30)
Ucayali, Huallaga, Putumayo and Amazonas drainages, collected near Tingo María, Pucallpa, Alto Aruya, Jenaro Herrera, Pebas and Santa Cecilia; tentatively identified material from the upper Putumayo.

Ecology
Two of Saul's (1975) Santa Cecilia *C. lucius* examined for stomach contents are *C. sedentaria* (ANSP 158168), so the list of food items, including plant debris, insect debris, insect larvae, and fish larvae applies for both species. In Peru, *C. anthurus* material comes chiefly from small forest streams, eg. SOK 45 and 78.

Notes
Adult *C. anthurus* are readily distinguished by the dorsally positioned, distinct and ocellated humeral spot, a character shared with nominal species *Crenicichla alta* Eigenmann (Guyana), *C. frenata* Gill (Trinidad), *C. albopunctata* Pellegrin (Guianas) and *C. vaillanti* Pellegrin (Guyana, French Guiana) and one or a few Ecuadorian species but with no other *Crenicichla* species. Distinguishing characters among *Crenicichla* species with humeral ocellus on the lateral line need to be explored further. Here, I will consider chiefly *C. anthurus* in relation to the Ecuadorian form(s) and its diagnostics relative to *C. proteus* and *C. lucius*.

The status of *C. anthurus* may be regarded as problematic; both because of uncertainty about the type material and the few specimens, from scattered localities, available.

Aside from colour differences, *C. anthurus* can be distinguished from *C. lucius* by the invariably biserial posterior upper jaw dentition (large *C. lucius* with two instead of one inner series posteriorly), a larger field of ctenoid scales anteriorly on back (only close to dorsal-fin origin in *C. lucius*, along upper lateral line to 8th-12th lateral line scale in *C. anthurus*), but variation in measurements and counts shows great overlap.

There is uncertainty concerning the type-material of *C. anthurus*. Cope (1872) gave the lengths TL 0.215 m, 0.055 m to dorsal-fin base (origin), 0.121 m to anal-fin base (origin), and recorded 3 specimens. The descriptive data appear acceptable and the figured specimen agrees with the description except for a shorter dorsal fin. No *Crenicichla* specimen 215 mm TL can be found in the Cope collection at ANSP. There are however, 3 specimens 78.4-118.4 mm SL (96.4-145.3 mm TL), ANSP 9074-9076, identified by Fowler (on label) as type/-material/ of *C. anthurus*. The largest specimen agrees best with the figure, save that the figure has the lengths SL *c.*140 mm, TL *c.*175 mm. In a lot, ANSP 9068-9073, of 6 specimens of *Crenicichla* in a very bad state of preservation, 2 large specimens are near the lengths of the figured specimens, 141/170, and 134/170 mm SL/TL (measurements very approximate). These are labelled with a modern label (from 1973) as from the 'Ambyiacu River', leg. J. Hauxwell. The specific identity of the ANSP 9068-9073 series is uncertain, although the remains are referable to *C. anthurus* and *C. lucius* as distinguished in this paper.

Although the largest ANSP 9074-9076 specimen is only 2/3 the stated length of Cope's material, that series is considered by myself, Fowler (label) and Böhlke (1984) as syntypes of *C. anthurus*. I consider the number of specimens and agreement with description (save lengths) and figure (save lengths) to support this view.

The type material appears relatively unimportant, however, as there is only one Peruvian *Crenicichla* species with a humeral spot or ocellus *on* the lateral line. Cope describes it for *anthurus* as 'black spot, white-edged, crossing the lateral line opposite the 3rd, 4th and 5th dorsal spines', and figures it below the 1st-4th dorsal-fin spines, but clearly *on* the lateral line. Peruvian *Crenicichla* with humeral ocellus on the lateral line are hence identified as *C. anthurus* in this paper.

The presumed type specimens are soft, but with most scales remaining in

position. The largest specimen has the left side humeral spot unocellated, the right side spot silver-ringed, a dark band from snout to opercular tip, but no suborbital stripe; caudal spot light-ringed, traces of light dots posterior to caudal spot. One has 60, two have 61 squ. long. scales; D. XIX.13, XIX.14 and XX.13.

Specimens from the upper Ucayali are more stout-bodied than other specimens (depth 19.1-23.5 % of SL, compared to 18.4-20.0 % of SL; caudal peduncle depth 77.1-106.3 % of length, compared to 72.5-86.4 %). The Huallaga specimen has squ. long. 64, which is high compared to 59-62 in the other material. Larger series are required to assess the significance of this variation.

Two larger (35.9 and 56.7 mm) specimens of 6 poorly preserved young from the Carahuayte (MHNG 2233.19-20, ZMA unreg.) do show a vertical humeral spot, contacting or overlapping the lateral line and hence these series are identified as *C. anthurus*. Otherwise they are identical to *C. lucius* and at smaller sizes appearing indistinguishable.

The lower Huallaga specimen (ANSP 21103) is the *C. lucius* specimen reported by Cope (1878). It is not well preserved and has the neck broken; D. XXI.13, squ. long. 64, and is referred to *C. anthurus* because of the humeral spot on the lateral line.

Material similar to *C. anthurus*, ie. having a humeral ocellus on the lateral line, is available from the Zamora, Pastaza and Conambo (upper Tigre) systems in Ecuador, and upper Putumayo in Colombia. The Ecuadorian material is dissimilar in having small scales (squ. long. 64-72). The Santiago and Conambo material also has a more pointed snout with engrossed premaxillary symphysial area. This Ecuadorian material is tentatively identified as specifically different from *C. anthurus*, although because of the bad state of preservation of much of it, I am uncertain of the number of species involved. Gilbert & Roberts (1972, Fig. 20) have a photo of 2 Zamora specimens, one showing well the position of the humeral ocellus on the lateral line, both in addition numerous small light spots scattered over sides and unpaired fins. Preserved Zamora material (MCZ 49317, 49321) is now faded to nearly all white, but the Pastaza (NRM unreg.) and one Zamora (BMNH 1898.12.31:37) specimen shows well scattered silvery-white spots on the side. This may be a distinguishing feature from *C. anthurus*, although similar spotting in Guianan *Crenicichla* species is intraspecifically variable. Regan (1905*a*) reported this species as *C. lucius* from Canelos and R. Zamora. The Colombian material is also poorly preserved, but agrees with *C. anthurus* in counts, shape and colour remains (squ. long. 62, D. XX.12).

Specimens from Morelia on the R. Caquetá identified by Fowler (1945*b*) as *C. saxatilis* were not re-examined, but the position of the humeral ocellus (bisected by the lateral line), as noted by Fowler, suggests that they may be *C. anthurus* or close to it.

Eigenmann & Allen (1942) resurrected *C. anthurus* from the synonymy of *C. lucius*, but without giving diagnostic characters and their material consists of two species, *C. proteus* and *C. lucius* (only two specimens consulted of the four *C. anthurus* listed by Eigenmann & Allen).

Geophagus Heckel

Geophagus Heckel 1840, p. 383 (type species *G. altifrons* Heckel, by subsequent designation in Eigenmann & Bray 1894, p. 621).

The genus *Geophagus* includes about 15 species, many still to be named, most of them in rivers draining the Guianas and Brazilian highlands. Only the widespread *G. proximus* is collected in Peru. *Geophagus* species have an 'epibranchial lobe', a flat anteroventral expansion of the first epibranchial, lined by a wide band of connective tissue. Several other cichlid genera have a similarly expanded first epibranchial, and some of them also a connective tissue lining, but only *Satanoperca* species have the lobe comparatively as

well developed. From *Satanoperca*, *Geophagus* can be distinguished by a large number of features. External features include scaly dorsal and anal fins, naked anterior half of cheek, discontinuous lip folds, a midlateral spot, and absence of caudal spot. *Satanoperca* species have naked vertical fins, cheek naked only ventrally, both or upper lip fold continuous, usually no midlateral spot, but always a distinct caudal spot. *Geophagus* species have several series of jaw teeth instead of only one or two, 4 instead of 3 infraorbitals (2nd with middle lateralis foramen), tooth-plates on 4th ceratobranchial, broader lower pharyngeal tooth-plate with fewer teeth, first ceratobranchial rakers inserted dorsal to skin fold of gill-filaments instead of on the skin fold, more caudal than abdominal vertebrae (14-15+17-19) instead of about equal number or more abdominal than caudal, and feature caudal ribs which may extend to the 12th vertebra, associated with paired extensions of the swimbladder missing in *Satanoperca*. See also description of *Satanoperca*, p. 146.

In Gosse's (1976) recent revision of the genus, it is confused with *Satanoperca* and other groups of cichlids with epibranchial lobe. Kullander *et al.* (1986) describe the four Surinamese species of *Geophagus*.

Geophagus proximus (Castelnau)

Figs 16, 31-34, Pl. XI (fig. 4), Table 8

Chromys proxima Castelnau 1855, p. 14 (descr.; un lac près de l'Ucayale, dans la mission de Sarayacu, au Pérou), Pl. 7, fig. 1 (coloured drawing, habitus).

Selected bibliography

Satanoperca proxima; Günther 1862, p. 314 (bibliogr.; diagn., data from Castelnau).

Geophagus surinamensis; (*pt.*) Steindachner 1874, p. 511 (synonymizes *Chromys proxima*). -- (*pt.*) Eigenmann & Bray 1894, p. 622 (*Chromys proxima* in synonymy). -- (*pt.*) Pellegrin 1904, p. 198 (types of *Chromys proxima* included in descr.) -- Fowler 1940*a*, p.289 (listed; Serayacu (*sic*)). -- (*pt.*) Fowler 1944, p.270 (bibliogr.; Peruvian records only; not fig.). -- (*pt.*) Fowler 1945*a*, p. 251 (bibliogr.; Peruvian records only; not fig.). -- (*pt.*) Gosse 1976, p. 24 (*Chromys proxima* in synonymy, syntypes listed).

Geophagus (Geophagus) surinamensis; (*pt.*) Steindachner 1875, p. 122 (*Chromys proxima* in synonymy). -- (*pt.*) Eigenmann & Eigenmann 1891, p. 71 (listed; *Chromys proxima* in synonymy.)

Chromys proxima; Blanc 1962, p. 205 (syntypes listed).

Material

Only two specimens, 141.5-167.8 mm SL from Peru, the syntypes from Sarayacu; 55 specimens, to 225.3 mm SL, from various Brazilian localities.

Description

Qualitative data from syntypes and Tefé specimens (MZUSP 34858); counts from syntypes, Amanã and Tefé specimens measured, measurements in Table 8. Refer to Pl. XI, fig. 4, for general aspect.

Shape. Moderately elongate with elevated anterior dorsum, strongly compressed laterally; in anterior view compressed, nape keeled, wider ventrally, chest flattened or slightly concave. Steeply ascending frontal contour straight to above middle of orbit, posteriorly rapidly level, dorsal-fin base contour about straight sloping except horizontal very anteriorly; Tefé specimens with soft swelling of front between nostrils and predorsal squamation, especially prominent in 185.0 mm specimen in which also continued by soft crested nape. Ventral contour much less arched compared to dorsal; ventral head slightly sloping, little curved, chest little curved, nearly horizontal;

abdomen straight, deeper caudad; anal-fin base straight, little sloping. Caudal peduncle edges nearly straight, ventral sloping and distinctly longer than dorsal.

Head short, deep, narrow; exposed operculum 2 1/2 times as deep as long. Snout long, deep; rounded off in dorsal aspect, nearly right-angled in lateral aspect. Interorbital vaulted, as wide as mouth. Jaws equal anteriorly, except in 187.2 mm specimen in which lower jaw much shorter than upper; maxilla reaching beyond or not quite to vertical at middistance nostril-orbit, premaxillary ascending processes as long as lower jaw, reaching to halfway between nostril and orbit, lower jaw articulation below anterior margin or orbit. Lip folds moderately wide, thin, both discontinuous anteriorly. Orbit in upper, and chiefly in posterior halves of head.

Scales. Squ. long. 32 (3), 33 (10), 34 (1). 18 scale series around caudal peduncle (7 dorsal, 9 ventral to lateral lines). All scales ctenoid except rostralmost cheek scales, a few opercular and subopercular, all or none of interopercular; chest scales in an oval patch between and anterior to pelvic-fin bases, larger and ctenoid, other prepelvic scales cycloid, and very small. Cheek scales in about 5-9 series below orbit, one vertical series behind orbit; cheek naked anterior to vertical from anterior margin of orbit or slightly behind, and below line continuing anterior edge of bony preorbital caudad. Opercular scales small, numerous, smaller centrally than marginally; subopercular scales in 4 irregular series, 0-3 scales posteriorly on interoperculum. 3 scales between genital papilla and anal fin.

Upper lateral line at 8-9 (anteriorly) to 2 1/2 (posteriorly) scales distance from dorsal fin, in 3rd scale series above lower lateral line. Lateral line counts 21/16 (1), 22/14 (1), 22/15 (2), 22/16 (2), 23/14 (1), 23/15 (4), 23/16 (2), 24/16 (1), plus 2 (3 in one) scales on caudal fin; accessory caudal-fin lateral lines long, between rays D3-D4 and V4-V5, to hind edge of squamation, lower or both curved toward median scale series proximally on fin,

Fin scales. Paired fins naked except in 187.4 mm specimen which has a few small cycloid scales on pectoral-fin base; but interpelvic scales cover bases of rays on medial side, pectoral axilla basally with numerous minute cycloid scales. Dorsal fin with narrow basal scale-layer over fin/body junction throughout fin length except on last 3 membranes; 1-2 small interradial ctenoid scales from 2nd membrane, in single or, posteriorly, usually double series, gradually longer to anterior soft membranes, posteriorly shorter and last 1-3 membranes usually naked; length of scale series on last spine, 1/3-1/2 length of exposed part of spine, 187.4 mm specimen with a few scales also between longer ray branches. Anal fin with few scales, in smaller specimens 1-6, in short series on soft membranes, some naked, in 187.4 and 186.3 mm specimens squamation similar to that of dorsal fin, with well-developed basal layer and single or double series on all soft membranes, anteriorly to half length of last spine.

Caudal fin sheathed in dense cover of scales to very near hind margin of fin, except that only 1/4 or less of middle membrane scaly, adjacent 2 membranes on each side increasingly less naked.

Fins. First dorsal-fin spine in advance of vertical from lateral line origin, 1/4-1/3 length of last; spines equal in length from 5th or 6th, except last 2-3 again increasing in length; soft fin damaged in all; anterior about 10 lappets rather long, pointed, shorter and tending to truncate posteriorly. D. XVI.12 (2), XVII.12 (7), XVIII.11 (3), XVIII.12 (2). Anal-fin origin opposite about last dorsal-fin spine; soft fin appearing damaged in most, otherwise pointed, 4th ray longest, reaching 1/4 of caudal fin. A. III.7 (1), III.8 (11), III.9 (2). Caudal fin injured in all, appearing subtruncate, 3 specimens with short pointed streamer formed by branches of rays D7 and D6. Pectoral fin long, pointed, 4th ray longest, reaching to above 3rd or 4th anal-fin ray. P. 15 (6), 16 (8). Pelvic-fin origin below pectoral axilla; fin pointed, injured in most specimens, in specimen 157.6 mm and 167.8 mm syntype long point to middle of caudal peduncle and near caudal-fin end, respectively, outer branch of first ray longest and inner branch and 2nd ray not much shorter.

Gill-arches. 9-10 epibranchial, 1 in angle and 12 (7), 13 (4), 15 (1) ceratobranchial rakers externally on first gill-arch (fig. 31). Prominent epibranchial lobe, connective tissue pad with mediad extension; 1st pharyngobranchial slender, widened ventrally (fig. 32). 5 upper external first epibranchial rakers flattened, with rounded tips, remainder with slightly expanded tips, all attaching close to edge of lobe; external first ceratobranchial rakers all attaching to arch, short, reduced in size rostrad, compressed, crowned by end of prominent strands of tuberculate tissue running transversely to join larger strand of opposite side across membranaceous medial ledge, ledge increasingly wider and tuberculate tissue pads reduced in size rostrally on arch. Basal skin cover of gill-filaments very narrow (fig. 31). Microgill-rakers externally on 2nd to 4th arches.

Jaw teeth. 18-27/17-22 in upper/lower jaw outer hemiseries; 2-3 (5 in one) inner series in upper jaw, 3-5 inner series in lower jaw. Outer series teeth almost immovable, larger than inner, well spaced anteriorly, pointed, little recurved, unicuspid, often worn anteriorly, erect or slightly labiad inclined; inner teeth completely depressible, slender, pointed, recurved and linguad inclined, forming wide band anteriorly. Outer series and inner band widely separated in upper jaw. Teeth on anterior half of lower jaw, and along almost all of upper jaw rim, but symphyses broadly naked.

Tooth-plates. Lower pharyngeal tooth-plate in 157.6 mm specimen (fig. 33) moderately long with many well-ordered teeth; those along lateral margin simple, with single cusp slightly antrorse, inner teeth slender, bicuspid, rarely tricuspid, with posterior cusp pointed, antrorse, anterior cusp minute but distinct; mediposterior teeth submammiform, with cylindrical neck, apex flattened except for approximately central large erect cusp. 4th ceratobranchial with 3 contiguous tooth-plates with 29.7 and 3 teeth in 2 irregular series.

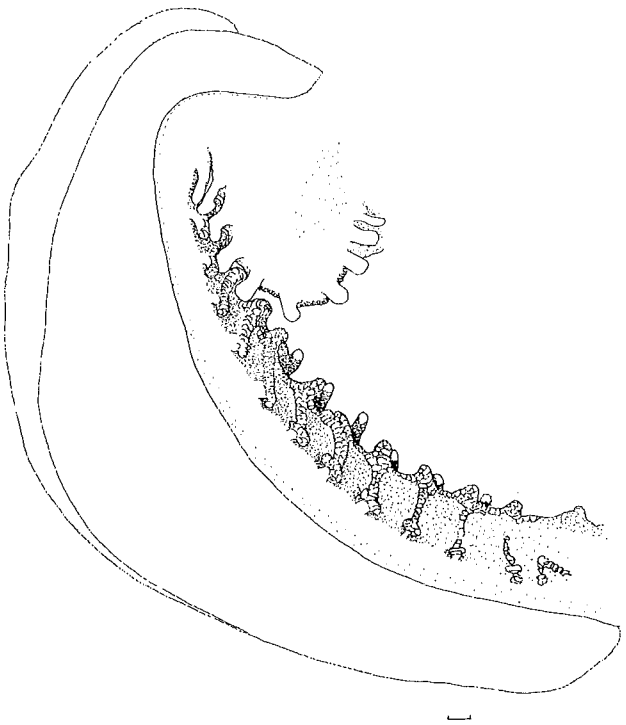


Figure 31. First gill-arch of *Geophagus proximus*, MZUSP 34858, 157.6 mm SL, in lateral aspect; epi- and ceratobranchials more juxtaposed than *in situ*. Scale 1 mm.

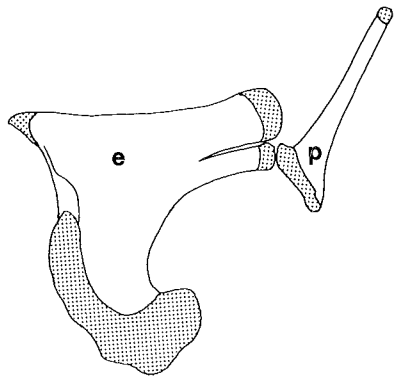


Figure 32. Anterolateral aspect of dorsal elements of first gill-arch in *Geophagus proximus*, MZUSP 34858, 157.6 mm SL. Cartilage and connective tissue pad stippled; e epibranchial 1, p pharyngobranchial 1. Scale 1 mm.

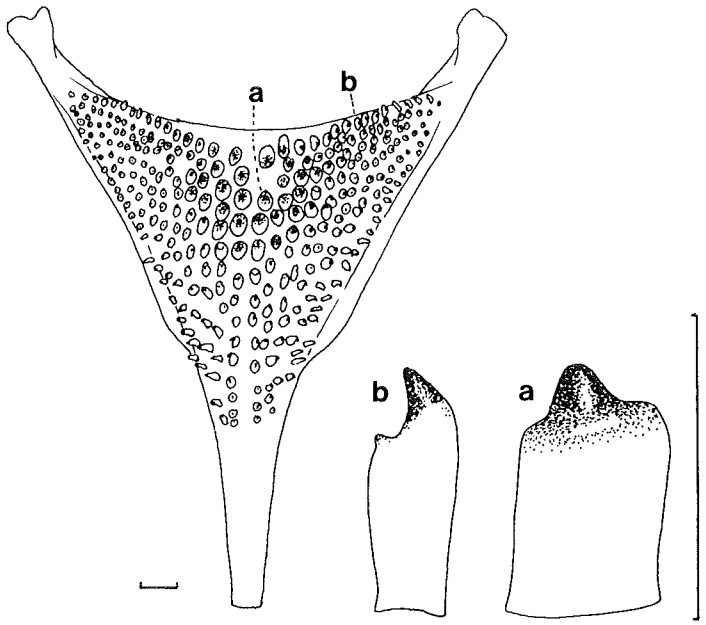


Figure 33. Occlusal aspect of lower pharyngeal tooth-plate in *Geophagus proximus*, MZUSP 34858, 157.6 mm SL, and lateral aspect of (a) mediopost-erior and (b) lateral posterior teeth. Scales 1 mm.

Vertebrae. Three Tefé specimens radiographed with 14+18 (1), 15+18 (2) vertebrae, caudal ribs to 11th (1) or 12th (2) caudal vertebra.

Colouration. Chest and abdomen yellowish white, flanks and abdominal sides light brownish yellow, dorsum and dorsal edge of caudal peduncle light brown. Scales of sides with very narrow black margin. Naked cheek, upper lip, preorbital, snout dorsally grey, frontal protuberance and nape dark brown. Lower jaw and lower lip yellowish white; gill-cover greyish dorsally, lighter ventrally; scaly cheek light yellowish brown. Intermandibular area yellowish white or dark grey; branchiostegal membrane between interoperculars dark grey, with whitish hind edge. Orange spot on base of pectoral axilla clearly recognizable in at least one specimen. Inside and dorsal edge of pectoral axilla dark brown. Dark brown spot on preopercular corner, extending as short stripe from posterior corner pore dorsorostrad to inner margin of preoperculum below lower vertical limb pore.

Prominent dark brown to blackish, roundish blotch covering lateral line scales 9-13 (8-12 in one), 2 scales above and 2 1/2 scales below; margined anteriorly and posteriorly by light (yellowish) bars about 3 scales wide.

Dorsal fin brownish with narrow whitish horizontal stripes, 2 on spinous portion, 3 on soft portion, lappets grey. Anal fin brownish with 3 horizontal whitish stripes. Caudal fin brownish with light (dirty yellowish) markings: 3-5 wide stripes on dorsal lobe, running obliquely between dorsal and caudal edges; on ventral lobes either similar, but less clearly defined stripes or a mottled pattern of light spots with narrow dark interspaces. Pelvic fin brownish, lighter inwardly, outer edge of first ray whitish.

225.3 mm Amanã specimen shows no trace of a midlateral spot.

Life colours. Brittan (1974, p. 89, lower photo, captioned *Geophagus thayeri*) has a colour photograph, obviously of a fresh caught specimen, origin not stated but probably from near Tefé. It has wide orange and bluish horizontal stripes along the flanks, orange stripes in fins and blue 'halter' stripe.

Distribution

The single Peruvian locality known is Sarayacu; extralimital material comes from Lago Amanã, lower R. Tefé, lower R. Trombetas and Lago Janauacá.

Notes

Castelnau's (1855) description of *G. proximus* does not indicate that he had more than one specimen, the total length of which is given as 18 cm. There are, however, two specimens labelled as types of *Chromys proxima* in the MNHN collection (MNHN A.950). These are then obviously syntypes of the species (cf. ICZN, Recommendation 72B). The larger of these agrees with lengths given in the description and on the figure (Castelnau 1855, Pl. VII, fig. 1). Castelnau's counts, D. XVI.12, C. 15, and P. 14 are not verifiable (D. XVIII.12; C. 16, and P. 15), and, as usual with Castelnau (1855), the figure is more accurate than the description (D. XVIII.*c*.11). The specimen is soft, eviscerated, has soft fins injured, and scales lost to a lesser extent. It is discolored especially on the right side. Its colour is brassy yellowish, with a trace of the midlateral spot. The specimen is abberrant in having 7 preopercular lateralis pores (as in, eg. *Cichla*) on the right side. The smaller specimen still shows the preopercular spot and the midlateral spot is evident on lateral line scales 10-13, 2 scales below and 1 1/2 above.

Since Steindachner's (1874) claim that *G. proximus* is an adult male *G. surinamensis*, there is no usage of the name other than in synonymies of *G. surinamensis*. Steindachner's material of *G. surinamensis* probably included several similar species, but apparently no *G. surinamensis*, which is a species endemic to the Marowijne and Suriname River systems in Surinam and French Guiana.

This may very well be the *Geophagus* species reported as *G. Pedroinus* by Agassiz (1865), observed and collected at Tefé, with males having a fore-

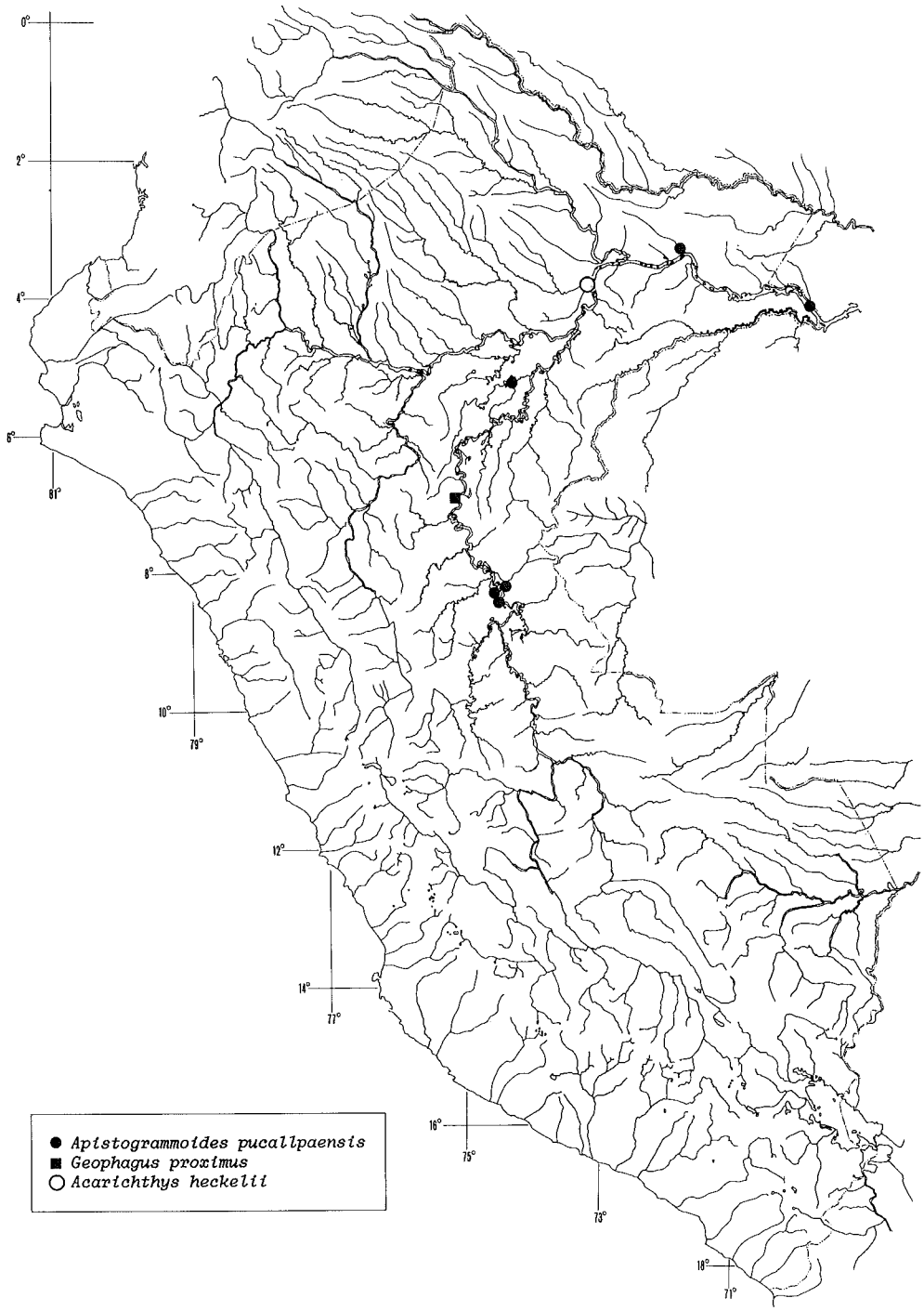


Figure 34. Collecting localities of *Apistogrammoides pucallpaensis* (total known range; a dot may represent more than one collecting site), *Geophagus proximus* and *Acarichthys heckelii* in western Amazonia.

head protuberance. Agassiz's (1865; slightly differently reprinted in Agassiz & Agassiz 1868) description is mostly concerned with the mouth brooding, and the availability of the name is disputable.

Geophagus proximus may be widely distributed along the Solimões, adjacent Peruvian Ucayali-Amazonas, and the Amazon downstream to at least the Trombetas. Collections of verified material are scattered, however. Localities indicate that it may be a black-water species. Eigenmann & Allen's (1942) *G. surinamensis* from R. Itaya, Yarinacocha and Iquitos, were redetermined as *Biotodoma cupido* by Gosse (1976).

Geophagus proximus is most similar to *G. megasema* Heckel, conveniently distinguished as lacking the preopercular spot, and an undescribed species from western Surinam and *G. altifrons* Heckel, in which the midlateral spot is smaller, extending not or only little dorsal to lateral line canals. The Surinamese species also has the gill-filaments largely covered by the basal skin.

Table 8. *Morphometry of* Geophagus proximus *and* Biotodoma cupido. *Measurements are in per cent of SL, except SL (in mm).*

	Geophagus proximus			*Biotodoma cupido*		
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$
SL (mm)	14	129.7-225.3	171.1±6.53	25	42.8-96.9	60.5±2.48
Head length	14	29.0- 32.3	30.5±0.22	25	27.3-32.2	29.9±0.20
Snout length	14	9.8- 13.6	11.8±0.27	25	6.3- 9.4	7.7±0.18
Body depth	14	40.6- 45.7	43.5±0.37	25	38.0-47.0	42.3±0.47
Orbital diameter	14	9.0- 10.5	9.7±0.11	25	11.2-14.7	12.9±0.17
Head width	14	13.4- 15.4	14.4±0.18	25	14.8-16.5	15.5±0.07
Interorbital width	14	8.4- 10.4	9.6±0.17	25	8.1- 9.7	9.1±0.10
Preorbital depth	14	11.5- 14.5	13.0±0.22	25	6.1- 8.8	7.2±0.16
Caudal peduncle depth	14	11.9- 13.8	13.1±0.11	25	11.7-14.2	13.2±0.13
Caudal peduncle length	14	16.7- 19.1	17.7±0.19	25	15.0-16.7	15.9±0.11
Pectoral-fin length	12	37.9- 43.7	41.1±0.46	23	32.5-38.0	35.7±0.27
Pelvic-fin length	10	35.1- 56.5	44.0±1.91	25	29.0-38.9	31.7±0.47
Last dorsal-fin spine length	12	17.7- 21.7	19.3±0.34	24	16.2-19.1	17.3±0.14

Biotodoma Eigenmann & Kennedy

Synonymy

Mesops Günther 1862, p. 311 (type species *Geophagus cupido* Heckel, by subsequent designation in Eigenmann & Bray 1894, p. 621).

Biotodoma Eigenmann & Kennedy 1903, p. 533 (nom. nov. subst. *Mesops* Günther, preoccupied).

Following the revision by Gosse (1976), the genus *Biotodoma*, includes two species, *B. wavrini* Gosse and *B. cupido*, of which only the latter occurs in Peru. These species were separated by Gosse from *Geophagus* by the possession of 2 instead of only one supraneural. Both counts are frequent among South American cichlids. The higher number is, however, interpreted as ancestral. *Biotodoma* has an epibranchial lobe, like *Satanoperca* and *Geophagus*, but it is not as prominent. The oral and pharyngeal dentition, the smooth preoperculum and supracleithrum, the interrupted lip folds, and the gill-arch morphology is more similar to *Geophagus* than to *Satanoperca*. There is a median hypural cartilage like in *Geophagus* and *Cichla*, but the vertebral count is lower (14+14) than in *Geophagus* (14-15+18-19), and there are no ribs on the caudal vertebrae, neither caudal swimbladder extensions, and the cheek squamation extends more anteriad than in *Geophagus*. There are only 3 infraorbitals, the last associated with the sphenotic, the middle long and with a middle foramen. The colouration is highly diagnostic, plain with black stripe through the eye from the nape to the preopercular corner and an ocellated black spot on posterior flanks.

When Günther proposed the name *Mesops* it was preoccupied by *Mesops* Audinet-Serville (1831; as *Mésops*). Eigenmann & Kennedy (1903) referred to *Mesops* Billberg (1820) when proposing *Biotodoma* as a substitute name for *Mesops* Günther. *Mesops* Billberg is, however, a nomen nudum. Despite this it was referred to also for substituting *Mesops* Audinet-Serville with *Mesopsis* Bolívar (1906).

Biotodoma cupido (Heckel)

Figs 35-38, Pl. XII (figs 1-2), Table 8

Geophagus cupido Heckel 1840, p. 399 (diagn.; descr.; Rio-negro; Rio-Guaporè und dessen Morästen in der Umgegend von Matogrosso).

Peruvian bibliography

Geophagus cupido; Cope 1878, p. 697 (listed: Peruvian Amazon).

Biotodoma cupido; (*pt.*) Fowler 1940*a*, p.281 (listed; Contamana; material, not *Acara subocularis* in bibliogr.). -- (*pt.*) Fowler 1944, p.271 (Peruvian bibliogr., not ref. to *Acara suboculariis*). -- (*pt.*) Fowler 1945*a*, p. 252 (Peruvian bibliogr., not ref. to *Acara suboculariis*). -- Gosse 1976, p. 99 (bibliogr.; descr.; Peruvian material: Rio Itaya; Yarinacocha; Iquitos; Pevas Cano; Tuyé Cocha; Ampyacu river).

Geophagus surinamensis; Eigenmann & Allen 1942, p. 399 (listed; R. Itaya; Iquitos; Yarinacocha).

Material

108 Peruvian specimens, 22.0-96.9 mm SL.

Description

Chiefly from specimens over 80 mm SL; counts from 25 specimens measured; measurements summarized in Table 8. Refer to Pl. XII, figs 1-2, for general aspect.

Shape. Moderately elongate and compressed, nape elevated. Predorsal contour steeply ascending, straight except minor concavity above orbit; dorsal-fin base initially little ascending to about 4th spine, posteriorly about straight sloping; prepelvic contour less steep, lower jaw straight, posteriorly little arched; abdominal contour straight horizontal; anal-fin base slightly convex, ascending; caudal peduncle slightly constricted near end, otherwise dorsal contour straight horizontal, ventral edge straight sloping, edges of equal length. Urogenital opening well removed from anal-fin origin, by 5-6 scales. In anterior view narrow, nape keeled, chest flattened. Orbit in about middle of head length, in dorsal half of head. Interorbital slightly vaulted, of about mouth width. Mouth small, maxilla and ascending processes of premaxilla not reaching to orbit; lower jaw prognathous, articulating below anterior margin of orbit or slightly posterior. Lip folds moderately wide, interrupted anteriorly. Snout narrowly rounded in dorsal aspect, deep, subtriangular in lateral aspect.

Scales. Squ. long. 27 (1), 28 (21), 29 (3); 20 scale-series around caudal peduncle. Predorsal scales small, ctenoid, in stochastic arrangement; prepelvic scales minute, cycloid. Cheek scales in 4 (7), 5 (16), 6 (2) series, chiefly cycloid, ctenoid posterosuperiorly; one vertical series behind orbit; naked anteroventrally, close to preoperculum and along anterior half of lachrymal (fig. 35). Opercular scales numerous, small, most cycloid; 3-4 series of subopercular scales, mixed cycloid and ctenoid; group of small cycloid and ctenoid scales posteriorly on interoperculum.

Upper lateral line at 5 1/2-6 (anteriorly) to 2 1/2 (posteriorly) scales distance from dorsal fin; 2 scale-series between lateral lines; lateral line counts: 17/14 (1), 18/- (1), 18/12 (1), 18/13 (3), 18/14 (3), 18/15 (2), 19/(1), 19/12 (1), 19/13 (2), 19/14 (7), 19/15 (2), including usual 1-3 pored scales anteriorly in lower also in large specimens, plus 2 tubed scales on

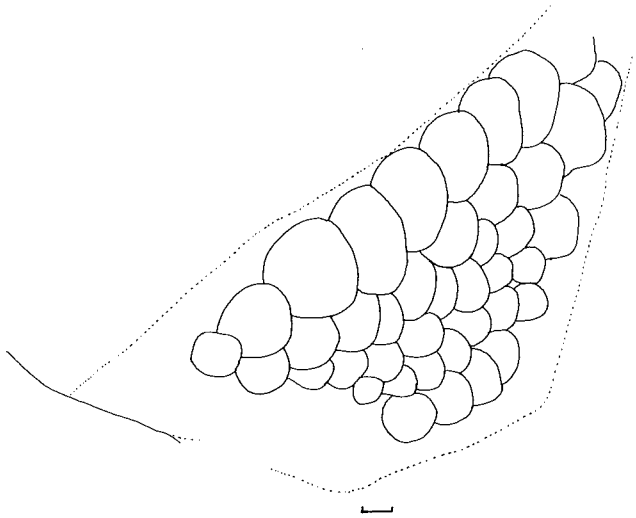


Figure 35. Suborbital cheek squamation of *Biotodoma cupido*, NRM SOK/1983-305.3795, 66.2 mm SL, to show incomplete ventral coverage; outlines of suborbitals and preoperculum indicated by dotted lines. Scale 1 mm.

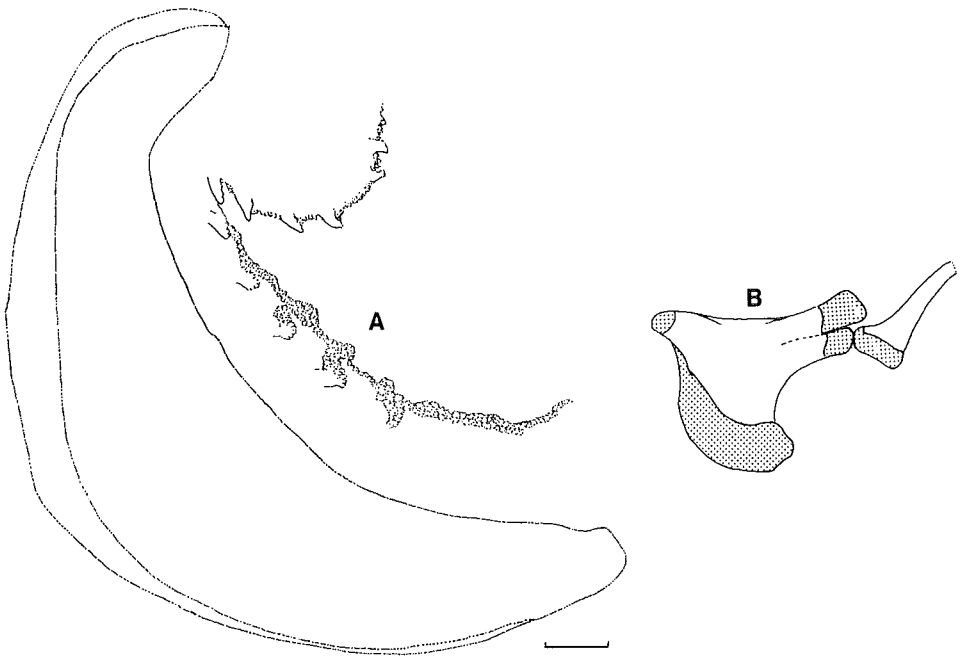


Figure 36. A first gill-arch of *Biotodoma cupido*, NRM SOK/1984322.3908, 68.3 mm SL, in lateral aspect, tuberculate tissue of lobe, rakers and median ledge shown, but not isolated patches or strands elsewhere; specimen has 4 ceratobranchial rakers; epibranchial portion somewhat lateral displaced compared to in situ position. B first epibranchial and pharyngobranchial from same specimen in rostral aspect; cartilage and ventral connective tissue pad of epibranchial stippled. Scale 1 mm.

caudal fin; accessory lateral lines on caudal fin between rays D3-D4 (1, in 4 specimens) and V4-V5 (1-2, in 4 specimens) or V3-V4 (1-2, in 2 specimens).

Fins naked except caudal fin, with deeply concave basal squamation, to 1/3 along median rays, 2/3 along margin, most scales ctenoid.

Fins. First dorsal-fin spine inserted slightly in advance of first lateral line scale, 2/5 length of last; in young specimens spines increasing in length to 6th through 8, posterior shorter, in adults either subequal from 6th or as in young but last two slightly longer than immediately preceding; lappets moderately long, pointed; soft part rounded, reaching beyond caudal-fin base, or pointed, to middle of caudal fin. D. XV.9 (1), XV.10 (21), XV.11 (3). Anal fin in posterior third of body, soft part rounded, reaching little beyond caudal-fin base; A. III.8 (1), III.9 (20), III.10 (4). Pectoral fin long, with pointed tip, 3rd ray longest, to above first anal-fin spine. Pelvic fin posterior to pectoral axilla; pointed outer branch of first ray longest, not filamentous, reaching to 2nd or 3rd anal-fin spine. Caudal fin emarginate, pointed corners formed by rays D6+D7 and V6.

Gill-arches. First gill-arch (fig. 36) with ventrally expanded pharyngobranchial, medial arms of epibranchial closely approximated, epibranchial deep and with ventral laterad extended connective tissue pad; gill-rakers minute, papilliform on lobe near edge and in corner, ceratobranchial compressed and forming ends of low strands of tuberculate tissue connecting with tuberculate tissue along edge of rostrad widening medial skin ledge; basal skin cover of gill-filaments narrow. Lobe rakers 5-6 (7), 0-1 in angle, ceratobranchial 3 (7), 4 (12), 5 (5), 6 (1) externally on first arch. Microgill-rakers externally on 2nd to 4th arches, verifiable internally on 4th arch in 2 specimens. No rakers on lower pharyngeal tooth-plate.

Tooth-plates. Dissected 68.3 mm specimen with 3 tooth-plates on 4th ceratobranchial, with 7, 8, 7 teeth; lower pharyngeal tooth-plate (fig. 37) anteriorly with few unicuspid teeth, marginal teeth slender and bicuspid, enlarged median teeth bicuspid with low posterior cusp, otherwise inner and posterior teeth compressed, bi- and tricuspid, occasionally quadricuspid, posterior cusp antrorse.

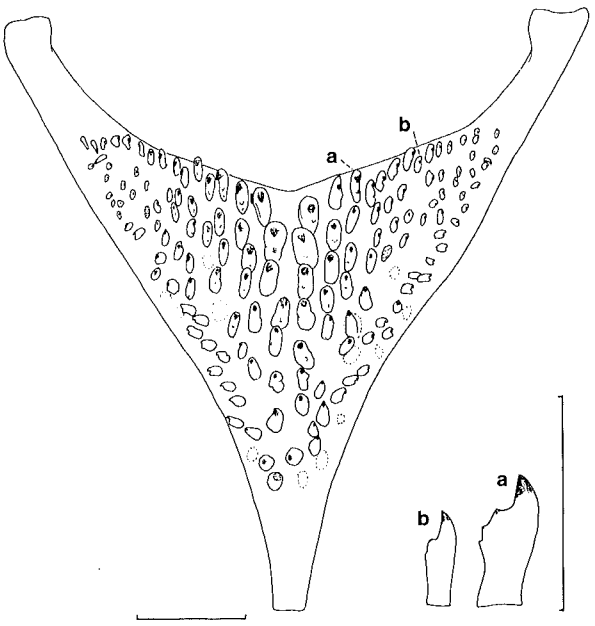


Figure 37. Occlusal view of lower pharyngeal tooth-plate and lateral view of two posterior series teeth (**a** quadricuspid, **b** weakly tricuspid) in *Biotodoma cupido*, NRM SOK/1984322.3908, 68.3 mm SL. Scales 1 mm.

Jaw teeth. All depressible, subconical, pointed, recurved, those in outer series larger than those in inner band. 9-16, $\bar{x}$=12.7±0.60 (n=15)/20-27, $\bar{x}$=23.0±0.46 (n=21) in outer series in upper/lower jaw in specimens 42.8-96.9 mm SL; inner band anteriorly in upper jaw (1-3, modally 3 series) well separated from outer series; inner band in lower jaw of 4-6 series anteriorly, one posteriorly.

Vertebrae. 14+14 (5).

Juveniles similar to adults but notably more elongate, eye proportionally larger; predorsal scales cycloid, and anterior half of prepelvic area and cheek naked.

Colouration. Simple, with dark vertical stripe on head and posteriorly placed midlateral spot with bordering light zones being prominent markings. Chest silvery, abdomen and underside of head greyish yellowish; faint silvery sheen on lower flanks, sides otherwise light brownish. Cheek brownish yellow; gill cover greyish or operculum greyish, suboperculum silvery. Snout and forehead light greyish. Dark brown to blackish stripe from near nape midline straight vertical to orbit posterior to middle, continued below orbit, wide, from posterior half of orbit across posterior cheek and preoperculum to free edge of preopercular corner or posterior edge of interoperculum. Contrasting light, dirty yellowish stripe bordering dark nape stripe posteriorly. Snout markings hardly visible; faint dark band from eye across snout tip passing between nostril and anterodorsal lachrymal lateralis pore, light zone posterior to this stripe.

No lateral band; narrow, very indistinct light bars close to dorsal fin below about 5th and 10th dorsal-fin spines; sides slightly darkened near dorsal-fin origin; hypaxially, many narrow indistinct light stripes extending dorsad from light ventral regions. Dark brown to blackish spot below anterior 3 dorsal-fin rays, usually covering 3 posterior lateral line scales, reaching 1/2-1 scale series ventrally, and 1-1 1/2 scale series dorsally, margined anteriorly and posteriorly by contrasting dirty yellowish white 1-2 scales wide bars that may include silvery reflections. Some specimens with midlateral spot not reaching below lateral line canal series and also slightly elongate (Pl. XII, fig. 2).

All fins immaculate, except occasionally faint spots on caudal fin. Dorsal fin smoky, 3 posterior membranes hyaline, lappets with narrow black edges. Anal fin smoky. Pelvic fin smoky, with wide white leading edge. Caudal fin dark grey distal to central scales, gradually lighter distad, rarely 3 series of very indistinct greyish dots across median portion.

Juveniles distinguished in particular by midlateral spot, which round and positioned between upper and lower lateral line, and broad dark vertical bars separated by narrow, indistinct light bars: 5 dark bars below dorsal fin, 4th from anteriormost containing midlateral spot, 2 on caudal peduncle.

Life colours. In life very similar to preserved specimens. Flanks greyish, shining silvery when taken out of water; two iridescent blue stripes on preorbital and cheek.

Distribution (fig. 38)

Peruvian collections of *B. cupido* are scattered along the Ucayali and Amazonas: Contamana, lower Pacaya, Jenaro Herrera, lower Nanay, lower Mazán, lower Ampiyacu, lower Yavarí. The species is probably wide-ranging in Amazonía; see further below.

Ecology

Biotodoma cupido is rarely collected in numbers. The only large sample (40 specimens) is from a drying tahuampa cocha (SOK 71) and consists of mostly young specimens of starved appearance. Other collections are from lakes, streams and sandy beaches, representing a wide range of physico-chemical conditions.

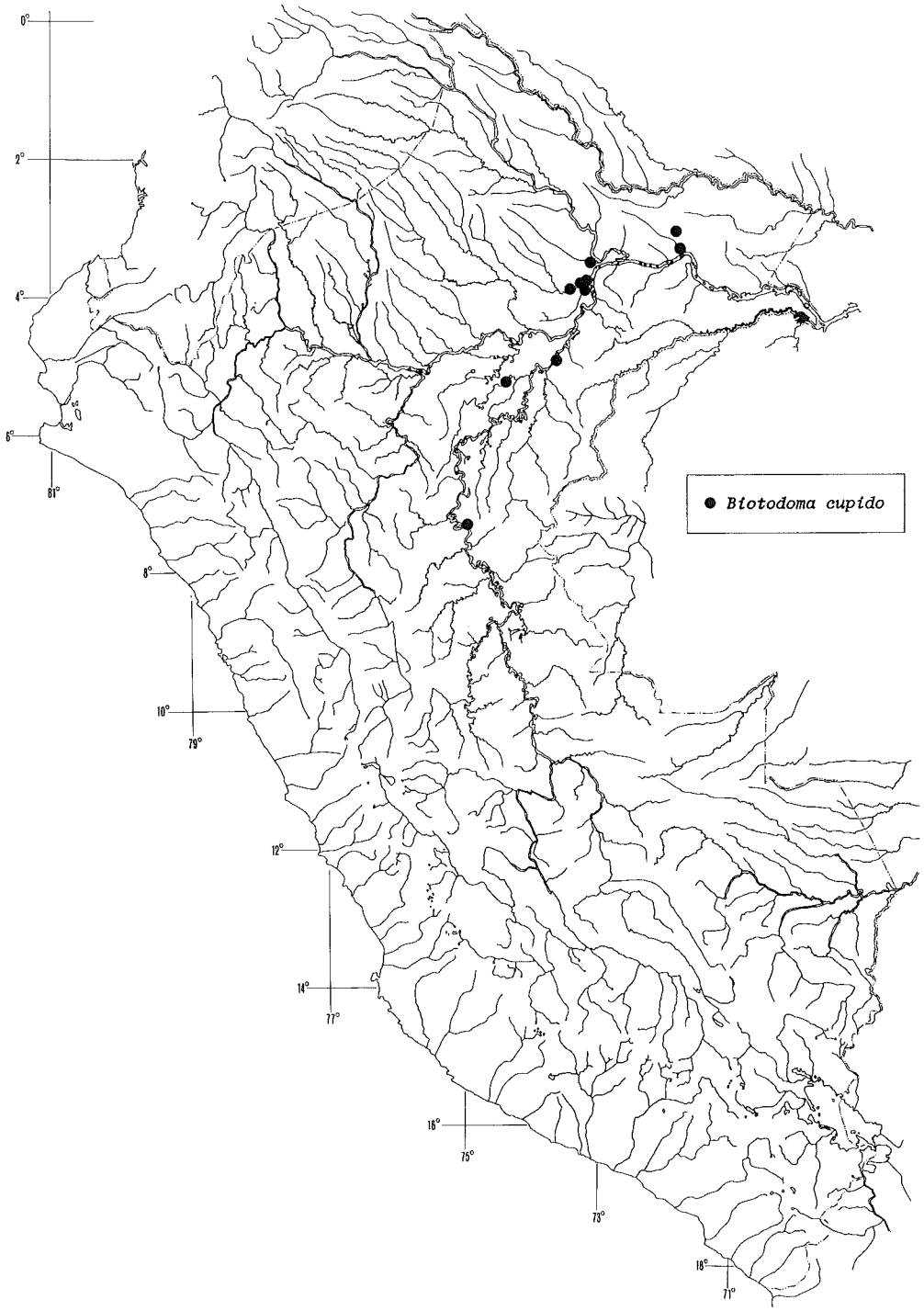


Figure 38. Collecting localities of *Biotodoma cupido* in western Amazonia. A dot may represent more than one collecting site.

Notes

I have examined the type material of *B. cupido* Heckel (1840) (R. Guaporé, R. Negro) and *B. wavrini* Gosse (1963) (upper R. Orinoco), and much other *Biotodoma* material from the Guaporé, Negro, Essequibo, Orinoco, Tapajós and Araguaia. *Biotodoma wavrini* is a rather elongate species that retains the midlateral spot below the upper lateral line as adult. Another feature, the snout stripe, which Gosse (1976) thought to be absent in *B. wavrini* and distinguishing it from *B. cupido*, is present in all fresh specimens of *Biotodoma* including *B. wavrini*. There is sufficient variation among *Biotodoma* from outside the range of *B. wavrini* (upper Negro and Orinoco systems) to tentatively consider *B. cupido* sensu Gosse (1976) a composite species. Detailed analysis remains to be done, however, and the Peruvian material is identified here as *B. cupido*. Two *B. cupido*-like species, and *B. wavrini*, are illustrated in colour in Kuhlmann (1983). Koslowski (1983) and Staeck & Linke (1985) have already commented on the possible existence of at least 3 *Biotodoma* species. Their characterization of the Peruvian form as having the midlateral spot above the lateral line is, however, not verified by the present study. The spot may be situated either on or above the lateral line in specimens in single samples, but is usually on the lateral line and shows no ontogenetic variation after the initial juvenile situation below the lateral line.

Acarichthys Eigenmann

Acarichthys Eigenmann 1912, p. 500 (type species *Acara heckelii* Müller & Troschel, by original designation).

Acarichthys is here ordered among geophagine genera, although its systematic position has never been clear, and still is not. In most characters, eg. the colour pattern, small scales, body shape, weakly serrated supracleithrum, emarginate caudal fin, and 5 dentary lateralis pores, the single species resembles rather geophagines than cichlasomines, but it does not have an epibranchial lobe. *Acarichthys* is further distinguished by the few dorsal-fin spines (D. XII.11-12, XIII.12 in Peruvian material), the broad tip of the pelvic fin (branches of first ray equally long or inner slightly the longer, instead of the outer the longer), single supraneural, and vertebral count 14+15, in combination. The swimbladder is not caudad extended and there are no caudal ribs. The infraorbitals are as in *Geophagus*.

Acarichthys heckelii (Müller & Troschel)

Figs 34, 39-40, Pl. XII (fig. 3), Table 9

Synonymy

Acara Heckelii Müller & Troschel, in Schomburgk /1849/, p. 624 (descr.; Sümpfen der Savanne /Guyana/).

Geophagus (Mesops) Thayeri Steindachner 1875, p.108 (diagn.; descr.; Amazonenstrom bei Teffé, Villa bella, Obidos, Cudajas, Tonantins, Jatuarana, Ueranduba, Serpa, Rio Tapajos, R. Trombetas, R. Negro, R. Xingu, See Hyanuary, José Assu, Saraca, Alexo und Lago maximo etc.), Pl. III, fig. 2 (sketch, habitus).

Acara subocularis Cope 1878, p. 696 (descr.; Peruvian Amazon).

Selected bibliography

Astronotus (Acara) subocularis; Eigenmann & Eigenmann 1891 (listed).

Geophagus Thayeri; Pellegrin 1904, p. 189 (*Acara subocularis* in synonymy).

Acara subocularis; Regan 1905c, p. 557 (descr. of Brazilian material; bibliogr.; *Geophagus Thayeri* in synonymy;). -- Böhlke 1984, p. 59

(type material missing).
Biotodoma cupido; (*pt.*) Eigenmann 1912, p. 501 (bibliogr. in part: *Acara suboculatis* in synonymy). -- (*pt.*) Fowler 1940*a*, p. 281 (not material; *Acara suboculatis* in synonymy).
Acarichthys heckelii; Eigenmann 1912, p.500 (redescr.; /Guianan material/; synonymy: *Acara suboculatis*, *Geophagus thayeri*).
Aequidens suboculatis; Fowler 1954, p. 269 (bibliogr.).

Material
Only 3 young specimens, 61.3-70.0 mm SL, from Peru; consulted Brazilian material, including type series of *Geophagus thayeri*.

Description
Based on available material; measurements in Table 9. Refer to Pl. XII, fig. 3, for general aspect.

Shape. Moderately elongate, strongly compressed laterally. Predorsal contour straight ascending; dorsal-fin base sloping or horizontal anteriorly; dorsal contour more arched than ventral; prepelvic contour about straight; abdominal contour straight, deeper anteriorly; anal-fin base straight, little sloping; caudal peduncle slightly constricted, ventral edge little longer than dorsal. Head moderately elongate. In anterior view compressed, nape keeled, chest flattened. Snout subtriangular in lateral aspect, dorsal contour steeper, slightly convex, compared to straight ventral contour. Interorbital vaulted, narrower than mouth. Orbit in middle of head length, in dorsal half of head. Maxilla reaching halfway between nostril and orbit; ascending processes of premaxilla not reaching to orbit; lower jaw articulation below anterior margin of orbit; lower jaw very little prognathous. Lip folds moderately wide, both discontinuous. Supracleithrum weakly serrated. Genital papilla and anal-fin origin well separated (5 scales).

Scales. Squ. long. 29 (2), 30 (1); 16 scale series around caudal peduncle. Scales ctenoid except on cheek and opercular bones, interradial caudal-fin scales, and prepelvic scales. Predorsal squamation stochastic; about 15 small scales along midline. Cheek completely scaly with thin, small cycloid scales, except for narrow naked area along preoperculum some distance dorsad from corner; cheek scales in 5 (1), 6 (2) series below orbit; one series vertically behind orbit. Gill-cover scales thin, small cycloid, numerous; about 4 vertical series on operculum; 3 series on interoperculum, or 2 series and wide naked margin; a group of scales posteriorly on interoperculum. Between pelvic-fin bases ctenoid large scales, rostrad cycloid, much smaller and gradually more deeply embedded in skin.

Upper lateral line at 6 (anteriorly) to 1 1/2 (posteriorly) scales distance from dorsal fin, on 3 scale series dorsal to lower lateral line. Lateral line counts 17/12, 18/12, 19/12, plus 2 on caudal fin, but no accessory caudal-fin lateral lines.

Fins naked, except caudal fin with strongly concave dorsal squamation, to 1/3 medianly, to 2/3 marginally.

Fins. First dorsal-fin spine above first lateral line scale, nearly 2/3 length of last, spines increasing in length to 5th or 6th behind which subequal or gradually little shorter to penultimate, last as long as 5th or 6th; lappets short, subtruncate; soft fin from rounded to subacuminate with increasing size, to or slightly beyond caudal-fin base, 5th or 6th ray longest. D. XII.11 (1), XII.12 (1), XIII.12 (1). Anal-fin origin below second dorsal fin ray; soft fin like soft dorsal fin but slightly shorter, 3rd or 4th ray longest. A. III.8 (2), III.9 (1). Pectoral fin with subacuminate tip, 3rd ray longest, reaching to above first anal-fin spine. Pelvic fin posterior to vertical from pectoral axilla; pointed, reaching from not quite 1st anal-fin spine to 2nd anal-fin spine; first ray longest, its 2 branches of equal extension. Caudal fin emarginate, rays D6+D7 and V6+V7 forming pointed corner tips.

Gill-rakers. Four epibranchial, one in angle and 7 (1), 8 (2) ceratobranchial rakers externally on first gill-arch (fig. 39). Epibranchial rakers

papilla-like, in close succession, ceratobranchial rakers minute, at ends of transverse strands of tuberculate tissue. First epibranchial slender without ventral expansion or ventral cartilage lining or connective tissue pad; prominent sessile pad of 2nd epibranchial partly coextensive with skin-cover of 1st epibranchial producing lobe-bearing impression of first epibranchial when viewed only with gill-cover opened. Microgill-rakers externally on 2nd to 4th arches.

Jaw teeth. Simple, very little recurved, unicuspid, pointed; 14/20, 13/21, 13/21 in upper/lower jaw outer hemiseries; in lower jaw 3 inner series anteriorly, close to outer series, outer teeth not much larger than inner; in upper jaw, outer series along half of jaw rim, of teeth larger than those of inner, anterior, 2 series which separated from outer series by distinct gap.

Tooth-plates. Lower pharyngeal tooth-plate (fig. 40) moderately long; teeth marginally unicuspid and slender, inner teeth also relatively slender with posterior antrorse cusp and feebly or moderately developed anterior cusp. 4th ceratobranchial with 4 tooth-plates with 3, 8, 9 and 6 teeth.

Vertebrae. 14+15 (2).

Colouration. Chest silvery, sides light greyish on whitish ground, little countershaded. Cheek dirty yellowish white; operculum grey to brown; preorbital and forehead grey. Dark brown narrow suborbital stripe from eye just posterior to infraorbital 2 little caudad inclined to free margin of preopercular corner; slightly fainter dark supraorbital stripe from eye between pores of clf3 and clf4 caudad inclined to nape midline. No other head markings. Sides with indistinct pattern, consisting of a dorsal and an axial series of short bars or blotches; dorsal side series bars: (1) from around dorsal fin origin ventrally to dorsal edge of operculum, slightly narrowed ventrally, (2-4) with narrow interspaces, from dorsal fin to upper lateral line, (5-6) hardly distinguishable blotches dorsally on caudal peduncle; axial series of 4 blotches with centers below interspaces of dorsal series bars, slightly deeper than long, from upper lateral line to about level of lower edge of pectoral axilla, except the first, which dorsal to pectoral axilla. Midlateral spot 2 scales long, 1 scale deep, dark brown, in squ. long. scales of 2nd axial series blotch, missing in 63.7 mm specimen. Flank scales with dark spot close to edge, fading ventrally on sides, absent from belly and chest scales.

Three anterior dorsal-fin membranes with black spot on distal 2/3, rest of fin dusky, with hyaline spot on each membrane base, lappet tips narrowly black; soft portion with up to 4 series of hyaline spots on posterior 1/3-1/2 and indistinct blackish dorsal margin. Anal fin smoky, with dark grey ventral edge, hyaline spot on base of each membrane and a few hyaline spots along posterior edge. Pelvic fin duskied along leading edge, inwardly hyaline. Caudal fin smoky, with 5 wide cross-series of hyaline spots on naked part except along dorsal and ventral margins.

Distribution (fig. 34)

Peruvian material available comes from Quisto Cocha (described on p. 15), from where also reported by Schulz (1980); collected eastward along the Amazon, in the lower R. Negro, upper R. Branco and in the Rupununi-Essequibo.

Notes

The Peruvian specimens examined are rather small - the species reaches 150 mm SL. Large Brazilian specimens have more elevated anterior dorsum, very deep preorbital, and more teeth, to five inner series in lower jaw. The caudal-fin tips develop into long streamers. The dorsal fin has long free filamentous rays from above the middle to past the caudal fin; the anal fin is long, with entire point to near end of caudal fin. The pelvic fin is produced, with the inner branch of the first ray slightly the longest. Small white spots develop on the dorsal and anal fins. Four minute dark spots on the head appear consistent in position: one on the edge of operculum and anterior process of preoperculum, little dorsal to ventral tip of operculum; another dorsally on opercular-subopercular edge; on cheek close to infraorbitals one on each side

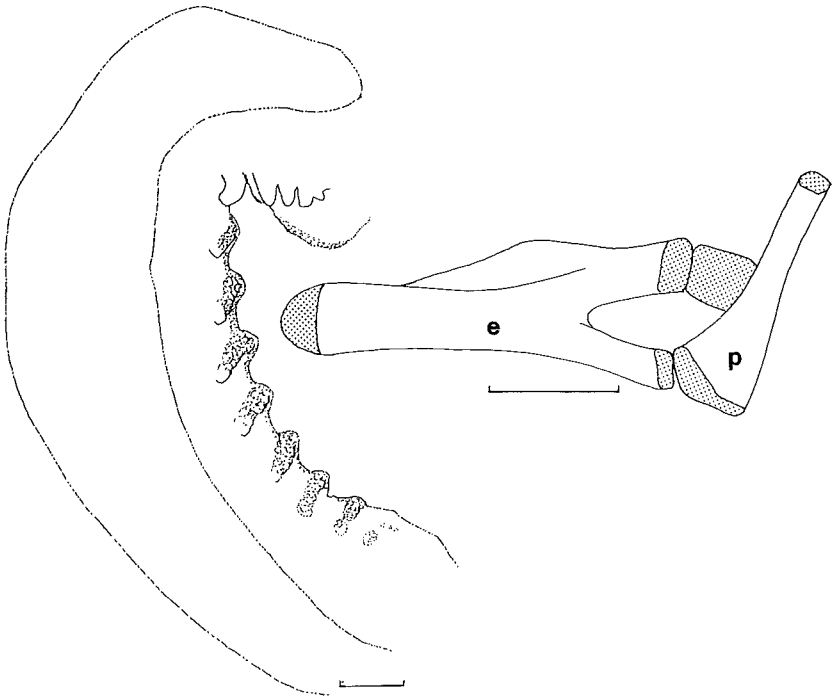


Figure 39. External aspect of first gill-arch of *Acarichthys heckelii*, NRM SOK/1984342.3897, 63.7 mm SL; semidiagrammatic, with emphasis on gill-rakers and associated tuberculate tissue strands, and (right) anterolateral aspect of dorsal elements of first gill-arch, cartilage stippled; **e** epibranchial, **p** pharyngobrachial. Scales 1 mm.

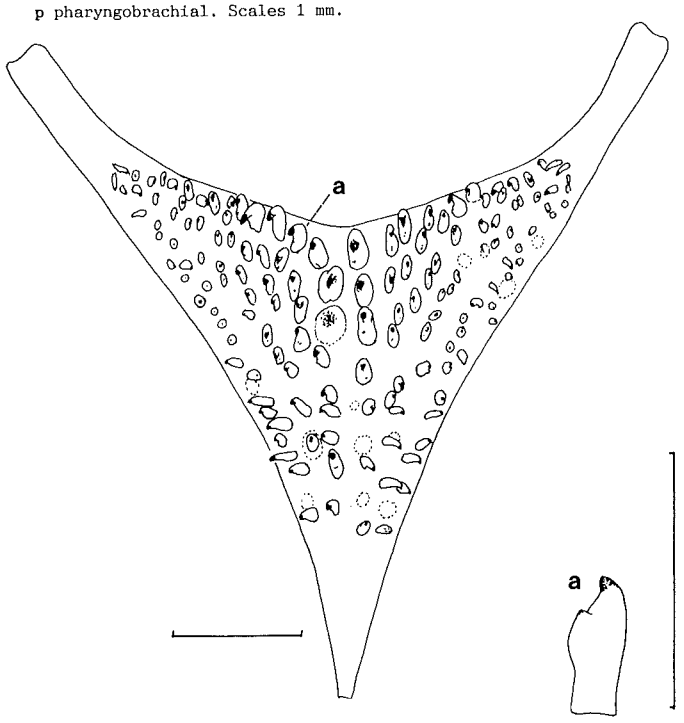


Figure 40. Occlusal view of lower pharyngeal tooth-plate and medial view of posterior tooth in *Acarichthys heckelii*, NRM SOK/1984342.3897, 63.7 mm SL. Scales 1 mm.

of suborbital stripe. There is frequently one or two tubed lateral line scales on the caudal fin between rays V4 and V5.

There is quite some confusion in the literature concerning the status of *Acarichthys* and *A. heckelii*, and one of its characters.

Acara heckelii was very briefly described by Müller & Troschel (in Schomburgk /1849/) on the basis of Guyanan material. There are no types preserved in the ZMB (searched for by H.-J. Paepke and myself). Data in the description, such as preorbital longer than eye, 5 cheek scale series, black spot on side below lateral line, no caudal spot, D. XIV.10, A. III.8, white spots on fins, in combination, would seem to exclude all known Guyanan cichlids except one, which also identified by Eigenmann as *A. heckelii* and which apparently the same species as that identified as *A. heckelii* among Peruvian cichlids. Referring to consensus with Eigenmann (1912) and some later authors (Lowe-McConnell 1969) about the identification of *A. heckelii*, and the uncomplicated taxonomy of the species, there seems to be no need for a neotype although the very weak nomenclatural basis of *A. heckelii* should be recognized. For instant, referring to data in the original description, only the spotted fins would distinguish effectively from *Biotodoma*, only dorsal-fin count from *Geophagus* (17-18 spines), and having a spot rather than a vertical stripe on the side from *Acarichthys geayi*-like cichlids. Large specimens of the undescribed genus including *Acarichthys geayi* (Pellegrin) may have the stripe reduced to a spot, but then it is rather on than below the lateral line (see Kullander *et al.* 1986, for discussion on this group).

The description of *Acara subocularis* (Cope 1878) is sufficiently precise to permit identification of the species. The 'black spot on the upper anterior portion of the spinous dorsal fin', mentioned by Cope, is a marking unique to *A. heckelii*. Fin counts (D. XIII.11, A. III.8) and other descriptive data are congruent with such an identification. The type(s) cannot be located in the ANSP collection and may be presumed lost. As there is no doubt about the species, and as *A. subocularis* is a junior synonym of *A. heckelii*, there is no obvious need to have a neotype. The type locality is uncertain; Cope had the specimen(s) from Orton's 1877 collection, which he referred to as 'partly obtained near Pebas'.

Eigenmann (1912), working on 9 specimens from the Essequibo, characterized *Acarichthys* as having a very feebly developed first epibranchial lobe with about 2 rakers along its base. He identified *Acara heckelii* with reference to the lateral spot and fin formula given in the original description, and synonymized *Geophagus thayeri* and *Acara subocularis*. Eigenmann's view of relationships is not quite clear, as *Acarichthys* is said to be allied to *Retroculus*, as well as bridging 'the gap' between *Aequidens* and *Geophagus*. Besides, *A. subocularis* is entered in the synonymy of both *Acarichthys heckelii* and *Biotodoma cupido*. Other authors on the lobe or relationships of *A. heckelii* vary in opinion:

Günther (1862) in the description of *Acara gymnopoma* suggested the possibility that it would be identical with *A. heckelii*. Later authors have synonymized *Acara gymnopoma* with *Geophagus brasiliensis* (Quoy & Gaimard).

Steindachner (1875) noted 'anfalled geringe Entwicklung der Hautfalte am oberen Theile des ersten Kiemenbogens' in his material of *Geophagus thayeri*.

Examination of a portion (particularly NMW 24133-24138, L. Janauari) of the large type series of *Geophagus thayeri* suggests that Steindachner misinterpreted the prominent anteriad expansion of the second epibranchial as belonging to the first epibranchial. The first epibranchial of syntypes of *G. thayeri* is actually a slender element.

Pellegrin (1904) united *Acara subocularis* and *Geophagus thayeri* under the latter name, remarking on the feebly developed lobe. *Acara heckelii* he considered as a questionable older synonym of his own *Acara geayi*.

Regan (1905c) considered *Acara subocularis* to be next to Pelle-

grin's *Acara geayi*, and noted in three Brazilian specimens that 'there is /not/ any trace of a lobe on the upper part of the anterior branchial arch'.

Gosse (1976) considered *Acarichthys* close to *Retroculus* Eigenmann & Bray, distinguished by possessing microgill-rakers, in having one instead of 2 supraneurals, and by deeper preorbital.

Kullander (1980*a*) placed *Acarichthys* in a group named 'larger geophagines', distinguished by the epibranchial lobe. *Acara geayi* was provisionally referred to *Acarichthys*, more with reference to its distinctness from *Aequidens*-like cichlids, than to obvious affinities with *Acarichthys*; the systematic position of *A. geayi* is being dealt with elsewhere (Kullander *et al.* 1986).

The present study confirms the absence of a lobe on the first epibranchial of *Acarichthys*, but does not indicate precise relationships.

The basic colour pattern of the sides is as in *Crenicara*, with the same positions and shapes of dorsal and axial series blotches. There is otherwise a general agreement with *Biotodoma* in colouration, especially in the reddish anterior flanks of living specimens (cf. photos pp. 23 and 42 in Staeck & Linke 1985), which is a feature unique to *Biotodoma* and *Acarichthys*. The filamentous dorsal-fin rays are unique to *Acarichthys*, *Laetacara flavilabris*, *L. thayeri*, *Satanoperca daemon*, and an undescribed *Satanoperca* species.

Table 9. *Morphometry of* Crenicara punctulatum *and* Acarichthys heckelii *from Peru. Measurements are in per cent of SL, except SL (in mm).*

	Crenicara punctulatum Ucayali-Amazonas			*Crenicara punctulatum* R. Tambopata			*Acarichthys heckelii*		
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$			
SL (mm)	25	24.9-100.9	46.1±3.60	5	42.7-67.1	53.5±5.23	61.3	63.7	70.0
Head length	25	26.7- 31.7	29.3±0.23	5	27.4-29.2	28.2±0.31	29.0	29.7	29.7
Snout length	25	4.1- 8.2	5.4±0.20	5	5.3- 7.0	6.1±0.30	8.3	9.4	10.4
Body depth	25	31.6- 42.1	37.7±0.58	5	37.9-40.9	39.9±0.55	37.4	39.2	38.6
Orbital diameter	25	9.8- 14.9	12.8±0.25	5	11.0-12.9	11.9±0.40	13.2	10.8	10.4
Head width	25	15.7- 17.3	16.6±0.10	5	14.9-16.2	15.6±0.25	14.4	14.1	13.9
Interorbital width	25	8.2- 11.0	9.2±0.14	5	8.4-10.3	9.6±0.33	6.9	7.5	7.6
Preorbital depth	25	3.1- 8.4	5.1±0.27	5	4.7- 6.9	5.8±0.44	7.5	7.8	9.9
Caudal peduncle depth	25	12.8- 15.1	14.0±0.12	5	13.1-14.8	14.1±0.33	12.7	12.7	12.3
Caudal peduncle length	25	14.4- 17.3	15.6±0.15	5	13.9-16.6	14.7±0.49	16.6	16.0	15.7
Pectoral-fin length	24	30.2- 36.8	33.0±0.35	5	30.9-33.9	32.6±0.59	31.6	32.0	32.6
Pelvic-fin length	25	26.7- 58.4	30.1±1.25	5	27.2-30.4	29.0±0.60	28.5	29.5	31.7
Last dorsal-fin spine length	24	14.9- 20.6	17.1±0.24	4	15.5-18.3	16.9±0.57	16.2	16.5	18.4

Crenicara Steindachner

Crenicara Steindachner 1875, p.99 (type species *Crenicara elegans* Steindachner, by monotypy).
Dicrossus Steindachner 1875, p. 102 (type species *Dicrossus maculatus* Steindachner, by monotypy).
Crenacara Regan 1905*a*, p. 152 (unjustified emendation of spelling of *Crenicara*).

In the latest revision of this genus, Regan (1905*a*) combined the two monotypic nominal genera *Crenicara* and *Dicrossus* under the name of *Crenacara*, an unjustified emendation of the spelling of *Crenicara*. The genus was associated with *Crenicichla*, obviously with reference to the denticulated preoperculum. Several differences from *Crenicichla* were indicated in Regan's diagnoses of the two genera. Since now a serrated preoperculum has been encountered in several other South American cichlid genera (*Apistogramma, Papiliochromis, Satanoperca*), and the development and occurrence of preopercular serrations is quite variable in all of these, and since preopercular serrations may be rather a percoid character, a close relationship between *Crenicara* and *Crenicichla* is not supported by available information.

The close relationships of *Crenicara* remain to be investigated. The genus may be defined by the 4 dental lateralis pores; unlike in cichlasomines, it is the anteriormost that is missing, probably in correlation with the likewise apomorphic rostroventrad shift of the lower jaw tooth band. Sexual dimorphism is manifest above all in the red pelvic fin of females, another apomorphic character state.

Although there is no epibranchial lobe, the first epibranchial does have a ventral flat expansion, and some justification for provisionally ordering *Crenicara* among geophagines is given also by the similarity to *Biotodoma* and *Satanoperca* in the infraorbital number. There are 3 tubular infraorbitals, the last associated with the sphenotic. As in *Biotodoma* and *Satanoperca* there is only one middle foramen on the longest element. Unlike *Biotodoma*, *Crenicara* has only one supraneural, and the colour pattern, which has inspired the name checkerboard cichlids in countries where *Crenicara* species are kept as aquarium fishes, is highly distinctive and diagnostic.

Since Regan's revision (1905*a*), the name *Crenicara* has generally been treated as feminine. It is, however, neuter, the second word in the name being from the Greek *kara*, face. Regan's unjustified emendation is probably based on a misconception that *-cara* is from *Acará*, the Guarani name for cichlids, occasionally used in generic names in the meaning of cichlid. *Crenacara* Regan is feminine, as decided from the author's usage of associated adjectival names (*punctulata, maculata*). *Crenicara* is adequately formed, from *krene* and *kara*, and must stand. One species, *Crenicara filamentosum* Ladiges, was recently described in some detail (Kullander 1978). There are at least 6 species in the genus, 3 not yet named. Only *C. punctulatum* has a wide geographical range. The others are relatively localized, in clear- and black-water drainages of the Amazon and Orinoco basins.

Crenicara punctulatum (Günther)
Figs 41-43, Pl. XIII, Table 9

Synonymy
Acara punctulata (*pt.*) Günther 1863, p. 441 (descr.; Essequibo).
Crenicara elegans Steindachner 1875, p. 99 (diagn.; descr.; Gurupa, Cudajas, Curupira), Pl. I, fig. 1 (sketch, habitus).
Aequidens madeirae Fowler 1913, p. 576 (descr.; Igarapé de Candelaria,

tributary of the Madeira River, approximately two miles distant in Lat. S. 8045', W. Long., 63054'S, Brazil), Fig. 25 (sketch, habitus, holotype)
Aequidens hercules Allen in Eigenmann & Allen 1942, p. 394 (descr.; Creek, Rio Morona), Pl. XII, fig. 7 (monochrome photo, habitus, holotype).

Peruvian bibliography
Aequidens hercules; Fowler 1944, p. 263 (bibliogr.). -- Fowler 1945*a*, p. 245 (bibliogr.). -- Fowler 1954, p. 266 (bibliogr.), Fig. 853 (sketch based on photo in Eigenmann & Allen 1942).
Apistogramma borelli; (*pt.*) Klee 1965, p. 424 (listed; pool... alongside of a logging road connecting the Pachitea river and Tournavista; habitat data).
Crenicara punctulata; Kullander 1978, p. 277 (comp. w. *C. filamentosum*; Coiava (R. Içá); Pau-Mari (R. Javari); Lago Matamata (R. Javari); Pucallpa, Peru; Pebas, R. Ampiyacú).

Material
75 specimens, 19.1-100.9 mm SL, from the Ucayali-Amazonas and nearby Solimoes tributaries, including type material of *Aequidens hercules*; 5 specimens, 42.7-67.1 mm SL from the Tambopata drainage; also consulted type materials of *Acara punctulata*, *Aequidens madeirae* and *Crenicara elegans*, and various extralimital material.

Description
General descriptive data from Amazonas drainage specimens between 50 and 70 mm SL, with notes on ontogenetic variation; data on Tambopata material given separately. Counts are from specimens measured, some also from additional specimens; measurements summarized in Table 9. Refer to Pl. XIII for general aspect.

Shape. Moderately elongate, compressed laterally. Dorsal contour well-arched, with straight, steep snout; less steep, straight nape; little ascending anterior, tapering posterior, dorsal-fin base. Caudal peduncle graudally slenderer caudally, edges straight, ventral little longer than dorsal; prepelvic contour little curved, much less sloping than predorsal contour, abdomen straight horizontal, anal-fin base straight ascending. In frontal aspect very narrowly elliptic, with keeled nape and narrow flattened chest. Snout short, rounded, narrow. Mouth small, low, narrower than interorbital; jaws equal anteriorly, lower jaw articulation below anterior edge of orbit; medial end of maxilla projecting; maxilla not reaching to vertical from anterior margin of orbit; deep preorbital shielding maxilla and posterior part of upper jaw. Upper lip fold very short; lower lip fold very narrow and restricted to middle about 1/3 of distance from attachment on upper lip to lower jaw tip. Orbit subtangential, major portion in upper and anterior head halves; interorbital vaulted; lateral ethmoid with projecting lateral flange. Preoperculum with straight vertical hind margin and slightly expanded corner, serrated on hind margin and corner, 36-103 projections ($\bar{x}$=62.7±3.46) in 23 specimens; exposed posttemporal serrated on caudal margin; supracleithrum smooth.

Scales. Squ. long. - (1), 26 (4), 27 (29); 16 scale-series around caudal peduncle. Scales strongly ctenoid, except lowermost cheek scales and usually lower opercular, subopercular and interopercular scales, all or anterior prepelvic scales (median series and one parallel series on each side), and interradial caudal-fin scales. Cheek completely scaly, 3 (20), 4 (5) series below orbit, one series vertically between eye and preoperculum. Opercular scales in about 4 vertical series; one, rarely 2 series on proximal half of subopercular, 2 scales posterodorsally on interoperculum. Predorsal squamation stochastic, 9-11 scales along midline.

Upper lateral line at 3-3 1/2 (anteriorly) to 1/2-1 1/2 scales distance from dorsal fin; 2 scale series between lateral lines; counts: 15/11 (1), 16/7 (1), 16/8 (1), 17/9 (1), 17/10 (2), 17/11 (1), 18/- (1), 18/8 (2), 18/10 (6), 18/11 (3), 19/8 (1), 19/10 (2), 19/11 (2), 20/11 (1); usually a few pored

scales anteriorly in lower line, lower counts among smaller specimens; 1-2 tubed scales continuing lower line on caudal fin, but no accessory caudal fin lateral lines. Caudal fin with concave basal squamation, little more than 1/4 scaly medially, 1/2 marginally. All other fins naked.

Fins. First dorsal-fin spine inserted in advance of vertical from first lateral line scale, 1/2 length of last, spines subequal in length from about 6th or slightly increasing in length to last; lappets short, rounded or subtruncate; soft fin pointed, 4th ray longest, reaching about 1/3 of caudal fin or little longer. D. XVI.9 (12), XVII.7 (1), XVII.8 (19), XVII.9 (2). Spinous anal fin opposite end of spinous dorsal fin; soft part with rounded tip, 4th ray longest, reaching little beyond caudal-fin base. A. III.6 (1), III.7 (26), III.8 (7). Pectoral fin with rounded tip, 4th ray longest, reaching to above spinous anal fin; P. 14 (7), 15 (17), 16 (1). Pelvic fin inserted behind vertical from pectoral-fin base; pointed, reaching to anal-fin origin in males, with rounded tip and slightly shorter in females; inner branch of 1st ray longest, 1st ray more distinctly longer than 2nd in males than in females. Caudal fin truncate.

Gill-rakers. 1-3, usually 2 epibranchial, one in angle, and 5 (3), 6 (25), 7 (6) ceratobranchial rakers externally on first gill-arch. No micro-gill-rakers. First gill-arch (fig. 41) with relatively smooth epithel and wide gill-blade; epibranchial and angle rakers pointed, ceratobranchial rakers decreasing in size rostrally on arch; all rakers smooth.

Jaw teeth. Young about 25 to about 45 mm with 6-9 teeth anteriorly in upper jaw outer hemiseries, inner series increasing from 1 to 3; specimens *c.*50-*c.*80 mm with 4-7 teeth posteriorly, 7-12 anteriorly (gap separating) in outer hemiseries, 3 inner series anteriorly; 100.9 mm specimen with complete outer series of 29 teeth, 4 inner series in wide band anteriorly; in lower jaw about 20 (16-24) teeth in outer hemiseries, 3-4 inner series in broad band anteriorly, but 100.9 mm specimen with 26 outer hemiseries teeth and 6 inner series anteriorly. Teeth slender, pointed, slightly recurved, anteriormost subprocumbent; in lower jaw outer slightly larger than inner; in upper jaw a strong increase of tooth length anteriorly, anterior upper jaw teeth distinctly longer than corresponding lower jaw teeth, and up to 4 teeth on each side bicuspid in some large specimens (100.9, 82.7, 54.0, 61.0 mm SL), the second cusp on lingual edge, nearer apex than base, pointed, but very small and easily overlooked if 'gum' not pushed aside.

Tooth-plates. No teeth on 4th ceratobranchial. Lower pharyngeal tooth-plate (fig. 42) moderately slender; anterior teeth simple, subconical, marginally slender, bicuspid, most inner and posterior teeth tricuspid, compressed, with long posterior cusp slightly antrorse, anterior cusps short, few teeth abraded apically.

Vertebrae. 14+14 (7).

Variation. Small specimens about 20-30 mm very elongate with only little ascending nape contour, very steep snout and subinferior mouth (muzzle slightly projecting); vertical and pelvic fins shorter than in adults. Two largest specimens (82.7 and 100.9 mm SL) displaying pronounced male secondary characteristics (Pl. XIII, fig. 2), including produced soft dorsal- and anal-fin tips, to 2/3 and beyond middle of caudal fin, respectively, pelvic fin very long, inner branch of first ray with filamentous tip to at most middle of caudal peduncle, also having long caudal fin, with rounded hind edge. Steep frontal contour with forwards shifted principal nape curvature and tapering trunk a marked feature of these large males. Largest female, 81.3 mm SL, showing tendency toward steep nape, but has short fins.

Colouration. Basic colour pattern similar in young and adults, but young lighter with more contrasted spots and immaculate fins. At about 65 mm SL (Pl. XIII, fig. 1) ground colour dirty yellowish white ventrally on chest and along abdominal midline; sides light brownish, lighter in bar (spot) interspaces; snout light grey with scattered dark dots that variably distinct, lower part of head dirty yellowish; operculum and suboperculum brownish. Wide brown band from eye to mouth covering adnasal 2/3 of preorbital, margined with light line

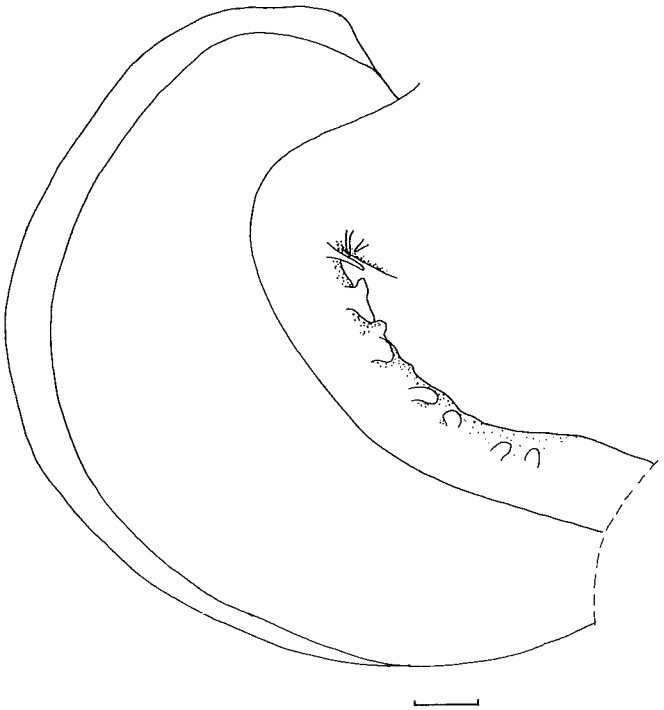


Figure 41. First gill-arch of *Crenicara punctulatum*, NRM SOK/1984326.3910, 66.7 mm SL, in lateral aspect; semidiagrammatic, to show wide gill-blade and small gill-rakers. Scale 1 mm.

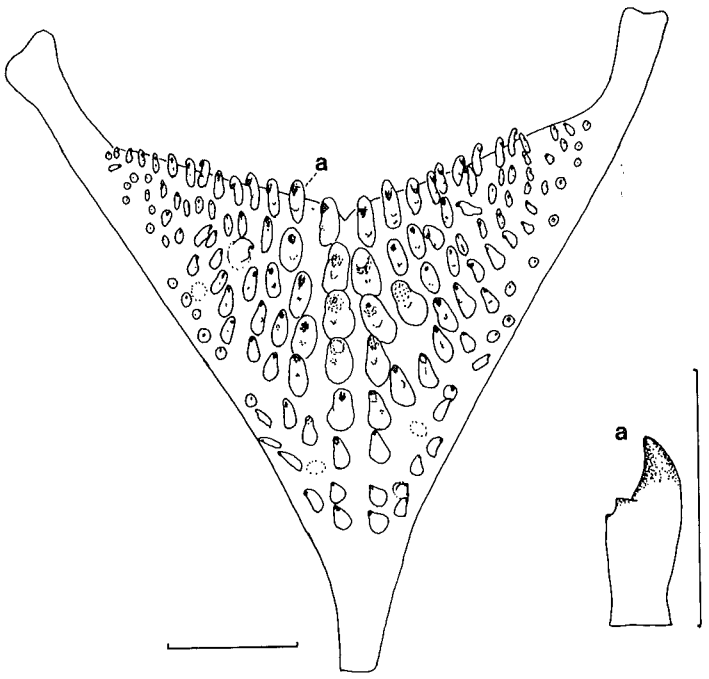


Figure 42. Occlusal aspect of lower pharyngeal tooth-plate and medial aspect of posterior tooth of *Crenicara punctulatum*, NRM SOK/1984326.3910, 66.7 mm SL. Scales 1 mm.

dorsally from eye to nostril, adbuccal 1/3 of preorbital whitish except diffuse brownish stripe along adbuccal margin. Cheek scales brownish with narrow yellow edge; dark pigment stronger posteriorly, a vertical band forming that continued by dark stripe across preopercular corner between corner pores, not quite reaching edge of preoperculum. Dark brown narrow field marginal to posterior periphery of orbit. Dark brown spot posterior to dorsal tip of preoperculum. Nape dark brown above orbit; occasionally tendency to concentration of pigment into stripe between orbits across nape. Suboperculum with dark brown margin along dorsal 3/4.

Sides with series of spots along middle; first spot roundish, adjacent to pectoral girdle, occupying 2 scales, blackish; 2nd-3rd spots above abdomen, brown, squarish, about 3 scales long, 2 scales deep, anterior more intense; 4th spot above anal fin, 5th between ends of dorsal and anal fin, 6th at end of caudal peduncle; spots gradually smaller and fainter and increasingly contiguous by interspace pigment from 3rd, except 1st, with short faint rostroventral oblique extensions. Spot series sharply delimited dorsally by light stripe occupying scales in series next dorsal to squ. long. scales. Another series of lighter brown spots or short bars on back: 4 from dorsal fin down to include lateral line scales, 1st vertical, posterior forwards inclined, on caudal peduncle 2 spots on dorsal margin. Scales on back and middle of sides with narrow dark edge, those of lower sides with light edge.

Dorsal fin light grey with dark spot on each membrane base and lighter lappets; soft part with irregular vertical series of hyaline dots that may extend also onto posterior spinous portion. Anal fin lighter, immaculate, with slightly darker ventral margin. Caudal fin with dark central band on scaly base, continuing lateral spot series, naked portion hyaline, with vertical series of dark dots which more intense along middle of fin. Pelvic fins smoky with darker anterior margin. No apparent sexual dichromatism.

Large males (Pl. XIII, fig. 2), if 100.9 mm specimen representative, with intermandibular area and branchiostegal membrane dark grey; dots in dorsal and caudal fin with pronounced dark edges; light scale edges of abdominal sides pronounced, and 4 posterior axial spots nearly indistinguishable in lateral band continued on caudal-fin base.

Life colours. Females from Quebrada Corrientillo like preserved, except that pelvic fins bright red with yellowish hue, and anal fin yellow.

R. Tambopata material (Pl. XIII, fig. 3)
Five specimens, of which 3 males, 42.7-64.6 mm and 2 females 43.1-67.1 mm SL, similar to *C. punctulatum* from elsewhere. Counts: Squ. long. 26 (1), 27 (4); cheek scales series 4 (1), 5 (4); lateral line scales 17/10 (1), 18/11 (2), 19/9 (1), 19/10 (1); preopercular serrations 51-76; D. XVI.9 (4), XVII.9 (1); A. III.7 (1), III.8 (3), III.9 (1); P. 15 (3), 16 (2); gill-rakers 5 (1), 6 (3), 7 (1); teeth 9/18, 11/19, 12/20, 18/23, 23/15 in upper/lower jaw outer hemiseries (from smallest to largest specimen; all teeth simple); vertebrae 14+14 (1). Caudal fin immaculate except a few spots close to basal band in largest female; young and especially large female rather dark in overall colour, and axial spot series in a well formed lateral band.

Distribution (fig. 43)
Widespread in the Amazon basin, collected in the lower Içá, upper Madeira, along the Amazon west to Gurupá, in the R. Essequibo in Guyana; in Peru in the Tambopata, along the Ucayali-Amazonas (Tournavista, Jenaro Herrera, lower Nanay, Pebas), in the Marañón (R. Morona), and Javari (Colonia Angamos and near mouth).

Ecology
The species is rarely collected in numbers; subadults and adults in fine condition are mostly from forest streams and sandy river beaches. The only large series (16 specimens) was obtained in a drying tahuampa lake (SOK 71). *Crenicara punctulatum* appears to be primarily a black-water species.

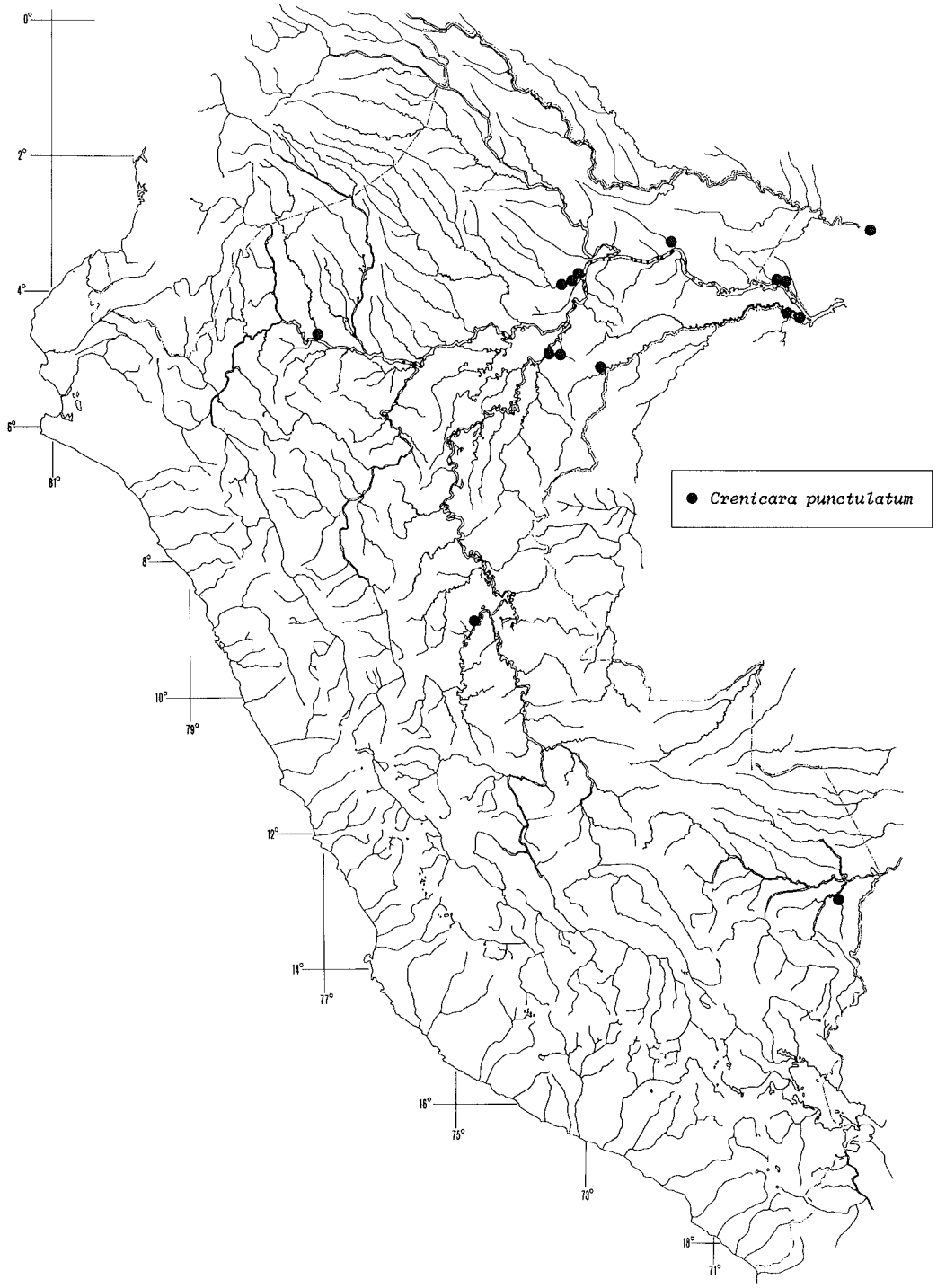


Figure 43. Collecting localities of *Crenicara punctulatum* in western Amazonía. A dot may represent more than one collecting site.

Notes

Crenicara punctulatum has more synonyms than its distinctive morphology would seem to qualify it for. All of these, however, refer to observation (*C. elegans*) or overlooking (remainder, placed in *Aequidens*) of the preopercular serrations. I did not examine the holotype of *Aequidens hercules*, but the photo in Eigenmann & Allen (1942), and the 10 paratypes that I examined (USNM 167835), show sufficiently well the characters of *C. punctulatum*. Eleven syntypes of *C. elegans* from Codajás (NMW 33026, 33031-33035 (3 lots) and 762428), Gurupá (NMW 33027-33028) and Curupira (NMW 33029-33030), the holotype of *Aequidens madeirae* (ANSP 39315) from the upper R. Madeira, and the lectotype of *Acara punctulata* (BMNH 1864.1.21:26), apparently represent the same species. Fowler (1945*c*) was the first to recognize the synonymy of *A. madeirae* with *C. punctulatum*.

Regan (1905*a*, *b*) distinguished two species in the type series of *Acara punctulata*. Two specimens were made syntypes of a new species, *Nannacara anomala* (Regan 1905*b*). The third specimen was identified (Regan 1905*a*) as the 'type' of *A. punctulata* and is to be regarded as lectotype of the species (ICZN, Art. 74a).

Crenicara punctulatum differs considerably from *C. filamentosum*, which occurs in the upper R. Negro and Orinoco drainages, particularly in being more deep-bodied. Males of *C. filamentosum* have long caudal-fin streamers, otherwise sexual dimorphism in finnage is similar. *Crenicara filamentosum* reaches only not quite 40 mm SL according to wild material and averages lower meristics than *C. punctulatum* (squ. long. 25-26, 1-2 cheek scale series, D. XIVXVI.7-8i) (Kullander 1978). The species of *Crenicara* were briefly reviewed in Kullander (1978), which has references to previous literature.

Ohm (1978, 1980*a*, *b*, *c*) reported on protogynous hermaphroditism in *C. punctulatum* kept in laboratory, and also gave incidental data on reproductive behaviour and sexual dimorphism. Ohm suggested as an explanation for the hermaphroditism that the males of this polygynous species would be carried away by fast currents often enough that recruitment of males from a large stock of females would have been selectively advantageous. Males maintain a harem and females are alone responsible for the brood care. The explanation may be simply a maximization of the availability of females provided that male reproductive success is limited only by female number. In any case, habitat data for *C. punctulatum* do not suggest that it would have any particular problems with current. Vaciante habitats have no or little current. It seems likely that *C. punctulatum* remains in forest streams or disperses from the river to the tahuampa zone during the creciente.

Satanoperca Günther

Satanoperca Günther 1862, p. 312 (type species *Geophagus daemon* Heckel, by subsequent designation in Jordan & Evermann 1898, p. 1542).

Günther (1862) divided Heckel's (1840) *Geophagus* into three genera, *Mesops* with the eye in or in advance of the middle of the head, *Satanoperca* with eye posterior to the middle of the head and naked dorsal fin, and *Geophagus* with eye like *Satanoperca* but dorsal fin scaly.

Mesops eventually became re-named *Biotodoma* and one of the two species originally included was placed in *Apistogramma*. Authors after Günther generally have maintained all the moderate to large sized South American cichlids with an epibranchial lobe (cf. p. 121) in a single genus, *Geophagus*. Gosse (1976), in the latest revision of the group, only separated *Gymnogeophagus* (no supraneurals) and *Biotodoma* (2 supraneurals) from *Geophagus* (one supraneural). *Geophagus sensu* Gosse, however, includes a morphologically very diverse assemblage. Using in part original diagnostic characters, and considering the designation of *G. daemon* as type species, *Satano-*

perca may be revalidated with the following particularly important and useful characters:

(1) Equal numbers of abdominal and caudal vertebrae or one more abdominal vertebra, instead of more caudal than abdominal vertebrae; (2) no ribs on caudal vertebrae and no postabdominal swimbladder extensions, both present in *Geophagus*; (3) cheek scaly rostral to middle instead of naked on anterior half; (4) dorsal and anal fins naked, instead of scaly; (5) gill-rakers externally on lower limb of first gill arch attached in skin covering gill-filaments instead of in ceratobranchial skin; (6) jaw dentition reduced to only one or two short series in each jaw instead of pluriseriate with wide band of inner teeth; (7) no tooth-plates on 4th ceratobranchial; (8) ocellus on caudal fin base; (9) both or only upper lip fold continuous instead of both interrupted anteriorly; (10) preoperculum and supracleithrum frequently serrated instead of entire; (11) no median hypural cartilage; (12) only 3, instead of 4 infraorbitals. These character states represent a mixture of apomorphic and plesiomorphic conditions. Further discussion is deferred to another context.

Satanoperca includes the species identified by Gosse (1976) as *Geophagus jurupari*, *G. daemon*, and *G. acuticeps* Heckel. *Geophagus leucostictus* Müller & Troschel, and *G. pappaterra* Heckel are also valid *Satanoperca* species. A few species only seem not to have been formally described. The genus is widely distributed throughout the Amazon basin, in the Tocantins, Orinoco and upper Paraguay drainages and in the Guianas. Only one species is known from Peru.

Satanoperca jurupari (Heckel)

Figs 44-47, Pls XIV (figs 1-3), XV (fig. 1), Table 10

Geophagus jurupari Heckel 1840, p. 392 (diagn.; descr.; Mündung des Rio-negro in den Amazonenstrom).

Peruvian bibliography

Geophagus jurupari; Cope 1872, p. 25 (notes; Ambyiacu River). -- (*pt.*) Fowler 1940*a*, p. 281 (listed; Contamana; bibliogr. only in part). -- Fowler 1944, p. 270 (Peruvian bibliogr.). -- Fowler 1945*a*, p. 252 (Peruvian bibliogr.). -- Lüling 1975, p. 50 (listed; Yarina Cocha; R. Ucayali), Abb. 51*pt.* (monochrome photo; habitus). -- (*pt.*) Gosse 1976, p. 49 (bibliogr.; descr.; Peruvian material: Contamana; Iquitos; Tuye Cano; Pevas Cano; Tuyé Cocha).

Geophagus (Satanoperca) jurupari; Steindachner 1883, p. 2 (note; Rio Huallaga; Rio Amazonas, Iquitos).

Material

270 specimens, *c.*6-159.5 mm SL from the Ucayali-Amazonas drainage in Peru and adjacent rivers in Brazil and Colombia; 77 specimens, 12.0-150.0 mm SL from the Madre de Dios system in Peru and Bolivia; also holotype and other Amazonian material consulted.

Description

Although no significant differences found, notes on Madre de Dios material are given separately (p. 152). Following description founded on Ucayali-Amazonas drainage material, and from selected specimens, mainly 151.0 female NRM SOK/1984344.3917), representing adults, data on young and juveniles separate entries; counts from 25 measured specimens; measurements summarized in Table 10. Refer to Pl. XIV for general aspect.

Shape. Deep, laterally compressed; dorsal contour elevated at nape, predorsal contour nearly straight ascending, dorsal-fin base nearly straight descending; prepelvic contour about straight, little sloping, deepest at pelvic-fin insertion, abdominal contour about straight horizontal, anal-fin base contour straight ascending; caudal peduncle gradually narrower caudally,

ventral edge slightly longer than dorsal. Head deep, compressed, in facial aspect with keeled nape, vauted front, gradually wider ventrally, ventrally flattened (slightly rounded); interorbital narrower than mouth. Snout long, with dorsal contour much steeper than ventral; rounded off anteriorly; preorbital about twice as deep as wide and depth nearly twice orbital diameter. Jaws equal or lower little prognathous; maxilla and ascending premaxillary processes reaching halfway to orbit; lower jaw articulation anterior to orbit. Lower lip fold narrowly interrupted anteriorly; upper lip fold continuous; thick fleshy upper lip projecting well rostral to upper jaw and also producing false appearance of upper jaw prognathy. Orbit very dorsally (in upper 2/5 of head depth) and posteriorly (in posterior half) on head. Operculum more than twice as deep as long.

Preoperculum rarely (in 5 of 25 measured specimens), supracleithrum frequently (in 13 of 25 measured specimens) serrated.

Scales. Squ. long. 27 (14), 28 (11); 16 horizontal scale-series around caudal peduncle. Scales ctenoid, except ventral cheek and gill-cover scales, anterior or most prepelvic scales and interradial caudal-fin scales. Predorsal squamation stochastic, about 10-12 scales along midline, anterior 2/3 flank scale size, posterior smaller; prepelvic scales posteriorly 2/3 flank scale size, much smaller rostrally; upper cheek scales slightly more than 1/2 flank scale size, ventrally smaller, naked below line continuing adlabial preorbital margin, about 5-7 series below orbit; operculum scaly only dorsally and along anterior margin; 2 series of scales on suboperculum; a few scales in single series on posterior 1/2 of interoperculum.

Upper lateral line 4 (or 3 1/2) scales distant from dorsal fin anteriorly, 1 1/2 at end; 2 scale series passing between free ends of lateral lines. Lateral lines of 16/10 (1), 18/8 (1), 18/10 (1), 18/11 (6), 19/8 (1), 19/10 (7), 19/11 (3), 20/10 (3), 20/11 (1), 20/12 (1) scales, plus 1 or, usually, 2 tubed scales on caudal fin (usually between rays V1 and V2); long accessory caudal-fin lateral lines between rays D3 and D4, and V4 and V5, occasionally displaced, of over 10 tubed scales in large specimens.

Fins naked, except caudal fin with deeply concave proximal squamation, marginally about half scaly, centrally only about 1/4.

Fins. First dorsal-fin spine inserted above gill-cleft, about 1/3 length of last; spines increasing in length to 4th or 5th, behind subequal or slightly shorter from about 8th, last again longer (but shorter than 5th); anterior lappets long, pointed, whereby 4th or 5th spines + lappets appearing longer than remainder, posteriorly lappets gradually shorter, subtruncate. Soft dorsal fin pointed, 3rd ray longest, reaching at most to near end of caudal fin. D. XIV.11 (1), XV.10 (16), XV.11 (3), XVI.9 (3), XVI.10 (2). Anal fin below soft dorsal fin; soft part pointed, 3rd ray longest, extending to middle or near end of caudal fin. A. III.7 (24), III.8 (1). Pectoral fin long, pointed, 3rd or 4th ray longest, reaching to 2nd or 3rd anal-fin spine; P. 13 (12), 14 (13). Pelvic fin inserted below pectoral-fin base, pointed, first ray produced, extending at most to about middle of caudal peduncle. Caudal fin hind edge damaged in all specimens over 100 mm SL, and in most young.

Gill-arches. First gill-arch with deep, narrow, compressed epibranchial lobe bearing medially digitiform otherwise compressed and distally expanded rakers; all except one dorsalmost of lower limb rakers attaching in skin ventral to ceratobranchial, short and compressed, forming ends of strands of soft tuberculate pads transversely on ceratobranchial and except anteriorly on arch connecting with similar pads extending from internal rakers across medial dorsal soft ridge which higher anteriorly than posteriorly. Exposure of gill-filaments moderately wide, ceratobranchial skin only slightly expanded ventral to about 4th to 9th ceratobranchial rakers (fig. 44).

Gill-rakers. 9 (1), 10 (3), 11 (12), 12 (8), 13 (1) epibranchial, 1 in angle, and 14 (2), 15 (9), 16 (13), 17 (1) lower limb rakers externally on first gill-arch. Microgill-rakers externally and internally on 2nd to 4th arches.

Jaw teeth (fig. 45). Small, pointed, simple, subconical and slightly

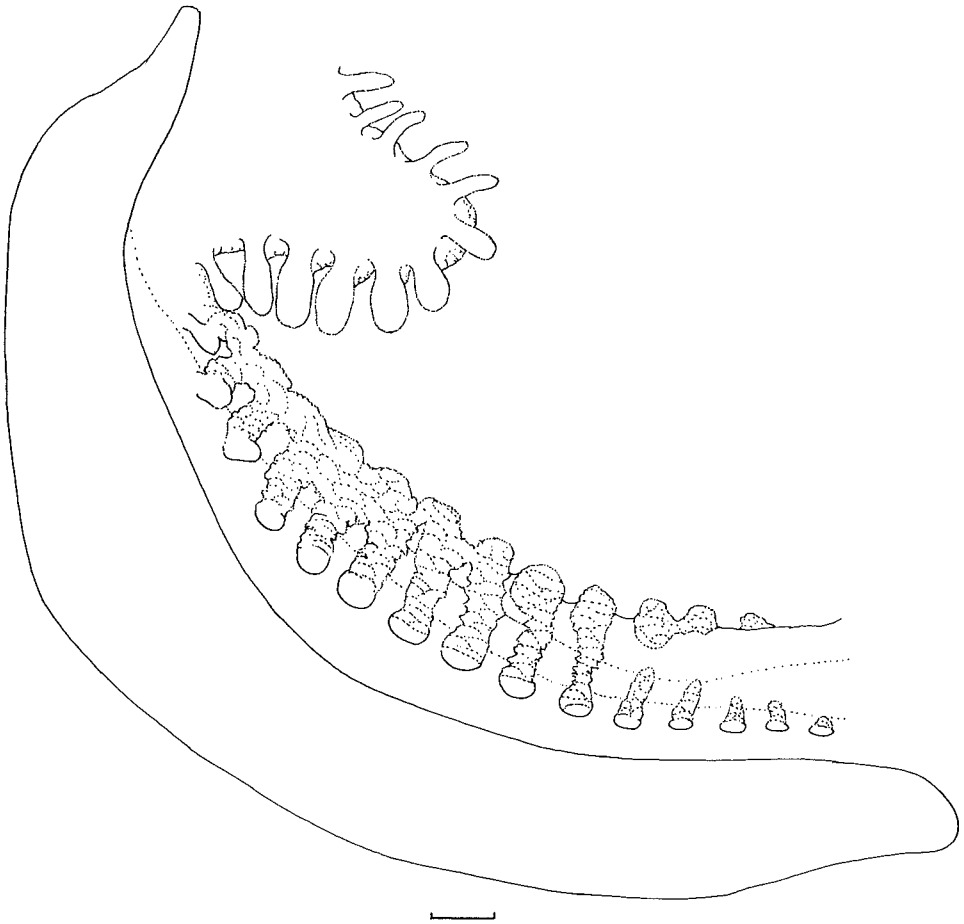


Figure 44. First gill-arch of *Satanoperca jurupari*, NRM SOK/1981325.3302, 79.3 mm SL, in lateral aspect, epibranchial slightly displaced from *in situ* transverse and more ventrally inclined orientation. Scale 1 mm. Semi-diagrammatic.

recurved; a short series anteriorly in lower jaw, with a few teeth forming inner series near symphysis which broadly edentulous; upper jaw dentition invariably uniserial, symphysis broadly edentulous, tooth series reaching posteriorly to near jaw tip. 15-27, $\bar{x}$=20.8±0.61/16-25, $\bar{x}$=20.3±0.47 teeth in outer (or only) hemiseries of upper/lower jaw.

Tooth-plates. Lower pharyngeal tooth-plate relatively slender, with many fine teeth, anteriorly and marginally slender, pointed unicuspids, medially and posteriorly compressed, tricuspidate, several medioposterior teeth with abraded tips (fig. 46). Fourth ceratobranchial edentulous.

Vertebrae. 15+13 (1), 15+14 (7).

Young, as 70.2 mm specimen figured (Pl. XIV, fig. 2), slightly more elongate than large adults (nape not as elevated), preorbital not much deeper than orbit, vertical and pelvic fins shorter, otherwise similar to adults. Caudal fin usually damaged, in occasional intact specimens truncate.

Juveniles elongate, with operculum not much deeper than long, preorbital wider than deep, and jaws reaching to or beyond vertical from orbit; both lip folds continuous; orbit in middle of head length; head moderately elongate, with rounded instead of keeled nape. Dorsal head scales non-imbricating, cycloid; cheek scales not formed; only a few prepelvic scales present; chest and gill-cover scales cycloid; lateral lines with only anterior (upper) or posterior (lower) scales canal-bearing.

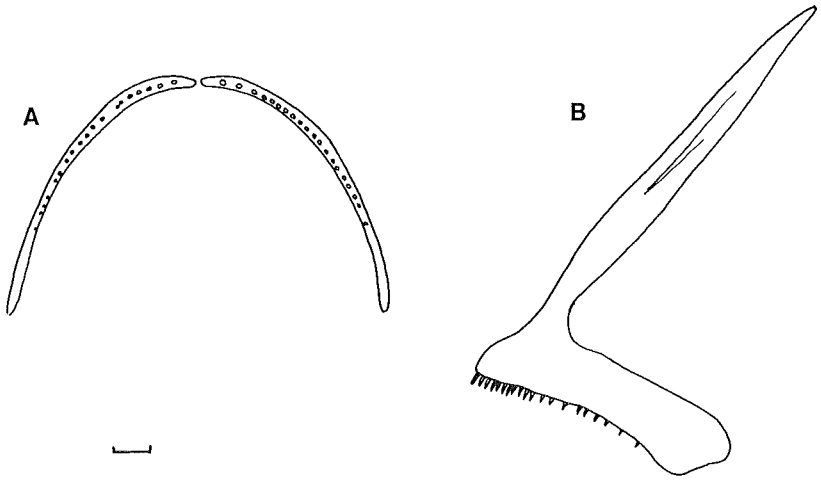


Figure 45. A occlusal view of dentigerous rim, and B lateral aspect of premaxilla of *Satanoperca jurupari*, NRM SOK/1981325.3302, 92.8 mm SL, to show few, small teeth and narrow toothed edge. Scale 1 mm.

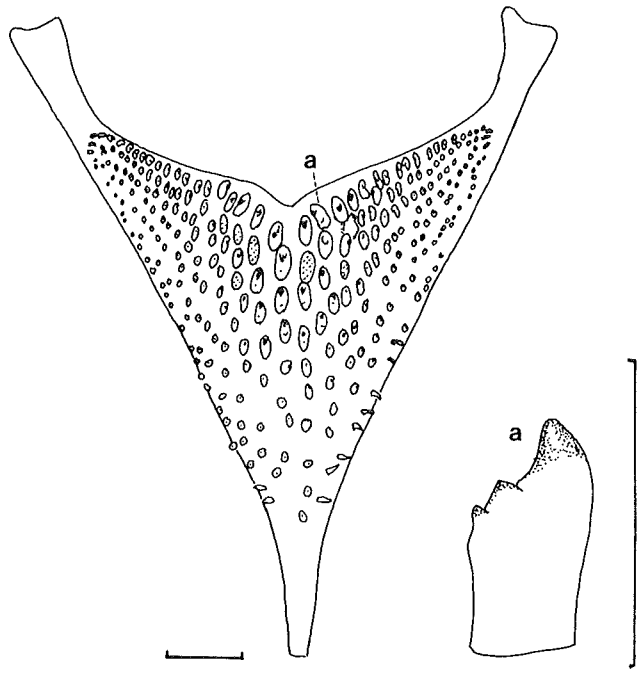


Figure 46. Occlusal view of lower pharyngeal tooth-plate of *Satanoperca jurupari*, NRM SOK/1981325.3302, 79.3 mm SL, and posterior tooth (a) in lateral aspect. Scales 1 mm.

Colouration. Considerable variation in general colour and expression of flank markings both ontogenetically and according to habitat; samples from light sand playas much lighter than those from forest creeks, those of clear dark water lighter and more distinctly marked than those from turbid water, young with more contrasted markings than large adults.

The basic colour pattern consists of a set of dark markings well contrasted on the head and usually indistinct on the flanks, most evident in medium-sized specimens (*c.* 50-100 mm). 2 dark parallel stripes on preorbital running from eye one along each edge of preorbital, fading out before reaching mouth. Dark, slightly forwardly curved or straight stripe between orbits slightly anterior to narrowest part of interorbital area, another anterior to it more strongly curved between orbits (lateral ethmoid projections), and in young, light specimens (not to be seen in fish over 100 mm) two stripes on snout proper, posterior between orbits, strongly curved, anterior v-shaped, between nostrils. A dark band slightly obliquely rostrad across nape from supero-posterior orbital margin, medially fading in large specimens and often intensified close to eye (forming sort of eye-brow marking). 7 vertical bars on trunk, slightly caudad inclined down sides, first across posterior nape and through dorsal-fin base origin, 4 from dorsal-fin base, and 2 on caudal peduncle; often dorsal section of a bar combining with bar preceding instead of with ventral section of bar to which it normally belongs; bars more intense along dorsal-fin base and along middle of side, axial intensifications often combined to form a faint, even edged band from head to shortly anterior to caudal fin above lower lateral line. Chest and ventral head region usually whitish, many large adults, however, with branchiostegal membrane and intermandibular region dark grey to blackish.

Dorsal fin with black lappet tips, otherwise dusky with 3 horizontal series of light spots which more distinct in young than in adults; caudal fin duskied, with clear spots on naked membranes and fine black lines along dorsal and ventral edges; anal fin dusky with a few clear dots on posterior membranes; pelvic fins duskied. Dark spot dorsally on basal portion of caudal fin usually distinct and ocellated.

Juveniles yellowish white, with brownish stripe from eye vertically across cheek to or onto anterior limb of preoperculum; faintly brownish gill-cover; 2 brown dots behind orbit; brownish stripe from eye to mouth on preorbital; wide brown stripe slightly backwardly curved across nape between orbits; without distinguishable cross-stripes on snout; 7 vertical bars on sides forming spots on dorsal trunk margin and along middle of side; dorsal fin narrowly black seamed on spinous porton; caudal spot deep black, midbasal with pointed rostral and dorsal projections.

Young with basic coloration as described above; suborbital stripe may still be traced to about 55 mm, caudal spot in adult position at about 25 mm.

Large adults tend to rather uniform coloration, sides and back dark, light ventrally and on lower sides of trunk and head. 151.0 mm specimen whitish on chest, belly, lower belly side, shading to dirty-whitish along anal-fin base and lower edge of caudal peduncle, most chest and prepelvic scales also with greyish central part; interoperculum, lower limb of preoperculum and lower jaw whitish, free edge of branchiostegal membrane white, intermandibular area and remainder of exposed branchiostegal membrane dark grey; lower lip dirty white, upper lip grey anteriorly, lighter posteriorly, maxilla grey. Snout, nape narrowly along back and dorsal edge of caudal peduncle grey; flanks and head sides brownish grey, lighter ventrally with yellowish tinge. Slight silvery reflections on flank and gill-cover. No obvious pattern of dark markings. Cheek scales light proximally, dark distally, but no light spots on cheek or otherwise on head. No dark line ventrally on cheek. Two indistinct preorbital stripes (cf. basic pattern), and two interorbital stripes distinct despite dark snout. 'Eye-brow' marking indistinct. Inside and dorsal edge of pectoral axilla dark grey. Dorsal fin smoky, semitransparent, lappets and tips of anterior spines blackish; indistinct light spots in 2-3 horizontal series basally on soft portion, a light spot basally on each membrane of spinous

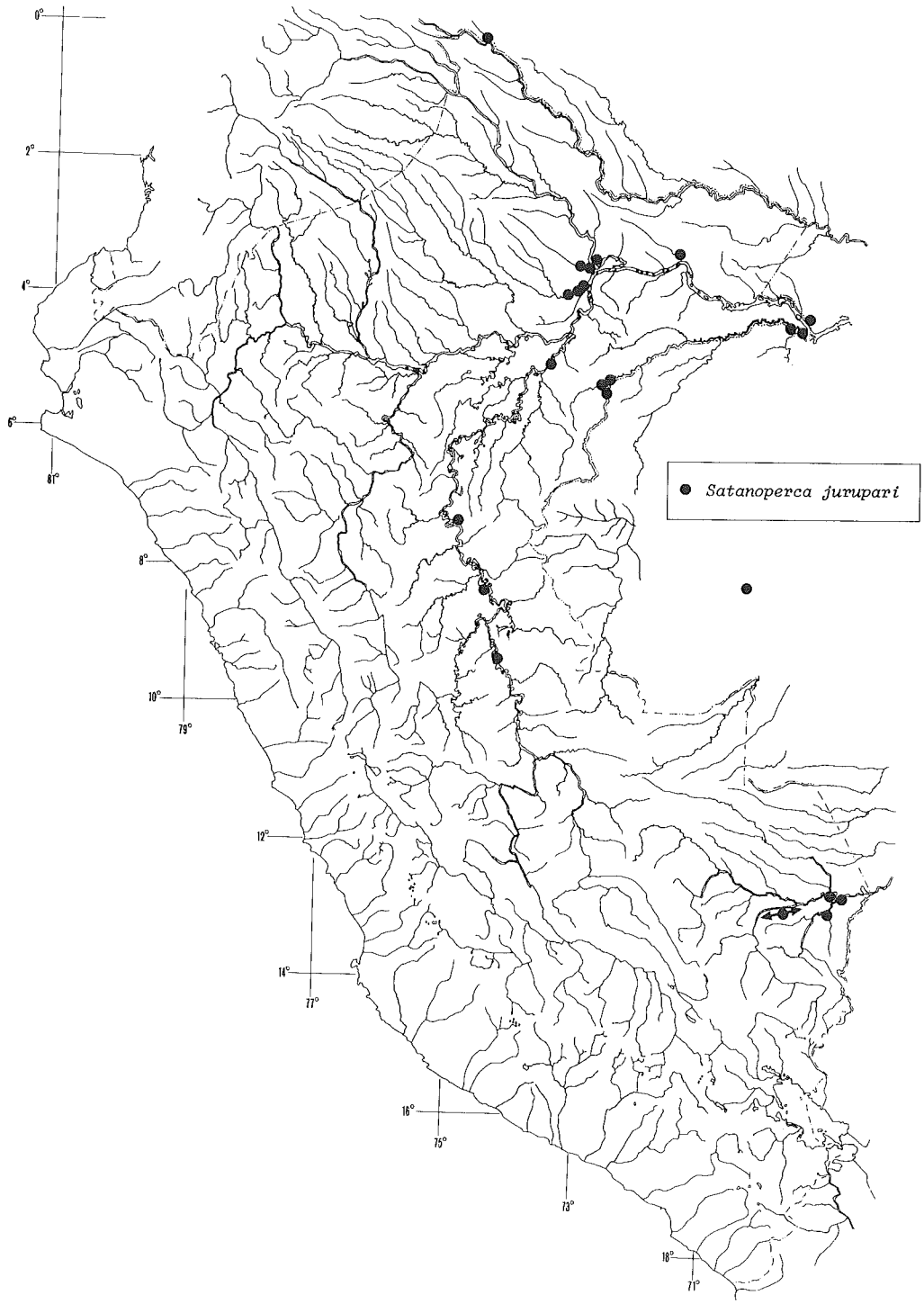


Figure 47. Collecting localities of *Satanoperca jurupari* in western Amazonía. A dot may represent more than one collecting site.

Apistogramma Regan

Synonymy

Heterogramma Regan 1906*a*, p. 60 (type species *Mesops taeniatus* Günther, by subsequent designation in Eigenmann 1910, p. 478).

Apistogramma Regan 1913*a*, p. 282 (nom. nov. subst. *Heterogramma*, preoccupied).

Pintoichthys Fowler 1954, p. 316 (type species *Biotodoma trifasciatus* Eigenmann & Kennedy, by original designation).

Apistogramma species are small fishes. The largest recorded wild specimen is a 65 mm SL male of the Guianan *A. steindachneri* (Regan). The number of species exceeds vastly that of other South American cichlid genera, with the fully 40 now known certain to increase to at least over 60. Most species have fairly restricted geographical ranges although the generic range covers much of cis-Andean tropical and subtropical South America (Orinoco, Amazon, Tocantins, Parnaíba, Paraguay, Alto Paraná and Paraná Medio drainages, and the Guianas).

Species of the genus are recognized by having a lobe on the first epibranchial, which is relatively much smaller than in *Geophagus* and *Satanoperca*, reduced number of external first ceratobranchial gill-rakers (commonly 1, occasionally absent or as many as 5), presence of gill-rakers on the lower pharyngeal tooth-plate, absence of microgill-rakers and epibranchial 4 tooth-plates, a single supraneural, few vertebrae (usually 12+12), and reduced lateralis system (only 2 infraorbitals, between lachrymal and sphenotic; lateral line scales to a great extent not developing tubes). Preopercular and posttemporal serrations are common. Sexual dimorphism is generally marked: males larger and often with relatively larger fins, often featuring caudal-fin streamers, produced dorsal-fin lappets, and filamentous extension of first pelvic-fin ray; females with species-specific brooding colour pattern consisting of contrasting yellow ground colour and intense black or dark brown markings.

Most species have 3 anal-fin spines, but at least two forms regularly (*A. commbrae* (Regan)) or nearly invariably (*A. luelingi*) have 4 anal-fin spines. This is the single important distinguishing character from *Apistogrammoides*, with 6-9 anal-fin spines, see p. 199. Other similar genera are not encountered in Peru: *Taeniacara* Myers in central Amazonía, lacks the 2nd frontal lateralis foramen, one pterotic lateralis foramen and the angulo-articular lateralis canal, and the infraorbitals are reduced to a single or two small bones without lateralis canal. *Biotoecus* Eigenmann & Kennedy, in central Amazonía and the Orinoco basin, lacks infraorbitals and has only 7 dorsal-fin spines (14-18 in *Apistogramma*). *Papiliochromis* Kullander in the Orinoco drainage and eastern Bolivia, lacks pharyngeal tooth-plate rakers.

The lateralis system of the head is both characteristic of the genus and offers some weak indications of infrageneric relationships. Basically as in *Cichlasoma*, differences are in (1) reduction of infraorbital bones to two; (2) separate openings for the posterior anguloarticular and rostralmost preopercular foramina, a character state unique to *Apistogramma* and *Apistogrammoides* species (in some species, however, the anguloarticular canal is lost); (3) 5 dentary foramina as in other geophagines, extept that the 4th from rostralmost foramen is lost in some species.

Within the genus, derived character states are (1) loss of anguloarticular canal; (2) loss of one infraorbital foramen; (3) loss of next to posteriormost dentary lateralis foramen. The basic *Apistogramma* pattern is featured by the *regani* group species (*eunotus, moae, urteagai, cruzi* in this paper) and others. Type 2 reduction is found in *cacatuoides* group (*cacatuoides, juruensis, luelingi*) and *nijsseni* group (*nijsseni, payaminonis*) species and others. Combined Type 2 and Type 3 reduction is encountered in *A. agassizii* and *A. bitaeniata* and a few other species.

Inasmuch as the lateral line system of *Apistogramma* species is overall

reduced, as is the development of tubed lateral line scales, it is uncertain whether the above reductions can be regarded independently of other characters as synapomorphies of the concerned species. The lateralis system generally shows a reductive tendency among South American cichlids, and *Apistogramma* is a genus especially characterized by size-correlated reductions. A priori dismissal of the lateralis system for being a system subject to reduction and hence a likely source of homoplasy is not appropriate, because some other systems display partial parallel distribution of apomorphies. On the other hand, a classification based on the lateralis system as currently known, would be relatively crude and other characters do not suffice for phylogeny resolution among the probably more than 60 *Apistogramma* species (current figure 44 valid named species).

Of other characters used in relationship analyses (eg. Kullander 1980*a*, 1983*a*, Koslowski 1985*b*), fin shape of adult males has appeared least informative, as closely related species may differ considerably in fin shape, and there is even a documented case of intraspecific variation, possibly polymorphism - *A. macmasteri* males featuring either a rounded or streamer-equipped caudal fin. Oral and pharyngeal dentition has not been studied systematically, and indications are of extensive ontogenetic variations masking identification of taxonomically useful character states. Squamation, especially reduction of thoracal and buccal scale cover, and fin meristics, has still some application which may gain in importance.

Colour pattern is the most useful tool for identifying *Apistogramma* species insofar as form and distribution of melanophore-based markings are concerned. Character state analysis, however, has not kept pace with descriptions and homology analysis and terminology is not comparable. Various markings designated by the same term may be non-homologues (eg. abdominal stripes) and some markings are certainly composites, the nature of which is masked by the use of yet another name (eg. tail-spot, for Bar 7 + caudal spot). In the descriptions below, vertical dark bars on sides are numbered 1-7 in caudad succession.

Measurements have played no significant role in *Apistogramma* systematics, both because of very slight variation between species, ontogenetic variation, local variation and the small size of specimens measured making measurements sensitive to effects of preservative, rough measurement techniques, variation in method between workers and obfuscation of primary data information through proportional calculations. Hence actual measurements are always given in descriptions, but so far they seem to indicate chiefly some variation in adult general body shape among species.

Apistogramma species are popular aquarium fishes; several popular books, eg. Koslowski (1985*a*), Linke & Staeck (1984) and Schmettkamp (1982), give useful information on life colours and reproductive behaviour based on aquarium studies.

Apistogramma eunotus Kullander

Fig 48, Pl. XV (figs 2-3)

Apistogramma eunotus Kullander 1981*b*, p. 184 (descr.; diagn.; bibliogr.; relationships; locs: Peru, Depto. Loreto, R. Ucayali system, near Pucallpa, on road to Aguaytia, "Dunkelwasser bei 'Campo Verde'" (type loc.); R. Ucayali, Tabatinga; ...Jenaro Herrera;...R. Yavari, Lago Matamata;...R. Yavari, San Sebastian, "Caño do Comprido"; Pucallpa; Lobococha-Masisea), Figs 1 (monochrome photo, habitus, holotype), 2 (monochrome photo, habitus, paratype), 3 (sketch, lower pharyngeal tooth-plate).

Bibliography

Mesops taeniatus; Cope 1870, p. 570 (listed; near Pebas, Equador /if ANSP 9110-9111 representing that material/).

Geophagus taeniatus; Cope 1878, p. 696 (note; Peruvian Amazon).

Apistogramma amoenus; Regan 1913*a*, p. 283 (descr.; River Ucayali, Peru). -- (*pt.*) Fowler 1940*a*, p. 289 (listed; Ucayali River; ref. to Regan 1913*a*). -- (*pt.*) Fowler 1944, p. 269 (bibliogr., ref. to Regan 1913 and Fowler 1939 /1940*a*/). -- (*pt.*) Fowler 1945*a*. p. 251 (bibliogr., ref. to Regan 1913 and Fowler 1939 /1940*a*/).

Apistogramma taeniatum; (?) Meinken 1961*a*, p. 138 (descr.; Umgegend von Letitia /probably Leticia, Colombia/; conditional proposal of subspecific name), fig. p.138 (sketch, habitus, male and female). -- (?, *pt.*) Meinken 1971, pp.38,40 (ref. to Meinken 1961*a*, Leticia *'A. taeniatum'*). -- Kullander 1979*a*, p. 944 (comparison with *A. nijsseni*; ref. to Meinken 1961*a*, Leticia *'A. taeniatum'*).

Apistogramma amoenum; Kullander 1979*a*, p. 944 (comparison with *A. nijsseni*; R. Ucayali).

/*Apistogramma* sp./ Kullander 1980*a*, p. 64 (R. Yavari; comparison with *A. moae*).

Apistogramma taeniata; (?) Kullander 1980*a*, p. 75 (ref. to Meinken 1961*a*, Leticia *'A. taeniatum'*), pp. 18, 25 ('longirostris' unavailable subspecific name).

Apistogramma sp. Kullander 1980*a*, pp. 10, 16, 64 (refs to Regan 1913, R. Ucayali *'A. amoenus'*).

Apistogramma eunotus; Lüling 1981, p. 178 (recorded; type loc.; habitat data). -- de Rham & Kullander 1983, p. 102 (recorded: Jenaro Herrera area). -- Busse 1984, p. 222 (type material listed). -- Koslowski 1985*b*, p. 159 (compared with *A. staecki* Koslowski).

Material

208 specimens, 9.0-52.5 mm SL.

Description

Apistogramma eunotus was described at length in Kullander (1981*b*), and little needs to be added on the basis of the much larger series now available. The largest known specimen is a male 52.5 mm SL (ANSP 9265-9269), the largest female 35.8 mm SL. Similar to *A. cruzi* and *A. moae* in body shape and colour pattern; see 'Notes' one these species for distinguishing characters. Large males have long, produced dorsal- and anal-fin tips, extending to about the end of the caudal fin, which rounded; no produced dorsal-fin lappets. Lateral band narrow, frequently broken up into spots where crossing Bars 2-4. Bars 5 and 6 or only Bar 6 divided vertically below lateral band in most specimens over *c.*25 mm SL, occasionally also in smaller specimens. Abdominal stripes either absent ot faint to distinct, not extending beyond Bar 5. Caudal fin with prominent base spot, otherwise immaculate or only faintly dotted along middle.

Squ. long. 21-23, modally 22. D. XIV-XVI.6-8, modally XV.7, A. III.6-7, modally III.6. 3-4 cheek scale series in adults. External first ceratobranchial gill-rakers 0-4, modally 2. (Rare counts of D. XIV.8, XVI.6 and 4 gill-rakers in new material.) Cephalic lateralis pores are as in *A. cruzi* (fig. 49), ie. with 5 dentary and 4 infraorbital pores.

Life colours: Large male from SOK 30 with blue iridescent spot beteen dark preorbital stripe and buccal margin of preorbital, and another on cheek paralleling suborbital series; also some blue spots scattered along lateral band and on caudal peduncle. Pelvic fin white. Soft dorsal and most of caudal fin (except basally) orange. Pebas specimens similar but pelvic-fin tip orange. Females with hyaline fins, and only small dots representing blue preorbital and cheek markings.

Distribution (fig. 48)

Apistogramma eunotus is collected along the Ucayali from the Shahuaya northward and along the Amazonas to the upper Solimões, further in the R. Tigre, R. Pacaya, lower R. Yavarí, and in Lago Amanã in the Japurá system.

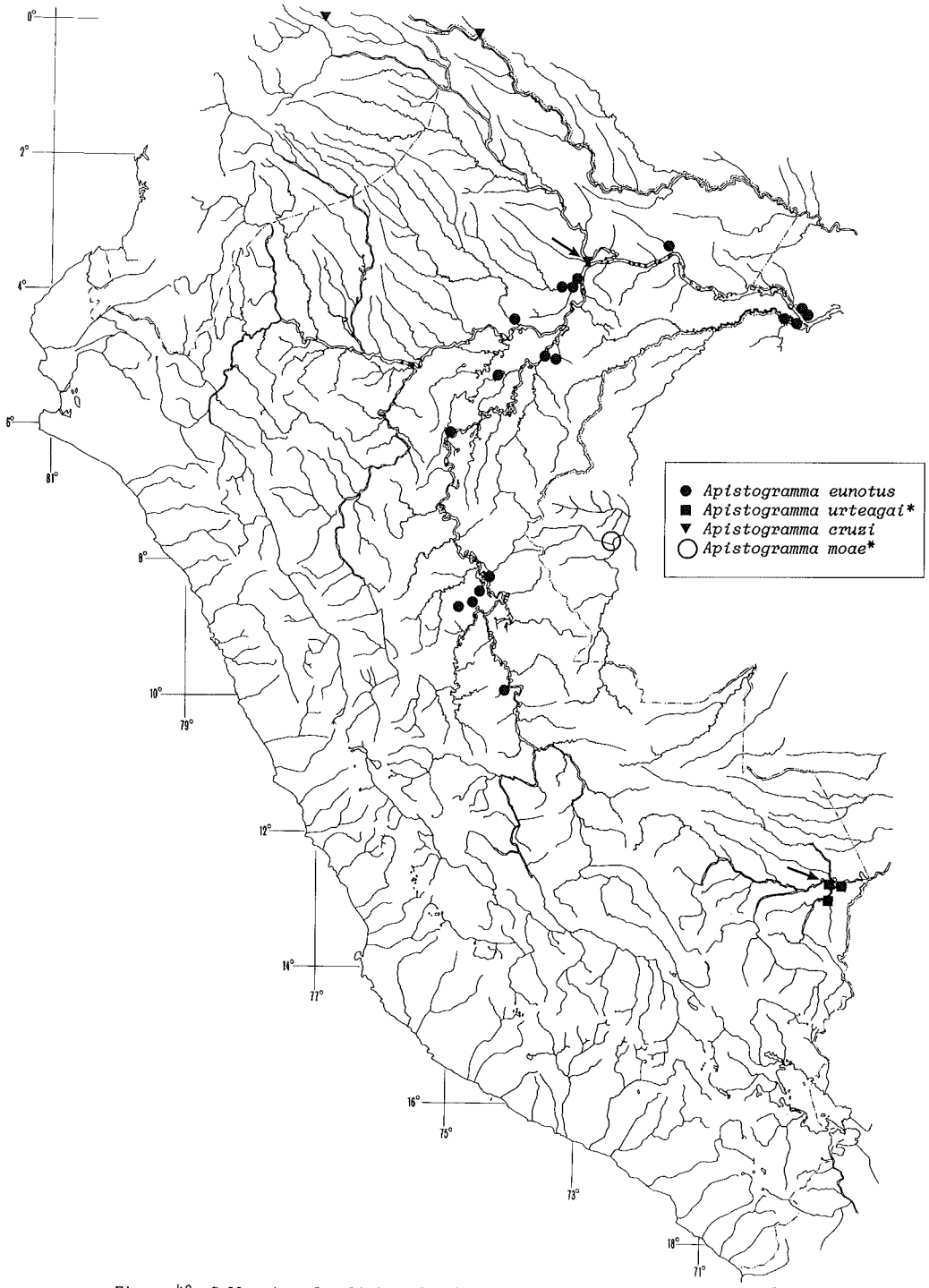


Figure 48. Collecting localities of *Apistogramma eunotus*, *A. urteagai**, *A. cruzi* and *A. moae** in western Amazonía. * = total known range. A symbol may represent more than one, adjacent collecting sites; arrows indicate type localities of new species (*A. cruzi*, *A. urteagai*).

Ecology
The species has been collected in many different kinds of habitats, in black-, clear- and white-water conditions, quebradas, canos, lakes and pools, in a floating meadow (SOK 27) and in aguajales, often together with *A. agassizii*, *A. cacatuoides* or *A. nijsseni*, but not syntopic with *A. bitaeniata* or *A. cruzi*. Lüling (1981) described the type locality. It is possibly identical with SOK 30, the only brook we could find along the Campo Verde-Tournavista road that resembles Lüling's photo and description. Lüling's water analysis showed a pH of 6.3-6.4, conductivity 22 µS (at 25-27 °C). Such acid ion-poor water contrasts with that of the Shahuaya site described by Linke & Staeck (1984), having a pH of 7.5-8, conductivity 160 µS at 27°C.

Notes
See descriptions of *A. cruzi* (below) and *A. moae* (p. 169) for differential diagnostic features.

Apistogramma cruzi n. sp.
Figs 48-50, Pl. XVI, Table 11

Diagnosis
Similar to *Apistogramma eunotus*, but with none of the vertical bars split and lateral band including all of squ. long. scale instead of only lower 1/2 to 2/3. Abdominal stripes distinct, 2 upper of 3 reaching Bar 6 or 7, instead of absent or faint and ending with Bar 4, occasionally Bar 5. 5 dentary, 4 infraorbital lateralis pores.

Holotype
NRM SOK/1984332.3941. A male, 25.9 mm SL, from Peru, departamento Loreto, Río Napo drainage system, lower course of a quebrada right bank tributary to the Río Mazán nearly 2 hours upstream from Puerto Alegre on the mouth of the Río Mazán. 14 August 1984. Leg. S.O. Kullander, J. Cruz. R., A. Hogeborn-Kullander (Station SOK 102).

Material
Holotype, and 34 paratypes, 11.4-50.5 mm SL.

Description
Based on the holotype, a male, 25.9 mm SL, and female topoparatype 26.3 mm SL. Refer to Pl. XVI for illustration of shape and colour pattern. Measurements are summarized in Table 11. Comparative notes on Colombian and Ecuadorian paratypes are given under separate subheadings.

Shape. Moderately elongate. Snout rounded off, dorsal profile curved, ventral straight. Interorbital flat, slightly narrower than mouth. Orbit tangented by frontal outline, entirely in upper and chiefly in anterior half of head. Maxilla reaching to slightly beyond vertical from anterior margin of orbit.

Scales. Squ. long. 21 (1), 22 (1). Scales ctenoid except along predorsal midline, anterior to extrascapulars, on head sides except posterodorsal cheek and dorsal opercular scales, and anterior to pelvic fins. Squ. prd. 9 (2), squ. prv. 10 (2). Cheek completely scaly except rostroventral corner, scales in 4 (2) series; squ. op. 9 (1), 10 (1); squ. sop., in single series, 3 (2); squ. iop. 2 (1), 3 (1). (Fig. 49.)

Upper lateral line at 3 (anteriorly) to 1/2 (posteriorly) scale distance from dorsal-fin base; lateral line counts: 12 + 3 pores + 3 subserial pores/2 pores + 4 + 1 on caudal fin (1), 12 + 2 pores + subserial pore + subserial canal/2 pores + 4 + 1 on caudal fin. Less than 1/3 of caudal fin scaly, distal scales cycloid; squ. caud. 5 (2). Squ. tr. 7+1+1-1 1/2.

Fins. D. XIV.7 (1), XV.7 (1); spines increasing in length to last, but less from 4th; lappets short, anterior rounded, posterior truncate; soft part

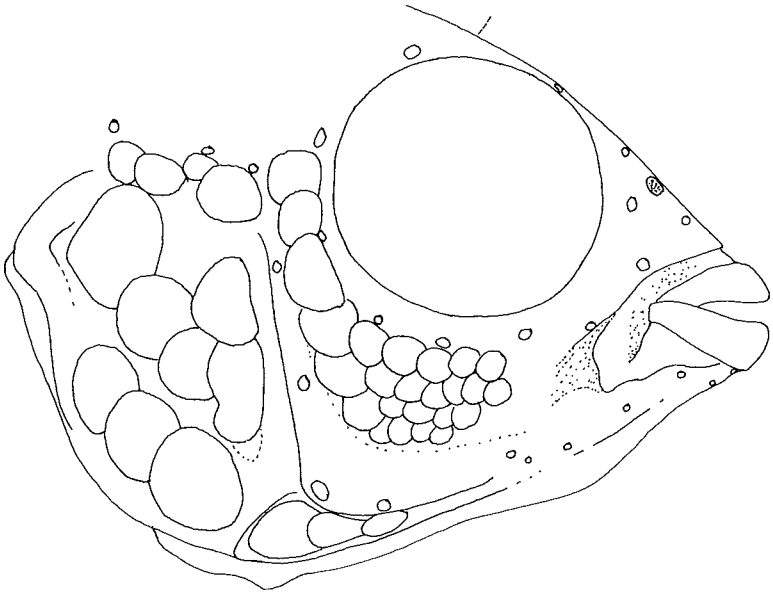


Figure 49. Distribution of cephalic lateralis pores and head side squamation in paratype of *Apistogramma cruzi*, NRM SOK/1984332.3924, 25.6 mm SL. Some dorsal opercular scales missing; cheek squamation not quite fully developed. Position of coronalis pore indicated by dashed line.

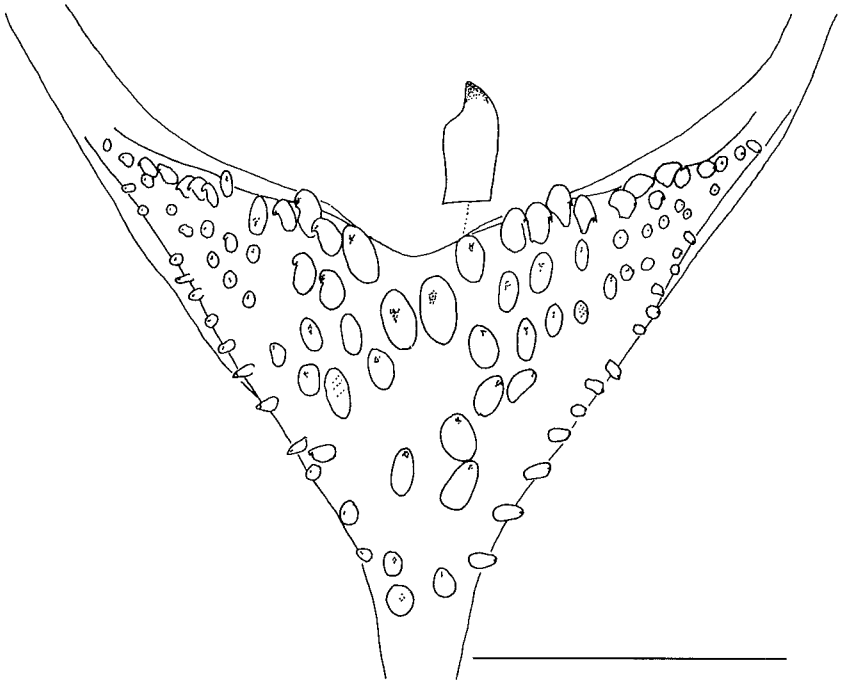


Figure 50. Lower pharyngeal tooth-plate in occlusal view and posterior tooth in lateral view of *Apistogramma cruzi*, GNHM unreg., 30.0 mm SL. Scale 1 mm.

pointed, not produced, not reaching 1/3 of caudal fin, 2nd ray longest. A. III.7 (1), IV.6 (1); soft part like soft dorsal fin, but 3rd ray longest and reaching only 1/5 of caudal fin. P. 12 (1), 13 (1); rounded, reaching to above first anal-fin spine. Pelvic fin pointed, first ray longest, not produced, reaching to 2nd anal-fin spine. Caudal fin with slightly convex hind margin.

Gill-rakers 2 (2) externally on first ceratobranchial; 11 (1), 14 (1) on lower pharyngeal tooth-plate.

Jaw teeth pointed, slightly recurved; outer anterior little longer than remainder; 27/27 in upper/lower jaw outer hemiseries in holotype, 2 inner series anteriorly, one (upper jaw) or both (lower jaw) along anterior half of jaw.

Cephalic lateralis pores, fig. 49; 4 infraorbital and 5 dentary pores.

Colouration. Ground colour whitish, markings grey-brown to blackish; pure ground colour thoracally, chest sides dusky in male; dorsum diffusely greyish. Gill-cover greyish, becoming whitish ventrally. Snout greyish; preorbital and cheek dirty whitish. Preorbital stripe moderately strong. Grey on lower jaw tip next to lip, but no distinct chin spot formed. Supraorbital stripe grey-brown, not reaching to nape midline; bordered posteriorly by contrasting light zone. Intense blackish brown suborbital stripe from between 2nd and 3rd infraorbital pores across preopercular corner along hind margin of interoperculum; of pupil width across cheek. Narrow postorbital stripe continuous with wide, rather even-edged lateral band to Bar 7, occupying all of squ.long. scales and intervening parts of those above and upper 1/3 (anteriorly) to 1/2 (posteriorly) of scales in series including lower lateral line. No lateral spot. Dorsal blackish pectoral spot. Faint Bars 1-7, intensified close to dorsal-fin base, wider than interspaces, Bars 4-7 reaching down to vertical edge of body, remainder to operculum (Bar 1) or lateral band (Bars 2-3); none split. Distinct abdominal stripes composed of more or less confluent dots on middle of each scale in 3 scale series below that containing lower lateral line, interrupted in Bar interspaces from behind Bar 4. Female only with black midventral stripe from vent halfway to pelvic-fin bases.

Anterior 2 dorsal-fin membranes black, in female also 3rd membrane basally black, remainder of fin duskied, lappets darker, lappet bases clear, soft portion with 2-3 indistinct terminal spot-stripes. Anal-fin with blackish lower margin, otherwise duskied, with 2 indistinct terminal spot-stripes. Caudal fin with ovate or squarish black midbasal caudal spot, otherwise immaculate, smoky, with indicated darker stripe across middle and darkened hind margin. Pelvic fin clear, male with spine and first membrane black, female also with next membrane black.

Colombian samples. Four samples from the Colombian-Peruvian border appear conspecific with Napo material described above. Most specimens were taken in Limón Cocha on the R. Caucayá, which drains to the R. Putumayo, a single specimen in the R. Caguán, a tributary of the R. Caquetá.

The Putumayo material (Pl. XVI, fig. 3) agrees with Mazán material in shape, finnage, squamation, colouration, and sexual dimorphism. It should be observed, however, that it was probably fixed in alcohol (eye lenses white) and the colour pattern is not distinct. Abdominal stripes are faint, but the upper two extend to at least Bar 6. The lateral band is wide as in Mazan material, continuous and uniform in adults but broken up into spots in Bars 2, 3 and 4 in some young; the largest female, 28.1 mm SL has a spot-like intensification where Bar 3 and the band cross. Variation in number of black anterior dorsal-fin membranes, either 2 or 3. Lower pharyngeal tooth-plate as in fig. 50, with bicuspid posterior teeth.

The Caguán specimen (Pl. XVI, fig. 4) is a male in a poor state of preservation and much larger than any Napo or Putumayo specimen, 50.5 mm SL. The colouration of the anterior part of the body cannot be made out. Abdominal stripes distinct, however, the upper two reaching caudad to the end of the caudal peduncle. Inside and pocket of pectoral axilla reddish. Dorsal-fin lappets long and pointed, but not produced, the anterior about half length of spine; soft dorsal fin pointed, with short filament reaching to about 2/3 of

Table 11. *Morphometry of* Apistogramma cruzi. *Measurements are in mm, except range and mean which are in per cent of SL.*

													Range	$\bar{x}$
SL	16.8	17.3	17.7	21.6	21.6	22.9	25.9	26.3	28.1	30.0	34.6	50.5		
Head length	5.8	5.9	5.8	7.2	7.1	7.5	8.5	8.5	9.6	9.6	10.8	15.4	30.5-34.5	32.8
Head depth	4.5	4.9	4.7	5.9	5.9	6.0	7.0	7.5	8.1	8.1	9.2	14.5	26.2-28.8	27.4
Body depth	5.9	6.0	5.8	7.4	7.6	7.4	9.1	9.1	10.2	10.6	12.6	19.3	32.3-38.2	35.0
Predorsal length	6.3	6.6	6.4	7.9	7.9	8.3	9.9	10.0	10.4	10.1	12.2	17.8	33.7-38.2	36.6
Prepelvic length	6.6	6.8	6.8	8.4	8.7	8.7	10.4	10.6	11.9	11.8	13.4	20.8	38.0-41.2	39.7
Orbital diameter	2.1	2.4	2.3	2.7	2.6	2.8	3.4	3.7	3.9	3.6	4.2	5.5	10.9-14.1	12.7
Snout length	0.8	0.8	0.7	1.0	1.2	1.0	1.6	1.6	1.6	1.6	2.0	3.0	4.0- 6.2	5.3
Cheek depth	1.0	0.9	0.9	1.3	1.1	1.3	1.6	1.5	2.1	2.0	2.7	4.9	5.1- 9.7	6.4
Head width	3.3	3.2	3.1	4.0	3.9	3.6	4.3	4.4	5.1	5.1	5.7	8.1	15.7-19.6	17.4
Interorbital width	1.3	1.3	1.3	1.7	1.6	1.6	1.9	1.9	2.0	2.1	2.5	3.8	7.0- 7.9	7.3
Preorbital depth	0.5	0.4	0.4	0.6	0.6	0.7	0.6	0.6	0.8	0.9	1.1	2.1	2.3 -4.2	2.8
Upper jaw length	1.4	1.5	1.4	1.8	1.9	1.9	2.5	2.5	3.0	2.7	3.4	5.5	7.9-10.9	9.2
Lower jaw length	2.4	2.4	2.4	3.2	2.9	3.0	3.7	3.7	4.1	4.3	5.0	7.1	13.1-14.8	14.1
Caudal peduncle depth	2.8	2.7	2.7	3.4	3.3	3.5	4.1	4.2	4.3	4.6	5.7	9.2	15.3-18.2	15.9
Caudal peduncle length	2.3	2.3	2.4	3.2	3.0	3.3	3.4	3.4	3.6	3.6	4.7	7.2	12.0-14.8	13.5
Dorsal-fin base length	9.6	9.7	10.2	12.5	12.4	13.0	14.3	15.0	16.1	18.0	20.9	31.5	55.2-62.4	57.9
Anal-fin base length	4.2	3.2	3.3	4.1	4.2	4.2	5.3	5.2	5.1	5.8	6.8	10.4	17.9-20.6	19.1
Pectoral-fin length	6.8	5.7	5.2	6.7	6.5	6.8	8.1	8.1	9.1	9.4	10.9	16.9	29.4-33.5	31.1
Pelvic-fin spine length	2.9	2.6	2.5	3.1	3.1	2.9	3.8	3.8	4.8	4.3	5.1	7.6	12.7-17.1	14.6
Pelvic-fin length	5.9	4.7	4.6	5.6	6.1	5.9	7.6	8.3	9.2	8.6	10.4	22.3	25.8-44.2	29.8
Last dorsal-fin spine length	3.7	3.1	2.8	4.1	4.1	3.7	5.1	5.0	5.5	6.0	6.7	12.4	15.8-24.6	19.0
Last anal-fin spine length	4.1	3.5	3.2	4.3	4.5	4.1	5.1	4.9	6.1	6.0	6.9	10.3	17.9-21.7	19.8
Sex	♀	--	--	♂	♀	♂	♂	♀	♀	♂	♂	♂		

caudal fin. Soft anal fin pointed, reaching to about middle of caudal fin. Pelvic fin pointed, reaching to first anal-fin ray. Jaws densely toothed; 25/30 teeth in upper/lower jaw outer hemiseries; 5 inner series anteriorly in lower jaw, one along anterior half of jaw rim; 3 inner series in upper jaw, one as long as outer series, to posterior tip of premaxilla; teeth all conical, recurved, inner anterior strongly recurved, with tips horizontal.

Counts from 28 of these specimens: D. XIV.7 (1), XV.6 (1), XV.7 (25), XVI.6 (1); A. III.6 (26), III.6i (1), III.7 (1); cheek scale series 3 (23), 4 (5). Counts from specimens measured: P. - (1), 11 (1), 12 (8); squ. long. - (1), 21 (4), 22 (5); squ. caud. - (6), 3 (1), 4 (2), 5 (1); squ. tr. 7+1+1 (2), 7+1+1/2 (8); squ. prd. 9 (8), 10 (2); squ.prv. 9 (2), 10 (3), 11 (3), 12 (1), 13 (1); squ. op. - (4), 9 (1), 10 (2), 11 (1), 12 (1), 13 (1); squ. sop. - (3), 3 (1), 4 (3), 5 (3); squ. iop. 2 (2), 3 (7), 4 (1); rakers - (1), 1 (1), 2 (7), 3 (1); lower pharyngeal tooth plate with - (6), 10 (2), 11 (1), 12 (1), rakers; upper lateral line of 13 (4), 14 (2), 15 (3), 17 (1) scales, including pored terminal scales in young; lower lateral line of 6 (5), 7 (4), 8 (1), including anterior pored scales or, in young, only of pored scales. Vertebrae 12+11 (1), 12+12 (5). Measurements in Table 11.

Ecuadorian material. The two Ecuadorian specimens are not well preserved, but agree otherwise well with Mazán specimens. D. XVI.7 (1), XIV.8 (1); A. III.7 (2); squ. long. 22 (2).

Distribution

Collected in the lower R. Mazan and the upper R. Aguarico in the Napo drainage, in Limón Cocha on the R. Caucayá in the Putumayo drainage, and in the R. Caguán in the Caquetá drainage.

Ecology

The Mazán sample was obtained from a drying quebrada, with slightly turbid colourless water, at most about 3 m wide and about 0.5 m deep. The bottom was clayey. Leaf litter, twigs and trunks of trees were abundant.

Etymology

Named for José Cruz Rodriguez, motorista and skilled volunteer co-collector on visits both to Pebas in 1981 and Mazán in 1984, in recognition of his tireless help on those trips which added considerably to the inventory of the Peruvian ichthyofauna.

Notes

The Mazán material was recognized as distinct from *A. eunotus* during sorting of the 1984 collection, but owing to the small size of the sample and the variability in material identified as *A. eunotus*, the conclusion that the Mazán specimens represent a different species rests mainly with the recognition of the same diagnostic characters in the previously distinguished Putumayo-Caquetá material. Numerous *A. eunotus*, from many localities, show a lateral band consistently narrower than that of the material here referred to *A. cruzi*, ie. not occupying the upper half or 1/3 of squ. long. scales. In other respects, *A. eunotus* is quite variable; abdominal stripes may be absent, faint (usually) or relatively distinct, but end before reaching split Bar 6. Bar 6 is entire in young, and may remain so in occasional adults, division of Bar 5 appears restricted to very large specimens. Blotches are frequently observed where Bars 2, 3 and 4 cross the lateral band (cf. Kullander 1981*b*, Fig. 2). The caudal fin is immaculate or very faintly dotted. Distinct, long abdominal stripes, entire vertical bars, a rather continuous lateral band and immaculate caudal fin appear to be characteristic of *A. cruzi*, but these traits need confirmation from well preserved large samples.

Although these species are very similar, there is no evidence of a particularly close relationship between *A. eunotus* and *A. cruzi*.

The female topoparatype is exceptional in having 4 anal-fin spines, and only 14 dorsal-fin spines.

Apistogramma urteagai n. sp.

Figs 48, 51-53, Pl. XVII, Table 12

Diagnosis

A moderately elongate species of the *A. regani* species group most similar to *A. resticulosa*, but different from that species in possessing midventral stripe in females and frequently in males, and in entire instead of interrupted suborbital stripe. 5 dentary, 4 infraorbital lateralis pores.

Holotype

NRM SOK/1983324.3930. A male, 28.3 mm SL, from Peru, departamento Madre de Dios, Rio Madre de Dios drainage system, Lago Túpac Amaru, near Puerto Maldonado. 11 August 1983. Leg. S.O. Kullander, A. Urteaga C., T. Townshend, A. Hogeborn-Kullander, E. Carpio C. (Station SOK 58).

Material

Holotype, and 238 paratypes, 10.3-40.6 mm SL.

Description

Based on the holotype unless otherwise stated; quantitative data from the holotype, NRM SOK/1983325.3652, SOK/1983324.3653, SOK/1983331.3673 (n = 31) or measured specimens (n = 10; measurements in Table 12); refer to Pl. XVII for general shape features; notes on variation based on total material available.

Shape. Body moderately elongate. Snout rounded; mouth clearly wider than flat interorbital area; orbit tangented by forehead contour, major portion in anterior half of head; maxilla extending posteriorly to little beyond vertical from anterior margin of orbit.

Fins. D. XIV.7 (1), XV.6 (2), XV.7 (23), XVI.6 (5); A. III.6 (28), III.7 (3); P. 12 (10). Dorsal-fin spines increasing in length to 5th, from which equal but the last slightly longer; lappets short, rounded; soft dorsal fin pointed, 3rd ray produced, filamentous, reaching to near end of caudal fin. Soft anal fin pointed, 3rd ray longest, reaching little distal to middle of caudal fin. Caudal fin with rounded hind edge, two marginal rays in each lobe simple, remainder bifid. Pectoral fin rounded, 4th ray longest, reaching to above base of first anal-fin spine. Pelvic fin pointed, first ray slightly

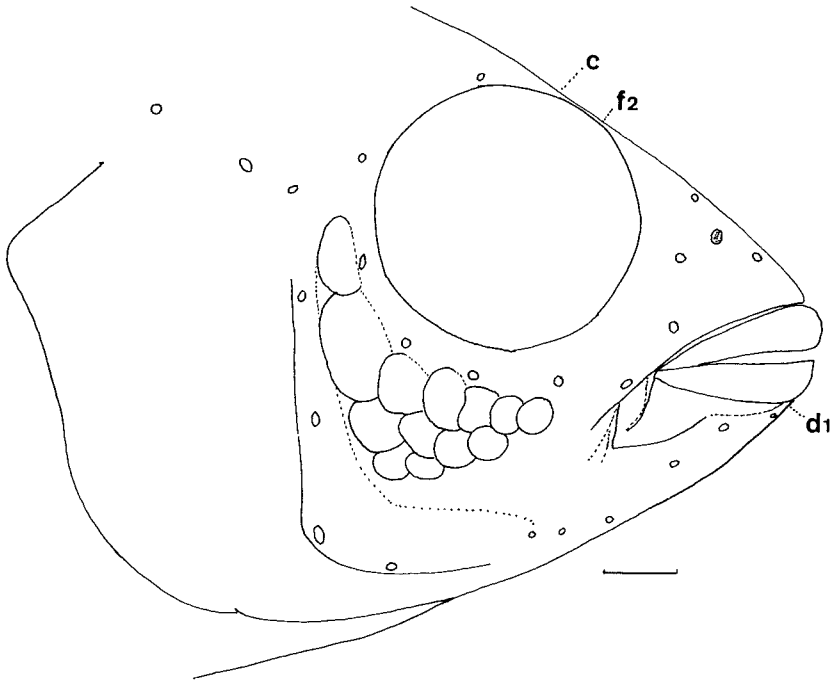


Figure 51. Distribution of cephalic lateralis pores and cheek scales in holotype of *Apistogramma urteagai*, NRM SOK/1983324.3653, 28.3 mm SL. Pores out of view indicated by stippled lines (d1 rostralmost dentary pore, f2 second frontal pore, c coronalis pore).

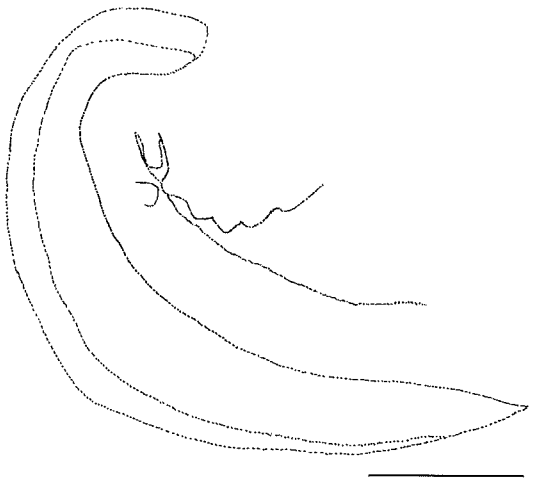


Figure 52. External aspect of right side first gill-arch in a paratype of *Apistogramma urteagai*, NRM SOK/1983325.3652, 24.0 mm SL. Scale 1 mm.

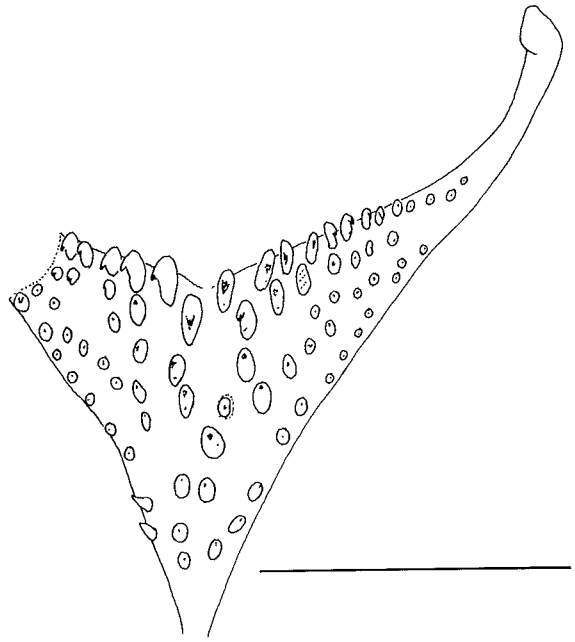


Figure 53. Occlusal view of lower pharyngeal tooth-plate in a paratype of *Apistogramma urteagai*, 24.0 mm SL, NRM SOK/1983325.3652. Right caudal process damaged. Scale 1 mm.

produced, reaching to 3rd anal-fin spine.

Scales. Squ. long. - (3), 21 (5), 22 (22), 23 (1); squ. tr. 7+1+1-1 1/4; squ. prd. 9 (3), 10 (5), 11 (2); squ. prv. 8 (4), 9 (5), 10 (1); cheek scale series 3 (10); squ. op. - (5), 8 (2), 9 (3); squ. sop. - (1), 3 (4), 4 (4), 5 (1); squ. iop. 2 (4), 3 (6); squ. caud. - (4), 4 (3), 5 (2), 6 (1). Upper lateral line 13 (2), 14 (4), 15 (4), including 2-6 pored scales, continued on next ventral scale series by 0-3 pored scales; lower lateral line - (1), 5 (1), 6 (4), 7 (1), 8 (3), including 2-5 pored scales; a pored scale on caudal-fin base in one specimen only. Body scales ctenoid save predorsally and dorsal to gill-cover, and anterior to pelvic fins. Head scales cycloid save a posterosuperior cheek scale and dorsal opercular scales. Subopercular scales in a single series. Cheek largely naked anteriorly (fig. 51). Upper lateral line separated from dorsal fin by 3 scales anteriorly, a half scale posteriorly, ending below base of penultimate dorsal-fin spine. Basal 2/7 of caudal fin scaly; distal scales cycloid.

Jaw teeth slender, pointed, apically slightly linguad curved; outer series of stronger teeth, along entire jaw rim, inner narrow band of anteriorly 3 series along anterior 2/3 of upper jaw rim, and along half of lower jaw rim; 27 teeth in one outer hemiseries in both jaws.

Cephalic lateralis pores distributed as shown in fig. 51; including 5 dental pores, separate posterior anguloarticular and rostral preopercular pores, and 4 infraorbital pores.

Gill-structures. Gill-rakers 1 (2), 2 (7), 3 (1) externally on first ceratobranchial, - (2), 9 (2), 10 (6) on lower pharyngeal tooth-plate. First gill-arch shown in fig. 52 from 24.0 mm specimen, with relatively smooth skin; of 4 marginal buds on epibranchial lobe at least the anterior 2 include basal ossifications; 8 internal ceratobranchial rakers; gill-filaments continued along hypobranchial, not forming paired blades but outer and inner filaments alternating along course of arch.

Lower pharyngeal tooth-plate shown in fig. 53, from 24.0 mm specimen, with rather few teeth, anteriorly and laterally simple, pointed, posteriorly

and medially laterally compressed, with long rostrad curved posterior cusp and smaller cusp anteriorly near base.

Variation. The largest specimen examined is a male, 40.6 mm SL (USNM 264079), the largest female is 32.3 mm SL (USNM 263873). Large males are similar to the holotype with regard to finnage; large females have shorter and more rounded dorsal-fin lappets than males of comparable size, also rounded off soft dorsal fin, reaching only little beyond the caudal spot, rounded or acuminate soft anal fin, reaching only little beyond the caudal spot, pointed pelvic fin, with first ray only slightly the longest, reaching to the genital papilla or 2nd anal-fin spine. Generally, the caudal fin is rounded, occasionally tending to subtruncate; the pectoral fin extends to above the 3rd anal-fin spine (juveniles) or to above the genital papilla or the anal-fin origin. Juveniles with all head scales and anterior scales on back cycloid, lateral lines largely or only of pored scales, cheek largely naked. Cheek scales remaining cycloid in the larger specimens, but scale cover extending further forward than in holotype, leaving only the mouth angle naked (also in some specimens smaller than the holotype). Jaw teeth arranged as in holotype, but variable number of outer hemiseries teeth: 19-28 in upper jaw; 21-27 in lower jaw, in 6 specimens 31-41 mm SL.

Colouration. Ground colour dirty whitish; slightly countershaded; markings on body brown to dark brown. Snout and lower jaw pale greyish; gill-cover greyish. Preorbital stripe distinct. Suborbital stripe slightly narrower than pupil, from orbital margin between 2nd and 3rd infraorbital pores uninterrupted over cheek and preoperculum (passing over and dorsal to posterior of corner pores) onto rostral process of suboperculum and border region of sub- and interoperculae. Supraorbital stripe diffuse, apparent chiefly through light posteriorly delimiting zone. Chin spot dark grey. Postorbital stripe narrow.

Lateral band brown, lighter than head stripes, about one scale wide, extending to Bar 7, on and above lower lateral line, distinct, but edges slightly wavy. No lateral spot. Dorsal pectoral spot on margin of pectoral axilla and adjacent body side.

Bars slightly wider than interspaces; Bars 2-6 diffuse, reaching ventrally to level of lower edge of caudal peduncle; Bar 1 indistinct, to operculum; Bars 1-6 darkened close to dorsal-fin base; Bar 7 distinct, across caudal peduncle sides, but including some light scale centers. No abdominal stripes, but scale bases of three horizontal scale series below lateral band each with a blackish (anteriorly on side) or brownish (posteriorly) bar, from behind pectoral axilla to Bar 5, fainter posteriorly and in Bar interspaces. Midventral stripe greyish, pale, visible only under magnification.

Anterior 2 spines and membranes of dorsal fin black; rest of fin smoky, and with dark brown dot on base of each membrane, most prominent over Bars; indistinct clear dots basally on posterior soft portion. Anal fin smoky; lower edge blackish; a few clear dots proximally on posterior soft portion. Caudal spot black, slightly ovate, not extending to fin margins; rest of caudal fin smoky with traces of lighter dots posteriorly on median part. Pelvic fin clear, but for blackish spine and membrane and base of first ray and membrane.

Variation: Among specimens over *c.* 20 mm SL variation in colour pattern is shown principally in the pigmentation of the flanks below the lateral band, in the dotting of the unpaired fins, and in the slight sexual dichromatism. Females, from *c.* 16 mm SL have a black midventral stripe, continued around the genital papilla and extending rostrad about two-thirds the distance from anal-fin origin to pelvic-fin bases; generally also the black portion of the pelvic fin is wider than in males. Males over 30 mm SL, however, frequently with a short midventral stripe, occasionally continued around the vent.

The vertical dark markings of the lower sides vary in prominence and commonly, in specimens larger than the holotype especially, they vanish in a general duskiness of the lower sides, usually correlated with intensification of the ventral portion of the vertical bars; the abdomen ventral to the level of the lower edge of the caudal peduncle remains relatively light, however.

The unpaired fins are usually dotted, but a pattern of dot-stripes is rarely clear except in large males, in which the caudal fin has up to 7 vertical stripes of dark dots with clear interspaces over most of the fin save the dorsal and ventral margins which dusky; and the dorsal and anal fins have up to 5 similar stripes across the posterior soft portion. The caudal-fin stripes run obliquely across the rays, either dorsocaudad from the ventral lobe or ventrocaudad from the dorsal lobe. The lateral band is generally evenly and strongly pigmented throughout, and Bar 7 commonly similarly dark, at least more prominent than other Bars except when these darkened as described above; some young females, however, with Bars 2-3 intensified where crossing band, and juveniles with band only to Bar 6.

Distribution (fig. 48)
Apistogramma urteagai has been collected only close to Puerto Maldonado.

Ecology.
In Lago Túpac Amaru, a white-water flood-plain lake close to R. Madre de Dios, a series of *A. urteagai* was seined from a shallow muddy strech of shore (SOK 58). Other collections are chiefly from small streams and swamps. In Quebrada San Roque the *Apistogramma* specimens were taken from thick vegetation at the mouth of a quebradita, not in the pool-like expansion of the creek where most fishing was done or in the aguajal downstream (SOK 61). The quebrada at Km 14 (SOK 64) varied in width between about 1-2 m; the water was stagnant, clear and colourless. Here the *Apistogramma* were taken by dip-net, one at a time from among pebbles providing hiding places below the bridge.

Apistogramma urteagai is occasionally syntopic with *A. luelingi*. Both species were taken together at stations RPV83-32 (Laguna Cocococha), TI83-10 and TI83-22 (swamp 14 km ENE Puerto Maldonado).

Etymology
The species is named for Jorge Andrés Urteaga Cavero, co-leader of the expedition during which the NRM material was collected, in appreciation of his considerable efforts to make our joint expeditions successful.

Notes
Apistogramma urteagai is very similar to *A. resticulosa* (Pl. XVIII, fig. 1), especially in the pronounced vertical dash-markings of the ventral sides. These markings are not unique to these species, but appear in different forms, eg. as dots (abdominal stripes) or are at most indistinct, in other *Apistogramma* species. General shape features, squamation, fin counts, male fin shape, colour pattern, pharyngeal and jaw dentition, and the lateralis system agree largely or completely.

Apistogramma urteagai is recognized as distinct on the basis of several features in the colour pattern. (1) The midventral stripe characteristic of female *A. urteagai*, and occurring also in males of that species, is invariably absent from *A. resticulosa*. (2) The lateral band of adult *A. urteagai* is unusually distinct and prominent for a *regani* group species, and extends to Bar 7, whereas in *A. resticulosa*, in which the band also appears comparatively narrower, it is marked by intensifications of the vertical bars, and it ends abruptly with Bar 6 or is continued faintly into Bar 7; spots formed at the overlaps of Bars 2-4 and the band are frequent in *A. resticulosa*, but are rarely encountered, and then not distinct, in *A. urteagai*. (3) *Apistogramma resticulosa* retains the dash-markings at all sizes, unlike *A. urteagai* in which the vertical bars are prominent in adults, and a general duskiness may absorb the dashes. (4) In *A. urteagai* Bar 7 is always distinct, as or nearly as prominent as the lateral band, but in *A. resticulosa* this bar is not emphasized in comparison with the other bars. (5) The suborbital stripe is continuous from eye to gill-cover margin in *A. urteagai*, but interrupted in *A. resticulosa* in which all of or the

free margin of the preoperculum is unpigmented.

I should note in this connection also that the black spot shown above the dorsal fin on the photo of the holotype of *A. resticulosa* in Kullander (1980*c*, Fig. 1) is actually a part of the black background that was inadvertently left when the contours of the specimen were cut out.

Apistogramma resticulosa was originally described from the left bank of the upper R. Madeira. Collections are now available from also the right bank (R. Machado, MZUSP 28227) and, apparently, from the Guaporé system (USNM 235635, 'Brazil-Bolivian border region between Guajara-Mirim and Mato Grosso). The Guaporean material, however, has very imprecise locality data. The existence of the species upstream of the Madeira falls should be confirmed by material with precise locality information.

Apistogramma linkei Koslowski (1985*b*) bears a general resemblance to *A. urteagai*, but in *A. linkei* Bar 7 and the caudal spot are equally intensely pigmented and confluent to form a so-called tail-spot, which is regarded as a synapomorphy of *A. linkei*, *A. commbrae* (Regan) and *A. inconspicua* Kullander (Koslowski 1985*b*, Kullander 1983*a*).

Apistogramma urteagai belongs to the *A. regani* group, recognized by the 4 infraorbital and 6 mandibular (5 dentary) lateralis pores, relatively narrow lateral band which does not reach to the caudal fin, distinct caudal spot, absence of a lateral spot, short dorsal-fin lappets and roundish caudal fin, fully scaled throat and black anterior dorsal-fin membranes. The most closely related species may be *A. resticulosa* or *A. linkei*, by virtue of the great overall similarity between these species, but characters permitting a satisfactory relationship analysis of *regani* group species are not available.

Table 12. *Morphometry of* Apistogramma urteagai. *Measurements are in mm, except range and mean which are in per cent of SL.*

											Range	$\bar{x}$
SL	22.4	22.5	23.1	23.6	24.3	24.5	25.1	25.6	27.4	28.3		
Head length	7.3	7.2	7.5	7.5	8.0	7.6	7.7	8.5	8.6	9.3	30.7-33.2	32.1
Head depth	6.1	6.1	6.5	6.7	6.6	6.5	6.9	6.6	7.6	8.2	25.8-29.0	27.5
Body depth	7.8	7.5	8.6	8.5	8.2	8.6	9.0	8.4	9.8	10.3	32.8-37.2	35.1
Predorsal length	8.5	8.5	8.8	8.7	9.3	8.5	9.2	9.7	10.3	10.6	34.7-38.3	37.3
Prepelvic length	8.8	8.5	9.7	9.1	9.7	9.4	9.5	10.0	10.8	10.9	37.8-42.0	39.1
Orbital diameter	3.1	2.9	3.0	3.1	3.2	3.2	3.1	3.5	3.5	3.7	12.4-13.8	13.1
Snout length	1.1	1.3	1.3	1.2	1.3	1.5	1.3	1.5	1.4	1.6	4.9- 6.1	5.5
Cheek depth	1.4	1.4	1.6	1.7	1.5	1.7	1.5	1.6	1.9	2.1	6.0- 7.4	6.6
Head width	3.9	3.7	4.3	4.1	4.1	4.3	4.2	4.4	4.6	5.1	16.4-18.6	17.3
Interorbital width	1.7	1.7	1.9	1.9	1.8	1.8	1.9	1.9	2.2	2.1	7.3- 8.2	7.7
Preorbital depth	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.9	2.7- 3.2	2.9
Upper jaw length	2.1	1.9	2.2	2.2	2.4	2.2	2.3	2.3	2.6	2.8	8.4- 9.9	9.3
Lower jaw length	3.1	3.0	3.4	3.2	3.3	3.4	3.4	3.7	3.8	4.1	13.3-14.7	13.9
Caudal peduncle depth	3.5	3.4	3.7	3.7	3.9	3.9	3.9	3.9	4.4	4.4	15.1-16.1	15.7
Caudal peduncle length	3.1	2.7	2.9	3.1	3.6	3.1	3.4	3.5	3.9	3.6	12.0-14.8	13.3
Dorsal-fin base length	13.2	13.3	13.7	14.2	14.5	14.8	15.1	14.8	16.4	16.8	57.8-60.4	59.5
Anal-fin base length	4.2	4.4	4.5	4.6	4.8	5.3	5.0	5.1	5.8	6.0	18.8-21.6	20.1
Pectoral-fin length	7.1	6.8	7.5	7.3	7.4	7.4	7.7	8.1	8.1	8.8	29.6-32.5	30.9
Pelvic-fin spine length	3.4	3.2	3.4	3.2	3.1	3.1	3.4	4.0	4.1	4.4	12.7-15.6	14.3
Pelvic-fin length	7.0	6.3	7.2	6.7	7.3	7.3	7.1	7.9	8.3	9.8	28.0-34.6	30.3
Last dorsal-fin spine length	4.1	4.1	4.1	4.0	4.5	4.2	4.2	5.1	5.0	5.5	16.7-19.9	18.1
Last anal-fin spine length	4.9	4.3	4.3	4.3	4.6	4.4	4.8	5.5	5.6	6.4	18.0-22.6	19.8
Sex	♀	♀	♀	♀	♂	♀	♀	♂	♂	♂		

Apistogramma moae Kullander
Fig 48, Pl. XVIII (fig. 2), Table 13

Apistogramma moae Kullander 1980*a*, p. 61 (descr.; diagn.; distr.; relationships; type-loc.: Brasil (Acre), Cruzeiro do Sul, R. Moá left bank, Igarapé São Salvador (7°38'S 72°36'W)), fig. 9 (monochrome photo, habitus, holotype), pp. 26, 49 (notes).

Bibliography
Apistogramma moae; Kullander 1981*b*, p.191 (compared with *A. eunotus*)

Material
Six specimens known, 27.2-49.9 mm SL.

Description
This species was known hitherto only from two adult males, 46.5 and 49.9 mm SL, from the R. Moá, a tributary of the R. Juruá. The following notes are based on four females, 27.2-31.9 mm SL and are given chiefly as a complement to the description in Kullander (1980*a*). See Pl. XVIII, fig. 2, for shape and colour pattern; measurements are given in Table 13, counts below from all four ZUEC specimens.

Shape. Moderately elongate to moderately deep. Interorbital about as wide as mouth. Maxilla reaching to vertical from margin or 1/4 of orbit. Preoperculum entire.

Jaw teeth. 19-25/25-26 in upper/lower jaw outer hemiseries, 2 inner series anteriorly; conical, slightly recurved.

Lateralis pores on head as in *A. cruzi* (fig. 49).

Scales. Squ. long. 22 (4); squ. tr. 7+1+1 (1), 7+1+1 1/2 (3); squ. prd. 9 (1), 10 (2), 11 (1); squ.prv. 9 (1), 10 (2), 11 (1); squ.caud. 4 (1), 5 (2), 6 (1), *c.* 1/4 of caudal fin scaled. Cheek scale series 3 (3), 4 (1); squ. op. - (1), 10 (2), 12 (1); squ. sop. - (1), 3 (1), 4 (1), 5 (1), in single series; squ. iop. 3 (4). Lateral line totals 14 (1), 15 (2), 17 (1) in upper, 6 (1), 7 (3) in lower; a pore (3) or canal (1) continuing lower on caudal fin.

Fins. D. XV.7 (2), XV.8 (2); lappets short, rounded to subtruncate; soft part with rounded tip, reaching to nearly 1/3 of caudal fin. A. III.6 (3), III.7 (1); soft part with rounded tip, reaching to 1/4 of caudal fin. Caudal fin rounded, dorsal lobe slightly longer than ventral. P. 11 (1), 12 (3), tip reaching to anal-fin origin. Pelvic fin pointed, with or without short prolongation of first ray, reaching to 2nd anal-fin spine.

Gill-rakers. 1 (4) externally on first ceratobranchial; 12 (4) on lower pharyngeal tooth-plate.

Vertebrae. 12+12 (1).

Colouration. Ground colour yellowish white on chest and belly, lightly countershaded with brownish on sides and back. Gill-cover greyish, cheek light brownish. Preorbital stripe present. Suborbital stripe brown or dark brown, width of pupil, ventrally to over edges of sub- and interopercula. Supraorbital stripe brown, faint. Some dark pigment on lower jaw tip, but no distinct chin spot. Postorbital stripe brown, faint; continued along side by a series of roundish or squarish spots where very faint or obsolete lateral band and faint vertical bars cross. Spots intense, dark brown in Bars 2-4, faint or obsolete in Bars 5-6, generally most intense in Bar 2. Lateral band occupying all of squ. long. scales and upper 1/3 (anteriorly) to 1/2 (posteriorly) in horizontal scale series below. Each scale base on sides below lateral band with brownish short vertical line. Largest specimen with light brown blotch anterior to pelvic fins. Midventral stripe brown or (largest specimen) dark brown, from vent forward nearly to pelvic-fin bases. Some dark pigment dorsally on pectoral axilla base, but no distinct pectoral spot.

Unpaired fins slightly smoky, dorsal and anal fins without or with 1-2 short dot-stripes posteriorly; anterior 2 dorsal-fin membranes black; caudal spot ovate, brown or dark-brown, rest of caudal fin immaculate. Pelvic fin

with outer membrane blackish, rest clear, free tip of first ray white. Dorsal fin with vertical bars faintly continued onto basal portion.

Distribution (fig. 48)
Known only from the upper R. Juruá system, near Cruzeiro do Sul.

Notes
Apistogramma moae is similar to both *A. eunotus* and *A. cruzi*. It apparently differs from both in never showing any abdominal striping, and in lacking a distinct pectoral spot. It differs from *A. eunotus* in having the lateral band wide, but indistinct, and in having entire vertical bars. *Apistogramma eunotus* may show a maculate lateral band, but then the Bar 2 spot is never as pronounced as in the *A. moae* females.

As predicted (Kullander 1980*a*), females of *A. moae* show more distinct markings than males, but the initial conception of this species as less distinctly marked than most other *Apistogramma* species still holds. The female in Pl. XVIII, fig. 2, has the most distinct markings of the specimens so far available, and may display breeding pattern even if the genital papilla is not distinctly swollen.

Table 13. *Morphometry of* Apistogramma moae *females. Measurements are in mm, except range and mean which are in per cent of SL.*

					Range	$\bar{x}$
SL	27.2	28.4	29.5	31.9		
Head length	8.6	9.6	9.8	10.3	31.6-33.8	32.7
Head depth	7.9	8.1	8.1	9.1	27.5-29.0	28.4
Body depth	10.2	10.5	10.4	12.1	35.3-37.9	36.9
Predorsal length	10.0	10.4	11.0	11.4	35.7-37.3	36.6
Prepelvic length	11.0	11.3	12.2	12.5	39.2-41.4	40.2
Orbital diameter	3.4	3.5	3.6	4.0	12.2-12.5	12.4
Snout length	1.5	1.7	1.8	1.9	5.5- 6.1	5.9
Cheek depth	2.1	2.2	2.0	2.4	6.8- 7.7	7.4
Head width	4.8	5.0	5.1	5.4	16.9-17.6	17.4
Interorbital width	2.2	2.3	2.3	2.6	7.8- 8.2	8.1
Preorbital depth	0.9	0.9	1.0	1.1	3.2- 3.4	3.3
Upper jaw length	2.5	2.7	2.9	3.1	9.2- 9.8	9.6
Lower jaw length	3.8	3.9	3.9	4.3	13.2-14.0	13.6
Caudal peduncle depth	4.1	4.7	4.6	5.4	15.1-16.9	16.0
Caudal peduncle length	3.3	3.5	4.0	4.2	12.1-13.6	12.8
Dorsal-fin base length	15.5	16.6	17.0	19.2	57.0-60.2	58.3
Anal-fin base length	5.4	5.5	5.6	6.0	18.8-19.9	19.0
Pectoral-fin length	9.2	9.1	10.0	11.1	32.0-34.8	33.6
Pectoral-fin spine length	3.9	3.7	4.2	4.5	13.0-14.3	13.9
Pelvic-fin length	8.4	8.9	8.9	10.6	30.2-33.2	31.4
Last dorsal-fin spine length	5.0	4.9	5.5	5.7	17.3-18.6	18.1
Last anal-fin spine length	5.2	4.9	5.5	5.6	17.3-19.1	18.2

Apistogramma luelingi Kullander
Figs. 54-59, Pl. XVIII (figs 3-4), Table 14

Apistogramma luelingi (*pt.*) Kullander 1976, p. 259 (descr.; bibliogr.; ecology; relationships; locs: kleine Quebrada unterhalb Todos Santos (Bolivien), type-loc. /incorrect/; "Hoffman Lagune", Rio Chaparé, unterhalb Todos Santos (Bolivien); kleine Quebrada mit Restwasser, 4 km unterhalb Todos Santos (Bolivien); not specimen from Bach zwischen Rio Chaparé und Rio Chimoré. /ZFMK 2303/, which *A. linkei* Koslowski), Fig. 1 (monochrome photo, habitus, holotype, excessively retouched).

Peruvian bibliography
Apistogramma luelingi; (*pt.*) Kullander 1982*a*, p.44 (note; Rio Manu).

Material
42 Peruvian specimens, 8.7-32.6 mm SL; type series not re-examined.

Description
Composite, but from 32.6 mm male unless variation specified; counts from specimens measured (n = 10) or all specimens available (n = 42); measurements of 10 specimens in Table 14. Refer to Pl. XVIII, figs 3-4, for general shape and colour pattern aspects.

Size. Largest specimen available a male, 32.6 mm SL; largest female 28.7 mm SL. Sexable from *c.*15 mm SL; sexual dimorphism in finnage and colouration evident in specimens over 20 mm SL.

Shape. Body moderately elongate. Snout rounded off, but contours straight. Interorbital area flattened, width equal to or nearly equal to mouth width. Maxilla extending caudad to slightly behind vertical from anterior margin of orbit. Orbit tangented by frontal contour; situated entirely in upper half of head and chiefly in anterior half of head. Preoperculum entire.

Scales. Squ. long. - (4), 21 (1), 22 (35), 23 (2). Scales ctenoid except along predorsal midline, rostral to extrascapulars, on head sides except posterodorsally on cheek and dorsally on operculum, and anterior to pelvic fins. Squ. prd. - (2), 9 (2), 10 (6); squ. prv. - (2), 9 (3), 10 (5). Cheek entirely scaled except next to mouth angle (fig. 55); scales in - (1), 3 (5) or 4 (4) series. Opercular scales in about 3 vertical series, squ. op. - (5), 14 (1), 15 (3), 17 (1); subopercular scales in 2 series, except in one specimen with an additional scale inserted between main series (fig. 55), squ. sop. - (5), 7 (1), 8 (1), 9 (2), 10 (1); interopercular scales in single series, 3 (8) or 4 (2).

Lateral lines largely of pored scales; upper with 8-11 canals and 4-6 pores, to a total of 12 (1), 13 (1), 14 (2), 15 (3) in measured specimens, count not possible in 3, 1-2 subserial pores in 6, none in 1 specimen; lower with 0-3 canals, 3-7 pores, total 5 (1), 6 (2), 7 (4); a pore on caudal-fin base in one specimen. To 1/3 of caudal fin scaly; squ. caud. - (5), 3 (2), 4 (3). Squ.tr. 7+1+1 (5), 7+1+1 1/2 (3), - (2); upper lateral line at 2-3 scales distance from dorsal-fin base anteriorly, 1/2 scale posteriorly.

Fins. D. XV.6 (2), XV.7 (1), XVI.5 (1), XVI.6 (30), XVI.7 (3), XVII.- (1), XVII.5 (2), XVII.6 (2); spines increasing in length to 5th from which subequal in length, the last longest; lappets in males long, pointed, but not produced except in one specimen (see below), relatively shorter in females, but anterior relatively slightly longer than posterior. Only one male, 23.3 mm SL, with distinctly produced dorsal-fin lappets, all long, but particularly 3rd-5th, 3rd almost spine length; remainder slightly shorter relative to spine length; this specimen also with best developed dorsal- and anal-fin elongations: soft dorsal fin pointed, 2nd ray filamentously produced, reaching beyond middle of caudal fin; soft anal fin pointed, 2nd and 3rd rays forming point extending to near middle of caudal fin. In other males, soft dorsal and anal fins pointed, reaching to at least 1/3 and 1/4 of caudal-fin, respectively, in females these fins rounded or pointed, dorsal fin to at most 1/3 of caudal fin, anal fin always shorter. A. III.6 (+raylet) (2), IV.- (1), IV.6 (+raylet) (37), IV.7 (2), spines increasing in length to last.

Caudal fin basically subtruncate, as in young; males always, females occasionally with marginal rays produced. Caudal fin of 23.3 mm male as shown in fig. 59; truncate, with branches of rays D4 and D5 produced and one branch of ray V4 produced. Four females with one or two streamers distinct or indicated, in the others caudal-fin hind edge truncated, or shape uncertain.

Pectoral fin rounded, 4th ray longest, reaching to above genital papilla or first anal-fin spine. P. 11 (2), 12 (6), 13 (2). Pelvic fin pointed, first ray longest, reaching to 1st to 3rd anal-fin spine in females; longer only in 23.3 mm male, with filament reaching to second anal-fin ray.

Cephalic lateralis pore arrangement as shown in fig. 55; only three infraorbital pores (including that shared with lachrymal).

Gill-rakers - (1), 1 (4), 2 (5) externally on first ceratobranchial; on

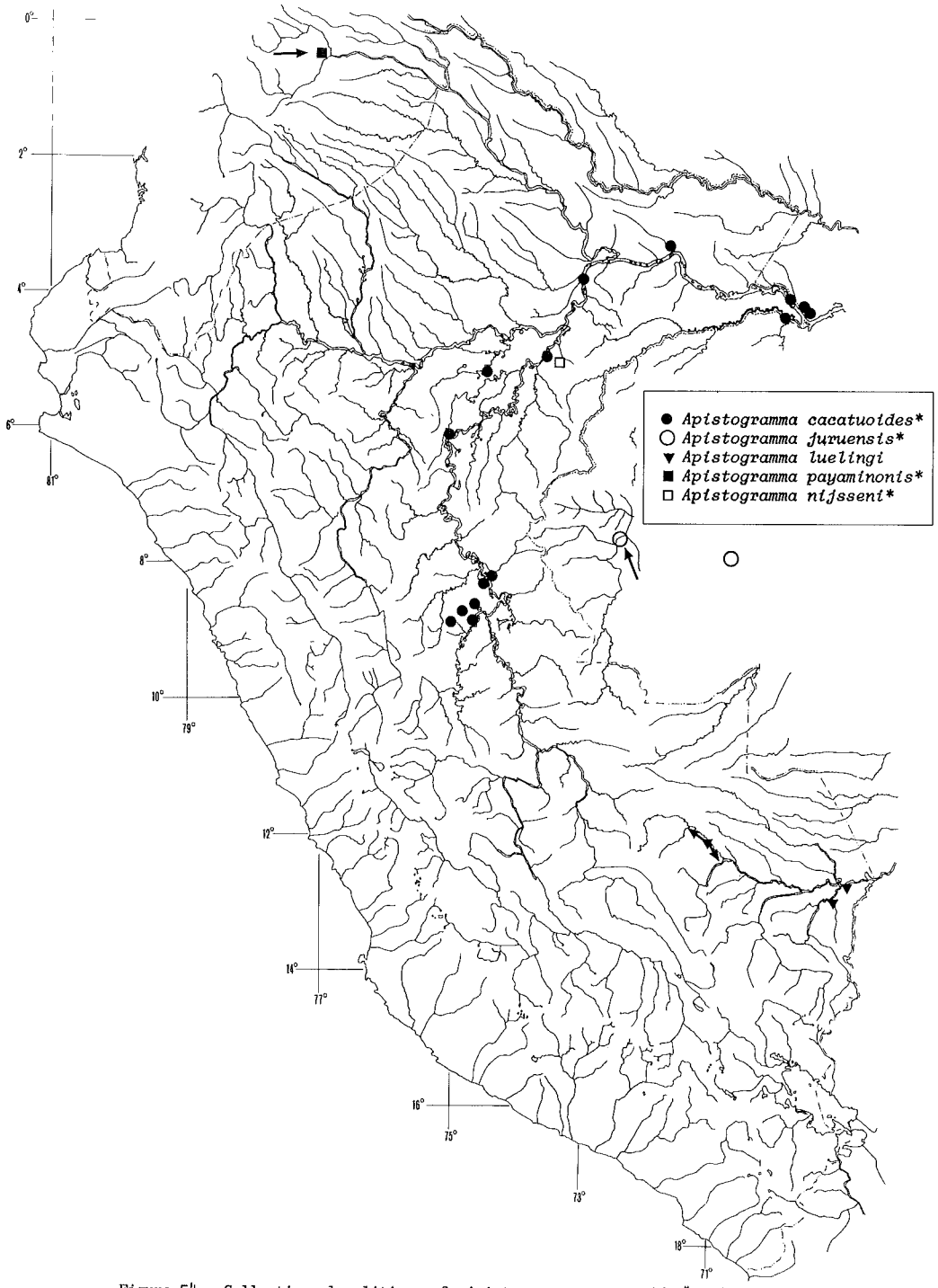


Figure 54. Collecting localities of *Apistogramma cacatuoides**, *A. juruensis** (arrow indicates type locality), *A. luelingi*, *A. payaminonis** (arrow indicates type locality) and *A. nijsseni** in western Amazonia. * = total known range. A symbol may represent more than one, adjacent collecting sites.

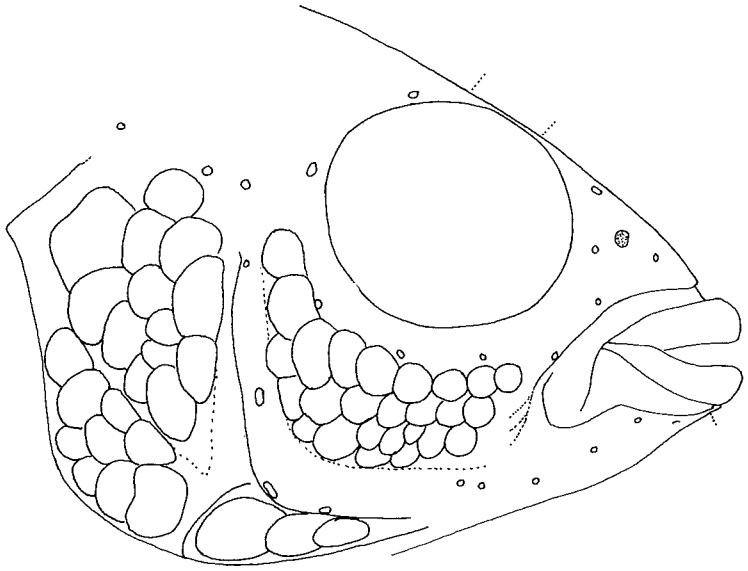


Figure 55. Outline of head of *Apistogramma luelingi*, USNM 263889, 24.2 mm SL, showing scale pattern and lateralis pores. Dotted lines indicate positions of pores out of view. Dorsal opercular squamation incomplete.

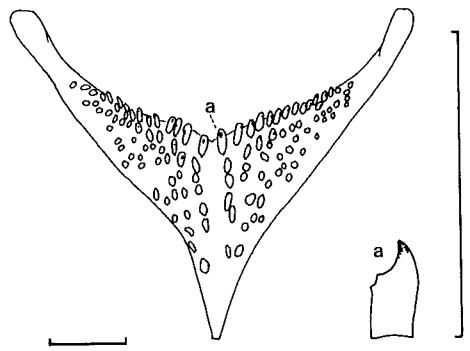


Figure 56. Lower pharyngeal tooth-plate in occlusal view and posterior tooth (a) in lateral aspect, of *Apistogramma luelingi*, NRM A85/1983237.3463, 24.4 mm SL. Scales 1 mm.

lower pharyngeal tooth-plate - (1), 11 (3), 12 (3), 13 (2), 14 (1).

Jaw teeth pointed, strongly recurved; outer stronger than inner which forming narrow band of 1-2 (upper) or 2-3 (lower jaw) series only anteriorly in each jaw; 27/26 teeth in outer series of upper/lower jaw in 32.6 mm specimen, but only 22/21, 20/19, 20/22, 19/21 in 27.4, 26.9, 27.6 and 27.6 mm specimens, respectively.

Vertebrae. Three specimens radiographed have 12+12 (2) or 13+12 (1) vertebrae.

Lower pharyngeal tooth-plate (fig. 56) with compressed, anteriorly simple, mostly bicuspid, posteromedially tricuspid teeth.

Colouration (considering all specimens; but all not in suitable condition). Dirty yellowish white on chest and abdomen; sides of head similar or greyish; countershaded to brownish above lateral band. Vertical bars obsolete in large specimens; quite distinct especially above lateral band in young; Bars 2 and 3 usually converging to lateral spot. Markings on body dark brown, but preorbital stripe may be greyish and rather faint; chin spot blackish; lateral spot, pectoral spot may be blackish, midventral stripe black.

Supraorbital spot generally disappearing in dark nape, more apparent in young. Suborbital stripe prominent, of about pupil width, from eye on infraorbital 3 passing preoperculum between corner pore and adjacent vertical limb pore, onto adjacent edges of sub- and interopercula. Postorbital stripe moderately wide, continued by even-edged, prominent lateral band, 1 1/2 (anteriorly) to 2 1/2 (posteriorly) scales deep, caudally reaching slightly ventral to lower lateral line, continued onto caudal-fin base except in some young in which ending with Bar 7. Lateral spot round, in Bar 3, often vanishing in intense lateral band colour. Pectoral spot on dorsal edge of pectoral axilla and adjacent body side. Abdominal stripes (fig. 57) usually on three scale series inferior to lateral band, occasionally also on next ventral series; in young and females dots on scale centres; in males vertical bars that usually continuous over 2 or 3 scale series anteriorly on the side; only two upper scale series distinctly marked, onto caudal peduncle, but gradually fainter caudad. Short midventral stripe in females only, but missing in one female. In

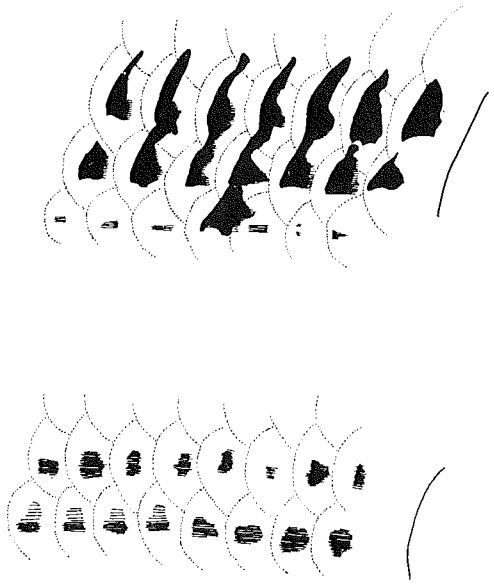


Figure 57. Abdominal markings anteriorly on side in male (top, from 27.4 mm specimen, USNM 266790) and female (bottom, from 24.2 mm specimen, USNM 263889) of *Apistogramma luelingi*. Dotted lines are scale outlines; broad line to the right marks pectoral axilla.

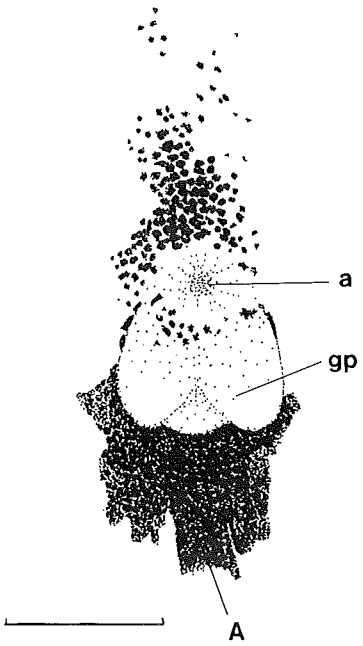


Figure 58. Black pigmentation of vent region in a female *Apistogramma luelingi*, ZMA 115.210, 27.6 mm SL. The swollen genital papilla (gp) is characteristic of breeding *Apistogramma* females; A first anal-fin spine, a anal orifice. Scale 1 mm.

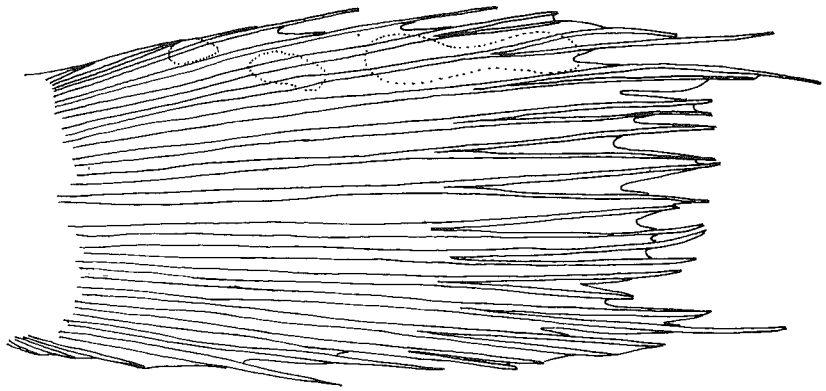


Figure 59. Caudal fin of male *Apistogramma luelingi*, USNM 264080, 23.3 mm SL. Clear ocelli outlined by dots.

both sexes, but more intense in females, a black spot occupying space between genital papilla and first anal-fin spine (fig. 58).

Dorsal fin anterior 2 spines and membranes black; remainder of spinous portion either uniform dusky, and/or with darker lappets, and/or basal 1/3 darkened, middle portion dusky, lappets blackish; soft part dusky, with usually rather indistinct clear dots posteriorly. Anal fin with black outer margin continuing spot behind genital papilla, lappets of spinous portion either black (males) or whitish (females); otherwise dusky, soft part like soft dorsal fin. Caudal fin without discrete caudal spot, except in smallest specimens in which a brownish bar, more intense midbasally over scaly portion; in adults lateral band continued on scaly part of fin; distal to base marking dusky, ventral and posterior edge blackish, especially over middle 1/3 indistinct hyaline dots in vertical series (up to 6 series); in males 1-3 distinct clear dots along upper margin enhanced by intensified surrounding pigmentation (fig. 59). Pelvic fin clear, spine, base of outer 2 rays, and corresponding membranes greyish to black, more intensely pigmented in females.

Table 14. *Morphometry of* Apistogramma luelingi. *Measurements are in mm, except range and mean which are in per cent of SL.*

											Range	$\bar{x}$
SL	23.3	23.5	23.9	24.2	25.6	26.1	26.9	27.4	27.7	32.6		
Head length	7.9	7.8	7.9	8.5	8.4	8.9	9.0	8.9	9.2	10.7	32.5-35.1	33.4
Head depth	6.4	6.4	6.5	7.1	7.1	7.1	7.6	7.5	7.4	9.2	26.7-29.3	27.7
Body depth	8.0	8.5	8.3	8.9	9.1	8.9	9.2	9.7	9.8	12.3	34.1-37.7	35.4
Predorsal length	8.8	8.8	8.7	9.4	9.3	9.8	9.8	10.0	10.6	11.5	35.3-38.8	37.1
Prepelvic length	9.4	9.4	10.1	10.3	10.3	10.8	11.5	11.1	11.5	13.3	40.0-42.8	41.2
Orbital diameter	3.1	3.1	3.1	3.4	3.4	3.4	3.6	3.4	3.6	3.9	12.0-14.0	13.1
Snout length	1.4	1.3	1.5	1.6	1.5	1.7	1.8	1.7	1.7	2.1	5.5- 6.7	6.2
Cheek depth	1.8	1.6	1.6	1.7	1.7	2.0	1.8	2.0	2.2	2.4	6.6- 7.9	7.2
Head width	4.3	4.3	4.4	4.4	4.7	4.6	5.0	4.9	5.0	5.9	17.6-18.6	18.2
Interorbital width	2.0	1.9	1.8	2.0	2.3	2.2	2.2	2.3	2.4	2.9	7.5- 9.0	8.4
Preorbital depth	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	1.1	2.6- 3.4	3.0
Upper jaw length	2.6	2.4	2.3	2.6	2.6	2.8	2.8	2.8	2.9	3.6	9.6-11.2	10.5
Lower jaw length	3.3	3.3	3.3	3.5	3.8	3.7	3.7	3.8	3.8	4.7	13.8-14.8	14.1
Caudal peduncle depth	3.7	3.7	3.8	3.9	3.9	4.2	4.4	4.6	4.5	5.7	15.2-17.5	16.2
Caudal peduncle length	2.7	2.8	2.6	2.5	3.4	2.9	3.2	3.3	3.0	3.6	10.3-13.3	11.5
Dorsal-fin base length	13.8	13.9	13.8	14.1	15.2	15.2	15.7	16.3	16.2	20.0	57.7-61.3	59.0
Anal-fin base length	4.9	5.5	4.9	5.2	5.5	5.5	5.7	5.6	6.1	6.6	20.2-23.4	21.3
Pectoral-fin length	6.9	7.5	6.9	7.3	7.3	7.2	8.1	7.8	7.7	---	27.6-31.9	29.2
Pelvic-fin spine length	3.2	3.2	3.3	3.4	3.2	3.6	3.4	3.6	4.2	4.4	12.5-15.2	13.6
Pelvic-fin length	---	7.1	6.7	7.2	7.4	8.1	9.2	8.3	8.0	9.6	28.0-34.2	30.1
Last dorsal-fin spine length	3.8	3.7	3.6	3.6	4.1	4.4	3.9	4.4	5.0	5.3	14.5-18.1	16.0
Last anal-fin spine length	3.9	4.2	4.1	4.1	4.3	5.1	4.2	4.8	5.4	5.6	15.6-19.5	17.5
Sex	♀	♀	♀	♀	♀	♂	♀	♂	♂	♂		

Distribution (fig. 54)

In Peru, *A. luelingi* has been collected only near Puerto Maldonado and in the Manú National Park. Other collections are from Bolivia: near Todos Santos on the R. Chapare (Kullander 1976), near Yapacani on the R. Yapacani (Linke & Staeck 1984; determination confirmed by Koslowski (1985*a*)). The area between the Bolivian and Peruvian localities is virtually unexplored.

Ecology

No detailed information is available for Peruvian habitats. The species is occasionally collected together with *A. urteagai* (stations TI83-10, TI83-22, RPV83-32). Kullander (1976, with references) and Linke & Staeck (1984) have detailed descriptions of Bolivian collecting sites; see also notes in Koslowski (1985*b*).

Notes

The original description of *A. luelingi* suffered badly from a rather poor photo of the holotype, poor material of small size (14.8-29.0 mm SL) and my limited experience with fishes of the genus. It has since been discovered that the single 3-spined paratype belongs to another species, *A. linkei* (Koslowski 1985*b*), and that the typelocality is not as stated on the label accompanying the fish. It should be a 'Quebrada mit Altwasser unterhalb San Francisco seitlich des Rio Chiripiri', where it was collected on the 3rd of October, 1966 (I. Koslowski and K.H. Lüling *in litt.* 25 May 1982). The present description and figures, although not based on type material, are hopely more useful. Koslowski (1985*a*) presented another photo of the holotype of *A. luelingi*.

Meinken (1967, 1969*b*) identified what later became the type series of *A. luelingi* as *A. borelli* (Regan) which name Meinken used for a species now recognized as *A. cacatuoides* (Kullander 1976). I listed a number of differences between *A. luelingi* and *A. cacatuoides* (Kullander 1976), but most of these refer to male characteristics which were then unknown for *A. luelingi* or reflect the small size and particular preservation method of the *A. luelingi* material.

It is obvious from the fresh material now at hand, that *A. luelingi* is very similar and most closely related to *A. cacatuoides* and *A. juruensis*. They agree in shape features, most meristics, fin shape, colour pattern and lateralis system. The ocellated spots on the dorsal lobe of the caudal fin are unique to *A. luelingi* and *A. cacatuoides*; I expect that this feature will be found in *A. juruensis* when more adult males become available. The group formed by these three species is distinguished from most *Apistogramma* species by the combination of 3 infraorbital (derived) and 6 mandibular (ancestral) lateralis pores. The sexual dichromatism in abdominal stripes is unique to these species, although there are interspecific differences. No other *Apistogramma* species shows sexual dichromatism in abdominal stripes.

In males of *A. cacatuoides* and *A. juruensis* the abdominal stripes are composed of dark colour on the upper and lower thirds of the scales excepting a wide colourless scale margin; this produces a characteristic jagged stripe. In *A. luelingi* the oblique vertical lines derive from pigment areas on the upper 2/3 of each scale, with a shape rather precisely corresponding to the pigmented upper and unpigmented median 1/3 in the other two species. Such a zonation of abdominal side scale pigment is not known from any other *Apistogramma* species.

Other than in colour pattern, *A. luelingi* is distinguished from the other two species, and most other *Apistogramma* species, above all in the anal-fin count. Two of the Peruvian specimens have 3 anal-fin spines, but the remaining 40 specimens agree with Bolivian material previously described in having 4. Koslowski (1985*b*) reported single specimens with 5 and 6 anal-fin spines, respectively. The only specimen of *A. cacatuoides* recorded to have 4 anal-fin spines is the paratype; otherwise only 3 anal-fin spines have been observed in *A. cacatuoides* and *A. juruensis*. In all other counts the three species agree. Occasional specimens of other *Apistogramma* species may have 4 anal-fin spines. The count is frequent only in *A. commbrae*, in which about 15% of the material examined has 4 instead of 3 anal-fin spines (Kullander 1982*a*).

Apistogramma juruensis n. sp.

Figs 54, 60, Pl. XIX (figs 1-2), Table 15

Diagnosis

Like *A. cacatuoides*, but lateral band relatively indistinct, ending on caudal peduncle, not continuous with caudal spot. 3 infraorbital, 5 dentary lateralis pores.

Holotype
ZUEC 1374. An adult male, 41.3 mm SL, 58.2 mm TL, 65.5 mm to tip of caudal-fin streamer, from Brazil, estado Acre, Rio Juruá drainage system, municipio do Cruzeiro do Sul, riachos near Igarapé Formoso. 2 January 1982. Leg. F.C.B. Haddad, J.R. Santos.

Material
Holotype, and 5 paratypes, 19.6-24.3 mm SL.

Description
Qualitative data below are from the holotype unless otherwise stated; counts from all specimens; measurements are given in Table 15. Se also Pl. XIX, figs 1-2, for shape and colour pattern. MZUSP specimens are in poor condition, with many scales lost and fins trashed; variation is thus chiefly from ZUEC paratypes. Description short because like *A. cacatuoides* in most respects. The largest female is 23.3 mm SL.

Shape. Moderately elongate; head elongate; snout wide, blunt; dorsal contour steep, ascend of predorsal contour less steep posterior to orbit; prepelvic contour less steep than predorsal. Orbit tangented by forehead outline. Mouth large, wider than interorbital, maxilla extending to vertical from 1/3 of orbit; lips thick, upper subcontinuous. Paratypes with shorter, rounded off snout, and shorter jaws (cf. Table 15); maxilla reaching anterior margin of orbit; interorbital as wide as mouth. Preoperculum entire.

Scales ctenoid except on head anterior to extrascapulars and along predorsal midline, anteriorly on cheek, on sub- and interoperculum and anterior to pelvic fins. Proximal 1/3 of caudal fin with ctenoid scales. Squ. long. - (3), 22 (3); squ. tr. 7+1+1; squ. caud. - (3), 3 (1), 4 (1), 8 (1); squ. prd. - (2), 10 (2), 11 (2); squ. prv. - (3), 10 (1), 11 (2); lateral line totals: upper - (2), 12 (1), 13 (1), 14 (2), including 2-4 terminal pores and plus 1-2 subserial pores in paratypes, lower - (3), 6 (1), 7 (1), 8 (1), including 1-6 pores anteriorly and plus a pore on caudal-fin base in 2 paratypes; 3 scale series on cheek in all; squ. op. - (3), 13 (2), 14 (1); squ. sop., in single series, - (2), 4 (1), 5 (3); squ. iop. 1 (1), 2 (3), 3 (2).

Fins. Dorsal-fin spines increasing in length to 5th from which equal although last slightly longer; lappets long and pointed from 2nd, increasing in length to 4th, which about 2 1/2 times length of spine, posteriorly gradually shorter; 4th and 5th lappets reaching to end of spinous dorsal-fin base. Soft dorsal fin pointed, reaching to hind edge of caudalfin. Soft anal fin with tip broken off, but still reaching beyond middle of caudal fin. Caudal-fin lower hind corner damaged, middle of edge truncate, upper corner with long streamer formed by rays D4 and D5, latter longest. Pectoral fin rounded, reaching to above anal-fin origin. Pelvic fin pointed; filamentous extension of first ray reaching to middle of caudal peduncle. Paratypes with short. round-tipped dorsal-fin lappets, anterior only slightly longer than posterior; soft dorsal and anal fin rounded, reaching little beyond caudal-fin base; caudal fin subtruncate; pelvic fin pointed, reaching to anal-fin origin. D. XVI.6 (3), XVI.7 (3); A. III.6 (4), III.7 (2); P. 11 (1), 12 (5).

Teeth. 30/27 teeth in upper/lower jaw outer hemiseries; in upper 1 or 2 irregular inner series anteriorly, 3 regular inner series posteriorly; in lower 2 inner series anteriorly; all teeth simple, conical, recurved, anterior strong, inner anterior particularly strongly recurved with distal portions horizontal. Dentition similar in paratypes except that teeth not as strongly recurved and posterior 1/3 of upper jaw edentulous.

Cephalic lateralis pores as in *A. cacatuoides*, but second from anteriormost frontal lateralis pore missing in holotype.

Gill-rakers. 1 (5), 2 (1) external first ceratobranchial rakers; 10 (1), 11 (1), 12 (2), 13 (2) rakers on lower pharyngeal tooth-plate.

Vertebrae. 12+12 in holotype.

Colouration. Ground colour yellowish, shaded with brownish on dorsal sides; cheek yellowish, operculum brownish; sub-, pre- and interoperculum,

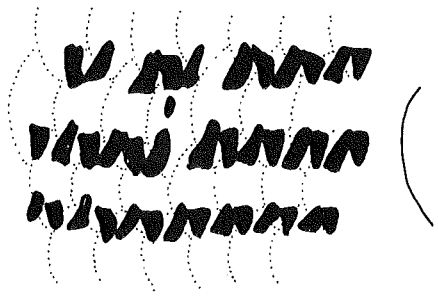


Figure 60. Abdominal markings anteriorly on lower sides in male *Apistogramma juruensis*, ZUEC 1374, holotype. Dotted lines are scale outline; broad line to the right marks position of pectoral axilla.

Table 15. *Morphometry of* Apistogramma juruensis. *Measurements are in mm, except range and mean which are in per cent of SL.*

							Range	$\bar{x}$
SL	19.6	20.0	21.0	23.3	24.3	41.3		
Head length	6.7	6.6	7.1	7.7	8.1	13.6	32.9-34.2	33.4
Head depth	5.5	5.7	5.8	6.2	6.7	12.4	26.6-30.0	28.1
Body depth	6.8	6.8	7.2	7.4	8.2	15.2	31.8-36.8	34.2
Predorsal length	7.4	7.7	7.9	8.6	8.6	15.1	35.4-38.5	37.1
Prepelvic length	8.5	8.2	8.7	9.3	10.0	17.1	39.9-43.4	41.4
Orbital diameter	2.6	2.5	2.5	2.9	3.0	4.9	11.9-13.3	12.4
Snout length	1.1	1.0	1.1	1.4	1.4	3.1	5.0- 7.5	5.9
Cheek depth	1.2	1.3	1.4	1.4	1.6	3.7	6.0- 9.0	6.8
Head width	3.4	3.5	3.7	4.1	4.4	7.5	17.3-18.2	17.7
Interorbital width	1.4	1.5	1.7	1.9	2.0	4.4	7.1-10.7	8.3
Preorbital depth	0.4	0.5	0.5	0.7	0.6	1.2	2.0- 3.0	2.6
Upper jaw length	1.8	1.9	1.9	2.3	2.5	6.3	9.0-15.3	10.5
Lower jaw length	2.7	2.6	2.8	3.1	3.4	7.0	13.0-16.9	14.1
Caudal peduncle depth	3.0	3.0	3.3	3.8	3.7	7.0	15.0-16.9	15.7
Caudal peduncle length	2.9	2.7	2.8	2.8	3.1	5.1	12.0-14.8	13.1
Dorsal-fin base length	10.9	11.4	12.0	14.2	14.5	25.2	55.6-61.0	58.6
Anal-fin base length	3.3	3.7	3.9	4.4	4.9	8.5	16.8-20.6	18.9
Pectoral-fin length	6.0	5.8	6.2	---	---	13.5	29.0-32.7	30.5
Pelvic-fin spine length	3.0	2.6	2.9	3.3	3.4	5.9	13.0-15.3	14.1
Pelvic-fin length	6.0	5.8	6.1	6.2	7.5	21.8	26.6-52.8	33.2
Last dorsal-fin spine length	3.2	3.0	3.2	3.8	4.4	8.1	15.0-19.6	16.8
Last anal-fin spine length	3.5	3.5	3.8	4.1	4.4	7.4	17.5-18.1	17.9
Sex	♂	♀	♀	♀	♂	♂		

preorbital, snout, lips, forehead and branchiostegal membrane grey. Scales of dorsal sides with faint dark margin. Faint blackish preorbital stripe. Dark brown suborbital stripe of about pupil width from between posterior two infraorbital pores across cheek and lower part of vertical limb of preoperculum, blackish on anterior limb of suboperculum, ventral tip of operulum and border regions of sub- and interopercula. 3 indistinct brownish stripes across forehead, anterior between nostril, two posterior between orbits. Superorbital stripe dark brown, obliquely dorsad to near nape midline. Narrow, faint postorbital stripe. Blackish chin spot.

Faint, brownish lateral band, *c.* 1 scale deep, with sharp lower margin, upper margin uneven as band confluent with vertical bars, which of same colour; on and above level of lower lateral line, ending on middle of caudal peduncle. Vertical bars 1-6 apparent, intensified close to dorsal-fin base; reaching ventrally to operculum (Bar 1) or lateral band. Lateral spot on right side only, small, roundish. Dark brown dorsal pectoral spot. 3 distinct and 1 ventral rudimentary dark brown abdominal stripes made up of triangular or rectangular spots on upper and lower 1/3 of scales (fig. 63); dorsalmost ending above soft anal-fin base, 2 stripes below from pectoral axilla converging on caudal peduncle, 4th below pectoral axilla between verticals from pelvic and anal-fin origins.

Dorsal-fin anterior 2 membranes blackish; otherwise smoky, produced lappets white; traces of clear dots on basal soft portion. Caudal fin with roundish midbasal brownish spot, yellowish dorsally and ventrally; rest of fin faintly patterned by 10 narrow alternating clear and light vertical dot stripes, which not extending to dorsal or ventral margins of fin. Anal fin clear, duskied marginally, with about 8 dot stripes on soft portion similar to those on caudal fin. Pelvic fin clear, rays faintly brownish, outer membranes brown, edge and filament white.

ZUEC paratypes (1 male, 2 females) similar to holotype but vertical bars not as distinct, lateral band better expressed although not sharp; lateral spot more or less distinct; stripes on forehead not evident; one female with dark dot anterior and posterior to vent. Abdominal stripes not or only indicated beyond level of anal-fin origin; in male composed of dark spot on upper 2/3 of scales, in females spot on middle 1/3 of scales. Dorsal fin smoky, base of each lappet slightly darker; lower edge of anal fin dark; caudal spot roundish, caudal fin otherwise with indistinct pattern of dark and clear dots; pelvic fin with outer 2 membranes blackish, edge white.

MZUSP paratypes (male and female): Male with zig-zag abdominal stripes as in holotype; other flank markings not satisfactorily preserved due to considerable loss of scales. Caudal fin base greyish basally, sligthly distally a wide vertical stripe of rosy colour and 2 greyish stripes but much of distal part of fin lost. Dorsal fin rosy basally, soft portion rosy with a few clear dots and duskied tip; anal fin like dorsal fin plus wide blackish lower seam. No midventral stripe. Pelvic fin marginally grey, inwardly rosy to hyaline. Female with anterior half of trunk badly damaged; abdominal stripes anteriorly of roundish spots, posteriorly more elongate, on scale centres; lateral band relatively distinct. Blackish spot posterior to genital papilla; blackish midventral stripe halfway to pelvic-fin bases. Fins as in male except that pelvic fin outer 2 membranes blackish, rest hyaline, and caudal fin (intact) with 4 broad vertical bars that dusky with some rosy.

Distribution (fig. 54)
Known only from the upper R. Juruá system, at Cruzeiro do Sul and Tarauacá.

Etymology
Named for the R. Juruá, in the drainage basin of which is the type locality.

Notes
The material on which the above description is based, was first identified as *A. cacatuoides*, but as the lateral band in the numerous specimens avail-

able of that species is always continuous with the caudal spot, its anterior termination in the Juruá material apparently constitutes a consistent difference hypothesized to be a species-level difference. In *A. cacatuoides* the lateral band is also intensely pigmented and contrasted against remaining flank pigment. These differences hold also in comparison with faded *A. cacatuoides*. As the material currently available of *A. juruensis* is limited, it remains a possibility that the caudal-fin pattern of adult males distinguish the species: most adult male *A. cacatuoides* have one or more ocelli dorsally on the caudal fin, and the striped pattern is obsolete or less regular than in the holotype of *A. juruensis*. Otherwise the two species appear identical.

The distinct caudal spot is shared with *A. luelingi* and as it is a common marking among *Apistogramma* species, the contiguity with the lateral band in *A. cacatuoides* may be considered an autapomorphy of that species within the *cacatuoides* group. The elaborate zig-zag abdominal stripes of *A. cacatuoides* and *A. juruensis* is, however, a synapomorphy of these species. The abdominal stripes of *A. luelingi* resemble those of other species of *Apistogramma* (cf., eg. Pl. XVII, fig. 3, of *A. urteagai*), but may also be regarded as an autapomorphy of *A. luelingi*.

Apistogramma cacatuoides Hoedeman

Figs 54, 61-63, Pl. XIX (figs 3-4)

Apistogramma cacatuoides Hoedeman 1951, p. 1 (descr.; habits; relationships; type loc.: near Paramaribo (Dutch Guiana) /erroneous/), Fig. p. 3 (sketch of holotype).

Bibliography

Apistogramma cacatuoides; Kullander 1980*a*, p. 83 (descr.; diagnosis; bibliogr.; distr.; ecology; restriction of type loc.: R. Amazonas basin, between 69° and 71°W; locs: Colombia (Amazonas), Isla Santa Sofia, isolated pool (3°58'S 70°10'W); Peru (Loreto), R. Yavari, Lago Matamata, caño (4°12'S 70°17'W); Peru (Loreto), R. Yavari, Caño Pirana (?4°12'S 70°17'W); Peru (Huanuco), logging road R. Pachitea-Tournavista, pool (c. 8° 50'S 74° 36'W)), Tab. 9 (counts and measurements), pp. 12, 18, 25, 26, 27, 29, 33, 34, 36, 39, 42, 43, 50, 71, 95, 102, 143 (notes and listings), Figs 5-6 (monochrome microphotos, epibranchial lobe). -- de Rham & Kullander 1983, p. 102 (record: zone du Supay). -- Seegers 1983, p. 74 (listed; bach zwischen den Flüssen Rio Chipiria und Amaquiria). -- Vierke 1983*c*, pp. 293, 296 (listed; Chicosa, Yarina Cocha, habitat data), Bild 3 (monochrome photo; living specimen; Chicosa). -- Linke & Staeck 1984, p. 40 (popular account; distinguishing characters; habitats: Umgebung der Stadt Pucallpa; Gebiet von Chicosa), Figs pp. 40, 42 (colour photos of adult males).

Apistogramma borelli; (*pt.*) Klee 1965, p. 424 (listed; pool... alongside of a logging road connecting the Pachitea river and Tournavista; habitat data).

Material

156 specimens, 11.2-50.3 mm SL, including type series of *A. cacatuoides*.

Description

The description in Kullander (1980*a*) is still valid, although based on much less material than is now available. Shape and colour pattern are illustrated by representative specimens on Pl. XIX, figs 3-4. The largest specimen available is a male, 50.3 mm SL; the largest female 31.3 mm SL.

Males over 30 mm SL and occasionally smaller males with all dorsal-fin lappets much produced, especially the 3rd and 4th, which may reach caudad to end of dorsal-fin base. Large males also with produced rays D4+D5 and V4 in caudal fin forming streamers; caudal fin of females truncate or slightly emarginate.

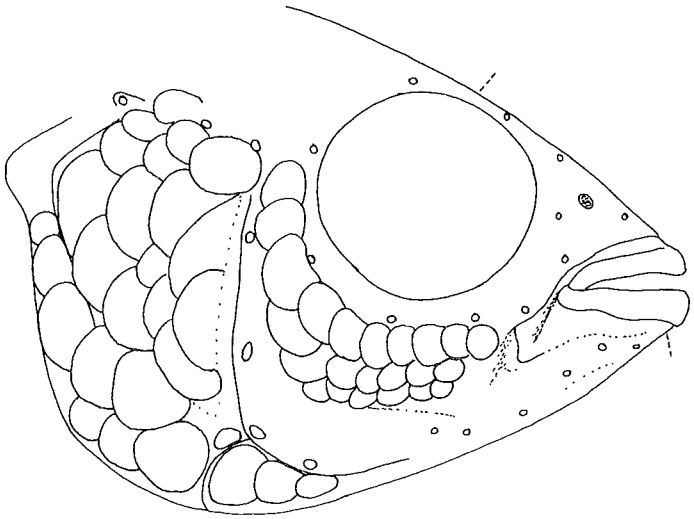


Figure 61. Distribution of cephalic lateralis pores and head side scales in *Apistogramma cacatuoides*, MHNG 2233.40, 23.2 mm SL. Pores out of view indicated by dash-lines.

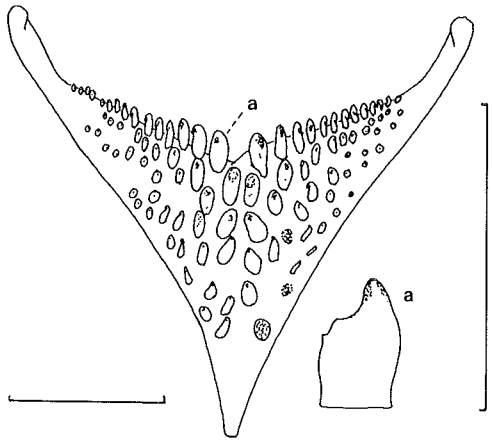


Figure 62. Lower pharyngeal tooth-plate in occlusal view and posterior tooth (a) in medial aspect of *Apistogramma cacatuoides*, NRM TH0/1971366.3175 32.3 mm SL. Scales 1 mm.

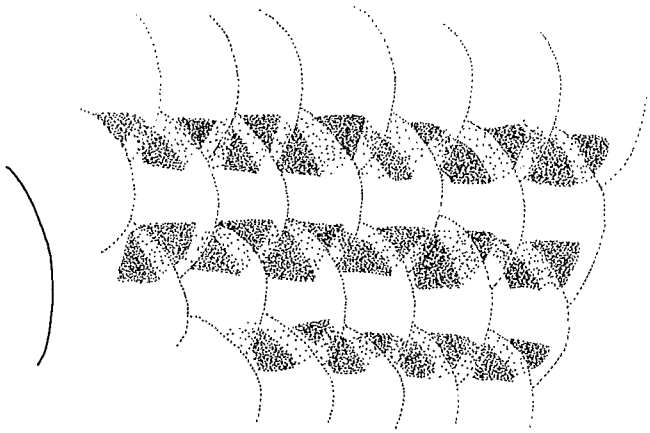


Figure 63. Abdominal markings anteriorly on lower sides in male *Apistogramma cacatuoides*, MHNG 2233.39, 30.0 mm SL. Dotted lines are scale outlines; broad line to the left marks position of pectoral axilla.

Lateral band, anteriorly 1 scale wide, posteriorly widened to cover 1 1/2 to 2 scales, always contiguous with round midbasal caudal spot which not distinguishable as such. Pectoral spot present. Sexual dimorphism in abdominal stripes: In males upper and lower 1/3 of abdominal side scales dark, distal margin of each scale colourless; generally 3 zig-zag stripes distinct, the dorsal running to lateral band, the 2 ventral to caudal peduncle. In females a round or elongate spot on centre of abdominal side scales, and only 2 stripes distinct, both from pectoral axilla to cadal peduncle. Males may show a faint midventral stripe; dark spot between genital papilla and anal fin more intensely pigmented in females than in males. Males usually with 1-7 clear ocelli in dorsal lobe of caudal fin.

Counts from 29 specimens from different localities covering the range of the species are: squ. long. 21 (4), 22 (24), 23 (1); cheek scale series 2 (4), 3 (21), 4 (4); D. XV.6 (1), XV.7 (6), XV.8 (2), XVI.6 (16), XVI.7 (4), A. III.6 (15), III.7 (14); gill-rakers 0 (1), 1 (17), 2 (11). 12-15 rakers on lower pharyngeal tooth-plate in 7 specimens examined for this character. Only one specimen in addition to material described in 1980 noted to have the preoperculum serrated (NRM A84/19833422.3013). 9 specimens radiographed with 12+11 (1) or 12+12 (8) vertebrae.

Cephalic lateralis pores as in *A. luelingi*; fig. 61. Lower pharyngeal tooth-plate shown in fig. 62; anterior teeth subconical, posterior compressed, medioposterior with anterior shoulder, at least the larger with a minor third projection on rostral edge, posterolateral teeth slender and bicuspid.

Distribution (fig. 54)
Collections are relatively well distributed along the R. Ucayali from the Pachitea to the Supay system near Jenaro Herrera, and further along the R. Amazonas to Tabatinga. Linke & Staeck (1984) reported the species from Chicosa on the upper Ucayali, but did not preserve any specimens. Yavarí and Samiria material comes from close to other localities.

Ecology
Apistogramma cacatuoides is collected mainly in white or clear water, occasionally together with *A. agassizii* and *A. eunotus*. Near Pebas a single specimen was obtained in a gramalotal along the bank of a slow-flowing sacarita with turbid water (SOK 27bis). Label data of NRM A84/1983422.3013 indicate a clear water creek with dead leaves and clay, pH 6.6, temperature 27 °C. The quebradas in the Supay system (de Rham Stas 21a, 26, 13, R.36) are within an inundation area; their waters are clear, with pH about neutral. The aquajal pool, SOK 30, however, had acid, tea brown, slightly turbid water. Other collectors have reported high pH values for *A. cacatuoides* localities (Linke & Staeck 1984, p. 41: 7-8; and Klee 1965, also cited in Kullander 1980*a*: 6.5-6.8).

Notes
Apistogramma cacatuoides is most closely related to *A. juruensis* and *A. luelingi* (see pp. 177 and 181).

The holotype was re-examined for this paper. I find it shorter than I measured it earlier (Kullander 1980*a*: 38.5 mm, now 37.9 mm). It still has the unusual dorsal-fin count XV.6, but obviously only a single first ceratobranchial gill-raker (not 3 as given earlier; or 13 as given by Hoedeman and likely taken from the second arch). The species was described originally as coming from Surinam; see Kullander (1980*a*) and Kullander *et al.* (1986) for correction of locality.

mm), both males and females with shorter fins: dorsal-fin lappets not reaching much beyond spine tips, anterior pointed, posterior subtruncate; pelvic fin with little produced first ray, reaching slightly beyond anal-fin origin; soft dorsal and anal fins rounded to moderately pointed, reaching to 1/3 of caudal fin or shorter.

Cephalic lateralis pores (fig. 64). Full number except for only 3 infraorbital pores.

Gill-rakers. 1 (3), 2 (7) minute external first ceratobranchial rakers; 12 (1), 13 (4), 14 (1), 15 (4) rakers on lower pharyngeal tooth-plate.

Jaw teeth. 22-30/23-29 in upper/lower jaw outer hemiseries teeth in 10 measured specimens. Pointed, recurved unicuspids; long outer series reaching posteriorly to jaw ends; 2-3 inner series anteriorly in lower jaw, except in 2 largest specimens in which one inner series also reaching to jaw end and also inner teeth except symphysially slightly larger than outer. In upper jaw one (2 in holotype) long inner series to jaw end, where extraserial teeth may occur; anteriorly 1-2, rarely 3, inner short series; inner teeth appearing slightly larger than outer in 2 largest specimens.

Vertebrae. 12+12 in holotype and topoparatype.

Colouration. Holotype (male): Ground colour greyish white on chest and belly, countershaded to pale brownish on lower sides to brown along back. Operculum and suboperculum greyish brown. Cheek brownish dorsally turning yellowish-whitish ventrally. Lips, lower jaw, horizontal limb of preoperculum, interoperculum, lateral portion of branchiostegal membrane light greyish. Forehead and preorbital grey brown. Intermandibular area dirty yellowish. Ventral portion of branchiostegal membrane blackish. Preorbital stripe black, hardly distinguishable from dark snout. Dark brown suborbital stripe of about pupil width, from anterior half of second infraorbital slightly curved, passing between posterior corner pore and lower vertical limb pore of preoperculum onto suboperculum and only little on interoperculum. Black spot on chin. Black superorbital stripe between 2nd and 3rd frontal pores (clf 3-4), disappearing in dark nape dorsally. Blackish brown postorbital stripe over dorsal edge of operculum.

On sides vertical bars (1-7) indistinct, brownish, reaching down to middle of side, intensified as dark brown spots close to dorsal-fin base and as dark dorsal margin of caudal peduncle. Indistinct brownish spot between lateral line origin and supracleithrum. No obvious lateral band, but discontinuity in countershading may be interpreted as such. Roundish-oval blackish lateral spot in Bar 3, covering 3 squ. long. scales, 2/3 of scales below, and slightly dorsad extended; similar, slightly fainter, more rounded spot behind, in Bar 4. A few scattered dark brown spots on scale bases/edges on lower half of caudal peduncle. Pectoral axilla pocket and some of adjacent side dorsally blackish. Dark brown spot between genital papilla and anal-fin origin; brown narrow midventral stripe from vent to pelvic fin bases.

Anterior 2 dorsal-fin lappets black, remainder of fin semitransparent, brownish, lappets slightly darker; soft portion immaculate, duskied. Anal fin duskied, with slightly darker ventral margin; immaculate. Caudal spot roundish, blackish, between rays D4 and V4; remainder of caudal fin duskied with wide hyaline inframarginal seam along tips of rays D8 to D3 and rays V7 to V3; distal margin black. Pelvic fin smoky, white outer edge of first ray.

Female topoparatype similar, but dark markings more intense. Suborbital stripe black, wide, from first infraorbital and anterior half or second infraorbital, straight onto gill-cover, where wider than in male. Branchiostegal membrane contrastingly brownish black between gill-covers. Chest blackish brown anterior to pelvic fins, light zone separating from dark branchiostegal membrane, and marginal to pelvic-fin spines. Intense black midventral stripe continuous with chest blotch, caudad onto anal fin; genital papilla + vent a contrasting white spot in stripe. Blackish brown band under pectoral axilla wider and more intense than in male and extending slightly more ventrad. Spots in Bars 3 and 4 as in male, of about equal intensity.

Anterior 2 dorsal-fin membranes black, rest of fin dusky, lappets with

narrow black dorsal margin; soft portion with large hyaline spots which dominating distally. First membrane and 2nd lappet of anal fin black, 3rd lappet and ventral edge of fin blackish; rest of anal fin dusky with hyaline and darker dots on last 3 membranes. Caudal spot black, rest of fin as in male but marginal stripes not as contrasted. Pelvic fin white with black anterior band occupying spine, first 2 membranes and base of 3rd membrane.

The MCZ specimens are all strongly faded, the smaller specimens virtually without pigment. The roundish Bar 3 spot is still present, however, and particularly strong in females. Females, besides the lateral spot, have retained the intense black markings of the female topoparatype, like sub- and superorbital stripes, branchiostegal membrane, band under pectoral axilla, chest blotch, midventral stripe and anterior 2 dorsal-fin membranes. The caudal spot is retained as a trace in 3 of the specimens.

Distribution (fig. 54)
Only 2 localities known, both in the R. Payamino drainage in Ecuador.

Ecology
Information on the type locality is provided by D.J. Stewart (*in litt.*, 21 Dec 1985): 'Water temperature 22.5°C, pH 6.4, stream width 8-10 m, current slow in backwater where *Apistogramma* collected to swift in midstream, depth 0.5 to 1.0 m, substrate large rocks, bedrock, logs and some silty sand in backwaters, water transparent to over 0.5 m, shore with undisturbed rainforest.' The two specimens from the type locality have a pronounced starved appearance.

Notes
The discovery of *A. payaminonis* apparently solves the problem of the closer relationships of *A. nijsseni*, addressed without solution by de Rham & Kullander (1983). These two species are unique among *Apistogramma* species in lacking a lateral band (may be shown very vaguely by living individuals, though). The caudal-fin colour pattern, particularly the distal light inframarginal band is highly distinctive, although a similar pattern is shown by *A. agassizii*. Sex dichromatism is similar in the two species, although *A. payaminonis* females do not have the much expanded cheek stripe and lateral spot of *A. nijsseni* females, which instead lack the chest blotch and pectoral axilla-pocket marking of *A. payaminonis*.

Body and fin shape, squamation, dentition, lateralis system and colouration is largely in agreement. *Apistogramma payaminonis*, however, has the stouter head shape of *A. cacatuoides*. Males of *A. payaminonis* obviously develop longer dorsal-fin lappets, although not as elongated as in *A. cacatuoides*. The caudal fin of *A. payaminonis* is subtruncate rather than rounded. Short soft dorsal and anal fins is characteristic of both *A. nijsseni* and *A. payaminonis*. In addition to colour differences mentioned earlier, the two lateral spots in *A. payaminonis*, unique to that species, may distinguish from *A. nijsseni*, but since no trace of the posterior spot is present in the MCZ specimens (which strongly faded) the constancy of posterior spot is open to doubt. A living adult female (collected near Coca) observed alive in aquarium had only the principal lateral spot (I. Koslowski, *in litt.*, Jan 1986).

Apistogramma payaminonis and *A. nijsseni* share with *A. cacatuoides*, *A. luelingi* and *A. juruensis* a reduced number of infraorbital foramina. The stout head shape of *A. payaminonis* males, greatly resembling that characteristic of *A. cacatuoides* and *A. juruensis*, and the moderately produced dorsal-fin lappets of males of *A. payaminonis* indicate that the closest relatives of the *A. payaminonis*+*A. nijsseni* species pair may be in the *cacatuoides* group. Such extensive relationship hypotheses in this genus need a firmer backing in anatomical studies, however.

The dark chest blotch of female *A. payaminonis* is shared with the *A. macmasteri* species group in the Orinoco basin (Kullander 1979*b*,

1980*a*). The finnage of males in the *macmasteri* group resembles that of *A. payaminonis*, with roundish caudal fin and produced dorsal-fin lappets. The *macmasteri* group species, however, have 4 instead of 3 infraorbital lateralis pores.

Apistogramma nijsseni Kullander
Fig. 54, Pl. XX (figs 3-4)

Apistogramma nijsseni Kullander 1979*a*, p. 938 (descr.; diagn.; distr.; relationships; locs: Peru (Loreto), R. Ucayali system, Jenaro Herrera, R. Copal, "marigots des Tupacs" (type loc.)), Fig. 1 (monochrome photo of holotype), Fig. 2 (sketch, cheek squamation), Fig. 3 (sketch, lower pharyngeal tooth-plate), Figs 4-5 (sketches, colour pattern).

Bibliography
Apistogramma nijsseni; de Rham & Kullander 1983, p. 97 (descr.; distr.; relationships; ecology; aquaristics; discovery; locs: /topotypes; sites along road Jenaro Herrera-Colonia Angamos from Km 13 to Q. Carahuayte/), Figs 1-7 (colour photos of living specimens), Fig. 8 (colour photo of type loc.).

Material
35 wild specimens, 15.0-39.2 mm SL, including type series.

Description
Detailed descriptions were given by Kullander (1979*a*; females only) and de Rham & Kullander (1983; both sexes, with colour photos).

Apistogramma nijsseni is a moderately deep-bodied species, reaching 39.2 (males) and 30.7 (females) mm SL, with short dorsal-fin lappets and clearly rounded caudal fin. No lateral band is evident at any size, but roundish lateral and caudal spots are well evident. In females, the suborbital stripe, lateral spot and caudal spot are greatly expanded; the suborbital stripe may cover all of the cheek and gill-cover. Counts: D. XV.7 (2), XV.8 (4), XVI.- (1), XVI.6 (1), XVI.7 (16), XVII.6 (1); A. III.- (1), III.6 (1), III.6i (1), III.7 (22); squ. long. 22 (20), 23 (1), - (4); cheek scale series 2 (8), 3 (9), 4 (8) (de Rham & Kullander 1983); gill-rakers 1 (10), 2 (4) (Table I material in de Rham & Kullander 1983). Cephalic lateralis pores as in *A. cacatuoides*, 3 infraorbital and 5 dentary. Anteroventral half of cheek naked. Simple (anteriorly) and bicuspid (posteriorly) lower pharyngeal teeth.

Distribution (fig. 54)
Known only from quebraditas along the road from Jenaro Herrera towards Colonia Angamos, from km 13 to the Quebrada Carahuayte; all those streams eventually drain into the Q. Carahuayte.

Ecology
Described and discussed at length by de Rham & Kullander (1983); Linke & Staeck (1984) have similar data. The shadowed quebraditas in which the species occur carry clear, tea-brown water, with a pH of 5.0-5.6, hardness less than 1 °dGH, temperatures 24.5-27.5 °C, conductivity 3-14 µS (*opp.cit.* and SOK 77), O_2 saturation 39% (SOK 77, after rain) or 79.5% (SOK 43). At some stations the species was taken together with *A. agassizii* or *A. eunotus*.

Notes
Apistogramma nijsseni appears to be most closely related to *A. payaminonis* (*q.v.*).

Apistogramma agassizii (Steindachner)
Figs 65-67, Pl. XXI (figs 1-2)

Geophagus (Mesops) Agassizii (pt.) Steindachner 1875, p. 111 (diagn.; descr.; Curupira; Cuadajas; Rio Puty; Lago Maximo; See Manacapuru), Pl. VIII, fig. 2 (sketch; habitus, scale, dorsal aspect of head).

Peruvian bibliography
Apistogramma agassizii; Kullander 1979*a*, p. 943 (listed; Jenaro Herrera, R. Copal, "marigots des Tupacs"; comp. w. *A. nijsseni*). -- Kullander 1980*a*, p.89 (descr.; diagn.; bibliogr.; distr.; ecology; relationships; lectotype designation; locs: Colombia (Amazonas), R. Pichuna (appr. 4°S 70°W); Peru (Loreto), R. Yavari, Caño Pirana (?4°12'S 70°17'W); Peru (Loreto), R. Yavari, Lago Matamata, caño estero (4°12'S 70°17'W); Peru (Loreto), Pau-Mari, Caño "Buraco da Lucia" (4°12'S 70°17'W); Peru (Loreto), Pau-Mari, Lago Guariba, caño (4°12'S 70°17'W) /+ Brazilian material/), pp. 7, 8, 9, 13, 14, 15, 19, 20, 25, 26, 28, 29, 33, 34, 39, 40, 41, 43, 49, 75, 88, 101, 102, 104, 105, 115, 118, 131 (notes, including Brazilian material). -- de Rham & Kullander 1983, p. 102 (distr.; Jenaro Herrera).

Material
445 specimens, 8.9-40.9 mm SL, from Peru and adjacent Brazil and Colombia.

Description
The description in Kullander (1980*a*), based chiefly on Brazilian material, is valid also for Peruvian material. The largest Peruvian specimen is a male, 40.9 mm SL; the largest female is 29.9 mm SL.

Adult males are distinguished by the long pointed caudal fin; dorsal-fin lappets short, soft dorsal and anal fins long, with filamentous extensions to at most end of caudal-fin; pelvic fin pointed, with long filament.

The colour pattern includes a wide lateral band continued onto caudal fin, a lateral spot often masked by the band and, commonly, faint abdominal stripes. In adult males the lateral band is extended to the end of the caudal fin, which is bordered by a wide black seam and white inframarginal stripe, the remainder dusky or clear (usually yellow or reddish in life); in females the caudal fin is narrowly black-seamed and the band fading out in dark dotting on middle inner 2/3 of fin.

Counts taken for this paper from 50-58 Peruvian specimens are: D. XV.7 (4), XV.8 (1), XVI.6 (9), XVI.7 (40), XVI.8 (1), XVI.6 (3). A. III.6 (53), III.6i (1), III.7 (4). Squ. long. 22 (7), 23 (38), - (5). Cheek scale series 1 (3, juvs), 2 (26), 3 (21). Gill-rakers 0 (1), 1 (29), 2 (13), 3 (1), - (6).

Cephalic lateralis pores as in fig. 65; 4th from rostralmost dentary pore absent. Lower pharyngeal tooth-plate (fig. 66) anteriorly with subconical, posteromedially tricuspid and posterolaterally bicuspid teeth.

Distribution (fig. 67)
Collected in the Ucayali-Amazonas system near Jenaro Herrera, Iquitos, Pebas, and Leticia; in the Yavarí near the mouth and near Colonia Angamos. In Brazil the species is recorded from many localities along the Solimões and Amazonas east to Santarém; marginally from R. Machado on the upper Madeira (MZUSP 28222).

Ecology
Apistogramma agassizii is widespread in the Amazon basin, and has been collected in many different biotopes in clear, black and white water. In Peru it is regularly taken in forest quebradas, but also obtained in a gramalotal (SOK 27a) and in aquajales (SOK 50; SOK 42, 82 have aguajal character).

Apistogamma agassizii is commonly collected together with one or more of the other Peruvian *Apistogramma* species, *A. eunotus*, *A. cacatuoides* and *A. nijsseni*, but rarely with *A. bitaeniata*. It seems that in Peru,

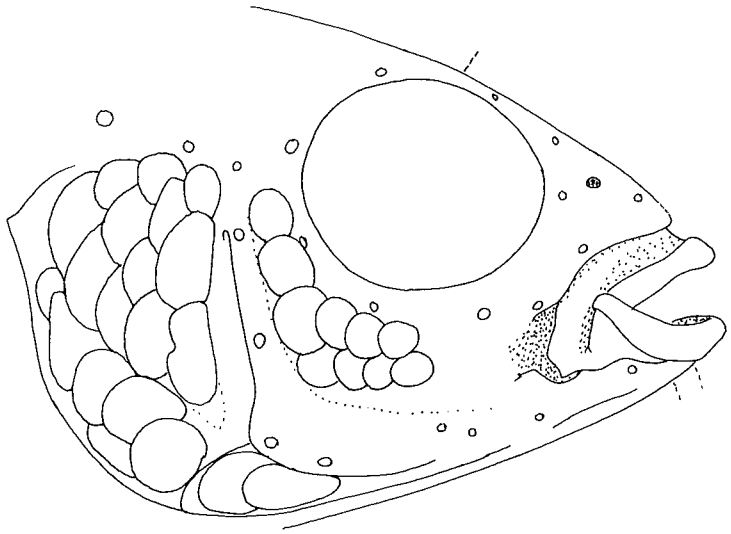


Figure 65. Outline of head of *Apistogramma agassizii*, NRM SOK/1983355.3759 24.6 mm SL, to show scale pattern and cephalic lateralis pores; pores out of view indicated by dotted lines.

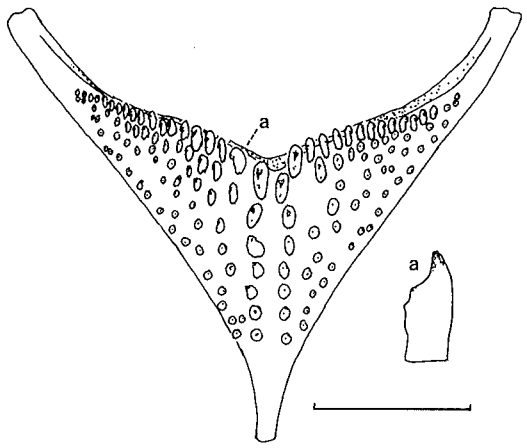


Figure 66. Lower pharyngeal tooth-plate in occlusal view and posterior tooth (a) in medial aspect of *Apistogramma agassizii*, NRM SOK/1983353.3757, 36.7 mm SL. Scale 1 mm.

A. agassizii and *A. bitaeniata* are mutually exclusive. The latter occupies black-water areas such as the Nanay and Mazán. As *A. agassizii* is taken in apparently similar habitats elsewhere, as in the Gálvez and Carahuayte, the segregation may have a historical rather than physico-chemical background. The only site where I found *A. bitaeniata* and *A. agassizii* together was SOK 50, a human-influenced portion of a small tributary to the Nanay. Other material of *A. bitaeniata* and *A. agassizii* may carry the same locality data, but it is not known whether the two species were collected in association.

Notes
Apistogramma agassizii and *A. bitaeniata* are very similar; see description of *A. bitaeniata* for distinguishing characters.

Apistogramma bitaeniata Pellegrin
Fig 67, Pl. XXI (figs 3-4)

Synonymy
Apistogramma pertense var. *bitaeniata* Pellegrin 1936, p. 57 (descr.; Rio Madeira (Brésil)).
Apistogramma sweglesi Meinken 1961*a*, p. 136 (descr.; relationships; Letitia in Peru /=Leticia, Colombia/, figs p. 137, upper (sketch, habitus), 137, lower (scale, sketch).
Apistogramma klausewitzi Meinken 1962, p. 138 (descr.; diagn.; relationships; type-loc. Brasilien, oberer Rio Solimoes, Igarapé Preto), Abb. 1 (sketch, holotype, habitus), Abb. 2 (sketch, female paratype, habitus), Abb. 3 (sketch, lateralis pores /grossly incorrect/), p. 141 (in synopsis of *Apistogramma* species).
Apistogramma kleei Meinken 1964, p. 293 (descr.; diagn.; distr.; type-loc. /inferred/ mittleren oder...nördlichen Teil des oberen Amazonas (Peru?)), 3 figs p. 295 (female paratype, male holotype /?/, sketches, habitus; sketch, head pores /grossly incorrect/).

Bibliography
Apistogramma sweglesi; Meinken 1961*b*, p. 192 (correction of error in Meinken 1961*a*). -- Meinken 1962, pp. 138, 140 (related to *A. klausewitzi*), p.141 (in synopsis of *Apistogramma* species). -- Meinken 1964, p. 293 (related to *A. kleei*). -- Kullander 1979*a*, p. 944 (compared with *A. nijsseni*). -- Kullander 1980*a*, p.144 (types probably lost), pp. 13, 18, 24, 25, 50, 102 (notes).
Apistogramma pertense bitaeniata; Blanc 1962, p. 203 (syntypes listed).
Apistogramma klausewitzi; Meinken 1964, p.293 (related to *A. kleei*).
Apistogramma bitaeniata; Kullander 1979*a*, p. 944 (comparison with *A. nijsseni*). -- Kullander 1980*a*, p. 97 (descr.; diagn.; bibliogr.; etymol.; distr.; ecol.; relationships; *A. kleei* and *A. klausewitzi* synonyms; locs: /Brazilian/; type loc. emended to Colombia (Amazonas), environments of Leticia), pp. 11, 13, 18, 24, 25, 26, 29, 33, 34, 43, 49, 95, 96, 105, 120, 144 (notes). -- de Rham & Kullander 1983, p. 102 (distr.; environs d'Iquitos).

Material
319 specimens, 9.8-46.5 mm SL, including type material of *A. bitaeniata*, *A. kleei* and *A. klausewitzi*.

Description
The description in Kullander (1980*a*) is valid also for Peruvian material, and only some comments and supplementary data are given here.

The largest wild specimen is a 36.7 mm SL male; the largest wild female 28.9 mm SL. The species grows larger in aquaria, as exemplified by the holo-

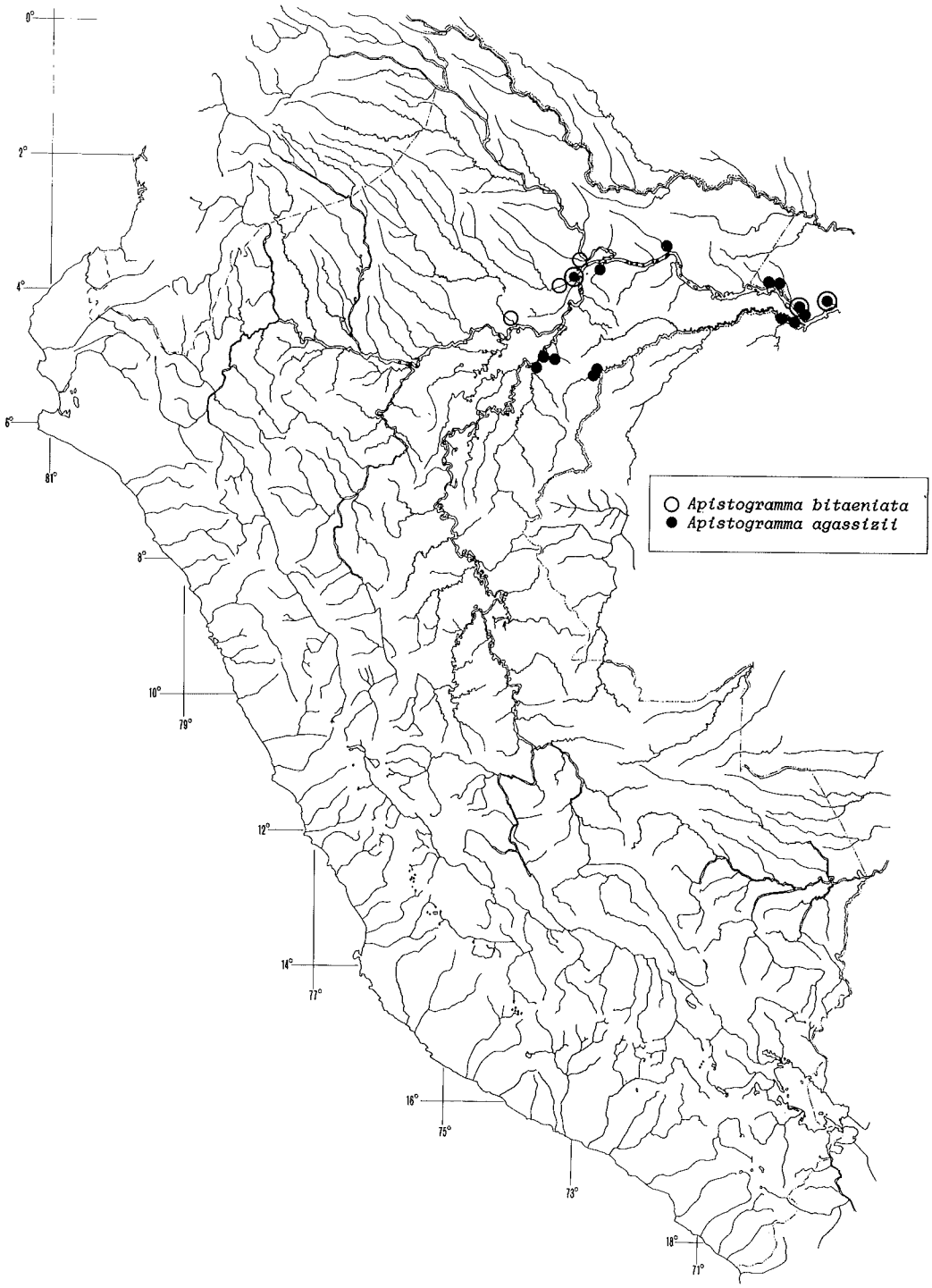


Figure 67. Collecting localities of *Apistogramma bitaeniata* and *A. agassizii* in western Amazonia. A symbol may represent more than one, adjacent collecting sites.

type of *A. kleei*, a 46.5 mm SL male.

Elongate; adult males distinguished by produced anterior dorsal-fin lappets, lyreate caudal fin with long streamers, and produced tips of soft dorsal, anal and pelvic fins. Prominent lateral band from eye to caudal fin where continued by oblong caudal spot, lateral spot sometimes masked by band. Abdominal stripes more or less strong (see below).

Counts from 30 Peruvian specimens from different localities are: D. XV.7 (6), XV.8 (2), XVI.6 (5), XVI.7 (15), XVI.8 (1), XVII.7 (1); A. III.6 (25), III.7 (5); squ. long. 22 (1), 23 (25), 24 (3), 25 (1); cheek scale series 1 (2), 2 (22), 3 (6); gill-rakers 1 (19), 2 (8), 3 (13). The extreme counts D. XVII.7 and squ. long. 25 in the same specimen (NRM A84/1983423.3010, 20.0 mm SL). Preopercular serrations noted in 6 specimens. A 20.8 mm specimen (NRM SOK/1984325.3887) has the preoperculum scaled, a condition not otherwise recorded in the genus.

Produced dorsal-fin lappets are rare in males smaller than 30 mm SL, and may also be only incipient in those larger; the lyreate caudal-fin shape is generally evident in males about 25 mm. Also females, otherwise with subtruncate or truncate caudal fin, may show indications of streamers. Pharyngeal dentition and cephalic lateralis pores as in *A. agassizii*.

Life colours: Most colourful males from the Mazán (SOK 108) with numerous blue spots on head sides and bordering postorbital stripe. Sides light grey with deep black lateral bands. Pelvic fin brick red; dorsal fin basally black, then narrowly yellow, distally greyish except for orange produced lappets and tip of soft fin. Anal fin orange except wide grey lower edge. Marginal thirds of caudal fin orange, middle third hyaline with black spots. Females yellowish on lower head sides and snout, abdomen yellow; pelvic fin with black anterior margin, otherwise orange, anal and caudal fin as in males, though less intensely orange on caudal fin. Dorsal fin like males except that fin lower and thus yellow and grey zones equally wide, lappets orange posterior to black anterior spot, soft part hyaline; no blue spots on head. Collections from elsewhere were much less colourful.

Distribution (fig. 67)

Restricted to Peruvian and adjacent Brazilian black-water river systems, collected in the lower Nanay, Mazán, and Tigre in Peru, near Leticia in Colombia, in Igarapé Preto and Lago Tefé in Brazil.

Ecology

Apistogramma bitaeniata appears to be strictly a black-water species, although many samples lack habitat information. It is common in the Nanay and Mazán, where *Apistogramma* are otherwise rare and represented only by *A. eunotus* and *A. cruzi*. Collecting sites include quebradas, lake shores, sand playas and backwater pools. The large sample from the backwater pool, SOK 71, is notable for the starved appearance, whereas the Yuto Cocha sample consists of only trim fish, suggesting that shadowed slow flowing forest quebradas with clear black water may provide optimal conditions for the species. Generally, the fishes were associated with leaf litter.

Notes

Apistogramma bitaeniata is similar to *A. agassizii* in most respects, including body shape, dentition, squamation, lateralis pores of head, fin counts and colour pattern. Young and females of *A. bitaeniata* and *A. agassizii* may be difficult to distinguish, especially in the field. The character I have found most useful is the light spots that form in bar interspaces between the lateral band and the adjacent abdominal stripe in *A. bitaeniata*. Such spots are never seen in *A. agassizii*. The truncate or lyreate caudal fin of *A. bitaeniata* is contrasted to the rounded or pointed of *A. agassizii*.

The lateral band is slightly, but distinctly narrower in *A. bitaeniata*, covering squ. long. scales but only on caudal peduncle as much as half of

scales in series below; thus the caudal spot, slightly more ventral in position, appears more distinct in *A. bitaeniata* than in *A. agassizii* in which the lateral band occupies the greater portion of each squ. long. scale and more than half of scales below.

The faint abdominal stripes of young *A. bitaeniata* are comparable in appearance with those frequently seen in *A. agassizii*. In adult *A. bitaeniata*, however, the dorsalmost covers the entire scales, not only the middle in the horizontal series below that containing the lateral line, switching to the next ventral series on the caudal peduncle; in some specimens widened to occupy most of scales in the next ventral series anteriorly. Most of the material available of *A. bitaeniata* does not show this abdominal stripe as strongly as the lateral band; such an intense dorsalmost stripe is limited to adult Mazan material and one Leticia sample in the material surveyed for this paper but some Mazan specimens show it only faint as in, eg. all Nanay specimens. The Mazan material was taken during lowering but still high water conditions, whereas the Nanay localities are from low water, partly backwater pools, and living conditions may be reflected in the colouration. Mazan waters were clear and black, Nanay waters ranged into turbid. In living specimens the stripe is variably evident, probably under emotional control.

The type material of *A. sweglesi* is most likely lost. My conjecture (Kullander 1980*a*) that it is a synonym of *A. bitaeniata* is reinforced by the study of the large material of *A. bitaeniata* now available and observations on living aquarium specimens of that species. Aside from some obvious errors in Meinken's description (eg. 17 caudal-fin rays, 8 pelvic-fin rays), the description agrees with *A. bitaeniata*. Meinken does not mention the intense, wide abdominal stripe typical of *A. bitaeniata*, but stresses light zones bordering the lateral band, as is shown on his figure of an adult male, based on a colour photo of a living specimen. As living specimens generally do not show the abdominal stripe well, and it may be quite inconspicuous in preserved specimens, this is not a crucial feature. Given that the locality, Leticia, is correct, I do not hesitate to place *A. sweglesi* among Meinken's several synonyms of *A. bitaeniata*. The photo on which Meinken's figure was based is not available for examination (I Koslowski *in litt.*, Jan 1986).

The only other *Apistogramma* species showing some similarity to Meinken's figure of *A. sweglesi* is the undescribed species from the R. Negro in Brazil called Glanzbinden-*Apistogramma* in German aquarium literature (Linke & Staeck 1984). Males of this form have short dorsal-fin lappets, however.

Meinken himself (1962, 1964) has alluded to a close relationship and similarity between *A. sweglesi*, *A. kleei* and *A. klausewitzi*.

Previously, I have synonymized *A. kleei* and *A. klausewitzi*, both described by Meinken, with *A. bitaeniata* (Kullander 1980*a*). I had then seen only paratypes of *A. kleei*, but an examination more recently of the holotype confirms the synonymy. It is probably the male figured by Meinken but on the holotype the lateral band is characteristically continued on the caudal fin. The head pores are as typical for the species and not as shown by Meinken. The specimen is 46.5 mm SL, not 50.5 mm as given by Meinken; few of his counts and measurements are verifiable from the actual specimen.

Apistogrammoides Meinken

Apistogrammoides Meinken 1965, p.48 (type species *Apistogrammoides pucallpaensis* Meinken, by original designation).

A monotypic genus, similar to *Apistogramma* in most respects, including synapomorphous separate pores of adjacent preopercular and anguloarticular lateralis canal foramina, distinguished especially by long anal fin with 6-9 instead of 3 (4 rare, 5 or 6 exceptional), wider interorbital (11.9-14.1 %

of SL compared to not over 11.4 %), an indistinct band along dorsal side and unique caudal fin + caudal peduncle marking consisting in a triangular spot on caudal peduncle and 3 elongate contrasting spots on caudal fin base.

The single species, *A. pucallpaensis* was described from four specimens collected in a stream near Pucallpa. The specimens are in a very bad state of preservation, especially the holotype, which is virtually discolored and probably preserved after death in aquarium. The description below is based on fresh, wild material. Some comments on Meinken's description (Meinken 1965) of the types appear warranted, however. (1) Meinkens's anal-fin counts, A. VIII.5 in 3, VIII.6 in one, is not correct as three specimens have A. VII.6 (including holotype), and one has VIII.5. (2) Contrary to Meinken's assertion, the first epibranchial does bear a ventral lobe, although small. (3) The gill-rakers are small, not well-developed, and although counts uncertain (at least 2-3), much fewer than Meinken's 'more than a dozen'. (4) Oral teeth as illustrated by Meinken (Abb. 2) apparently include chiefly epithelial papillae. Most other descriptive data are likewise unverifiable, but those listed above are important as they were recognized as generic characters, and in part suggested that *Apistogrammoides* might be 'a transition from *Apistogramma* to *Cichlasoma*'.

Apistogrammoides pucallpaensis Meinken

Figs 34, 68-70, Pl. XXII (figs 1-2), Table 17

Apistogrammoides pucallpaensis Meinken 1965, p. 48 (diagn.; descr.; Bach kurz ausserhalb der Vorstadt von Pucallpa, Peru, der in den Ucayali mündet), Abb. 1 (sketches, male and female, habitus), Abb. 2 (sketch, dentition).

Bibliography

Apistogrammoides pucallpaensis; Klee 1965, p. 426 (listed; tributary (of the Ucayali river) which forms over a third of the boundary of the town of Pucallpa; habitat data). -- Linke 1986, p. 52 (life colours; habitat; Yarinacocha), figs pp. 52-53 (colour photos, habitus).

Material

69 specimens, 10.0-27.3 mm SL, including type series of the species, with locality data.

Description

From large male, 26.2 mm SL, with notes on variation; counts from 7 measured specimens or (D., A., squ. long.) 22 specimens; measurements in Table 17; refer to Pl. XXII, figs 1-2, for general aspect; data on types given above in the introduction to the genus.

Shape. Moderately elongate; head short and deep; snout wide, bluntly rounded. Orbit tangented by predorsal contour; interorbital nearly flat, wider than mouth. Maxilla reaching 1/4 of orbit, lower jaw articulation nearly below middle of orbit; jaws equal anteriorly.

Scales. Squ. long. - (1), 21 (12), 22 (9), then females 21 (8), 22 (3), males 21 (4), 22 (6); 16 circumpeduncular scale series; squ. tr. 7+1+1 1/2. Scales ctenoid except along predorsal midline and anterior to vertical from dorsal tip of preoperculum, cheek scales (excepting a few posteriorly), anterior prepelvic scales, inter- and subopercular scales. Squ. prd. - (1), 9 (2), 10 (2), 11 (1), 12 (1), squ. prv. - (1), 8 (4), 9 (2). Cheek scales large, in 2 (2) or 3 (5) series, the 3rd series of 1-2 small scales only (fig. 68); cheek completely scaly. Squ. op. - (3), 11 (1), 13 (2), 15 (1); squ. sop. - (1), 5 (4), 6 (1), 7 (1) in principal or only series, 1-2 scales may make up additional series; squ. iop. 3 (2), 4 (5).

Upper lateral line initially at 3 scales distance from dorsal fin, comprising - (1), 1 (1), 2 (2), 4 (1), 6 (2) tubed scales anteriorly, succeeded by

pored scales (6-11) to total 12 (3), 13 (3) scales in principal series, which ending at 1/2 scale distance from dorsal fin, always 2-3 subserial pores, occasionally also subsubserial pores (3, in one of measured specimens); lower lateral line of 6 (2), 7 (3), 8 (2) pored scales, not continued onto caudal fin. Large ctenoid scales on basal 1/7 of caudal fin.

Fins. Dorsal-fin origin above first lateral line scale, first spine 2/5 length of last, spines slightly increasing in length to last; lappets relatively short, truncate; soft fin with long point, 2nd ray longest, to past 4/5 of caudal fin. D. XVI.6 (2), XVII.- (1), XVII.4 (1), XVII.5 (13), XVII.6 (2), XVIII.5 (3). Anal-fin origin below 6th from last dorsal-fin spine, in posterior 1/2 of body; spines increasing in length to last; lappets short, tips rounded; soft fin with long point, 2nd ray longest, to 4/5 of caudal fin; A. VI.6 (2), VI.7 (1), VII.5 (5), VII.6 (8), VIII.- (1), VIII.5 (2), VIII.6 (3). Pectoral fin with rounded tip, 5th ray longest, to above 5th anal-fin spine. P. 11 (4), 12 (3). Pelvic-fin pointed, outer branch of first ray filamentously produced, reaching to caudal peduncle. Caudal fin rounded in specimens in which not damaged, with 16 principal rays.

Cephalic lateralis pores (fig. 68) as in *Apistogramma*, with 5 dentary, but only 3 infraorbital pores.

Jaw teeth. Dentition not well-preserved in large specimens, but apparently in narrow bands comprising an outer series of stout, strongly recurved, pointed teeth, along the length of each jaw rim, and 1 (lower jaw) or 1-2 (upper jaw) short inner series anteriorly in each jaw.

Gill-arches. First gill-arch (fig. 69) with epibranchial lobe with narrow connective tissue lining along lateral edge; one epibranchial, one in angle and 3 (5), 4 (2) ceratobranchial rakers, all short; - (2), 10 (1), 11 (2), 12 (2) rakers on lower pharyngeal tooth-plate. No microgill-rakers.

Tooth-plates. 4th ceratobranchial edentulous. Lower pharyngeal tooth-plate (fig. 70) with few teeth, those along lateral margin subconical and unicuspid, inner teeth bicuspid, compressed, medially elongate, along posterior margin slender.

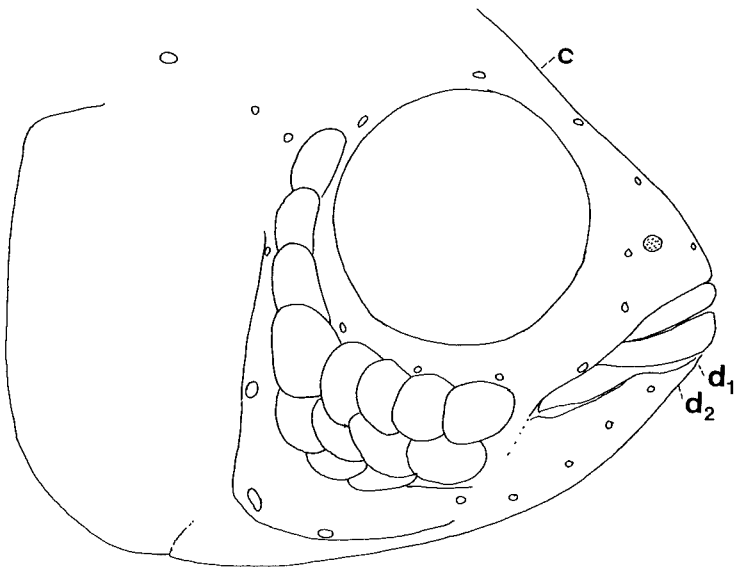


Figure 68. Outline of head of *Apistogrammoides pucallpaensis*, to show cheek scale cover and positions of lateralis pores; pores out of view indicated by dash lines: c coronalis pore, **d1-d2** anteriormost dentary pores. Chiefly from NRM SOK/1983333.3379, 26.2 mm SL.

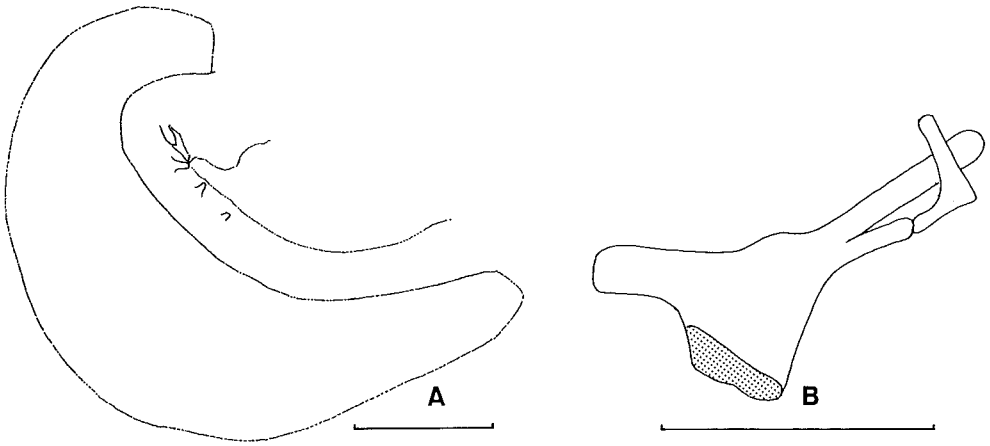


Figure 69. A external aspect of first gill-arch and B rostrolateral aspect of dorsal part of arch of *Apistogrammoides pucallpaensis*, NRM SOK/1981333.3379, 22.8 mm SL. First pharyngobranchial tilted from normal position with dorsal process more rostrad oriented; only connective tissue shaded in B as bone/cartilage borders not clearly recognizable. Scales 1 mm.

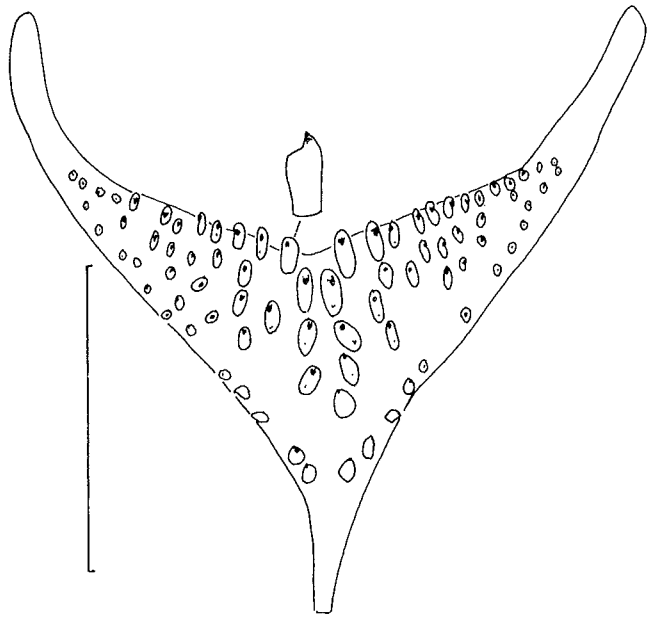


Figure 70. Occlusal aspect of lower pharyngeal tooth-plate and medial view of posterior tooth in *Apistogrammoides pucallpaensis*, NRM SOK/1981333.3379, 22.8 mm SL. Scale 1 mm.

Vertebrae. 11+12 (1), 12+12 (1), 12+13 (1).

Colouration. Ground colour yellowish whitish; gill-cover light brown, snout dorsally grey. Narrow brown suborbital stripe from between posterior two infraorbital pores across preopercular angle onto posterior margin of interoperculum. Brown preorbital stripe passing between two dorsal lachrymal pores. Forehead medially with short dark stripe anteriorly caudad from postlabial skin margin; posteriorly a spot slightly separated from anterior stripe and coronalis pore, connecting with less distinct pigmentation tracing nasals; laterally, close to orbit dark spot between pores of 2nd and 3rd from anteriormost frontal lateralis canal foramina. Supraorbital stripe brown, from between pores of 3rd and 4th frontal lateralis foramina, fainter caudad to near nape midline. Lower jaw darkened anteriorly close to lower lip. Narrow postorbital stripe continued as narrow brown lateral band on side, slightly widened on scales of lower lateral line; containing small roundish, not well defined, lateral spot. Paralleling much fainter band below anterior lateral line canals anteriorly, on scales below lateral line posteriorly, caudad as trace to caudal-fin base. Flank scales with light centers and dark (brownish) edges; light portion larger and more contrasting close to lateral band posteriorly on side. No vertical bars, but 5 more or less distinct dark spots close to dorsal-fin base. Caudal peduncle with triangular terminating bar, wider point connecting with lateral band.

First 2 dorsal-fin membranes with base and lappets blackish, remainder of membrane nearly hyaline; rest of fin lightly duskied with dark spot at base of each membrane, posteriorly also light spot anterior to dark basal spot, dorsal edge darkened, a few hyaline spots on posterior soft membranes and intense black spot on base of last 2 rays. Anal fin smoky with hyaline spot on each membrane base, a few hyaline spots along hind margin and darkened ventral edge. Caudal fin basally yellowish white with 3 contrasting horizontally elongate dark spots, one medianly and one on middle of each lobe, distal to these hyaline to slightly smoky with numerous dark dots. Pelvic fin hyaline except for slightly duskied spine membrane and dark spot on lateral side of base of first ray.

Life colours. Linke (1986) figures a freshly caught male (probably representing the NRM A85/1985312.3521 series) from the Yarina Cocha area, which bluish on sides and with yellow pelvic and anal fins and agreeing with males collected near Pebas (station SOK 27a).

Sexual dimorphism. Sexes distinguishable by colouration above 10.0 mm. Females with short pelvic-fin, not reaching beyond 3rd anal-fin spine; soft dorsal and anal fins short, with rounded tips; spinous dorsal fin lower, with rounded lappets; but small males similar to females with regard to finnage. Females with wide black pelvic-fin edge, frequently also black spot on side of chest adjacent to pelvic-fin spine; black around vent and with short black midventral stripe; anterior dorsal-fin lappets black from base to tip; caudal fin uniformly duskied, base spots and triangular marking on end of caudal peduncle less contrasted compared to males.

Distribution (fig. 34)

Known only from Peru and Colombia, collected in the Ucayali drainage near Pucallpa and near Bretaña, in the Amazonas drainage at Pebas and on Isla Santa Sofía.

Ecology

Klee (1965) described the type-locality with a long list of associated species, and water data (86°F, pH 6.8, hardness 51 ppm, conductivity 350 µΩ, oxygen 4.2 ppm). Linke (1986) described a drying pool habitat near Yarina Cocha which had much floating vegetation, relatively hard (9°dGH) and alkaline (pH 7.1) water. The species was also collected in a floating meadow in the lower R. Ampiyacu (stations SOK 27a, b).

Notes

Apistogrammoides pucallpaensis is one of the smallest cichlid species, much shorter than its name, the largest male available among wild specimens is 27.3 mm SL and the largest females 22.8 mm SL. Aquarium specimens 37.6 (male) and 27.0 (female) mm SL, indicate, however, that larger wild specimens may be expected. Sexes are distinguishable at 10 mm.

Meinken (1965) considered *Apistogrammoides* to possibly represent a link between *Apistogramma* and *Cichlasoma*. That conclusion was based on a set of incorrectly interpreted character states. *Apistogrammoides pucallpaensis* is in most respects like an *Apistogramma*, as evidenced by the separate openings of the rostralmost preopercular and posterior anguloarticular lateralis foramina, the epibranchial lobe, lack of infraorbital 6, continuous lip folds, gill-rakers on lower pharyngeal tooth-plate, reduced number of gill-rakers on first gill-arch and many pored scales in the lateral line. The single character that would suggest affinity with *Cichlasoma* is the high anal-fin spine number (6-9; the 9 spines in a single aquarium specimen (NRM unreg.)). The totality of other character states, however, distinguish *A. pucallpaensis* from *Cichlasoma* (and genera that were assigned to *Cichlasoma* at the time of Meinken's writing), and suggest instead a close relationship with *Apistogramma*, particularly the lateral line system.

Compared with *Apistogramma*, *A. pucallpaensis* has a rather wide interorbital space, 11.9-14.1 % of SL. The generic range for *Apistogramma* is 4.8-11.4 % (Kullander 1980*a*). The cheek scales are comparatively large; in *Apistogramma* species with principally biserial cheek squamation, the scales do not cover all of the cheek as in *A. pucallpaensis*. Both dorsal- and anal-fin spine counts are high; maximum anal-fin spines recorded in *Apistogramma* being 6, in a single specimen tentatively identified as *A. luelingi* (Koslowski 1985*a*); maximum dorsal-fin spines 18 (XVIII.5 in *A. commbrae*, Kullander 1982*a*), 17 a rare count in the genus. The narrow lower jaw tooth band is different, as in adult *Apistogramma* there are at least 2-3 inner series anteriorly. The colour pattern includes several distinctive features such as the faint band along the dorsal side, the spots on the forehead, the marking formed by the triangular caudal peduncle spot and caudal-fin spots. The lateral line is extremely reduced compared to most *Apistogramma* species, adults of which have most of upper line scales tubed, and with a few exceptions at least some lower line scales tubed.

All those traits are tentatively recognized as apomorphic, and when different from *Apistogramma*, serve to diagnose *Apistogrammoides*. Data currently available do not allow precise relationship hypotheses and the status of *Apistogrammoides* should be considered in a revision of *Apistogramma*.

Table 17. *Morphometry of* Apistogrammoides pucallpaensis. *Measurements are in in mm, except range and mean which are in per cent of SL.*

								Range	x̄
SL	18.2	18.5	21.8	22.5	22.6	22.6	26.2		
Head length	6.2	6.2	7.4	7.5	7.6	7.5	8.4	32.1-34.1	33.4
Head depth	5.3	5.3	6.7	6.7	6.7	6.7	7.8	28.6-30.7	29.6
Body depth	6.5	6.7	8.2	8.7	8.1	9.2	10.1	35.7-40.7	37.6
Predorsal length	7.0	6.9	8.4	8.6	8.6	8.5	9.3	35.5-38.5	37.7
Prepelvic length	7.5	7.5	8.8	9.3	9.7	9.5	10.4	39.7-42.9	41.1
Orbital diameter	2.5	2.3	2.9	2.8	2.9	3.0	3.6	12.4-13.7	13.1
Snout length	1.1	1.2	1.3	1.3	1.5	1.2	1.3	5.0- 6.6	5.9
Cheek depth	1.1	1.1	1.3	1.6	1.4	1.7	2.0	5.9- 7.6	6.6
Head width	3.6	3.5	4.3	4.3	4.4	4.1	5.2	18.1-19.8	19.3
Interorbital width	2.2	2.2	2.7	2.8	2.8	2.9	3.7	11.9-14.1	12.6
Preorbital depth	0.6	0.5	0.6	0.7	0.7	0.7	1.0	2.7- 3.8	3.1
Upper jaw length	1.9	1.9	2.1	2.2	2.2	2.2	2.9	9.6-11.1	10.1
Lower jaw length	2.8	2.5	3.1	3.3	3.3	3.4	3.7	13.5-15.4	14.5
Caudal peduncle depth	3.2	3.1	3.6	4.2	3.9	4.1	5.2	16.5-19.8	17.8
Caudal peduncle length	1.6	1.6	2.0	2.3	2.2	2.1	2.4	8.6-10.2	9.3
Dorsal-fin base length	10.7	10.9	12.9	13.5	13.2	14.0	16.8	58.2-64.1	60.1
Anal-fin base length	5.2	5.1	6.4	6.7	6.0	6.4	7.6	26.5-29.8	28.5
Pectoral-fin length	6.1	5.6	6.7	7.6	7.1	---	9.2	30.3-35.1	32.5
Pelvic fin spine length	3.0	3.1	3.6	3.6	3.5	4.0	4.5	15.5-17.7	16.6
Pelvic fin length	5.4	5.6	6.6	8.6	7.2	8.1	12.9	28.6-49.2	34.8
Last dorsal-fin spine length	3.2	---	3.4	4.2	3.6	4.4	6.1	15.6-23.3	18.2
Last anal-fin spine length	3.3	3.2	4.1	4.4	4.0	---	6.2	17.3-23.7	19.2
Sex	♀	♂	♀	♂	♀	♂	♂		

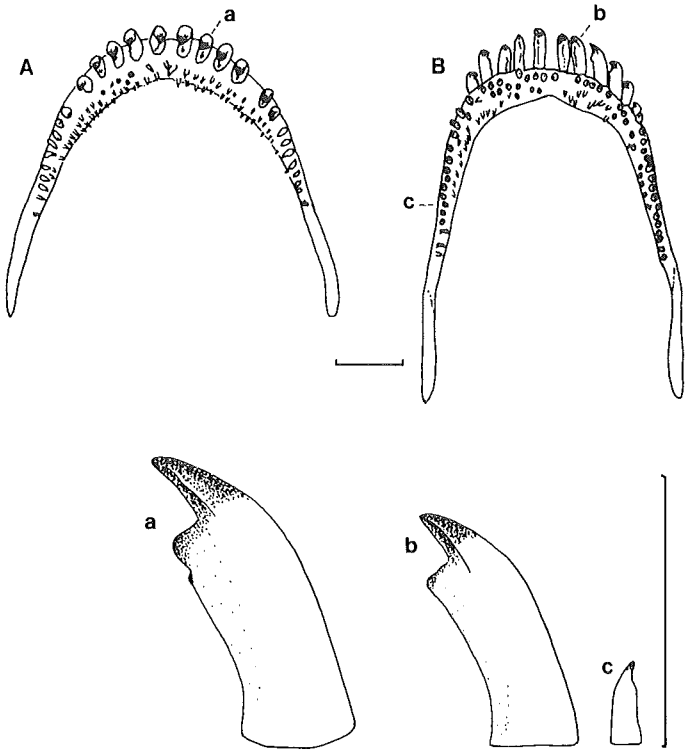


Figure 71. A upper and B lower jaw dentition in occlusal view, and a-c teeth in lateral aspect, of *Mesonauta insignis*, NRM SOK/1983305.-3769, 65.0 mm SL. Scales 1 mm.

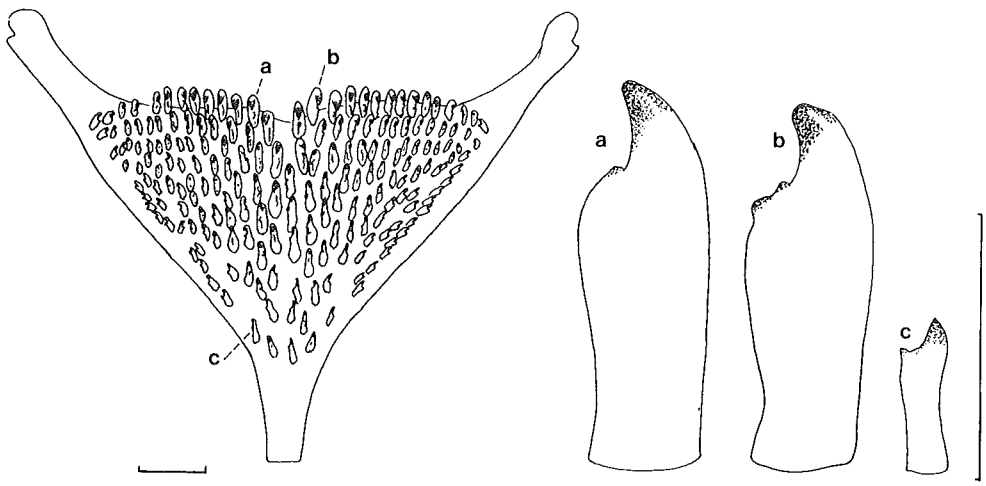


Figure 72. Occlusal view of lower pharyngeal tooth-plate, and medial (a,c) or lateral (b) aspect of teeth in *Mesonauta insignis*, NRM SOK/1983354-.3771, 78.3 mm SL. Scales 1 mm.

interradial scales appearing at *c.* 30 mm SL. Basal scaly area of caudal fin with concave hind edge, marginal scales extending to at most middle of fin.

Fins. First dorsal-fin spine above 2nd lateral line scale slightly posterior to vertical from pelvic-fin spine; spines increasing in length to last, but little from 4th, last 3-4 times length of first; anterior lappets rounded, posterior truncate. Soft dorsal fin pointed, 2nd-3rd ray longest, latter produced to filament that may reach beyond caudal fin. D. XIV.10 (2), XIV.11 (3), XIV.12 (2), XV.10 (4), XV.11 (12), XV.12 (1), XVI.10 (1). Anal-fin origin only slightly posterior to middle of body; spines increasing in length to last, which about twice length of first; lappets rounded, anterior membranes, like anterior dorsal-fin membranes with deep cleft preceding succeeding spine. Soft anal fin pointed, point broad, tipped by ray 4 or 5, reaching about hind edge of caudal fin. A. VIII.10 (1), VIII.11 (10), VIII.12 (3), IX.10 (3), IX.11 (6), IX.12 (2). Caudal fin, with 16 principal rays, rounded. Pectoral fin short, reaching to above 4th anal-fin spine, 3rd ray longest, tip rounded. P. 10 (1), 11 (24). Pelvic fin pointed, reaching to about 4th or 5th anal-fin spine, but thick outer branch of first ray prolonged, forming filament reaching to at most hind edge of caudal fin. Young similar to adults, but soft dorsal and anal fins and pelvic fin slightly shorter. Pelvic-fin filament not verifiable in 13 mm specimens, at 16-17 mm reaching to middle of anal-fin base.

Gill-rakers. 1-2 epibranchial, 1 in angle and 6 (5), 7 (18), 8 (2) ceratobranchial rakers externally on first gill-arch; epibranchial rakers short, digitiform, angle raker flattened and pointed, ceratobranchial rakers dorsally flattened and broad, with curved edge, ventrally gradually reduced to rudiments, angle and ceratobranchial rakers denticulate apically. Microgill-rakers externally on 2nd-4th arches.

Jaw teeth (fig. 71). Teeth of outer series larger than those of inner series (1-2 (modally) in upper, 2 (modally)-3 in lower jaw), increasing in size towards symphysis, anterior teeth subprocumbent, size increase gradual in upper jaw, in lower jaw 5+5 anterior teeth distinctly enlarged compared to remainder; anterior upper jaw teeth larger than corresponding lower jaw teeth; gap separating labial series from band of smaller teeth distinct in upper jaw, but not in lower jaw. Anterior teeth cylindrical, with flattened lingual edge ledge tipped by 1 (usually) or 2 small cusps and major cusp of cylindrical portion recurved and pointed, lingual face slightly cupped and with rudimentary medial ledge; posterior labial and inner teeth similar, but major cusp tending to conical and lingual ledge much reduced on the smallest teeth; shape of lingual side cusp(s) variable; ledge margin occasionally appearing serrate rather than cuspidate. Bicuspid anterior teeth from 13 mm SL (smallest specimen available). Teeth in outer hemiseries of upper jaw 9 (1), 10 (2), 11 (3), 12 (6), 13 (6), 14 (4), 16 (2), 17 (1), of lower jaw - (1), 13 (1), 15 (2), 16 (3), 17 (4), 18 (3), 19 (10), 23 (1); invariably fewer upper than lower jaw teeth in each specimen.

Tooth-plates. Lower pharyngeal tooth-plate (fig. 72) with numerous laterally compressed slender teeth, all distinctly bicuspid with long antrorse posterior cusp and smaller rostral cusp, except indication of additional rostral edge cusps on large medioposterior teeth. Dissected specimen with 3 tooth-plates on 4th ceratobranchial, with 2, 9 and 10 subconical, pointed teeth.

Vertebrae. 11+14 (1), 12+14 (4), 12+15 (3), 13+13 (1), 13+14 (1) vertebrae; no caudal peduncle vertebrae; swim-bladder diverticula reaching to 6th or 7th hemal spine, 2-4 caudal ribs.

Colouration. Ground colour white or yellowish along chest and belly midline, yellowish or silvery laterally on chest; sides greyish whitish or greyish yellow, on forehead, nape and along spinous dorsal-fin base greyish brown. Cheek and preoperculum dirty yellowish or yellowish whitish. Brown spot on dorsal edge of pectoral axilla. Lips grey. Operculum silvery or brownish. Usually faint, narrow, brownish to greyish vertical bars across sides, none

above lateral band; number slightly variable due to coherence especially in young, but usually 7 recognizable, (1) along hind edge of caudal peduncle, (2)-(3) forwards curved, between soft dorsal and anal fins, (4)-(5) above spinous anal fin, (6) above vent, (7) slightly posterior to pelvic-fin base. Distinct, dark brown to blackish lateral band, wider than pupil, narrower than eye, from eye straight to origin of soft dorsal fin, continued as strong, or fading out on anterior rays and membranes of soft dorsal fin to tips of longest rays. Commonly a faint light band along ventral margin of lateral band. Most of preorbital covered by dark grey to blackish stripe from eye to mouth, slightly wider than lateral band and more inclined, bordered by usually obsolete light stripe between eye and nostril and along buccad margin of preorbital. Anterior half of lower jaw and rostral edge of intermandibular skin grey.

Pectoral fin hyaline, other fins greyish except as follows: Dorsal fin posterior to lateral band greyish, either with large hyaline spots that reduce grey interspaces to very thin lines or entirely hyaline except for grey base and occasionally a few spots near lateral band; much smaller, indistinct spots on lateral band and posterior 1/3 of spinous fin, commonly not traceable. Anal fin lighter along hind margin and on tip of soft fin, light dots on soft portion hardly discernible or absent. Pelvic filament white, edge of fin proper hyaline, occasionally obsolete light dots on greyish portion. Caudal fin either with numerous obscure light dots, especially on dorsal part, or appearing immaculate. Caudal spot prominent, dark brown to black, ovate or roundish close to caudal peduncle on all (usually) or lower 2/3 of dorsal lobe, ocellated by yellowish to whitish ring which incomplete when spot extending to dorsal edge of fin.

Young similar to adults, but usually with more blotchy appearance on sides due to gradual development of vertical bars from juvenile pattern. Juveniles *c.* 13-20 mm with posterior sides (Bars 1-5) greyish with scattered yellowish spots (that expand to form bar interspaces in larger specimens), Bars 6-7 united and delimited anteriorly and posteriorly by yellowish stripes from back to belly; also a vertical bar between operculum and back and dark spot above orbit, these two markings separated by yellowish line; lateral band interrupted by light stripes bordering Bar 6+7; dark spot ventrally on base of pectoral axilla and onto adjacent chest; soft unpaired fins hyaline; caudal spot roundish, blackish, bordered by yellowish spot anteriorly.

Life colours. Living fishes are similar to preserved, with white to yellowish or, ventrally, silvery ground colour and grey (bars) to black markings. There are no red or blue colours.

Distribution (fig. 73)

Mesonauta insignis is widespread in western Amazonia. Peruvian localities are all close to the Ucayali and Amazonas rivers. The species was not observed at Colonia Angamos on the upper Yavarí. Owing to the uncertain taxonomy, a precise range for the species cannot be postulated.

Ecology

Mesonauta insignis is easily observed in the wild, seen swimming near shore in small groups. Undisturbed they stay near the surface. When approached with a net they commonly escape by jumping unlike other cichlids which dive to the bottom when alarmed, but they may also hide in vegetation or under logs. Habitats at which *M. insignis* has been collected are very varied and comprise black-, clear- and white-water conditions, sand playas, lakes and, occasionally, small streams, all having in common, however, that the water is still or only slow-flowing and floating vegetation or tree litter is present. In Quisto Cocha and R. Pacaya, *M. insignis* is an aufwuchs feeder according to Lüling (1963).

Local name

Bujurqui (Iquitos); Bufurqui (Lüling 1963: Quisto Cocha).

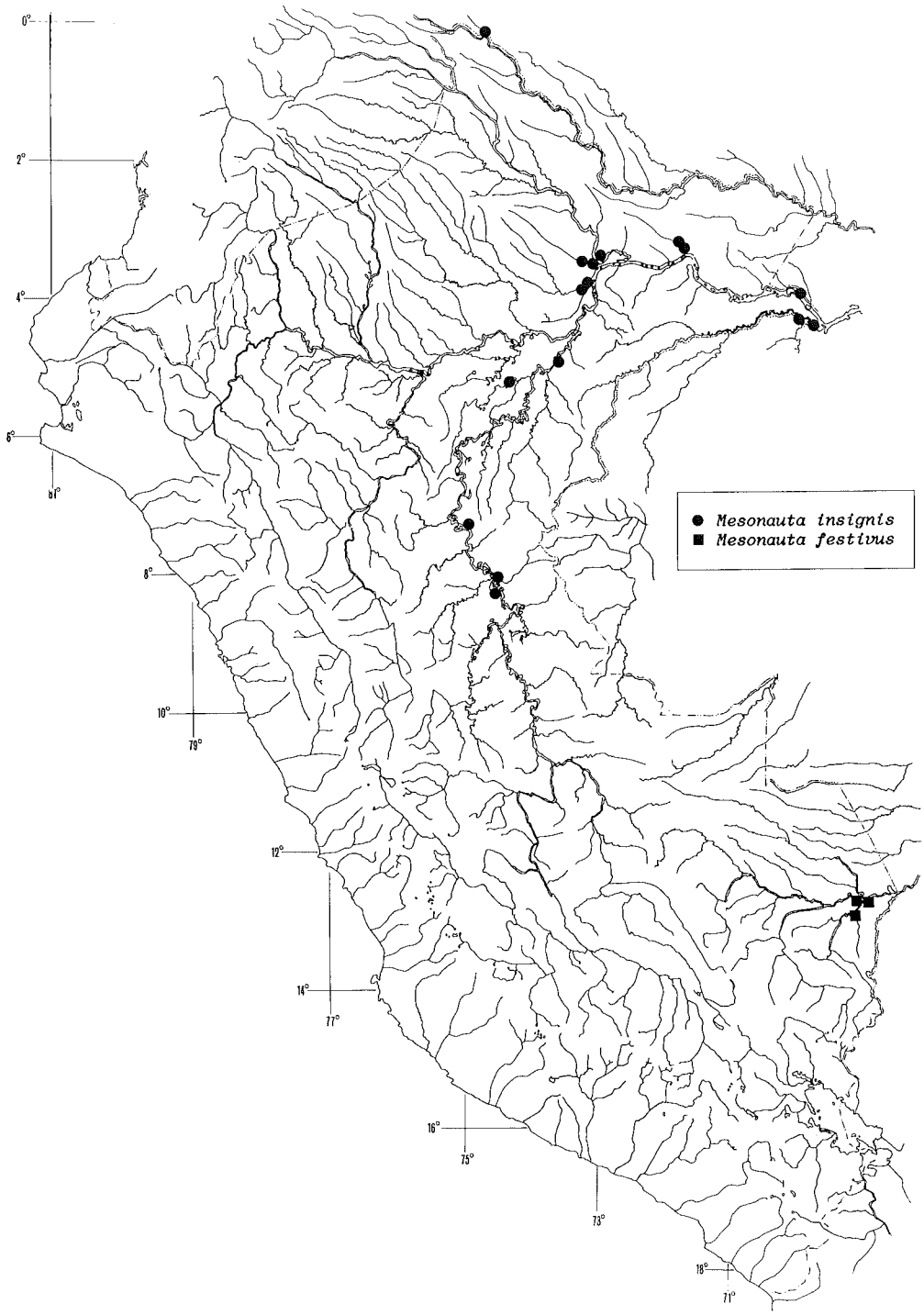


Figure 73. Collecting localities of *Mesonauta* species in western Amazonía. A symbol may represent more than one, adjacent collecting sites.

Notes

Mesonauta insignis is compared with *M. festivus* on p. 208. The *Mesonauta* material from the Ucayali-Amazonas drainage is identified as *M. insignis* following comparison with the holotype of *M. insignis*, and other material from the upper R. Negro, upper R. Orinoco, lower R. Içá and the Manaus region. I exclude western Orinocoan, Tapajós and Xingu material from *insignis* because of differences in colouration, microgill-raker distribution and preopercular squamation (Xingu species only), but no large-scale comparative studies of extra-limital *Mesonauta* was attempted.

Recognition of the validity of Heckel's two *Mesonauta* species, is only a start to what may turn out to be a very complex taxonomic situation. Incidentally, it rehabilitates the oldest available species name, *insignis*, which was chosen before *festivus* by the first reviser, Günther (1862), although a reverse usage has dominated later literature in which the species were regarded as synonyms. Whereas *M. festivus* is well characterized, the nomenclatural and biological status of Peruvian *M. insignis* is a subject for continued investigation. Fresh material from the type-locality area of *M. insignis* is scarce. Limited series from the San Carlos area, north of Marabitanas, and material from the upper R. Orinoco may be characterized by slenderer shape, longer snout, higher meristics and slight differences in colouration (eg. in retaining relatively wide vertical bars as adult) compared to Peruvian (Ucayali-Amazonas) *Mesonauta*.

Mesonauta festivus (Heckel)

Figs 73-74, Pl. XXIII (fig. 4), Table 18

Heros festivus Heckel 1840, p. 376 (diagn.; descr.; Fluss Guapore und dessen nahe gelegenen Moräste).

Material

49 specimens, *c.* 8.5-78.6 mm SL, from near Puerto Maldonado and the lower R. Tambopata.

Description

Based on NRM SOK/1983325.3772, 60.2-73.7 mm SL, with notes on young; counts from 25 specimens measured; measurements summarized in Table 18. Refer to Pl. XXIII, fig. 4, for general aspect and colour pattern. As most characters are as in *M. insignis*, the following account is made short by comparative references to that species.

Shape. Deep and high; laterally compressed, especially posteriorly. Predorsal contour straight to slightly in advance of dorsal-fin origin or slightly curved, less steep ascending dorsal contour along spinous dorsal-fin basal scale cover. Prepelvic contour straight or slightly concave, chest not prominent. Anterior aspect, orbit position, interorbital, jaws and lips as in *M. insignis*. Snout only slightly extended, with rounded tip. Ventral edge of caudal peduncle distinctly shorter than dorsal edge.

Scales. Squ. long. - (1), 24 (1), 25 (14), 26 (9). Anterior and median predorsal, cheek and opercular scales cycloid; scale patterns as in *M. insignis*. 20 circumpeduncular scale-series. Preoperculum naked except in one of 25 specimens checked, with a scale at angle on both sides. Cheek with 3 (25) scale-series. Upper lateral line at 6 (anteriorly) to 3 (posteriorly) scales distance from dorsal fin, of - (3), 16 (2), 17 (14), 18 (6) scales; lower lateral line of - (1), 7 (3), 8 (16), 9 (5) scales, plus 1-2 on caudal fin; accessory caudal-fin lateral lines between rays D2-3 and V4-5, of 2-6 (dorsal lobe; absent in 1), 2-11 (ventral lobe; absent in 2) tubed scales. Fin squamation as in *M. insignis*, but interradial scales between 3-4 posterior dorsal- and anal-fin spines.

Fins. Dorsal-fin origin at vertical from pelvic-fin spine base or slightly posterior; first spine about 1/4 length of last, spines about equal

in length from 5th, last 4 strongly increasing in length; lappets as in *M. insignis*; soft fin pointed, 3rd ray longest, with filament to beyond caudal fin. D. XIV.11 (1), XIV.12 (1), XV.10 (1), XV.11 (16), XV.12 (6). Anal-fin origin slightly posterior to midbody; soft fin with broad point tipped by ray 5, longer than soft dorsal fin. A. VII.12 (1), VII.13 (4), VII.14 (1), VIII.11 (1), VIII.12 (9), VIII.13 (7), IX.12 (2). Pectoral fin with rounded tip, 3rd ray longest, reaching to above 3rd or 4th anal-fin spine. P. 10 (1), 11 (21), 12 (3). Pelvic fin as in *M. insignis*. Caudal fin rounded.

Gill-rakers. 2-3 epibranchial, one in angle and 6 (15), 7 (10) ceratobranchial rakers externally on first gill-arch, as in *M. insignis*. Micro-gill-rakers externally on all arches, also in juveniles as small as 13.9 mm SL, occasionally also a few internally on 4th arch.

Jaw dentition. As in *M. insignis*; 9-15/8-18 teeth in upper/lower jaw hemiseries in 21 specimens, 43.5-78.3 mm SL; 2 (modally)-3 inner series in both jaws.

Tooth-plates. In 66.9 mm specimen dissected, 2 tooth-plates with 6 and 22 teeth, respectively, on 4th ceratobranchial; lower pharyngeal tooth-plate as in *M. insignis* except that very few, posteromedian, teeth bicuspid, anterior teeth slender, with indicated subapical rostral edge projection, posterior teeth compressed, with posterior antrorse cusp and uncusped rostral edge.

Young. Similar to adults, but with shorter soft dorsal, anal and pelvic fins. Anterior teeth bicuspid at 13.9 mm. Basal anal- and dorsal-fin scales present at *c.* 16 mm SL.

Vertebrae. 12+14 (3), 13+13 (4), 13+14 (1) vertebrae; no caudal peduncle vertebrae.

Colouration. Ground colour light yellowish, pure on midline of chest and belly. Cheek yellowish with pale brownish scale edges, gill-cover brownish, lower jaw greyish white. Chest sides yellowish, peppered with brown. Dark brown on forehead, nape and narrowly along spinous dorsal fin base. Sides with broad, light greyish brown irregular vertical bars; bar interspaces obscured by dark pigment except ventrally where forming contrasting yellow spot or, anterior and posterior to Bar 4, band extending from belly to horizontal level of pectoral fin; also whitish dot in interspaces between bars 3-4 and 4-5 and anterior to bar 5 both above and below lateral band; bars positioned as follows (1) covering caudal peduncle, (2) between soft dorsal and anal fins, divided by light spot ventrally, (3) above middle of spinous anal fin, (4) above origin of anal fin or genital papilla, (5) slightly posterior to pelvic-fin insertion. Back above lateral band of same colour as bars. Pectoral axilla with or without dark dorsal edge. Brown band from eye to mouth covering most of preorbital and margined by parallel light lines. Lips grey-brown. Dark brown band, wider than pupil, from eye obliquely dorsorostrad to end on scale cover of anterior soft dorsal-fin rays; maculate due to intensified pigmentation where crossing vertical bars, and anterior to Bar 5; distinctly, though slightly angled more dorsad from Bar 4; not, or vaguely continued on dorsal fin.

Dorsal fin greyish, lappets darkened distally, soft portion with darkened dorsal edge and small, indistinct light dots, which may extend onto posterior spinous portion, posterior edge of soft portion hyaline except basally where greyish. Anal fin immaculate, grey, lower edge and tip of soft fin darkened. Caudal fin light greyish with up to about 10 vertical series of indistinct light dots on membranes of dorsal lobe; prominent black ovate caudal spot on dorsal lobe, across fin edge, margined with whitish zones anteriorly and posteriorly. Pelvic fin dark grey with greyish white filament.

No well-preserved juveniles available, but young and juveniles apparently similar to adults although fins immaculate, and specimens less than 20 mm apparently without or with only indicated lateral band caudal to Bar 4, Bars 1-3 not separated except ventrally. Many young with dark spot on dorsal 2/3 of pectoral axilla.

Distribution (fig. 73)
Mesonauta festivus has been collected so far only at Peruvian localities near Puerto Maldonado and along the Bolivian-Brazilian border in the Guaporé drainage.

Ecology
The Quebrada San Roque (SOK 61) material was obtained by seining a pool-like widened section of the brook, between two bridges. The water was clear, slightly tinted, soft and slightly acid. The collecting site lacked vegetation and was quite bare, with a bottom of sand, mud and gravel. Associated cichlids were *Aequidens tetramerus* and *Bujurquina tambopatae*. Station SOK 64 yielded *M. festivus* both in a stagnant clear-water stream and in a shallow pool, used by cattle, with clayey bottom, water without transparency. The *Mesonauta* were taken with *Cichlasoma boliviense* in the pool, and with *Apistogramma urteagai* in the stream.

Notes
Following Günther (1862) and Steindachner (1875), most modern authors have synonymized the three nominal species referable to the genus *Mesonauta*, viz. *Heros festivus*, *H. insignis* and *Chromys acora* Castelnau.

A preliminary survey of *Mesonauta* material from the vast range of the genus, including the Amazonas, Paraguay and Orinoco drainages as well as Guianan rivers, suggests the existence of several species. Two species occur in Peru. *Mesonauta insignis* (p. 200) is found in the Ucayali-Amazonas drainage and further east in Brazilian Amazonía. *Mesonauta festivus* is taken in the Madre de Dios drainage and occurs also in the Guaporé system (Brazil/Bolivia).

The type(s) of *M. festivus* cannot be located, and the identification of Madre de Dios material is based on comparison with Heckel's (1840) description and limited material from the Guaporé system (type-locality drainage).

The following observations, mainly from Peruvian material, justify rehabilitation of *M. insignis* as distinct from *M. festivus*.

(1) Colouration. The two species were originally (Heckel 1840) distinguished chiefly with reference to presence (in *festivus*) and absence (in *insignis*) of vertical bars on the sides. Young of both species have more or less contrasting dark vertical bars over the sides, but in *M. insignis* they are relatively indistinct in adults, whereas adult *M. festivus* retain distinct dark bars that contrast against the light ground colour. Adult *M. festivus* also retain the pattern of barring shared by young of both species, whereas in *M. insignis* there is a further subdivision of the bars, resulting in 7 narrow rather than 5 wide recognizable vertical dark pigment units. Adult *M. insignis* also characteristically have a uniformly pigmented lateral band, running straight from the eye to end on anterior dorsal-fin rays. In *M. insignis* the band is blotchy, with a distinct knee above the lateral line, and a continuation on the dorsal fin can at most be traced.

(2) Shape. *Mesonauta festivus* is more round-bodied than *M. festivus* as reflected in several measurements (Table 18), including slightly shorter head and snout, greater depth, narrower preorbital and deeper caudal peduncle. *Mesonauta festivus* also has an average larger eye (Table 18), which is more evident when orbital diameter is compared to head length than to SL. This adds to the short-snouted appearance. Snout length and orbital diameter are plotted against head length in fig. 74.

(3) Microgill-rakers. *Mesonauta insignis* lacks microgill-rakers from the first gill-arch and the inside of the 4th gill-arch. In contrast, *M. festivus* has microgill-rakers invariably present on the external face of the first arch from very small size and occasionally also a few microgill-rakers internally on the 4th arch. Gill-raker counts are higher in *M. insignis* (mode 7) than in *M. festivus* (mode 6).

(4) Pharyngeal teeth. The pharyngeal teeth of *M. insignis* have a pronounced anterior cusp lacking in *M. festivus*; but variation in that char-

acter is still unstudied.

(5) Anal fin. *Mesonauta festivus* averages a higher total anal-fin count (spines+rays: 19 (2), 20 (13), 21 (10)) than *M. insignis* (18 (1), 19 (13), 20 (9), 21 (2)), but also features 7-spined specimens (6 of 25) and few 9-spined specimens (2 of 25), whereas *M. insignis* has 8 or 9 anal-fin spines nearly equally frequent (56% 8-spined, 44 % 9-spined).

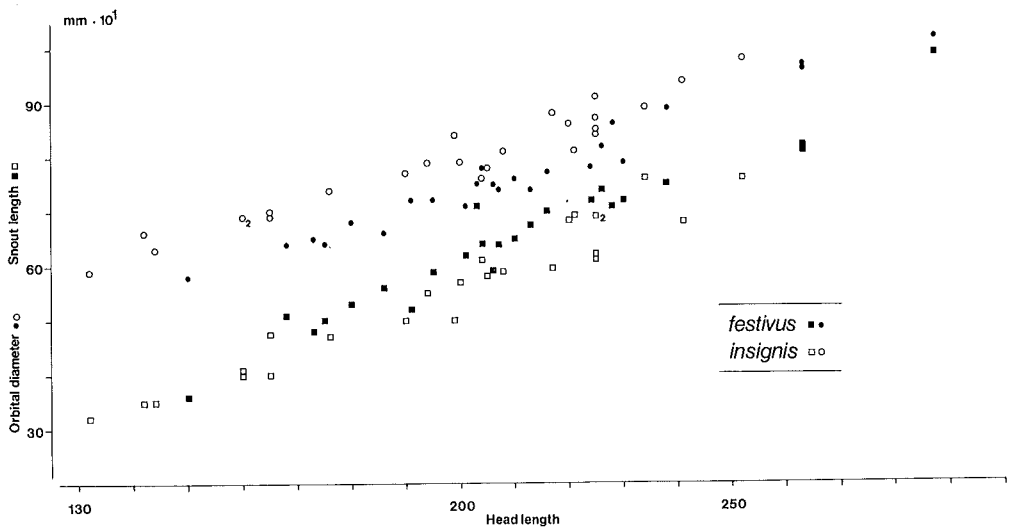


Figure 74. Plots of snouth length and orbital diameter against head length in Peruvian *Mesonauta insignis* and *M. festivus*.

Table 18. *Morphometry of* Mesonauta *and* Pterophyllum *species in Peru. Measurements are in per cent of SL, except SL (in mm) and orbital diameter and snout length in* Mesonauta *species which also given as per cent of head length and orbital diameter, respectively.*

	M. insignis			*M. festivus*			*P. scalare*		
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$
SL (mm)	25	43.3- 86.2	63.1±2.01	25	40.8- 78.3	60.6±2.06	25	33.8- 71.1	48.9±2.08
Head length	25	31.6- 35.4	33.6±0.15	25	31.1- 34.3	32.6±0.17	25	33.8- 38.5	36.7±0.24
Snout length	25	8.3- 11.5	10.3±0.14	25	7.7- 10.3	9.0±0.17	25	8.6- 11.0	9.9±0.13
Body depth	25	49.8- 56.6	53.3±0.38	25	52.7- 58.5	55.2±0.27	25	65.7- 74.6	70.0±0.45
Orbital diameter	25	11.2- 13.4	12.3±0.12	25	11.8- 14.5	13.2±0.16	25	13.1- 16.6	14.9±0.18
Head width	25	17.9- 21.4	19.4±0.15	25	18.6- 20.1	19.4±0.08	25	16.0- 18.0	17.0±0.11
Interorbital width	25	13.0- 18.7	16.0±0.22	25	14.9- 17.5	15.7±0.13	25	12.3- 14.9	13.9±0.15
Preorbital depth	25	7.1- 10.0	8.4±0.16	25	5.9- 8.7	7.4±0.18	25	4.4- 6.3	5.5±0.09
Caudal peduncle depth	25	20.9- 23.2	22.1±0.14	25	21.6- 24.6	23.0±0.14	24	19.2- 23.5	21.5±0.23
Caudal peduncle length (dorsal)	25	4.0- 6.2	5.1±0.12	25	5.1- 7.0	6.1±0.11	24	7.3- 9.4	8.5±0.11
Pectoral-fin length	25	27.0- 30.5	28.7±0.20	25	28.0- 31.7	29.6±0.19	22	30.8- 36.4	33.8±0.29
Pelvic-fin length	18	64.9-100.2	83.5±2.20	21	67.8-104.4	88.0±2.07	21	114.5-186.8	160.1±4.22
Last dorsal-fin spine length	20	21.1- 27.3	24.4±0.33	24	22.3- 26.6	24.8±0.23	23	28.7- 39.9	33.9±0.63
Orbital diameter (% head length)	25	34.3- 38.7	36.4±0.25	25	37.3- 46.5	40.5±0.49			
Snout length (% orbital diameter)	25	62.1- 97.1	84.1±1.56	25	53.0- 85.4	69.1±1.93			

Pterophyllum Heckel

Synonymy

Pterophyllum Heckel 1840, p. 334 (type species *Platax scalaris* Cuvier, by monotypy).

Plataxoïdes Castelnau 1855, p. 21 (type species *Plataxoïdes dumerilii* Castelnau, by monotypy).

Pterophyllum species are strongly compressed cichlids with strongly arched dorsal and ventral contours; the rounded outline of the body is changed into a triangular appearance by the shape of the vertical fins: spines gradually increasing in length from a minute first spine to a long ultimate, a few anterior soft rays very long. The height between tips of longest soft dorsal and anal fin rays exceeds body length. The colouration of living fishes is silvery with contrasting black vertical bars and a spot on the dorsal-fin base in one of the bars. The relatively slender, large-scaled and short-finned *Pterophyllum leopoldi* bridges the morphological gap between *Mesonauta* and *Pterophyllum*, but has smaller scales, produced anterior soft dorsal and anal fins, caudal fin truncate with marginal filamentous extensions, accessory caudal-fin lateral lines long and between rays D3 and D4 in dorsal lobe, as characteristic of other *Pterophyllum* species. See notes on *P. scalare* for status of nominal species. Vandewalle (1971) and Koltzer (1953) describe aspects of the anatomy of *Pterophyllum* and Paepke (1983) has a popular summary covering much of the biology, morphology and systematics of *Pterophyllum* species.

Pterophyllum scalare, the only species of the genus studied anatomically, has a ventral laminar, cartilage-lined expansion of the first epibranchial. Unlike in geophagines, the structure is not associated with an external lobe-like projection from the dorsal limb of the first gill-arch. There are 2 supraneurals; a freely suspended, ball-like interarcual cartilage; microgill-rakers externally on 2nd to 4th arches; long tubed caudal-fin lateral lines between rays D3 and D4, D1 and V1, and V4 and V5; no caudal pecuncle vertebrae; predorsal squamation stochastic. The first one or two caudal vertebrae bear pleural ribs; caudal paired prolongations of swimbladder reaching to 9th hemal spine.

Pterophyllum scalare (Lichtenstein)

Figs 75-80, Pl. XIII, Table 18

Synonymy

Zeus scalaris Lichtenstein 1823, p. 114 (diagn.; Or. Brasil).

Platax? scalaris Cuvier, in Cuvier & Valenciennes 1831, p.237 (descr.; Brésil).

Plataxoïdes dumerilii Castelnau 1855, p. 21 (descr.; Para), Pl. 11, f'g. 3 (coloured drawing; habitus, teeth).

?Pterophyllum eimekei Ahl 1928, p. 252 (descr.; Mündung des Rio Negro in den Amazonas), Abb. 1 (monochrome photo of syntype).

Peruvian bibliography

Pterophyllum scalare; Cope 1872, p. 250 (listed; the Ambyiacu). -- Pellegrin 1904,p.251 (descr.; bibliogr.; Haut-Pérou and Brazilian material).-- Fowler 1944, p. 272 (Peruvian bibliogr.), fig. 88 (sketch, habitus). -- Fowler 1945*a*, p. 253 (Peruvian bibliogr.), fig. 88 (sketch, same as in Fowler 1944, fig. 88, captioned as from Pebas). -- Lüling 1961*a*, p. 240 (listed; Rio Pacaya; habitat data). -- Lüling 1961*b*, p. 333 (listed; Cano Yarina). -- (*pt.*) Schultz 1967, p. 6 (bibliogr.; descr.; meristics; Yarinacocha; Iquitos; Pévas; Lago Cashiboya; Peru (Amazon); Peru; near Pévas; /extralimital material possibly composite/). -- Lüling 1975, p. 50 (listed; Yarina Cocha; R. Ucayali), Abb. 9*pt.* (habitus, monochrome pho-

to; Rio Pacaya). -- (*pt.*) Burgess 1976, p. 93 (analysis of meristics, data from Schultz (1967)). -- Lüling 1979, p. 424 (Yarina Cocha; habitat), Abb. 3 (habitat photo; Yarina Cocha). -- Staeck 1982, p. 290 (ecology; Ucayali, Peru), Bild 1, 4, 6 (habitats), 2 (monochrome photo, freshly caught, habitus; Ucayali, Peru).

Pterophyllum; Lüling 1961*b*, Abb. 6 (monochrome photo, habitus; Rio Pacaya).

Pterophyllum scalare scalare; (*pt.*) Paepke 1979, p. 15 (new comb. based on Burgess 1976; status of aquarium material referred to subspecies uncertain). -- (*pt.*) Burgess 1979, p. 56 (new comb., otherwise nearly as Burgess 1976).

Material

113 specimens, 18.6-75.0 mm SL.

Description

Based on large specimens, 65-75 mm SL, with notes on ontogenetic variation; counts from 25 measured specimens, some from 57 specimens; measurements summarized in Table 18. Refer to Pl. XXIII for general aspect.

Shape. Very deep, depth at anal-fin origin 77.5-93.4 % of SL, $\bar{x}$ = 86.5±0.79 (in Table 18 material), strongly compressed laterally. Predorsal contour strongly concave as dorsal snout outline much less inclined than slightly convex ascending remaining predorsal outline, dorsal-fin base contour convex, semicircular; prepelvic contour nearly straight, lower jaw posterior end slightly projecting, almost as steep as predorsal contour; abdomen short, deepening caudad; anal-fin base slightly convex anteriorly, almost straight sloping base of soft portion; caudal peduncle short, dorsal edge much longer than ventral and sloping. In frontal aspect narrow with keeled nape, concave between pelvic-fin bases. Snout rather long, triangular in lateral aspect, rounded in dorsal aspect. Interorbital vaulted, somewhat flattened medially. Jaws anterior to orbit, which in center of head. Interorbital wider than mouth. Lower jaw slightly prognathous. Lips moderately thick, narrow lower lip fold narrowly interrupted, upper lip fold widely interrupted anteriorly.

Scales. Squ. long. - (3), 30 (1), 31 (1), 32 (5), 33 (8), 34 (15), 35 (15), 36 (5), 37 (2), 39 (2); 23-25 scale-series around caudal peduncle. Cheek completely scaly, scales thin, cycloid, in 3 (10), 4 (15) series; numerous small thin cycloid opercular scales; subopercular scales in two series, most cycloid, anteriorly ctenoid; ctenoid interopercular scales in one series. Preopercular scales mostly ctenoid on anterior limb, principal series of 4-8 scales, commonly 1-2 dorsally, occasionally one between corner canal branches. Body scales ctenoid except a patch on anterior side much of which covered by inner half of adpressed pectoral fin.

Upper lateral line at 11 1/2-13 (anteriorly, to edge of scale cover) to 4-5 (posteriorly) scales distance from dorsal fin; 4 (-5) scale series between free ends of lateral lines. Lateral lines on -/- (1), 16/11 (2), 17/8 (2), 17/9 (3), 17/10 (2), 17/11 (1), 18/- (1), 18/8 (1), 18/9 (6), 18/10 (1), 18/12 (1), 19/8 (1), 19/9 (3) scales; lateral line tube series between rays D3-D4, D1-V1 and V4-V5 on caudal fin, to end of scaly area, median series of 1-6 scales.

Fin scales. Pectoral and pelvic fins naked. Dorsal fin with narrow basal scale cover, leaving about 10 posterior rays naked, interradial scales from 6th spine, last 6-9 membranes naked, ctenoid or cycloid, edge of interradial scale cover about paralleling fin-base contour, width anteriorly on soft fin slightly exceeding 1/3 of length of last spine, gradually narrower caudad. Anal-fin scale cover continuous with body squamation anteriorly, chiefly interradial scales on soft portion, scaly area widening to a point anteriorly on soft portion, near tip of last spine, narrowing caudad to last membrane, scales ctenoid basally, cycloid distally. Caudal fin with concave basal scale layer, slightly more than 1/4 scaly centrally, nearly half marginally, mostly ctenoid scales.

Fins. First dorsal-fin spine above gill-cleft, 1/10-1/8 length of last, spines increasing in length to last; soft fin with very long anterior rays, 1st to about 8th ending in rounded off tip, 2nd ray longest, behind 8th-10th ray rapidly shorter, 1st-2nd or 3rd rays unbranched, remainder of anterior rays bifid, length of anterior soft dorsal fin exceeding 2-2 1/2 times length of last spine. D. XI.24 (1), XI.25 (2), XII.- (1), XII.23 (6), XII.24 (21), XII.25 (18), XII.26 (2), XIII.23 (1), XIII.24 (3), XIII.25 (2). Anal-fin origin slightly anterior to midbody, first spine 1/10-1/8 length of last, spines increasing in length to last; soft part pointed by long unbranched first ray and tips of branches of bifid second ray which more than twice length of last spine, posterior rays gradually much shorter. A. V.27 (1), VI.- (1), VI.24 (3), VI.25 (12), VI.26 (19), VI.27 (18), VI.28 (3). Length of last anal-fin spine 40.2-55.1 % of SL, $\bar{x}$ = 48.3±0.85, in Table 18 material.

Pectoral fin with rounded tip, 2nd or 3rd ray longest, reaching to above about first anal-fin ray base. P. 11 (22), 12 (23). Pelvic fin inserted anterior to vertical from pectoral axilla; base plane parasagittal, posterior two rays lateral to abdominal side when fin spread; pointed, first ray outer branch much produced, reaching far posterior of caudal fin. Caudal fin usually damaged, otherwise truncate with filamentous extensions of rays V6 and D6 as long as rest of fin. Posterior dorsal- and anal-fin spines and pelvic-fin spine with slightly curved tip.

Gill-rakers. 4 epibranchial, one in angle and 11 (1), 12 (8), 13 (15), 14 (1) ceratobranchial rakers externally on first arch, compressed, with laminar tooth-bearing edge, as a whole especially upper ceratobranchial rakers appearing pointed, gradually reduced in size and truncate rostrally; teeth not emerging from skin cover which fills up groove between toothed edges (fig. 75). Microgill-rakers externally on 2nd to 4th arches. First epibranchial notably wide, with cartilage-lined ventral flange (fig. 76).

Jaw teeth (fig. 77). 12-21/(13)17-26 in upper/lower jaw outer hemiseries in measured specimens, with irregular increase with increasing SL; always more teeth in lower jaw; 3-4, occasionally 2 or 5 in upper, 5-6 in lower, inner series in a band anteriorly; teeth close-set in series, those of outer series increasing in size anteriorly, larger than inner teeth; outer teeth movable, inner teeth depressible. Tooth shape seemingly identical in small and large specimens, except that in those over 65 mm outer anterior and some posterior teeth with insignificant lingual edge cusp, teeth otherwise cylindrical, apically recurved, slightly widened and labial surface convex or slightly flattened, lingual surface bilaterally slightly concave; posterior and inner teeth with shorter neck and broad, compressed cusp, hence more prominent.

Tooth-plates. 71.1 mm specimen dissected with numerous slender pharyngeal teeth, well-spaced anteriorly, close set and longer posteriorly, all freely movable but not depressible; all of similar shape but cusps gradually more pronounced from anterior to posterior which slightly compressed with wide antrorse posterior cusp with convex posterior surface, concave rostral surface with narrow median ledge, small anterior cusp distinct from posterior (fig. 78). No teeth on 4th ceratobranchial.

Vertebrae. 13+16 (7), 13+17 (1), 14+15 (1).

Young, about 2 cm, have the predorsal contour about straight or little concave as a whole, cycloid preopercular scales and narrower scale layer on vertical fins, and finnage more impressive than in adults; longest dorsal and anal-fin rays longer than body, first 6 dorsal-fin rays forming rather narrow tip of dorsal fin, 3 times longer than last spine, first 2 anal-fin rays forming point of anal fin, 3 1/2 times length of last spine; pectoral fin reaching to above about 4th anal fin ray; caudal fin with marginal filaments longer than rest of fin; long pelvic-fin filament.

Colouration. At about 2 cm chest silvery, sides pale whitish, forehead light grey. Brownish grey narrow vertical bars on body and head; 1st, intense, from dorsal-fin origin obliquely rostrad to dorsal margin of orbit, from ventral margin of orbit obliquely caudad to middle of preoperculum between corner lateralis canals, on interoperculum, and slightly caudad displaced on chest

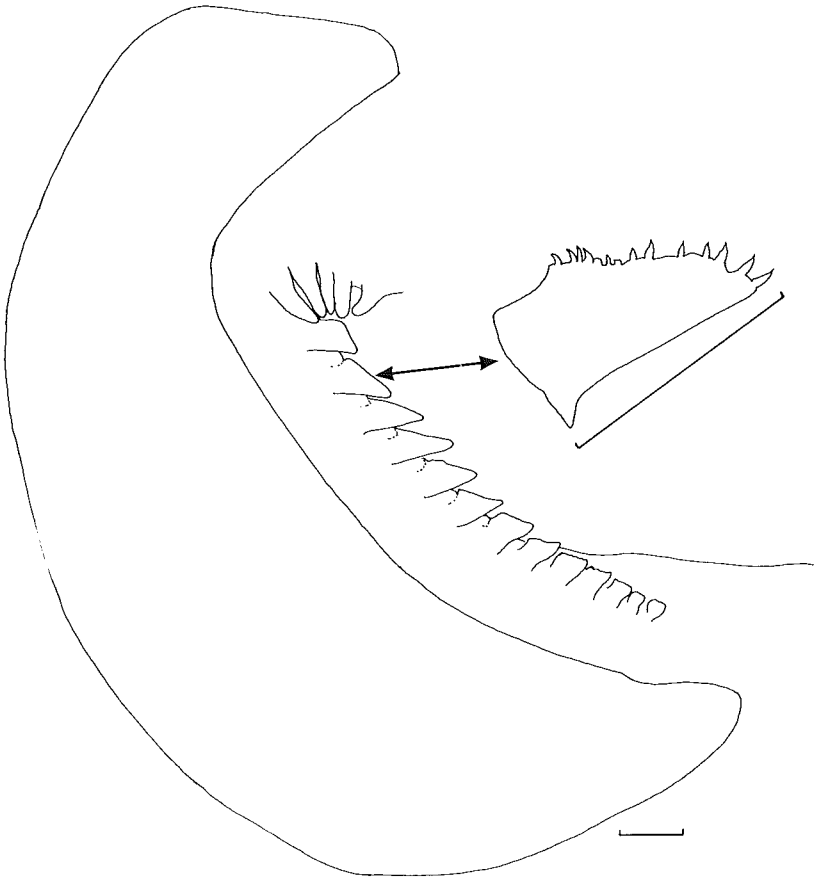


Figure 75. First gill-arch in lateral aspect of *Pterophyllum scalare*, NRM SOK/1983357.3692, 71.1 mm SL, and, enlarged, upper ceratobranchial raker in lateral aspect with skin removed; note that rakers not pointed but compressed, with thin laminar edges surrounding narrow groove filled up with epithelial tissue. Scales 1 mm.

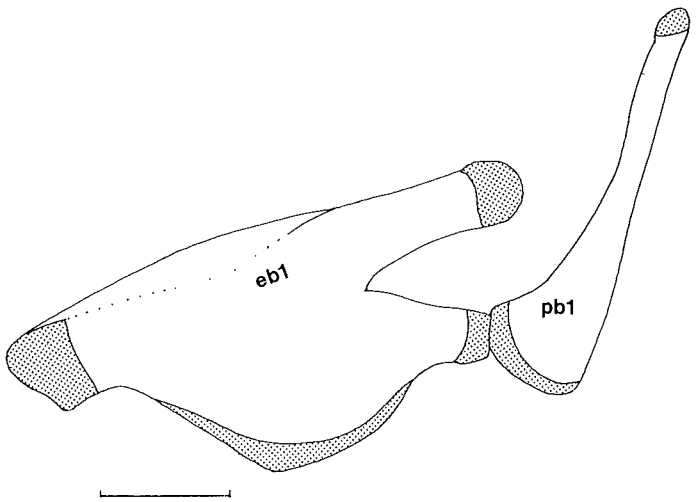


Figure 76. Anterolateral aspect of first epi-(eb1) and pharyngobranchial (pb1) of *Pterophyllum scalare*, NRM SOK1983357.3692, 71.1 mm SL. Cartilage stippled. Scale 1 mm.

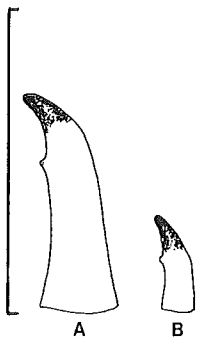


Figure 77. Oral teeth of *Pterophyllum scalare*, NRM SOK/1983354.3717, 74.6 mm SL. A medial aspect of adsymphysial upper jaw tooth, B lateral aspect of lower jaw tooth from middle of outer series. Scale 1 mm.

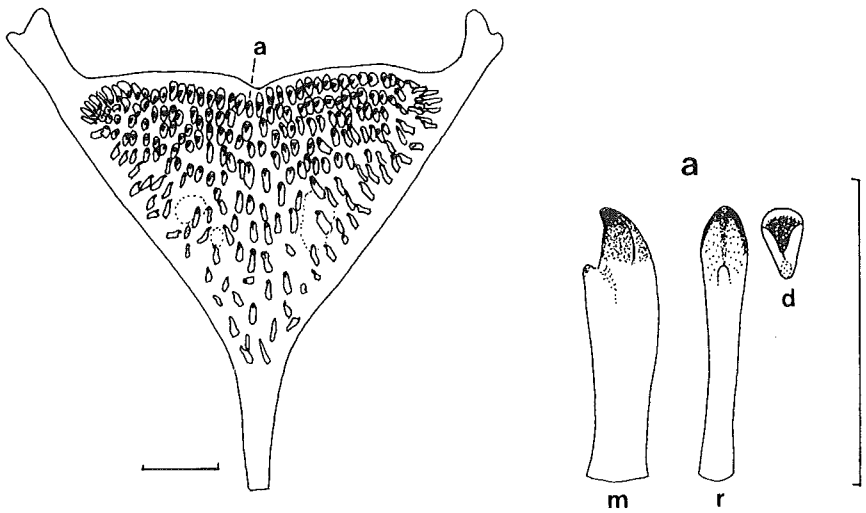


Figure 78. Occlusal aspect of lower pharyngeal tooth-plate and medial (m), lingual (r), and occlusal (d) aspects of a posterior tooth (a), of *Pterophyllum scalare*, NRM SOK/1983357.3692, 71.1 mm SL. Scales 1 mm.

where joining opposite side corresponding marking in a stripe on chest midline caudad to between pelvic-fin spine bases; 2nd, as a trace, from dorsal-fin origin to level of lower lateral line; 3rd, distinct, from 6th-7th dorsal-fin spines, ventrally narrower, to above vent; 4th below origin of soft dorsal fin, faint, virtually vanishing at lower lateral line level, reappearing close to anal-fin base; 5th, intense, from middle of soft dorsal-fin base ventrally onto anal-fin base; 6th, relatively faint, from anterior edge of caudal pecuncle ventrally to end of anal-fin base. 3rd and 4th bars gradually fading, slightly caudad inclined on anal fin, 3rd also on dorsal fin. 5th bar, which widest, continuous with blackish spot covering dorsal fin base from 4th ray caudad, anteriorly with more or less marked pointed widening toward fin tip posteriorly rapidly narrowing, very narrow along posterior 1/3 of fin base; on anal fin bar ending in blackish spot which continuous with dark fin prolongation.

Spinous dorsal fin brownish grey to level of 3rd bar, remainder of fin smoky, posteriorly hyaline except produced rays which blackish distal to spot terminating 5th bar. Anal fin brownish grey along edge of spinous portion; produced part blackish; duskied stripe along base of soft part and anterior 2/3 of dorsal margin of soft portion posterior to produced rays with wide duskied seam. Caudal fin basally light with concave wide blackish bar that not quite extending proximad to base of fin; 3 wide faint dark cross bars with hyaline interspaces and dark marginal filaments. Pelvic fin blackish except along inner and posterior edge, leading edge whitish.

Large adults (Pl. XXIII) with gill-cover and lower half of body silvery, dorsally white, lightly countershaded with grey. Forehead narrowly dark grey, snout and interorbital area grey. First vertical bar above orbit with unsharp margins, interrupted ventrally on preoperculum and interoperculum; 2nd vertical bar of young absent; 3rd bar as in young; 4th bar a faint shadow on dorsal half of side; 5th bar as in young, spot on dorsal-fin base prominent, form variable, more or less completely margined narrowly with hyaline, on anal fin simply drawn out toward fin tip; 6th bar absent, dorsal edge of caudal peduncle dark grey. Specimens from very turbid water tend to be lighter, lacking bar below orbit and with other bars faint, but bars also susceptible to fading with time of preservation.

Dorsal fin dusky on scaly portion, rest of spinous fin lighter; produced soft portion greyish, darkening distally, rest of soft portion hyaline with about 5 narrow hyaline stripes perpendicular to rays with dusky interspaces. Anal fin dusky except silvery base anterior to 5th bar; produced portion dark grey, posterior half of soft fin with hyaline spots in 2-3 irregular series perpendicular to rays, and darkened hind margin. Caudal fin with dark proximal bar slightly variable in appearance, distal to it 3-4 wide alternating hyaline and dusky cross-stripes, hind margin and filaments blackish. Pelvic fin slightly paler than in young.

Life colours. Living specimens similar to preserved; silvery with black markings. There may be a bluish hue on back and some yellowish in the vertical fins; the nape is pale brownish. There are no red or blue iridescent markings.

Distribution (fig. 79)
Peruvian localities are scattered along the Ucayali-Amazonas: R. Neshuya, Yarina Cocha, Supay Cocha, Cahuana (Pacaya), near Iquitos, lower R. Napo and Pebas; also on the upper and lower R. Yavarí. See notes on probable wide distribution in Brazil.

Ecology
Pterophyllum scalare is collected chiefly in white-water conditions, or in turbid black-waters. Habitats are mostly lakes or otherwise lentic, either bare or densely vegetated shores. Series are usually small; 15 specimens from station SOK 68 were obtained by extensive efforts in dense vegetation in a relatively small pool. Staeck (1982) described vaciante habitats and considered forest litter habitats important for the species.

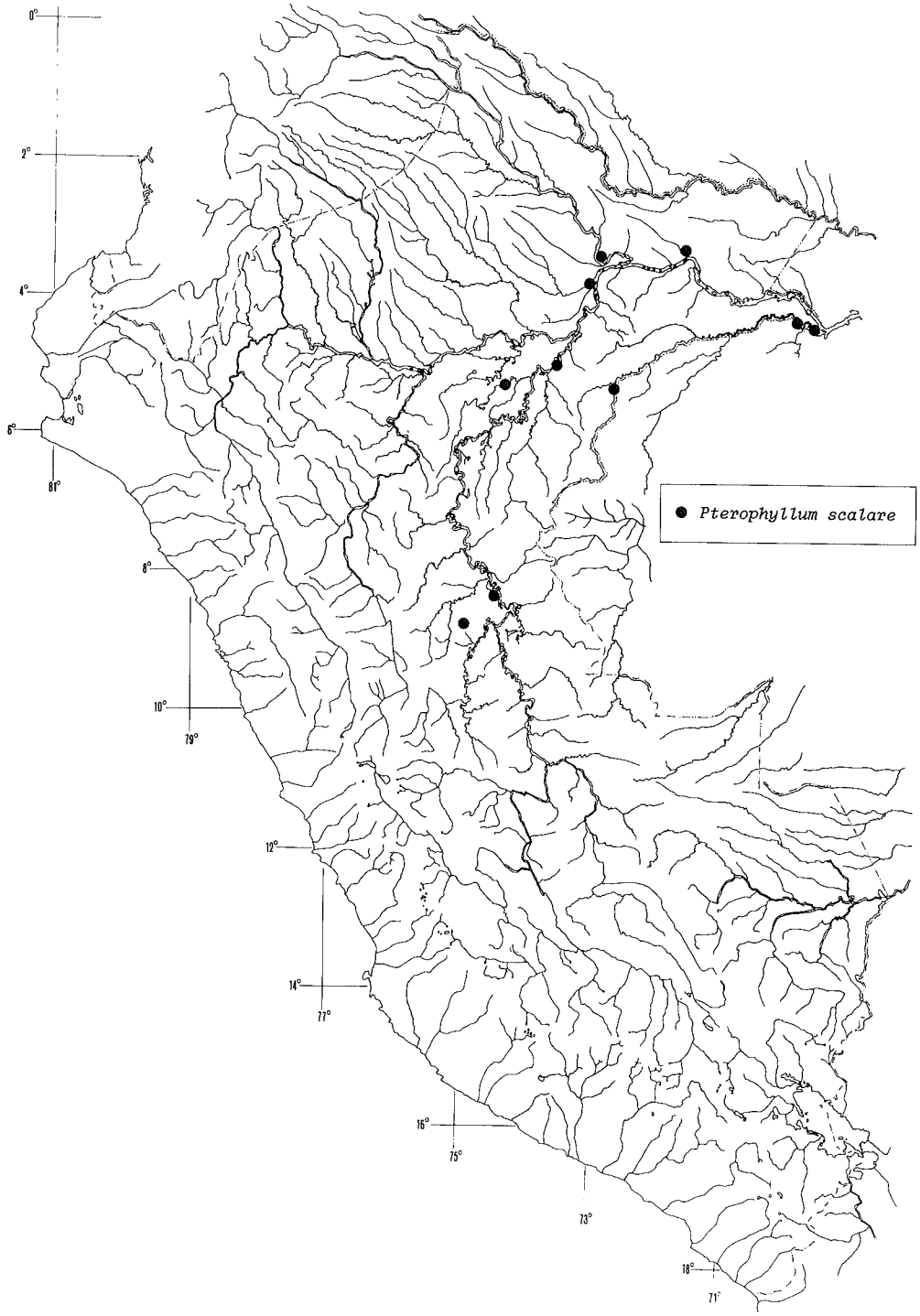


Figure 79. Collecting localities of *Pterophyllum scalare* in western Amazonía. A dot may represent more than one collecting site.

Notes

There are 6 nominal species in the genus *Pterophyllum*, viz. *P. scalare* (Lichtenstein), *P. scalare* (Cuvier), *P. dumerilii* (Castelnau), *P. altum* Pellegrin, *P. eimekei* Ahl and *P. leopoldi* (Gosse).

Of these, *P. altum*, an upper Orinoco and Negro endemic, is more deep-bodied than the others and has higher scale counts (squ.long. 46-48 in NRM material; 40-47 according to Schultz 1967), and *P. leopoldi* in the Solimões-Amazonas and Rupununi is distinguished by broad nape, straight predorsal contour, and several colour pattern particulars including a black spot dorsally in what is termed the 4th vertical bar in the above description. The status of the remainder is uncertain, and they may belong to a single species.

I am identifying the Peruvian material as *P. scalare* only tentatively because the type of *P. scalare* is lost and the description insufficient, and because survey of *Pterophyllum* material from the Essequibo, Oyapock, Branco, Negro and Solimões-Amazonas, suggests the possible existence of several similar species, varying in meristics and coloration. A future revision may suggest the application of a different specific epithet on the upper Amazonian *Pterophyllum*.

Pterophyllum scalare was described, very briefly, as *Zeus scalaris* from eastern Brazil in a sales catalogue of duplicates in the Zoological Museum of the Royal University in Berlin, now ZMB (Lichtenstein 1823). The length is given as 3 inches. In 1831, Cuvier (in Cuvier & Valenciennes 1831) reported on a specimen found in the Bloch collection in the Berlin Museum (ZMB), labelled 'Zeus scalaris', 2.5 inches long, which he described as *Platax ? scalaris*. This description obviously refers to a *Pterophyllum* species, and the label name suggests that it is either the same specimen as that described by Lichtenstein (1823) or the 'original' of the 'duplicate' advertised by Lichtenstein. The notes for the description were probably taken by Valenciennes who visited Berlin in 1826 and 1829 (Karrer 1978).

In the ZMB collection there is a *Pterophyllum* specimen, *c.* 44 mm SL, *c.* 59 mm TL, ZMB 1347, which is labelled 'Platax scalaris C.V. Zeus scalaris Mus. Brasilien . It is most likely the specimen described by Valenciennes, but is smaller than the 3 inches given by Lichtenstein. The dorsal-fin spine count, XII, agrees with Cuvier's, but not with Lichtenstein's (X).

Considering that Lichtenstein's description must have been derived from study of at least 2 specimens, even though descriptive data may be from one only, I consider ZMB 1347 as representing the type series of *Z. scalaris* Lichtenstein as well as it is the holotype of *P. scalaris* Cuvier. The 'duplicate' of *Z. scalaris* was probably sold and there is no trace of its whereabouts.

The specimen is in a very bad state of preservation, soft, with most flank scales lost and fins damaged. I count D. XII.$\geq$24, A. VI.26. It has a marked notch in the forehead contour with the dorsal contour of the snout nearly horizontal.

No later revisions of the genus *Pterophyllum* have considered this type specimen, but nevertheless have applied the name *scalare* on *Pterophyllum* material (Ahl 1928, Schultz 1967, Burgess 1976, 1979). Whether the Peruvian material is referable to *P. scalare* of Lichtenstein, and whether *P. scalare* of other authors is correctly identified and/or the same as the Peruvian form are questions requiring a revision of a magnitude beyond the capacity of this paper.

The problem of the identity of *P. scalare* is not entirely nomenclatural because there is considerable variation in meristics amongst the large material studied by Schultz (1967) and Burgess (1976, 1979) which I can verify from additional material and there is also variation in colour pattern within *P. scalare* auctt. suggesting that it may be a composite.

If *P. scalare* is diagnosed by its scale count (30-39), notched predorsal contour, and absence of a prominent spot in the bar numbered as the 4th in the above description, it would have a range extending from Peruvian localities east to Belém along the Amazon and is also found in the Essequibo, Oyap-

ock, Madeira, Araguaia, middle R. Negro and R. Branco (maps in Schultz 1967 in part, Burgess 1976 in part, 1979 in part). It would include *P. eimekei* Ahl, described from aquarium material (ZMB unreg., MNHN 29-12) and *P. dumerilii* Castelnau from Para (Belém) as synonyms.

Schultz (1967) regarded *P. dumerilii* as a valid species with *P. leopoldi* a synonym. *Pterophyllum leopoldi* is characterized by a straight predorsal contour (not notched in front of orbit) and among colour features differs in having a conspicuous black spot at the dorsal end of the vertical bar corresponding to that termed the 4th in the above description of *P. scalare* from Peru. The holotype of *P. dumerilii* (MNHN A.254), however, has a notched frontal profile typical of *P. scalare* (fig. 80). The specimen is in a very bad shape and lacks body colouration and most scales (no scale count possible, but slightly over 30 squ.long. scales estimated from scale-pockets). Fin counts, D. XII.24 and A. VI.25 are high for *leopoldi* (D. XI-XIII.19-22, A. VI.19-22 according to Gosse 1963). Hence I refer *P. dumerilii* to *P. scalare* and consider *P. leopoldi* a valid species.

Variability in Schultz's (1967) material of '*P. dumerilii*' suggests that it may include additional specimens of *P. scalare*. Schultz's (1967) colour pattern data and counts from the holotype of *P. dumerilii* are not verifiable, and may derive from a mix-up of examination notes.

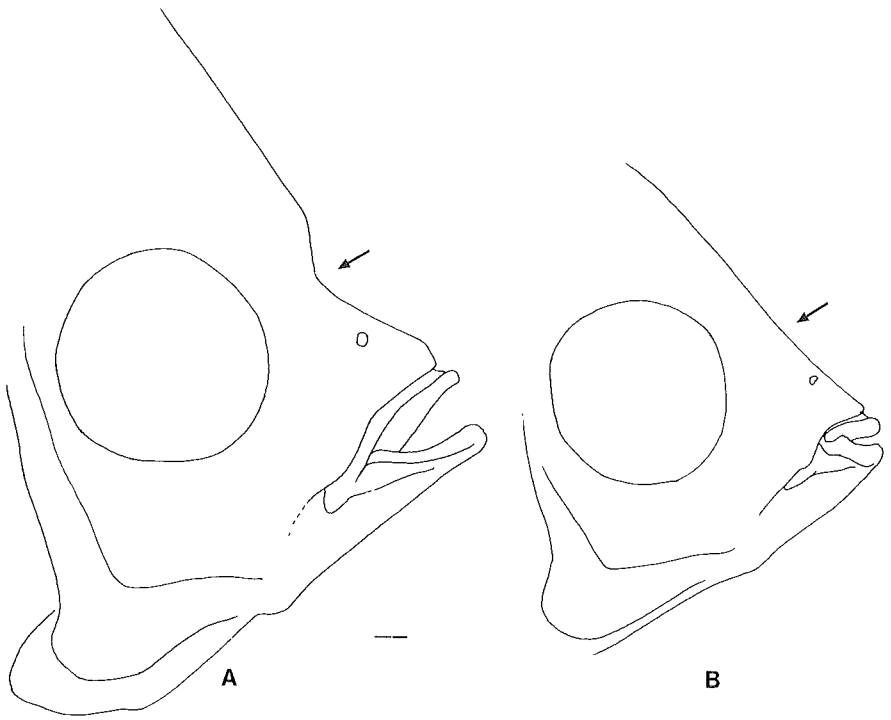


Figure 80. Profiles of head of (A) holotype of *Plataxoides dumerilii*, MNHN A.254, and (B) specimen of *Pterophyllum leopoldi*, FMNH 15255, to show species difference in dorsal outline (notch or no notch at arrow), that of *P. dumerilii* specimen typical of *P. scalare*.

Pterophyllum altum Pellegrin from the R. Orinoco and R. Negro is recognizable by its very deep body and higher meristics and appears adequately conceived in Schultz (1967) although I count 46-48 squ.long. scales in NRM material (Schultz gives the range 40-47).

Burgess (1976) regarded *P. altum* and *P. scalare* as based on meristic characters (D,A, squ.long. counts) showing clinal variation along the R. Negro and Orinoco and synonymized *P. altum* with *P. scalare*. The conclusion is based in part on Schultz's (1967) meristic data. In a later review of the genus, Burgess (1979) considered *P. altum* an Orinoco-upper R. Negro subspecies of *P. scalare*, and added a colour feature to the diagnosis (distinct 2nd vertical bar, as counted in Peruvian *P. scalare*, cf. description above). *Pterophyllum altum* (*P. s. altum sensu* Burgess), however, has much wider vertical bars including that distinct bar present only as a trace in young *P. scalare* below the dorsal-fin origin, and analysis of characters other than meristics will likely show Burgess's polytypic *P. scalare* to be composed of distinct species.

Heros Heckel

Heros Heckel 1840, p. 362 (type species *Heros severus* Heckel, by subsequent designation in Jordan & Gilbert 1883, p. 608).

Heros species are deep-bodied, strongly compressed cichlids which resemble *Symphysodon* in both shape and colour pattern. The latest revision (Regan (1905*d*) treated the genus as a monotypic section of *Cichlasoma*, with some unspecified affinity to *Pterophyllum* and *Symphysodon*. Kullander (1983*b*) suggested that the presence of caudal swimbladder diverticula (to 4th hemal spine) without associated caudal ribs might indicate a closer relationship to *Symphysodon* (swimbladder to 13th hemal spine; no caudal ribs) than to *Pterophyllum* or *Mesonauta* (swimbladder diverticula and caudal ribs); and that anterolateral apophyses on the second basibranchial would be a distinguishing feature of *Heros*. The relationship question certainly needs more work. Also, it appears that *Heros* is not monotypic and a revision of component species needs to be made.

The description of *H. appendiculatus* below, is fairly representative for the genus, the species differing in body depth (all deep-bodied, however), lip thickness and minor colour pattern particulars.

Heros is similar to other polyacanth cichlasomine cichlids dealt with herein, with 7-8 anal-fin spines, bi-or tricuspid anterior teeth, small scales, two supraneurals, scaled dorsal and anal fins; and can be recognized by colour pattern (8 vertical bars on side) and dorsal-fin spine number (15-16, cf. *Symphysodon* and *Pterophyllum*).

The genus has a wide distribution in South America, encompassing much of the Amazon adn Orinoco basins, the Tocantins drainage and marginal Guianan rivers.

Heros appendiculatus (Castelnau)

Figs 81-84, Pl. XXIV (figs 1-2), Table 19

Synonymy

Chromys appendiculata Castelnau 1855, p. 15 (descr.; l'Ucayale (Pérou)), Pl. 7, fig. 3 (coloured drawing, habitus).

Uarus centrarchoides; Cope 1872, p. 253 (descr.; Ambyiacu River), Pl. XI, fig. 2 (sketch, habitus; holotype).

Peruvian bibliography

Heros spurius; (*pt.*) Günther 1862, p. 293 (*Chromys appendiculata* questionable synonym). -- (*pt.*) Pellegrin 1904, p. 237 (holotype of

Chromys appendiculata included in descr.).
Acara (Heros) spuria; (*pt.*) Steindachner 1875, p. 83 (*Uarus centrarchoides* and *Chromys appendiculata* in synonymy). -- Steindachner 1883, p. 2 (listed; Rio Huallaga).
Cichlasoma severum; (*pt.*) Fowler 1940*a*, p. 281 (listed; Contamana; bibliogr. only in part). -- Lüling 1963, p. 51 (Quisto Cocha; habitat; local name), Abb. 16 (sketch, habitus). -- Lüling 1975, p. 50 (listed; Yarina Cocha, R. Ucayali), Abb. 13*pt.* (sketch). -- Vierke 1983*d*, p. 440 (record; Yarinacocha).
Uaru amphiacanthoides; Eigenmann & Allen 1942, p. 390 (listed; Iquitos; Contamana; Lago Cashiboya).
Cichlaurus severus; (*pt.*) Fowler 1944, p. 265 (Peruvian bibliogr.). -- (*pt.*) Fowler 1945*a*, p. 246 (Peruvian bibliogr.). -- Bérenz & Zelada 1975, p. 51 (descr.; local names; markets of Iquitos), Fig. 3 (sketch, habitus).
Chromys appendiculata; Blanc 1962, p. 205 (holotype listed).
Uarus centrarchoides; Böhlke 1984, p. 57 (holotype listed).
Heros severus; (*pt.*) Staeck & Linke 1985, p. 136 (popular account; habitat data; R. Shahuaya), fig. p. 136 (colour photo, aquarium).

Material
63 specimens, 16.3-132.1 mm SL, including holotypes of *Chromys appendiculata* and *Uarus centrarchoides*, from Peru and vicinal Brazil and Colombia.

Description
From fresh specimens over 100 mm, with notes on young; counts from 27 specimens; measurements summarized in Table 19. Refer to Pl. XXIV for general aspect.

Shape. Deep, compressed laterally; narrow in frontal aspect, with keeled nape and narrowly flattened chest; predorsal contour rising straight or feebly concave to nape where little curved; prepelvic contour feebly sigmoid, concave anteriorly, chest convex, slope less than that of predorsal; dorsal-fin base outline obscured by scales, feebly sloping to near caudal peduncle where strongly descending; abdominal contour straight; anal-fin base contour slightly convex, ascending, obscured by scales; caudal peduncle narrower posteriorly, edges straight, dorsal as long as or little longer than ventral. Orbit in dorsal half of head and in middle of head length; interorbital area convex, wide, wider than mouth. Snout deep, triangular in lateral, nearly pointed in dorsal aspect. Jaws equal anteriorly; entirely anterior to orbit. Lower lip fold wide (about half orbital diameter anteriorly), continuous, gradually wider toward symphysis, thick; in largest specimens upper lip fold widely interrupted, but secondary median fold wide (not as wide as lower lip fold) projecting caudad medially, fitting concave postlabial skin margin; upper jaw in specimens less than 115 mm with less marked median lip fold, posteriorly obscured by overlying postlabial skin; in young and juveniles skin thick but no median fold recognizable, lower lip fold wide and continuous at all sizes.

Scales. Squ. long. - (2), 27 (6), 28 (17), 29 (2); 20-23 scale series around caudal peduncle. Predorsal scales numerous, small, ctenoid except some cycloid along midline; prepelvic scales smaller than flank scales, cycloid. Cheek scales cycloid, in 4 (1), 5 (20), 6 (6) series; opercular scales in 4-5 vertical series, ctenoid dorsal scales; subopercular scales in 2 series, cycloid; interopercular scales in 1 series, cycloid; preoperculum naked.

Upper lateral line at 8-9 1/2 (anteriorly) to 4-4 1/2 (posteriorly) scales distance from dorsal fin; 2 scale series passing between free ends of lateral lines; lateral line counts -/- (2), -/9 (1), 18/9 (2), 19/9 (7), 19/10 (5), 19/11 (1), 20/9 (5), 20/10 (3), 21/8 (1), plus 2 scales on caudal fin and long tube-series between caudal-fin rays D2 and D3 (to 6 scales), and V4 and V5 (to 8 scales), shorter in young and vestigial at about 20-25 mm SL.

Fin scales. Pectoral and pelvic fins naked. Dorsal-fin base scaly except

along 3-6 posterior rays; dense basal layer of 2-3 scales width (over basal 1/4 of middle spines), short series of mostly ctenoid scales from posterior spinous part membranes forming convex scaly area through soft part, 2 to 8 scales (including basal) between rays 3 and 4 in measured specimens, number increasing with increasing size. Anal-fin squamation similar, slightly more extensive on soft portion, basal scales from 3rd spine to end of fin, distal scales cycloid. Caudal fin scaly basally, marginally to 1/3, centrally to 1/4, chiefly ctenoid scales.

Fins. First dorsal-fin spine slightly posterior to vertical from dorsal tip of preoperculum, about 1/3 length of last, spines subequal or little increasing from 6th, last few again slightly longer; lappets with long free hind edge and pointed anteriorly, shorter and truncate posteriorly; soft portion usually damaged, otherwise generally pointed and reaching beyond middle of caudal fin. D. XV.13 (1), XV.14 (4), XVI.12 (3), XVI.13 (19). Anal-fin origin posterior to middle of body, first spine opposite about 5th from last dorsal-fin spine; spines increasing in length to last; soft part commonly damaged, otherwise like soft dorsal-fin but tip slightly broader; A. VII.13 (5), VIII.11 (4), VIII.12 (14), VIII.13 (4). Pectoral fin with rounded-subacuminate tip, 3rd ray longest; reaching to above 5th or 6th anal-fin spine; P. 12 (3), 13 (23), 14 (1). Pelvic-fin spine inserted below pectoral-fin base; pointed, outer branch of first ray produced, at most to caudal-fin base. Caudal fin damaged in large specimens, in young subtruncate.

Gill-rakers. 2-3 epibranchial, one in angle, and 9 (12), 10 (14), 11 (2) ceratobranchial rakers externally on first gill-arch, all rakers smooth, short, epibranchial and angle rakers digitiform, ceratobranchial compressed, lower ceratobranchial papilliform (fig. 82). Microgill-rakers externally on 2nd to 4th arches, also internally on 4th arch in those larger than 50 mm SL, occasionally large specimens with short sequences internally on 2nd to 3rd arches.

Jaw teeth (fig. 81). 3-11/5-14 in 17, 22.4-64.0 mm SL; 11-14/11-19 in 8, 80.0-116.4 mm SL, in upper/lower jaw outer hemiseries, increase in number with size more marked in upper jaw; at 16.3 mm SL all teeth unicuspid, in those *c.* 23 mm SL lower jaw teeth unicuspid, anterior outer upper jaw teeth bicuspid; gradual shape change then rapid to adult condition: lower jaw with anterior outer 4+4 teeth enlarged and gradually larger symphysiad, with round-tipped anterior cusp with slightly recurved tip that curved on labial part, on lingual side bilaterally feebly concave with median rise, and labial compressed narrow ledge bearing dorsal cusp; posterior and inner teeth smaller, some in labial series and some anterior inner teeth bicuspid, otherwise erect and subconical. Upper jaw outer teeth like anterior lower jaw teeth excepting a few posterior, graduated in size toward symphysis and anterior 4+4 especially long, inner teeth much smaller, anterior bicuspid, posterior usually unicuspid, very rarely tricuspid anteriormost upper jaw teeth. Inner teeth in single series (to *c.* 60 mm) or 2-3 irregular series anteriorly in upper jaw; in lower jaw 1 (to *c.* 40 mm), 1-2 (40-60 mm), or 2, rarely 3 (60 mm and over) inner series anteriorly.

Tooth-plates. Lower pharyngeal tooth-plate in 101.9 mm specimen dissected densely toothed; a few anterior teeth unicuspid, remainder bicuspid, marginally slender, medioposteriorly slightly oblong (fig. 83). 4th ceratobranchial with 4 close-set tooth-plates with 5, 6, 4, 4 teeth.

Vertebrae. 14+14 (2), 14+15 (1).

Juveniles, 16.3-*c.* 25 mm SL similar to adults, but the smallest much more elongate, head longer, eye larger and snout shorter; predorsal and prepelvic contours straight, about equally angled; interorbital flat; soft dorsal and anal fins rounded; see also dentition and fin scale descriptions. Deep body of adults (about 60 % of SL) attained at *c.* 50 mm SL. Lips thin, fold of lower subcontinuous in smallest.

Colouration. Juveniles pale yellowish with brown narrow vertical bars. Dark brown suborbital stripe from orbit ventrally narrower to interoperculum, little inclined; supraorbital stripe dark brown,. from posterosuperior edge of

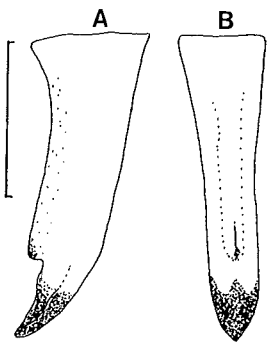


Figure 81. Adsymphysial upper jaw tooth of *Heros appendiculatus*, NRM SOK/ 1981325.3331, 101.9 mm SL, in A medial and B lingual aspect. Scale 1 mm.

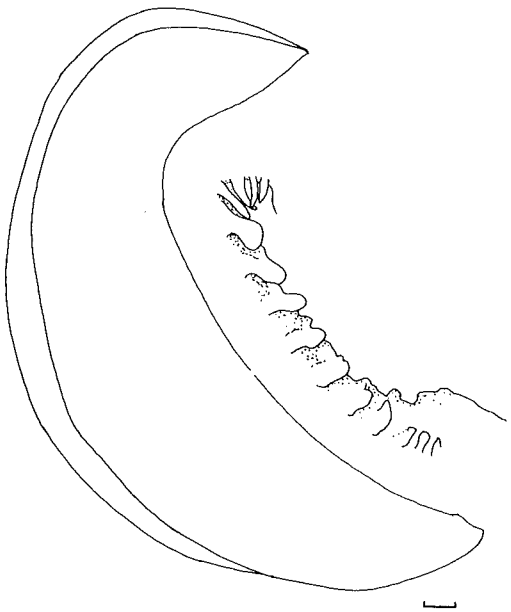


Figure 82. First gill arch of *Heros appendiculatus*, NRM SOK/1983354.3678, 92.8 mm SL, in lateral aspect. Semidiagrammatic, scale 1 mm.

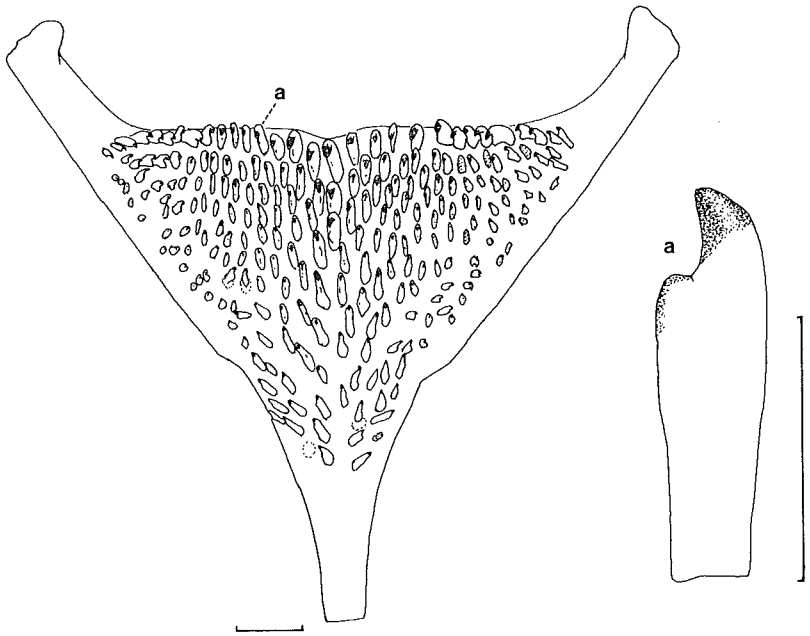


Figure 83. Occlusal aspect of lower pharyngeal tooth-plate and posterior tooth (a) in medial aspect of *Heros appendiculatus*, NRM SOK/1981325.3331, 101.9 mm SL. Scales 1 mm.

orbit slightly caudad-dorsad, vanishing in brown colour of nape and forehead. Vertical bars brown: 1, between dorsal-fin origin and operculum, slightly slanting, operculum light brownish, continued on chest as dark blotch which a brown stripe from pelvic fin to suboperculum in slightly larger specimen; 2, between pectoral axilla and dorsal fin slightly slanting, continued ventrally between pectoral axilla and belly slightly posterior to pelvic-fin origin; 3, slightly convex between belly middle and dorsal fin; 4-7, from anal-fin base to dorsal fin, anterior straight vertical, posterior sloping, 7th darker than remainder; 8, over end of caudal peduncle and base of caudal fin. Brown spot on pectoral axilla. Dorsal fin light brownish, soft portion hyaline with some pigment marginally, and black spot tapering caudad along fin base above Bar 7. Anal fin like dorsal fin, but dark brown basal extension of Bar 7 instead of black spot. Caudal fin hyaline. Pelvic fin hyaline with blackish anterior edge.

Transformation to adult colour pattern includes restriction of suborbital spot to cheek between 30-40 mm and ultimate vanishing, general darkening of head and sides more uniform, bars usually prominent only ventrally in specimens 40 mm and larger, small scattered dark spots on anterior sides from *c.* 30 mm, spinous vertical fins darkening and dorsal fin with two horizontal series of dark dots from *c.* 40 mm. Large adults with sides light grey brown, head dark grey, chest grey; vertical bars indistinct or absent from sides of back, as vertical blackish spots below lower lateral line level (bars 2 or 3, to 6), pectoral axilla and pectoral-fin base darkened; suborbital stripe not evident; commonly small dark spots scattered over sides, operculum and nape; rarely a dark dot on caudal-fin base slightly dorsal to lateral line; Bar 7 intense, including dorsal-fin spot as little intensified component and extending onto anal-fin base, anal-fin portion occasionally spot-like; dark bar on caudal-fin base faint. Dorsal fin dark grey with darker dots in two horizontal series, soft part hyaline with brown spots in cross-series; anal fin blackish, last few membranes lighter with dark dots. Pelvic fin dark grey to blackish, caudal fin hyaline or smoky with irregular series of dark

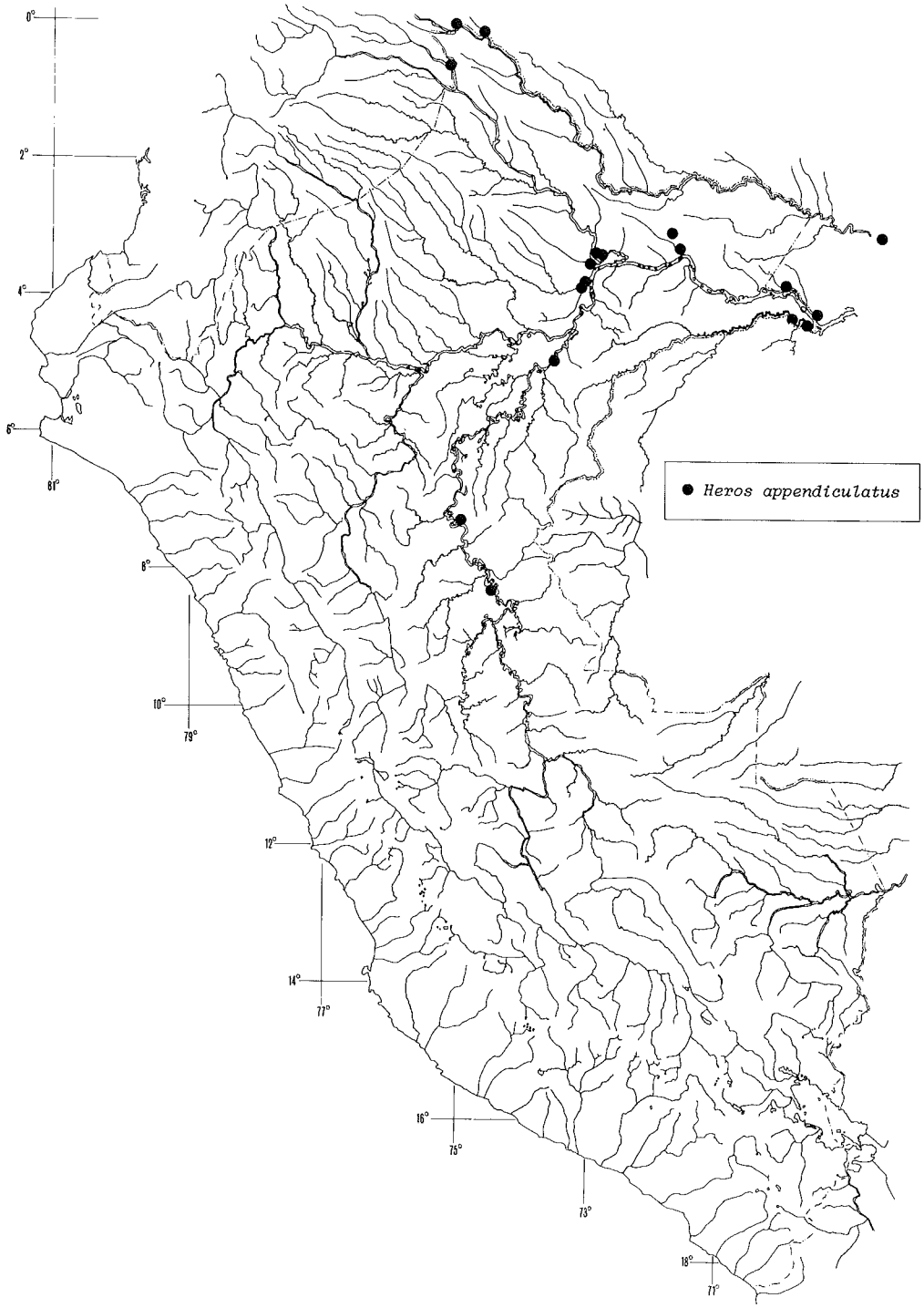


Figure 84. Collecting localities of *Heros appendiculatus* in western Amazonía.

spots. Light stripe from orbit to nostril not conspicuous. Dark stripe along upper edge of exposed portion of lower jaw, continued dorsally on horizontal limb of preoperculum, obsolete or absent.

Life colours. Young are similar to preserved fish; adults are very colourful with particularly notable a complex pattern of dark red spots in a network of blue lines on head and nape sides.

Distribution (fig. 84)
Material here referred to *H. appendiculatus* comes from along the Ucayali (Yarina Cocha, Contamana, Jenaro Herrera), the lower reaches of the rivers Nanay, Itaya, Napo, Ampiyacu and Yavarí, as well as Leticia and Putumayo-Içá localities Cuiabá and R. Caucayá.

Ecology
Samples of *Heros appendiculatus* are generally small, one or a few specimens. Habitats are predominantly lentic, commonly lakes, and as a rule with turbid water.

Local names
Bufurque, bujurqui (Bérenz & Zelada 1975: markets of Iquitos); bufurqui (Lüling 1963: Quisto Cocha).

Notes
Application of the name *appendiculatus* is provisional pending revision of the genus *Heros*. It is the oldest name applicable on the Peruvian *Heros* species, distinguished by thick lips, deep body and vertical bars that change into black ventral blotches in large specimens. I have seen too little material from the rest of the Amazon basin to be able to give a judgement on the eastward range of the species and possible synonymy with other nominal species. Only the distinctness from *Heros severus* seems clear. That species, in the upper R. Negro and upper R. Orinoco, is much more slender, has a distinct caudal spot (like some *H. appendiculatus*), distinct vertical bars except in some large specimens in which all fade except the 7th, which not extending onto anal fin, and narrower lips. The 6th bar of *H. severus* commonly does not reach as far dorsally as to the dorsal fin.

The holotype of *U. centrarchoides* is readily recognized with reference to the mutilated dorsal fin as shown on Cope's figure (1872, Pl. XI, fig. 2). Cope did not state any particular diagnostic features, and I cannot distinguish it from *H. appendiculatus*.

Table 19. *Morphometry of* Heros appendiculatus, Symphysodon aequifasciatus *and* Hypselecara temporalis. *Measurements are in per cent of SL, except SL (in mm).*

	Heros appendiculatus			*Symphysodon aequifasciatus*			*Hypselecara temporalis*		
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$
SL	27	22.4-128.2	65.8±5.37	13	66.5-137.2	97.8±6.54	25	39.0-137.2	64.4±4.70
Head length	27	32.2- 37.2	34.2±0.26	13	26.4- 30.8	28.8±0.38	25	32.9- 37.5	34.9±0.34
Snout length	27	6.7- 10.6	8.9±0.22	13	6.6- 8.2	7.5±0.18	25	7.7- 10.9	9.3±0.14
Body depth	27	49.6- 64.0	58.9±0.68	13	68.2- 76.5	72.1±0.83	25	45.5- 58.0	52.5±0.60
Orbital diameter	27	11.0- 17.0	13.3±0.34	13	10.3- 13.1	11.3±0.19	25	10.3- 15.9	13.2±0.36
Head width	27	17.8- 20.4	19.0±0.11	13	15.8- 18.0	16.8±0.20	25	18.0- 21.4	19.5±0.18
Interorbital width	27	12.2- 15.5	14.1±0.18	13	12.6- 15.2	13.9±0.20	25	11.5- 17.9	14.8±0.32
Preorbital depth	27	4.8- 11.0	8.2±0.34	13	8.4- 10.3	9.4±0.14	25	4.6- 9.4	6.6±0.26
Caudal peduncle depth	27	16.1- 19.3	18.3±0.14	13	17.6- 19.3	18.5±0.14	24	16.6- 20.5	18.6±0.21
Caudal peduncle length (dorsal)	25	5.3- 7.7	6.3±0.12	12	3.1- 4.2	3.7±0.12	23	5.2- 7.7	6.1±0.13
Pectoral-fin length	25	30.4- 37.2	34.7±0.31	12	29.2- 35.1	33.1±0.46	25	27.1- 30.9	29.3±0.22
Pelvic-fin length	22	21.4- 55.4	39.9±1.75	10	39.6- 51.7	45.2±1.17	25	34.5- 61.7	43.6±1.26
Last dorsal-fin spine length	24	17.8- 23.7	21.6±0.29	9	29.1- 32.3	30.6±0.39	24	18.9- 22.7	20.7±0.19

The specimen MNHN 1971-131 from R. Lagartococha, Ecuador, was labeled *Cichlaurus festivus* and possibly stems from the Orcés collection on which Ovchynnyk's (1967, 1968) records are based. The *Cichlaurus festivus* recorded by Ovchynnyk may thus be partly or entirely *Heros appendiculatus*.

Staeck & Linke (1985) reported *H. severus* from R. Shahuaya, which would be the southernmost locality, but no material was preserved.

The legend of a sketch of an *H. appendiculatus* in Lüling (1975; as *Cichlasoma severum*, Abb. 13) gives a length of 28.5 cm.

Eigenmann & Allen's (1942) Peruvian *Uaru amphiacanthoides* are misidentified *H. appendiculatus*; the *Cichlaurus severus* that they report may be another species, perhaps *Hypselecara temporalis*, but this material was not checked.

Symphysodon Heckel

Symphysodon Heckel 1840, p. 332 (type species *S. discus* Heckel, by monotypy).

Symphysodon species are characterized by the very deep, strongly compressed body and extensively scaly dorsal and anal fins. Dorsal and anal fins are long, D. VIII-X.28-33, A. VI-IX.27-31. Caudal swimbladder diverticula reach to the 13th hemal spine and are not associated with ribs. Unique traits include the 3 extrascapulars (other cichlids have 2, rarely 1) and edentulous 2nd pharyngobranchial. Both oral and pharyngeal jaws and dentition are greatly reduced (see description below).

Symphysodon aequifasciatus Pellegrin
Figs 85-87, Pls XXV-XXVI, Table 19

Synonymy

Symphysodon discus var. *aequifasciata* Pellegrin 1904, p. 250 (descr.; Teffé (Brésil); Santarém (Brésil)).

Symphysodon aequifasciata haraldi Schultz 1960, p. 11 (descr.; bibliogr.; Benjamin Constant, Brazil in the Amazon), fig. p. 8 (living specimen, colour photo, habitus) /reprinted in Axelrod 1978, p. 39/.

Symphysodon aequifasciata axelrodi Schultz 1960, p. 14 (descr.; Belém, Brazil, Amazon River; Rio Urubu), fig. p. 9 (colour photo, habitus, living specimen) /reprinted in Axelrod 1978, p. 46/.

Western Amazonian bibliography

Symphysodon discus; Fowler 1944, p. 272 (part bibliogr.), fig. 87 (sketch, habitus). -- Fowler 1945*a*, p. 253 (part bibliogr.), fig. 87 (sketch, same as in Fowler 1944, fig. 87; captioned 'del Amazonas peruano'). -- Anon. 1960, p. 20 (aquarium import; 'headwaters of the Amazon River near Leticia, Columbia, S.A.').

Symphysodon discus Tarzoo; Lyons 1960, p. 6 (aquarium importation; Leticia; availability of subspecific epithet disclaimed), figs pp. 7-8 (monochrome photos, live specimens).

Symphysodon aequifasciata aequifasciata; Schultz 1960, p. 10 (descr.; Lago Teffé) /reprinted in Axelrod 1978, p. 38/.

Symphysodon aequifasciata; Burgess 1981, p. 32 (review of subspecies, distribution, colour photos of holotypes of *S. a. haraldi, S. a. axelrodi* and other specimens; locs: Benjamin Constant; Lago Tefé; Rio Ipixuna; Rio Urubu(?); Belém).

Material

27 upper Solimões and Putumayo-Içá specimens and 3 specimens from ornamental fish collectors and exporters in Iquitos, 66.5-137.2 mm SL; including type

material of *S. aequifasciatus* and *S. haraldi*. Also consulted type series of *S. axelrodi*.

Description

Based on Cuiabá specimens; counts from 17-19 specimens, measurements from 13 wild specimens summarized in Table 19; refer to Pls XXV-XXVI for general aspect.

Shape. Deep, strongly compressed laterally, wide scaly sheath of vertical fins give a discoid outline. Predorsal outline in young straight ascending to above middle of orbit, posteriorly little curved, in large specimens front vertical; prepelvic contour slightly less steep, feebly sigmoid, with concave head and convex chest; abdominal contour straight, deepening caudad; dorsal scale cover outline strongly convex, dorsal-fin base little ascending along spinous, nearly straight descending along soft portion; anal-fin scale cover edge convex, anal-fin base horizontal along spinous, straight sloping along soft portion; caudal peduncle vert short, edges straight, dorsal feebly longer than ventral. In anterior aspect narrow, with narrow nape in young, slightly broader in large specimens, rounded chest, flat between pelvic fins. Head short and deep; orbit at middle of length and depth; interorbital narrow, vaulted, wider than mouth. Mouth small, jaws all anterior to orbit, equal anteriorly; lower lip thick, especially medially, fold continuous; upper lip fold discontinuous, but lip thick medially.

Scales. Squ. long. - (2), 54 (1), 55 (4), 56 (4), 57 (5), 58 (1), 59 (1), 60 (1); 34-38 circumpeduncular scale series. All scales ctenoid and small except cycloid cheek scales (a few posteroventral may be ctenoid), opercular and subopercular scales variably, usually mixed, cycloid or ctenoid, and anterior or all predorsal midline scales. Cheek scales in 5-8 series, one series behind orbit; opercular in about 5 series, subopercular in 4, interopercular in 2 series.

Upper lateral line at 14-15 (anteriorly) to 6-8 (posteriorly) scales distance from dorsal-fin base; 6-7 scale series passing between free ends of lateral lines; posteriormost course of upper lateral line frequenty slightly upturned. Lateral line scales 20/12 (1), 20/13 (1), 21/10 (2), 21/12 (1), 22/12 (2), 22/13 (1), 23/10 (1), 23/11 (3), 23/12 (1), 24/10 (1), 24/12 (1), 25/12 (1), 26/10 (1), plus 2-3 scales on caudal fin; short accessory caudal-fin lateral lines between rays D2 and D3 (1-4 scales), and V4 and V5 (1-6 scales).

Pectoral fin with small cycloid basal scales in MNHN syntypes and in those NRM specimens 87.1 mm and larger (not checked in other lots), pelvic fin naked. Dorsal fin with wide basal scaly sheath of small ctenoid scales, widening to anterior 1/3 of soft part, posteriorly narrower, covering half of last spine, last 3 membranes naked. Anal fin similarly scaly, but without naked membranes. Narrow basal concave caudal-fin layer of ctenoid scales.

Fins. Dorsal-fin origin at vertical from dorsal tip of preoperculum, first spine about 1/4 length of last, spines increasing in length to last; lappets long and pointed; soft fin with straight dorsal edge and rounded posterior corner. D. IX.30 (5), IX.31 (3), IX.32 (2), IX.33 (1), X.29 (4), X.30 (3), X.31 (1). Anal-fin origin slightly anterior to midbody, spines increasing in length to last, lappets pointed, soft part with straight hind margin and rounded posterior corner. A. VII.28 (1), VII.31 (1), VIII.27 (1), VIII.28 (3), VIII.29 (4), VIII.30 (4), VIII.31 (1), IX.28 (4). Pectoral fin with rounded tip, 3rd ray longest, reaching to above end of spinous/origin of soft anal fin. P. 11 (1), 12 (12), 13 (4). Pelvic fin below or slightly anterior to pectoral fin, pointed, first ray outer branch slightly produced, reaching to at most base of 8th anal-fin ray. Caudal fin damaged in all specimens.

Gill-rakers. - (2), 4 (6), 5 (6), 6 (2), 7 (1) ceratobranchial rakers externally on first gill-arch. 110.7 mm specimen on first arch without epibranchial and corner rakers, ceratobranchial rakers short, smooth, conical, adpressed to arch; all other rakers also edentulous; because of adpression

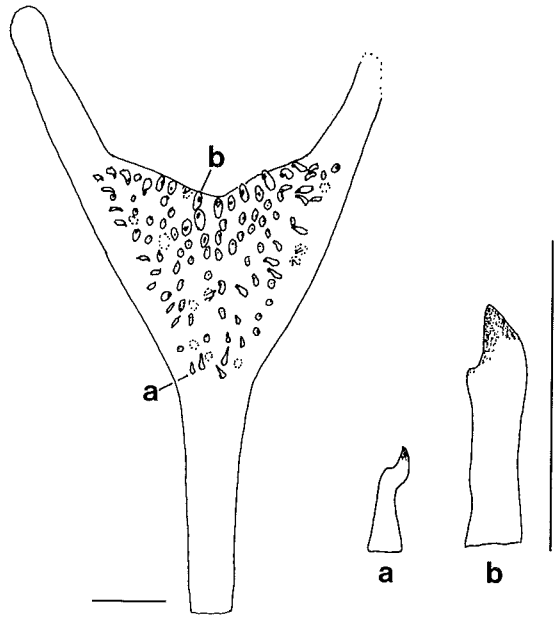


Figure 85. Occlusal view of lower pharyngeal tooth-plate and teeth in medial aspect of *Symphysodon aequifasciatus*, NRM SOK/1981325.3322, 110.7 mmm SL. Scales 1 mm.

and wide gill-cover in situ inspection of gill-rakers difficult, especially in large specimens; microgill-rakers rudimentary, externally on 2nd to 4th arches.

Jaw teeth. Difficult to examine in situ because of small mouth and thick lips; 2-4/1-4 unicuspid slender, apically slightly recurved and pointed cylindrical teeth in upper/lower jaw outer (or only) hemiseries, one or a few small teeth may be present lingual to outer series teeth.

Tooth-plates. 110.7 mm specimen dissected with elongate, long-shafted lower pharyngeal tooth-plate (fig. 85) with rather few teeth, several cavities with or without emerging teeth, anteriorly a few unicuspid with shape as in fig. 85b, the majority bicuspid, slender, medially and posteriorly compressed, with slightly recurved posterior cusp and more or less pronounced anterior cusp; no teeth on 2nd pharyngobranchial or 4th ceratobranchial.

Vertebrae. 13+18 (3), 14+18 (1).

Colouration. Light to medium brown. Intense dark brown straight vertical bar from nape midline, anterior to extrascapulars, interrupted by eye, continued on cheek, preoperculum and interoperculum, on chest by slightly darker stripe continuous around chest midline. 7 fainter brown bars on sides: 1st between first dorsal-fin spine and posttemporal or not quite as far ventrad; 2nd from third dorsal-fin spine to pelvic fin level above vent, passing under adpressed pectoral axilla; 3rd to 7th above anal fin, last ending dorsally on junction of dorsal fin and caudal peduncle. Flank bars extend onto dorsaland anal-fin bases, fading and inclined in direction of spines and rays. Dark brown spot between and slightly rostrad of pelvic-fin spine bases. Lower lip light, contrasting with duskied adjacent lower jaw.

Scale cover of dorsal and anal fins shading to brown grey; spinous dorsal and anal fins dark brown to blackish, soft fins with wide dark brown band distal to scales, posterior tips of both fins hyaline, in dorsal fin some indistinct cross-series of dark spots and in one specimen a whitish line along dorsal margin of dark band. Caudal fin basally like body, slightly distal to

base a dark brown vertical bar, rest of fin hyaline and usually some dark spots proximally. Pelvic fin dark brown, with hyaline inner and distal edge, produced ray edge light.

Life colours. Pale brownish with dark brown to black vertical bars. Several wide wavy blue lines across nape and on scaly base of anal fin; two blue lines also between eye and mouth. Pelvic fin tip red; base with a blue streak. Many red spots scattered over scaly sheath of anal fin (from NRM SOK/1983311.3837).

Distribution (fig. 87)

Symphysodon aequifasciatus reaches its western limit of distribution in Peru. There is only one lot recorded as collected in Peru, without precise locality (Putu Mayo), but several Brazilian localities are adjacent: Tefé, Cuiabá, Benjamin Constant, Lago Amanã. Ornamental fish exporters in Iquitos report that their *Symphysodon* are collected only in the Putumayo, and claim of introduction in the Nanay remains unverified. To the east, localities extend to at least the Xingu, perhaps to Belém, along the Amazon. The distribution record of *S. aequifasciatus* was summed up by Burgess (1981), and is only slightly modified by the present paper.

Notes

Recent reviews of the genus *Symphysodon* (Schultz 1960, Burgess 1981, Hanel 1981) concerned chiefly species and subspecies characteristics. There are two species in the genus, *S. discus* in the lower Negro, Trombetas and Abacaxis rivers, and *S. aequifasciatus* along the Brazilian Amazon. Colour pattern offers the best distinguishing characters: *S. aequifasciatus* has the 9 dark vertical bars (one on head, one on caudal-fin base, 7 on flanks) about equally intense, whereas in *S. discus* only the head and caudal-fin bars and the middle flank bar are intense, the remainder obsolete. Schultz (1960) also considered scale counts species diagnostic. I cannot repeat Schultz's counts, but still find lower counts in *S. discus* (48-56) than in *S. aequifasciatus* (54-60), except in Abacaxis *S. discus* material described as *S. discus willischwartzi* by Burgess (1981) (55-62 in syntypes, USNM 224866).

Various subspecies, based on life colours and scale counts, have been recognized, see Burgess (1981) for most recent review and bibliography.

Schultz (1960) separated 3 subspecies of *S. aequifasciatus* as distinguished by life colours and a squamation character:

S. a. aequifasciatus: dark brown lengthwise streaks on body, ground colour green, eye reddish brown; patch of isolated scales dorsoposterior to orbit.

S. a. haraldi: bright blue lengthwise streaks on body, ground colour light brown, eye bright red; patch of isolated scales dorsoposterior to orbit.

S. a. axelrodi: no lengthwise streaks except sometimes on forehead, vertical bars purple, ground colour olive, eye red; no isolated patch of scales dorsoposterior to orbit.

Burgess (1981) has colour photos of holotypes of *S. a. haraldi* and *S. a. axelrodi*, and of *S. a. aequifasciatus* from Lago Tefé.

Schultz's life colour data are evidently from colour slides. I have reexamined most of Schultz's specimens, including the types, and do not find any significant colour differences. The squamation character is doubtful: In the holotype of *haraldi* the cheek and nape squamation is continuous on the right side of the head, and on the left side there are 2 isolated scales between the nape squamation and the vertical scale series between orbit and preoperculum. The area is naked on both sides of the head in the holotupe of *axelrodi* but naked also in young Tefé (*aequifasciatus*) and Urubu (*axelrodi*) specimens and continuously scaly in large Tefé and Urubu specimens. All NRM specimens, and the Tefé syntypes of *S. aequifasciatus* have a continuous series of scales connecting cheek and nape, running between orbit and preopercuilum (which naked to the dorsal tip) (fig. 86). The scales of the

region are thin, covered by skin for the major part, and easily rubbed off.

Burgess (1981), in a review of *Symphysodon aequifasciatus* subspecies with colour photos of living freshly collected specimens, considered that 'at least some of the color differences seem to be only in the eye of the beholder and others are apparently influenced by diet and/or environment factors'. It seems likely also that the technical quality of the slides from which Schultz worked, and emotional stress of specimens shown, very much influenced the appearance of colours. I am unaware of any deliberate subsequent qualified identification of wild *S. aequifasciatus* as belonging to any particular 'subspecies'.

Schultz (1960) did not examine type material of either *S. discus* or *S. aequifasciatus*, and Pellegrin (1904) was explicit only about colour pattern in his description of *S. aequifasciatus*. The two *S. aequifasciatus* syntypes from Tefé (MNHN 02-134-135) are in relatively good condition although faded. The similarly intense vertical bars can still be traced; they have squ. long. 55 and 56.

The holotype of *S. discus* (figured by Kner 1862) still shows traces of vertical bars typical of the species: one on head, one on middle of side and one on caudal-fin base. It has 51 squ. long. scales.

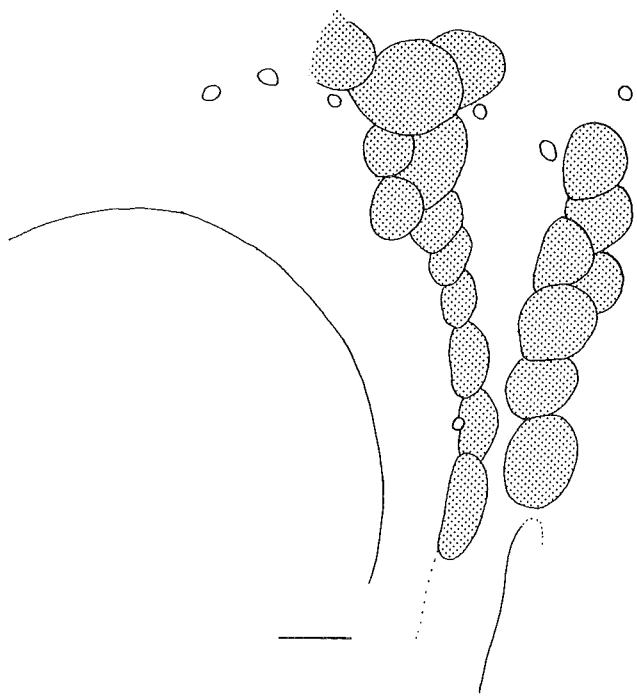


Figure 86. Squamation of temporal region of head of *Symphysodon aequifasciatus*, NRM TH0/1971518.4071, 73.6 mm SL,; anterior to the left, large semicircle skin border of orbit, scales stippled, small circles lateralis pores. Anterior vertical scale series continuous with squamation dorsal and ventral to that figured, posterior vertical series are anteriormost scales of continuous head and flank squamation; naked portion between vertical series of scales traces dorsalmost portion of preoperculum. Scale 1 mm.

Figure 87. Collecting localities of *Symphysodon aequifasciatus*. A dot may represent several adjacent collecting sites. Open circle literature record.

Hypselecara n. gen.

Diagnosis
Medium-sized (to *c.* 180 mm SL) South American cichlids with American type lips, six preopercular, four dentary lateralis foramina, unicuspid jaw teeth, first epibranchial without ventral flange, 6-8 anal-fin spines; distinguished from similar genera (South American *Cichlasoma sensu* Regan (1905*d*)) by characters in combination: no sutural contact between mesethmoid and vomer; posteromedial palatine wing narrow and not articulating with lateral ethmoid; swimbladder confined to abdominal cavity; no caudal ribs; divided cheek squamation (fig. 88); dorsal caudal-fin acessory lateral line between rays D3 and D4; stochastic predorsal squamation; short caudal peduncle not including any vertebral centra; squ. long. 25-34 (26-30 common); no prominent notch ventrally in posterior margin of preoperculum.

Type-species
Heros temporalis Günther, 1862.

Etymology
From the Greek *hypselos*, high, and Acará, the Guarani name for cichlid, in allusion to the prominent raise of the forehead in adults of species of this group. The last part of the name might also be taken to derive from the Greek *cara*, head. The gender is feminine.

Included species
Heros temporalis Günther (synonyms: *Heros goeldii* Boulenger, *Acara crassa* Steindachner, *Cichlasoma hellabrunni* Ladiges).
Heros coryphaenoides Heckel (synonyms: *Heros niger* Heckel, *Cichlasoma arnoldi* Ahl, *Chuco axelrodi* Axelrod=*Chuco axelrodi* Fernández-Yépez).

The recognition of *Hypselecara* is merely the nomenclatural establishment of Heckel's (1840) division B of *Heros* and Regan's (1905*d*) Section 4 of *Cichlosoma* and represents a further subdivision of the catch-all assemblage *Cichlasoma* that was begun by Kullander (1983*b*).

Cichlasoma, in the sense of Regan (1905*d*), included all South American cichlids with more than 3 anal-fin spines but lacking other noteworthy features. Kullander (1983*b*) recognized seven genera among cis-Andean *'Cichlasoma': Cichlasoma, Mesonauta, Heros, Caquetaia, Hoplarchus* Kaup, *Hypselecara* (unnamed) and an unnamed group for *'C.' facetum* (Jenyns).

Hypselecara is distinct from *Cichlasoma* in most aspects of external morphology and anatomy. There is no indication of a particularly close common ancestry. The range of anal-fin spine counts is higher than in *Cichlasoma* (6-8 *vs.* 3-5(6)), and 2-3 instead of only one anal-fin pterygiophore articulate anteriorly with the first hemal spine. Unlike *Cichlasoma*, but similar to *Mesonauta, Heros, Pterophyllum, Symphysodon, Hoplarchus* (pers. obs.) and *'C.' facetum* (Greenwood 1985), there is only one, anterior, direct articulation between the palatine and the lateral ethmoid. In *Cichlasoma*, the mesethmoid is suturally connected to the vomer. The mesethmoid and vomer are separate in *Hypselecara*, but data on other *'Cichlasoma'* are not available.

In Kullander (1983*b*), *Hypselecara* was suggested to be possibly closely related to *Hoplarchus*. Further study brings out no substantiation of that possibility, ie. although there is a general resemblance, no character has been identified that would be a unique synapomorphy of these two genera. *Hoplarchus* can be distinguished by a long caudal peduncle, a strong mesethmoid-vomer sutural union, and much smaller scales (squ. long. *c.* 50), and particularly by a prominent notch in the preopercular margin.

Hypselecara differs from *Mesonauta, Heros, Pterophyllum* and *Symphysodon* in having the swimbladder confined to the abdominal cavity. There are no caudal ribs. The jaws are comparatively long and the teeth are simple,

caniniform, the anterior somewhat enlarged.

The anatomy of *Caquetaia* and *'Cichlasoma' facetum* is still unstudied but the former genus is well characterized by its jaw morphology (premaxillary ascending process reaching to near dorsal fin, well developed maxillad process on alveolar ramus of premaxilla, much prolonged maxilla), and the latter has bicuspid anterior jaw teeth.

Anatomical data from *Hypselecara* are derived chiefly from study of *H. temporalis*. In two cleared and stained specimens was found a minute cartilage posterior to the central cartilage (cartilaginous 4th basibranchial; Barel *et al.* 1976); this feature is shared with *Satanoperca jurupari*, *Biotodoma cupido*, and several other cichlids (unpubl.) and is of potential interest as a taxonomic character, but its status needs further study.

Fernández-Yépez (1969) assigned *H. temporalis* to the genus *Vieja* Fernández-Yépez. The type species of *Vieja* is *V. panamensis* Fernández-Yépez, based on a single specimen MCZ 33281, 69.1 mm SL, from Panama (Gatún Lake according to label).

I have reexamined the holotype of *V. panamensis*, which I identify as a *'Cichlasoma' maculicauda* (Regan). The specimen has 30 squ. long. scales, not the 36 given by Fernández-Yépez, and his skeletal length of 72.5 mm was obviously taken to the posterior end of the caudal spot. I get a standard length of 69.1 mm SL. The bicuspid teeth probably inspired Fernández-Yépez to the description, as such had not been described or figured for South American cichlids previously, though *'C.' maculicauda* and many other neotropical cichlids do have bicuspid teeth. None of the other three species originally referred to *Vieja*, viz. *Hypselecara temporalis*, *H. coryphaenoides*, and *Cichlosoma biocellatum* Regan (= *'C.' octofasciatum* (Regan)) have bicuspid teeth, however.

Hypselecara temporalis (Günther)

Figs 88-99 Pl. XXVIII (figs 1-3), Table 19

Synonymy

Heros temporalis Günther 1862, p. 286 (descr.; no locality information).

Acara (Heros) crassa Steindachner 1875, p. 88 (diagn.; descr.; Amazonenstrom bei Teffé, Tonantins, Cudajas, Coary, Villa bella...Obidos; see Hyanuary... Saraca; Rio Hyutay), Pl. V (sketch, habitus).

Heros Goeldii Boulenger 1897, p. 298 (descr.; Upper Cunani River, French Guiana, south of the Oyapok River).

Cichlasoma Hellabrunni Ladiges 1942, p. 199 (descr.; entweder die Umgebung von Rockstone am Essequibo in Britisch-Guayana oder aber die Umgebung von Leticia), Abb. 1 (monochrome photo, habitus).

Peruvian bibliography

Heros autochthon; Cope 1878, p. 695 (note; Peru).

Acara (Heros) crassa; Steindachner 1883, p. 2 (note; Rio Huallaga).

Cichlaurus temporalis; Fowler 1944, p. 266 (bibliogr.). -- Fowler 1945*a*, p. 247 (bibliogr.).

Cichlaurus autochthon; (*pt.*) Fowler 1944, p. 266 (ref. to Cope 1878 only). -- (*pt.*) Fowler 1945*a*, p. 247 (ref. to Cope 1878 only).

Cichlaurus facetus; (*pt.*) Fowler 1954, Fig. 877 (sketch based on specimen from Peru /ANSP 112721?/).

Cichlaurus crassa Bérenz & Zelada 1975, p. 51 (descr.; local name; markets of Iquitos), Fig. 4 (sketch, habitus).

Cichlasoma temporale; Lüling 1975, p. 50 (listed; Yarina Cocha; R. Ucayali), Abb. 12*pt.* (monochrome photo, habitus).

Material

55 specimens from Peru and adjacent western Amazonía, 14.1-137.2 mm SL; also consulted type material of *Heros temporalis*, *H. goeldii*, *Acara crassa*, and

other Brazilian material.

Description

Based on series of 11 specimens from Sacarita del Tuyé, 49.0-137.2 mm SL, with notes on variation, Counts are from 25 measured specimens, measurements summarized in Table 19. Refer to Pl. XXVIII for general aspect.

Shape. Deep, moderately compressed laterally; in facial aspect sides straight vertical, nape rounded, chest nearly flat. Head short, deep; snout deep, rounded in lateral aspect. Predorsal contour ascending straight to above anterior margin of orbit, posteriorly less steep. Dorsal-fin base contour slowly descending, obscured by scales forming straight, horizontal margin along spinous portion. Prepelvic contour slightly irregularly convex; abdominal contour straight, horizontal; anal-fin base contour slightly convexly ascending, obscured by scale-cover. Caudal peduncle short, contours straight, horizontal, of about equal length. Interorbital wide, strongly vaulted, wider than mouth. Eye well removed from predorsal outline, in middle of head length, in upper half of head. Jaws equal anteriorly, narrow, lower jaw articulation below anterior margin of orbit; premaxilla and maxilla entirely anterior to orbit. Lip folds thin, both discontinuous. Juveniles elongate, with pointed snout and large eye. Forehead outline straight and snout triangular in outline in young less than 60 mm SL (Pl. XVIII, fig. 2), and chest contour markedly convex in large specimens only, from c. 90 mm.

Scales. Squ. long. 25 (1), 26 (12), 27 (10), 28 (2); 16 circumpeduncular scale series in small specimens, increasing to 20 (9 above and below lateral line series) in large specimens. Scales cycloid along predorsal midline and anterior to extrascapulars, on cheek, suboperculum and interoperculum, and anterior to pelvic-fin bases, elsewhere ctenoid. Predorsal squamation stochastic. Cheek with 3 (10) or 4 (15) scale series, serial arrangement not always clearly discernible; naked line continuing preorbital edge anteriorly on cheek (fig. 88). Four vertical series of ctenoid scales on operculum; suband interoperculum with single scale series. Preoperculum naked.

Upper lateral line anteriorly at 4, occasionally 5, posteriorly at 2 to 2 1/2 scales distance from dorsal fin; 2 scale series between upper and lower lateral lines. Lateral line counts 18/8 (2), 18/9 (4), 19/8 (4), 19/9 (10), 20/8 (1), 21/9 (1); 3 specimens unilaterally with last tube of upper line slightly ventral to preceding and with a ventral branch, in two of these a vertical tube connecting upper and lower line (fig. 89): 18+three-armed/8 (1), 17+three-armed + vertical/8 (1), 17+three-armed+vertical/9 (1). 2, occasionally 1, tubed scales continuing lower line on caudal fin; accessory caudal-fin lateral lines between rays D3 and D4, and V4 and V5, one or both frequently absent in specimens smaller than c. 50 mm SL, rarely in those larger, upper of 1-4, lower of 1-8 tubed scales.

Fin scales. Pelvic fin naked. Pectoral-fin base with patch of cycloid scales in large specimens (6, 60.3-137.2 mm SL with; 5, 49.0-82.6 mm SL without, in NRM SOK/1981333.3383). Dorsal and anal fin with incipient scales basally in 15.0 mm Quistococha juvenile, absent in those 14.5 mm and smaller. In large specimens, as in 137.2 mm specimen (Pl. XVIII, fig. 1) a scale series shielding dorsal-fin base, interradial scales in convex layer, width to half length of last spine on soft portion, in mostly double series, longest between 3rd and 4th rays (to 10 scales), last 3 membranes naked, most scales ctenoid. Anal fin similarly scaled. Caudal fin with chiefly ctenoid scales, hind margin of scaly area slightly concave, about 1/3 to half of fin scaly marginally.

Fins. First dorsal-fin spine above first lateral line scale, 1/3 length of last; spines increasing in length to last; anterior lappets rounded, posterior truncate with posterior point and slightly longer; soft fin commonly damaged, otherwise pointed in large specimens, reaching to middle or, by short filament, to at most about end of caudal fin, in young shorter and rounded. D. XVI.10 (2, obviously low soft ray count correlated with injury), XVI.11 (5), XVI.12 (8), XVII.10 (1), XVII.11 (9). First anal-fin spine opposite about 5th from last dorsal-fin spine; soft fin commonly damaged, otherwise similar to

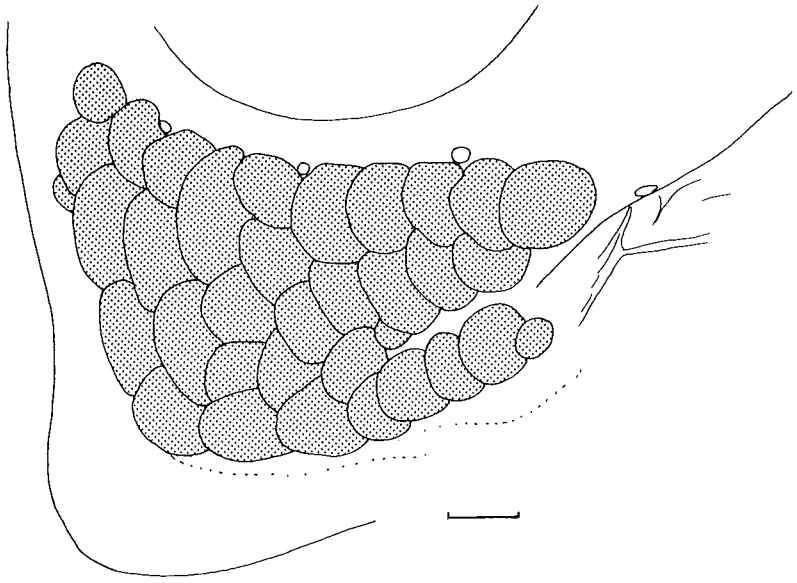


Figure 88. Cheek squamation of *Hypselecara temporalis*, NRM SOK/1981333.-3383, 49.0 mm SL, to show naked line dividing scale cover anteriorly. Scales shaded; outline of ventral margin of orbit, free edge of preoperculum, posterior part of mouth, and suborbital lateralis pores provided for orientation. Scale 1 mm.

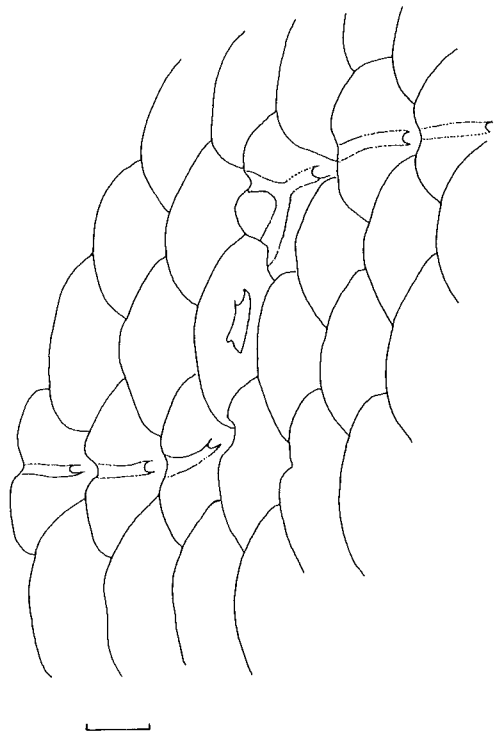


Figure 89. Posterodorsal flank scale pattern in a *Hypselecara temporalis*, NRM SOK/1981364.3604, 50.4 mm SL, to show upper and lower lateral lines continuous. Scale 1 mm.

soft dorsal fin and may be longer. A. VI.9 (1), VI.10 (3), VII.8 (1), VII.9 (6), VII.10 (6), VIII.8 (1), VIII.9 (7). Pectoral fin short, rounded, 4th ray longest, reaching to above 3rd to 4th anal-fin spine; P. 12 (5), 13 (20). Pelvic fin inserted posterior to pectoral axilla; pointed, outer branch of first ray filamentuously produced, reaching to along soft anal-fin base or even caudal-fin base. Caudal fin rounded.

Gill-rakers. Externally on first gill-arch 1-2 epibranchial, 1 in angle and 6 (4), 7 (18), 8 (3) ceratobranchial. Epibranchial and angle rakers short, subconical; ceratobranchial rakers short, tips slightly widened, toothed on internal face (fig. 90), gradually smaller, to rudiment, rostrally (fig. 90). First epibranchial slender, without ventral flange, first pharyngobranchial slender, slightly widened ventrally; interarcual cartilage minute. Microgill-rakers externally on 2nd to 4th arches, of cichlasomine type (fig. 91).

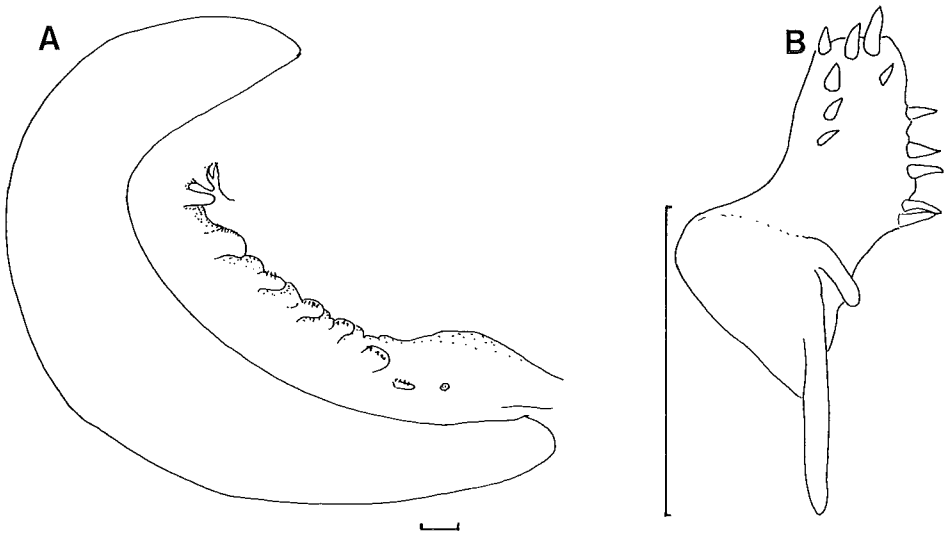


Figure 90. Gill-arch structures of *Hypselecara temporalis*, NRM SOK/1981-333.3383, 79.8 mm SL. A external aspect of first gill-arch, to show short gill-rakers, semidiagrammatic; B medial, slightly ventral aspect of second external gill-raker of first ceratobranchial, to show arrangement of teeth in semielliptic series. Scales 1 mm.

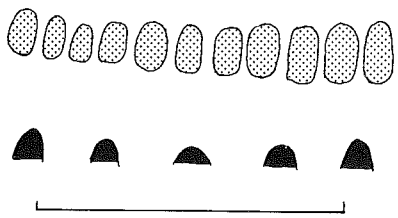


Figure 91. Sequence of microgill-raker (shaded) series of external face of 2nd gill-arch of *Hypselecara temporalis*, NRM SOK/1981333.3383, 79.8 mm SL, to show small size, outline and regular arrrangement, bases of gill-filament interspaces in black. Scale 1 mm.

Jaw teeth. In 16 specimens, 40.3-105.8 mm SL, 13-19/19-23 ($\bar{x}$= 16.9±0.5/21.1±0.35) teeth in upper/lower jaw outer hemiseries. In large specimens dentition similar in both jaws; outer series of fixed, conical, pointed recurved teeth increasing in size anteriorly, especially 4-5 anterior in each hemiseries long; middle pair in upper jaw longest; teeth in inner band of 2 (upper jaw, in young) to 3 series anteriorly, depressible, much smaller than outer, otherwise similar.

Tooth-plates. Lower pharyngeal tooth-plate in 79.8 mm specimen dissected (fig. 92) with many teeth about to emerge, and many strongly abraded. Rostralmost simple, with slightly retrorse cusp; anteriorly and along lateral margin slender with posterior cusp more or less erect, medially and posteriorly compressed with narrow anterior shelf, occasionally with indicated cusp, and posterior antrorse pointed cusp. All fixed. 4th ceratobranchial with 2 toothplates with 16 and 11 teeth, respectively.

Vertebrae. 13+14 (2), 14+13 (1), 14+14 (3), if first caudal vertebrae is that having the first hemapophysis.

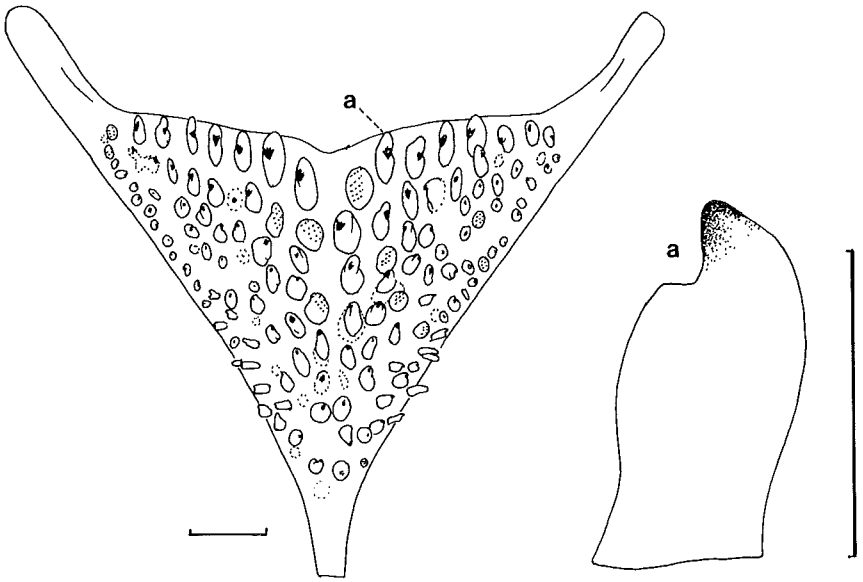


Figure 92. Occlusal aspect of lower pharyngeal tooth-plate and posterior tooth (a) in lateral aspect of *Hypselecara temporalis*, NRM SOK/1981333.3383, 79.8 mm SL. Scales 1 mm.

Osteology. Two cleared and stained specimens both have 27 vertebrae and 2 supraneurals. The first 2 vertebrae bear epineural ribs, the 3rd to 13th pleural ribs, the 3rd to 7th or 8th epipleural ribs; a pair of prominent spine-like hypapophyses on the 4th vertebra; the 14th vertebra with hemal foramen, basapophyses and hemal spine. The first 2 or 3 anal pterygiophores (of first 3-4 spines) are inserted anterior to the first hemal spine. The caudal skeleton includes 2 epurals, 2+3 hypurals, a minute parhypurapophysis, 3 (4 dorsally in one) procurrent and 8 principal rays in each lobe; there are two major cartilaginous distal radials ventrally, one dorsally, and no cartilage between hypurals 2 and 3.

The cephalic lateralis system is basically as in *Cichlasoma*, with 4 dentary foramina (fig. 93) and 4 infraorbitals posterior to the lachrymal (fig. 94).

The jaws are moderately long, the premaxilla with the ascending processes much longer than the alveolar process; the rostral premaxillary foramen varies in size (fig. 95).

The suspensorium (fig. 93) offers no notable features; the hyomandibula and endopterygoid are not sutured, the palatine has a narrow posteromedial wing that does not articulate with the lateral ethmoid.

The neurocranium (not figured) offers no notable features, being similar to that of *Cichlasoma*. The mesethmoid, however, has no anterior projections forming a suture with the vomer, and the pharyngobranchiad apophysis posteriorly on the parasphenoid is elevated and has a transversely oriented articulating area. The sagitta has a conspicuous anterior notch (fig. 96).

The branchiocranium (fig. 97) is elongate, and includes of noteworthy features a minute piece of cartilage little posterior to the central cartilage, a notched medial border of the 3rd hypobranchials, and a minute interarcual cartilage. The anterior ceratohyal (fig. 98) has an even dorsal margin.

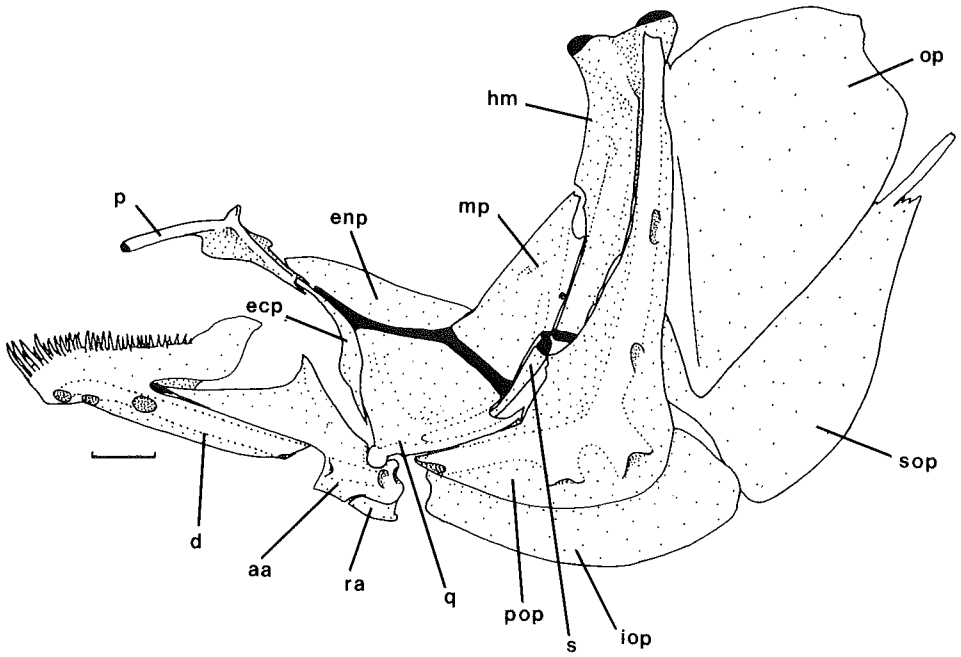


Figure 93. Left side suspensorium, lower jaw and operculars of *Hypselecara temporalis*, NRM SOK/1984333.3871, 35.8 mm SL, in lateral aspect. Cartilage black. Scale 1 mm.

aa anguloarticular	iop interoperculum	q quadrate
d dentary	mp metapterygoid	ra retroarticular
ecp ectopterygoid	op operculum	s symplectic
enp endopterygoid	p palatine	sop suboperculum
hm hyomandibula	pop preoperculum	

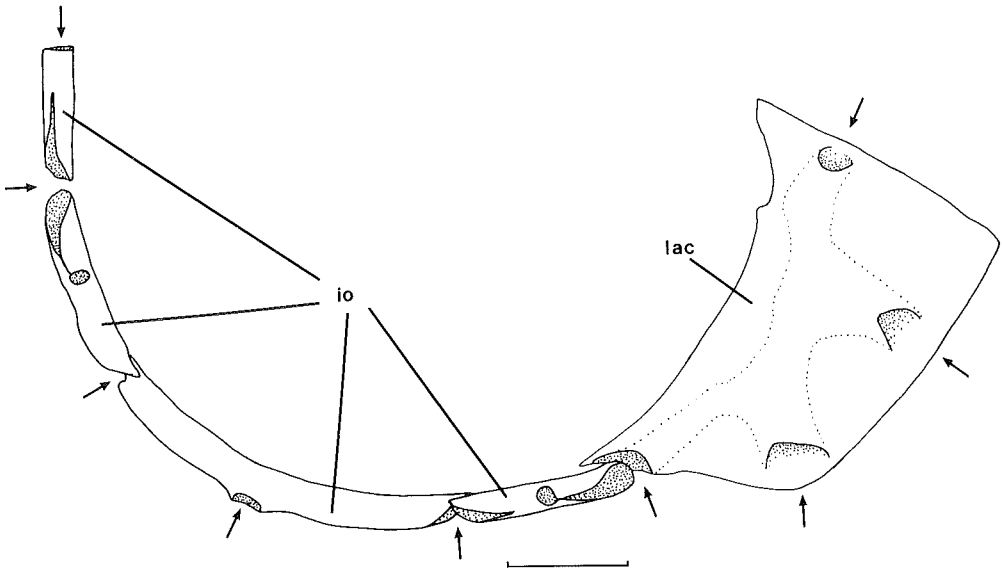


Figure 94. Right suborbital series of *Hypselecara temporalis*, NRM SOK/ 1984333.3871, 35.8 mm SL, in lateral aspect. Arrows point to lateralis canal foramina. io infraorbitals, lac lachrymal. Scale 1 mm.

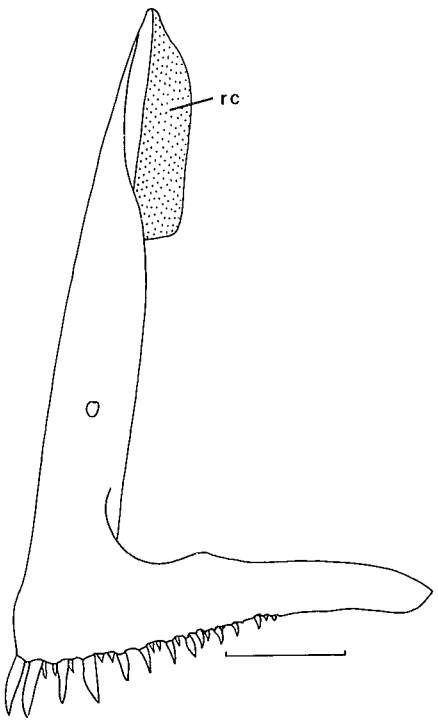


Figure 95. Anterolateral aspect of left premaxilla in *Hypselecara temporalis*, NRM SOK/1984333.3871, 35.8 mm SL. rc rostral cartilage (dotted). Scale 1 mm.

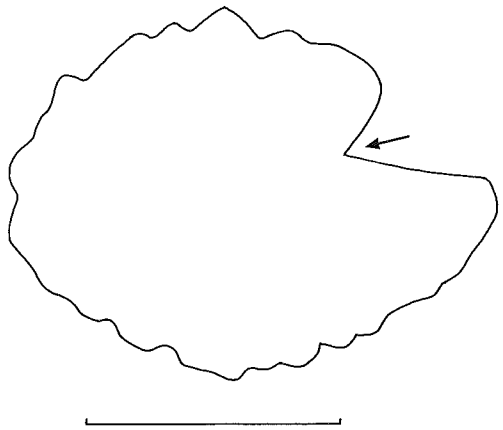


Figure 96. Outline of right sagitta in *Hypselecara temporalis*, NRM SOK/ 1984333.3871, 35.8 mm SL. Arrow points to deep rostral incisura. Scale 1 mm.

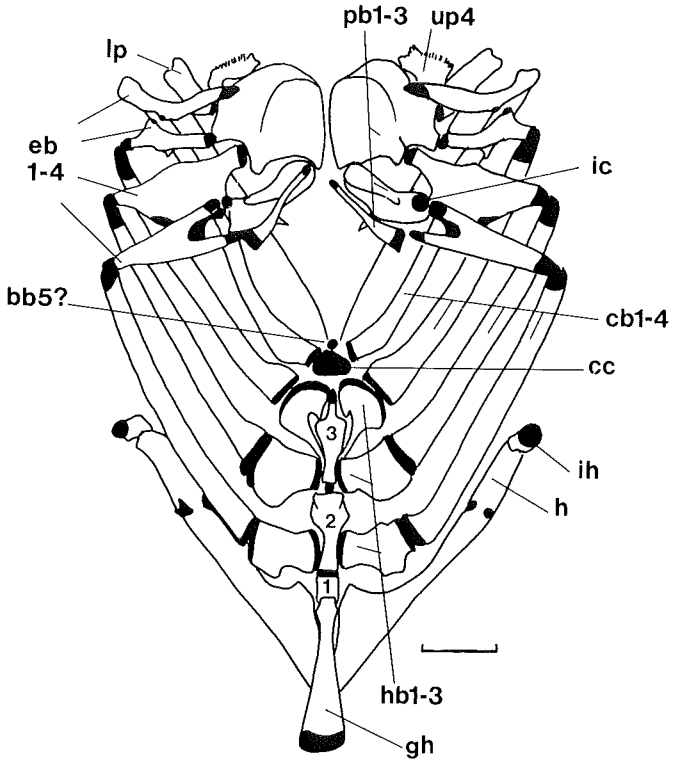


Figure 97. Dorsal aspect of branchial skeleton in *Hypselecara temporalis*, NRM SOK/1984333.3871, 35.8 mm SL. Cartilage, except dorsal pharyngobranchial, black. Scale 1 mm.

1-3 basibranchials 1-3
bb5? unidentified cartilage
cb1-4 ceratobranchials 1-4
cc central cartilage
eb1-4 epibranchials 1-4
gh glossohyal
h hyoid
hb1-3 hypobranchials 1-3
ic interarcual cartilage
ih interhyal
lp lower pharyngal tooth-plate
pb1-3 pharyngobranchials 1-3
up4 fourth upper tooth-plate

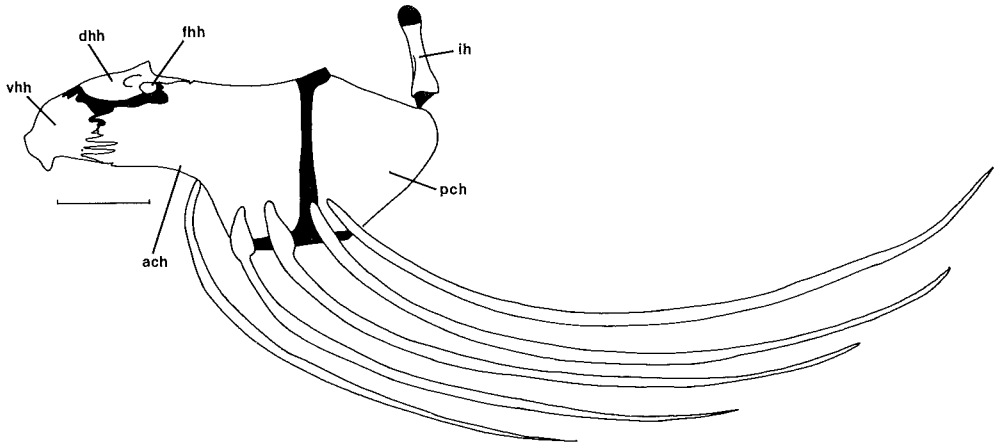


Figure 98. Lateral aspect of left hyoid in *Hypselecara temporalis*, NRM SOK/1984333.3871, 35.8 mm SL. Scale 1 mm.

ach anterior ceratohyal	ih interhyal
dhh dorsal hypohyal	pch posterior ceratohyal
fhh hypohyal foramen	vhh ventral hypohyal

Colouration. Colour pattern very variable, from nearly uniform brown with dark spots on head, lateral band, midlateral spot and caudal spot distinct, to, usually, marbled with dark on lighter ground. The following is indicative of the modal condition in large specimens.

Ground colour yellowish white, contrasting against brown to blackish brown markings. Principal markings blackish brown spot on cheek and adjacent operculum posteroventral to orbit, short caudodorsad oblique stripe from dorsal margin of orbit (may be divided in two spots by light horizontal stripe), lateral band from dorsal edge of gill-cleft or cheek spot, on lower halves of squ. long. scales and upper halves of scales in series below to vertical bar on caudal peduncle, midlateral spot which deeper than long, 3-4 scales wide from lateral band up to include lateral line scales 12-14 or 13-15.

Snout, lips, lower jaw and gill-cover grey brown, cheek of dirty ground colour; chest, branchiostegal membrane grey brown, prepelvic area grey brown posteriorly, lighter anteriorly. Pectoral axilla yellowish white. Light stripe between eye and nostril. Young with ventral head parts and chest lighter than large specimens. Young with two dark forwards curved stripes between orbits, nape light greyish; large specimens not showing interorbital stripes, scaly nape light greyish on posterior half, front otherwise greyish brown except light grey white horizontal stripe across nape close above eye, beteween light supraopercular areas.

Yellowish white contrasting blotch close above operculum, with pointed caudodorsad extension on anterior dorsal side and similar spot anterior to dorsal part of dark stripe above orbit.

Seven brown vertical bars on sides, of somewhat variable appearance, one on caudal peduncle, 5 from edge of dorsal-fin base squamation to edge of anal-fin squamation or ventral abdominal sides, one between dorsal-fin origin and light blotch above operculum. Bars on sides partially more or less confluent, 3rd and 4th from posteriormost diverging ventrally; contrasting yellowish white spots in interspaces of bars at fin bases and fainter light spots in interspaces near lateral band. Unpaired fins brownish grey; soft dorsal fin with

indistinct darker dots basally; caudal fin with darker round or ovate spot between rays V1 and D6, not ocellated; pelvic fin dark grey.

Juveniles have small roundish midlateral spot, caudal spot on dorsal lobe, and faint suborbital stripe from eye down onto preoperculum; suborbital stripe only a trace at 23 mm, dark spots above and below orbit from 28 mm. There is considerable variation in the relative expression of flank markings in adults.

The specimens in the sample from Quebrada Corrientillo, station SOK 67, NRM SOK/1983334.3762, are distinguished as being very elongate, with acute snout and large eye. They are notably dark-coloured and have a larger midlateral spot than *H. temporalis* from elsewhere. Most (5 of 6 measured) have 12 instead of 13 pectoral-fin rays, the only *H. temporalis* with 12 pectoral-fin rays; 3 of the 4 specimens with 6 anal-fin spines are among them. This, perhaps also with FMNH 84270 of average appearance, is the only sample not from a lake or a near-lake habitat, and I tentatively consider the Corrientillo material as representing a stream ecophenotype. Other fishes taken in the Corrientillo, a dark water stream, were noted to be more intensely coloured than average for their species.

One specimen from Sacarita del Tuyé (NRM SOK/1981333.3383), 89.2 mm SL, is notable for having a circular hole through the back posteriorly, evidently completely healed and scale-clad.

Distribution (fig. 99)
Along the Ucayali-Amazonas downstream from about Pucallpa, many localities to the east along the Solimões and Brazilian Amazonas, to Gurupá and Cametá, R. Branco, R. Xingu, Amapá rivers and R. Oyapock.

Ecology
Hypselecara temporalis has been collected chiefly in lentic habitats with turbid water. The only large sample (11 specimens) is from a gramalotal (SOK 27a); otherwise Quisto Cocha and the Supay system are well represented. The only sample from a black-water stream, the Corrientillo (SOK 67) departs in general appearance from the average (see above).

Local name
Bufurque, bujurqui (Bérenz & Zelada 1975: markets of Iquitos).

Notes
The holotype of *Heros temporalis* (BMNH 1855.12.26:638) is a 119 mm specimen with no other procedential data than 'Zoological Society'. It was described by Günther (1862) and Regan (1905*d*). There are two syntypes of *Heros goeldii* (BMNH 1897.7.17:9; Naturhistorisches Musum Basel 24885), described by Boulenger (1897), one figured by Goeldi (1898). The type locality, upper Cunani R., French Guyana, is the R. Cunani in the Amapá territory of Brazil on current maps. There is no known type material of *C. hellabrunni*, but BMNH 1956.12.17:1, deposited by B. Oehlert, is labelled as 'descended from Hellabrunn Import', and would seem to qualify as reference material of *C. hellabrunni*. Said import was either from Guyana or the Leticia area (2 imports mixed; Ladiges 1942), but is unlikely to be from Guyana where no *Hypselecara* species has been collected. Ladiges did not provide any differential diagnostic characteristics. Four syntypes of *Acara crassa* have been located, NMW 17373-17374 (2, Codajás), 33617 (1, Silves), 33618 (1, Villa Bella = Parintins).

The second species in the genus, *H. coryphaenoides*, is easily distinguished from *H. temporalis* by having the midlateral spot dorsal to the upper lateral line. It has been collected in the Negro, Orinoco, and Trombetas drainages.

Cope (1878) identified ANSP 21459 and ANSP 112721 as *Heros autochthon* Günther, a nominal species currently regarded as a synonym of *'Cichlasoma' facetum* (Jenyns), which occurs along the southern Brazilian coast and parts of the Paraná drainage.

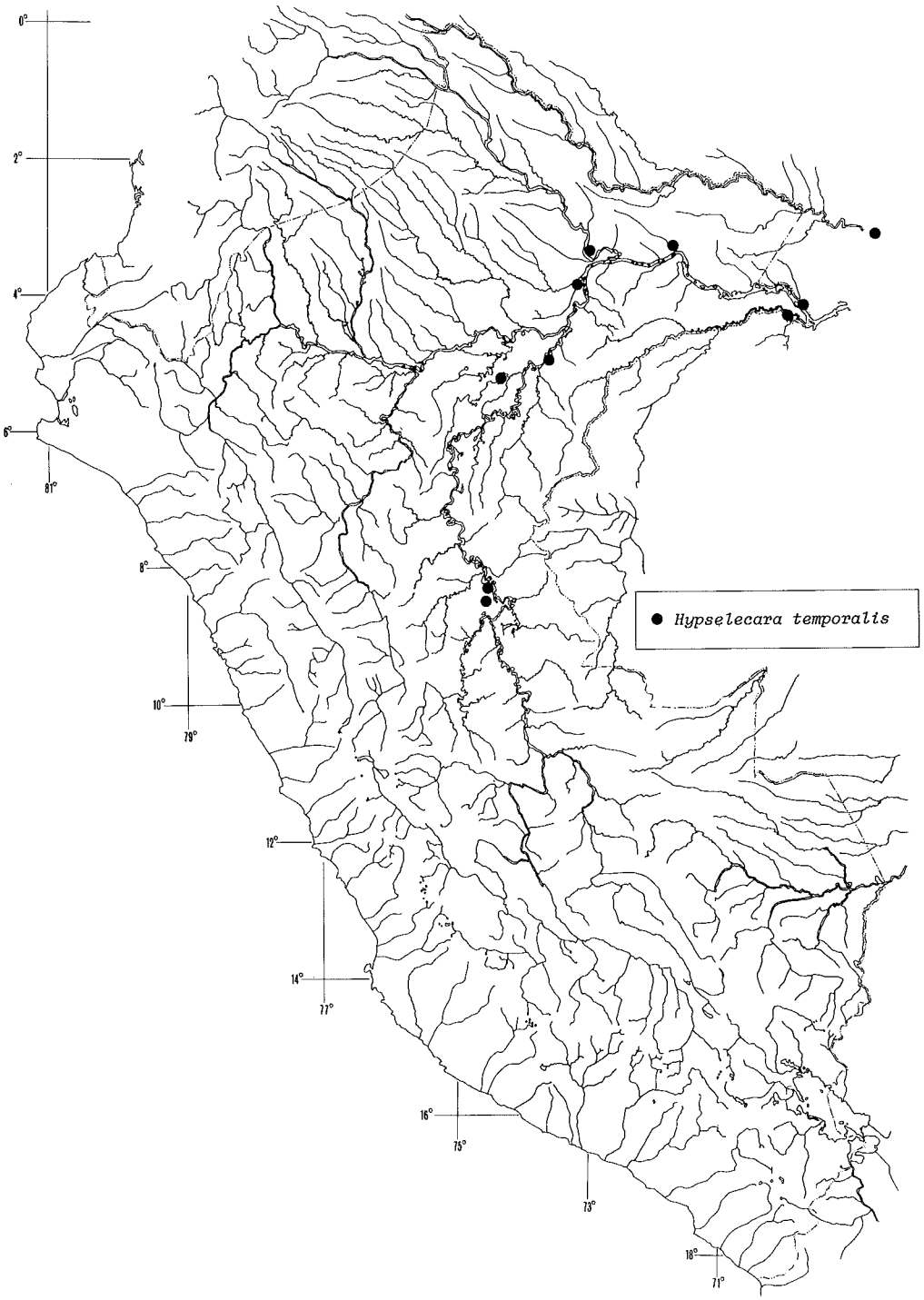


Figure 99. Collecting localities of *Hypselecara temporalis* in western Amazonía.

Bujurquina n. gen.

Diagnosis
Moderate-sized (to 110 mm SL) South American cichlids with American type lips, six preopercular and four dentary lateralis foramina, minute interarcual cartilage suspended in collagenous fibre tract, relatively slender first epibranchial (without ventral flange). Similar to a restricted number of *Aequidens*-like species (*Tahuantinsuyoa*, *'Aequidens' pulcher* group, *'A.' guianensis* group) in having enlarged lateralis foramina, uniserial predorsal scale pattern (8 scales), and notched dorsal margin of anterior ceratohyal with laminar ledges bordering arterial groove. Distinguished from similar genera by a combination of characteristics: posterodorsal wing of palatine articulating with lateral ethmoid; 24-26 vertebrae; emarginate caudal fin; oblique lateral band running from opercular cleft to or toward either end of soft dorsal fin or junction of dorsal fin and caudal peduncle, continuation of band on head obliquely forwards across nape; caudal-fin accessory lateral lines modally present and running between rays V4 and V5, and D1 and D2; naked vertical fins; wide and feebly sloping lateral ledges producing indented lateral outline of lower pharyngeal tooth-plate; parhypurapophysis rudimentary or absent; leaf spawning oral brooders.

Type species
Bujurquina moriorum n.sp.

Contained species
13 new species described below, *Acara vittata* Heckel, *Acara zamorensis* Regan, *Aequidens mariae* Eigenmann, and *Acara syspilus* Cope.

Distribution
Bujurquina includes species in western Orinoco tributaries, Peruvian, Ecuadorian, and western Colombian Amazon tributaries, Bolivian Amazonía, the Paraguay drainage, the Paraná up to the Guaira falls and scattered along the Amazon (Codajás, lower Trombetas) to the mouth region (Maracaná). Distribution map, fig. 7.

Etymology
Bujurquina is from the local *bujurqui*, the best known Peruvian name for fishes of the family Cichlidae. It is to be treated as of feminine gender.

Description
Shape moderately deep to moderately elongate (generally 40-45 % of SL, range *c.* 37-48 %); dorsal and ventral contours equally arched or, generally, dorsal more arched; head moderately deep, with dorsal contour generally gently curved and steeper than ventral contour. Interorbital as wide as or slightly wider than mouth, flat or little vaulted. Mouth moderately large, maxilla reaching to or not quite to vertical from anterior margin of orbit in adults, jaws equal anteriorly or upper slightly prognathous. Lips narrow or widened, fold of both interrupted anteriorly. Caudal peduncle deeper than long or, rarely, about as long as deep, ventral edge longer than dorsal.

Scales large, 22-25 in squ. long. series, 16 horizontal series around caudal peduncle. Predorsal and prepelvic scales not much smaller than anterior flank scales; predorsal scales ctenoid, normally in three series caudad from between orbits, median of 8 scales of which one or more posterior with more or less deeply notched posterior margin; prepelvic scales usually cycloid, occasionally posterior scales ctenoid, two large interpelvic scales commonly ctenoid.

Cheek completely scaled, squamation extending into mouth angle; usually in 3, rarely in 2 series; usually all cycloid or posterior ctenoid. Opercular scales in 2 vertical series, usually all cycloid or dorsal ctenoid. Sub- and interopercular scales in single series, usually cycloid, 2 or 3 scales on each

bone. Preoperculum naked.

Upper lateral line in 3rd horizontal scale series above that containing lower, initially at 3, terminally at 1 1/2 scale distance from dorsal fin; initial ascend of canal line either smooth or, in species of Madeira and Paraguay drainages, stepped up after 3-4 scales; of 14-17, modally 16 scales. Lower lateral line of 6-10 (8 or 9 most frequent) scales, plus 1-3 on caudal-fin base. Acessory lateral lines of caudal fin between rays D1 and D2 (to 9 tubed scales) and rays V4 and V5 (to 10 scales), in adults nearly always including tubed scales anteriorly, pored scales extending to hind edge of dorsal-fin squamation.

Caudal fin with posteriorly concave basal scaly area, marginally reaching to about middle of fin in adults. Pectoral fin normally naked. Dorsal, anal and pelvic fins always naked.

Dorsal fin with 13-15 spines, 9-11 rays (modal count within species XIV.10, occasionally XIV.9); first spine about half length of last, spines subequal in length from about 4th to 6th; soft fin pointed, often with short filament in adults. Anal fin with 3 spines and 5-8 rays (modally 7 in all species); soft fin pointed in adults. Pectoral fin short and rounded, or long and subacuminate; with 12-15 rays (mode 13 except in *B. huallagae* in which 14). Pelvic fin with one spine and 5 rays, first ray longest and may be filamentously produced. Caudal fin subtruncate to emarginate, commonly with long streamers from produced marginal rays; 8 principal and 3 procurrent rays in each lobe.

Gill-rakers short, 1-2 epibranchial, one in angle and 5-8, modally 6 ceratobranchial externally on first arch. Microgill-rakers present on external side of 2nd to 4th gill-arches, rudimentary or well-formed, or completely absent; intraspecific variation occurs. Fourth ceratobranchial with 1-4 small tooth plates with simple pointed teeth. Lower pharyngeal tooth-plate short and wide, with prominently wide fossa ledge (Barel *et al.* 1976, p. 227). Lower pharyngeal teeth slender to mammiform, simple or bicuspid. Jaw teeth conical, little recurved; an outer series of larger teeth (generally 15-20 in each jaw half) and 2-5, modally 3 inner series of smaller teeth anteriorly in each jaw.

Osteological description based on cleared and stained specimens of *B. moriorum* (3: 29.1-48.6 mm SL) and *B. apoparuana* (1: 50 mm SL), which in extensive agreement. In general skeletal features are as in *Cichlasoma* which described in some detail in Kullander (1983*b*) and there are no particularly noteworthy features.

Neurocranium (fig. 100) similar to that of other cichlasomines. Rostral lateral processes of mesethmoid sutured to vomer. Distinct intraorbital ligament connect opposed prootic and pterosphenoid processes in *B.moriorum* but not in *B. apoparuana*. Skull slightly wider in *B. apoparuana*, especially in relatively wider and shorter frontals (depth 59 %, postorbital width 67 %, frontal width 38 %, orbital length 49 % of neurocranial length 13.4 mm in *B. apoparuana*; 54 %, 62 %, 31%, 54 % in 31.3 mm SL *B. moriorum*, neurocranial length 9.0 mm). Sagitta with only slight rostral incisure (fig. 101).

Cephalic lateralis system similar in the two species, but anterior frontal foramina slightly more apart in *B. moriorum* than in *B. apoparuana*. Four lachrymal foramina; 4 infraorbitals, the first of which anteriorly largely contained in posterior lachrymal foramen and caudally overlapped by rostral foramen of succeeding infraorbital, posterodorsal tip of lachrymal and anterodorsal tip of second infraorbital nearly in contact on dorsal edge of first infraorbital; first to third infraorbitals with ventral lamina, fourth tubular; anteriormost and two posteriormost infraorbitals with terminal foramina only, second also with lateral middle foramen (fig. 102). Dentary with four foramina, anguloarticular with canal with terminal foramina, preoperculum with six foramina; terminal nasal foramina; frontal canal with rostral, adnasal and three lateral branches, medial branch ending with that of opposite side branch in coronal foramen; posteriormost foramen joined to anteriormost of pterotic. Pterotic with three foramina, middle of which opposed to dorsal

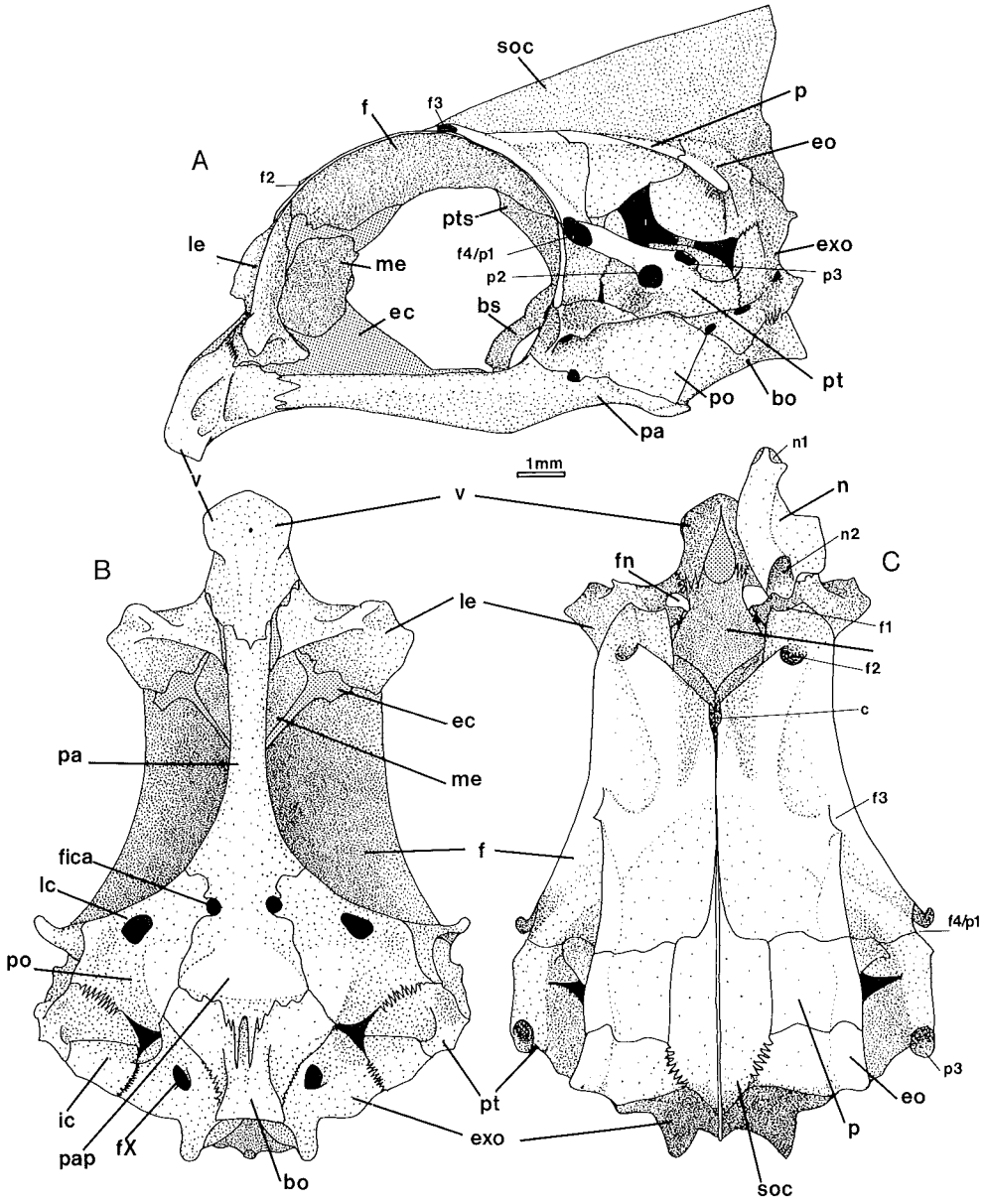

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Figure 100. Neurocranium of *Bujurquina apoparuana*, NRM A85/1981293.3089, 50 mm SL. Cartilage shaded. A lateral, B ventral, C dorsal aspect.

bo basioccipital
bs basisphenoid
c coronalis foramen
ec ethmoid cartilage
eo epioccipital
exo exoccipital
f frontal
f1-f4 frontal lateralis foramina
fica internal carotid artery foramen
fn olfactory nerve foramen
fX foramen of vagus nerve
ic intercalar
le lateral ethmoid
lc lateral commissure
me mesethmoid
n nasal
n1-n2 nasal lateralis foramina
p parietal
p1-p3 pterotic lateralis foramina
pa parasphenoid
pap pharyngobranchiad apophysis
po prootic
pt pterotic
pts pterosphenoid
soc supraoccipital
v vomer

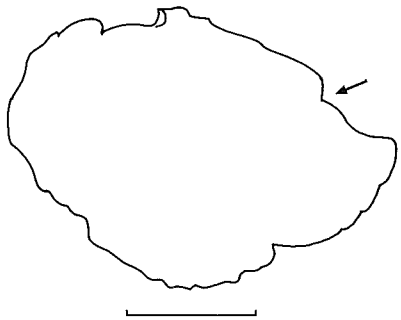

Figure 101. Outline of right sagitta (lateral aspect) of *Bujurquina apoparuana*, NRM A85/1981293.3089, 50 mm SL. Arrow points to shallow rostral incisura. Scale 1 mm.

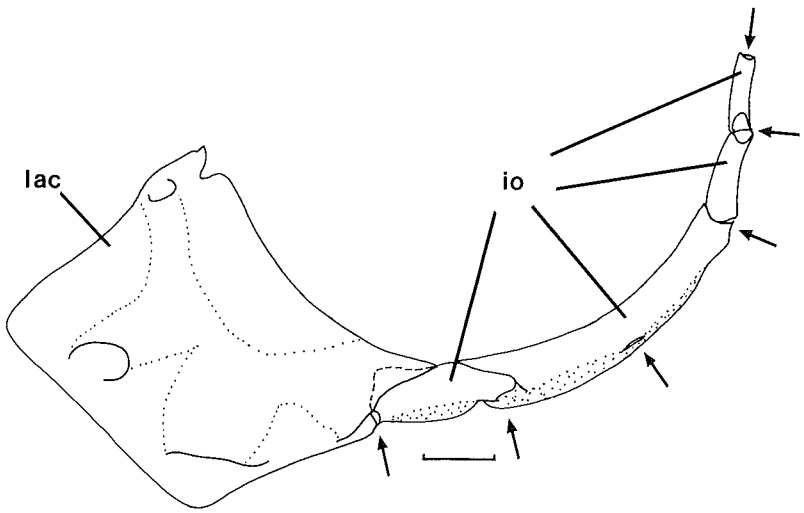

Figure 102. Left side suborbital series in *Bujurquina apoparuana*, NRM A85/1981293.3089, 50 mm SL. Arrows point to infraorbital foramina. io infraorbitals, lac lachrymal. Scale 1 mm.

Jaws of modal cichlasomine appearance (premaxilla, fig. 106). A large rostral foramen in premaxilla evident only in the smallest *B. moriorum*. In dissected *B. moriorum* (31.3 mm SL), mandibular length 48 %, maxillary length 33 %, alveolar premaxillary process 26 %, articulating premaxillary process 22 %, medial premaxillary process 37 % of neurocranial length; in dissected *B. apoparuana* 51 %, 39 %, 29 %, 25 %, 44 %, respectively.

Gill-arches (fig. 107) of modal cichlasomine appearance. First epibranchial slender, with little diverging medial arms. Interarcual cartilage minute, suspended in connective tissue tract; absent unilaterally in *B. apoparuana* and one *B. moriorum*. Shank spine of epibranchial 4 relatively well developed. Ceratobranchial 4 lacking internal process except in the largest *B. moriorum*. Tooth-plates on fourth ceratobanchial (left/right): 4/4 (*B. apoparuana*), 2/2 (2 *B. moriorum*), 1/1 (1 *B. moriorum*).

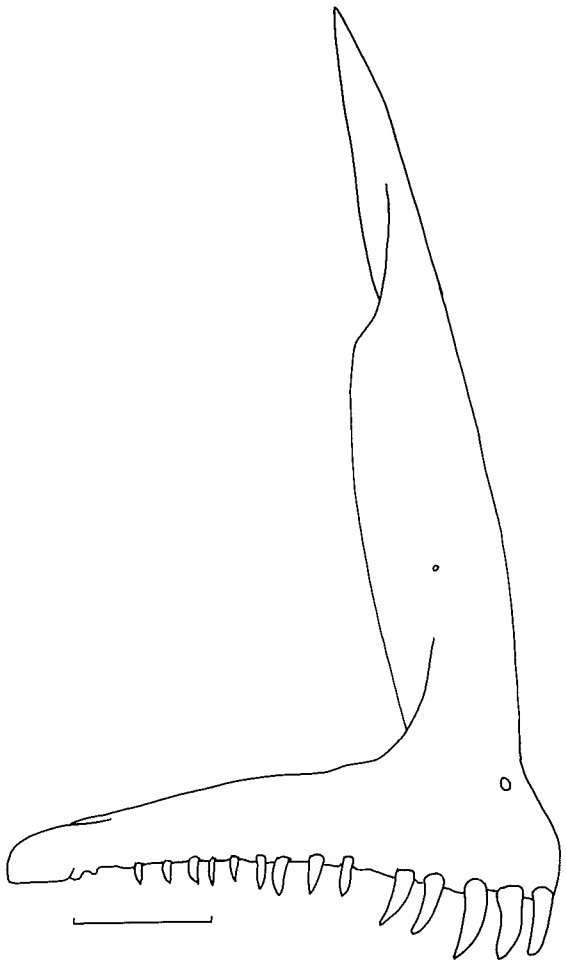

Figure 106. Anterolateral aspect of right premaxilla in *Bujurquina apoparuana*, NRM A85/1981293.3089, 50 mm SL. Scale 1 mm.

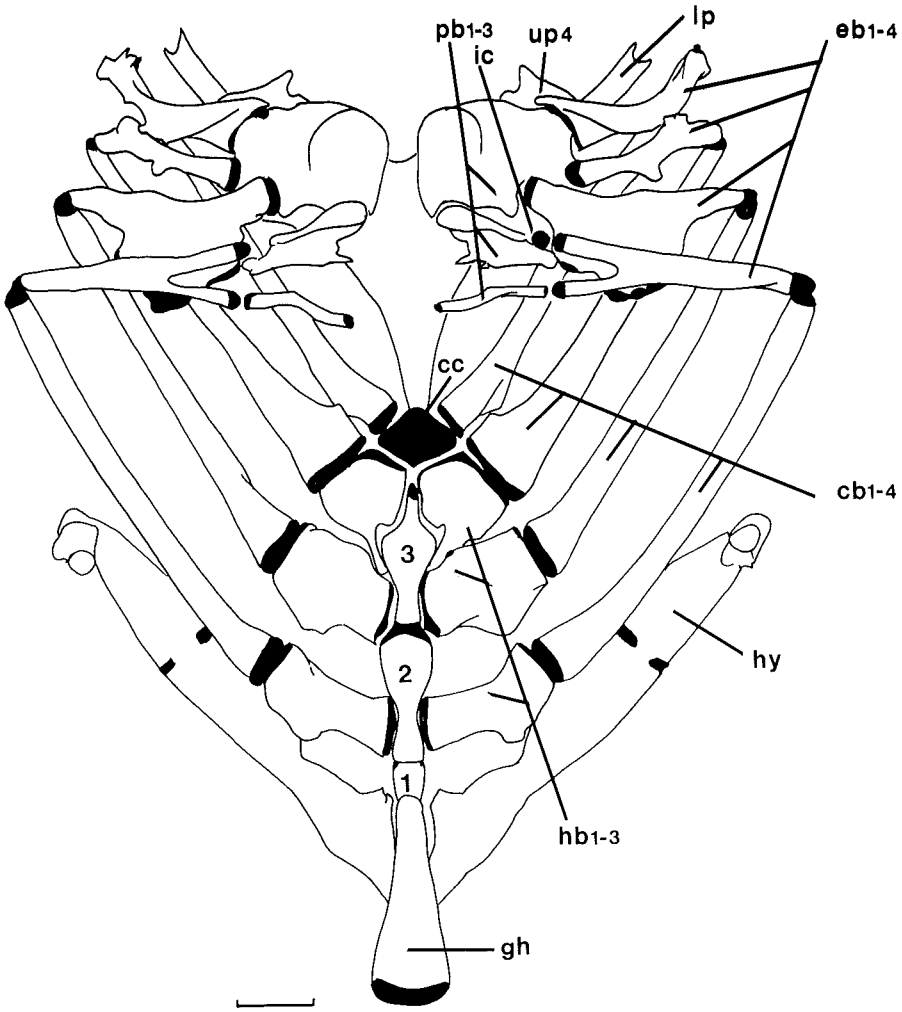

Figure 107. Dorsal aspect of gill-arch skeleton in *Bujurquina apoparuana*, NRM A85/1981293.3089, 50 mm SL. Cartilage, except of pharyngobranchials 2 and 3, black. Scale 1 mm.

cb ceratobranchials
cc central cartilage
eb epibranchials
gh glossohyal
hb hypobranchials
hy hyoid
ic interarcual cartilage
lp lower pharyngeal tooth-plate
pb pharyngobranchials
up4 fourth upper tooth-plate
1-3 basibranchials

Hyoid arch (fig. 108) of modal cichlasomine appearance except for low dorsal edge laminar wings flanking oblique transverse shallow groove in which runs the hyoid artery. Urohyal with moderately long, slightly caudad directed dorsal spine.

Pectoral girdle (fig. 109) of modal cichlasomine appearance. Three ventral proximal radials sutured together in vertical succession in *B. apoparuana*, only two ventral in largest *B. moriorum*, separate in remaining specimens. Distal postcleithrum with broad, rounded anterior expansion, and subacuminate dorsal edge.

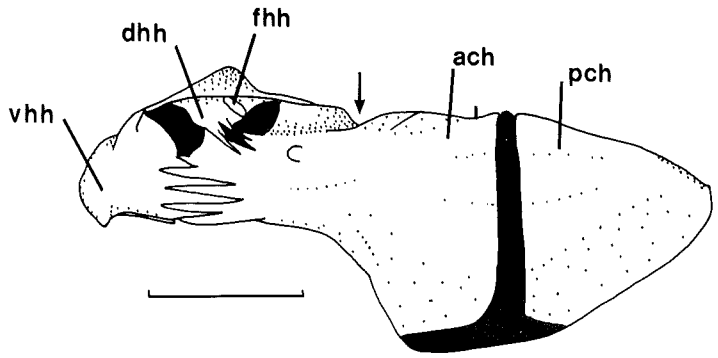

Figure 108. Left hyoid of *Bujurquina moriorum*, NRM SOK/1983351.3793, 31.3 mm SL. Cartilage black. Arrow points to notch in anterior ceratohyal outline. Scale 1 mm.
ach anterior ceratohyal fhh hypohyal foramen vhh ventral
dhh dorsal hypohyal pch posterior ceratohyal hypohyal

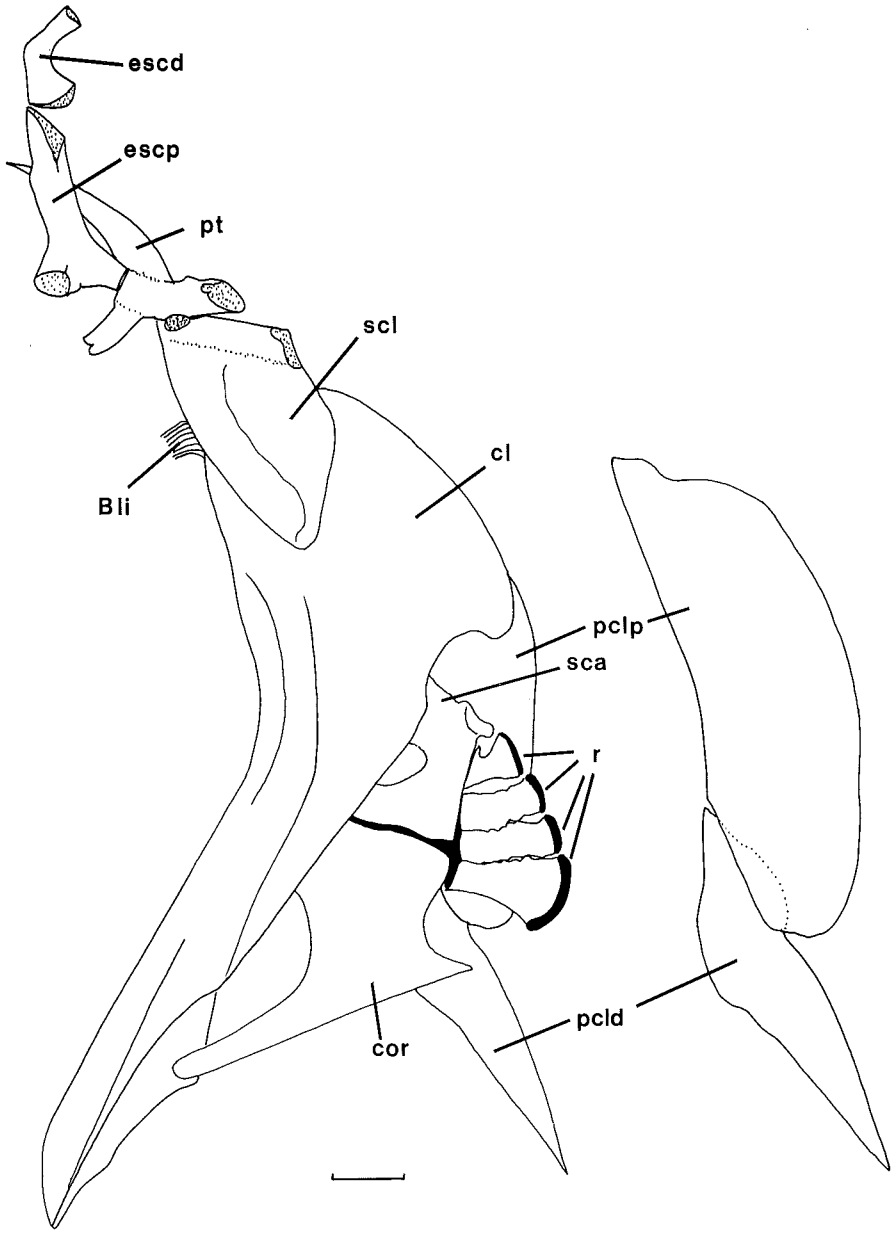

Figure 109. Lateral aspect of left pectoral girdle and (to the right) postcleithra in *Bujurquina apoparuana*, NRM A85/1981293.3089, 50 mm SL. Cartilage black. Scale 1 mm.

Bli proximal part of Baudelot's ligament
cl cleithrum
cor coracoid
escd distal extrascapular
escp proximal extrascapular
pcld distal postcleithrum
pclp proximal postcleithrum
pt posttemporal
r proximal pectoral radials
sca scapula
scl supracleithrum

Two supraneurals. Hypapophyses on 3rd vertebra; paired, separate, short, triangular in *B. moriorum*; paired elements joined apically, forming canal in *B. apoparuana*. Epineural ribs on first two vertebrae. Epipleural ribs sessile from 3rd to 8th vertebra, autogenous posteriorly to 9th (*B. apoparuana*) or 11th (*B. moriorum*) vertebra. Pleural ribs from 3rd to 12th vertebra; in two *B. moriorum* also autogenous rudimentary pleural rib on 13th vertebra. Basapophyses from 3rd to 13th vertebra. Hemal canal from 12th (*B. apoparuana*) or 12th vertebra, except in one *B. moriorum*. First hemal spine on 13th (*B. apoparuana*) or 14th (*B. moriorum*) vertebra. First anal pterygiophore anterior to hemal spine of 14th vertebra. Total vertebrae 26 (*B. moriorum*) or 25 (*B. apoparuana*), 4 last of which within caudal peduncle.

Radiographs of all *Bujurquina* species covered in this paper and some extralimital species confirm observations from *B. moriorum* and *B. apoparuana*, and show in addition that (a) lower scale counts are correlated with lower vertebral numbers, and (b) a shorter caudal peduncle includes fewer vertebrae. All species have 2 supraneurals, with occasional exceptions of 1 or 3 representing abnormal conditions whereby the 3rd supraneural seems to be a spine-less pterygiophore. Most species have modally 12 preanal and 14 posterior vertebrae (ie. 13+13 abdominal+caudal vertebrae) and the four last centra are contained within the caudal peduncle. The species with squ. long. 23 (*B. megalospilus, B. cordemadi, B. tambopatae*) average 25 vertebrae,representing a reduction by one caudal vertebra; and only 2 centra are contained in the caudal peduncle. The rest have 26 vertebrae; the stout-bodied *B. robusta* and *B. apoparuana*, and some *B. huallagae*, with 3 caudal peduncle vertebrae. *Bujurquina peregrinabunda* appears to have 13 rather than 12 preanal vertebrae (like cleared and stained *B. moriorum*, but not the radiographed holotype).

Caudal skeleton (fig. 110) probably atypical in *B. apoparuana* (2 neurapophyses on penultimate vertebra) and one *B. moriorum* (2 neurapophyses and 2 hemapophyses on penultimate vertebra), in the others apophyses of 23rd vertebra anterior to caudal cartilages, neurapophysis of 24th ending between dorsal cartilage and first procurrent ray, rays V8 and Vi articulating at tip of hemapophysis of 24th vertebra. 3 procurrent and 8 principal rays in each lobe. 2 epurals, 2+3 hypurals, parhypurapophysis indicated or absent; major distal radial cartilages: 1 dorsal, 2 ventral, no median hypural or peduncular cartilages.

Colouration: Lightly countershaded, with ventral parts white to yellowish white, sides straw-coloured or yellowish, duskied on back. Markings generally well contrasted, excepting commonly vertical bars, which fade out at level of lower edge of caudal peduncle.

Head with characteristic markings, here termed *interorbital band*, a dark grey to black field between orbits, passing between second frontal lateralis pore and nostril; *preorbital stripe*, a light, whitish line between orbit and nostril along margin of interorbital band; *suborbital stripe*, a dark band, brownish to black, from eye ventrally across cheek, variously modified in adults; *buccal stripes* and *dots* which are brown or silvery (blue in life) lines and dots on lachrymal, cheek and operculars. Buccal stripes appear in about the same position in those species that have them: *1* from posteroventral margin of orbit to mouth angle, *2* from below middle of orbit toward posterior ventral lachrymal lateralis pore, *3* on lachrymal, paralleling and close to stripe 2. The intensity, continuity and length of the stripes varies considerably.

A dark more or less intense *nape band* continues the lateral band on the dorsal edge of the gill-cover, passing across nape, obliquely forwards curved, often faint to the nape midline. The *lateral band* runs either to the junction of dorsal fin and caudal peduncle (in Bar 2) or ends with Bar 3 which intensified dorsally to the soft dorsal-fin base. Vertical *bars* are numbered from posterior to anterior, *1-7*; 1-2 on caudal peduncle, 3-4 above anal fin, 5-6 above abdomen, 7 across dorsum between upper lateral line

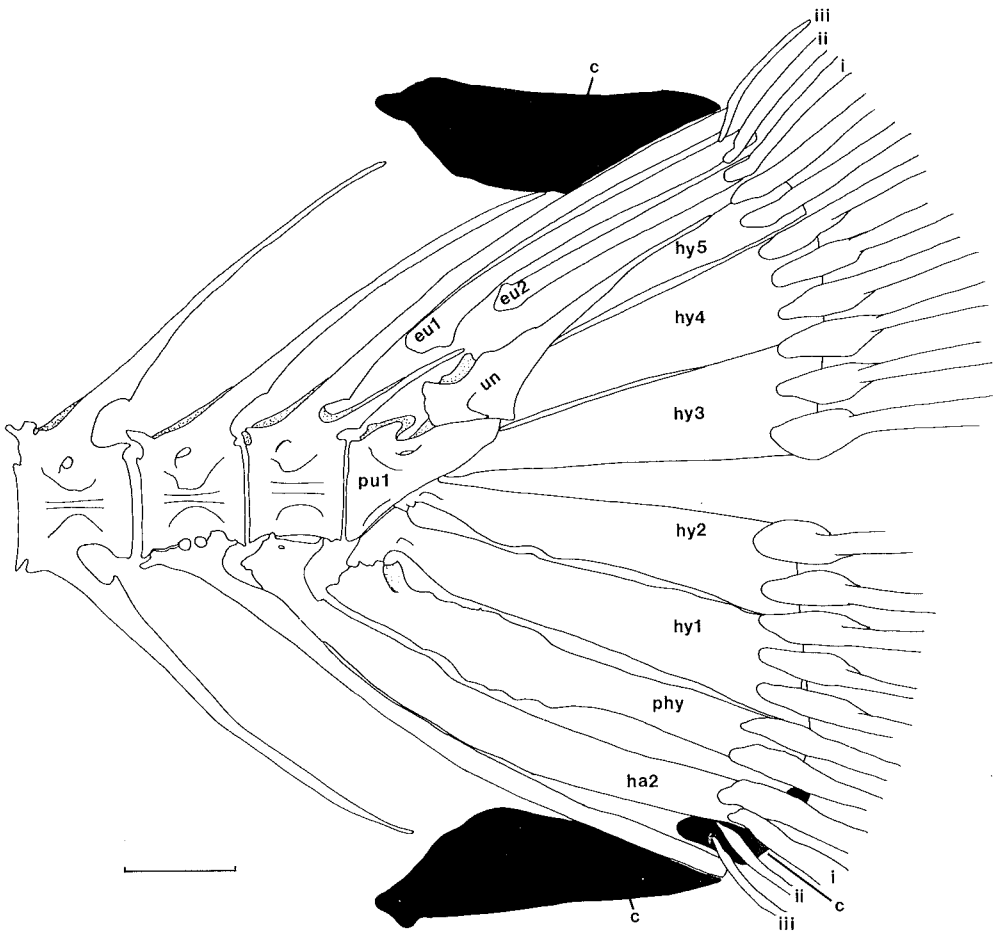

Figure 110. Caudal skeleton in *Bujurquina apoparuana*, NRM A85/1981293.-3089, 50 mm SL. Distal radials (cartilaginous) black; fin rays cut near bases. Scale 1 mm.

c distal radial	i-iii procurrent rays	pu last vertebral centrum
eu epural	ha hemal spine	un uroneural
hy hypural	phy parhypural	

origin of each side; Bar 7 may be divided by light stripe or blotch-like. *Caudal spot* small, on dorsal lobe base, not reaching dorsal edge of fin, and vaguely or not light-ringed. *Midlateral spot* usually merely a component of lateral band.

Dorsal fin with light spots, either over the whole fin and rounded or stripe-like, or restricted to soft portion; margin with various combinations of light and dark lines, eg. white edge/black lappet/white lappet base. Caudal fin with usually indistinct light and dark alternating spots, more distinct in dorsal lobe. Anal fin with a few indistinct spots on posterior membranes and generally well-expressed dark ventral margin.

Notes

Bujurquina and the 4 succeeding genera differ from the cichlasomines dealt with above in having much larger scales, squ. long. usually 24, extremes of 22 or 26 rare. Except for a few *Cichlasoma* species (with 4-6), they have 3 anal-fin spines. The relatively larger scales are best appreciated predorsally, where there are 8 (rarely 7 or 9) scales along the midline (uniserial pattern, cf. fig. 136) or 4 anteriorly and 4 (rarely 3) scale pairs posteriorly on the midline (triserial pattern, cf. fig. 153).

Bujurquina species up to now have been referred to the catch-all assemblage *Aequidens*.The group was recognized as distinct in Kullander (1983*b*, *Aequidens syspilus* group), but not formally described. *Bujurquina* is similar to *Aequidens* only in a general fashion; there is nothing to suggest a particularly close relationship.

A character of interest to relationships of *Bujurquina* is the shape of the ceratohyal. In most cichlids, the dorsal margin of the anterior ceratohyal is about straight or slightly and evenly concave. In *Bujurquina*, *Tahuantinsuyoa*, and species of the *'Aequidens' pulcher* and *'A.' guianensis* species groups (distinguished in Kullander 1983*b*), the dorsal margin is distinctly notched. The notch is formed by low medial and lateral laminar wings forming low walls between which passes the hyoid artery. A similar notch but in the ceratohyal and without laminar walls, is present in *Laetacara* (p.321).

'Aequidens' rivulatus (Günther), a member of the *'A.' pulcher* group, differs from all other groups under discussion in having the hyoid artery passing through a bony canal along the upper edge of the ceratohyal. This condition appears to be unique at least among cichlids. The bone canal may be a derivate of the notch+groove condition. Dissection of large *'A.' pulcher* and *Tahuantinsuyoa* indicates no ontogenetic change in the hyoid shape of cleared and stained young. The ceratohyal notch and canal are quite different from the beryciform foramen (McAllister 1968) in beryciforms and some percoids. In *Holocentrus* (NRM 1060-1091) the ceratohyal portion of the hyoid artery is enclosed in a bone canal only very anteriorly and for most of its course it runs in a longitudinal groove, but not obviously transmitting anything (cf. also Patterson 1964). The notched condition in *Laetacara* is different from that of *Bujurquina* and taken to represent an independent derived condition.

Bujurquina, *Tahuantinsuyoa*, the *'A.' pulcher* group, and the *'A.' guianensis* group, are also united by a uniserial predorsal scale pattern, ie. there is a single series of 8 (rarely 7 or 9) scales on the predorsal midline. This pattern occurs in a few other cichlids (two *Cichlasoma* species, *Nannacara* Regan).

The lateral outline of the lower pharyngeal tooth-plate is characteristic, with lateral ledges protruding except anteriorly, producing an indentation in the margin as shown best in figures 121 and 134. A similar shape is found in other cichlids with a broad pharyngeal tooth-plate, eg. *Heros* (fig. 83). Among cichlasomine cichlids, the dorsal accessory caudal-fin lateral line generally runs between rays D3 and D4 as in most other cichlids, and it is usually short (1-2 tubed scales) or absent. A relatively long, nearly invariably present tube sequence between rays D1 and D2 is found only in *Bujur-*

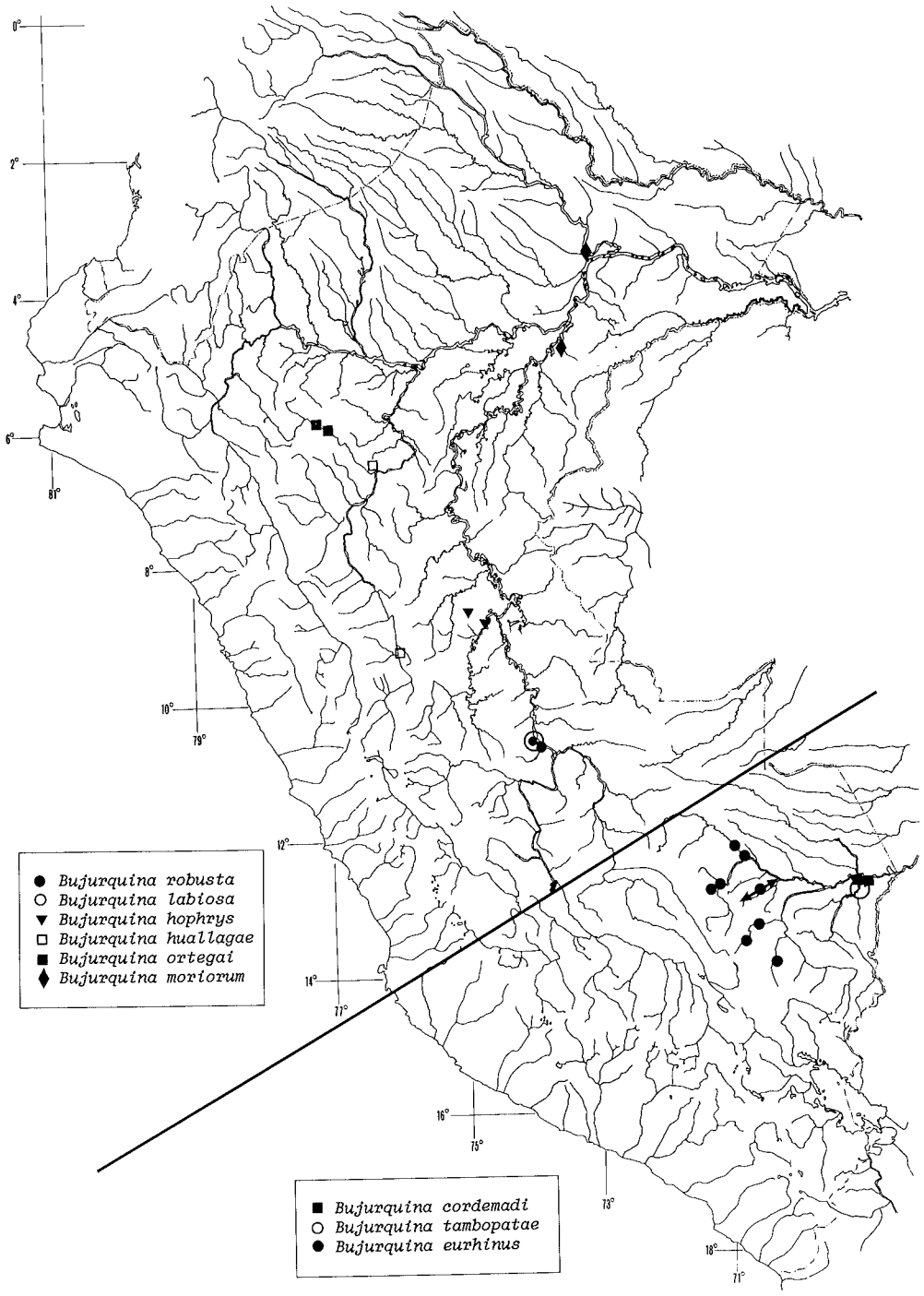

Figure 111. Collecting localities of *Bujurquina cordemadi*, *B. tambopatae*, *B. eurhinus*, *B. robusta*, *B. labiosa*, *B. hophrys*, *B. huallagae*, *B. ortegai* and *B. moriorum*. A symbol may represent more than one, adjacent collecting sites. Arrows distinguish imprecise 'R. Colorado' locality.

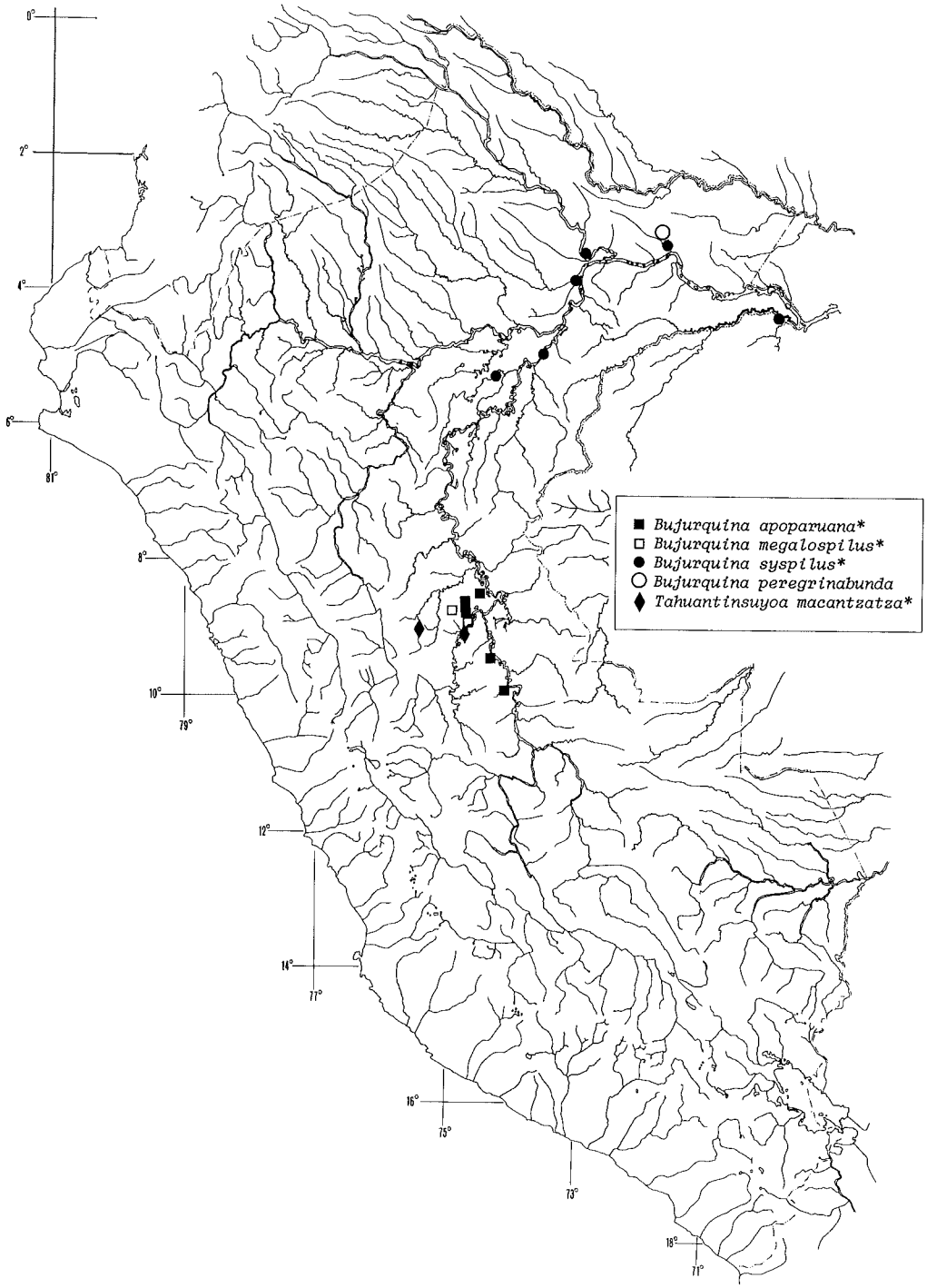

Figure 112. Collecting localities of *Bujurquina apoparuana**, *B. megalospilus**, *B. syspilus**, *B. peregrinabunda* and *Tahuantinsuyoa macantzatza** in western Amazonía. * = total known range. A symbol may represent more than one, adjacent collecting sites.

quina and the *'A.' pulcher* group among cichlasomines, and among other cichlids the character is shared only with *Chaetobranchus*. The character state is a synapomorphy for *Bujurquina* and the *'A.' pulcher* group.

The shape of the caudal fin is variable among cichlasomines; among the large-scaled forms, all genera except *Bujurquina* and some *'A.' guianensis* group species gave a rounded-subtruncate caudal fin.

Cichlids with lateral band usually have it running from head to caudal-fin base; the more dorsal course as in *Bujurquina* is rare among cichlids, though among cichlasomines the condition is encountered in *Tahuantinsuyoa*, the *'A.' pulcher* group, and the *'A.' guianensis* group besides in *Bujurquina* and it may be a synapomorphy of these taxa in addition to the ceratohyal notch. The nape band, however, is restricted to *Bujurquina* and, as a fainter marking, Caribbean versant species of the *'A.' pulcher* group. The pigment patch of which this marking is a modification seems to be present in all large-scaled cichlasomine cichlids, however.

Several *Bujurquina* species are known to be mouth brooders. Mouth brooding is common among cichlids in both the New and the Old World, and has been assumed, without support, to have evolved independently in different lineages (eg. Trewavas 1983). Peters & Berns (1982) have shown that mouth brooding involves a set of co-ordinate features allowing a finer characterization of the phenomenon. Mouth brooding has been observed in *B. vittata* (eg. Timms & Keenleyside 1975, as *Aequidens paraguayensis*), *B. robusta* (Staeck & Linke 1985), *B. mariae* and *B. tambopatae*; it is inferred from finding fry in the mouth of adults in *B. moriorum*, an Ecuadorian and a Colombian *Bujurquina* species. In Peters & Berns's categorization of mouth brooders *B. vittata* is a larvophilous mouth brooder, ie. only the young, not the eggs are brooded. Both parents are active in the brooding. Leaf carrying, ie. deposition and maintenance of eggs on a movable substrate is reported for both *B. vittata* and *B. robusta*. Spawning on leaf litter is reported also from hypothesized closely related groups, ie. *'Aequidens' pulcher* group species *'A.' pulcher* and *'A.' coeruleopunctatus* (Barlow 1974), and an *'A.' guianensis* group species, probably *'A.' guianensis* (Keenleyside & Bietz 1981, as *Aequidens vitattus*). Leaf litter spawning is possibly restricted to this assemblage of genera, but field observations on reproductive behaviour is unavailable for the majority of South American cichlid species. Generally, however, they spawn on fixed substrate and are not mouth brooders. Known other South American mouth brooders include *Geophagus (s. str.)*, *'Geophagus' steindachneri* group species, some *Gymnogeophagus* species, *Satanoperca*, *Aequidens diadema* and, as inferred from fry in the mouth of an adult, *Tahuantinsuyoa macantzatza*.

Characterization of *Bujurquina* requires further comparison with similar groups of species, the *'A.' pulcher* group and the *'A.' guianensis* group.

'Aequidens' pulcher group species have caudal-fin lateral lines as in *Bujurquina*. The colouration is duskier, with de-emphasis of the nape band in *'A.' pulcher* and total lack of nape marking in *'A.' rivulatus*. The caudal spot is midbasal. The caudal fin is rounded. *'Aequidens' pulcher*, studied in some detail, lacks interarcual cartilage, but has a prominent parhypural spine. *'Aequidens' rivulatus*, still only superficially studied, has a unique canal for the hyoid artery. Species of this group are substrate brooders.

'Aequidens' guianensis group species have the dorsal caudal-fin lateral line between rays D3 and D4. There is a blotchy lateral band from head to dorsal-fin end, but no nape band or blue lines on the head sides. The caudal spot is dorsal and very large. *'Aequidens' guianensis*, studied in some detail, has scaly dorsal and anal fin, a prominent parhypural spine, and is a substrate brooder.

Characters distinguishing *Bujurquina* and *Tahuantinsuyoa* are discussed in the description of the latter, p. 320.

Bujurquina species are very similar to each other, and as series of

Table 20. Summary of characters that are useful for distinguishing Peruvian Bujurquina species. Refer to species descriptions for more particular diagnostic features.

	Squ.long. mode	'Diadem' appearance of Bar 7[1]	Dorsal fin richly spotted	Dorsal-fin margin stripes[2]	Pectoral-fin length (% SL)	Suborbital stripe[3]	Lateral band course[4]	Lips
B. cordemadi	23	+	-	w-b-w	32.5-34.1	vert. → O	to D	Thin
B. tambopatae	23	+	-	w-b	32.6-37.9	vert. → O	to D	Thick
B. eurhinus	24	+	-	w-b	27.1-34.0	vert. → O	to D	Thick
B. robusta	24	- (blotch)	-	w-b-w	30.3-33.2	vert. → (O)	to D	Thin
B. labiosa	24	+	-	w-b-w	28.5	vert. → ?	to D	Turgid
B. apoparuana	24	-	-	b-w	32.2-36.9	vert. → O/PS	to D	Thin
B. hophrys	24	-	-	b	32.0-36.6	oblique → PS	to D	Thin
B. megalospilus	23	-	-	b-w	37.2-40.6	vert. → O	to D	Thin
B. huallagae	24	(-)	+	b-w	28.6-32.9	curved	to CP	Thin
B. ortegai	24	-	-	b-w	32.7-34.4	curved	to CP	Thin
B. syspilus	24	(-)	+	b-w	37.6-39.9	curved/vert.	to D	Thin
B. moriorum	24	-	+	b-(w)	32.7-37.4	curved → PS	to CP	Thin
B. peregrinabunda	24	-	+	b-(w)	33.6-37.1	vert. → PS[5]	to CP	Thin

[1] +, intensely pigmented bar crossing nape in advance of dorsal fin, - and (-) no such intense expression or only indicated.

[2] from distal to proximal, w white, b black

[3] vert. vertical, O absent, (O) faint, PS preopercular spot, arrow signifying ontogenetic change.

[4] D, dorsal-fin base, CP caudal peduncle.

[5] Preopercular spot of B. peregrinabunda different from that of other Bujurquina species in the table, being more like a stripe along the preopercular margin.

available material are generally very small, both characterization and identification is difficult. Some species may be more easily identified. These are particularly *B. labiosa* with its broad lips and elongate snout, and *B. megalospilus* with its large, prominent midlateral spot. Characters useful for identification among the remainder are especially pectoral-fin length, course of lateral band (to dorsal fin or caudal peduncle), the suborbital marking of adults, and dorsal-fin colour pattern. The dorsal-fin colouration is very sensitive to preservation. To some extent also squ. long. count and the appearance of Bar 7 (blotch-like, bar-like, or divided) may be useful, and morphometric traits occasionally separate otherwise similar-looking species. The group is left without a phylogenetic analysis pending description of remaining species. Table 20, listing some important diagnostic features may be a helpful complement to diagnoses in descriptions.

Burjurquina cordemadi n. sp.

Figs 111, 113-115, Pl. XXVIII (fig. 1), Tables 20, 21

Diagnosis

Squ.long. 23; jaws equal anteriorly; lips narrow; pectoral fin moderately long, 32.5-34.1 % of SL; lateral band maculate and running towards dorsal-fin; dorsal portions of Bars 5 and 6 contiguous or converging ventrally; vertical, indistinct suborbital stripe, no preopercular spot; nape band faint; Bar 7 chiefly in advance of dorsal fin; posterior dorsal-fin lappets white-margined distal to grey, light and grey zones, spinous dorsal fin otherwise immaculate.

Distinguished from similar species, *B. tambopatae* by united instead of separate Bars 5 and 6, thin lips and short snout (6.6-7.4 % *vs.* 7.7-10.0 % of SL); *B. eurhinus* with snout length 7.8-10.4 % of SL also by fewer squ. long. scales (23 instead of modally 24), and shorter caudal peduncle (11.3-11.8 % of SL *vs.* 12.6-15.7 %).

Holotype

NRM SOK/1981324.3800. A male, 61.8 mm SL. Perú, departamento de Madre de Dios, R. Madre de Dios drainage system, quebrada 8 km from airport road on sideroad to Lago Túpac Amaru. 11 August 1983. Leg. S.O. Kullander, A. Urteaga C., T. Townshend, A. Hogeborn-Kullander, E. Carpio (Station SOK 60).

Material

Holotype and 2 paratypes, 32.0-50.4 mm SL; the smaller paratype not in good condition.

Description

Based on the holotype, 61.8 mm SL, unless otherwise stated; counts from all specimens; measurements are summarized in Table 21; refer to Pl. XXVIII, fig. 1, for illustration of general aspect.

Shape. Moderately deep, with slightly curved frontal profile indented between orbits; snout rounded, with steep tip. Dorsal and ventral outlines well arched, similar. Interorbital vaulted, wider than mouth. Maxilla reaching to vertical from anterior margin of orbit; jaws equal anteriorly. Lips narrow.

Scales. Squ. long. 23 (3); 8 (2), 9 (1) scales in a median series predorsally. Upper lateral line with stepped ascend; lateral line counts 14/9 (1), 16/8 (1), - /8 (1); 1-2 scales continuing lower on caudal fin; 5 tubed dorsal and 7 tubed ventral accessory lateral line scales in holotype, absent in larger paratype, caudal-fin squamation damaged in smaller paratype. Cheek scales, all cycloid, in 3 (3) series. Some posterior prepelvic and dorsal opercular scales ctenoid, otherwise all head side and prepelvic scales cycloid. Basal 1/2 of caudal fin scaly.

Fins. First dorsal-fin spine 1/2 length of last; 4th spine damaged, but about equal in length from 5th except that last longer. Soft dorsal fin pointed, not reaching middle of caudal fin. D. XIII.10 (1), XIV.10 (2). Soft anal

fin pointed, reaching to 1/3 of caudal fin. A. III.7 (3). Pectoral fin with rounded tip, reaching to above first anal-fin spine; P. 13 (2), 14 (1). Pelvic fin pointed, first ray slightly produced, reaching to base of 3rd anal-fin spine. Caudal fin subtruncate.

Gill-rakers. 1-2 epibranchial, one in angle and 6 (3) ceratobranchial rakers externally on first gill-arch. Microgill-rakers externally on 2nd to 4th gill-arches in two larger specimens; present, but distribution uncertain in 32.0 mm specimen.

Jaw teeth. 15/15 (32.0 mm specimen), 16/17 (holotype) teeth in outer hemiseries in upper/lower jaw; inner series 3 in holotype, 2 in 32.0 mm specimen.

Tooth-plates. In 50.4 mm specimen dissected 2 tooth-plates on 4th ceratobranchial, posterior with 2, anterior with 4 teeth. Lower pharyngeal tooth-plate in same specimen (fig. 113) anteriorly with subconical teeth, posteriorly compressed, bicuspid, with moderately long antrorse posterior cusp; no worn teeth.

Vertebrae. Holotype with 25 vertebrae (12 preanal), 2 within caudal peduncle.

Colouration. Ground colour yellowish white, pure on chest and abdomen; ventral sides of head pale greyish; operculum faintly brownish; cheek yellowish; preorbital and snout grey. Weakly contrasted interorbital band. No light stripe between eye and nostril, lines or spots on head sides or pectoral axilla spot. Suborbital stripe (fig. 114) narrow, faintly greyish, straight vertical, onto dorsal edge of anterior limb of preoperculum. Maculate lateral band of brown elongate spots, commencing on lower 1/2 of anterior 3 lateral line scales, covering upper 1/2 of squ. long. scales and all of those above, succeeded by lighter interspace preceding elongate, darker spot in and slightly wider than Bar 5, covering upper 1/2 of squ. long. scales and all of those above; 3rd flank spot pale, from anterior edge of Bar 4 to posterior edge of Bar 3, chiefly in scale series containing upper lateral line, Bars 3 and 4 dorsally of same colour. Band continued on head by elongate spot over dorsal edge of operculum, much more intense than faint, but transversely continuous nape band.

Vertical bars 1-6 faint, brownish grey, reaching ventrally to about level of lower edge of caudal peduncle, slightly darker close to dorsal fin; Bar 6 above lateral band reduced to narrow zone close to dorsal-fin base and continuous with Bar 5. Bar 7 brownish, crossing nape chiefly in advance of dorsal fin, pigmentation most intense anteriorly, not reaching to lateral band.

Dorsal fin light greyish with whitish lappet tips; 10th and following lappets grey with light spot basally, dorsal edge remaining whitish; dorsal edge of soft part narrowly white-lined with grey submarginal stripe; hyaline spots in about 5 series across 6 posterior membranes. Anal fin light greyish, with grey seam along lower edge and indistinct light dots on last 4 membranes. Pelvic fin white, shading to greyish along anterior edge; leading edge white. Caudal fin with brownish round, light margined spot on ventral 2/3 of dorsal lobe; rest light greyish with clear dots on basal half except lower half of ventral lobe, distally membranes clear with greyish margins; dorsal and ventral edges of fins narrowly black-lined.

50.4 mm specimen with lateral band spots more intense and separate spots in Bars 3 and 4; dorsal portions of Bars 5 and 6 converging to form a Y with ventral section of Bar 5. Suborbital stripe slightly caudad curved ventrally, extending onto preoperculum in advance of anterior corner pore. Caudal fin not black-seamed.

Distribution (fig. 111)

Bujurquina cordemadi has been collected only at two localities near Puerto Maldonado, both in tributaries to the R. Madre de Dios.

Ecology

Collecting at the type locality (station SOK 60) was incidental; hence no

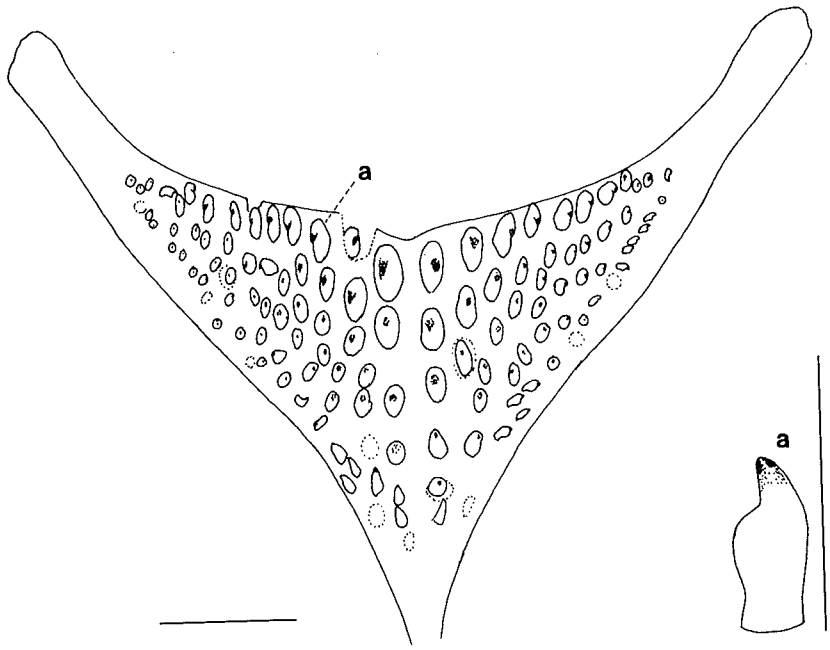

Figure 113. Lower pharyngeal tooth-plate in occlusal view, and posterior tooth (a) in medial aspect, of *Bujurquina cordemadi*, NRM SOK/1983324.3998, 50.4 mm SL. Scales 1 mm.

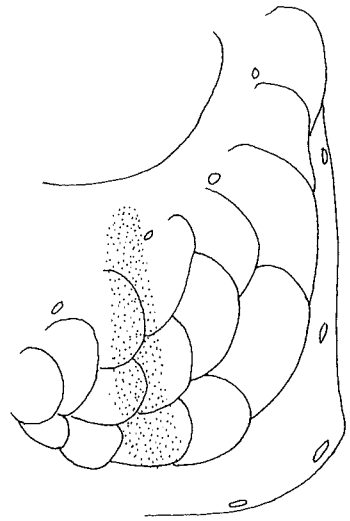

Figure 114. Buccal region of *Bujurquina cordemadi*, NRM SOK/1983324.3800, 61.8 mm SL, to show course of suborbital stripe. Diagrammatic.

water analysis was made. It was a forest stream with clear, tinted water. Collecting was made to a depth of *c.* 0.5 m, over a bottom of sand and thick soft mud. Associated species included *Aequidens tetramerus* and *Crenicichla semicincta*.

Etymology

The Corporación Departamental de Desarrollo de Madre de Dios, through its director, greatly facilitated the collecting around Puerto Maldonado in 1983 that led to the discovery of this species, which takes its genitive name from the acronym (CORDEMAD) of the corporation.

Notes

Only three, rather small specimens of *B. cordemadi* are available. Even the largest specimen does not show adult characteristics of *Bujurquina* species such as caudal-fin streamers or buccal dots, so a more extensive analysis of this form requires larger series. I recognize *B. cordemadi* chiefly with reference to the blunt snout, narrow lips and the configuration of Bars 5 and 6. Otherwise, *B. cordemadi* is quite similar to *B. tambopatae*. The difference in the width of the lower lip between those two species is shown in fig. 115. *Bujurquina cordemadi* bears some resemblance also to Paraguayan and Bolivian *Bujurquina* species. From an undescribed Paraguayan *Bujurquina* species it is readily distinguished by short snout and non-molariform pharyngeal teeth, from *B. vittata* and a Bolivian *Bujurquina* species (undescribed) by the discontinuous anterior portion of the lateral band.

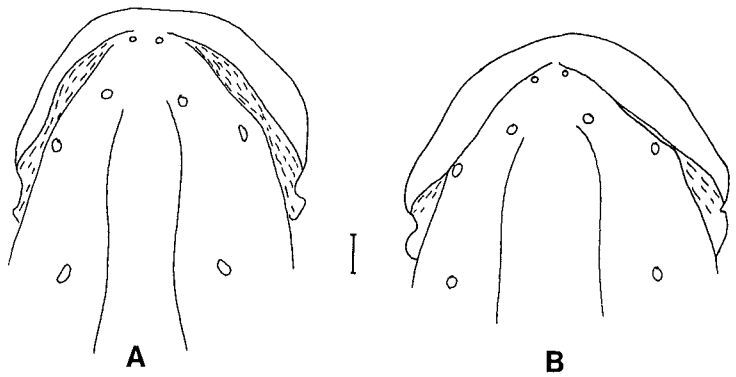

Figure 115. Ventral aspect of snout of *Bujurquina cordemadi* (A; from NRM SOK/1983324.3800, 61.8 mm SL), and *B. tambopatae* (B; from NRM SOK/1983325.3823, 61.2 mm SL), to show more obtuse tip and narrower lip fold in *B. cordemadi*. In *B. tambopatae* the lower lip covers most of the folded skin over the mandibular cartilage, but in *B. cordemadi* it is well exposed (hatched lines). Irregular outlines and apparent asymmetry represent preservation artefacts. Scale 1 mm. Diagrammatic.

Table 21. *Morphometry of* Bujurquina *species in the Madre de Dios drainage system. Measurements are in per cent of SL, except SL (in mm).*

	B. cordemadi			*B. tambopatae*			*B. eurhinus*		
				n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$
SL (mm)	32.0	50.4	61.8	9	36.4-81.5	62.7±4.73	23	45.0-82.5	67.0±2.35
Head length	35.3	33.3	33.7	9	32.6-36.0	34.1±0.34	23	31.2-35.8	33.8±0.26
Snout length	6.6	6.9	7.4	9	7.7-10.0	8.4 ±0.27	23	7.8-10.4	9.0±0.14
Body depth	40.6	42.3	43.5	9	39.2-43.4	41.7±0.56	23	38.0-43.8	40.1±0.31
Orbital diameter	15.0	13.3	12.1	9	11.3-14.3	12.3±0.32	23	9.9-12.9	11.2±0.17
Head width	20.3	19.2	19.7	9	18.1-19.4	18.9±0.16	23	17.1-19.9	18.7±0.13
Interorbital width	10.0	11.3	12.3	9	9.9-12.3	11.2±0.31	23	9.6-13.4	11.1±0.18
Preorbital depth	5.9	7.1	7.8	9	6.0- 9.4	8.0±0.44	23	6.6-10.1	8.5±0.20
Caudal peduncle depth	16.9	17.3	17.2	9	15.4-17.3	16.4±0.23	23	14.7-17.2	16.1±0.14
Caudal peduncle length	11.3	11.3	11.8	9	10.7-12.5	11.5±0.19	23	12.6-15.7	14.0±0.22
Pectoral-fin length	---	32.5	34.1	9	32.6-37.9	35.5±0.51	23	27.1-34.0	30.7±0.39
Pelvic-fin length	33.4	34.5	35.0	9	33.2-48.0	40.5±1.48	23	26.0-42.1	36.1±0.77
Last dorsal-fin spine length	16.6	17.7	17.2	9	16.4-19.7	18.2±0.39	23	13.4-18.3	16.2±0.27

Table 22. *Morphometry of* Bujurquina *species in the uppper Ucayali drainage system. Measurements are in per cent of SL, except SL (in mm).*

	B. robusta			*B. labiosa* (n=1)	*B. apoparuana*			*B. hophrys*		
	n	Range	$\bar{x}\pm s(\bar{x})$		n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$
SL	7	25.7-87.6	70.6±7.79	55.4	17	26.1-77.0	54.2±2.92	15	45.6-79.7	56.6±3.14
Head length	7	32.1-35.0	33.6±0.34	37.0	17	32.8-36.8	34.5±0.30	15	32.9-36.1	34.2±0.27
Snout length	7	7.4-10.6	9.2±0.41	10.3	17	5.4-10.1	7.7±0.28	15	6.3-11.5	8.3±0.36
Body depth	7	40.5-44.7	42.2±0.50	39.4	17	41.4-48.0	44.8±0.42	15	37.2-44.7	40.7±0.52
Orbital diameter	7	10.4-15.2	11.4±0.64	11.7	17	11.3-15.7	13.2±0.31	15	10.9-14.1	12.5±0.29
Head width	7	17.8-19.8	18.9±0.28	19.0	17	18.7-20.0	19.2±0.09	15	18.0-19.8	18.6±0.14
Interorbital width	7	10.5-12.9	11.7±0.36	9.7	17	10.3-13.2	11.6±0.18	15	9.2-12.4	10.6±0.22
Preorbital depth	7	5.1-10.7	9.3±0.73	8.8	17	4.6- 9.0	7.2±0.26	15	5.6- 9.2	6.9±0.29
Caudal peduncle depth	7	16.3-17.8	17.0±0.25	15.9	17	16.2-18.4	17.3±0.14	15	14.8-16.9	15.9±0.16
Caudal peduncle length	7	12.6-14.7	13.7±0.31	13.7	17	11.2-13.0	12.2±0.12	15	12.1-14.8	13.5±0.24
Pectoral-fin length	7	30.3-33.2	31.4±0.44	28.5	17	32.2-36.9	35.1±0.33	12	32.0-36.6	34.4±0.32
Pelvic-fin length	7	26.5-42.8	37.9±2.06	28.7	17	28.7-36.9	28.7±0.55	13	29.5-41.2	34.5±0.91
Last dorsal-fin spine length	7	15.6-17.3	16.4±0.20	14.4	17	15.3-19.6	18.7±0.31	14	15.4-18.2	17.1±0.24

Table 23. *Morphometry of* Bujurquina megalospilus, B. huallagae *and* B. ortegai. *Measurements are in per cent of SL, except SL (in mm).*

	B. megalospilus			*B. huallagae*			*B. ortegai*		
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$
SL (mm)	9	29.9-70.7	44.2±4.44	29	34.5-82.8	60.6±2.32	5	60.4-110.1	73.4±9.34
Head length	9	33.4-36.9	35.0±0.37	29	31.8-35.2	33.1±0.17	5	32.9- 34.1	33.4±0.25
Snout length	9	5.3- 7.9	6.2±0.30	29	7.2- 9.9	8.5±0.14	5	8.6- 11.3	9.4±0.49
Body depth	9	40.1-44.8	42.7±0.55	29	39.1-44.7	41.9±0.29	5	37.9- 42.9	40.9±0.97
Orbital diameter	9	12.4-16.1	14.8±0.40	29	10.3-13.6	11.5±0.14	5	9.4- 11.9	11.0±0.44
Head width	9	19.8-20.9	20.3±0.11	29	16.8-18.8	17.8±0.10	5	17.9- 19.2	18.6±0.21
Interorbital width	9	9.7-12.0	11.0±0.26	29	9.6-13.2	10.9±0.15	5	11.0- 13.4	11.7±0.43
Preorbital depth	9	5.0- 7.9	6.2±0.34	29	5.2- 8.9	7.5±0.21	5	7.1- 10.5	8.5±0.57
Caudal peduncle depth	9	16.7-19.3	17.6±0.30	29	15.8-17.8	16.6±0.10	5	15.6- 16.7	16.1±0.21
Caudal peduncle length	9	10.6-13.4	12.1±0.27	29	11.8-14.7	13.4±0.14	5	14.1- 15.7	14.9±0.21
Pectoral-fin length	9	37.2-40.6	38.6±0.37	28	28.6-32.9	30.7±0.23	4	32.7- 34.4	33.4±0.36
Pelvic-fin length	9	34.3-47.6	37.7±1.38	27	26.9-40.3	31.9±0.56	5	31.1- 35.5	33.6±0.71
Last dorsal-fin spine length	9	19.0-20.9	19.8±0.23	28	15.7-19.1	17.2±0.15	5	13.4- 16.0	15.2±0.47

Table 24. *Morphometry of* Bujurquina *species in the R. Amazonas drainage system and adjacent regions. Measurements are in per cent of SL, except SL (in mm).*

	B. syspilus			*B. moriorum*			*B. peregrinabunda*		
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$
SL (mm)	11	52.4-77.4	63.6±2.32	25	27.9-97.1	52.9±4.25	10	58.2-101.7	78.5±5.09
Head length	11	31.8-35.6	33.7±0.33	25	33.8-36.9	34.8±0.18	10	31.4- 33.5	32.7±0.22
Snout length	11	6.9- 8.5	7.7±0.14	25	5.5-10.7	7.7±0.30	10	5.8- 8.4	7.6±0.25
Body depth	11	42.9-48.1	45.2±0.44	25	38.6-46.3	42.0±0.38	10	41.4- 45.4	43.9±0.43
Orbital diameter	11	11.2-14.2	12.5±0.27	25	11.1-16.8	13.8±0.37	10	10.5- 12.6	11.7±0.22
Head width	11	18.9-19.7	19.3±0.08	25	18.1-20.4	19.2±0.13	10	18.2- 19.5	18.8±0.12
Interorbital width	11	11.1-12.8	12.0±0.18	25	9.0-13.3	10.6±0.26	10	11.4- 14.1	12.5±0.35
Preorbital depth	11	7.6- 9.6	8.3±0.21	25	4.5-10.7	6.6±0.36	10	6.8- 10.8	8.7±0.41
Caudal peduncle depth	11	16.4-17.7	17.2±0.12	25	14.3-17.6	16.0±0.20	10	15.5- 17.1	16.0±0.15
Caudal peduncle length	11	12.0-13.1	12.6±0.11	25	12.6-16.0	14.0±0.17	10	11.8- 14.4	13.1±0.27
Pectoral-fin length	11	37.6-39.9	38.9±0.20	24	32.7-37.4	34.4±0.23	10	33.6- 37.1	35.0±0.37
Pelvic-fin length	11	35.5-44.6	38.9±0.78	25	25.4-39.9	33.1±0.64	10	32.4- 37.5	34.3±0.66
Last dorsal-fin spine length	10	17.7-20.6	19.2±0.32	25	15.7-19.1	17.7±0.17	7	17.3- 19.5	18.7±0.30

Bujurquina tambopatae **n. sp.**
Figs 111, 115-116, Pl. XXVIII (fig. 2), Tables 20, 21

Diagnosis
Squ. long. modally 23; jaws equal anteriorly or lower retrognath; lips wide; pectoral fin moderately long, 32.6-37.9 % of SL; lateral band maculate or continuous, running toward dorsal-fin; Bars 5 and 6 separate; vertical suborbital stripe, fading away with increasing size, no preopercular spot; nape band strong; Bar 7 chiefly expressed as cross-bar anterior to dorsal-fin origin; posterior dorsal-fin lappets white-tipped, otherwise black, spinous dorsal fin otherwise immaculate.

Distinguished from the similar *B. cordemadi* by thicker lips (fig. 115) longer snout (7.7-10.0 % *vs.* 6.6-7.4 of SL) and separate Bars 5 and 6; from *B. eurhinus* by fewer squ. long. scales (23, exceptionally 22 *vs.* 24-25, exceptionally 23), shorter caudal peduncle (10.7-12.5 % *vs.* 12.6-15.7 % of SL), and less prominent upper lip.

Holotype
NRM SOK/1983325.3822. An adult male, 75.2 mm SL. Perú, departamento de Madre de Dios, R. Tambopata drainage system, Quebrada San Roque at Km 11 on Puerto Maldonado-Cuzco road. 12 August 1983. Leg. S.O. Kullander, A. Urteaga C., T. Townshend, A. Hogeborn-Kullander, E. Carpio C. (Station SOK 61).

Material
Holotype and 9 topoparatypes, 36.4-81.5 mm SL; also several larvae and juveniles to *c.* 9.5 mm SL from mouths of adults.

Description
Composite, but principally from adults over 60 mm SL; counts from all specimens; measurements summarized in Table 21 (62.1 mm specimen with head damaged, not measured); refer to Pl. XXVIII, fig. 2 for general aspect.

Shape. Moderately elongate; frontal curvature varying from steep to level; prepelvic contour less steep than predorsal, straight or slightly curved. Snout rounded, dorsal contour steeper than ventral. Jaws isognath except in 81.5 mm specimen in which lower distinctly retrognath and 62.9 mm specimen, with slight lower jaw retrognathy; tip of maxilla below anterior margin of orbit (or slightly beyond or slightly in advance); lips moderately thick, lower wide, covering folded skin between alveolar and vertical arms of dental (fig. 115). Interorbital width equal to mouth width, except in 36.4 mm specimen in which slightly wider.

Scales. Squ. long. 22 (1; 68.9 mm SL), 23 (9); upper cheek and opercular scales ctenoid except on sides. Predorsally a median series of 8 scales, except in 62.1 mm specimen with next to posteriormost scale replaced by scale pair. Cheek with 2 (1) or 3 (9) scale series. Upper lateral line, with distinctly stepped or nearly smooth ascend, of 15 (5), 16 (5) scales; lower lateral line of 6 (1), 7 (1), 8 (5) or 9 (3) scales, continued by 1-3 scales on caudal fin; long lateral line sequences between caudal-fin rays D1 and D2 (1-3 tubed scales, missing in 1 specimen), and V4 and V5 (2-10 tubed scales, missing in 2 specimens). Caudal fin with proximal layer of ctenoid scales, distal to it deeply concave layer of cycloid interradial scales, marginally to near middle of fin length. 68.9 mm specimen also with single scale on right side pectoral-fin base.

Fins. First dorsal-fin spine about 2/5 length of last, spines subequal in length from 4th, last about 3 spines slightly increasing in length; anteriorly lappets with rounded tips, posteriorly more truncated. Soft dorsal fin rounded to pointed, reaching 1/3 to 1/2 of caudal-fin in smaller specimens (36.4-62.1 mm SL), in the others 3rd and 4th ray contributing to long filament reaching past middle, at most to end of caudal fin. D. XIV.9 (6), XIV.10 (2), XIV.11 (2; one with base lacking from 2nd ray). Soft anal fin like soft dorsal fin, but without filament, reaching to middle or 2/3 of caudal fin, shorter in

young specimens A. III.7 (9), III.8 (1). Caudal fin in 4 small specimens, 36.1-62.1 mm truncate to slightly emarginate, with well-rounded corners; males otherwise with middle of hind edge slightly emarginate, rays D5 or D6 and branches of rays V4 and V5 slightly produced, the upper forming short streamer; in females emarginate, without streamer. P. 11 (1), 12 (1), 13 (8); tip rounded, 4th ray longest, reaching to middle of Bar 4 (above first anal-fin spine) except in 36.4 mm specimen, in which extending beyond Bar 4, above 3rd anal-fin spine. Pelvic fin pointed; in males first ray with filament to middle of soft anal-fin or caudal peduncle, 2nd ray ending at base of 2nd or 3rd anal-fin spine; in young and females first ray long, but only reaching 3rd anal-fin spine or first anal-fin ray, 2nd ray ending at genital papilla or first anal-fin spine.

Gill-rakers. First gill-arch externally with 5 (1) or 6 (9) ceratobranchial rakers, one in the angle, and one epibranchial. No microgill-rakers.

Jaw teeth in labial hemiseries in upper/lower jaw 17/13, 12/12, 19/15, 18/16, 21/17, 18/13, 16/13, 15/14 in 8 specimens 49.4-81.5 mm (listed in order of increasing SL). In lower jaw outer teeth strong, well-spaced, erect, conical, little recurved, tip rounded, along little more than anterior half of each ramus; inner shorter band of smaller otherwise similar teeth, of 2 or 3 series anteriorly. Entire upper jaw rim toothed, except in 3 smallest specimens (36.4-54.2 mm; distal 3rd of each jaw half edentulous), by outer series of teeth less spaced than in lower jaw and distinctly increasing in size symphysiad, where longer than anterior lower jaw teeth, otherwise like lower jaw teeth; inner band of 2 or 3 series of teeth in anterior half of each jaw-half, smaller than outer teeth, but similar in shape.

Tooth-plates. 74.1 mm specimen dissected, with 3 tooth-plates on 4th ceratobranchial, with 1, 4 and 5 teeth, respectively; 62.1 mm specimen with single tooth-plate with 8 teeth. Lower pharyngeal tooth-plate (fig. 116) anteriorly with subconical, posteriorly compressed bicuspid teeth, anterior cusp only weakly developed.

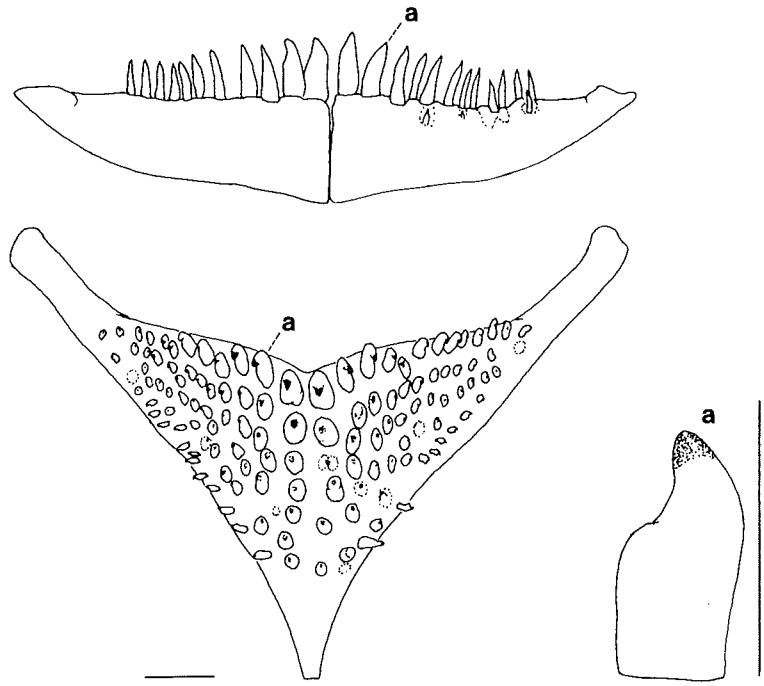

Figure 116. Lower pharyngeal tooth-plate in caudal and occlusal view, and posterior tooth (a) in medial view, of *Bujurquina tambopatae*, NRM SOK/1983325.382, 74.1 mm SL. Scales 1 mm.

Vertebrae. Holotype with 25 vertebrae (12 preanal), of which 2 within caudal peduncle.

Colouration. Ground colour yellowish white on chest, abdomen and ventral portion of head, dorsad lightly countershaded with greyish. Snout, operculum and forehead grey; cheek, remaining gill-cover dirty yellowish white. Dark markings grey-brown to black. Whitish stripe from eye to nostril. Dark grey interorbital band. Suborbital stripe indistinct in large specimens, distinct in smaller (<60 mm), straight ventrad from middle of orbital rim, not onto preoperculum. In specimens over 60 mm scattered brownish dots over opercular bones except interoperculum, and cheek, occasionally confluent to form short stripes (cheek lines 1-2), especially on cheek along margin of lachrymal; a narrow brown stripe along buccad margin of lachrymal. Dark spot on internal side of pectoral axilla extending onto dorsal edge of axilla.

Sides with prominent blotchy oblique lateral band and slightly fainter vertical bars. Bars 1-6 grey-brown, not sharply delimited, from dorsal edge of body, down to level of lower edge of pectoral axilla. Bar 6 a wide bar ventral to lateral band, but dorsal portion differentiated into a spot close to dorsal-fin base, more or less strongly connected to lower portion of bar. Bar 7 from lateral band spot through which runs Bar 6, obliquely rostrad across nape in advance of dorsal-fin origin and, fainter or as indistinctly separated short parallel bar, through dorsal-fin origin; nape band continuing lateral band across nape above eye, prominent.

Lateral band of series of oblong or roundish dark brown or black blotches from head to middle of soft dorsal-fin base; first spot over dorsal edge of operculum, usually extended rostrad to eye; narrowly separated or continuous with 2nd spot, which an oblong spot from lower 1/2 of anterior 2 lateral line scales, in upper halves of squ. long. scales and 3/4 to all of these in series above, usually separated from roundish spot, about 3 scales long and 2 1/2 scales deep, below lateral line in Bar 5, always separated from succeeding spot. 4th and 5th spots, in Bars 4 and 3 respectively, usually continuous; the anterior just below lateral line, the posterior on and above end of lateral line and intense dorsad to dorsal-fin base.

Dorsal fin smoky to light grey; lappets and dorsal margin of soft portion white, black line at base of 4-5 posterior lappets, continued as submarginal stripe along soft portion; clear dots on 4-5 posterior membranes. Anal fin similar, with 2-3 posterior membranes with clear dots, but ventral margin blackish or black except in 2 smallest specimens (36.4, 49.4 mm). Caudal fin greyish, posterior half of dorsal and ventral margins with black seam which wider on ventral margin; indistinct clear dots on proximal half of middle portion. Dark brown to black caudal spot on and above lateral line level, size variable, but not reaching dorsal margin of fin, covering 2/3 of dorsal lobe base; narrow light zones immediately anterior and posterior to spot. Pelvic fin with white outer margin, outer 2 rays and membranes grey, inwardly whitish or clear; uncoloured in 36.4 mm specimen and faintly pigmented in 49.4 and 54.9 mm specimens.

Life colours. Holotype when freshly caught showing blue buccal stripes and spots, and scattered blue/silvery spots on scales associated with anterior portion of lateral band and midlateral spot. Flank scales bluish basally, on lower sides forming narrow blue oblique vertical stripes. Dorsal-fin lappets whitish; soft dorsal fin with blackish inframarginal and reddish marginal band. Upper and lower margins of caudal fin narrowly black; caudal fin otherwise yellowish with light blue spots; light spots of soft dorsal and anal fins pale blue. Leading edge of pelvic fin white. Blackish ventral edge of anal fin contrastingly black.

Distribution (fig. 111)

Known only from the type locality, a tributary to the R. Tambopata near Puerto Maldonado.

Ecology
The type locality (field station SOK 61) was a widened, pool-like portion of a quebrada, formed between the bridge of the highway and a smaller downstream bridge just before the water reaches an aquajal. The bottom substrate, derived from road construction consisted in sand, mixed with mud and sparse gravel. The water was clear with a slight tint of brownish. Associated fishes included *Aequidens tetramerus* and *Mesonauta festivus*.

Several *B. tambopatae* were observed along the margin of the pool, including a brooding pair, with a school of freeswimming young. When disturbed, most or all the young were taken into the mouth of one of the fish in the pair. The type series was assembled by seining repeatedly across the pool, with other nets blocking entrance and outlet. Two of the adults obtained ejected numerous larvae during fixation, but most of the young were eventually lost during subsequent processing of the material. 68.9 mm specimen (female) was preserved with irregular globular structures identified as eggs, and larvae, 61.2 mm specimen (male) with larvae in the oropharyngeal cavity. The larvae may have entered incidentaly during initial preservation, but the eggs indicate that at least females are mouth brooders and suggests that this species is different from other *Bujurquina* species, which tend the eggs on movable substrates. It is possible, however, that disturbance from collecting activities provoked oral ingestion, or the eggs may be from some other species, obtained from, eg. an *Aequidens tetramerus* spawning deserted following disturbance (although no *A. tetramerus* reproduction was observed).

Etymology
Named after the recipient river of the quebrada that is the type locality.

Notes
Bujurquina tambopatae is most similar to *B. cordemadi* and *B. eurhinus*. Distinguishing characters are discussed in descriptions of these species.

Whereas *B. eurhinus* appears restricted to upper tributaries of the R. Madre de Dios, localities of *B. tambopatae* and *B. cordemadi* are close enough that these may be considered sympatric lowland species.

Bujurquina eurhinus n. sp.

Figs 111, 117, Pl. XXVIII (fig. 3), Tables 20, 21

Diagnosis
Squ. long. 23-25, modally 24; jaws equal anteriorly or lower jaw slightly retrognath; lips wide; pectoral fin short, 27.1-34.0 % of SL; lateral band usually continuous, running toward dorsal fin; Bars 5 and 6 separate, dorsal section of Bar 6 not reaching to lateral band; vertical suborbital stripe, fading away with increasing size, no preopercular spot; nape band strong; Bar 7 chiefly expressed as cross-bar anterior to dorsal fin; posterior dorsal-fin lappets black with white distal edge, otherwise spinous dorsal fin immaculate.

Different from the similar *B. cordemadi* and *B. tambopatae* in having modally 24 instead of 23 squ. long. scales. The lips are wide and fleshy, the upper lip especially so, giving a prognathous appearance to the upper jaw. Only *B. labiosa* among *Bujurquina* species shows stronger lip development.

Holotype
ANSP 158173. An adult female, 80.1 mm SL. Perú, departamento de Cuzco, R. Madre de Dios drainage system, R. Hospital at 71°27'W, 12°53'S. 11-14 July 1977. Leg. R. Horwitz (Field no. RH 1 HO 0X06).

Material
Holotype and 54 paratypes, 17.4-88.5 mm SL, from the Manú, Pilcopata, Madre de Dios, Colorado and Inambarí drainages.

Description

Composite, considering primarily measured specimens (Table 21); counts from measured specimens (n = 23); for general aspect, refer to Pl. XVIII, fig 3.

Shape. Body shape variable, generally moderately elongate; frontal outline variable, generally steeply ascending to nape in advance of dorsal-fin origin where levelling out; prepelvic contour less steep than predorsal, nearly straight. Snout rounded, dorsal contour steep, straight. Jaws isognath or upper slightly prognathous; tip of maxilla below or slightly in advance of anterior margin of orbit; upper lip usually thick medially, giving impression of prognath upper jaw; lower lip fold usually wide, extending ventrad to third from rostralmost mandibular lateralis pore, or narrower (about as in Fig. 115) especially in small specimens. Interorbital vaulted, width equal to mouth width, or slightly narrower.

Scales. Squ. long. 23 (1), 24 (16), 25 (6); predorsally 8 scales in a median series in 5 of 22 specimens, remainder with 9 (4) or 10 (1), or a total of 8-9 scales along midline, but posterior 1-3 scale pairs rather than midline scales. Cheek with 2 (1) or 3 (22) scale-series. Upper lateral line usually with stepped ascent, comprising 14 (1), 15 (3), 16 (10), 17 (9) scales; lower line with 8 (4), 9 (15), 10 (4) scales, continued on caudal fin by 1-3 scales; 0-2 tubed scales in dorsal, 0-5 in ventral accessory caudal-fin lateral lines. Basal caudal-fin scale layer marginally to near middle of fin. Squamation otherwise as in *B. tambopatae*; in comparison with which predorsal scales appear relatively smaller, as in *B. eurhinus* 2nd horizontal scale series lateral to the median predorsal scale series usually commences well above orbit, instead of dorsocaudal to orbit as in *B. tambopatae*.

Fins. D. XIII.10 (3), XIV.9 (2), XIV.10 (15), XV.9 (1), XV.10 (2). First dorsal-fin spine about half length of last, spines subequal from about 5th, but last longest; soft fin rounded, reaching little behind caudal-fin base in young; pointed in large specimens, 3rd and 4th ray longest, with or without short filament, reaching at most 2/3 of caudal fin, usually shorter. A. III.6 (1), III.7 (18), III.8 (4); soft fin like soft dorsal fin, without filamentous tip, and caudad extension slightly shorter than that of soft dorsal-fin. Caudal fin subtruncate to slightly emarginate, corners rounded, no streamers. P. 12 (1), 13 (17), 14 (5), tip rounded, 4th ray longest; extending to between hind edge of Bar 5 (in advance of vertical from vent) and middle of Bar 4 (above second anal-fin spine), but usually not reaching past anterior edge of Bar 4 (above genital papilla). Pelvic fin pointed, first ray longest, to about genital papilla in young, slightly produced in large specimens, to 2nd or 3rd anal-fin ray, to caudal peduncle only in 88.5 mm male.

Gill-rakers. First gill-arch externally with 1-2 epibranchial rakers, one in the angle, and 5 (5) or 6 (18) ceratobranchial. Microgill-rakers externally on 2nd to 4th arches, with the exception that they are not positively verifiable in specimens less than 25 mm SL; absent except for rudiments on 4th arch in 88.5 mm specimen (NRM A84/1977375.3085), except for dorsal portion of 2nd arch in 48.4 mm specimen (ANSP 143564), totally in 39.8 mm specimen (ANSP 143566); usually well-developed, in regular series, occasionally of rudimentary appearance.

Jaw teeth. Dentition as *B. tambopatae*, but 88.5 mm specimen with inner tooth-series in upper jaw as long as outer. In 17 specimens 46.9-82.5 mm SL 14/19, 14/17, 18/13, 16/17, 19/18, 17/13, 13/14, 19/19, 15/21, 14/14, 20/18, 20/17, 13/12, 15/14, 18/17, 18/14, 18/18 teeth in upper/lower jaw outer hemiseries (listed in order of increasing SL); 2-4, usually 3 inner series anteriorly in each jaw.

Tooth-plates. Lower pharyngeal tooth plate in 88.5 mm specimen (fig. 117) anteriorly with a few unicuspid teeth, median teeth rostrocaudally compressed, remainder laterally compressed with posterior antrorse cusp and anterior rounded shelf; teeth increasing in size posteromedially. Two tooth-plates on 4th ceratobranchial, each with a single tooth.

Vertebrae. 26 (12 preanal) in 3 specimens, 4 within caudal peduncle.

Colouration. From holotype, with notes on variation. Ground colour yel-

lowish white on chest, abdomen and ventral portion of head, dorsad lightly countershaded with brown. Cheek and gill-cover light brownish on yellowish ground, operculum greyish dorsally. Upper lip, snout and forehead grey. Whitish preorbital stripe from orbit to snout. Dark grey interorbital band. Cheek and all gill-cover bones with scattered brown dots, usually oblong somewhat like short stripes; narrow brownish cheek lines 1-2 on lachrymal along buccad edge and parallel on cheek. No dark spot on pectoral axilla. No suborbital stripe evident.

Brownish Bars 1-6 on sides, fading on level of lower edge of pectoral axilla; epaxial portion of Bar 6 isolated above lateral line; epaxial portion of Bar 5 faint over lateral line. Bar 7 and nape band as in *B. tambopatae*. Lateral band blackish, continuous, but widened where crossing bars, from dorsal edge of operculum to Bar 3 on and above end of upper lateral line.

Dorsal fin greyish, lappets and dorsal margin of soft portion white; 2 posterior lappets and soft fin with narrow black submarginal stripe; posterior 6 membranes with clear dots. Anal fin greyish, shading to blackish along ventral margin; indistinctly clear dots on last 3 membranes. Caudal fin greyish, edges along distal 3rd narrowly black-seamed, narrower along dorsal edge; clear dots on middle of inner half of fin; black deep caudal spot on and above lateral line level occupying 2/3 of dorsal lobe base, light zones immediately preceding and succeeding. First pelvic-fin ray with white leading edge distal to spine, fin otherwise grey anteriorly, fading to white inwardly.

Variation: Lateral band commencing in lower halves of anterior 3 lateral

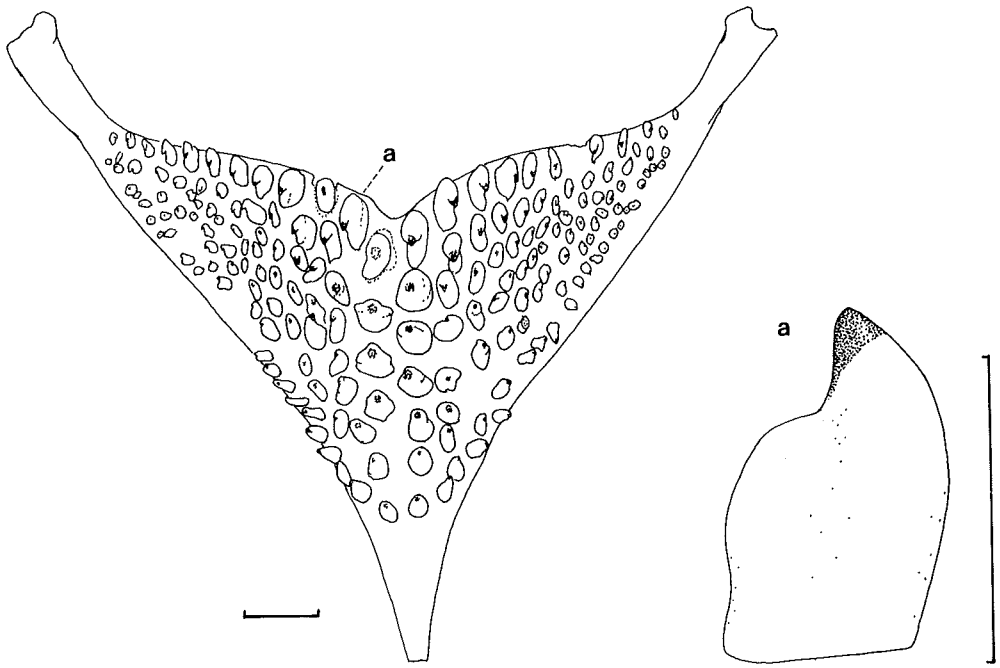

Figure 117. Lower pharyngeal tooth-plate in occlusal aspect, and posterior tooth (a) in medial aspect of *Bujurquina eurhinus*, NRM A84/1977375.-3085, *c.* 88.5 mm SL.

line scales, of varying width anteriorly, commonly occupying all of squ. long. scales and 3/4 of those above, but may be covering only 1/2 of scales in both series, ending in Bars 3 and 4 in lateral line scale series; commonly interrupted, especially between Bars 4 and 5 and always as a spot series in juveniles, in which Bar 5 spot particularly prominent, and nape band not shown. Suborbital stripe faint, to middle of cheek or, usually, absent in large specimens (*c.* 55 mm and larger), distinct in juveniles, onto dorsal edge of lower limb of preoperculum. Dots on head sides absent in young, gradually more numerous ventrad in specimens over 50 mm SL; lines on lachrymal and cheek expressed as spot series in Marcapata material. Quincemil specimen, probably alcohol-fixed, shows head spots silvery rather than brown. Caudal spot variable in shape, roundish or ovate; in juveniles instead a blackish short stripe over caudal-fin base middle. Inframarginal black stripe in dorsal fin may extend to 6th from last lappet; but missing in young which also have less pigmented fin, clear with indistinct dotting on soft unpaired fins in juveniles.

Life colours. A colour print of a photo of freshly caught 88.5 mm specimen from Quincemil, shows abdomen, chest and underside of head white, cheek and gill-cover yellowish, dots on head sides iridescent blue-green, forehead dark green, back brownish, vertical bars, caudal spot and nape band black; iridescent green spots on scales along middle of sides forming lines above adpressed pectoral fin; fins yellowish, dorsal-fin lappets and dots on unpaired fins white or clear, inner half of pelvic fin clear; lower margin of anal fin appearing bluish; iris golden.

Distribution (fig. 111)
Collected at several localities in the Pilcopata-Alto Madre de Dios drainages, in the lower Manú, in the R. Colorado and in the Marcapata, all in the upper reaches of the R. Madre de Dios system. Labels of Horwitz material give localities as coordinates; they can thus be only approximately indicated on the map.

Etymology
The species epithet is a noun in apposition, derived from the Greek *eu*, well or big, and *rhinos*, snout, referring to the prominence of the snout due to the well-developed lips.

Notes
Several particular minor differences, absolute or statistical, between *B. tambopatae* and *B. eurhinus*, appear reflective of the relatively elongate shape of the latter among *Bujurquina* species. Such include s qu. long. (modes 23 and 24, respectively), lateral line (commonest counts 15-16/8 and 16-17/9, respectively) and dorsal-fin (modes XIV.9 and XIV.10, respectively), counts, definitely longer caudal peduncle in *B. eurhinus* (12.6-15.7 % of SL) than in *B. tambopatae* (10.7-12.5 % of SL) and generally shorter pectoral fin (means 35.5 and 30.7 % of SL, respectively), although there is overlap in body depth to SL ratio. The species differ further in the absence of microgill-rakers in *B. tambopatae*, whereas most *B. eurhinus* have them, even if rudimentary; also in the development of caudal-fin streamers in *B. tambopatae* but not in *B. eurhinus*. Both species show considerable variation in colour pattern. The suborbital stripe may be more persistent in *B. tambopatae*, and the lateral band is typically maculate in that species, whereas in *B. eurhinus* it is generally continuous at least from the gill-cleft through Bar 5. The mouth shape is variable in both species, but the short lower jaw of two *B. tambopatae* specimens may be abnormal. The lower lip fold is somewhat variable in width in both species, but no *B. tambopatae* specimens have that thick projecting upper lip characterizing both young and adult *B. eurhinus* and giving a prognath upper jaw profile.

Bujurquina eurhinus is the only *Bujurquina* species south of the Ucayali basin that has more than 23 squ. long. scales.

Bujurquina robusta **n. sp.**
Figs 111, 118-119, Pl. XXIX (fig. 1), Tables 20, 22

Bibliography
Aequidens syspilus; Vierke 1983*a*, p. 204 (habitat, reproductive behaviour; Rio Chicosa), Bild 1-9 (loc. map, habitat, brooding specimen; sketch, monochr. and colour photos). -- Vierke 1983*b*, p. 175 (Rio Chicosa, listed), Bild 5 (underwater colour photo).
"Aequidens" spec. Staeck & Linke 1985, p. 35 (popular account; colour descr.; habitat; reproduction; R. Chinipo), fig. p. 35 (colour photo).

Diagnosis
Squ.long. 24; jaws equal anteriorly; lips thin; pectoral fin short, 30.3-33.2 % of SL; lateral band usually continuous, running toward dorsal-fin; Bars 5 and 6 separate; vertical suborbital stripe, faint but not completely faded with increasing size, no preopercular spot; nape band strong; Bar 7 blotch-like; posterior dorsal-fin lappets black with white edge, otherwise spinous dorsal fin immaculate.

Most similar to *B. eurhinus*, which has Bar 7 modified to a band in advance of dorsal-fin origin and wider lower lip fold. *Bujurquina robusta* has buccal stripes more conspicuous than in any other *Bujurquina* species.

Holotype
NRM A83/1983254.3086. An adult male, 79.0 mm SL. Perú, departamento Ucayali, R. Ucayali drainage system, R. Chinipo drainage within farm Bella Vista *c.* 10 km south of Chicosa. 23 June 1983. Leg. W. Staeck & H. Linke (Station P5/83).

Material
Holotype and 6 topoparatypes, 25.7-87.6 mm SL. A tentatively identified 32.8 mm non-paratype.

Description
Compound, from 70.6-87.6 mm type specimens, unless otherwise stated; counts also including 25.7 mm specimen. Refer to Pl. XXIX, fig. 1, for general aspect; measurements summarized in Table 22.

Shape. Moderately elongate, rather robust. Frontal outline straight, nape curved, anterior half of dorsal-fin base contour horizontal. Ventral outline little curved. Snout short and blunt or slightly produced. Interorbital very slightly curved, width equal to mouth width. Lips moderately wide, lower lip fold not reaching over mandibular cartilage skin. Maxilla little visible, reaching to or nearly to vertical from anterior margin of orbit.

Scales. Squ. long. 24 (7); 8 median predorsal scales except in one specimen with 9, and one specimen with 7 median and a posterior pair. Upper lateral line with more or less distinctly stepped ascend, of 16 (5), 17 (2) scales (6 canals + 10 pores in 25.7 mm specimen, only canals in the others). Lower lateral line of 8 (3), 9 (4) scales (4 of 9 scales, pored in 25.7 mm specimen; only canals in the others); canal bearing scales on caudal fin: 0-3 in dorsal, 2-3 in median and 1-4 in ventral sequence, except in 25.7 mm specimen which lacks caudal-fin lateral lines. Cheek scales in 3 (7) series. Basal half of caudal fin scaly.

Fins. First dorsal-fin spine about half length of last; spines subequal in length from 4th, 5th or 6th, last 2 again increasing in length; soft part pointed, 5th ray longest, to middle or 2/3 of caudal fin. D. XIII.10 (1), XIV.9 (1; 2 anterior rays with shared base), XIV.10 (5). Soft anal fin pointed, 3rd ray longest, reaching to middle of caudal fin or slightly beyond. A. III.5 (1), III.7 (6). Pectoral fin with rounded tip, reaching to above genital papilla to 2nd anal-fin spine; P. 13 (6), 14 (1). Pelvic fin pointed, first ray slightly produced, reaching to base of 3rd spine to 4th ray of anal fin. Caudal fin with emarginate hind edge, indicated or, usually, well-developed

streamers formed by rays D5 and/or D6, and rays V4-V6, the ventral shorter and blunt, the dorsal to 1/2 length of rest of fin.

Gill-rakers. 1 epibranchial, 1 in angle, and 6 (4), 7 (2), 8 (1) ceratobranchial rakers externally on first arch. No microgill-rakers.

Jaw teeth. An outer series of stronger, conical, slightly recurved teeth, slightly increasing in size anteriorly, most worn apically and/or subapically on labial edge; 17/14, 16/13, 14/17, 14/12, 17/14, 20/17 in outer hemiseries in upper/lower jaw (from smallest to largest specimen, 70.6-87.6 mm SL). Inner teeth in 2-3, modally 3, series anteriorly in upper jaw, 3 (modally) -4 in lower jaw, smaller than labial series teeth, and not worn, bands extending to middle of jaws.

Tooth-plates. Dissected 74.0 mm specimen with 2 tooth-plates, each with one tooth, on 4th ceratobranchial. Lower pharyngeal tooth-plate (fig. 118) with anterior teeth subconical, erect or slightly recurved apically, posteriorly compressed, bicuspid, posteriormost constricted near base and with long antrorse posterior cusp; several teeth with flat-worn apex.

Vertebrae. 26 (12 preanal), 3 within caudal peduncle, in holotype.

Colouration. Ground colour yellowish white, pure on chest and along abdomen, dusky on lower head sides. Operculum greyish. Cheek dirty light brown on yellowish ground. Snout and forehead greyish. Dark interorbital band. Scale centers below lateral band slightly lighter than edges. Inside of pectoral axilla pale greyish, but no spot formed.

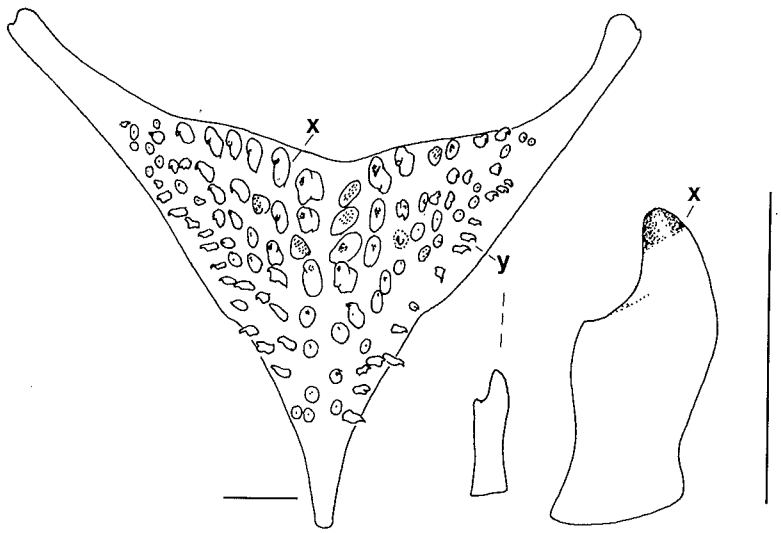

Figure 118. Lower pharyngeal tooth-plate in occlusal view, and medial (x) and lateral (y) aspect of teeth, in *Bujurquina robusta*, NRM A83/1983-254.3051, 74.0 mm SL. Scales 1 mm.

Suborbital stripe (fig. 119) wide, with uncontrasted edges, extending vertical from below lower margin of orbit to but not onto anterior limb of preoperculum; in 87.6 mm specimen only a trace of suborbital stripe; contrasted and extending onto dorsal edge of preoperculum in 25.7 mm specimen. Dark buccal dots scattered over cheek, operculum (2-3 along anterior margin), suboperculum (1-2, posterodorsally), and preoperculum (1-3, on vertical limb), size, shape and position variable. Buccal stripes 1-2 present, stripe 3 faint or absent; intensity, continuity and length of stripes variable. Whitish stripe on preorbital from anterior margin of orbit to just below nostril.

Dark brown lateral band commencing on lower halves of anterior 2 lateral line scales; caudad to Bar 3, anteriorly on dorsal 1/2 of squ. long. scales and scales above, narrowing to scale series above squ. long. series posteriorly; uneven, faint and narrow or interrupted in interspaces between Bars 5-6 and 4-5, faint and narrow in interspace between Bars 3 and 4. Midlateral spot in Bar 5, blackish. Lateral band continued on head across nape close behind eye, narrow but distinct over nape midline.

Vertical bars brown, distinct except in largest specimen; Bars 1-6 darkest dorsally, reaching ventrally to level of lower edge of caudal peduncle, Bars 2-6 slightly rostrad curved; Bar 7 a blotch around dorsal-fin origin, not reaching ventrally to lateral band.

Dorsal fin grey, lappets white, except 1-3 last lappets which are black with narrow white margin; light stripe at base indistinct; soft part with narrow white upper margin and black inframarginal band; 4-5 series of hyaline spots over last 4-5 membranes. Anal fin grey, with wide black seam to ventral edge; 4 hyaline spots on last 2-3 membranes. Caudal fin grey with minute slightly elongate hyaline dots on inner 2/3-3/4, distally membranes hyaline with grey edges, lower lobe with wide grey immaculate ventral seam; caudal spot ovate or vertically rectangular, on ventral 2/3 of dorsal lobe, without light borders. Pelvic fin inwardly clear, outwardly grey, edge and produced portion of first ray white.

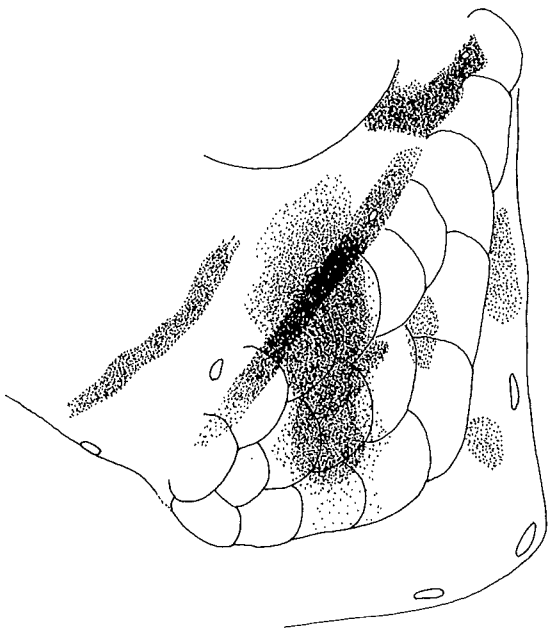

Figure 119. Buccal region of *Bujurquina robusta*, NRM A83/1983254.3086, 79.0 mm SL, to show appearance of suborbital stripe, and prominent buccal stripes. Diagrammatic.

Life colours. A *Bujurquina* species photographed underwater by Vierke (1983*a*, *b*) is recognizable as *B. robusta*. It has dark markings as in preserved material, but notable on the photos is that Bar 7 is transversely divided by a light zone or only a band crossing the nape anterior to the dorsal fin is developed. The prominent buccal lines (1 and 2) and dots are bright blue, like dots in series along the flanks. The anterior edge of the pelvic fin is contrastingly white in one of the specimens. The spinous dorsal fin appears white-edged, the soft dorsal fin red-edged.

Distribution (fig. 111)
Collected only at the type locality, near Chicosa on the left bank of the upper R. Ucayali. Vierke (1983*a*,*b*) photographed the species nearby. A specimen not with certainty referable to *B. robusta* comes from near Atalaya.

Ecology
Vierke (1983*a*, *b*) studied *B. robusta* in the clearwater R. Chicosa and gives information on habitat as well as reproductive behaviour accompanied by underwater photos.

Bujurquina robusta was encountered in July (low water) particularly in slowflowing or pool-like portions of the river. The fishes were frequently encountered pairwise and were apparently territorial. A lone fish, tentatively identified as a male with an estimated length of 12 cm was observed tending eggs attached to a dead leaf about as long as the fish. Upon disturbance the fish dragged the leaf into shelter among rocks, swimming backwards carrying the leaf by the edge in the mouth. Vierke noted that the eggs on the leaf were deposited over the central portion, leaving the edges free for biting. Water analyses showed pH 8.0, conductivity 160 µS, temperature fluctuating over the day 21-27 °C. A pair was observed with 40-50 newly freeswimming young. When disturbed the pair assembled the young close, but did not take them into the mouth.

Staeck & Linke (1985) gave a general description and specific data from the type locality: water clear, pH 7.9, total hardness 4 dGH, conductivity 116 µS, temperature 26 °C. Aquarium studies as reported by Staeck & Linke (1985) confirm biparental larvophilous oral brooding.

Etymology
Named with reference to the general aspect, from the Latin *robustus*, robust, especially in comparison with the otherwise similar *B. eurhinus*.

Notes
Bujurquina robusta bears some resemblance to *B. eurhinus*. It differs in general aspect, being more robust, as reflected in a slightly deeper body (depth 41.6-44.7 % of SL, $\bar{x}$ = 42.6±0.57, n = 5, 70.6-82.5 mm SL, *vs.* 38.0-43.8 % of SL, $\bar{x}$ = 39.9±0.55, n=10, 72.8-82.5 mm SL, only one specimen with a depth over 41 % of SL), preorbital (depth 9.2-10.6 % of SL, $\bar{x}$ = 9.9± 0.26, n = 5, 70.6-82.5 mm SL, *vs.* 8.1-10.1 % of SL, $\bar{x}$ = 9.2±0.19, n = 10, 72.8-82.5 mm SL), caudal peduncle (depth 16.3-17.6 % of SL, $\bar{x}$ = 17.0± 0.28, n = 5, 70.6-82.5 mm SL, *vs.* 15.3-17.2 % of SL, $\bar{x}$ = 16.1±0.18, n = 10, 72.8-82.5 mm SL, specimen with caudal peduncle depth 17.2 % unique, remainder in range 15.3-16.4 %). Meristic data are similar, although frequent squ. long. count 25 in *B. eurhinus* is not found in available *B. robusta*. *Bujurquina robusta* lacks microgill-rakers, in contrast to *B. eurhinus*, and large specimens have well-developed caudal-fin streamers unlike *B. eurhinus*. The lips are not as prominent or wide as in *B. eurhinus* and no upper jaw prognathy, false or real, is seen in *B. robusta*. In colouration, *B. robusta* is characterized by a blotch-like Bar 7, a more or less continuous Bar 6, and more persistent suborbital stripe. The buccal stripes vary slightly in appearance, but in general they are more prominent than in other *Bujurquina* species.

The type series was collected together with *B. labiosa*, which is readily distinguished by the hypertrophied lips and narrow Bar 7 crossing the nape well anterior to the dorsal fin.

A 32.8 mm specimen from Ahiriya is excluded from the type series, and the description, although it most likely belongs to *B. robusta*. It is not well preserved, has a curiously deep head and only 23 squ. long. scales.

Bujurquina labiosa n. sp.

Figs 111, 120, Pl. XXIX (fig. 2), Tables 20, 22

Diagnosis

Squ. long. 24; jaws equal anteriorly; lips fleshy, upper lip with median lobe; pectoral fin short (28.5 % of SL); lateral band continuous, running toward dorsal fin; Bars 5 and 6 separate; vertical suborbital stripe, no preopercular spot; nape band strong; Bar 7 chiefly expressed as transverse band anterior to dorsal fin; posterior dorsal-fin lappets blackish with white edge, spinous dorsal fin otherwise immaculate.

The species differs from all other *Bujurquina* species by the hyperdeveloped lips. It has a longer head than any other Peruvian *Bujurquina* species (37.0 % of SL), and the snout is very long for a *Bujurquina* species (10.3 % of SL).

Holotype

NRM A83/1983254.3070. A young female, 55.4 mm SL. Perú, departamento Ucayali, Río Ucayali drainage system, Río Chinipo drainage within farm Bella Vista, *c.* 10 km south of Chicosa. 23 June 1983. Leg. W. Staeck & H. Linke (Station P5/83).

Material

Holotype, and a poorly preserved paratype, *c.* 27.0 mm SL.

Description

From the holotype, but counts also including poorly preserved paratype. Measurements are given in Table 22; refer to Pl. XIX, fig. 2, for general aspect.

Shape. Elongate; frontal outline straight, nape curved; dorsal outline more arched than nearly horizontal ventral outline. Snout elongated, rounded off anteriorly. Interorbital flat, narrower than mouth. Jaws equal anteriorly; maxilla not reaching to vertical from anterior margin of orbit. Lips thick and wide; lower lip fold laterally wider than intermandibular distance; upper lip fold continuous through median caudad expanded lobe.

Scales. Squ. long. - (1), 24 (holotype). 7 median scales and a posterior scale pair along predorsal midline in holotype; critical scales lost in paratype. Lateral lines of 16/9 scales plus 1 on caudal fin in holotype, ascend of upper smooth; 1 tubed scale in dorsal, 2 in ventral accessory lateral lines on caudal fin in holotype (on right side; 3 in both on left side); critical scales lost in paratype. Cheek, operculae and prepelvic scales cycloid. Cheek scales in 3 (2) series. Nearly half of caudal fin scaly.

Fins. First dorsal-fin spine nearly 1/2 length of last; spines subequal from 4th, last slightly longer; soft dorsal-fin rounded, reaching little beyond caudal-fin base. D. XIII.11 (1), XIV.10 (holotype). Soft anal fin pointed, reaching little beyond caudal-fin base. A. III.7 (1), III.8 (holotype). Pectoral fin rounded, reaching to above first anal-fin spine; P. 13 (1), 14 (holotype). Pelvic fin pointed, first ray little the longest, reaching to first anal-fin spine. Caudal-fin hind edge truncate, with indicated incipient dorsal and ventral elongations.

Gill-rakers. 1-2 epibranchial, one in angle, and 6 (2) ceratobranchial rakers externally on first gill-arch. No microgill-rakers.

Jaw dentition. Teeth of outer series (14/17 in upper/lower jaw hemiseries) larger than those of inner 3 series, but nearly all worn apically to

level of gum, otherwise conical, slightly recurved like teeth in inner series, which not worn.

Tooth-plates. Not examined.

Vertebrae. 26 (12 preanal), 4 within caudal peduncle, in holotype.

Colouration. Chest and median abdomen white, ventral portion of head greyish white, lower sides yellowish. Operculum dorsally grey, ventrally white like subopercular. Cheek yellowish, thinly overlayered with brown. Snout and forehead grey. Upper lip grey, lower lip greyish white. Buccal lines 1 and 2 indicated, broken up into spots. Faint brownish dots scattered over operculum and adjacent subopercular. Black, contrasted, interorbital band. No white preorbital stripe evident. Suborbital stripe brown (fig. 120), not contrasted, from slightly behind middle of eye rim down to middle of cheek, continuous with dark area along posteroventral margin of orbit.

Lateral band blackish, commencing on lower 1/2 of 3 anterior lateral line scales, anteriorly on 1/2 or all of squ. long. scales and all of those above, from close anterior to Bar 5 in upper 1/3 of squ. long. scales and all of scales in series above, caudally narrower, to end in Bars 3 and 4, dorsal portions of which ventrally confluent and of same colour as band. No midlateral spot. Lateral band continued on head by blackish nape band from dorsal margin of operculum obliquely forward across nape, slightly separated from orbit; narrowing dorsally to only thin line across nape.

Vertical bars dorsally blackish, below lateral band brown, reaching to level of lower edge of caudal peduncle. On right side Bar 2 divided into a dorsal spot and a ventral section confluent with Bar 3, and Bar 4 not reaching dorsally to dorsal-fin base; on left side Bar 3 below lateral band narrow and faint compared to other Bars. Dorsal portion of Bar 6 isolated as spot close to dorsal-fin base. Bar 7 composed of blackish stripe across nape anterior to dorsal-fin base, continuous with lateral band, and light brown posterior field separated from blackish stripe by light stripe across back at level of first dorsal-fin spine.

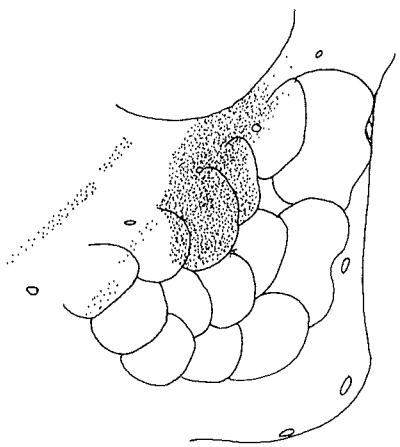

Figure 120. Buccal region of *Bujurquina labiosa*, NRM A83/1983254.3070, 55.4 mm SL, to show appearance of suborbital stripe. Diagrammatic.

Scale centers on flanks slightly paler than edges; producing a pattern of indistinct alternating light and dark horizontal stripes along flanks. Inside of pectoral axilla dorsally dark, but no actual spot formed.

Dorsal fin greyish, indistinct lighter spot at base of each membrane, lappet bases blackish, lappet tips clear; soft part with clear dorsal edge and clear spots in 3 cross-series. Anal fin greyish, darker toward lower margin; clear spots on last 4 membranes. Pelvic fin greyish brown along anterior margin, lighter inwardly, leading edge of first ray white. Caudal fin greyish with clear dots scattered over dorsal 2/3 and distal portions of membranes clear with narrow dark edges; caudal spot deep, blackish, margined anteriorly and posteriorly by light bars, covering slightly more than 1/2 of dorsal lobe base and extending slightly onto ventral lobe.

Distribution (fig. 111)
Known only from the type locality, a backwater on the R. Chinipo near Chicosa on the upper R. Ucayali.

Ecology
The species is syntopic with *B. robusta*, from which it differs strikingly in mouth structures, suggesting that the co-existence is associated with different trophic habits. Staeck & Linke's (1985) habitat data for *B. robusta* also apply to *B. labiosa* (this paper, p. 276).

Etymology
The specific epithet is a Latin adjective meaning big-lipped, given in allusion to the hypertrophied lips.

Notes
Hypertrophied lips, similar to those of *B. labiosa*, but generally with better developed median lobes, and associated long snout, are found in several species of cichlids, representing different phyletic lineages, both in Africa and America. In the Central American *'Cichlasoma' citrinellum* (Günther) and *'C.' labiatum* (Günther), lip development is intraspecifically variable, and environmental conditions are suspected to be influential for lip development (Barlow & Munsey 1976). Also in *'Cichlasoma' tuba* Meek, there is variation in lip fleshiness from normal to greatly thickened and lobed (Bussing 1975). Variation from just thick to thick and with prominent medial lobes is found also within the African *Thoracochromis albolabris* (Trewavas & Thys) (Greenwood 1984). No particular variation has been described for *Cyrtocara euchilum* (Trewavas) and similar species of *Cyrtocara* Boulenger in Lake Malawi (Ribbink *et al.* 1983), or *Lobochilotes labiatus* Boulenger in Lake Tanganyika. In *Paralabidochromis chilotes* (Boulenger) median lobes vary in development (Greenwood, 1980).

The lobed lips of all those fishes represent a trophic specialization, although it is not clear whether they serve the same purpose in all species (see further Barlow & Munsey 1976, Ribbink *et al.* 1983). Given the generality of such variability it may be inferred to also occur in *B. labiosa*. Many other small differences from the syntopic *B. robusta*, however, prevents the identification of these as representing different morphs of the same species. Wide, lobed lips are known from a few South American cichlids. *Tahuantinsuyoa macantzatza*, *Retroculus* species, and *Gymnogeophagus labiatus* (Hensel) resemble *B. labiosa* both with regard to lips and snout shape. In *Heros* species, the lips are very thick and wide, but this genus is characterized by a deep blunt snout, quite unlike that of all other cichlids with hypertrophied lips.

Bujurquina labiosa is known from only two specimens, one of which is in very bad condition. Both have, however, conspicuously long, pointed snouts and hyperdeveloped lips that separate them from all other *Bujurquina*. From the sympatric *B. robusta*, *B. labiosa* differs also in head length (37 % of SL *vs.* 32.1-35.0 %), slenderer body (depth 39.4 % *vs.* 40.5-44.7 % of

SL), narrower interorbital (9.7 % *vs.* 10.5-12.9 % of SL), slenderer caudal peduncle (depth 15.9 % *vs.* 16.3-17.8 % of SL), shorter pectoral fin (length 28.5 % of SL, *vs.* 30.3-33.2 %), and lower dorsal fin (last spine 14.4 % of SL, *vs.* 15.6-17.3 %); but the differences are small and series of specimens of comparable size are likely to show some overlap. As Bar 7 is differentiated into a band across the nape anterior to the dorsal fin, *B. labiosa* resembles rather Madre de Dios species, among which *B. eurhinus* is most similar. From that species it differs in the absence of microgill-rakers and much thicker and wider lips. It is similarly slender, but has longer head, longer snout (only one *B. eurhinus* with snout length over 10 % of SL), narrower interorbital (only one *B. eurhinus* with interorbital narrower than 10 % of SL), and deeper preorbital (8.8 % of SL, *vs.* 6.7-8.1 % in *B. eurhinus* 45.0-61.4 % of SL, n = 7).

Bujurquina apoparuana n. sp.

Figs 100-107, 109-110, 112, 121-122, Pls XXIX (fig. 3), XXX (fig. 1), Tables 20, 22

Bibliography

Aequidens syspilus; Lüling 1981*a*, p. 178 (listed, "Dunkelwasserbach"... Strasse Pucallpa-Campo Verde-Turnavista), Abb. 13 (lower; monochr. photo, habitus). -- (*pt.*) Staeck 1983, p. 24 (aquarium and field data, partly compiled), photo p. 25 (colour photo, living specimen).
'Aequidens' syspilus; (*pt.*) Kullander 1983*b*, p. 276 (osteology).

Diagnosis

Squ. long. 24; jaws equal anteriorly; lips thin; pectoral fin moderately long, 32.2-36.9 % of SL; lateral band usually continuous, running toward dorsal fin; Bars 5 and 6 separate; curved suborbital stripe, fading with increasing size, with or without preopercular spot; nape band moderately strong; Bar 7 blotch-like; posterior dorsal-fin lappets hyaline basally, distally dark, spinous dorsal fin otherwise immaculate.

Bujurquina apoparuana is distinguished from similar species, *B. syspilus* by shorter pectoral fin (Tables 22 and 24), curved suborbital stripe, frequent preopercular spot, and immaculate spinous dorsal fin; *B. hophrys* by less prominent nape band and preopercular spot, basally clear instead of uniformly dark posterior dorsal-fin lappets, wider lateral band, and curved instead of straight suborbital stripe.

Holotype

FMNH 84269. An adult male, 77.0 mm SL. Perú, departamento Ucayali, Río Ucayali drainage system, 3.4 km from Pucallpa on road to Lima, first bridge over stream. 27 July 1975. Leg. D.W. Greenfield & G.S. Glodek (Station G75-68).

Material

Holotype and 28 paratypes, 17.8-77.0 mm SL.

Description

Based on the holotype, variation as noted in other large specimens; counts from 17 specimens measured (Table 22); see Pl. XXIX, fig. 3, and Pl. XXX, fig. 1, for general aspect; osteological data, p. 245.

Shape. Moderately deep; anterior predorsal contour straight, nape level or evenly curved; ventral and dorsal outlines about equally arched. Interorbital flat to slightly vaulted, as wide as mouth. Maxilla not reaching vertical from anterior margin of orbit. Jaws equal anteriorly. Lips moderately wide, width of lower lip fold about equal to anterior intermandibular distance.

Scales. Squ. long. 23 (1), 24 (16). 8 median predorsal scales, except in one specimen with 7. Operculum, suboperculum and posterior half of cheek with ctenoid scales. Upper lateral line of 14 (1), 15 (1), 16 (12), 17 (3)

scales, one subserial tubed scale in one specimen. Lower lateral line of 8 (9), 9 (7), 10 (1) scales plus 2 on caudal fin; accessory caudal-fin lateral lines of 0-4 (dorsal) and 0-5 (ventral) tubed scales. Cheek scales in 3 (17) series. Caudal-fin squamation extending to about 2/5 of fin marginally.

Fins. First dorsal-fin spine about half length of last, spines subequal in length from 4th or 5th, last 2 again longer; soft dorsal fin pointed, to middle of caudal fin, in holotype with 5th ray produced and reaching 3/4 of caudal fin. D. XIII.10 (2), XIV.9 (1), XIV.10 (12), XV.9 (2). Soft anal fin pointed, reaching to middle of caudal fin. A. III.7 (15), III.8 (2). Pectoral fin with rounded tip, reaching 2nd spine to first ray of anal fin. P. 13 (13), 14 (4). Pelvic fin pointed, first ray slightly produced, reaching to 2nd and 3rd anal-fin spine. Caudal fin truncate, with or without incipient streamers, which well developed only in holotype, tipped respectively by rays D6 and V5, lower longest, its length slightly greater than 1/4 of rest of fin.

Gill-rakers. 1-2 epibranchial, 1 in angle and 5 (5) 6 (12) ceratobranchial externally on first arch. Microgill-rakers externally on 2nd to 4th arches.

Jaw teeth. Conical, pointed, slightly recurved, outer larger than those of inner band. 15/21, 13/19, 14/23, 14/21, 14/21, 13/20, 16/20, 17/24, 14/17, 16/22, 16/20, 17/18, 17/24, 19/16 in upper/lower jaw outer hemiseries in 14 specimens 44.9-77.0 mm SL (from smallest to largest); inner teeth in 2-4, modally 3 series anteriorly in upper jaw, 2-4, modally 4 in lower jaw.

Tooth-plates. Dissected 56.1 mm specimen with 2 tooth-plates, posterior with 3, anterior with 19 teeth, on 4th ceratobranchial. Lower pharyngeal tooth-plate (fig. 121) anteriorly with subconical recurved teeth; posteriorly and marginally teeth compressed, bicuspid; posterior not much constricted basally; some medioposterior teeth slightly worn apically.

Vertebrae. 26 (12 preanal) in 6 specimens radiographed, 3 vertebrae within caudal peduncle; 25 in cleared and stained specimen (p. 254).

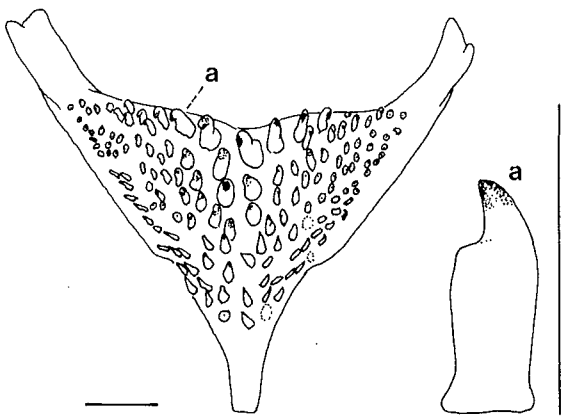

Figure 121. Lower pharyngeal tooth-plate in occlusal view, and tooth (a) in medial aspect of *Bujurquina apoparuana*, NRM 11299, 56.1 mm SL. Scales 1 mm.

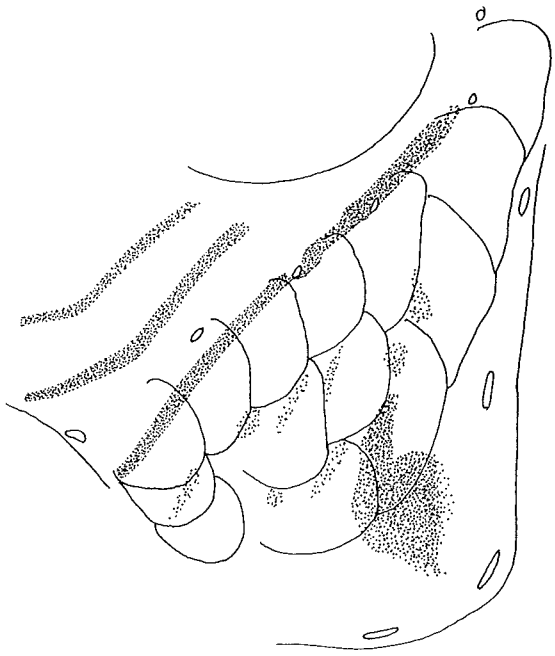

Figure 122. Buccal region of *Bujurquina apoparuana*, FMNH 84269, 77.0 mm SL, to show faded suborbital stripe and relatively indistinct preopercular spot.

Colouration. Ground colour whitish on chest, abdomen and underside of head, yellowish on sides. Operculum greyish, with silvery shine, suboperculum pale golden. Cheek light-brownish on yellowish ground. Snout greyish. Distinct dark grey interorbital band. No apparent light stripe between eye and nostril. Brown buccal stripes 1-3 and faint brown dots scattered on cheek, vertical limb of preoperculum, operculum and dorsally on suboperculum; faint brown spot over inner corner of preoperculum and adjacent cheek associated with posterior of preopercular corner pores (fig. 122). The only other specimens with distinguishable preopercular spot are the largest specimens in Amaquiria and Shahuaya samples, also with faint buccal stripes and dots; buccal stripes and dots in larger (>60 mm) topotypes, but no preopercular spot. Suborbital stripe in young dark brown, strongest near eye, ventrally curved toward corner pores (not just the posterior), in large specimens fading out, but trace of dorsal portion generally apparent.

Lateral band brown, commencing in lower halves of anterior 2 lateral line scales; anteriorly covering upper half of squ. long. scales and all of those in series above, narrow (commonly interupted) in interspace between Bars 5 and 6, Bars 4 and 5, and Bars 4 and 3, from Bar 4 chiefly in lateral line scale series and continuous with dorsal portions of Bars 4 and 3, which of same colour. Midlateral spot in Bar 5, roundish, blackish. Lateral band continued on head (narrowly interrupted over posttemporal) over dorsal margin of operculum and obliquely forward across nape where distinct.

Vertical bars 1-7; 1-6 as traces on sides down to level of lower edge of caudal peduncle, light brown above lateral band; Bar 7 a blotch around dorsal-fin origin, extending ventrally to lateral band. Dark squarish spot on scale bases in vertical bars on sides ventral to lateral band; side scales otherwise light centrally, little darker marginally. Inside of pectoral axilla light.

Spinous dorsal fin uniformly light grey, save for clear lappet bases from behind 7th spine (remainder of lappets usually darker grey); soft portion greyish with about 5 cross-series of hyaline dots across posterior 2/3. Anal fin greyish with slightly darker ventral border and hyaline dots on 2 posterior membranes. Pelvic fin inwardly whitish, outwardly greyish, outer edge of

free portion of first ray whitish. Caudal spot of irregular shape, slightly vertical, with light borders, on lower 1/2 of dorsal lobe base; rest of fin greyish with scattered hyaline dots on inner 3/4, chiefly in dorsal lobe.

Life colours. Staeck (1983) has a colour photo of a freshly caught specimen, and brief colour description. The pattern of dark markings is about as in preserved fish, but the suborbital stripe barely visible; buccal stripes and dots iridescent green, light stripes along flanks gold-green; many back scales with light center.

When freshly caught, NRM SOK/1981343.3471 was light grey with very faintly expressed vertical bars and blackish lateral band. Buccal stripes were light blue. Dorsal-fin lappets tips were reddish; light spots in soft unpaired fins pale blue.

Distribution (fig. 112)
The material available is from streams between Pucallpa and Tournavista, and, more southerly, the lower reaches of the left bank Ucayali tributaries Shahuaya and Amaquiria.

Ecology
Lüling (1981) presented a detailed habitat description for the sample ZFMK unreg. + NRM 11299 (Station PU2). It was a stream with clear, tea-coloured water (downstream of an aguajal) with pH 6.3-6.4, total hardness 1.7 ^{0}dGH, conductivity 22 µS, and a temperature of 25-27^{0}C. Lüling has a list of associated species, which included *Cichlasoma amazonarum* and *Apistogramma eunotus* of cichlids. My station SOK 30 (p. 21) is possibly identical with Lüling's PU2. SOK 33, at which *B. apoparuana* was obtained, was a turbid-water stream nearby.

Etymology
Named for the Río Ucayali, the ancient name of which was Apoparu, or Great River (Villarejo 1979, p. 210).

Notes
Bujurquina apoparuana is notable for the somewhat undecided appearance of the suborbital stripe, which even in large specimens may be obsolete, as in *B. syspilus*, but may also form a preopercular spot similar to that of geographically adjacent *Bujurquina* species. It is the southernmost occurring species of *Bujurquina* species not referrable to the *B. tambopatae* complex, distinguished from these by the inversed dorsal-fin lappet colouration, blotchy Bar 7, thin lips, and long pectoral fin, in addition to the preopercular spot. It is compared further with geographically adjacent *Bujurquina* species on p. 287.

Bujurquina hophrys n. sp.
Figs 111, 123-124, Pl. XXX (figs 2-3), Tables 20, 22

Diagnosis
Squ. long. 24; jaws equal anteriorly or lower jaw retrognath; lips thin; pectoral fin moderately long, 32.0-36.6 % of SL; lateral band continuous, running toward dorsal fin; Bars 5 and 6 separate (or latter not distinguishable); oblique suborbital stripe, substituted by prominent preopercular spot; nape band widened and strongest close to orbit; Bar 7 as wide band, across dorsum through and anterior to dorsal-fin base; posterior dorsal-fin lappets dark, spinous dorsal fin otherwise immaculate.

Bujurquina hophrys is variable with regard to shape and colour pattern. It is somewhat similar only to *B. apoparuana* from which it can be distinguished conveniently by having a straight oblique, instead of vertical, curved, suborbital stripe as young and much more intensely pigmented preopercular spot as adult. Typical is also that the midlateral spot is virtually absorbed

by the lateral band, and that the adorbital portion of the nape band is particularly wide and intensely pigmented.

Holotype
NRM SOK/1981343.3462. An adult female, 68.5 mm SL. Perú, departamento Huánuco, Río Pachitea drainage system, 2-3 km downstream of Tournavista, right bank quebrada near its mouth in the Río Pachitea. 19 August 1981. Leg. S.O Kullander, A. Hogeborn-Kullander (Station SOK 32).

Material
Holotype, and 22 paratypes, 21.7-84.7 mm SL.

Description
From the holotype, compared with other large specimens, unless otherwise stated. Counts from 17 specimens. Measurements from 15 specimens are summarized in Table 22. Refer to Pl. XXX, figs 2-3 for general aspect.

Shape. Very variable, from moderately deep with compressed nape as in holotype, to rather elongate with depressed nape as in 70.3 mm specimen (Pl. XXX, fig 3). Snout triangular or rounded in lateral aspect. Interorbital nearly flat, width equalling mouth width. Upper jaw distinctly prognathous in holotype, ANSP specimen, and some small paratypes; in other specimens jaws equal (cf. Pl. XXX, figs 2-3); maxilla reaching to slightly beyond vertical from anterior margin of orbit and lips thinner in those with prognathous jaw, maxilla nearly to vertical from anterior margin of orbit and lips fleshier in those with isognath mouth.

Scales. Squ. long. - (3), 23 (1), 24 (16). 8 scales in a median series predorsally, except in 3 young in which pattern not apparent due to damage, and in one specimen with 9. Upper lateral line of - (4), 14 (1), 15 (2), 16 (11), 17 (2) scales; lower lateral line of - (3), 8 (9), 9 (5), 10 (3) scales plus 1-2 scales on caudal-fin base; 0-3 tubed scales in accessory caudal-fin lateral lines. Cheek scales in - (1), 3 (19) series. About half of caudal fin scaly.

Fins. First dorsal-fin spine 2/5-1/2 length of last, spines subequal in length from 5th, last 2 slightly longer; soft fin pointed, 4th or 5th ray longest, damaged in holotype, filamentously prolonged to 3/4 of caudal fin in 70.3 mm specimen. D. XIII.10 (1), XIV.9 (4), XIV.10 (15). Soft anal fin pointed, reaching to 1/3 of caudal fin, in 70.3 mm specimen, 4th ray prolonged to 1/2 of caudal fin. A. III.7 (7), III.8 (12), III.9 (1). Pectoral-fin tip rounded, reaching to above 2nd anal-fin spine. P. 13 (17), 14 (3). Pelvic fin pointed, first ray slightly produced, reaching to 3rd anal-fin ray (or shorter). Caudal-fin damaged in holotype, probably truncate with at least dorsal streamer; in other large specimens truncate with streamers tipped by rays D5 and V5 or V5+V6, the dorsal longer, its length maximally almost 1/3 of rest of fin.

Gill-rakers. 1-2 epibranchial, 1 in angle, and 5 (7), 6 (11), 7 (2) ceratobranchial rakers externally on first gill-arch. Microgill-rakers externally on 2nd to 4th arches in 79.7, 70.5, 68.5 and 45.6 mm specimens, on 2nd and 3rd arches in 25.0-31.1 mm specimens (MHNG 2233.64), absent in the rest.

Jaw teeth. 16/19, 14/19, 17/17, 15/-, 19/19, 18/15, 16/16, 13/-, 20/17, 17/-, 15/14, 20/18, 14/11, 17/16, 20/17 teeth in outer hemiseries in upper/lower jaw in specimens 41.2-79.7 mm SL (listed in order of increasing SL). Inner band of 2-3 (upper jaw) and 3-4 (lower jaw) series. Teeth conical, slightly recurved, those of inner band smaller than those of outer series.

Tooth-plates. 59.3 mm specimen with 2 tooth-plates with 3 and 4 teeth on 4th ceratobranchial. Lower pharyngeal tooth-plate (fig. 123) anteriorly with slender, unicuspid teeth, otherwise with posterior antrorse cusp and anterior shelf or minor cusp, marginal slender, medioposterior stout, compressed, many round- or flat-worn.

Vertebrae. 26 (4), of which 12 preanal, 4 within caudal peduncle.

Colouration. Holotype: ground colour greyish white, chest silvery,

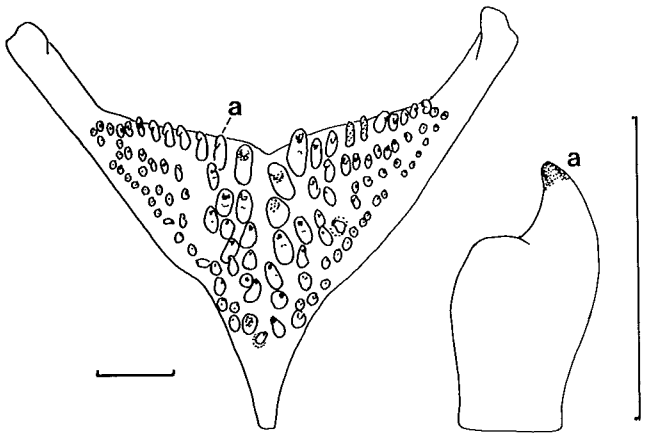

Figure 123. Lower pharyngeal tooth-plate in occlusal view, and tooth in medial aspect of *Bujurquina hophrys*, NRM A85/1985325.3523, 59.3 mm SL. Scales 1 mm.

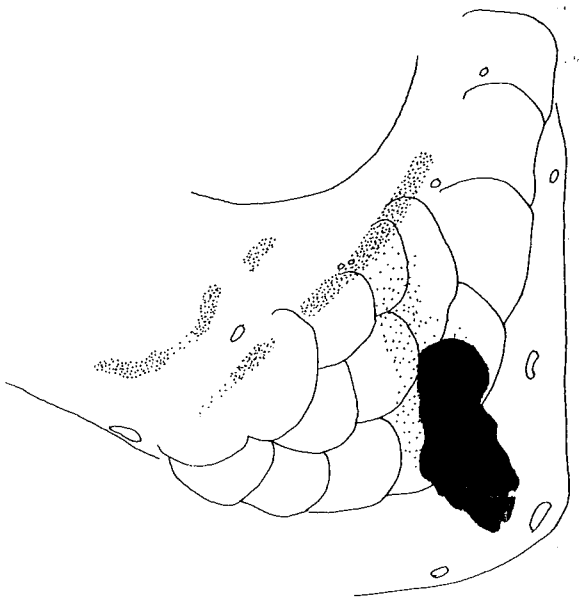

Figure 124. Buccal region of *Bujurquina hophrys*, ZMH 4799, 70.3 mm SL, to show situation of intense subopercular spot. Diagrammatic.

lower head dusky; cheek powdered with brown. Operculum greyish over silvery sheen. Snout greyish; light stripe from eye to nostril vague; interorbital band indistinct. Buccal stripes 1-2 partially discontinuous. Dark brown spot in angle of preoperculum associated with posterior corner pore canal and extending onto adjacent cheek. No suborbital stripe. No distinct buccal dots on cheek or gill-cover.

Lateral band dark brown, commencing on lower 1/2 of anterior 2 lateral line scales; anteriorly on dorsal half of squ. long. scales and all of those in next dorsal series, in adjacent halves of squ. long. and superior scales in Bar interspace preceding Bar 5, posteriorly irregular, narrow, to posterior edge of Bar 3 in scales series including upper lateral line. Band interrupted in posttemporal region, but continued forwards very wide across nape close to orbit, contrasted laterally, faint across nape midline.

7 vertical bars faint, light brown, Bars 1-6 ventrally to level of lower edge of caudal peduncle; dorsal portion of Bar 6 not distinguishable; Bar 7 from lateral band across back through dorsal-fin origin and adjacent nape. Scales of sides with light center and pigmented edges. Pectoral axilla light.

Dorsal fin light greyish, posterior lappets slightly darkened; about 4 series of hyaline dots on last 4 membranes. Anal fin similar; with clear dots on last 2 membranes. Caudal spot ovate, over slightly more than half of depth of dorsal lobe base; no apparent light border zone. Rest of caudal fin light grey with scattered clear dots except along lower border. Pelvic fin clear inwardly, along anterior edge greyish, anterior margin white.

ANSP paratype discoloured (in isopropanol). No vertical bars apparent, but preopercular spot intense. Nape band wide, but not continuous over nape; not continuous with flank lateral band. Lateral band anteriorly in upper half of squ. long. scales and lower half of those above, posteriorly uneven, narrow, ending posteriorly in Bar 3 on adjacent edges of scales in lateral line series and in series below.

45.6 mm specimen with brown suborbital stripe from slightly behind middle of orbit ventrally to preopercular angle between corner pores. Lateral band anteriorly on upper half of squ. long. scales and all of those in series above. Midlateral spot in Bar 5 indicated. Nape band wide.

Fundo Flor specimens faded; R. Pacal material in good condition, with emphasized dark markings, differing slightly from holotype in particulars (mainly from 70.3 mm specimen (Pl. XXX, fig. 3). Interorbital band dark grey. Buccal stripes 1 and 2 partly broken up into spots; scattered dark dots on operculum, suboperculum, cheek and vertical limb of preoperculum. Suborbital stripe indistinct down from slightly behind middle of orbit, brownish (fig. 124). Lateral band anteriorly in upper halves of squ. long. scales and lower halves (in others to 2/3) of those in series above, from Bar 4 on scales below lateral line scale series, from Bar 3 in lateral line scale series, terminating with Bar 3 at dorsal-fin base; margins uneven, but band continuous (in others interrupted anterior and posterior to Bar 5 and/or blackish elongate midlateral spot much wider than band); rostrally band continued over dorsal edge of operculum and across nape above orbits. No distinct midlateral spot, but Bar 5 more intensely pigmented where crossed by lateral band. Inside of pectoral axilla pigmented, but no spot formed. Dorsal fin with clear lappet edges except posterior which uniformly slightly darker than rest of fin and narrow grey dorsal margin on soft part. Anal fin with slightly darkened ventral edge. Caudal spot narrowly light-margined. BMNH specimens and NRM A85/1985325.3523 similar.

R. Capirona specimen with all of squ. long. scales covered by lateral band anteriorly, otherwise like R. Pacal specimens.

Distribution (fig. 111)
Restricted to the Pachitea and Aguaytía drainages, where collected near Tournavista, near Panguana and some tributaries in the von Humboldt national forest.

Ecology
MHNG 2233.63 was taken in backwater with temperature 25.9°C, pH 7.5, conductivity 250 µS. MHNG 2233.64 came from a stream 4 m wide, 0.5 m deep, with water data: temperature 25.0°C, pH 7.6, conductivity 340 µS. The holotype was taken in a quebrada (station SOK 32), margined by secondary forest on one bank, the other bank cleared. The site was slightly influenced by being a watering place for cattle, but the water was colourless ad clear Many *Bujurquina* were seen along the banks, but no other cichlids were observed or caught.

Etymology
Named with reference to the emphasized lateral portion of the nape band, from the Greek *hophrys*, eye-brow.

Notes
Bujurquina hophrys is a very variable species with regard both to shape and colouration (cf. Pl. XXX, figs 2-3). To some extent this variation is due to the very heterogenous material. Inasmuch as all of it is uniquely defined by the colouration of the dorsal fin, the appearance of the preopercular spot and the absence of a midlateral spot in adults, in combination, and since the variation in body depth is continuous, the retrognath lower jaw and relatively more upper jaw teeth of lower Pachitea material and slightly different lateral band course between upper and lower Pachitea material are not emphasized. Other *Bujurquina* species also display quite some variation in mouth shape (cf. descriptions of *B. tambopatae, B. eurhinus*, and *B. syspilus*).

Bujurquina hophrys and *B. megalospilus* are readily distinguished with reference to colour pattern, squ. long. count, and the long pectoral fin and high dorsal fin of *B. megalospilus* (Table 23). *Bujurquina apoparuana* (Table 22) is deeper (1 of 17 *B. apoparuana* under 42 %, 6 of 15 *B. hophrys* over 42% of SL), averages a shorter snout, has a deeper caudal peduncle (1 of 17 *B. apoparuana* under 16.5 %, 3 of 15 *B. hophrys* over 16.5 % of SL), shorter caudal peduncle (5 of 15 *B. hophrys* under 13 % of SL) and higher dorsal fin (3 of 15 under 18 %, 1 of 14 *B. hophrys* over 18 % of SL), proportional characters that may be correlated. Meristic data of *B. apoparuana* and *B. hophrys* agree. Colouration is variable in both forms, although differences in preopercular spot development, absence of light spot at dorsal-fin lappet bases in *B. hophrys*, the comparatively wider nape band and generally, slenderer continuous lateral band in *B. hohprys* have been given weight to the separation. Upon direct comparison it is easy to separate the two species on the course of the suborbital stripe, which is straight from slightly behind the middle of the orbit to the preopercular corner in *B. hophrys* but in *B. apoparuana* vertical from about the middle of the orbit and only ventrally merging with pigment that eventually forms the preopercular spot.

Bujurquina megalospilus n. sp.
Figs 112, 125, Pl. XXXI (fig. 1), Tables 20, 23

Bibliography
'Aequidens' sp. Kullander 1983*b*, p. 156 (listed; habitat data /type locality/).

Diagnosis
Squ. long. 23; jaws equal anteriorly; lips thin; pectoral fin long, 37.2-40.6 %of SL; lateral band usually discontinuous, lateral spot dominant flank marking; Bars 5 and 6 separate; suborbital stripe vertical, indistinct in adult, no preopercular spot; nape band indistinct; Bar 7 blotch-like; posterior dorsal-fin membranes dark with hyaline base, spinous dorsal fin otherwise immaculate.

Similar to *B. syspilus* in having long pectoral fin but differing in fewer squ. long. scales. Distinguished from all other *Bujurquina* species by the large, prominent midlateral and caudal spots.

Holotype
NRM SOK/1981343.3456. An adult female, 70.7 mm SL. Perú, departamento Huánuco, Río Pachitea drainge system, drying pool *c.* 100 m from the left margin of the Río Pachitea and *c.* 1 km upstream from Tournavista. 19 August 1981. Leg. S.O. Kullander, A. Hogeborn-Kullander (Station SOK 31).

Material
Holotype and 8 paratypes, 29.9-53.8 mm SL, from Tournavista and R. Neshuya.

Description
From the holotype, unless otherwise stated; counts from all specimens available; measurements summarized in Table 23. Refer to Pl. XXXI, fig. 1, for illustration of general shape and colour pattern.

Shape. Moderately deep; predorsal contour little convex; dorsal outline more arched than ventral. Snout short, bluntly rounded. Interorbital flat, slightly wider than mouth. Jaws equal anteriorly; maxilla reaching to vertical from anterior margin of orbit (slightly beyond in all other specimens); lips narrow, width of lower lip fold equal to anterior intermandibular distance.

Scales. Squ. long. - (1), 23 (7), 24 (holotype only). 8 scales in a median series predorsally in 4 specimens, only 7 in one, 7 + posterior pair in one, irregular predorsal squamation in one, and most predorsal scales lost in 2 specimens. Upper lateral line of - (1), 14 (2), 15 (6), 17 (1) scales. Lower line of 7 (1), 8 (5), 9 (2), 10 (1) scales, plus 0-2 tubed scales on caudal-fin base; accessory lateral lines on caudal fin absent or critical scales lost, except in holotype with 2 tubes beween rays D2 and D3 and 3 tubes between rays V4 and V5 on left side, 1 tube between rays D1 and D2 and 2 tubes between rays V4 and V5 on right side, and in 46.1 mm specimen with at least 2 tubes on left side between rays V4 and V5. Cheek scales in 2 (3), 3 (6) series. In holotype cheek, opercular and prepelvic scales ctenoid, save anteriormost cheek scales; 46.1 mm specimen similar but opercular and subopercular scales lost; 32.9 mm specimen with ctenoid prepelvic scales but cycloid cheek scales; MHNG specimens with all or anterior half of prepelvic squamation cycloid; cheek scales cycloid. Slightly less than half of caudal fin scaly.

Fins. First dorsal-fin spine about 1/2 length of last; spines subequal in length from about 6th, last 2 again longer. Soft fin pointed, reaching beyond middle of caudal fin. D. XIII.10 (1), XIV.9 (5), XV.9 (2), XV.10 (1). Soft anal fin pointed, reaching to 1/3 of caudal fin. A. III.6 (1), III.7 (6), III.8 (2). Pectoral fin with rounded tip, reaching to above 3rd anal-fin spine; P. 13 (9). Pelvic fin pointed, first ray slightly produced, reaching to 3rd anal-fin spine. Caudal fin subtruncate. 50.2 mm specimen with best developed finnage: soft dorsal fin pointed, with long filament reaching to end of caudal fin, anal fin pointed, reaching to middle of caudal fin, caudal fin truncate with short ventral streamer tipped by ray V5, pelvic fin with very long first ray, reaching to end of anal fin. Remaining paratypes with subtruncate (young) to truncate caudal fin, probably a streamer tipped by ray V5 in 53.8 mm specimen.

Gill-rakers. One epibranchial, one in angle, and 6 (5), 7 (4) ceratobranchial rakers externally on first gill-arch. Microgill-rakers externally on 2nd to 4th arches in holotype and topotypes, but not in IVITA specimens.

Jaw teeth. 14/24, 15/21, 16/18, 17/16, 14/21, 17/17 teeth in outer hemiseries in upper/lower jaw, 2-4, modally 3 inner series, in 6 specimens 32.3-75.7 mm SL.

Tooth-plates. Dissected 53.8 mm specimen with 3 tooth-plates on 4th ceratobranchial, with respectively 3, 3 and 4 teeth. Lower pharyngeal tooth-plate of same specimen (fig. 125) anteriorly with subconical teeth, the majority compressed and bicuspid.

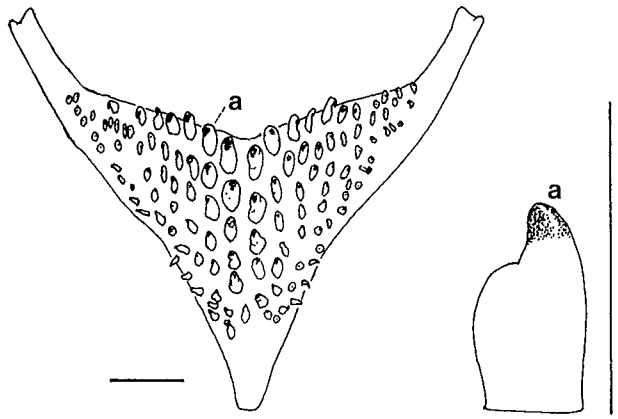

Figure 125. Lower pharyngeal tooth-plate in occlusal view, and tooth (a) in medial aspect of *Bujurquina megalospilus*, NRM A85/1984414.3090, 53.8 mm SL. Scales 1 mm.

Vertebrae. 25, of which 12 preanal, in 2 paratypes; 26, probably 13 preanal, in holotype; 2 caudal peduncle vertebrae.

Colouration. Ground colour white on chest, yellowish white on lower flanks and abdominally. Cheek faintly yellowish, thinly overlayered with brown. Operculum faintly brown-grey. Snout and forehead light grey. No dark interorbital band or white eye-nostril stripe. No dark dots or lines on head. Suborbital stripe from orbital margin below middle of eye to but not onto horizontal limb of preoperculum feebly indicated.

Brown, not sharp-margined lateral band commencing in lower halves of 2 anterior lateral line scales, over upper 1/2 of squ. long. scales and lower 1/2 of scales above to Bar 5, behind narrower, fainter, ending in Bar 3 on scale series below that containing upper lateral line and of same colour as dorsal sections of Bars 3 and 4. Band continued on head over dorsal edge of operculum and a long posterodorsal margin of orbit, but only indicated across nape; narrowly interrupted in posttemporal region. Midlateral spot in Bar 5 prominent, dark brown, roundish, extending dorsally to lateral line canals, ventrally slightly deeper than anterior lateral band section. Vertical bars pale brownish dorsally; Bars 1-5 fading out on sides above level of lower edge of caudal peduncle; Bar 6 reaching ventrally to lateral line canals; Bar 7 expressed as a spot anterior to and through dorsal-fin origin, reaching ventrally to lateral line scales. Inside of pectoral axilla light. Scales of anterodorsal sides with faint sivery sheen, on sides ventral to lateral band a silvery dot on each scale base.

Dorsal fin smoky, anterior lappets hyaline but 11th and following blackish with hyaline base; soft fin with narrow blackish edge and a few hyaline dots basally on posterior membranes. Anal fin smoky, immaculate, lower margin blackish. Caudal fin smoky, with darker ventral edge and scattered clear dots on inner half of dorsal lobe; prominent caudal spot brown, roundish and extending slightly onto caudal peduncle, not distinctly ocellated, covering lower 2/3 of dorsal lobe base. Pelvic fin greyish, densely grey along anterior

margin, outer edge of first ray white.

IVITA paratypes with dark grey to blackish rather than brown principal markings, otherwise similar. None of the paratypes with eye-nostril stripe, interorbital band or more than traced nape band. Lateral band on side continuous or interrupted anterior and/or posterior to prominent midlateral spot. Suborbital stripe only indicated in 47.4-53.8 mm specimens, distinct but faint in all smaller (29.9-46.1 mm), from middle of orbital margin to horizontal limb of preoperculum, more intense dorsally than ventrally. 47.4-53.8 mm specimens with fins as in holotype except that clear dorsal-fin lappets reddish, and smoky portions of soft unpaired fins reddish shading to grey; lower margin of anal and caudal fin conspicuously black edged; last 2 anal-fin membranes with hyaline dots.

Life colours. Holotype when freshly collected white on chest, abdominal sides and lower sides of head. Buccal stripes 1-2 bluish. Faint greyish interorbital stripe. Iris black, with light, reddish spot dorsally; pupil ring golden. Head, back and sides overall light café-au-lait. Suborbital stripe barely indicated. Lateral band dull black. No nape band. Vertical bars faintly grey, showing on back only. Scales anteriorly on back and laterally on nape with faint metallic sheen. Middle lateral line scales with silvery dot near tube. Near lateral spot, which not well discernible, three scales with large silvery spot. Fins as in preserved fish though yellowish rather than grey. Caudal spot dull black.

Distribution (fig. 112)
Taken so far at two localities, at Tournavista and in a fish pond on the IVITA station on the R. Neshuya.

Ecology
The type-locality was a long, nearly knee-deep isolated pool in a depression in a cattle field, within the flooding area of the R. Pachitea (station SOK 31). Of associated fishes, *Cichlasoma amazonarum* and the characid *Ctenobrycon hauxwellianus* (Cope) were very abundant.

Etymology
Named with reference to the large midlateral and caudal spots; from the Greek *mega*, large, and *spilos*, spot. The name is a noun in apposition.

Notes
Bujurquina megalospilus is a distinctive species in many respects. It has long pectoral and pelvic fins and high dorsal fin, a but faint suborbital stripe, and lacks distinct nape band. The very large, roundish caudal spot, extending onto the caudal peduncle, the prominent midlateral spot and the absence of an interorbital band are unique features.

It is the only Ucayali species with modally 23 squ. long. scales. Most similar among sympatric (but not syntopic) species, is *B. apopar'ana*, which, however, is readily distinguished by colouration and fin shape (*cf.* data in Tables 20, 22, 23).

Bujurquina huallagae n. sp.
Figs 111, 126-127, Pl. XXXI (figs 2-3), Tables 20, 23

Bibliography
Aequidens vittata; (*pt.*) Lüling 1971*a*, p.203 (habitat data, field obs. near Tingo María; not photo, Abb. 9 or eastern Peruvian distribution). -- Lüling 1971*b*, p. 167 (listed; reference to Lüling 1971*a*).

Diagnosis
Squ. long. 24; upper jaw little prognathous; lips thin; pectoral fin short, 28.6-32.9 % of SL; lateral band continuous, running toward caudal peduncle;

Bars 5 and 6 usually separate; suborbital stripe vertical behind middle of orbit, onto preoperculum, may fade on middle of cheek otherwise strong in adults; nape band intense; Bar 7 blotch-like, frequently including light cross-stripe; posterior dorsal-fin lappets basally light, distally dark, two horizontal series of more or less distinct light spot along spinous dorsal fin.

Similar to *B. ortegai*, from which readily distinguished by the spotted spinous dorsal fin, a character also separating *B. huallagae* from all upper Ucayali and Madre de Dios *Bujurquina* species. The caudal spot tends to be midbasal instead of confined to the dorsal caudal-fin lobe as in other *Bujurquina* species.

Holotype

ANSP 158171. An adult male, 75.4 mm SL. Peru, departamento Huánuco, Río Huallaga drainage system, vicinity of Tingo María, *c.* 1/4 mi above Río Huallaga. 30 September 1955. Leg. Catherwood Expedition: C.C.G. Chaplin, M.H. Hohn (Station 3).

Material

Holotype and 73 paratypes, 12.0-82.8 mm SL.

Description

Based on the holotype and ANSP 158172 topotypes, 66.5-72.6 mm SL, with consideration of other adults, unless otherwise stated. Counts are from 29 specimens, measurements of which summarized in Table 23. See also Pl. XXXI, figs 2-3, for general shape and colour pattern.

Shape. Relatively elongate, with moderately sloping slightly convex frontal outline; ventral outline slightly arched. Snout shape variable, short and blunt or slightly elongate. Upper jaw very little prognathous. Interorbital area slightly vaulted, width equalling mouth width. Maxilla reaching to or nearly to vertical from anterior margin of orbit. Lips moderately thick; width of lower lip fold about equal to anterior intermandibular gap.

Scales. Squ. long. 23 (3), 24 (25), 25 (1). 8 median predorsal scales in 24 specimens, 9 in two, 7 + posterior pair in one, 5 + pair + 2 median in one, 8 irregularly placed in one. Upper lateral line of 14 (1), 15 (6), 16 (19), 17 (3) scales. Lower lateral line of - (1), 8 (3), 9 (20), 10 (5) scales, plus 1-2 medianly on caudal-fin base; dorsally 0-4, ventrally 0-5 tubed scales in accessory caudal-fin lateral lines. Cheek scales, all cycloid, in 3 (29) series. Proximal half of caudal fin scaly.

Fins. First dorsal-fin spine 2/5 to nearly 1/2 length of last; spines subequal in length from 5th or 6th, last 2 again slightly longer; soft part pointed, tip reaching to 1/3 to 2/3 of caudal fin. D. XIII.10 (3), XIV.9 (5), XIV.10 (14), XV.9 (6), XV.10 (1). Soft anal fin pointed, tip reaching 1/4-1/3, exceptionally middle of caudal fin. A. III.6 (5), III.7 (23), III.8 (1). Pectoral-fin tip rounded, reaching to above genital papilla or first anal-fin spine. P. 13 (10), 14 (18), 15 (1). Pelvic fin pointed, first ray slightly produced, reaching to 2nd spine or 1st ray of anal fin. Caudal fin truncate to slightly emarginate; specimens over *c.* 65 mm developing streamers which longer in larger specimens, length of longer, dorsal, to 1/3 length of rest of caudal fin, from rays D6 and V6.

Gill-rakers. One epibranchial, one in angle, and 6 (26), 7 (3) ceratobranchial externally on first gill-arch. No microgill-rakers.

Jaw teeth. 11-20/13-19 in upper/lower jaw outer hemiseries in 19 specimens 36.3-80.9 mm SL (14/19, 13/15, 16/16, 14/14, 16/18, 13/17, 18/19, 15/16, 11/16, 13/16, 14/17, 16/16, 14/14, 18/17, 15/13, 14/14, 16/17, 17/14, 20/17, from smallest to largest). Outer series teeth conical, slightly recurved, larger than those of inner series; many flat-worn apically or subapically on lingual side in holotype and ANSP 158172, but not in others. Inner band of teeth back to middle of each jaw half or longer, of 2-3 (modally)/3 (modally) - 4 series anteriorly; similar to outer teeth but shorter, slenderer, and not

worn.

Tooth-plates. Dissected 74.5 mm specimen (ZFMK 2152-2168) with 2 tooth-plates, posterior with 2, anterior with 4 teeth, on 4th ceratobranchial; lower pharyngeal tooth-plate (fig. 126) with numerous teeth: anterior subconical, posterior compressed, bicuspid, posteriormost only slightly constricted near base; teeth in 6 series on each half of plate, posterolateral teeth extending well onto caudal processes.

Vertebrae. 26 (12 preanal), 3-4 within caudal peduncle, in 8 specimens.

Colouration. Holotype: Ground colour yellowish, pure on chest, lower part of head, and along abdomen. Cheek faint brownish yellow. Snout greyish. Whitish stripe from orbit to nostril. Wide, brown greyish interorbital band. Pectoral axilla light.

Brown suborbital stripe (fig. 127) with diffuse edges from between 2nd and 3rd infraorbital pores very little curved, nearly straight, on to preoperculum between canals of corner pores. 3 series of dark dots paralleling adbuccal edge of preoperculum; 1 from near posteroventral edge of orbit to mouth angle, another along edge of preorbital from middle of orbit toward posteroventral lachrymal corner pore, 3rd near middle of preorbital. Other dots scattered on cheek, vertical limb of preoperculum, operculum and subopercular.

Brown lateral band commencing in lower halves of anterior 2 lateral line scales, caudad continuous to hind margin of Bar 3; in upper halves of squ. long. scales and half or all of those above to Bar 5, behind only on scales above squ. long. scales; continued on head from dorsal edge of operculum across nape, continuous and distinct over nape midline. Midlateral spot in Bar 5, slightly darker than lateral band on right side, indistinguishable on left side.

Vertical bars brown on back, light brown and narrow across sides, 1-6 reaching level of lower edge of pectoral axilla or slightly farther, Bars 4-5 slightly curved; Bar 6 discontinuous between lateral line canals and lateral band; Bar 7 a blotch around dorsal-fin origin, ventrally continuous with lateral band, including a light cross stripe nearly dividing it.

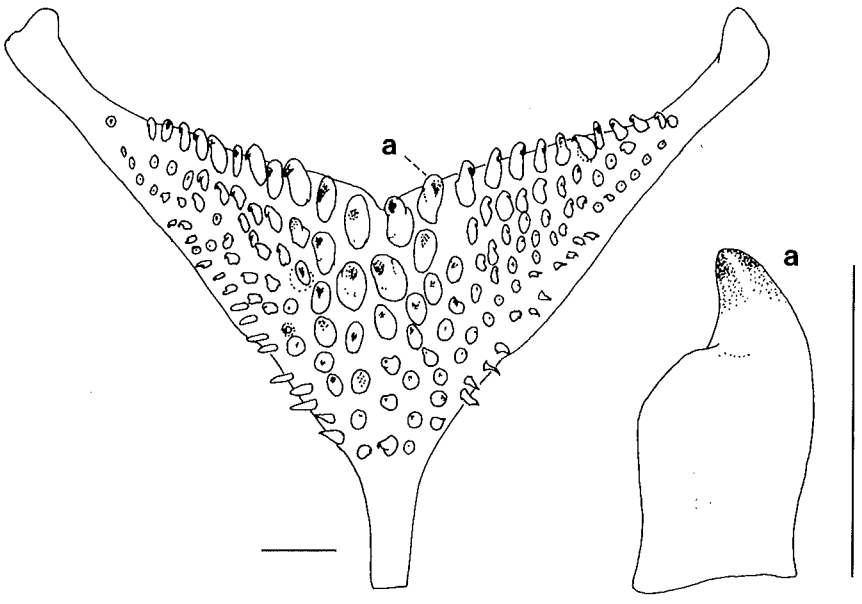

Figure 126. Lower pharyngeal tooth-plate in occlusal view, and tooth (a) in lateral aspect of *Bujurquina huallagae*, ZFMK 2152-2168, 74.5 mm SL. Scales 1 mm.

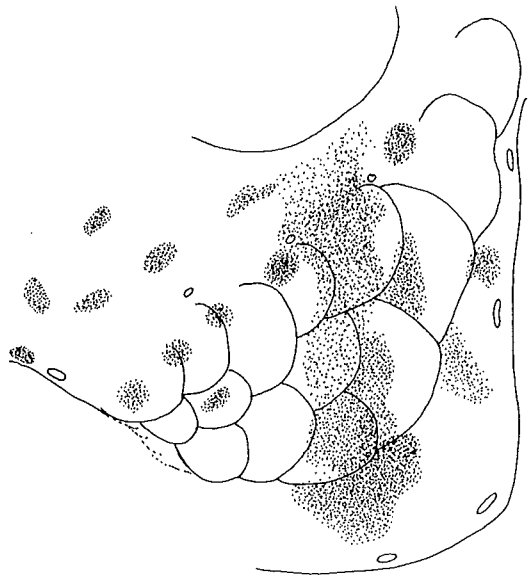

Figure 127. Buccal region of *Bujurquina huallagae*, ANSP 158171, 75.4 mm SL, to show course of suborbital stripe. Diagrammatic.

Dorsal fin faintly greyish; clear spot on lappet bases, lappet tips darker grey; soft part with about 5 cross-series of clear dots (dotting of spinous portion indicated). Anal fin light grey, faintly dark-edged, with indistinct light dots on last 2 membranes. Pelvic fin hyaline, with greyish anterior border. Caudal fin with brown vertical basal spot, midbasal but more intense in upper lobe, lower half of which covered; no light margins around spot; rest of fin light greyish with moderately large clear dots on inner 2/3, lower edge and posterior corner greyish.

Variation in ANSP and MHNG material: Dark dots on head may be confluent, forming short lines; anteriormost dot-series variable in occurrence; larger specimens with more and more distinct dots than smaller specimens. Midlateral spot generally well evident. Bar 6 always isolated above lateral line, occasionally forming Y-marking with Bar 5. Bar 7 with light cross-stripe that may divide it into 2 narrow bars, the anterior then more prominent. Dorsal fin with 2 horizontal series of more or less distinct whitish or clear dots, lappet bases with light dots, lappets distally darkened. The lateral band rarely gives the impression of being raised to the dorsal-fin base by Bar 3 as in most *Bujurquina* species, instead the band is much more intense than the bars, remains essentially below the lateral line and is in line with dark dorsal portion of Bar 2 on caudal peduncle. Lateral band constricted anterior and posterior to lateral spot, but always continuous. Caudal spot midbasal with dorsal tendency, shape slightly variable. Suborbital stripe always present.

Alcohol-fixed ZFMK material different especially in having buccal dots silvery; and upper and lower 1/4 of scales on flanks from upper lateral line series and below silvery, forming faint light horizontal stripes. 3 specimens, 74.5, 65.5 and 77.5 mm differing from all others in having the middle portion of the suborbital stripe faded, resulting in a spot over preopercular corner + adjacent cheek and a spot close to orbit.

Distribution (fig. 111)
Most of the type material comes from the vicinity of Tingo María, although precise data are unavailable for many samples. The remainder was collected near Tarapoto.

Ecology
Patrick (1966) has detailed habitat data for Catherwood material, probably obtained in R. Tulumayo, R. Rondos and Quebrada de Puente Perez (three stations indicated on labels, otherwise only saying 'vicinity of Tingo Maria', and perciforms listed by Patrick as collected at the above sites). At low water, the water was clear, relatively swift. The river beds were made up of sand, rubble, gravel and mud, according to current in a given section. In Puente Perez a daily temperature variation from 22.0-26.0°C was recorded over one day, oxygen levels varying from 73.1-107.5 %. Total hardness was 247.20 ppm in R. Tulumayo, 241.20 ppm in Q. de Puente Perez, 14.00 ppm in R. Rondos, pH 7.6 in R. Tulumayo, 7.2 in Q. de Puente Perez, and 5.0 in R. Rondos. The only cichlid species found in association with *B. huallagae* at Tingo María is *Crenicichla sedentaria*.

Lüling (1971*a*) gave some general information on *B. huallagae* habitats near Tingo María, including the observation of a brooding individual on 3 June.

Etymology
Named *huallagae* for the river to which drainage the distribution of the species appears restricted.

Notes
Bujurquina ortegai and *B. huallagae* are readily separated with reference to the dorsal-fin coloration, spinous portion uniform in *B. ortegai*, with series of light spots in *B. huallagae*. *Bujurquina ortegai* also has a relatively longer caudal peduncle and longer pectoral fin (cf. Table 23), and does not show the typical division of Bar 7 as in *B. huallagae*.

The only other *Bujurquina* species similar to those of the Huallaga system, is *B. robusta*, with comparable body proportions and counts, but with white-edged dorsal-fin lappets, suborbital stripe straight vertical and faint ventrally. In contrast to *B. huallagae* in particular, *B. robusta* has immaculate spinous dorsal fin and blotch-like Bar 7.

The definite tendency for a midbasal caudal spot in *B. huallagae* is a notable characteristic of this species. The lateral band gives the impression of being directed toward the caudal peduncle instead of to the dorsal fin, but it is more like in upper Ucayali species than in *B. moriorum* in being contracted in bar interspaces.

The specimen shown on Lüling's (1971*a*, Abb. 9) photo of an '*Aequidens vittata*', published in connection with natural history data on *B. huallagae* cannot be located amongst his Tingo María specimens. I suspect that it is actually an Ucayali species. Lüling mentioned having obtained '*Aequidens vittata*' also at Pucallpa and Iquitos.

Bujurquina ortegai n. sp.
Figs 111, 128-129, Pl. XXXII (fig. 1), Tables 20, 23

Diagnosis
Squ. long. 24; jaws equal anteriorly; lips thin; pectoral fin short, 32.7-34.4 % of SL; lateral band usually continuous, running toward caudal peduncle; Bars 5 and 6 separate; suborbital stripe slightly curved; no preopercular spot; Bar 7 blotch-like; posterior dorsal-fin lappets proximally light, distally dark, spinous dorsal fin otherwise immaculate.

Most similar to *B. huallagae*, especially in lateral band course and

appearance of suborbital stripe, recognized as distinct by immaculate spinous dorsal fin.

Holotype
MHNG 2205.27. Adult male, 110.1 mm SL. Perú, departamento San Martín, Río Huallaga drainage system, Moyobamba, Puerto Juan Antonio, Río Mayo. 9 September 1984. Leg. P. de Rham, H. Ortega.

Material
Holotype, and 4 paratypes, 60.4-70.7 mm SL.

Description
Based on the holotype, comparative notes from paratypes; counts from all specimens available. Measurements are summarized in Table. 23. Refer to Pl. XXXII, fig. 1, for general aspect.

Shape. Relatively elongate. Frontal outline nearly straight, slightly elevated near dorsal-fin origin (only indicated in paratypes). Dorsal outline slightly more arched than little curved ventral outline. Snout moderately long, anteriorly rounded off (shorter, rounded, in paratypes). Interorbital vaulted, width about equal to mouth width. Jaws equal anteriorly, maxilla not reaching to vertical from anterior margin of orbit (to or almost to that vertical in paratypes). Lips moderately thick; width of lower lip fold equal to anterior intermandibular distance.

Scales. Squ. long. 24 (5). 8 scales in a median series along predorsal midline except in one specimen with 7 and a posterior scale pair, and one with 3 median, a pair, 2 median, a pair, a median and a pair in succession. Upper lateral line of 16 (3), 17 (2) scales. Lower lateral line of 8 (1), 9 (4) scales plus 1-2 on caudal fin base; accessory caudal-fin lateral lines of 1-6 (dorsal) and 1->5 (ventral) tubed scales. Cheek scales in 2 (2), 3 (3) series; but one biserial specimen with 3 series on left side. Posterior cheek and upper opercular scales ctenoid; in paratypes cheek scales cycloid, dorsal opercular scales ctenoid in the larger specimens. Distal caudal-fin scales cycloid, 1/2 of caudal fin scaly.

Fins. First dorsal-fin spine slightly more than 1/3 length of last (about 1/2 in others); spines subequal in length from 5th, last 2 again slightly longer. Soft dorsal fin damaged in holotype, but reaching at least to about middle of caudal fin; in paratypes rounded or pointed, to 1/3 of caudal fin or shorter. D. XIV.9 (3), XV.8 (1), XV.9 (1). Soft anal fin pointed, reaching little beyond caudal-fin base. A. III.6 (2), III.7 (2), III.8 (1). Pectoral fin with rounded tip, reaching to above 2nd or 3rd anal-fin spine; P. 13 (3), 14 (2). Pelvic fin pointed, first ray only little longer than remainder, reaching to 2nd or 3rd anal-fin spine, longest in 60.4 mm specimen, to first anal-fin ray. Caudal fin appearing subtruncate in holotype, but hind edge damaged; in paratypes damaged or slightly emarginate.

Gill-rakers. 1-2 epibranchial, one in angle and 6 (1), 7 (3), 8 (1) ceratobranchial rakers externally on first gill-arch. No microgill-rakers.

Jaw teeth. Outer series of conical, slightly recurved teeth, 17/17, 17/18, 15/15, 18/18, 16/13 in outer hemiseries in upper/lower jaw; inner series teeth smaller, in band of anteriorly 3 (modal) -4 series in upper jaw and 3-5 (4 modal) series in lower jaw.

Tooth-plates. 4th ceratobranchial in 70.7 mm specimen dissected with 2 tooth-plates with respectively 3 and 2 teeth. Lower pharyngeal tooth-plate in same specimen (fig. 128) anteriorly with subconical teeth, posteriorly bicuspid with compressed bases; several median teeth with posterior cusp round- or flat-worn.

Vertebrae. 26, of which 12 preanal and 4 within caudal peduncle in holotype and one paratype.

Colouration. Ground colour whitish on chest and along belly; lower part of head light greyish; operculum, snout and forehead greyish; no interorbital band or light eye-nostril stripe apparent. Cheek thinly overlayered with grey

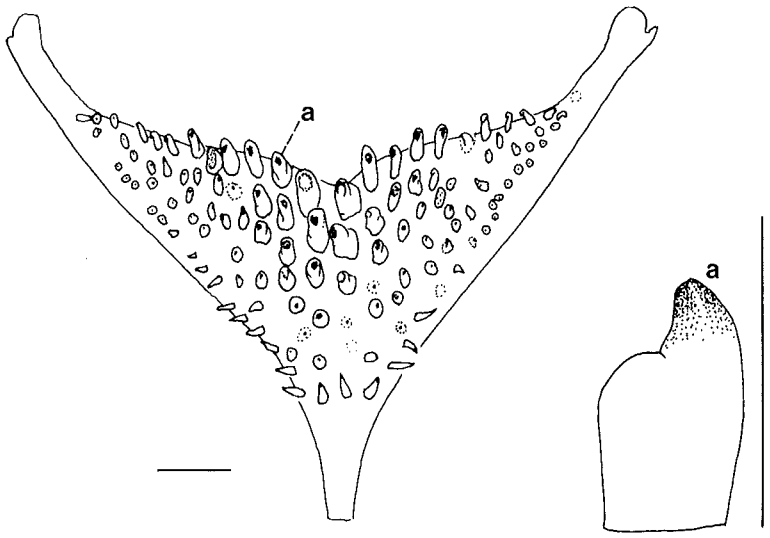

Figure 128. Lower pharyngeal tooth-plate in occlusal view, and tooth (a) in medial aspect of *Bujurquina ortegai*, NRM A85/1984372.3095, 70.7 mm SL. Scales 1 mm.

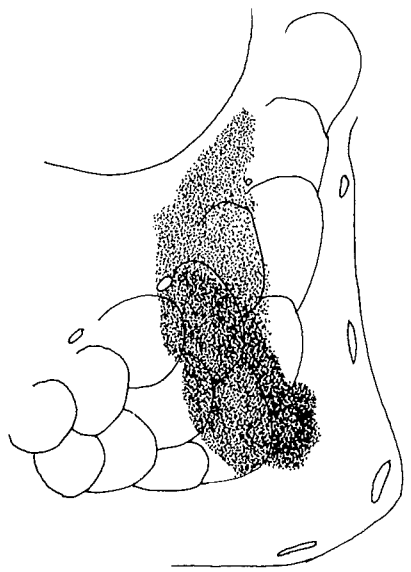

Figure 129. Buccal region of *Bujurquina ortegai*, NRM A85/1984372.3095, 70.7 mm SL, to show course of suborbital stripe. Diagrammatic.

on yellowish white ground. Numerous dark dots and a few short lines over preorbital, cheek, operculum, suboperculum, posteriorly on interoperculum and on vertical limb of preoperculum. Suborbital stripe (fig. 129) blackish, but not densely pigmented, from about posterior pore of first infraorbital (below about middle of orbit, but distant from orbit as infraorbitals wide) ventrally onto preopercular corner associated with posterior preopercular corner pore.

Lateral band faint, indistinct from lower halves of anterior 3 lateral line scales caudad to Bar 3, of same colour as light grey vertical bars, roundish midlateral spot slightly darker; no distinct continuation on gill-cover, but relatively strong nape band from posterodorsal margin of orbit, narrow and indistinct across nape midline. Bars 1-7 distinct but faint, Bars 1-6 reaching ventrally to level of lower edge of caudal peduncle, Bar 7 a blotch anterior to and through dorsal-fin origin. Inside of pectoral axilla light. Flank scale centra light with faintly darkened margin.

Dorsal fin faintly greyish except for large hyaline spots over 5 last membranes on inner 1/2 of soft part, distal 1/2 of soft part hyaline with greyish membrane margins. Anal fin greyish, somewhat darker along ventral margin, hyaline dots on last 3 membranes. Pelvic fin light greyish along anterior margin, inwardly whitish. Caudal fin without caudal spot; basally mottled greyish and whitish; beyond muscular portion greyish with hyaline spots which smaller in ventral than in dorsal lobe, lower margin grey-seamed, along distal margin clear with grey membrane margins.

Much variation in colour pattern among paratypes. None shows dots on head sides, but cheek stripes 1-3, or 2 and 3, or 1 and 2 more or less evident. Suborbital stripe contrasted, from posteroventral margin of orbit ventrally onto inner edge of preoperculum associated with posterior corner pore, with or without faint or distinct extension toward anterior corner pore. Interorbital band faint or absent; no light stripe between orbit and nostril. Lateral band absent in 63.1 mm specimen, which alone shows distinct but faint midlateral spot, otherwise commencing on lower 1/2 of anterior 2 lateral line scales, anteriorly on upper 1/2 of squ. long. scales and all of those above, posteriorly narrower and raised to end on scales in series containing upper lateral line; distinct to hind edge of Bar 3, or faint posteriorly, blending with Bars 3 and 4, of same colour, vaguely continuous with dark dorsalmost portion of Bar 2; slightly paler posterior and anterior to Bar 5. Dorsal portion of Bar 6 extending only to lateral line scales or continuous with ventral section. Opercular edge section of lateral band always less distinct, to obsolete, than nape band and flank section of band (if present). Nape band strongest, as an oblique stripe posterodorsal to eye, but continuous across nape. Fins about as in holotype; anal fin with reddish tinge in two larger paratypes; posterior dorsal-fin lappets with clear base, darkened tip in 63.1 mm specimen only; caudal spot distinct, deep and narrow (across 2/3 of dorsal and onto ventral lobe base) in 60.4 mm specimen, fainter in larger paratypes.

Distribution (fig. 111)
Known only from the R. Mayo, collected near Moyobamba and Rioja.

Etymology
Named in honour of Hernán Ortega Torres, ichthyologist of IVITA, Pucallpa, and Museo de Historia Natural Javier Prado, Lima.

Notes
See *B. huallagae* for diagnostic characters.

Bujurquina syspilus (Cope)

Figs 112, 130-131, Pl. XXXII (figs 2-3), Tables 20, 24

Acara syspilus Cope 1872, p. 255 (descr.; small streams tributary to the Ambyiacu, as well as...the river itself), Pl. XI, Fig. 3 (sketch, habitus).

Bibliography

Astronotus (Acara) syspilus; (*pt.*) Eigenmann & Eigenmann 1891, p. 68 (listed; distr. in part: Maranon).

Aequidens syspilus; Eigenmann & Kennedy 1903, p. 534 (new comb.; compared with *Aequidens paraguayensis*; Cope's description quoted in full). -- Fowler 1944, p. 264 (bibliogr.). -- Fowler 1945*a*, p. 245 (bibliogr.).

Acara vittata; (*pt.*) Pellegrin 1904, p. 173 (synonymy including *Acara syspilus*).

Aequidens vittatus; (*pt.*) Haseman 1911*c*, p. 335 (type specimen mentioned, synonym status of *Acara syspilus*; not material).

Aequidens mariae; (*pt.*) Eigenmann & Allen 1942, p. 392 (listed: Yarinacocha; Rio Itaya, Iquitos).

Acara syspilus; Böhlke 1984, p. 59 (types listed).

Material

Syntypes, 4 specimens *c*.26.0-*c*.36.4 mm SL, and 19 referred specimens, 32.3-103.0 mm SL.

Description

Based on fresh NRM SOK adults; counts from 17-20 specimens, including 11 measured specimens (Table 24).

Shape. Moderately deep; predorsal contour evenly convexly ascending; ventral outline curvature similar to dorsal curvature. Snout rounded, moderately long. Interorbital flat, width slightly greater than mouth width. Lips narrow, width of lower equalling anterior intermandibular distance. Jaws equal anteriorly. Maxilla reaching to or slightly beyond vertical from anterior margin of orbit. The material includes an 87.6 mm specimen without premaxilla and a 63.4 mm specimen with Mopskopf appearance due to malformed premaxilla - both conditions appearing congenital. A 71.0 mm specimen with a nearly fresh deep cut through the back.

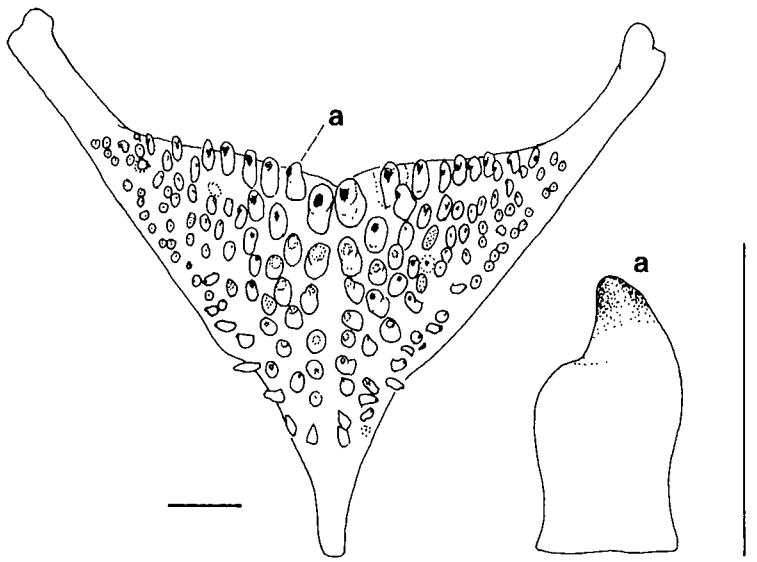

Figure 130. Lower pharyngeal tooth-plate in occlusal view, and tooth (a) in medial aspect of *Bujurquina syspilus*, NRM SOK/1981333.3363, 71.0 mm SL. Scales 1 mm.

Scales. Squ. long. 23 (1), 24 (13), 25 (3). 8 predorsal midline scales except in one specimen with 7 median scales and a posterior scale pair. Posterior ctenoid prepelvic scales common, to 1/2 or even 2/3 of prepelvic length. Posterior half of cheek, all of operculum and subopercular with ctenoid scales. Upper lateral line of - (1), 15 (4), 16 (9), 17 (3) scales, in one specimen also a tubed scale in the next ventral series adjacent to the last scale in the principal lateral line series. Lower lateral line of - (2), 8 (2), 9 (8), 10 (5) scales plus 1-2 tubed scales medianly on caudal-fin base; tubed accessory lateral line scales 0-9 in dorsal, 0-10 in ventral sequence. Cheek scales in 3 (17) series. Proximal 1/3 (young) to 1/2 of caudal fin scaly.

Fins. First dorsal-fin spine 2/5 to 1/2 length of last, spines subequal from 4th or 5th, last 2 again longer; soft part pointed, 4th or 5th ray longest, reaching to 1/3 or 1/2 of caudal-fin. D. -.10 (1), XIV.9 (1), XIV.10 (14), XV.9 (2), XV.10 (2). Soft anal fin pointed, 4th ray longest, reaching to 1/3 or 1/2 of caudal fin. A. III.6 (1), III.7 (15), III.8 (4). Pectoral fin subacuminate, tip reaching to above 3rd anal-fin spine. P. 12 (1), 13 (14), 14 (2). Pelvic fin pointed, 1st ray little produced, reaching to 1st or 2nd anal-fin ray. Caudal fin damaged in most specimens; in 64.7 mm specimen truncate, with ray D6 forming long streamer, about 1/4 length of rest of fin.

Gill-rakers. 1-2 epibranchial, one in angle and 5 (1), 6 (13), 7 (3) ceratobranchial rakers externally on first arch. Microgill-rakers externally on 2nd to 4th arches, not verifiable in 2 large specimens, on only 2nd or 2nd and 3rd arches in 3 large specimens.

Jaw teeth. 15/19, 16/19, 17/21, 18/21, 15/19, 20/22, 19/22, 16/15, 17/19, 15/21, 17/20 teeth in upper/lower jaw outer hemiseries in 11 specimens 52.4-77.4 mm SL (from smallest to largest). Outer series teeth conical, slightly recurved, larger than those in inner band of anteriorly 2-3 (modally) series in upper jaw, 3-4 series in lower jaw.

Tooth-plates. Dissected 71.0 mm specimen with 3 tooth-plates on 4th ceratobranchial with 5, 8 and 7 teeth, respectively; lower pharyngeal tooth-plate (fig. 130), anteriorly with subconical teeth, posteriorly compressed and bicuspid with moderately constricted bases, many posteromedian teeth apically worn.

Vertebrae. 13+13 (4).

Colouration. Ground colour whitish or yellowish white, pure on chest and along abdomen, duskied on underside of head. Operculum greyish; cheek yellowish, thinly overlayered with brownish. Snout grey. Whitish stripe between eye and nostril not well-defined. Interorbital band indistinct. No dark dots on head, but cheek stripes 1-2 indicated. Suborbital stripe from below middle of orbit straight or slightly curved onto anterior limb of preoperculum toward anterior corner pore or slightly in advance of it; hardly apparent in adults, dark brown or blackish in young.

Brown to blackish lateral band commencing in lower halves of anterior 2 lateral line scales, caudad to anterior or, usually, posterior margin of Bar 3, which dorsally of same colour or slightly paler. Band anteriorly covering dorsal 1/3 of squ. long. scales and all of scales above but not on lateral line scales posterior to 3rd, posteriorly narrowing to all or dorsal halves of scales below lateral line scales; of unchanged width, narrower or interrupted in interspace between Bars 5 and 6, discontinuous or narrower in interspace, between Bars 4 and 5. Band rostrad continued along dorsal edge of operculum and obliquely dorsorostrad across nape where indistinct. Midlateral spot evident chiefly through narrow or interrupted adjacent lateral band portions and commonly slightly greater depth and height relative to band.

Vertical Bars 1-7 faint but distinct; light brown on back above lateral line scales, fading down sides to level of lower edge of caudal peduncle; Bars 3-6 slightly curved, Bar 7 a blotch around dorsal-fin origin divided transversely by lighter zone. Lower side scales in bars with dark squarish spot at base, otherwise side scales light centrally, little darkened marginally. Inside of pectoral axilla duskied, but no distinct spot formed.

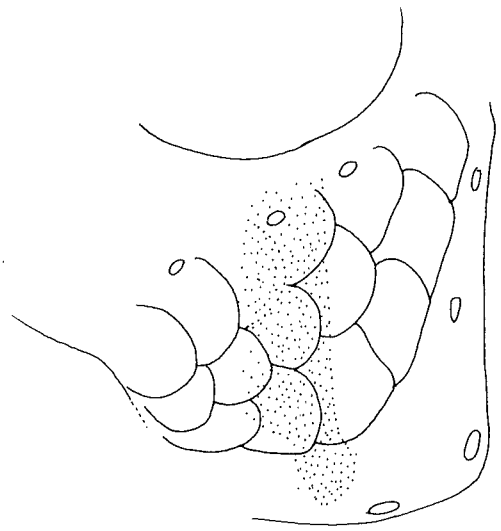

Figure 131. Buccal region of *Bujurquina syspilus*, NRM SOK/1981357.3559, 64.7 mm SL, to show course of suborbital stripe. Diagrammatic.

Dorsal fin smoky; spinous part with horizontal series of oblique not contrasted hyaline elongate spots along outer 1/2, lappet bases with distinct hyaline spot, lappets otherwise greyish; soft part greyish or dusky, with about 5 cross-series of hyaline spots. Anal fin greyish, lower margin slightly darker; about 5 hyaline dots in series on last 2 membranes. Caudal spot small, brownish to blackish, occupying about lower 1/2 of dorsal lobe base, roundish or vertical with indistinct lighter marginal zone; rest of fin smoky with 5-6 cross-series of hyaline spots, lower and posterior margins smoky, immaculate. Pelvic fin inwardly clear, outwardly smoky or greyish.

Syntypes. Four specimens, about 26.0-36.4 mm SL, all in a very poor state of preservation, are identified as syntypes of *A. syspilus*. They are all discoloured, darkened, one strongly curved; the squamation and finnage are incompletely preserved. The largest specimen (ANSP 21430) has microgill-rakers externally on the 2nd to 4th gill-arches. The suborbital stripe ends anteriorly on the anterior limb of the preoperculum and the lateral band runs to the dorsal-fin base, judging from melanophore concentrations still remaining.

Distribution (fig. 112)

Bujurquina syspilus appears restricted to the eastern lowlands of Peru, collected in the lower Ucayali, lower Napo, lower Ampiyacu, and lower Yavarí.

Ecology

Both stations SOK 26 and SOK 40 were forest clear-water streams running down slopes, with much reduced flow, and abundant forest litter. The SOK 104 specimens came from a gramalotal bordering a laguna on a river island.

Notes

Bujurquina syspilus is a distinctive species with the oblique alternating dark and light stripes adorning the dorsal fin, rounded body, and long

pectoral fin. It differs further from *B. peregrinabunda* and *B. moriorum*, with overlapping ranges, in having the lateral band upturned caudally and in lacking a preopercular spot. *Bujurquina megalospilus* has a similarly long pectoral fin, but squ. long. modally 23 rather than 24, much larger caudal spot, and immaculate spinous dorsal fin.

Haseman (1911*c*) remarked that he had examined 'the type' of *Acara syspilus* and that it is a synonym of *Aequidens vittatus*. The two specimens that he lists as *A. vittatus* are, however, *Aequidens pallidus* (Heckel).

Bujurquina peregrinabunda n. sp.

Figs 112, 132-133, Pl. XXXIII (fig. 1), Tables 20, 24

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Acara vittata; (*pt.*) Steidachner 1875, p. 72 (descr.; Cudajas am Amazonenstrome; See Manacapuru; not ref. to types of *A. vittatus*), Pl. III, figs 1, 1a, 1b (sketch, habitus, scale and dorsal profile of head).

Aequidens vittatus; (?; *pt.*) Fowler 1943*b*, p. 264 (descr.; Florencia) -- (?) Fowler 1945*b*, p. 131 (descr.; Morelia, Rio Caqueta drainage /ANSP 84151/).

Diagnosis

Squ. long. 24; jaws equal anteriorly; lips thin; pectoral fin moderately long, 33.6-37.1 % of SL; lateral band continuous, running toward dorsal edge of caudal peduncle; suborbital stripe caudally on cheek, in adults preopercular spot combined with stripe along margin of vertical limb of preoperculum; nape band faint; Bars 5 and 6 separate; Bar 7 blotch-like; posterior dorsal-fin lappets dark with light spot immediately proximal, dorsal fin otherwise with horizontal series of light spots.

Similar to *B. moriorum*, but with different preopercular spot, lateral band running close along upper lateral line canal series, and shorter head.

Holotype

NRM SOK/1981333.3337. An adult female, 78.3 mm SL. Perú, departamento Loreto, Río Ampiyacu system, quebrada tributary to Río Yaguasyacu, just below the village Esperanza. 12 August 1981. Leg. S.O. Kullander, A. Hogeborn-Kullander, J. Cruz R. (Station SOK 25bis).

Material

Holotype and 9 paratypes, 63.2-101.7 mm SL. Another 6 specimens tentatively referred, *c.* 35.0-106.8 mm SL.

Description

From the holotype and topoparatypes unless otherwise stated; counts from all specimens available; measurements are summarized in Table 24. Refer to Pl. XXXIII, fig. 1, for general shape and colour pattern.

Shape. Moderately deep, with evenly ascending predorsal contour; ventral outline gently curved, save for horizontal abdomen. Interorbital slightly vaulted, width equalling that of mouth. Jaws equal anteriorly. Maxilla reaching to (smallest specimen only) or not quite to vertical from anterior margin of orbit. Lips narrow, lower lip fold width less than anterior intermandibular width.

Scales. Squ. long. - (1), 23 (1), 24 (7), 25 (1); 8 median predorsal scales in all. Upper lateral line of - (3), 14 (1), 16 (2), 17 (4) scales. Lower lateral line of - (1), 8 (5), 9 (3), 10 (1) scales, plus 2 scales between caudal-fin rays V1 and V2; accessory caudal-fin lateral lines of 2 (dorsal) and 4 (ventral) tubed scales respectively in one specimen, no count possible in others. Cheek scales in 3 (10) series; posterior ctenoid. Basal half of caudal fin scaly.

Fins. Dorsal-fin spines subequal in length from 4th, last 2 again longer, last more than twice length of first. Soft fin pointed, reaching to about middle of caudal fin. D. XIII.10 (1), XIV.10 (5), XIV.11 (1), XV.9 (1), XV. 10 (2). Soft anal fin pointed, reaching to about 1/3 of caudal fin. A. III.7 (7), III.8 (3). Pectoral fin with rounded tip, reaching to above 1st of 2nd anal-fin spine; P. 12 (1), 13 (8), 14 (1). Pelvic fin pointed, first ray slightly produced, reaching to 2nd anal-fin spine or first anal-fin ray. Caudal fin intact only in some Codajas specimens, with truncate hind edge.

Gill-rakers. 0-2 epibranchial, one in angle and 5 (4) or 6 (6) ceratobranchial rakers externally on first gill-arch. No microgill-rakers.

Jaw dentition as in *B. moriorum*; 3-4 inner series anteriorly in each jaw, modally 3 in upper, 4 in lower; 17/20, 19/19, 16/20, 14/17, 17/18, 16/18, 14/-, 17/20, 19/20, 17/20 teeth in upper/lower jaw outer hemiseries in specimens 58.2-101.7 mm SL (in order of increasing SL).

Tooth-plates. Dissected 66.2 specimen with lower pharyngeal tooth-plate (fig. 134) as in *B. moriorum*; 2 small tooth-plates on 4th ceratobranchial, each with 4 teeth.

Vertebrae. 26, of which 13 preanal, in holotype and two paratypes, 4 vertebrae within caudal peduncle.

Colouration. From holotype and topoparatypes: Ground colour yellowish white, pure or chest and along abdomen. Cheek yellowish. Operculum light greyish. Forehead and snout brownish grey. Flank scales ventral to lateral band with yellowish white centre and light brownish grey borders. Back pale grey. Brown to dark brown spot on upper inner side of pectoral axilla.

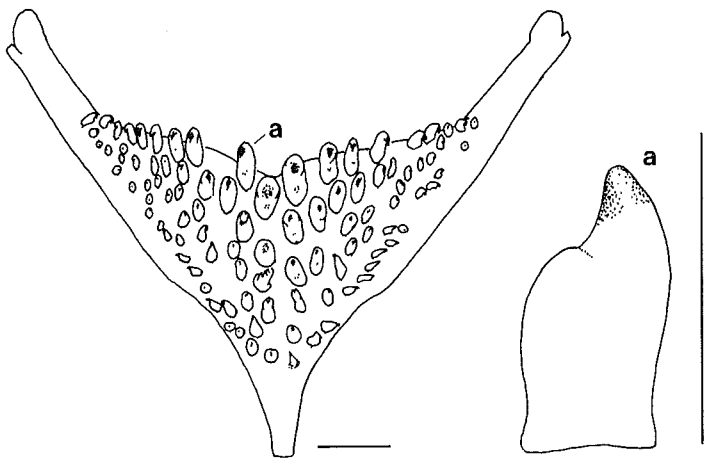

Figure 132. Lower pharyngeal tooth-plate in occlusal view, and tooth in medial aspect of *Bujurquina peregrinabunda*, NRM SOK/1981333.4001, 66.2 mm SL. Scales 1 mm.

Faint suborbital stripe from posterior lower margin of orbit (middle of second infraorbital) down to posterior preopercular corner pore where forming a spot; in holotype, however, a stripe on cheek along preopercular edge (fig. 133). No dark dots or lines on head. Lateral band brown, commening on anterior two lateral line scales, caudad horizontally to hind edge of Bar 3, upper edge close to lateral line canals, lower edge over dorsal 1/3 of squ. long. scales. Dark brown lateral spot in Bar 5, not wider than band. Lateral band continued anteriorly to eye and fainter across nape, which of about same colour. Vertical Bars 1-7 faint, brownish, 1-6 reaching level of lower edge of caudal peduncle, Bar 7 down to lateral band.

Dorsal fin light grey, with 2, posteriorly 3 horizontal series of opaque spots on spinous portion, about 7 cross-series of spots on soft portion. Anal fin light grey, with about 6 cross-series of clear dots on last 3 membranes. Caudal spot deep, narrow, on ventral 2/3 of dorsal lobe, with light anterior and posterior border zones; rest of caudal fin with about 5 cross-series of clear spots with grey interspaces, lower posterior corner smoky, upper corner clear. Pelvic-fin anterior margin smoky, inwardly hyaline.

Colouration of NMW specimens not well preserved, but similar to that of topotypes. Preopercular marking usually in the form of a short stripe along preopercular margin as in holotype. Two specimens have the lateral band interrupted anterior and posterior to midlateral spot.

Life colours. Freshly caught topoparatype with chest white, sides and head straw-coloured. Interorbital band only incicated. Dots and lines on head icy blue. Suborbital stripe black, with incomplete icy blue narrow border. Vertical bars and nape band faint, greyish dorsally, on flanks apparent chiefly through dark grey vertical bar at scale bases. Abdominal side scales with faint bluish border. From lateral line scale series ventrally 5 series of dots on upper edge of each scale, diminishing in side posteriorly on side, bright yellow except in lateral band in which white. Anterior back scales with faint metallic sheen. Lateral band suppressed, faint leaden grey. Fins yellowish rather than grey, otherwise as in preserved fish. Caudal spot black. Iris with black and golden spots, pupil ring white dorsally, orange ventrally.

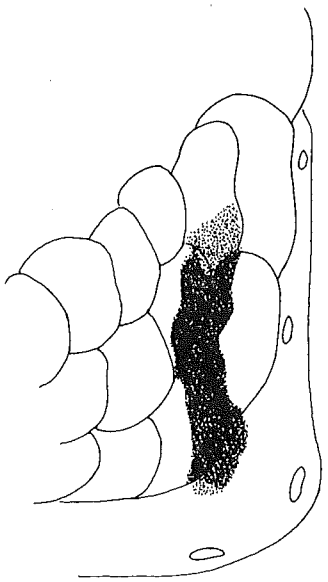

Figure 133. Buccal region of *Bujurquina peregrinabunda*, NRM SOK/1981333.-3337, 78.3 mm SL, to show stripe posteriorly on cheek. Diagrammatic.

Distribution (fig. 112)
Collected near Pebas and Codajás. Material of uncertain identity comes from the R. Orteguasa drainage in the upper Caquetá.

Ecology
The type-locality was a quebrada with very little water, coming down a slope with primary forest. At the mouth, the quebrada was margined by thick clay and a small sand playa. The *Bujurquina* came from the stream, which had clear, slow-running water.

Etymology
The specific epithet is a Latin adjective meaning 'one that travels abroad' suggested by the wide distribution of this species, found in Peru and Brazil, expected from Colombia.

Notes
Bujurquina peregrinabunda is similar to *B. moriorum*, in the richly spotted dorsal and caudal fins, and in the lateral band course, though readily distinguished by the stripe-like fashion of the preopercular spot and shape features (see under *B. moriorum*).

Fresh, well-preserved material is scarce and similar looking material from distant localities is not readily recognized as conspecific with the type series.

ANSP Orteguasa (Caquetá drainage) material already reported by Fowler (1943*b*, 1945*b*) agrees with the type-series in shape and colour pattern remains. The largest specimen appers to have a foreshortened body, however, showing in low counts (D. XIII.11, squ. long. 23), and long snout (8.8 % of SL). At least the larger specimens have microgill-rakers externally on 2nd to 4th gill-arches. The specimens are in a poor state of preservation and considering the distant locality, it is desirable to have fresh material from the Orteguasa for comparison with type-material.

Bujurquina specimens from the upper Putumayo, with preopercular spot like in *B. peregrinabunda*, are poorly preserved. Fine Santa Rosa de Sucumbío specimens, however, have a blotchy lateral band, and in all the lateral band runs well ventral to upper lateral line canals. This material probably represents another species, close to *B. peregrinabunda*.

Seven *Bujurquina* specimens from Iquitos are darkened, but seem to have the lateral band as in *B. peregrinabunda*. As they possess somewhat produced snout and buccal stripes, and neither fin pattern nor suborbital stripe or preopercular spot can be seen, they are nevertheless not identifiable as *B. peregrinabunda*. The precise locality cannot be traced.

Steindachner (1875) described Amazonian *'Acara vittata'*, from Codajás and Lago Manacapuru. His Codajás material is included here in the type series of *B. peregrinabunda*. Steindachner's data agree in general with those I find, but none of my specimens shows small sky blue, silvery spots on cheek and gill-cover noticed by Steindachner as 'nicht selten'. *Bujurquina peregrinabunda* is very different from *B. vittata*, and Steindachner's figure shows well the dark stripe along the posterior margin of the cheek that characterizes *B. peregrinabunda*.

Bujurquina moriorum **n. sp.**
Figs 108, 111, 134-135, Pl. XXXIII (figs 3-4), Tables 20, 24

Diagnosis
Squ. long. 24; jaws equal anteriorly; lips thin; pectoral fin moderately long, 32.7-37.4 % of SL; lateral band continuous, running toward dorsal edge of caudal peduncle; nape band strong; Bars 5 and 6 separate; suborbital stripe, in young, curved, preopercular spot in adults; Bar 7 blotch-like, posterior

dorsal fin lappets dark with light basal spot; 2-3 horizontal series of light round spots on spinous dorsal fin.

Similar only to *B. peregrinabunda*, in the richly spotted dorsal and caudal fins and the wide, straight lateral band, but with lateral band separated from upper lateral line canals, preopercular spot not continued along preopercular margin and with longer snout (8.5-10.4 % of SL *vs.* 5.8-8.3 % of SL in specimens *c.* 58-94 mm SL).

Holotype

NRM SOK/1983347.3942. An adult female, 85.2 mm SL. Perú, departamento Loreto, Río Ucayali drainage system, Quebrada Carahuayte at first bend downstream of km 20 on road Jenaro Herrera-Colonia Angamos. 28 August 1983. Leg. S.O. Kullander, A. Urteaga C., T. Townshend, L. Mori P., R. Mori (Station SOK 76).

Material

Holotype and 108 paratypes, 6.0-97.1 mm SL.

Description

From the holotype, unless otherwise stated; counts from 25 specimens measured (Table 24).

Shape. Moderately elongate, with evenly curved predorsal contour; ventral outline gently arched. Interorbital slightly vaulted (flat in specimens 50 mm and smaller), of about mouth width. Jaws equal anteriorly, tip of maxilla exposed, not reaching to vertical from anterior margin of orbit (to, or beyond in specimens 50 mm and smaller). Lips moderately wide, lower lip fold width equal to anterior intermandibular width. Mazan specimens (Pl. XXXIII, fig. 3) have a more deep-bodied aspect than Carahuayte specimens (Pl. XXXIII, fig. 2).

Scales. Squ. long. - (1), 23 (2), 24 (22). 8 median predorsal scales in 21, 7 median + 1 pair in 2, 3 median + 2 pairs + 2 median + 1 pair in 1, no count possible in 1. Upper lateral line on 15 (8), 16 (17) scales, plus one terminal scale in series below in 8 specimens. Lower lateral line on - (1), 7 (2), 8 (8), 9 (12), 10 (2) scales, plus 1-2 between caudal-fin rays V1 and V2. Accessory caudal-fin lateral lines of 0-6 (both) tubed scales. Cheek scales in - (1), 3 (24) series; posterior ctenoid. Basal half of caudal-fin scaly.

Fins. Dorsal-fin spines subequal in length from 6th, last 2 again longer, last twice length of first. Soft fin pointed, reaching beyond middle of caudal fin. D. XIII.11 (2), XIV.10 (19), XIV.11 (2), XV.9 (1), XV.10 (1). Soft anal-fin pointed, not reaching middle of caudal fin. A. III.7 (20), III.8 (5). In young, soft vertical fins rounded or pointed, to 1/4 of caudal fin. Caudal fin truncate, rays D5 and V6 only slightly longer than the rest; damaged in most specimens, but appearing truncate in all, without long streamers. Pectoral fin with rounded tip, reaching to above 2nd or 3rd anal-fin spines, in one specimen to 2nd anal-fin ray; P. 12 (1), 13 (17), 14 (7). Pelvic fin pointed, 1st ray longest, to 2nd anal-fin spine to 3rd anal-fin ray.

Gill-rakers. 1 epibranchial, 1 in angle, and 5 (1), 6 (20), 7 (4) ceratobranchial externally on first arch. Microgill-rakers rudimentary, externally on 2nd to 4th arches, or absent.

Jaw teeth. Outer series extending to near ends of jaws, of conical, apically slightly recurved teeth showing slight size increase anteriorly, 10/22, 14/20, 13/18, 14/21, 13/21, 15/20, 18/22, 16/18, 19/20, 19/21, 15/18, 19/19, 20/19, 17/16, 20/15, 20/18 teeth in upper/lower jaw hemiseries in 16 specimens 34.8-97.1 mm SL (sequenced from smallest to largest); inner wide band of smaller teeth in 2-4 series (mode 3) anteriorly in upper, 3-5 (mode 4) anteriorly in lower jaw, narrower posteriorly, to middle of each jaw.

Tooth-plates. 89.0 mm specimen dissected lacking ceratobranchial 4 tooth-plates on right side, one plate with 3 teeth on left side; lower pharyngeal tooth-plate as in fig. 134, wide, with anterior teeth subconical, some with recurved tips, posterior and marginal teeth compressed, with posterior antrorse cusp and anterior shelf or saddle, no molariform teeth.

Vertebrae. 26, of which 12 (2) or 13 (4) preanal in radiographed and

cleared and stained specimens; 4 caudal peduncle vertebrae. Further osteological data, p. 245.

Colouration. Holotype: Ground colour yellowish white, pure on chest and along abdomen, dirty on underside of head. Gill-cover dirty silvery. Snout, upper lip pale grey. Cheek yellowish white, overlayered with grey. Flank scales ventral to scale series including lower lateral line with yellowish white center and pale greyish brown borders. Back and dorsal edge of caudal peduncle greyish brown.

Dark brown spot, size of pupil, in inner corner of preoperculum and adjacent cheek, associated with posterior of preopercular corner lateralis foramina. Minute dark dots scattered over cheek. Wide grey band between eyes, between nostrils and anterior edge of predorsal squamation. Lateral band dark brown, covering anterior 2 lateral line scales and extending horizontally caudad to end of Bar 3, caudally covering upper 1/3 of squ. long. scales and all of scales in next superior series; continued on head to eye and dorsorostrad across nape, but not distinct in dark nape colour. Lateral spot indistinct, mere intensified portion of lateral band where crossing Bar 5.

Vertical bars darkest, greyish brown, near dorsal fin, faint in light zone bordering lateral band dorsally, only indicated on flanks; wider than interspaces. Bar 1 not apparent; Bar 2 faint, marking root of caudal peduncle; Bar 3 below origin of soft dorsal-fin; Bar 4 below end of spinous dorsal-fin; Bar 5 across middle of abdominal side section; Bar 6 close behind pectoral axilla; Bar 7 a spot around and anterior to dorsal-fin origin.

Spinous dorsal-fin grey with anteriorly 2, posteriorly 3 horizontal series of large opaque spots (ie. 2 and 3 spots, respectively, on each membrane); posterior lappets grey with light basal spot; on soft portion spots clear and grey pigment on distal half limited to membrane margins. Anal fin smoky with 4-5 cross-series of hyaline dots on last 3 membranes. Marginal 2 membranes, spine and first ray of pelvic fin greyish, remainder hyaline. Caudal spot narrow, on lower 2/3 of dorsal lobe of caudal-fin base, indistinctly light-margined; distal to it greyish, with 8 cross-series of large clear spots, lower distal corner uniformly grey, upper distal corner clear.

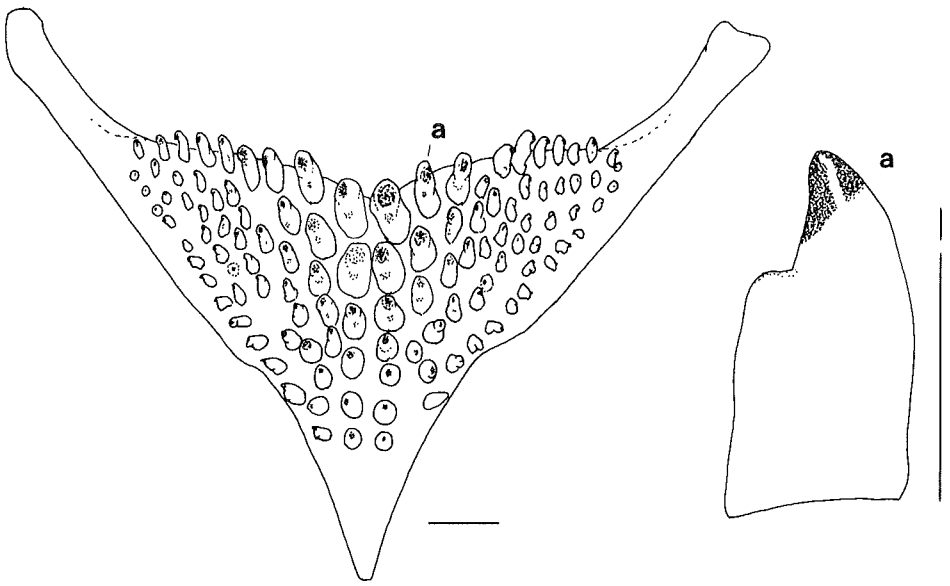

Figure 134. Lower pharyngeal tooth-plate in occlusal view, and tooth (a) in lateral aspect of *Bujurquina moriorum*, NRM SOK/1983347.3792, 89.0 mm SL. Scales 1 mm.

Paratypes: Other large specimens (≥76.0 mm) similar; dark dots and short lines on cheek minute, but may extend onto operculum, suboperculum and vertical limb of preoperculum. Bar 1 variably evident, mostly obsolete. Preopercular coverage of preopercular spot slightly variable, may occupy space between corner pores. Straight vertical suborbital stripe remaining in 76.0 mm specimen, but lost in those larger (89.0-97.1 mm SL).

Specimens *c.*45-50 mm without cheek dots; suborbital stripe intense, continuous with preopercular spot. At 30-40 mm vertical bars much more evident than at larger sizes and extending to ventral body edge or lower abdominal sides; lateral band either continuous or divided into spots (interrupted anterior and posterior to lateral spot, which more intense than remainder of band) as characteristic of still smaller specimens; spinous dorsal fin uniformly greyish.

At 6 mm colouration consisting only of midbasal caudal spot and cross-bar representing Bars 3+4. At 9 mm suborbital stripe present; vertical bars on sides present though not well defined; caudal spot still midbasal and minute; horizontal band section uniting Bars 3+4 present, but no lateral spot. At 15 mm lateral spot present, Bar 5 evident only ventral to lateral spot, anterior and posterior lateral band sections still faint. At 20 mm caudal spot only a black line marking fin base, but more intense in dorsal lobe. Nape band and maculate lateral band present from 25 mm, and caudal spot assuming adult appearance; unpaired fins only slightly dotted.

Distribution (fig. 111)
Quebrada Carahuayte and tributaries along the Jenaro Herrera-Colonia Angamos road, lower R. Mazán, lower R. Napo near Mazán; possibly in the upper Napo.

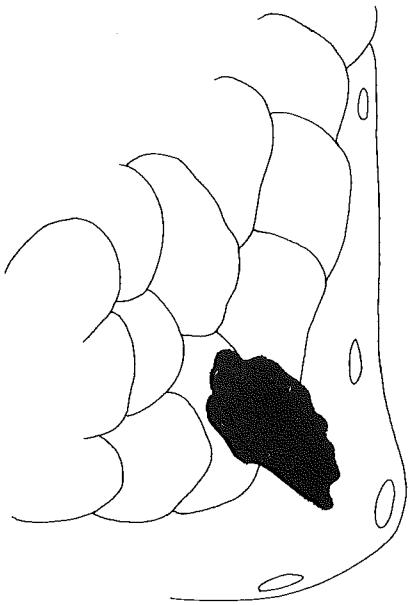

Figure 135. Buccal region of *Bujurquina moriorum*, NRM SOK/1983347.3792, 92.3 mm SL, to show position of intense subopercular spot. Diagrammatic.

Ecology
Carahuayte localities are forest streams with near colourless, clear to slightly turbid water with moderate to swift current varying with rains. The Carahuayte at the type locality was about 10 m wide, estimated depth generally about 2 m but fluctuates with rain. The Copal is similar. The Mazán sample was obtained from the slightly sloping clayey bank of a cleared section of the shore. The Aucapoza Cocha was a long lake which changed gradually from white-water to blackwater character between the connection with the Napo and the other end in primary forest; the *B. moriorum* were taken in an intermediate situation, with turbid, colourless water, seining floating vegetation over a muddy shore. Several broods were observed in the Copal site 29-30 August 1983, and some juveniles are preserved, but mouth brooding was not noted.

Etymology
Named for Luís Mori Pinedo and Palmira Padilla de Mori of PARI, Jenaro Herrera, in appreciation of their assistance to ichthyologists collecting in the Jenaro Herrera region.

Notes
A single young, 22.2 mm SL from Leticia (NRM A84/1983423.3011) agrees with similar-sized *B. moriorum* from Jenaro Herrera and the Mazán, but is not included in the description. *Bujurquina* specimens from Santa Cecilia (ANSP 119900, 119911, 130455) may be distinguished by narrower-looking lateral band, slightly shorter head and shorter caudal peduncle, but are otherwise referable to *B. moriorum*.

Bujurquina moriorum is more similar to *B. peregrinabunda* than to any other *Bujurquina* species, especially in the richly spotted dorsal and caudal fins and the lateral band running straight to the caudal peduncle edge instead of to the dorsal fin. The lateral band is, however, wider in *B. peregrinabunda*, running close along lateral line canals instead of being separate from these for most of the length. *Bujurquina moriorum* has a preopercular spot like in *B. apoparuana* and *B. hophrys*, whereas the corresponding marking in *B. peregrinabunda* is rather a band along the preoperculad margin of the cheek. *Bujurquina moriorum* also has a longer head and, when specimens of comparable sizes are considered, a longer snout than *B. peregrinabunda* (cf. Table 24; snout length in *B. peregrinabunda* 58.2-93.6 mm SL, 5.8-8.3 % of SL, in *B. moriorum* 57.6-92.3 mm SL, 8.5-10.4 % of SL).

Tahuantinsuyoa n. gen.

Diagnosis
South American cichlids of moderately small size (to *c.* 75 mm), with 4 dentary lateralis pores, uniserial predorsal squamation, and dorsal margin of anterior ceratohyal with notch margined by laminar ledges. Similar to *Bujurquina*, distinguished from that genus by having only one (anterior) instead of two palatine-lateral ethmoid articulations, dorsal caudal-fin accessory lateral lines running between rays D2 and D3, frequently D3 and D4, instead of between rays D1 and D2; caudodorsad directed supraorbital stripe, notched dorsal edge of distal postcleithrum and emphasized sigmoid posterior gill-cover margin.

Type species
Tahuantinsuyoa macantzatza n.sp.

Etymology
From the Quechua name for the Inca Empire, Tahuantinsuyo; to be regarded as of feminine gender.

Tahuantinsuyoa macantzatza n. sp.
Figs 112, 136-148, Pl. XXXIV (fig. 1), Table 25

Diagnosis
As for the genus.

Holotype
MZUSP 16212. An adult female, 74.4 mm SL. Perú, departamento Ucayali, Río Aguaytía drainage system, Río Huacamayo. 13 September 1979. Leg. H. Ortega T., J. Guevara, P. de Rham.

Material
Holotype, and 48 paratypes 17.1-70.6 mm SL. Also 5 alevins.

Description
Based on the holotype and other specimens over 50 mm SL. Counts from 25 specimens. Measurements of 14 specimens are summarized in Table 25. Refer to Plate XXXIV, fig. 1, for general aspect.

Shape. Elongate, laterally compressed, contour in anterior view elliptic. Predorsal contour little curved; dorsal and ventral outlines only little arched. Snout long, little narrower anteriorly. Jaws equal anteriorly; maxilla reaching to or nearly to vertical from anterior margin of orbit; mouth wider than interorbital. Lips thick; upper subcontinuous through symphysial thickening which prominent and raised above postlabial skin in 62.5 and 58.1 mm specimens; fold of lower lip discontinuous but wide, covering mandibular cartilage.

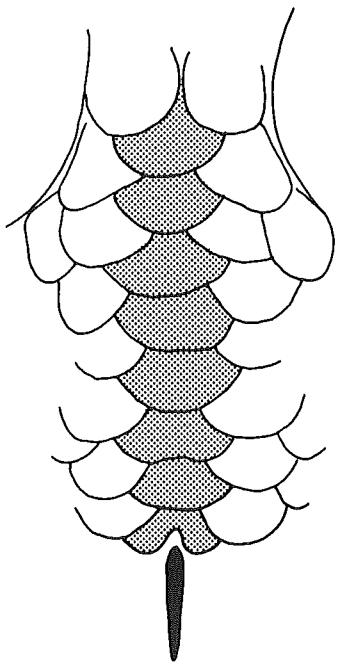

Figure 136. Uniserial predorsal scale pattern in *Tahuantinsuyoa macantzatza*. Midline scales shaded, first dorsal-fin spine black. From ZFMK P53285, 50.5 mm SL.

Scales. Squ. long. 24 (2), 25 (22), 26 (1); 16 circumpeduncular scale series. Prepelvic, cheek and interopercular scales cycloid; opercular and interopercular scales ctenoid or cycloid, or dorsal opercular scales ctenoid, rest cycloid. Uniserial predorsal scale pattern (fig. 136), frequently posteriormost scale replaced by scale pair. Cheek scales in 3 (25) series, posterior scales largely covering vertical limb of preoperculum; 2 vertical series on operculum, one on sub- and interopercula. Prepelvic scales of varying size, generally 2/3 size of anterior flank scales.

Upper lateral line in 3rd horizontal scale series above that containing lower, on 15 (2), 16 (12), 17 (10), 19 (1) scales; lower line on - (1), 8 (1), 9 (10), 10 (13) scales, plus 1-2 on caudal-fin base; 0-4 tubed scales in dorsal, 0-2 in ventral accessory caudal-fin lateral line, dorsal between rays D2 and D3 in 6, D3 and D4 in 3 of 9 measured specimens in which present, ventral always between rays V4 and V5. Caudal-fin squamation with slightly concave hind margin, extending to nearly half of fin.

Fins. First dorsal-fin spine nearly half length of last, spines subequal from about 5th, last longest; lappets anteriorly with rounded tips; posteriorly subtruncate. Soft dorsal fin with rounded or barely pointed tip, reaching little beyond vertical from caudal-fin base. D. XIII.11 (1), XIII.12 (1), XIV.10 (8), XIV.11 (13), XV.10 (2). Soft anal fin like soft dorsal fin, but frequently reaching a little further back. A. III.7 (6), III.8 (18), III.9 (1). Pectoral fin with rounded tip, 4th ray longest, reaching to vertical from genital papilla or 1st anal-fin spine; P. 13 (16), 14 (9). Pelvic fin pointed, first ray longest, reaching to genital papilla, or slightly produced, to 2nd or 3rd anal-fin spine. Caudal fin with subtruncate to roundish hind edge.

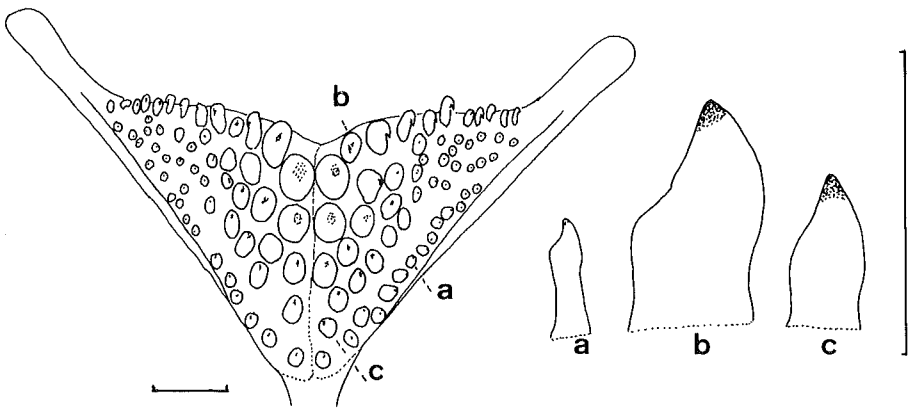

Figure 137. Lower pharyngeal tooth-plate in occlusal view and teeth (a, b, c) in lateral view, of *Tahuantinsuyoa macantzatza*, NRM A85/1979262.3096, 61.9 mm SL. Scales 1 mm.

Gill-rakers. 1-2 small epibranchial rakers attached to branchio-suspensorial velum, one in epi-ceratobranchial angle and - (2), 5 (1), 6 (18), 7 (3) ceratobranchial rakers externally on first gill-arch, all short. External first ceratobranchial rakers denticulate, except lowermost enlarged by soft compressed expansion, basally connected to inner rakers by prominent narrow fold. Inner rakers simple, apically denticulate, except digitiform inner 4th ceratobranchial rakers. Microgill-rakers externally along 2nd-4th arches.

Jaw teeth. In holotype all teeth simple, conical, slightly recurved; outer series of larger teeth, especially 3-4 anteriormost in each jaw half, along entire rim of upper jaw, over 2/3 of lower jaw; inner band of anteriorly 3 series, only along anterior 1/3 of upper jaw, one series nearly as long as outer series in lower jaw. Most of anterior outer teeth noticeably abraded on labial side, wear in some reducing tooth length to half that expected. In other specimens wear may be rather apical, but is usually subapical; 61.9 mm female with larvae in oropharynx notable for not having any worn teeth. 17/17, 14/14, 13/18, 17/19, 18/19, 15/15, 19/19, 19/22, 24/21, 18/16, 16/21, 16/17, 18/16, 15/19, 18/20 teeth in upper/lower jaw outer hemiseries in 15 specimen 37.6-74.4 mm SL (in order of increasing SL).

Tooth-plates. Dissected 61.9 mm specimen without tooth-plate on 4th ceratobranchial but in another specimen checked, 67.4 mm SL, two with 3 and 4 teeth. Lower pharyngeal tooth-plate (fig. 137) along anterior margin with subconical teeth, longer than those behind, which low, stout and, posteriorly, submolariform, with small blunt posterocentral cusp; posterior and posteromarginal teeth slender, bicuspid, with more or less prominent anterior shelf and antrorse posterior cusp. A few mediolateral teeth with signs of slight abrasive wear. Median upper pharyngeal teeth stout like opposing.

Osteology. From cleared and stained specimen, 35.8 mm SL. Neurocranium (fig. 138) relatively elongate, with low supraoccipital crest, narrow frontals and long premaxillary frontal fossa (compare *Bujurquina*). Neurocranial depth 56%, width 50%, frontal narrowest width 27%, orbital length 47% of neurocranial length (9.65 mm). Mesethmoid and vomer sutured together.

Table 25. *Morphometry of* Tahuantinsuyoa *and* Laetacara *species in Peru. Measurements are in per cent of SL, except SL (mm).*

	T. macantzatza			*L. thayeri*			*L. flavilabris*		
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$
SL (mm)	14	45.7-74.4	62.0±1.92	18	32.4-64.5	45.9±2.76	27	23.7-81.7	54.8±3.07
Head length	14	33.8-36.8	35.3±0.25	18	31.3-37.9	34.6±0.41	27	31.0-35.3	32.7±0.23
Snout length	14	8.4-10.3	9.4±0.19	18	4.6- 7.1	5.9±0.13	27	5.4- 7.8	6.5±0.13
Body depth	14	37.1-40.1	38.4±0.29	18	43.5-49.8	46.1±0.38	27	40.5-47.2	48.9±0.22
Orbital diameter	14	10.9-12.7	11.9±0.13	18	11.9-15.4	13.4±0.25	27	10.8-16.0	12.5±0.27
Head width	14	16.7-18.1	17.6±0.10	18	20.1-21.6	20.9±0.11	27	18.8-21.2	19.9±0.13
Interorbital width	14	8.1- 9.8	9.1±0.12	18	11.9-14.5	13.1±0.19	27	10.1-14.0	12.0±0.19
Preorbital depth	14	6.6- 8.3	7.6±0.13	18	4.1- 6.5	5.2±0.19	27	3.0- 7.5	5.3±0.23
Caudal peduncle depth	14	14.3-15.9	15.2±0.13	18	18.6-21.9	20.2±0.21	27	17.7-21.2	19.6±0.15
Caudal peduncle length	14	13.5-16.2	15.2±0.21	18	8.7-10.9	9.8±0.16	27	9.1-11.7	10.2±0.12
Pectoral-fin length	13	26.3-30.0	27.7±0.35	18	30.2-33.3	32.2±0.20	26	28.5-33.5	31.3±0.27
Pelvic-fin length	14	26.5-33.6	30.0±0.52	17	30.3-42.8	34.6±0.79	25	26.6-43.6	33.3±0.82
Last dorsal-fin spine length	13	14.7-17.3	16.1±0.21	18	15.7-19.5	17.6±0.22	26	14.8-17.7	16.4±0.17

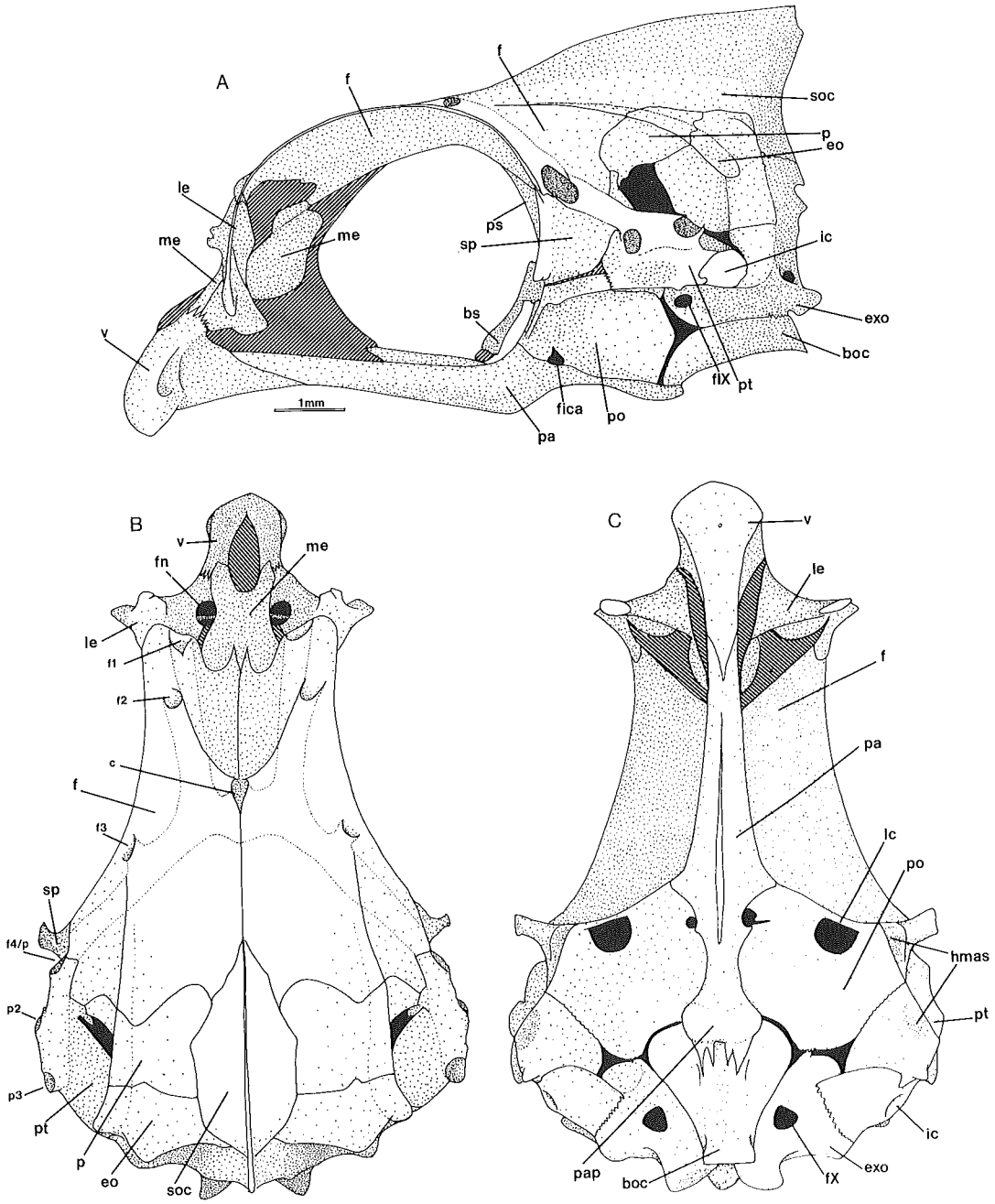
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Figure 138. Neurocranium of *Tahuantinsuyoa macantzatza*, NRM A85/1984407.-3097, 35.8 mm SL. Ethmovomerine cartilage striped. A lateral, B dorsal and C ventral aspect.

boc basioccipital
bs basisphenoid
c coronalis foramen
eo epioccipital
exo exoccipital
ic intercalar
f frontal
f1-4 frontal lateralis foramina
fica internal carotid artery foramen
fIX glossopharyngeal nerve foramen
fX vagus nerve foramen
fn olfactory nerve foramen
hmas articulation facets for hyomandibula
lc lateral commissure
le lateral ethmoid
me mesethmoid
p parietal
p1-3 pterotic lateralis foramina
pa parasphenoid
pap parasphenoid apophysis
po prootic
ps pterosphenoid
pt pterotic
soc supraoccipital
sp sphenotic
v vomer

Cephalic lateralis canals (figs 138-140) as in most other cichlasomines. Preopercular, lachrymal and dentary foramina relatively large. 4 dentary, 6 preopercular, 2 anguloarticular, 2 nasal, 5 bilateral frontal of which one pair forming coronalis foramen, 3 pterotic. Suborbital series (fig. 139): 4 lachrymal foramina, posterior enclosing anterior end of first infraorbital; anterior 3 infraorbitals with narrow ventral lamina; first infraorbital short, posterior end contained in rostral foramen of second infraorbital; second infraorbital longest, with middle and terminal foramina; 3rd and 4th infraorbitals short; 4th infraorbital on sphenotic.

Suspensorium (figs 140-141) similar to that of *Bujurquina*. Calyx well developed; metapterygoid and hyomandibula with opposing notched projections, but not sutured. Dorsal edge of hyomandibula deeply concave between neurocraniad condyles. Palatine with posteromedial wing distinct, but not articulating with lateral ethmoid.

Opercular series (fig. 140): the suboperculum is notably indented posteriorly.

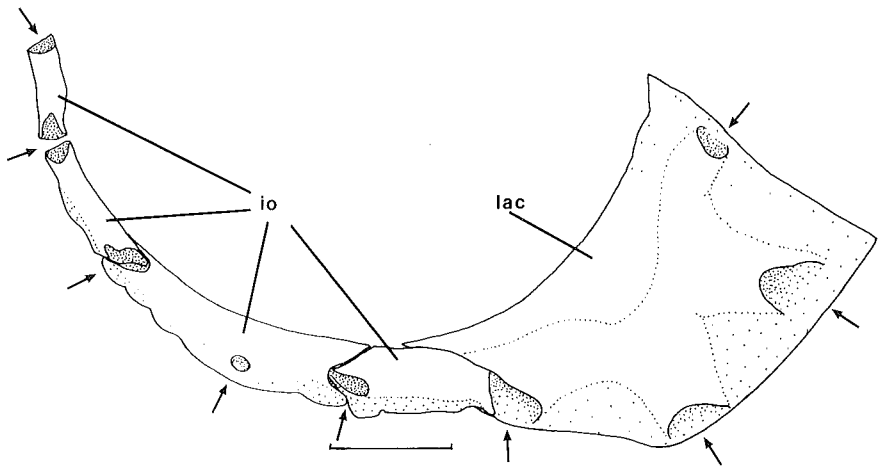

Figure 139. Right side suborbital series in *Tahuantinsuyoa macantzatza*, NRM A85/1984407.3097, 35.8 mm SL. Arrows pointing at foramina of lateralis canal. lac lachrymal, io infraorbitals. Scale 1 mm.

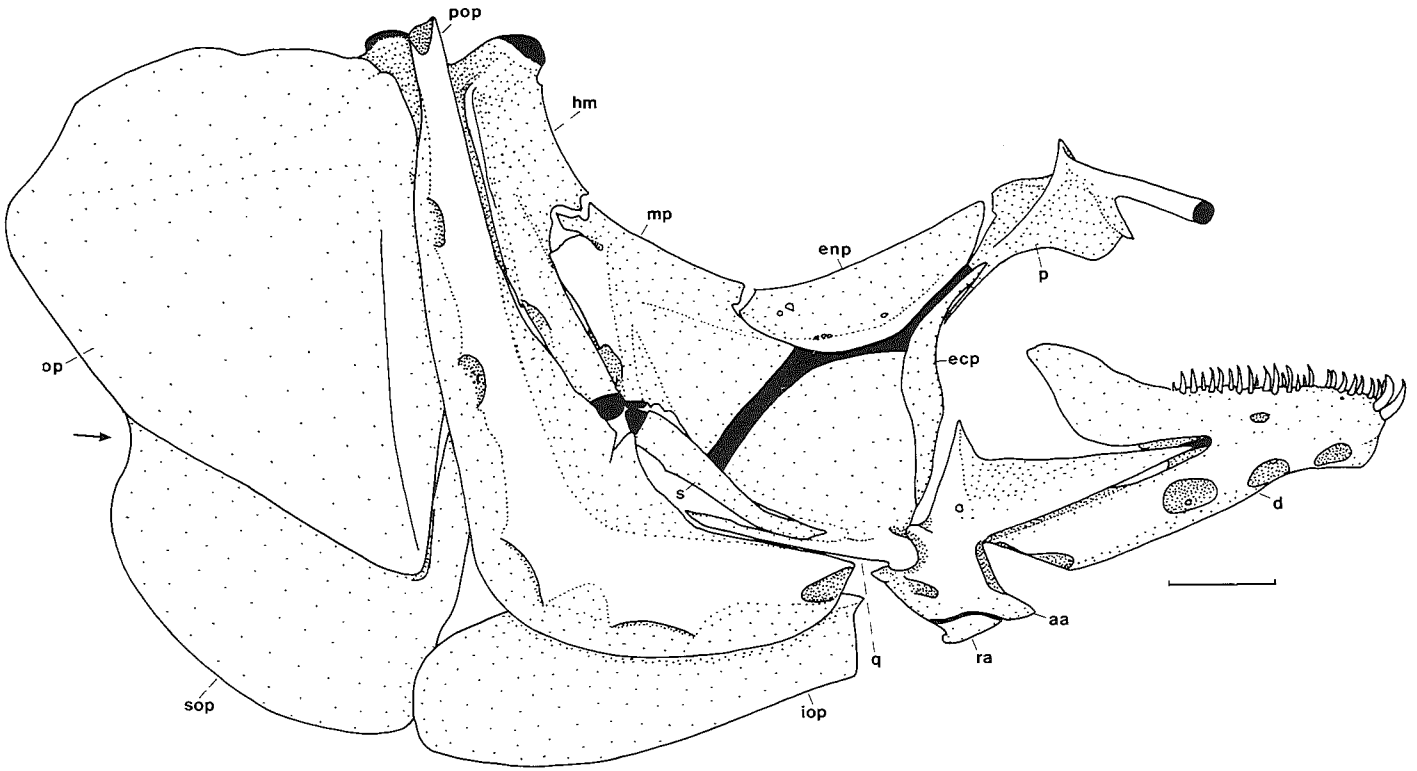

Figure 140. Suspensorium, opercular series and lower jaw in *Tahuantinsuyoa macantzatza*, NRM A85/1984407.3097, 35.8 mm SL. Cartilage black. Arrow points to concavity in gill-cover outline. Scale 1 mm.

aa anguloarticular	**iop** interoperculum	**q** quadrate
d dentary	**mp** metapterygoid	**ra** retroarticular
ecp ectopterygoid	**op** operculum	**s** symplectic
enp entopterygoid	**p** palatine	**sop** suboperculum
hm hyomandibula	**pop** preoperculum	

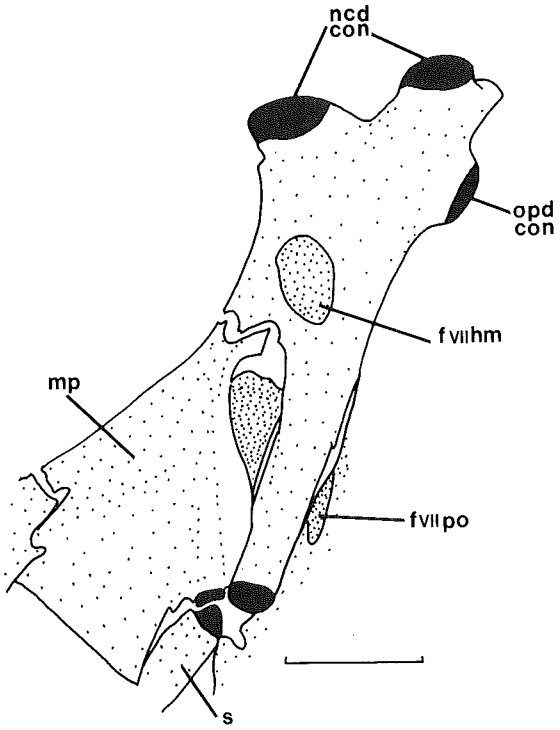

Figure 141. Medial aspect of hyomandibula and adjacent bones in *Tahuantinsuyoa macantzatza*, NRM A85/1984407.3097, 35.8 mm SL. Cartilage black. fVIIhm foramen of hyomandibular trunk of facialis nerve, fVIIpo preopercular foramen for mandibular ramus of facialis nerve, mp metapterygoid, ncd con neurocraniad condyles of hyomandibula, opd con operculad condyle of hyomandibula, s symplectic. Scale 1 mm.

Jaws (figs 140, 142) similar to *Bujurquina*. No rostral premaxillary foramen. Lengths in % of neurocranial length: medial premaxillary processes 47%, articulating premaxillary processes 25%, alveolar premaxillary processes 27%, maxilla 36%, mandible (dentary + anguloarticular) 51%.

Branchial skeleton (fig. 143) similar to that of other cichlasomines. Interarcual cartilage minute, suspended in connective tissue sheet. First epibranchial slender, medial arms closely approximated. Fourth ceratobranchial with 3 tooth-plates and without medial ledge (fig. 144).

Hyoid arch (fig. 145) as in *Bujurquina*, dorsal border of anterior ceratohyal with slight notch and bordering low laminar elevations. Branchiostegal rays relatively short.

Pectoral girdle (fig. 146) similar to that of *Bujurquina* and other cichlasomines, but distal postcleithrum with notched dorsal margin.

Axial skeleton: vertebrae 1-2 with epineural ribs; vertebra 3 with dextral short hypapophysis; vertebrae 3-12 with pleural ribs; vertebrae 3-8 with epipleural ribs, the last ligamentuously attached; vertebra 12 with first hemal arch; vertebra 13 with reduced basapophyses and hemal spine articulating with first anal-fin pterygiophore; vertebra 27=preural centrum. Two supraneurals. 3 specimens radiographed with 26 and 27 (2) vertebrae, of which 12 clearly abdominal; 3-4 complete centra plus half-centrum within caudal peduncle.

Caudal skeleton (fig. 147): the single noteworthy feature are the two minute plate-like cartilages close to the caudal peduncle edges at the level of the articulation of the 3rd and 4th caudal vertebrae (counted from the last), one dorsally, one ventrally. Two epurals, 5 hypurals, a parhypural with only indicated parhypurapophysis; neural spine of penultimate centrum autogenous; hemal and neural spines of antepenultimate centrum contribute to fin ray sup-

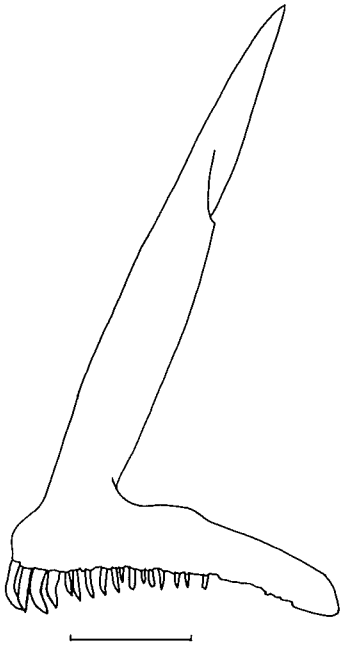

Figure 142. Left premaxilla in anterolateral aspect in *Tahuantinsuyoa macantzatza*, NRM A85/1984407.3097, 35.8 mm SL. Scale 1 mm.

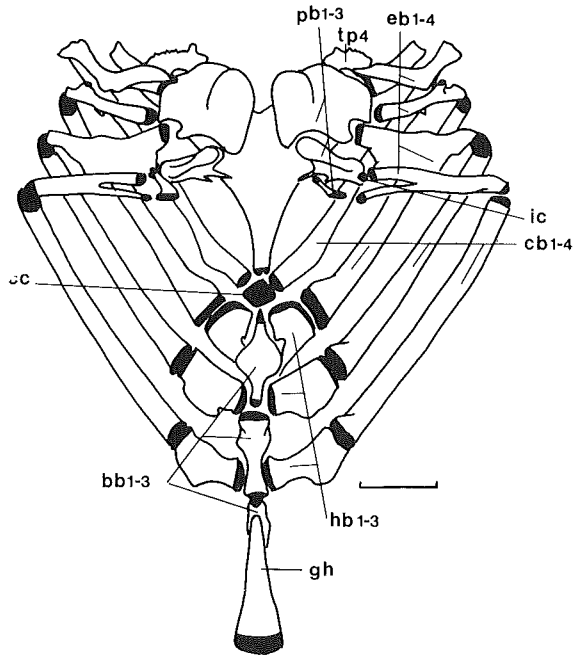

Figure 143. Branchial skeleton of *Tahuantinsuyoa macantzatza*, NRM A85/1984407.3097, 35.8 mm SL, in dorsal aspect. Gill-rakers and teeth omitted; cartilage, except on pharyngobranchials 2 and 3 black. Scale 1 mm.

bb basibranchials
cb ceratobranchials
cc central cartilage
eb epibranchials
gh glossohyal
hb hypobranchials
ic interarcual cartilage
pb pharyngobranchials
tp4 fourth upper tooth-plate

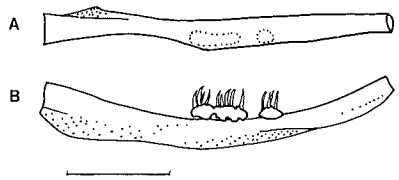

Figure 144. Fourth ceratobranchial of *Tahuantinsuyoa macantzatza*, NRM A85/1984407.3097, 35.8 mm SL, in A dorsal aspect, outlines of tooth-plates dotted, and B medial aspect. Caudal is to the right. Scale 1 mm.

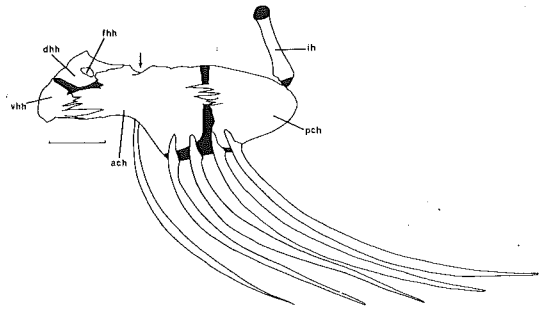

Figure 145. Left hyoid of *Tahuantinsuyoa macantzatza*, NRM A85/1984407 - 3097, 35.8 mm SL, in lateral aspect. Cartilage black. Scale 1 mm.

ach anterior ceratohyal
dhh dorsal hypohyal
fhh hypohyal foramen
ih interhyal
pch posterior ceratohyal
vhh ventral hypohyal

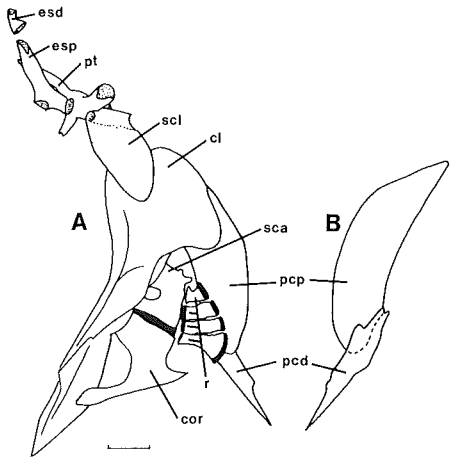

Figure 146. A left pectoral girdle of *Tahuantinsuyoa macantzatza*, NRM A85/1984407.3097, 35.8 mm SL, in lateral aspect, B postcleithra in medial aspect. Cartilage black. Scale 1 mm.

cl cleithrum
cor coracoid
esd distal extrascapular
esp proximal extrascapular
pcd distal postcleithrum
pcp proximal postcleithrum
r proximal radials
pt posttemporal
sca scapula
scl supracleithrum

port. Large cartilaginous distal radials precede neural and hemal spines of antepenultimate centrum. Distal to neural spine of 3rd caudal vertebra, epurals and hypural 5, are 4 minute distal radial cartilages; ventrally a cartilaginous distal radial separates distal portions of last two hemal spines and continues distal to tip of last hemal spine; another smaller cartilage distal to the adjacent tips of last hemal spine and parhypural. 8 principal and 3 procurrent rays in each lobe.

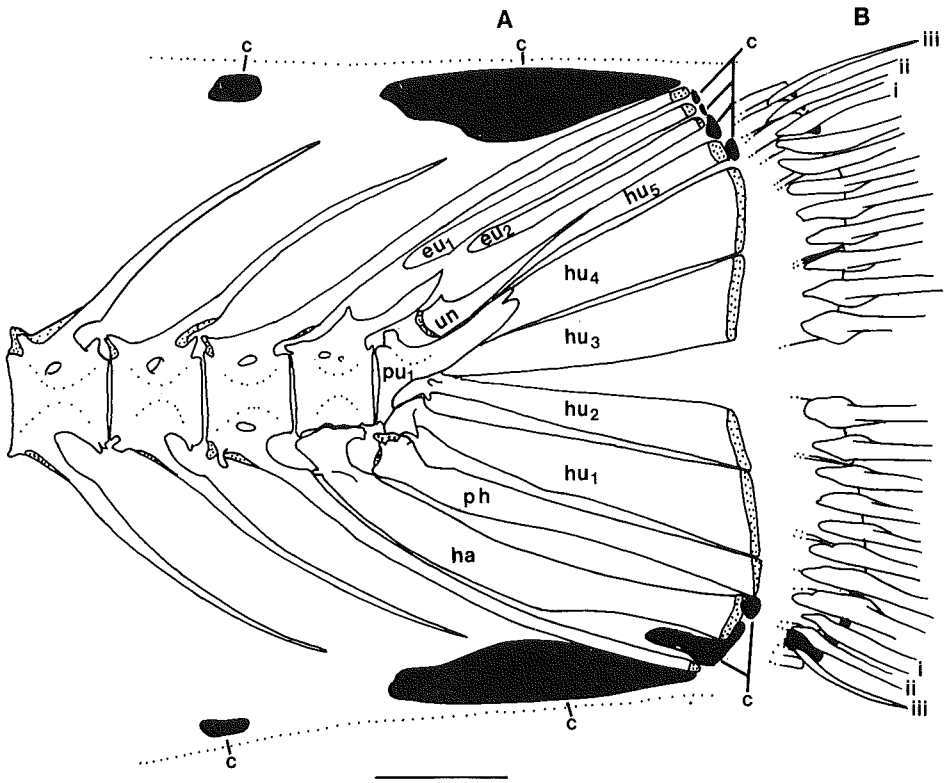

Figure 147. Caudal skeleton of *Tahuantinsuyoa macantzatza*, NRM A85/1984-407.3097, 35.8 mm SL. A (left) complete without fin rays, B (right) only distal portion with proximal ends of rays. Distal cartilage of urophore component bones stippled, caudal peduncle margins shown by dotted lines. Scale 1 mm.

c distal radials (black)
eu1-2 epurals
ha hemal spine of penultimate vertebra
hu1-5 hypurals
i-iii procurrent rays
ph parhypural
pu1 last half-centrum
un uroneural

Colouration. Ground colour as seen on chest, abdomen and lower part of head, pale greyish, whitish, or whitish with silvery sheen; on posterior of sides and caudal peduncle whitish or yellowish. Snout and preorbital grey; cheek and gill-cover brownish yellow. Nape, back and anterior sides warm brownish or greyish. Blackish brown prominent suborbital band from postero-ventral border of orbit straight to preopercular corner, reaching free edge of preoperculum. Similar band from close behind orbit, little below dorsal margin, obliquely caudad across nape, continuous with corresponding band on opposite side of head. No light preorbital stripe, dark interorbital band or buccal dots; some specimens with barely discernible thin dark lines below eye (fig. 148): one from below orbit at origin of suborbital stripe to anterior edge of lachrymal between anterior lateralis pores, another paralleling on lachrymal dorsally, a third, short, extending caudad from mouth angle, occasionally a broken stripe dorsally on preorbital close to nostril.

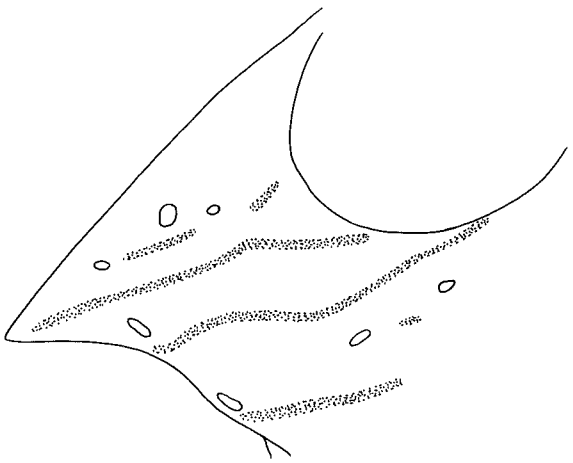

Figure 148. Preorbital stripes (dotted) in *Tahuantinsuyoa macantzatza*; traced from several specimens in which completeness of individual stripes variable.

Faint narrow lateral band from eye straight horizontal to midlateral spot, barely visible. Five vertical bars prominent, dark brown, contrasting against interspaces which do not extend to dorsal margin of body: 2 on caudad peduncle, 2 above anal fin and one anterior to vertical from genital papilla (corresponding to Bars 1-5 in *Bujurquina*); series of darker brown to blackish spots delimiting bars dorsally, anteriormost (midlateral spot) roundish, most prominent, below lateral line, in anteriormost vertical bar; spots in next two bars more or less confluent, forming, with midlateral spot and lateral band anterior to midlateral spot, an interrupted band to junction of dorsal-fin base and caudal peduncle.

Dorsal fin greyish; lappets white distally, dark basally, light sub-basal spot often not clearly evident; soft fin with white dorsal margin and series of large hyaline dots over posterior half. Caudal fin with blackish basal spot concentrated in lower part of dorsal lobe, but with adjacent dark pigmentation usually appearing rather midbasal; rest of fin greyish with hyaline spot especially medially and distally but not on lower 1/3. Anal fin greyish with

black lower margin and hyaline dots on posterior membranes. Pelvic fin dusky inwardly, shading to dark grey along leading edge.

Young have distinct lateral band from eye to or nearly to midlateral spot. An additional vertical bar may show more or less clearly in advance of that containing midlateral spot. At *c.* 20 mm the caudal spot appears small and midbasal, at larger sizes as a narrow bar.

Distribution (fig. 112)
Nearly all material comes from small rivers and streams tributaries to the R. Aguaytía, principally the Huipoca, Huacamayo and Negro, along the Tingo María-Pucallpa road. A single small specimen from Puerto Inca on the R. Pachitea indicates a wider distribution in uncollected regions.

Ecology
The R. Huacamayo is a clear-water river flowing over a bed of sand and gravel. Data taken in connection with collection of the holotype are: temperature 26°C, pH 6.3-6.6, conductivity 52 µS, hardness 2.0-2.5°dGH. The 18 September 1981 sample is accompanied by the data: 27.6°C, pH 7.7, conductivity 48 µS. The only other cichlid obtained in *T. macantzatza* localities is *Crenicichla sedentaria*. A female, 61.9 mm SL, with 5 larvae in the oropharyngeal cavity suggests that this may be a mouth brooder like *Bujurquina* species.

Etymology
The specific epithet, to be treated as a noun, is put together from the Shipibo words for stone (*macan*) and fish (*tzatza*) (Villarejo 1979), suggested by the predominantly stony bed of the R. Huacamayo at the type-locality.

Notes
Tahuantinsuyoa macantzatza has a hyoid notch like *Bujurquina* and two other groups of South American cichlids (p.256), and also uniserial predorsal scale pattern and a lateral band course as in these. The species is distinct from those groups in having the dorsal sequence of the caudal fin accessory lateral line between rays D2 and D3, sometimes D3 and D4, instead of between rays D3-D4 (*'Aequidens' guianensis* group) or D1-D2 (remainder). The more dorsal position is common among cichlids and may be widely plesiomorphic, the position between rays D2 and D3 is less frequent and shared with, eg. *Cichlasoma*. The deep smooth notch in the gill-cover outline produced by the short suboperculum, the dorsally notched distal postcleithrum and the single lateral ethmoid-palatine articulation facet distinguish *T. macantzatza* from all genera with notched ceratohyal, and also from *Cichlasoma*. These are taken as generic characters.

A suite of characters distinguish *T. macantzatza* from most or all *Bujurquina*-like cichlids, but seem more trivial, eg. thick, wide lips; absence of parhypural spine (present in the *'A.' guianensis* group); long narrow neurocranium (proportions variable among *Bujurquina* species, cf. p. 245); stout pharyngeal teeth (stouter in an undescribed *Bujurquina* species); roundish caudal fin (as in *'A.' pulcher* group species), more caudal vertebrae (one more than in *Bujurquina*); short soft fins. The caudal peduncle cartilages are found also in other cichlids with long caudal peduncle (eg. *Crenicichla*) and may primarily reflect shape. The colour pattern is distinctive, although most elements are shared with *Bujurquina*. *Tahuantinsuyoa* resembles the *'A.' pulcher* group species in having prominent suborbital stripe, nearly midbasal caudal spot, and rather dark overall colour. The oblique caudodorsad ascending supraorbital stripe is unique to *Tahuantinsuyoa*. In *Bujurquina* there is a rostrad inclined stripe above the orbit, *'A.' pulcher* group species either have a faint stripe as in *Bujurquina* or, like *'A.' guianensis* group species, do not possess any particular supraorbital marking. A supraorbital stripe similar to that of *T. macantzatza* is common among cichlids, however. *Bujurquina* and *Tahuantinsuyoa* are the only mouth brooders in the assemblage.

Diagnosis
Small (to *c.*80 mm SL) South American cichlids with American type lips, 6 preopercular and 4 dentary lateralis foramina, minute interarcual cartilage suspended in collagenous fibre tract, slender first epibranchial (without ventral flange); distinguished by characters in combination: a deep notch in the dorsal margin of the anterior ceratohyal, scaly preoperculum (2 scales on horizontal, 1, rarely 2 on vertical limb), only 2 cheek scale series, lacking posterior lateral ethmoid-palatine articulation and accessory caudal-fin lateral lines.

Type species
Acara flavilabris Cope.

Etymology
Laetacara is composed from the Latin word *laetus*, happy, and Acará, the Guarani name for cichlids, inspired by the appellation 'smiling acara', suggested by Langhammer (1971) for *L. flavilabris* (identified as *Aequidens thayeri*) with reference to the expression produced by the snout markings; this face expression is shared by other members of the genus.

Laetacara will be dealt with more extensively elsewhere (Åhlander & Kullander, in prep.), but sufficient data is available for anticipated nomenclatural recognition (Kullander 1983*b*; *'Aequidens dorsiger* group) which facilitates reference. Nominal species referred to *Laetacara* are *L. flavilabris*, *L. thayeri*, both described below, *Acara dorsiger* Heckel and *Acara curviceps* Ahl. The genus includes at least 3 undescribed species, one of which has already been referred to in this paper (p. 33).

A synapomorphy of these species is the shape of the hyoid, with a deep notch in the dorsal margin of the anterior ceratohyal (fig. 149), which is not margined by laminar ledges (cf. *Bujurquina* and *Tahuantinsuyoa*). The hyoid artery runs dorsally on the anterior face of the ceratohyal in a shallow but distinct groove. The particular ceratohyal notch is shared only with *'Aequidens' maronii* (Steindachner) among cichlids. *'Aequidens' maronii* is distinguished by a set of autapomorphies (Kullander *et al.* 1986). *Nannacara* is similar to *Laetacara* in preopercular squamation and general osteology, but distinguished by distinctive autapomorphies (Kullander *et al.* 1986). The Guianan endemics *Nannacara anomala* and *'A.' maronii* have only one supraneural and a well-developed posterior palatine-lateral ethmoid articulation.

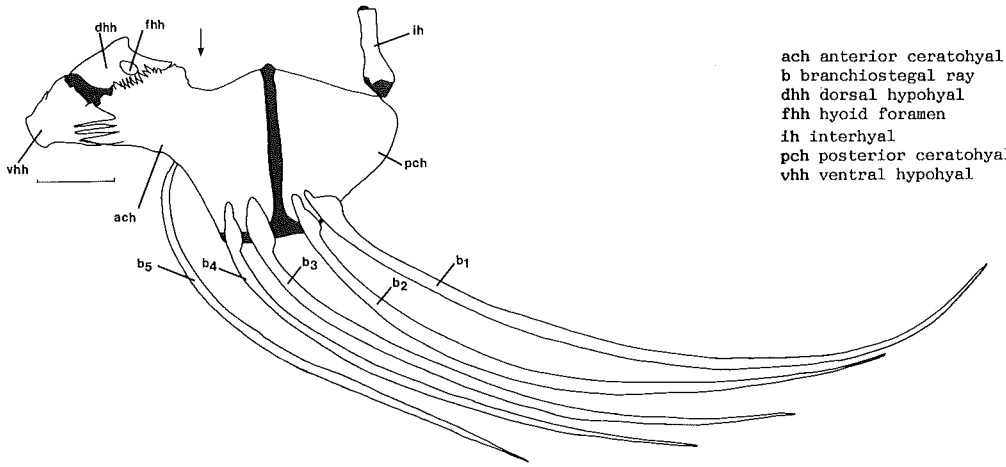

Figure 149. Left hyoid arch in *Laetacara flavilabris*, NRM SOK/1981363.-3579, 40.1 mm SL. Cartilage black. Arrow points to ceratohyal notch. Scale 1 mm.

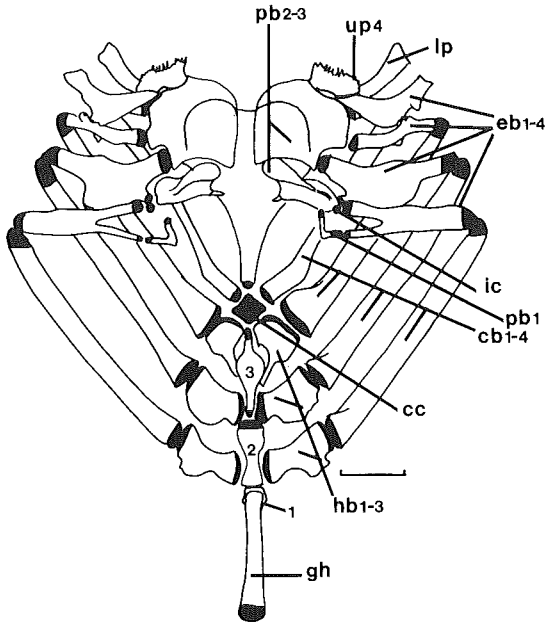

Figure 150. Gill-arch skeleton of *Laetacara flavilabris*, NRM SOK/1981363.-3759, 40.1 mm SL. Cartilage except on pharyngobranchials 2 and 3 black. Scale 1 mm.

1-3 basibranchials
cb ceratobranchials
cc central cartilage
eb epibranchials
gh glossohyal
hb hypobranchials
ic interarcual cartilage
lp lower pharyngeal tooth-plate
pb pharyngobranchials
tp4 fourth upper tooth-plate

Externally, and in skeletal features, *Laetacara* is similar to other cichlasomines, in particular *Cichlasoma*. Two supraneurals. Minute interarcual cartilage suspended in collagenous band (fig. 150). Slender first epibranchial. Unicuspid oral teeth. Cephalic lateralis canal system modal, about as in *Bujurquina*, with laminar ventral expansions on the first two infraorbitals (fig. 151); the second infraorbital has a middle foramen in the larger species (*L. thayeri*, *L. flavilabris*, *L.* sp. Orangeflossen), absent in smaller species (*L. dorsigera*, *L. curviceps*); canal branches are not enlarged as they are in *Bujurquina*, but as in that genus the lachrymal and second infraorbital are nearly in contact. Ceratobranchial 4 is edentulous and has a well developed medial anterior projection (fig. 152). The posterodorsal wing of the palatine is well-developed, but obviously does not articulat with the lateral ethmoid. The mesethmoid is not sutured to the vomer. Vertebral numbers 12+12 or 13+13, the last two vertebrae within caudal peduncle. Epipleural ribs from the third vertebra to the last abdominal or first caudal vertebrae; no caudal swimbladder projections.

Only *L. flavilabris*, *L. curviceps*, and one undescribed species have been examined for osteological characters. Externally, *Laetacara* species can be distinguished by characters in combination, such as preopercular and cheek squamation (cf. diagnosis; usually 3 cheek scale series and naked preoperculum in other cichlids), triserial predorsal squamation (like *Cichlasoma*, *Aequidens*, *'Aequidens' maronii*; but commonly 3 instead of four scale pairs posteriorly (fig. 153); total absence of caudal-fin lateral lines (absent also in several other cichlasomines); a mid-basal small and unocellated caudal spot or caudal spot absent (only *Nannacara* and *'A.' maronii* similar among cichlasomines with tri- or uniserial predorsal squamation); rounded caudal fin (rather common condition).

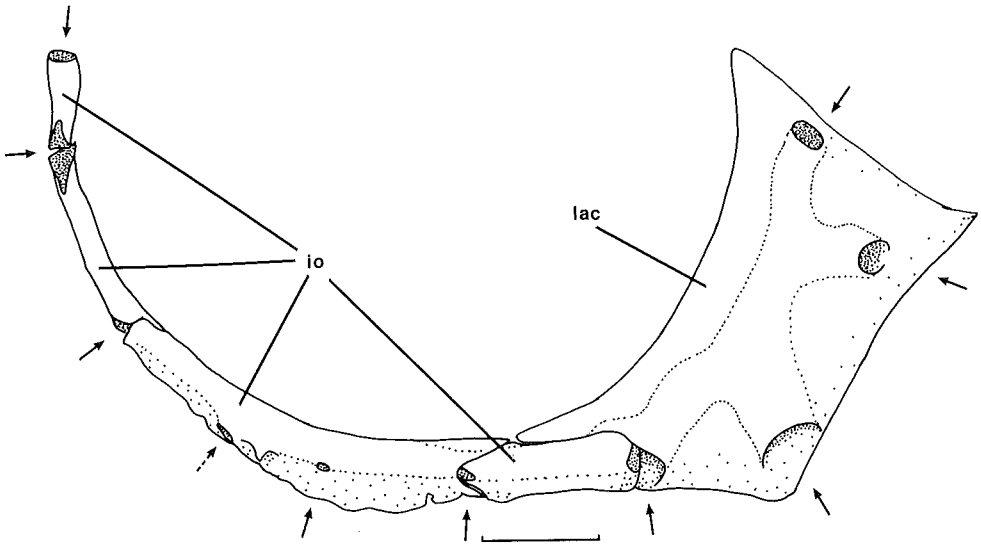

Figure 151. Right suborbital series of *Laetacara flavilabris*, NRM SOK/ 1981363.3579, 40.1 mm SL. Arrows point to foramina, broken arrow to atypical foramen. io infraorbitals, lac lachrymal. Scale 1 mm.

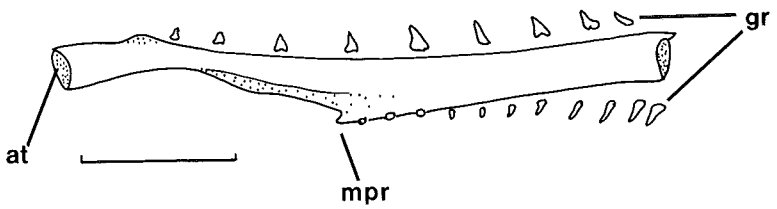

Figure 152. Fourth ceratobranchial with gill rakers, of *Laetacara flavilabris*, NRM SOK/1981363.3759, 40.1 mm SL, in dorsal aspect. at anterior termination, gr gill-raker series, mpr medial process. Scale 1 mm.

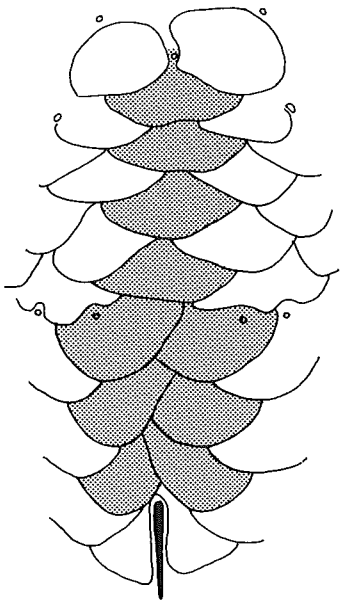

Figure 153. Triserial predorsal scale pattern in *Laetacara flavilabris*, NRM SOK/1981362.3571, 57.1 mm. Midline scales shaded.

Whitley (1951) proposed a substitute name *'Parvacara'*, with type species *Acara dorsiger* to replace *Nannacara* Ribeiro (1918), preoccupied by *Nannacara* Regan. Ribeiro identified two species, viz. *Acara dorsiger* Heckel, and *Nannacara hoehnei* Ribeiro, as belonging to *Nannacara*, but there is no indication in his paper that a new generic name is proposed. In fact, on p. 4 Ribeiro made it perfectly clear that he is referring to Regan's genus: '...as collecções Rondon distendiam para o Brasil a área de dispersão de outro /genero/ (*Nannacará* /sic/, de Regan).' This circumstance is already pointed out by Trewavas (1957). As there was never any genus *'Nannacara* Ribeiro', Whitley's substitute name has no nomenclatural standing.

Laetacara thayeri (Steindachner)
Figs 154-157, Pl. XXXIV (figs 2-3), Table 25

Acara (Acara) Thayeri Steindachner 1875, p. 68 (diagn.; descr.; Cudajas; See Hyanuary bei Manaos; Lago Maximo bei Alemquer), Taf. I, fig. 2 (sketch, habitus).

Material
29 Peruvian specimens, 20.2-64.5 mm SL; type series and Brazilian material also consulted.

Description
From specimens *c.* 60 mm and larger; counts from measured specimens; measurements summarized in Table 25.

Shape. Moderately deep, moderately compressed laterally, head short, with broad, bluntly rounded snout; predorsal contour evenly arched or with slight concavity anterior to orbit, slight ascent continuing through anterior half of spinous dorsal-fin base; prepelvic contour straight or slightly arched, slightly less steep compared to predorsal ascent; abdominal contour hori-

zontal; anal-fin base slightly convex; dorsal edge straight, horizontal, ventral edge straight, oblique. In frontal aspect elliptic with rounded nape and chest. Orbit in dorsal and chiefly in anterior half of head, little below frontal contour. Interorbital very little curved, wider than mouth. Jaws equal anteriorly; maxilla reaching to vertical from anterior margin of orbit; ascending processes of premaxilla not reaching orbital margin; lower jaw articulation little posterior to vertical from anterior margin of orbit. Lip folds interrupted.

Scales. Squ. long. 22 (19). 16 circumpeduncular scale series. Predorsally 4 median anterior scales and 3 posterior scale pairs, all ctenoid. Cheek scales in 2 (19) series; 1/2 (16), 2/2 (3) scales on vertical/horizontal limbs of preoperculum; 2 vertical scale series on operculum, one series on sub- and interoperculum; all head side scales ctenoid. Prepelvic scales ctenoid except a few anterior.

Upper lateral line at 2 1/2 (anteriorly) to 1 1/2 (posteriorly) scales distance from dorsal fin; lateral lines on -/7 (1), 14/7 (2), 14/8 (3), 14/9 (1), 15/6 (2), 15/7 (4), 15/8 (5), 16/7 (1) scales, plus 2 on caudal-fin base; no accessory caudal-fin lateral lines.

Pectoral and pelvic fins naked; soft dorsal and anal fins scaly, dorsal fin (fig. 154) with 1-6 scales between last spine and first ray, convex scaly layer on both fins commencing posteriorly on spinous portion or anteriorly on soft portion, but leaving posterior membranes naked; fin scales ctenoid. Caudal fin basal half densely scaly, scales ctenoid; hind margin of scaly area about truncate.

Fins. First dorsal fin spine above first lateral line scale, 2/5 to 1/2 length of last, spines subequal from about 4th, last 3 again slightly increased; soft portion damaged in most specimens, otherwise pointed, branches of rays 2-4 distally filamentous, reaching to near end of caudal fin. D. XIV.10 (1), XV.9 (15), XV.10 (2), XVI.9 (1). Anal-fin origin opposite 3rd from last dorsal-fin spine; soft portion pointed, 4th ray longest, to about middle of caudal fin; A. III.7 (11), III.8 (8). Pectoral fin short, rounded, 4th ray longest, reaching to above about vent; P. 12 (9), 13 (10). Pelvic fin pointed, outer branch of first ray longest, reaching to end of spinous anal-fin base. Caudal fin with roundish hind edge.

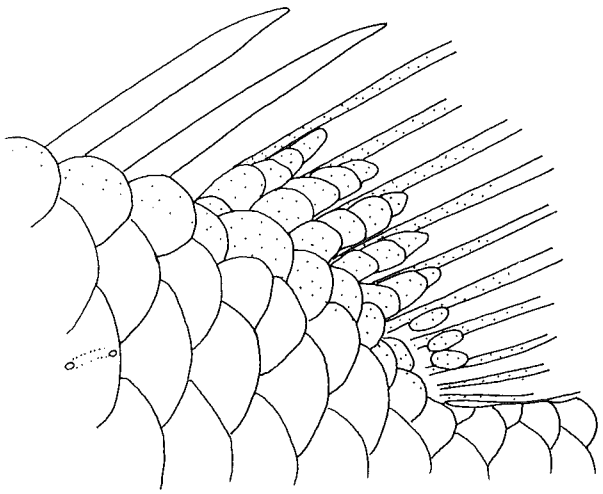

Figure 154. Dorsal-fin squamation of *Laetacara thayeri*, NRM THO/1971372.-3357, 59.4 mm SL. Soft rays and scales covering fin shown stippled. Semidiagrammatic.

Gill-rakers similar to those of *L. flavilabris*; 0-1 epibranchial, one in angle and 4 (1), 5 (11), 6 (6), 8 (1) ceratobranchial rakers externally on first gill-arch. Microgill-rakers externally on 2nd to 4th arches.

Jaw teeth. 9-11/19-22, in 10, 32.4-48.8 mm SL, 16-24/19-22 in 7, 53.0-64.5 mm SL, in upper/lower jaw outer hemiseries; large specimens, with more upper jaw teeth, also with one inner tooth series to end of jaw; inner teeth in 2-3 series, usually 2 in young, 3 in large specimens anteriorly in upper jaw; 2-4, usually 3 anteriorly in lower jaw. Shape as in *L. flavilabris*.

Tooth-plates. Lower pharyngeal tooth-plate in 59.4 mm specimen dissected anteriorly with subconical teeth, most teeth compressed bicuspid, some posteriormost with more or less distinct 3rd cusp (fig. 155); 4th ceratobranchial edentulous.

Vertebrae. 12+12 (5).

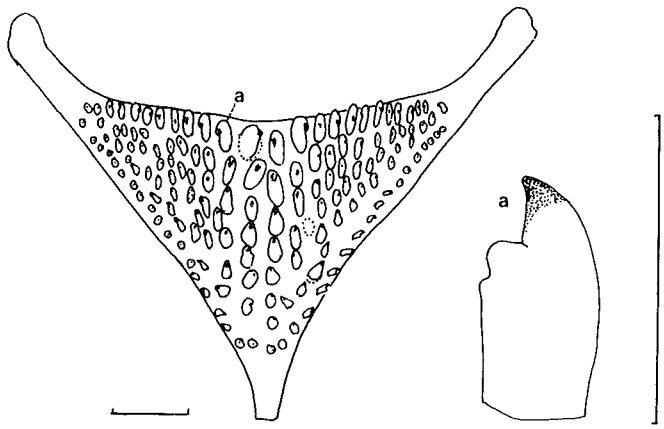

Figure 155. Occlusal aspect of lower pharyngeal tooth-plate and medial aspect of tricuspid posterior tooth (a) in *Laetacara thayeri*, NRM THO/1971-372.3357, 59.4 mm SL. Scales 1 mm.

Colouration. Colouration not well-preserved in most specimens. Ground colour whitish on chest, sides yellowish white; nape and back anterior to mid-lateral spot light brown; a dark brown blotch on nape just anterior to dorsal fin; interorbital area grey; narrow oblique vertical stripes along scale edges of abdominal sides. Dark brown short band along posterosuperior margin of orbit connecting dark nape with band along dorsal edge of gill-cover continued as lateral band limited dorsally by upper lateral line tube-series, reaching ventrally to middle of squ. long. scales; postorbital band portion with short pointed ventral extension on operculum just posterior to preoperculum; band bordered dorsally by light zone, narrowly interrupted by greyish white ante-

rior to midlateral spot, continued very faintly in vertical halves of lateral line scales 6-9 and 1 1/2 scale below, margined by light zone or less evident and complete, except dorsally where continued as dark brown light-margined bar obliquely caudad/dorsad to dorsal fin, which darkened as a continuation of bar except on lappets. Posterior to midlateral spot, 4 vertical bars separated by narrow light interspaces; anterior two, above anal fin, each divided into two narrower bars below lateral band, third bar between ends of vertical fin bases, fourth bar posteriorly on caudal peduncle. Suborbital stripe brown, from ventral margin of orbit, little curved, to interoperculum, distinct in young, retained faint to *c.* 60 mm, then dissolved in general cheek colour. Variably distinct dark and light stripes on snout and probital involving (in ventral successsion:) grey interorbital area, light broad stripe from orbit to orbit across snout tip, dark stripe on middle of preorbital from eye to eye across upper lip (and intermediate mouth parts hidden by preorbital when mouth closed), slightly lighter dark stripe along lower edge of preorbital and adjacent infraorbitals, and contrasting colourless stripe continued on lower lip.

Dorsal fin semitransparent grey with light or hyaline lappets, dorsal edge of soft portion narrowly white, about posterior 4 membranes with hyaline spots. Anal fin light with dark grey ventral edge. Caudal fin without base spot, basally brownish yellow, on naked part smoky, dorsal lobe with numerous cross series of hyaline spots. Pelvic fin hyaline with greyish leading edge of first ray.

Distribution (fig. 157)
Uncommon in Peru. Collected at Nueva York (R. Tigre), Jenaro Herrera (Supay system), near Iquitos, and on the lower Yavarí; extralimital distribution in Brazil along the Amazon (Lago Tefé; near Manaus, Codajás, Ueranduba).

Ecology
Laetacara thayeri is collected in small numbers. I have seen only one collecting site (SOK 40). Data available do not allow a characterization of habitat preferences, though it seems that *L. thayeri* may not be such a strictly black-water species like *L. flavilabris*.

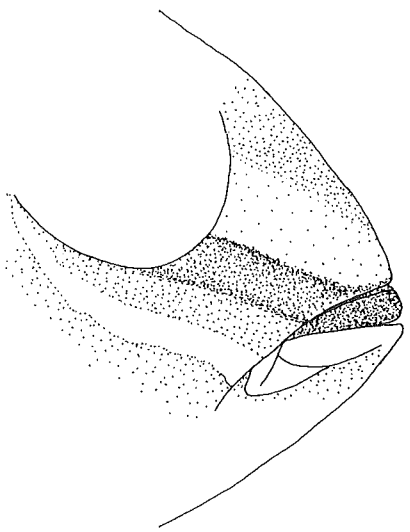

Figure 156. Lateral aspect of snout of *Laetacara thayeri* to show snout stripes, semidiagrammatic, reconstructed from several specimens and somewhat idealized, degree of stippling purporting to represent pigmentation intensity, not pigment structures.

Notes

Laetacara thayeri is most similar to *L. flavilabris* with which it is sympatric in eastern Peru although never syntopic. The species have the same general colour pattern, but *L. thayeri* is readily distinguished by the dark blotch on the nape, the more intense dorsal extension of the midlateral spot, absence of a caudal spot, and well-defined snout stripes. Meristics are clearly different: Squ. long. 22, D. modally XV.9, A. modally III.7, upper/lower lateral line modes 15/8, vertebrae 12+12, in *L. thayeri*; squ. long. 24, D. modally XVI.10, A. modally III.8, upper/lower lateral line modes 16-17/7, vertebrae 13+13 in *L. flavilabris*. Higher counts probably correlate with slenderer shape of *L. flavilabris*.

Laetacara thayeri at all sizes available (from 20 mm) have scaly soft dorsal and anal fin whereas in *L. flavilabris* a less extensively scaly dorsal-fin base occurs only in large specimens (*c.* 70 mm and larger) and the anal fin typically remains naked. Proportional measurements show considerable overlap at all sizes, but *L. thayeri* averages deeper body, and wider head and interorbital.

Laetacara flavilabris (Cope)

Figs 5, 149-153, 157-161, Pl. XXXV (fig. 1), Table 25

Synonymy

Acara flavilabris Cope 1870, p. 570 (descr.; near Pebas, Ecuador).
Acara freniferus (*pt.*) Cope 1872, p. 255 (descr.; the Ambyiacu).

Peruvian bibliography

Acara flavilabris; Cope 1872, p. 255 (descr.; Ambyiacu River). -- Cope 1878, p. 696 (note; Peruvian Amazon). -- Cope 1894, p. 107 (note; diagnostics). -- Regan 1905*b*, p. 343 (bibliogr.; descr. cop. Cope). -- Böhlke 1984, p. 58 (holotype listed).

Acara (Acara) tetramerus; (*pt.*) Steindachner 1875, p. 65 (status of *A. flavilabris* discussed).

Astronotus (Acara) freniferus; Eigenmann & Eigenmann 1891, p. 68 (listed; new comb.).

Acara tetramerus; (*pt.*) Pellegrin 1904, p. 171 (*Acara flavilabris* in synonymy).

Acara freniferus; Pellegrin 1904, p. 177 (bibliogr.; descr. abstr. Cope). -- (*pt.*) Böhlke 1984, p. 58 (type material listed; synonym of *Acara flavilabris* Cope).

Acara frenifera; Regan 1905*b*, p. 343 (bibliogr.; descr. cop. Cope).

Aequidens dorsigera; (*pt.*) Haseman 1911*c*, p. 336 (ref. to Cope's type material of *Acara freniferus* and *A. flavilabrus* (sic), synonyms of *A. dorsiger*).

Aequidens flavilabris; Fowler 1940*a*, p. 289 (listed; Nauta; ref. to Cope 1870). -- Fowler 1944, p. 264 (bibliogr.). -- Fowler 1945*a*, p. 245 (bibliogr.). -- Fowler 1954, p. 264 (bibliogr.), Fig. 851 (sketch, based on Cope 1872).

Aequidens dorsigerus; (*pt.*) Eigenmann & Allen 1942, p. 393 (listed: Rio Itaya; Iquitos; Yurimaguas; not bibliogr.). -- (*pt.*) Fowler 1944, p. 263 (Peruvian bibliogr.; cit. Eigenmann & Allen 1942). -- (*pt.*) Fowler 1945*a*, p. 244 (Peruvian bibliogr.; cit. Eigenmann & Allen 1942).

Aequidens freniferus; Fowler 1944, p. 264 (bibliogr.). -- Fowler 1945*a*, p. 246 (bibliogr.). -- Fowler 1954, p. 265 (bibliogr.).

Aequidens sp.; Saul 1975, p. 121 (habitat, reproduction, parasite, food; Rio Aguarico tributary).

Material

94 specimens, 17.5-81.7 mm SL, including types of *Acara flavilabris* and *A. freniferus* and 3 specimens from the Juruá in Brazil.

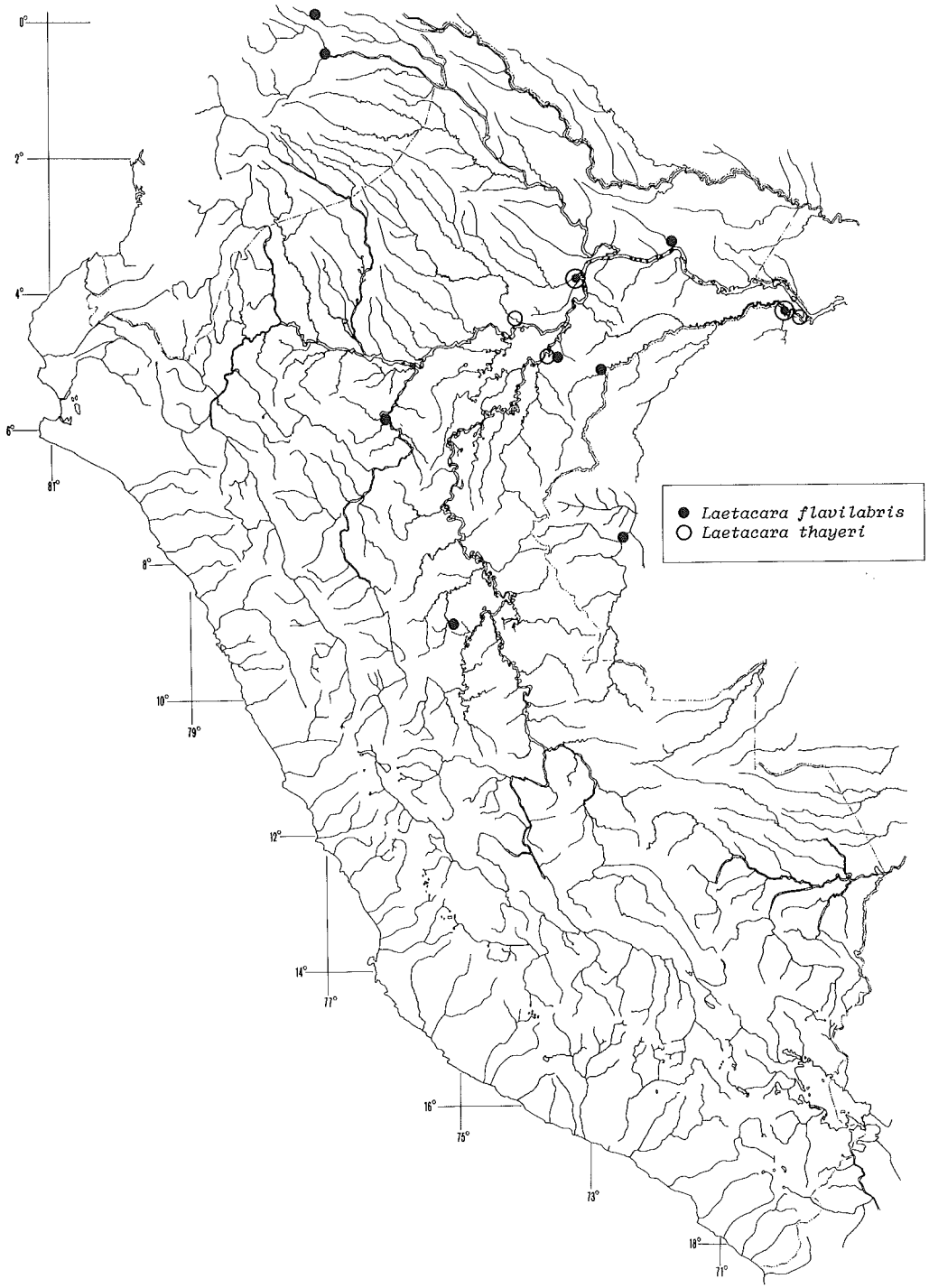

Figure 157. Collecting localities of *Laetacara* species in western Amazonia. A symbol may represent more than one, adjacent collecting sites.

Description

From adults, *c.* 65 mm and larger, with separate note on young; counts from 27 specimens measured, measurements summarized in Table 25. Refer to Pl. XXXV, fig. 1, for general aspect.

Shape. Moderately, elongate, moderately compressed laterally. Predosal contour ascending, slightly and evenly curved in females and young, largest males with slight concavity anterior to orbits, rise continued to about middle of spinous dorsal-fin base, dorsal-fin base posteriorly slightly descending; prepelvic contour about straight, slope lesser than that of predorsal contour; abdominal contour straight horizontal; anal-fin base contour ascending, slightly convex; dorsal edge of caudal peduncle straight, horizontal, ventral edge, which longer, straight, oblique. In frontal aspect outline narrowly elliptic with narrowly rounded nape and chest. Interorbital slightly curved in large, flattened in small specimens; slightly wider than mouth. Snout little produced, rounded, broad in lateral view, narrow in dorsal view. Orbit in upper and chiefly in anterior half of head. Maxilla reaching to level of anterior margin of orbit; ascending processes of premaxilla not reaching to level of orbit; lower jaw articulation below anterior 1/3 of orbit; jaws equal anteriorly; lip folds discontinuous.

Scales. Squ. long. 24 (27); 16 scale-series around caudal peduncle. Predorsal scales ctenoid, usually (in 16 of 25) 4 anterior medial single scales and 3 posterior scale pairs along midline, occasionally 4+4 (5 of 25), 5+3 (1 of 25), 6+2 (1 of 25) or irregular behind anterior 4 scales (2 of 25). Cheek scales in 2 series, anterior cycloid; preopercular scales cycloid, - (1), 0/2 (1), 1/2 (19), 2/2 (5), 2/3 (1) on vertical/horizontal limb (fig. 158). Opercular scales in 2 series, ctenoid, subopercular scales in 1 series, cycloid or ctenoid; interopercular scales in 1 series, cycloid. Prepelvic midline scales cycloid.

Upper lateral line at 2 1/2 (anteriorly) to 1 1/2 (posteriorly) scales distance from dorsal-fin base; lateral lines on -/- (1), 15/8 (1), 16/6 (2), 16/7 (4), 16/8 (3), 16/9 (2), 17/6 (1), 17/7 (5), 17/8 (4), 17/9 (1), 18/6 (2), 18/7 (1) scales, plus 1-2 on caudal fin; no accessory lateral lines on caudal fin.

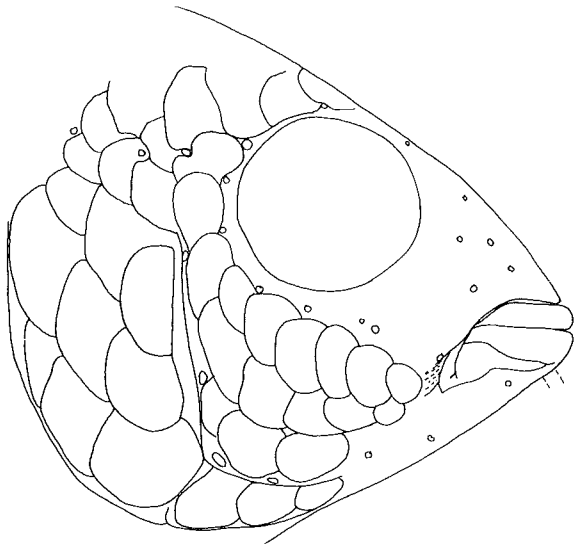

Figure 158. Cheek and gill-cover scale-pattern in *Laetacara flavilabris*, NRM SOK/1981362.3571, 57.1 mm dotted lines indicate dentary pores out of view; semidiagrammatic.

Fins naked except caudal fin which is densely scaled to about middle, hind margin of scaly area little concave, interradial scales ctenoid; and dorsal fin in large specimens with from one or a few interradial scales (69.2, 71.2 mm specimens) to basal scale-cover of soft portion (78.4 mm specimen, fig. 159), 78.4 specimen also with interradial scale on 4th soft anal-fin membrane.

Fins. First dorsal-fin spine at vertical from first lateral line canal, over 1/4 length of last spine, spines subequal in length from about 6th, last 3 again increasing; lappets short, truncate with pointed posterosuperior corner; soft fin pointed, longest rays or ray branches (3rd to 6th) filamentous from above middle of caudal fin, longest (5th) reaching beyond caudal fin. D. XV.9 (1), XVI.9 (4), XVI.10 (12), XVI.11 (4), XVII.9 (4), XVII.10 (2). First anal-fin spine opposite 3rd from last dorsal-fin spine; soft fin pointed, tip broad, 4th and, longest, 5th rays reaching to between middle and near end of caudal fin; A. III.8 (14), III.9 (13). Pectoral fin short, rounded, 4th ray longest, reaching to or not quite to above vent; P. 12 (2), 13 (24), 14 (1). Pelvic fin pointed, first ray produced, outer branch longest, but inner branch and 2nd ray also long, reaching about end of spinous or origin of soft anal fin. Caudal fin rounded.

Jaw teeth. In both jaws outer series teeth much larger than those of inner band, and slightly larger anteriorly; 5-10/14-21 in 6, 23.7-39.8 mm, 9-23/16-20 in 7, 47.6-57.1 mm, 17-22/15-18 in 10, 64.8-81.7 mm SL, in upper/lower jaw outer hemseries.

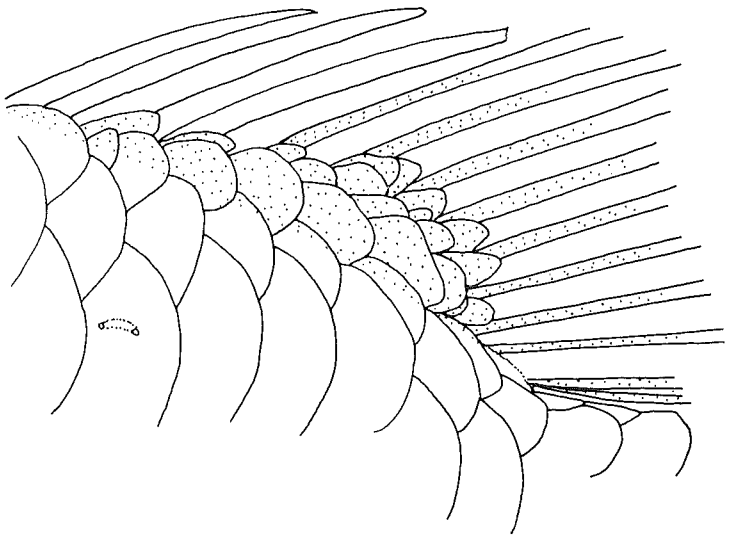

Figure 159. Dorsal-fin squamation in a large specimen of *Laetacara flavilabris*, NRM SOK/1983362.3096, 78.4 mm SL; semidiagrammatic; shading indicates scale coverage of dorsal fin, and soft rays.

Gill-rakers. 1-2 epibranchial, one in angle and 4 (1), 5 (20), 6 (6) ceratobranchial rakers externally on first gill-arch (fig. 160), all smooth, short, epibranchial and angle rakers subconical, remainder flattened. Micro-gill-rakers externally on 2nd to 4th arch in some large specimens, difficult to observe, hence variation among small specimens uncertain.

Tooth-plates. 71.2 mm SL specimen dissected with broad lower pharyngeal tooth-plate anteriorly with subconical teeth, medially and posteriorly compressed, laterally bicuspid, medioposteriorly tricuspid (fig. 161); no teeth on 4th ceratobranchial.

Vertebrae. 13+13 (9).

Smallest specimen available, 17.5 mm, similar to adults in shape, but snout shorter, maxilla reaching beyond vertical from anterior margin of orbit; interorbital flat; 1/2 preopercular scales present; anterior predorsal scales cycloid; soft dorsal and anal fins with rounded tips, reaching beyond caudal fin base, pectoral fin reaching to above 2nd anal-fin spine; pelvic fin short, without prolongation, reaching to first anal-fine spine; 1/4 of caudal fin scaly.

Colouration. Young overall lighter, with contrasted dark markings, adults rather dull. 17.5 mm specimen with chest yellowish white, sides of same colour but overlain with brownish on anterior half, behind midlateral spot as narrow light stripes, delimiting 4 posteriorly gradually narrower brownish bars, 2 above anal fin, 1 anteriorly and 1 posteriorly on caudal peduncle. Gill cover light brownish; cheek and underside of head yellowish white. Wide brown suborbital stripe from orbit straight, slightly inclined down onto preoperculum anterior to corner and continued fainter, on interoperculum. Dark brown spot slightly dorsocaudad extended marginal to posterosuperior margin of orbit. Forehead and snout dorsally light grey. Light brown band from orbit over dorsal margin of operculum to slightly in advance of midlateral spot, 1 1/2 scales wide on side, margined dorsally by lateral line canals, continued as trace by intensifications in vertical bars posterior to midlateral spot. Midlateral spot roundish, covering lateral line scales 6-10 and reaching ventrally to cover much of squ. long. scales. Midbasal brown, narrow caudal spot distinct. Dorsal fin grey with narrow white dorsal margin, soft part hyaline with short greyish cross bars. Caudal, anal and pelvic fins duskied. Adults *c.* 65 mm and larger with chest greyish, abdominal sides yellowish white with narrow dark oblique lines along scale edges from series containing lower lateral line and 4 horizontal scale series below. Head grey, lower lip and adjacent lower jaw whitish, upper lip grey; operculum dark grey, cheek brownish grey dorsally, lighter ventrally; preorbital grey; snout dorsally, forehead, nape and narrowly along back dark grey. Markings on head indistinct or not traceable: wide light band from orbit rostrad across snout reaching above nostril, ventrally to anterodorsal lachrymal lateralis pore, preorbital grey, light stripe on cheek along preorbital margin, in small specimens distinct a brown stripe from posteroventral margin of orbit to mouth angle; posterosuperior cheek scales with lightened bases.

Blackish brown band from orbit to slightly in advance of midlateral spot, widened caudally, margined dorsally by lateral line tube series and a light narrow zone about 1/2 scale wide. Midlateral spot slightly variable in shape, commonly rhomboidal, black below lateral line, (1 1/2 scale deep), passing 7-10 (or 8-10) lateral line scales either as black or, usually, brown and as bar obliquely caudad to dorsal fin, which darkened basally adjacent to this bar. Behind spot, 4 dark bars separated by indistinct narrow light bars, positioned as in young.

Dorsal fin grey with slightly lighter lappets and narrow white lappet edges and dorsal margin and filaments of soft part; about 5 cross-series of light spots on 4 last membranes. Anal fin grey, little darker along ventral margin, posterior rays lighter, a few dark dots on last few membranes. Caudal fin with indistinct narrow greyish midbasal spot, remainder greyish with numerous cross-series of round light spots that parallel to convex hind margin of fin and commonly distinct only on posterior part of dorsal lobe, hind margin with

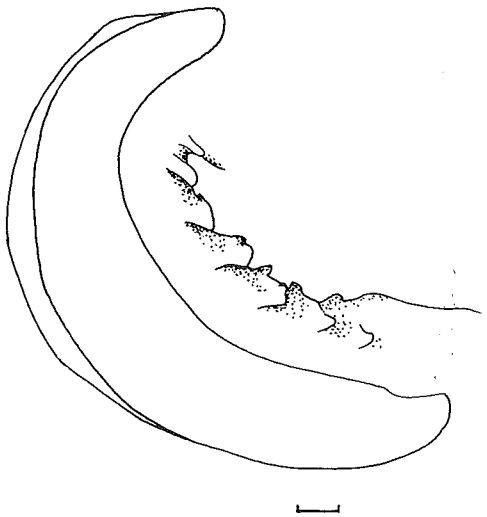

Figure 160. External aspect of first gill-arch in *Laetacara flavilabris*, NRM SOK/1983355.3719, 71.2 mm SL. Scale 1 mm.

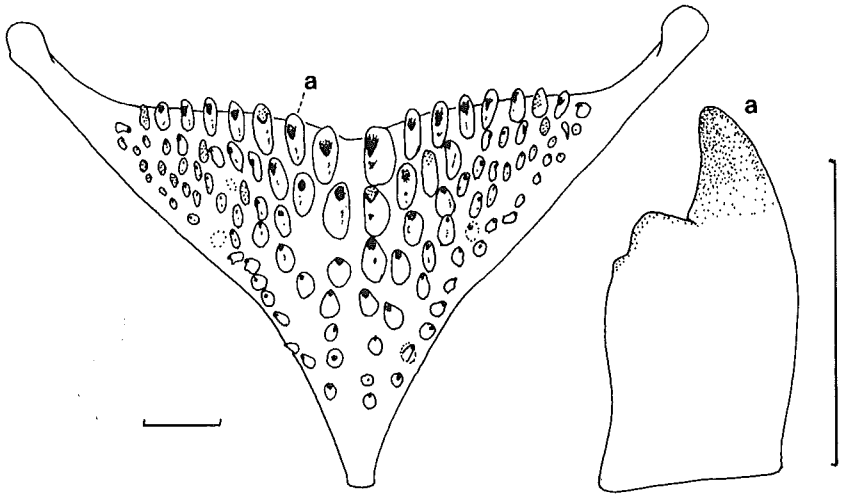

Figure 161. Occlusal view of lower pharyngeal tooth-plate and medial aspect of posterior, tricuspid, tooth (a) in *Laetacara flavilabris*, NRM SOK/ 1983355.3719, 71.2 mm SL. Scales 1 mm.

wide plain light grey seam. Pelvic fin dark grey outwardly, almost hyaline inwardly.

The suborbital stripe is retained more or less distinct to *c.* 40 mm SL, may be seen as trace to *c.* 50 mm.

Life colours. Koslowski (1985*a*, p. 173) has a colour photo of a breeding pair in aquarium, originally from the Quisto Cocha aguajal. In sexually active *L. flavilabris*, as observed in aquarium, the body is warm brown, with dark brown to black head markings, lateral band and midlateral spot; light bars and the light zone bordering the lateral band are contrastingly yellow; light scale bases form vertical, oblique thin bluish stripes on lower sides. The produced filamentous dorsal-fin rays are orange.

Distribution (figs 5, 157)
Collected in Peru, Ecuador and Brazil, localities scattered, chiefly in blackwater, near Pebas, Iquitos, Santa Cecilia, Coca, Colonia Angamos, on the lower Yavarí, Yurimaguas, in the von Humboldt national forest, and in the upper Juruá near Cruzeiro-do-Sul.

Ecology
Laetacara flavilabris for which habitat data are available were collected in forest streams and aguajales with clear, dark water. Saul (1975) reported insect debris, fish scales and shrimp in stomachs of two specimens (ANSP 130463) from Santa Cecilia.

Notes
Laetacara flavilabris is easily distinguished from *L. thayeri* with reference to average more slender shape, more scales (squ. long. 24 *vs.* 22), naked anal fin and dorsal fin moderately scaly, in large specimens only, and several colour pattern features such as lack of a dark blotch on nape.

Cope (1870) described *Acara flavilabris* as having 3 series of scales on the cheek, corrected to 2 series on cheek and one on interoperculum in Cope (1872), to 2 series on cheek and one on peroperculum (sic) in Cope (1878), and to 2 series on cheek, 1 on preopercle and 1 on interopercle in Cope (1894).

The description of *A. flavilabris* is probably based on a single specimen, stated to have a total length of four inches. Among several series of *Acara flavilabris* in ANSP, one specimen, ANSP 9156 is most likely be the holotype of the species. It is in any case recognizable as the specimen figured as *A. flavilabris* in Cope (1872), with reference especially to the characteristic erect dorsal and anal fins. This specimen, however, has a total length of only about 91 mm, which is much less than 4 inches (*c.* 102 mm). Dorsal and anal fin counts agree, among proportions there is marked disagreement with the length of the longest dorsal-fin spine said to equal muzzle by Cope, but I find it 2.56 times longer.

The description of *A. freniferus* is based on 'several specimens', and although including other species, the lot ANSP 9157-9179 seems to approximate the syntype series of *A. freniferus*. There are 8 *A. flavilabris* (now ANSP 9157, 9158-9164), 12 *Cichlasoma amazonarum* (now ANSP 9165-9176) and 2 probable *A. tetramerus* (now ANSP 9177-9178). The largest specimen in the lot (now ANSP 9157), an *A. flavilabris*, is now 110.7 mm TL with damaged caudal fin, and would agree with the 0.117 m given as total length for *A. freniferus* by Cope. This is the largest specimen known of *A. flavilabris*. Because the type series is polyspecific, it seems desirable to have a lectotype. The 110.7 mm TL specimen was called holotype by Böhlke (1984), but as the lot is a syntype-series it should properly be a lectotype. However, I suspect that some or most of the specimens in ANSP 9157-9179 actually represent material referred to as *A. flavilabris* in Cope (1872). Other old ANSP lots of *A. flavilabris* do not include specimens large enough to be considered potential types of either *flavilabris* or *freniferus*. The original labels on all lots are either illegible or missing.

Haseman (1911*c*) synonymized *Acara flavilabris*, *A. freniferus*, and

A. thayeri with *A. dorsiger* Heckel. In his discussion he refers to Cope's description and figure of *Acara flavilabris* and to Cope's count of scales for *A. freniferus*, and says that 'only one of Cope's many specimens belong to this species /*A. dorsiger*/. The remainder are *Cichlasoma bimaculatum*.' It seems certain that Haseman examined at least the large series of specimens in which the lectotype of *A. freniferus* is selected (ANSP 9157-9179), which contains several *Cichlasoma* specimens, otherwise his statement would be unclear. *Acara dorsiger*, to which probably belongs all or most material of Haseman, from Bolivian Amazonía and the Paraguay drainage, is a distinct *Laetacara* species.

ANSP 130463 is labelled as coming from a R. Conejo tributary, but was reported by Saul (1975) as being collected in a R. Aguarico tributary.

Cichlasoma Swainson

Plesiops (Cichlasoma) Swainson 1839, p. 230 (type species *Labrus bimaculatus* Linnaeus by subsequent designation in Kullander 1983*b*, p. 9).
Plesiops (Cichlaurus) Swainson 1839, p. 173 (variant equivalent to *Cichlasoma*, suppressed by first reviser, Swain 1883).
Cichlosoma Regan 1905*d*, p.61 (unjustified emendation of *Cichlasoma*).

Cichlasoma was subjected to an extensive revision recently (Kullander 1983*b*). From being a major, nearly pan-neotropical cichlid genus with over 100 species (cf. Regan 1905*d*), the revised diagnosis includes only 12 species, distributed in cis-Andean tropical-subtropical South America.

Cichlasoma species range in recorded maximum length from about 75 to about 135 mm. They have large scales (squ. long. 22-25, 23-24 most frequent; circumpeduncular scale series 16), and usually triserial, occasionally uniserial predorsal scale arrangement. The dorsal and anal fins are scaled basally. Anal-fin spine counts range from 3 to 6. Accessory lateral lines on the caudal fin are short or absent, positioned between rays D2 and D3, and V4 and V5 when present. The adult colour pattern includes a dark spot posterosuperiorly on the cheek, a large midlateral spot, a lateral band connecting the eye and midlateral spot (sometimes fainter to caudal-fin base), a more or less distinctly ocellated dark spot dorsally on the caudal-fin base, and a richly spotted caudal fin.

The osteological description of *Cichlasoma amazonarum* by Kullander (1983*b*) serves as standard reference for osteological descriptions of other taxa in this volume.

Cichlasoma is much more similar to *Aequidens* and genera hitherto included in *Aequidens* (eg. *Bujurquina, Laetacara* in this paper) than to groups previously referred to *Cichlasoma* (eg. *Mesonauta, Heros, Hypselecara* in this paper), and the closest relationships are probably rather with the *Aequidens*-like cichlasomines (large scales, three anal-fin spines) than with any of the remaining cichlasomines (small scales, polyacanth anal fin).

Cichlasoma amazonarum Kullander
Fig 162, Pl. XXXV (fig. 2)

Cichlasoma amazonarum Kullander 1983*b*, p. 115 (bibliogr.; diagn.; descr.; type-loc.: Peru, depto Loreto, R. Ampiyacu system, little upstreams of Pebas, Sacarita del Tuyé, right bank tributary of the R. Ampiyacu, floating meadow near mouth /Other Peruvian localities: Peru, 'Otocoro stream'; 'Otocoro R.'; 'Amazon, Maranon'; Yurimaguas; R. Shahuaya; near Tournavista; near Pucallpa, R. Neshuya tributary; Bosque Nacional Alexandre von Humboldt; Chauahan Cocha; Yarina Cocha; Contamana; Supay system; near

Iquitos; Quisto Cocha; Mishana; R. Ampiyacu; Pevas Cano/), Pl. V, figs 2-3, Pls. VI-VIII (monochrome photos), Figs 48-61 (sketches).

Peruvian bibliography

Heros bimaculatus; Cope 1872, p. 254 (note; the Ambyiacu). -- Cope 1878, p. 698 (listed; Peruvian Amazon).

Acara (Heros) bimaculata; Steindachner 1883, p.2 (listed /Peru/).

Cichlasoma bimaculatum; (*pt.*) Fowler 1940*a*, p. 280 (listed; Contamana; local name; bibliogr. only in part). -- Lüling 1975, p. 50 (listed; Yarina Cocha; R. Ucayali), Abb. 12*pt.* (monochrome photo, habitus). -- Lüling 1981, p. 178 ('Dunkelwasser' near Campo Verde; habitat data), Abb. 13*pt.* (monochrome photo, habitus).

Cichlaurus bimaculatus; Fowler 1944, p. 265 (Peruvian bibliogr.). -- Fowler 1945*a*, p. 246 (Peruvian bibliogr.).

Cichlaurus sp.; Bérenz & Zelada 1975, p. 52 (descr.; local names; markets of Iquitos), (?) Fig. 5 (sketch, habitus /species actually not recognized/).

Cichlasoma facetum; Lüling 1975, p. 50 (listed; Yarina Cocha; R. Ucayali), Abb. 10*pt.* (monochrome photo, habitus).

Aequidens portalegrensis; Lüling 1978*c*, p. 205 (Yarina Cocha; habitat data). -- Lüling 1979, p. 424 (Yarina Cocha; habitat), Abb. 3 (habitat photo, Yarina Cocha), Abb. 8 (monochrome photo, habitus; Yarina Cocha). -- Vierke 1983*d*, p. 441 (recorded; Yarinacocha).

Cichlasoma amazonarum; Busse 1984, p. 221 (type material listed).

Material

Number of specimens from Peru and adjacent Colombia (Leticia) and Brazil (Tabatinga, Tonantins) used by Kullander (1983*b*), with some recent additions, amounting to 645, largest 114.5 mm SL.

Description

This species is extensively described in a recent revision (Kullander 1983*b*) with consideration of particular Peruvian samples, to which is referred for descriptive data. The species can be distinguished from all other Peruvian cichlids except *C. boliviense* by the following combination of character states. Dorsal- and anal-fin bases scaly; anal-fin spines 3-6, though usually 4; 5 vertical bars behind that containing midlateral spot; caudal fin with light-margined caudal spot in dorsal lobe and asymmetrically dotted with dark and light; predorsal scale-pattern triserial. *Aequidens tetramerus* is the most similar species, easily distinguished by naked vertical fins, and invariably, 3 anal-fin spines. *Cichlasoma boliviense* is most conveniently distinguished by its 3 anal-fin spines.

Distribution (fig. 162)

The range of *C. amazonarum* mapped in Kullander (1983*b*) is considerably expanded by new material from the Tambo, Mayo and upper Yavarí. The species has also been collected at Tarauacá (Juruá) but there are no new collections expanding the Brazilian range, which extends along the Amazon east to Gurupá, without ascending any of the tributaries.

Ecology

Some collecting sites are described in Kullander (1983*b*). The species is commonly taken in fish culture ponds or other 'unnatural' habitats where it is then plentiful and usually of stunted appearance. 'Natural' habitats are floating meadows in lentic white water.

Local name

Bujurqui, bufurque (Berenz & Zelada 1975: markets of Iquitos). The local appellation 'Acara', is provided by Fowler (1940*a*) for Contamana specimens.

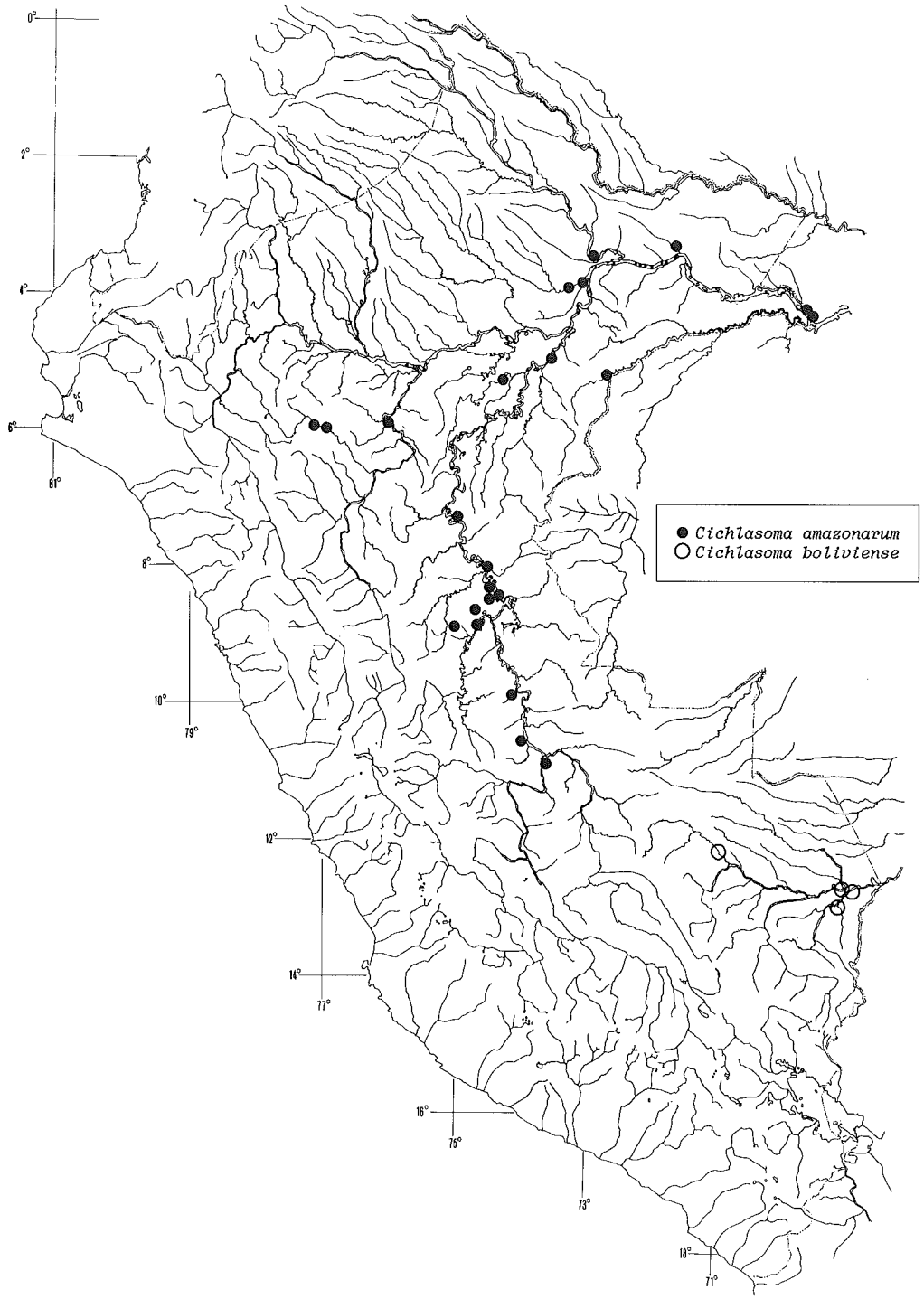

Figure 162. Collecting localities of *Cichlasoma* species in western Amazonía. A symbol may represent more than one, adjacent collecting sites.

Cichlasoma boliviense Kullander
Fig. 162, Pl. XXXV (fig. 3)

Cichlasoma boliviense Kullander 1983*b*, p. 165 (bibliogr.; diagn. descr.; type-loc.: Bolivia, depto Santa Cruz, R. Guaporé system, R. Uruguaito, tributary of the R. Quizer, 13 km S San Xavier; Peruvian loc.: Puerto Maldonado), Pls VIII, figs 2-3 (monochrome habitus photos), Figs 62-66 (sketches).

Peruvian bibliography
Cichlasoma boliviense; Busse 1984, p. 222 (type material listed).

Material
271 Peruvian specimens, 7.5-107.5 mm SL.

Descriptive notes
The description in Kullander (1983*b*) applies. *Cichlasoma boliviense* is similar to *C. amazonarum*, but readily recognized by the 3 rather than 4 anal-fin spines. The posterior sides are commonly mottled dark on light, and the caudal spot prominently ocellated. Staeck & Linke (1985) have a colour photo of a living Bolivian specimen maintained in aquarium. Yellowish preorbital and light blue lower lip as in that specimen were the only notable colours of large specimens from SOK 64.

Distribution
Most of the new material is from near the locality of Peruvian material previously reported (Kullander 1983*b*, R. Tambopata near Puerto Maldonado), but a single specimen is from the R. Manú. The species is widely distributed in Bolivia, from where comes material in addition to that listed in the original description: Mamoré system: near Trinidad, near Mineria, near Yapacaní, and R. Guaporé system: R. Blanco.

Ecology
Personal collections are from Lago Túpac Amaru (SOK 58) where a large number of mostly juvenile specimens were seined from a shallow clayey portion of the shore, and from shallow cattle pools (SOK 64) with muddy water. *Cichlasoma boliviense* would seem to be a turbid water species like *C. amazonarum*.

Aequidens Eigenmann & Bray

Astronotus (Aequidens) Eigenmann & Bray 1894, p. 616 (type species *Acara tetramerus* Heckel, by original designation).

Aequidens species are moderately large (reaching about 120-160 mm SL), moderately deep-bodied *Cichlasoma*-like cichlids with triserial preorsal scale pattern, 2 supraneurals, usually 13+13 (12+13 occurs) vertebrae, slender first epibranchial, minute interarcual cartilage, large scales (squ. long. usually 24; 16 circumpeduncular scale series), three anal-fin spines, comparatively small mouth with pluriserial unicuspid dentition, few gill-rakers (4-6), rounded to subtruncate caudal fin, 1-2 tooth-plates on 4th ceratobranchial, microgill-rakers externally on 2nd to 4th gill-arches and occasionally internally on 4th, acessory caudal-fin lateral lines very rarely occurring; a cheek spot like *Cichlasoma*, a midlateral spot, and a dorsally positioned more or less ocellated caudal-fin base spot.

Aequidens, counting known undescribed forms, includes little more than a dozen species in the Orinoco, Amazon, Tocantins, Parnaíba and Paraguay drainages, and the Guianas. Until my recent review (Kullander 1983*b*), the genus encompassed also species now referred to *Cichlasoma, Laetacara, Bujurquina* and other genera. No autapomorphic character has been proposed to diagnose *Aequidens s. str.*, and the monophyly of the group is a subject

for critical investigation. From what is known about external morphology and anatomy, *Aequidens* species are similar to *Cichlasoma* species. Distinguishing characters of *Aequidens* include (1) naked instead of scaled vertical fins, (2) longer caudal peduncle (2-3 vertebral centra included), (3) cycloid prepelvic scales, (4) 4-5 instead of 6 vertical bars on side from that including midlateral spot back to caudal peduncle, (5) dorsal accessory caudal-fin lateral lines between rays D3 and D4 instead of rays D2 and D3, (6) lateral band from head to caudal fin, instead of ending with midlateral spot, (7) long instead of short or absent parhypural spine (cf. also Kullander 1983*b*). Character states 3-4 occur also in *Cichlasoma* and the diagnosis does not include the little studied *A. chimantanus* Inger and *A. viridis* Heckel.

Members of the genus are chiefly black-/clear-water forms and several, like the Peruvian *A. diadema* and *A. patricki* are very colourful. The ubiquitous *Aequidens tetramerus* is frequently collected from white-water and is also drab-coloured though life colours vary with habitats. Somewhat detailed descriptions of particular species were published recently (Kullander 1984*a,b*).

Aequidens tetramerus (Heckel)

Figs 163-166, Pls XXXVI-XXXVII, Table 26

Synonymy

Acara tetramerus Heckel 1840, p. 341 (descr.; diagn.; Rio-branco).

Chromys uniocellata Castelnau 1855, p. 15 (descr.; rio Ucayale, mission de Sarayacu), Pl. 6, fig. 1 (coloured drawing, habitus).

Aequidens stollei Ribeiro 1918, p. 13 (descr.; Rio Jamary), Est. V, 3 figs (monochrome photos, habitus).

Acaronia trimaculata Allen, in Eigenmann & Allen 1942, p. 380 (descr.; Iquitos), Pl. XXII, fig. 8 (monochrome photo of holotype, habitus).

Peruvian bibliography

Acara uniocellata; Günther 1862, p. 281 (bibliogr.; diagn., data from Castelnau 1855).

Acara tetramerus; Cope 1872, p. 255 (listed; Ambyiacu River). -- Steindachner 1883, p. 2 (note; Rio Huallaga und Rio Amazonas, Iquitos). -- (*pt.*) Pellegrin 1904, p. 171 (descr., incl. syntypes of *Chromys uniocellata*). -- Regan 1913*a*, p. 282 (listed; River Ucayali, Peru).

Acara (Acara) tetramerus; (*pt.*) Steindachner 1875, p. 65 (status of *Chromys uniocellata* discussed).

Aequidens tetramerus; Fowler 1940*a*, p. 289 (listed; Ucayali River; ref. to Castelnau 1855). -- Fowler 1944, p. 262 (Peruvian bibliogr.). -- Fowler 1945*a*, p. 243 (Peruvian bibliogr.). -- Bérenz & Zelada 1975, p. 53 (descr.; local name; markets of Iquitos), Fig. 7 (sketch, habitus). -- Saul 1975, p. 120 (habitat, reproduction, food; Lower lake...creek tributary of the Rio Conejo /Santa Cecilia/). -- (*pt.*) Lüling 1978*a*, p. 128 (habitat data; aguajal between Iquitos and Quisto Cocha; not *Crenuchus*, a characid), Abb. 9 (monochrome photo, habitus /ZFMK 8665-8666*pt.*/).

Acaronia trimaculata; Fowler 1944, p. 261 (bibliogr.). -- Fowler 1945*a*, p. 242 (bibliogr.). -- Fowler 1954, p. 262 (bibliogr.).

Chromys uniocellata; Blanc 1962, p. 206 (syntypes listed).

Aequidens portalegrensis; Lüling 1975, p. 50 (listed; Yarina Cocha, R. Ucayali), Abb. 11*pt.* (monochrome photo, living specimen).

Aequidens uniocellatus; Kullander 1984*b*, pp. 5 (distr.), 6 (comparison with *A. patricki*), Fig. 8 (colour photo; Yarina Cocha). -- Staeck & Linke 1985, p. 37 (popular account; habitat data; R. Tambo tributary; vicinity of Pucallpa).

Material
220 specimens, including 45 Madre de Dios specimens, syntypes of *Chromys uniocellata* and paratypes of *Acaronia trimaculata*, and extralimital material from the upper Napo, Içá and Juruá; size range 12.1-161.6 mm SL.

Description of Ucayali-Amazonas drainage material
From medium-sized adults, *c.*80-*c.*125 mm unless otherwise stated; counts from 39 measured specimens; measurements summarized in Table 26. See Pls XXXVI and XXXVII (fig. 1) for general aspect.

Shape. Moderately deep; snout short, blunt or very slightly extended. Interorbital wider than mouth; maxilla reaching to or not quite to orbit.

Scales. Squ. long. 24 (36), 25 (3); predorsal scales cycloid or weakly ctenoid. Cheek scales in 3 (34), 4 (5) series. Upper lateral line at 3 (anteriorly) to 1 1/2 (posteriorly) scales distance from dorsal fin; counts 15/8 (1), 16/7 (1), 16/8 (8), 16/9 (5), 17/7 (5), 17/8 (15), 17/9 (4), plus two scales on caudal-fin base; accessory caudal fin lateral line canal between rays V4-V5 in 6 specimens, in one specimen a tubed scale on left side between rays D3 and D4, well-preserved specimens with series of pored scales in these positions. Caudal-fin scaly area concave, scales reaching about middle of fin marginally, 1/4-1/3 medially.

Fins. First dorsal-fin spine 1/3-2/5 length of last, spines subequal in length from 5th or 6th, last 2-3 increasing; soft fin pointed, rarely with filamentous extension, reaching beyond 3/4 of caudal fin or shorter. D. XV.10 (24), XV.11 (8), XVI.9 (5), XVI.10 (2). Anal fin pointed, without prolongation, reaching about middle of caudal fin. A. III.7 (3), III.8 (32), III.9 (4). Pectoral fin with rounded tip in young, pointed in large specimens, 4th ray longest, reaching to above last spine or first ray of anal fin. P. 13 (5), 14 (31), 15 (3). Pelvic fin inserted slightly posterior to vertical from pectoral axilla; pointed; outer branch of first ray with filamentous extension in adults, reaching at most to end of anal-fin base. Caudal fin with rounded or subtruncate hind edge.

Gill-rakers. 1-2 epibranchial, one in angle, and 4 (5), 5 (25), 6 (9) ceratobranchial rakers externally on first gill-arch (fig. 163). Microgill-rakers externally on 2nd to 4th arches, occasionally also internally on 4th arch.

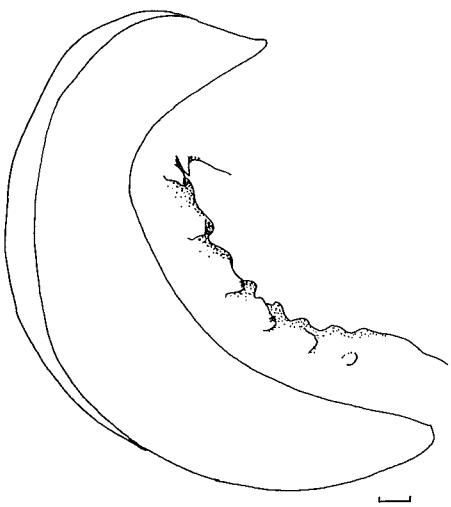

Figure 163. External aspect of first gill-arch in *Aequidens tetramerus*, NRM SOK/1981357.3558, 82.6 mm SL. Scale 1 mm.

Jaw teeth. 11-21, $\bar{x}$=16.8±0.37/16-26, $\bar{x}$=20.5±0.37 in upper/lower jaw hemiseries in 35 specimens 34.2-146.0 mm SL; fewer teeth in upper jaw or, rarely, equal numbers; 2 (young) to 3 (large) inner series anteriorly in upper jaw, 2 (in one) -4, modally 3 inner series anteriorly in lower jaw.

Tooth-plates. In 82.6 mm specimen dissected, lower pharyngeal tooth-plate (fig. 164) with anterior and marginal teeth subconical or with slight subapical swelling and posterior erect or retrorse (anteriorly) or antrorse (posteriorly) cusp; inner teeth compressed, with posterior antrorse cusp and anterior long shelf; no tricuspid teeth. 4th ceratobranchial with single tooth-plate with 8 teeth. An 80.0 mm specimen similar, but with 2 4th ceratobranchial tooth-plates having 10 and 6 teeth, respectively.

Vertebrae. 13+13 (4).

Colouration. Dull, general appearance countershaded with, rarely without distinct dark cheek spot, black midlateral spot bordered by indistinct light vertical stripes, caudal spot most prominent marking, black, bordered with light or silvery dots; fin markings indistinct, restricted to faint spots in dorsal and caudal fin.

Adults with yellowish white ground colour, pure ventrally on chest, along middle of abdomen, dusky ventrally on head and lower chest and abdominal sides; cheek dirty yellow; snout grey dorsally, operculum light greyish brown dorsally. Sides countershaded, darkening to brown on back and nape. White stripe from orbit to nostril distinct. Cheek spot posterosuperiorly on cheek, of varying shape, usually round to subtriangular, brown to blackish; only in Nanay and Itaya drainage specimens (92.9, 82.8, 117.4, 118.4, 99.8 mm) and one Yarina Cocha specimen (66.2 mm) with little fainter ventral extension along preopercular margin down onto inner edge of preopercular corner, in some specimens in other samples, however, a thin, shorter line, ventrad from cheek spot proper. In several Nanay specimens spot obscure or absent.

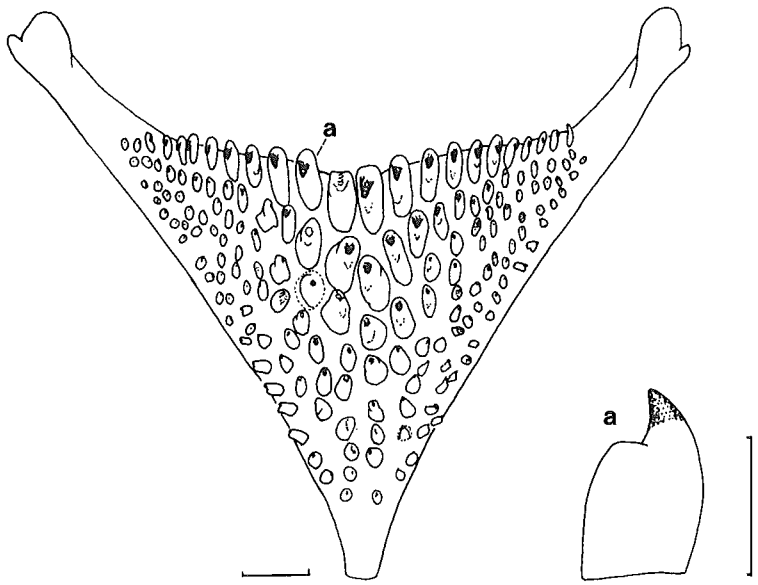

Figure 164. Occlusal view of lower pharyngeal tooth-plate and medial aspect of posterior tooth (a) in *Aequidens tetramerus*, NRM SOK/1981357.3558, 82.6 mm SL. Scales 1 mm.

Midlateral spot blackish, in squ. long. scales 8-10, 8-11, 9-11 or 9-12, (usually 9-11), and 1/4 of scales below, little fainter dorsally to lateral line; narrow light line bordering anteriorly and posteriorly, from close to dorsal-fin base ventrally onto abdominal sides. Faint brownish lateral band from below lateral line origin, on squ. long. scales and dorsalmost portion of those below, straight to just in advance of end of caudal peduncle, above lower lateral line shifting course to run on lower halves of squ. long. scales + upper halves of lateral line scales. Dorsal edge of pectoral axilla faintly darkened.

Dorsal fin semitransparent grey; frequently showing two horizontal series of light spots on spinous portion; soft part with indistinct light spots in cross-series. Anal fin light grey; rarely a few light spots on posterior membranes. Caudal fin immaculate, light grey or with a very indistinct asymmetrical pattern of light grey and opaque spots; dark brown caudal spot about ovate, from level of lower lateral line to dorsal edge of fin, margined by light, yellowish, lines anteriorly (on caudal peduncle edge) and posteriorly sometimes also distinctly around ventral edge; Jenaro Herrera, some Nanay, and Yarina Cocha material with anterior light edge silvery and silvery spots in posterior light edge, occasionally also other adjacent silvery spots. Pelvic fin lightly pigmented inwardly, gradually darker grey outwardly, prolonged ray edge usually whitish.

Adults with rather uniform flanks (excepting lateral spot, light bars and faint lateral band); young, however, with sides posterior to lateral band more or less distinctly barred, usually 3 dark vertical bars, but middle or two anterior commonly more or less completely split vertically. Juveniles light with sharp straight lateral band and distinct, though pale vertical bars; those less than 20 mm with lateral spot contained within lateral band, those larger with spot slight dorsad extended; caudal spot a bar across caudal fin base, but more intense dorsally, in those less than 20 mm, clearly epaxial in those larger. Suborbital stripe in juveniles contrasting, from orbit across cheek onto lower limb of preoperculum, very little curved, gradually fainter in larger specimens, distinct to *c.* 35 mm, then gradually replaced by cheek spot, which distinct from *c.* 40 mm.

Life colours. A single specimen (not preserved) from Yarina Cocha (SOK 34) kept in aquarium to a size of *c.* 12 cm was overall grey, countershaded to whitish ventrally on abdomen and on chest. The lower jaw and adjacent gill-cover and cheek were yellowish. Narrow vertical bars margined the blackish midlateral spot. Silvery spots ringed the caudal spot and spread over the adjacent caudal fin and caudal peduncle. The dorsal portion of the iris was bright red, the rest silvery. The fins were very fainly marked.

A specimen from Quisto Cocha (SOK 35a), also kept in aquarium, was overall grey, never developing the yellow anteroventral colouration seen in the Yarina Cocha specimen. Otherwise the two were very similar.

A specimen from SOK 51 (lower Nanay) also kept in aquarium, differed significantly from the other two aquarium specimens. It developed an emerald iridescence over most of the flank and the yellow colour of the lower head was more golden than in the Yarina Cocha *A. tetramerus*. This specimen never showed a cheek spot. The iris was reddish dorsally. The caudal spot was ringed with silvery. Greenish iridescent flank sheen was conspicuous also in specimens from Nanay localities SOK 36 and SOK 71.

A freshly caught specimen from SOK 104 was overall olivaceous; belly and chest whitish. There was a faint green iridescence close to the cheek spot dorsally; otherwise no colours were expressed.

Description of Madre de Dios material

Available 46 specimens, 13.5-138.2 mm SL. Description from 132.5 mm specimen (male), unless otherwise stated; counts from 23 measured specimens summarized in Table 26. Refer to Pl. XXXVI, fig. 2, for general aspect.

Shape. Moderately elongate. Large males with rather steep frontal contour and level posterior nape contour compared to females, with gently arched

predorsal contour. Interorbital about as wide as mouth; maxilla not reaching to vertical from orbit. Snout bluntly rounded.

Scales. Squ. long. 24 (22), 25 (1); predorsal scales weakly ctenoid. Cheek scales in 3 (22), 4 (1) series. Lateral lines: -/8 (1), 17/7 (2), 17/8 (11), 18/7 (2), 18/8 (6), 18/9 (1), plus 0-1 or, usually, two tubed scales on caudal-fin base; two specimens with a tubed scale between caudal-fin rays V4 and V5. Caudal-fin squamation concave, to 1/4 medially, to near middle of fin marginally.

Fins. First dorsal-fin spine 2/5 length of last, spines subequal from 6th, last 4 again increasing in length; soft fin pointed, with broad prolongation formed by rays 3-5, 5th longest, to end of caudal fin. In other specimens dorsal-fin prolongation may reach beyond caudal fin, but is usually shorter. D. XV.10 (4), XV.11 (18), XV.12 (1). Soft anal fin pointed, 4th ray slightly produced, reaching middle of caudal fin. A. III.8 (7), III.9 (16). Pectoral fin with pointed, occasionally rounded tip, reaching to above first to last anal-fin spine; P. 13 (2), 14 (18), 15 (3). Pelvic fin pointed, outer branch of first ray prolonged, reaching 3rd anal-fin spine (commonly shorter). Caudal fin rounded (may be subtruncate).

Gill-rakers. 1-2 epibranchial, 1 in angle and 4 (5), 5 (17), 6 (1) ceratobranchial rakers externally, on first arch. Microgill-rakers externally on 2nd to 4th arches, variably internally on 4th arch.

Jaw teeth. 20 specimens 42.9-138.2 mm SL with 12-20, $\bar{x}$=16.4±0.54/14-24, $\bar{x}$=18.2±0.55, teeth in upper/lower jaw outer hemiseries.

Tooth-plates. Lower pharyngeal tooth-plate densely toothed in 116.4 mm specimen dissected (fig. 165); anterior and marginal teeth subconical, inner and posterior teeth compressed, with short anterior shelf or bulge and posterior cusp which frequently flat- or round-worn. 4th ceratobranchial with one tooth-plate with 2 teeth.

Vertebrae. 13+12 (1), 13+13 (2).

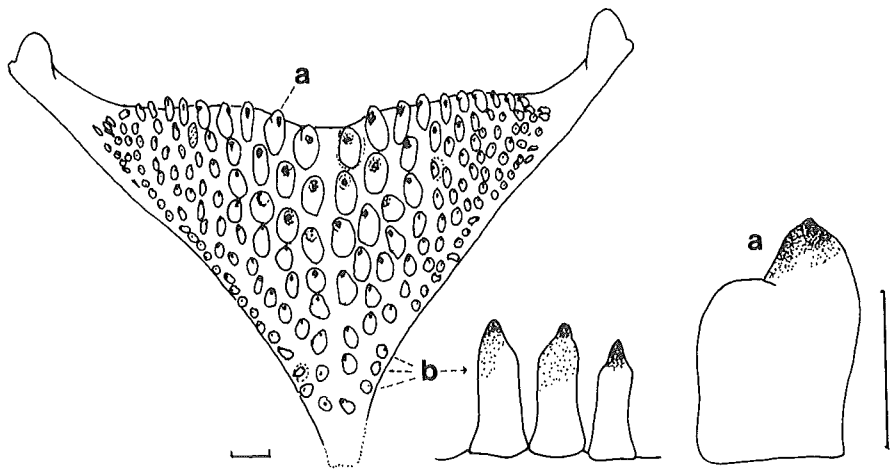

Figure 165. Occlusal view of lower pharyngeal tooth-plate, with medial aspect of a posterior (a) tooth and lateral aspect of 3 anterior (b) teeth in *Aequidens tetramerus*, NRM SOK/1983325.3798, 116.4 mm SL. Scales 1 mm.

Colouration. Chest and abdomen medially slightly dusky whitish; lower head pale greyish white; sides countershaded, light brownish grey on flanks, dark grey-brown on back; nape and forehead dark grey. Cheek light brownish grey; gill-cover brownish grey. Whitish stripe from eye to nostril. Cheek spot triangular, dark brown. Intense dark brown lateral band from eye over dorsal margin of gill-cover onto flanks, running chiefly on squ. long. scales, interrupted 1 scale in advance of midlateral spot, slightly ventrad shifted posteriorly, lower margin along lower lateral line tube-series, to near hind edge of caudal peduncle. Midlateral spot black, squarish, in squ. long. scales 9-12, dorsally to cover upper lateral line scales; light vertical stripe, one scale wide, bordering anteriorly and posteriorly, reaching ventrally to abdominal sides. Blackish band along superoposterior margin of orbit.

Dorsal fin greyish with 2 horizontal series of light spots from middle of spinous dorsal fin; cross-series of light spots on inner half of soft dorsal fin not distinct. Anal fin grey, darker along ventral margin; a few light spots on last 2 membranes. Pelvic fin greyish, darker outwardly, outer edge of first ray white. Caudal spot round, black, above level of lower lateral line, to dorsal fin margin; light border not clearly defined; fin base ventrally light greyish brown; membranes of lower lobe of caudal fin with alternating grey and hyaline oblique stripes, turning spots along distal margin, dorsal lobe membranes hyaline except distally where light grey with hyaline spots.

Midlateral spot position slightly variable, in squ. long. scales 9-11, 9-12, 8-12 or 10-12; some specimens with otherwise uniform colour of sides posterior to midlateral spot subdivided by lighter bars into 3 or 4 dark vertical bars; light zone around caudal spot variably distinct, never including silvery spots; light spots in dorsal fin variably distinct; lateral band usually interrupted or fainter where crossed by light bars bordering midlateral spot. Young (<90 mm) similar to large adults, trace of suborbital stripe retained to at least *c.* 50 mm SL, cheek spot appearing between *c.*30 and *c.*40 mm; caudal fin immaculate; 3-4 dark vertical bars posterior to midlateral spot not reaching above lateral line in those *c.*30 mm and smaller; at *c.*15 mm caudal spot expressed chiefly as a midbasal black dot, but epaxial from *c.*20 mm.

Distribution (fig. 166)

Material referable to *Aequidens tetramerus* has been collected throughout the Amazon, and in the Tocantins, Orinoco, Parnaíba drainages and in the Guianas. In western Amazonía, *A. tetramerus* is one of the most wide-spread species (fig. 166), taken in the Madre de Dios, Ucayali-Amazonas, Yavarí, Juruá, Içá, and upper Napo.

Table 26. *Morphometry of* Aequidens *species in Peru. Measurements are in per cent of SL, except SL (in mm).*

	A. tetramerus Ucayali-Amazonas			*A. tetramerus* Madre de Dios			*A. diadema*		
	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$	n	Range	$\bar{x}\pm s(\bar{x})$
SL (mm)	39	34.2-161.6	87.1±5.06	23	41.5-138.2	91.6±6.91	10	49.1-117.7	72.0±6.75
Head length	39	30.2- 36.5	33.1±0.23	23	30.1- 35.8	32.1±0.33	10	31.2- 34.8	33.2±0.38
Snout length	39	5.8- 10.8	7.8±0.20	23	6.1- 8.9	7.5±0.15	10	7.4- 8.5	8.2±0.22
Body depth	39	44.4- 49.0	46.9±0.21	23	42.3- 48.5	46.7±0.26	10	41.8- 44.8	43.4±0.35
Orbital diameter	39	10.0- 16.7	12.3±0.22	23	10.0- 15.2	12.0±0.35	10	10.3- 13.8	12.3±0.38
Head width	39	18.8- 22.2	20.3±0.13	23	18.7- 20.8	19.5±0.12	10	17.0- 19.1	18.2±0.22
Interorbital width	39	10.8- 18.7	13.8±0.26	23	10.4- 15.0	12.7±0.29	10	10.2- 12.8	11.2±0.23
Preorbital depth	39	4.4- 11.4	7.5±0.24	23	4.9- 9.1	7.4±0.27	10	6.2- 9.1	7.2±0.31
Caudal peduncle depth	39	16.2- 18.4	17.4±0.09	23	16.6- 19.1	17.9±0.14	10	15.0- 16.9	16.2±0.19
Caudal peduncle length	39	8.5- 12.0	10.8±0.13	23	9.4- 12.2	10.6±0.15	10	11.1- 12.4	11.7±0.14
Pectoral-fin length	34	36.5- 43.2	39.2±0.30	21	36.2- 40.4	37.8±0.25	10	32.2- 36.1	33.8±0.39
Pelvic-fin length	37	32.2- 50.7	38.4±0.68	23	27.4- 47.7	37.1±1.19	10	31.0- 37.1	32.7±0.60
Last dorsal-fin spine length	38	16.0- 20.5	18.5±0.19	22	16.6- 19.5	17.8±0.16	10	15.2- 17.0	16.1±0.20

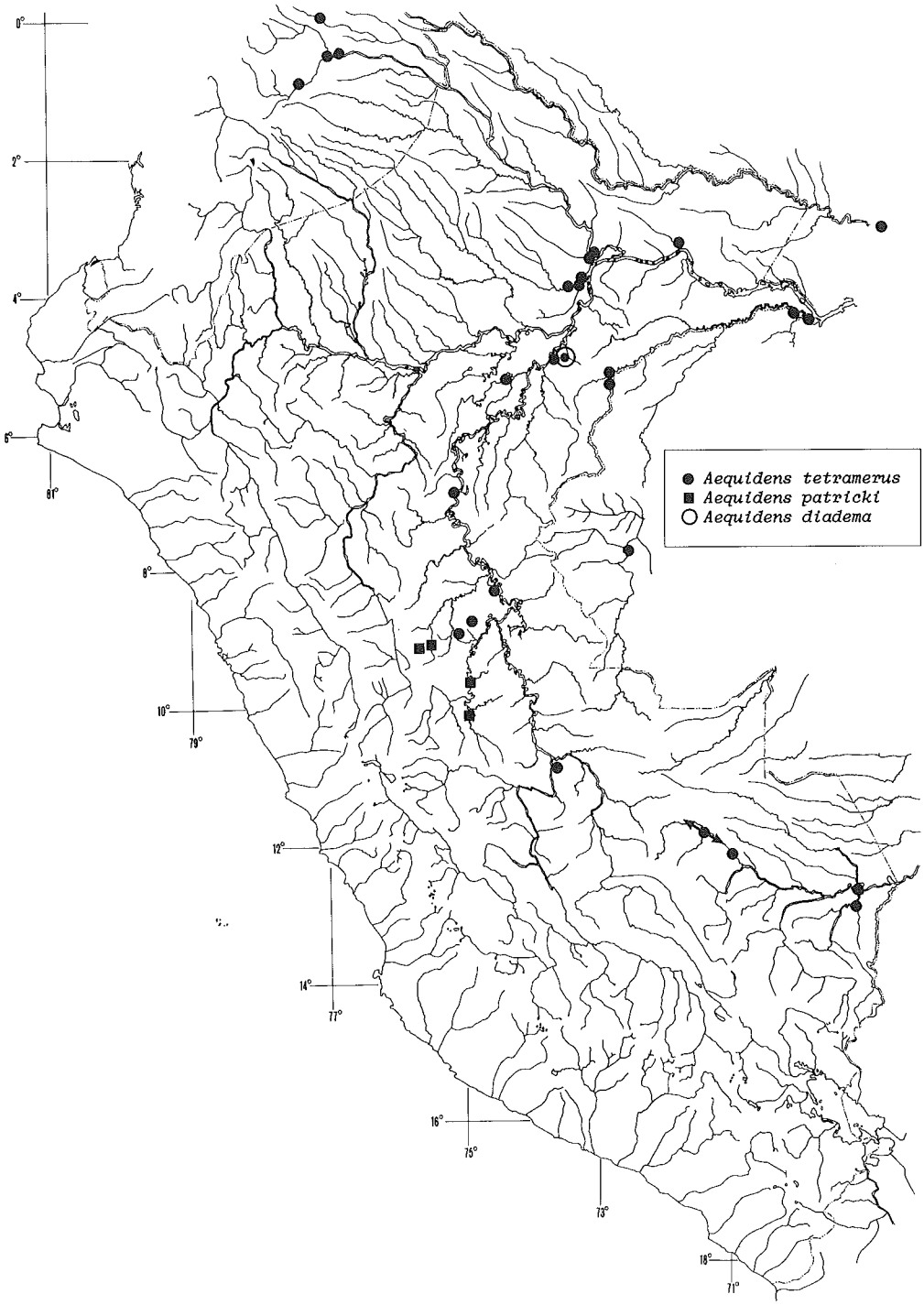

Figure 166. Collecting localities of *Aequidens* species in western Amazonia. Total known range for *Ae. patricki*. A symbol may represent more than one, adjacent collecting sites. Arrows distinguish imprecise Manú locality.

Ecology

Most western Amazonian collecting sites are in black-water drainages such as the Nanay. Habitats range from small forest streams through lakes. In Yarina Cocha the species was collected in a caño of rather dark water, and not in the lake proper (white-water); SOK 104, a pool on a Napo sand bank island, was, however, a typical white-water gramalotal.

Notes

The *Aequidens* from the Madre de Dios drainage is different from *A. tetramerus* from the Ucayali-Amazonas drainage. Shape features are similar and no mensural data distinguish the forms, although sexual dimorphism in head shape is not evident in Ucayali-Amazonas *A. tetramerus*. Madre de Dios material is more boldly marked, with a prominent squarish midlateral spot reaching above the lateral line tube-series, and lateral band intense in large adults. Fin markings are also more conspicuous in Madre de Dios material. Modal dorsal-fin (D. XV.11) and anal-fin (A. III.9) counts are higher than in Ucayali-Amazonas material (D. XV.10, A. III.8).

The Madre de Dios form is not recognizable as a different species, as the colour pattern dissimilarity is referable to a lesser intensification of particular components and modal counts are adjacent. Modal vertical fin counts agree with those of Guianas *A. tetramerus* rather than with Ucayali-Amazonas *A. tetramerus*.

I have not seen any well-preserved *A. tetramerus*-like *Aequidens* from Bolivia or adjacent Brazilian Amazonía. A specimen from the R. Guaporé (AMNH 39950) is not well-preserved. Pearson (1925) reported *A. tetramerus* from near Reyes.

Aequidens tetramerus is based on two specimens from the R. Branco (NMW 33757-33758). R. Branco and Guianas material of *A. tetramerus* averages slenderer than similar forms from elsewhere and have modal counts D. XV.11 and A. III.9. These are also dark-coloured fishes with vividly spotted caudal-fin. The deep-bodied Peruvian form with D. XV.10, A. III.9 modal, ranges east at least to Manaus. Material referable to either form, or maybe slightly different, is collected throughout the Amazon and Orinoco basins and in smaller Atlantic rivers (Guianas to Parnaíba).

Aequidens tetramerus from the R. Branco and Surinam (Kullander *et al.* 1986, and unpublished) are consistently dark-coloured, with well-patterned unpaired fins, in contrast to the lighter Ucayali-Amazonas *A. tetramerus* with barely visible fin pattern. They also average slenderer, (depth 43.0-48.0 % of SL x=45.3 ±0.44, n=13, 81.8-125.7 mm SL; 44.4-49.9 %, x=47.3±0.37, n=11, 80.6-125.0 mm SL in Peruvian material) and have shorter pectoral fin (34.4-39.3, x=37.3±0.44 % of SL; in Peruvian material 37.1-42.4, x= 39.8±0.63, n=9, 80.6-125.0 mm SL). D. XV.11 and A. III.9 are modal fin counts, to be compared with D. XV.10 and A. III.8 in Ucayali-Amazonas *A. tetramerus*.

The type-series of *Chromys uniocellata* consists of 2 poorly preserved specimens, MNHN A.9481, *c.* 53.7 and *c.* 135.5 mm SL. The larger specimen is obviously the one figured by Castelnau (1855, Pl. VI, fig. 1), but is more elongate than he shows it (depth *c.* 47.4% of SL). The description mentions an ocellated spot on 'le dos à la base de la nageoire dorsale', but 'dorsale' is likely a misprint for 'caudale', as an ocellated caudal spot is figured. In addition, not mentioned or figured by Castelnau, there is a trace of a dark spot on squ. long. scales 8-10; the caudal spot now appears only as a trace. The specimen has D. XV.10, A. III.8, squ. long. 24, lateral lines 18/7, 5 gill-rakers. The pectoral fin reaches to above about the 4th anal-fin ray.

Acaronia trimaculata was described from a series of specimens with deep, stripe-like cheek spot characteristic of Nanay and Itaya specimens. I have examined two topoparatypes, USNM 167768; Allen's (Eigenmann & Allen 1942) description and figure of the holotype leaves no doubt as to the identity of this form. The assignation to *Acaronia* is unexplainable.

The Ucayali-Amazonas *A. tetramerus* is somewhat variable in shape and some colour pattern features. I have to no avail tried to subdivide the Peruvian material available, but even though the variation shows a certain tendency to geographical centering, it is not practically possible to consider more than one species.

The type specimens of *A. uniocellatus* are in bad condition and not referable with greater certainty to one more than to another of the forms that inspired a search for slight species differences amongst the Peruvian *A. tetramerus*.

One form was described by Allen (in Eigenmann & Allen 1942) as *Acaronia trimaculata*, and has the cheek spot extending as a stripe along the preopercular margin (Pl. XXXVI, fig. 2). This marking is seen only in specimens collected near Iquitos and, less well-developed, in Yarina Cocha material, but not in all *A. tetramerus* from these places. Other *A. tetramerus* may feature a thin streak of dark pigment running slightly ventrally from the cheek spot proper, and the shape and size of the spot is variable within samples. In the absence of any correlated difference from *A. tetramerus* with normal cheek spot, there seems to be no argument for recognition of *trimaculata*.

Another 'form' is that recognized by adult life colours and collected only in the Nanay drainage; it is characterized by green iridescence over the flanks and faint or absent cheek spot (faint or absent also in preserved material; Pl. XXXVII, fig. 1). In one locality this 'green form' and 'trimaculata form' were collected together (SOK 36). Comparison of a living specimen of the 'green form' with normal grey specimens in aquarium brought out life colour differences very dramatically. Preserved material cannot be satisfactorily separated into one or another 'form'. Data on colour variation in the 'grey form' are too scant to permit a satisfactory characterization.

Aequidens patricki Kullander

Fig. 166, Pl. XXXVII (fig. 1)

Aequidens patricki Kullander 1984*b*, p. 2 (bibliogr.; descr.; /locs near Aguaytia and Panguana/), Figs 1 (colour photo, holotype, habitus), 2 (sketch, gill arch), 3 (sketch, lower pharyngeal tooth-plate).

Bibliography

Aequidens tetramerus; (*pt.*) Eigenmann & Allen 1942, p. 392 (listed: creek, Pto. Bermudez; life colours). -- Foersch & Hanrieder 1980, p. 691 (capture of ZFMK 10770-10771).

Aequidens cf. tetramerus ; Lüling 1978*b*, p. 28 (mentioned). -- Lüling 1980*a*, p. 181, 182 (habitats, identification, /ZFMK 10766-10769/), figs 3 (habitat), 9 (upper: monochrome photo, habitus, /ZFMK 10768/). -- (*pt.*) Lüling 1980*b*, p. 41 (habitat data, only Llullapichis material), Abb 1 (monochrome photo, 2 freshly captured specimens).

Material

Holotype, 11 paratypes, and 17 additional specimens, 14.8-116.2 mm SL.

Description

Only six specimens have been collected since the original description, but one of the samples reported by Eigenmann & Allen (1942) as *A. tetramerus* was found to be *A. patricki*. Another CAS specimen was found in a series of *Crenicichla sedentaria*. As the original description is fairly detailed, only a few notes are given here. In shape, finnage and counts, *A. patricki* is similar to other *Aequidens* in this paper. Colouration is most similar to that of *A. diadema*, but large dark (blue-green in life) spots on cheek and gill-cover are species diagnostic; hyaline caudal-fin spots are distinct, fin otherwise reddish in females.

Counts (from Kullander 1984*b*, some plus new material): squ. long. 24 (28); D. XIV.11 (2), XIV.12 (1), XV.10 (2), XV.11 (17), XVI.10 (5), XVIII.11 (1, abnormal); A. III.8 (5), III.9 (23); P. 14 (22); lateral lines 16/8 (1), 16/9 (1), 17/7 (4), 17/8 (12), 17/9 (4); cheek scale series 3 (16), 4 (6), gill-rakers 4 (7), 5 (19), 6 (1), vertebrae 13+12 (1), 13+13 (3).

Distribution (fig. 166)
Streams in the Aguaytía drainage near Aguaytía, and in the Pachitea drainage near Panguana and Puerto Bermúdez. Habitat data and photos have been published as recorded in the bibliography.

Notes
This and the following species, *A. diadema*, together with *A. metae* Eigenmann (upper Meta drainage) and *A. pallidus* (Heckel) (lower Negro drainage), form a species group characterized in distinction from other *Aequidens* species by characters in combinations: short pectoral fin, iridescent blue spots and/or lines on head sides, dark-edged dorsal scales and relatively narrow head.

Aequidens diadema (Heckel)
Figs 5, 166, 167, Pl. XXXVIII (figs 2-3), Table 26

Acara diadema Heckel 1840, p. 344 (diagn.; descr.; Ygarapé oder Waldbache bei Marabitanos).

Peruvian bibliography
"*Aequidens*" spec.; Staeck & Linke 1985, p. 33 (popular account; habitat data; Jenaro Herrera), fig. p. 33 (colour photo, living aquarium specimen).

Material
201 specimens from Peru, many of which juveniles, young and/or in bad condition, largest specimen 117.7 mm; also consulted types and other extralimital material.

Description
From 117.7 mm specimen, an adult male, supplemented with notes on other specimens as stated; counts from 25 specimens; measurements from 10 specimens summarized in Table 26; see Pl. XXXVIII, figs 2-3; for general aspect.

Shape. Moderately elongate; head moderately elongate, predorsal contour straight ascending on snout, more level ascent of nape continued to middle of dorsal-fin base, prepelvic contour less sloping, straight except for anterior terminal curvature. Snout slightly produced, blunt, deep. Orbit well below predorsal outline, in middle of head length; interorbital little wider than mouth, narrow, strongly vaulted. Maxilla reaching to vertical from anterior margin of orbit. - In smaller specimens, interorbital less curved, almost flat in those about 60 mm and smaller.

Scales. Squ. long. 24 (25). Predorsal scales cycloid (or ctenoid); only 9 of 25 specimens with strictly triserial predorsal scale pattern of 4 medial scales succeeded by medial 4 scale pairs, in the others various arrangements with 4-6 anterior scales single, posterior single or pairs, perfectly uniserial in 2. Cheek and opercular scales cycloid; 3 (19), 4 (6) series of scales on cheek. Lateral lines of 16/6 (2), 16/7 (1), 16/8 (8), 16/9 (1), 17/8 (9), 17/9 (4) scales, plus 2 scales on caudal fin; no accessory caudal-fin lateral lines. Caudal-fin squamation convex, to 1/2 of fin marginally, 1/3 medially.

Fins. First dorsal-fin spine slightly less than half length of last; spines subequal from 7th, last 3 again increasing; soft fin damaged in 117.7 mm specimen, in other large specimens pointed, 5th ray slightly produced, reaching about 2/3 or end of caudal fin. D. XIV.11 (12), XIV.12 (5), XV.10 (3), XV.11 (5). Soft anal fin damaged in 117.7 mm specimen, in other large

specimens pointed, 4th ray longest, reaching to middle of caudal fin or slightly shorter. A. III.8 (1), III.9 (22), III.10 (2). Pectoral fin with subacuminate tip, reaching to above first or second anal-fin spine; P. 13 (1), 14 (24). Pelvic fin pointed, first ray slightly produced, reaching to 3rd anal-fin spine. Caudal fin damaged in 117.7 mm specimen, in the others with rounded or subtruncate hind edge.

Gill-rakers. 1-2 epibranchial, 1 in angle and - (2), 4 (8), 5 (15) ceratobranchial rakers externally on first gill-arch. Microgill-rakers externally on 2nd to 4th gill-arches.

Jaw teeth. 10-18, $\bar{x}$=14.2±0.60/14-19, $\bar{x}$=16.4±0.34 in upper/lower jaw outer hemiseries in 14 specimens 40.4-117.7 mm SL. Outer series teeth larger than those in inner band of 2 (3 in largest specimen) series in upper, 2-3 series in lower jaw, especially in upper jaw where anteriormost more distinctly enlarged, the anteriormost on each jaw half slightly tilted mediad, not quite crossing with anteriormost tooth of other jaw half.

Tooth-plates. Lower pharyngeal tooth-plate sparsely toothed in 68.0 mm specimen dissected (fig. 167); anterior teeth subconical, lateral teeth more slender and with anterior subapical bulge, inner and posterior teeth compressed and with posterior antrorse cusp and anterior shelf. 4th ceratobranchial with 2 tooth-plates, each with 2 teeth.

Vertebrae. 13+13 (9), including 3 centra within caudal peduncle.

Colouration. Ground colour yellowish white, scales of lower chest covered with light brown leaving only narrow edge of ground colour, on chest sides posteriorly to above anal fin, brown colour gradually reduced to basal spot. Sides light brownish, countershaded, back brown; scales of dorsal and posterior sides and particularly wide and prominent on back and posterior nape, with dark brown distal edge; nape, and forehead dark brown. Cheek and preorbital light brown, irregular light dots and lines on preorbital and adjacent cheek, light line from orbit to nostril; 4 light, yellowish, lines between eyes, forwards curved, posterior two complete, next anterior only medially,

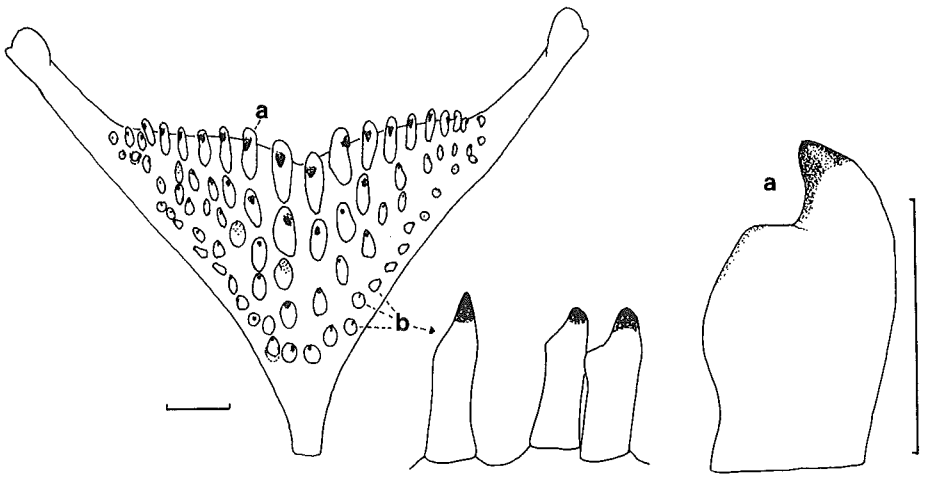

Figure 167. Occlusal view of lower pharyngeal tooth-plate, with medial aspect of posterior tooth (a) and lateral aspect of 3 anterior marginal teeth (b) in *Aequidens diadema*, NRM SOK/19813643606, 58.0 mm SL. Scales 1 mm.

anteriormost interrupted at posterior opening of nasal lateralis canal. Lower jaw, lips, operculae brown grey, operculum with lighter lines along scale edges. Blackish brown vertically elongate cheek spot posterosuperior. Jurua specimens have the cheek spot ventrad extended as a stripe along the vertical margin of the preoperculum. Dark brown lateral band anteriorly chiefly on squ. long. scales and lower portion of scales next dorsally, behind midlateral spot on squ. long. scales and upper 1/3 of lower lateral line series scales and lower halves of those above anteriorly, slightly narrower posteriorly, to near end of caudal peduncle. Midlateral spot blackish brown, squarish, from posteriorly on squ. long. scale 8 to squ. long. scale 12, and those above; fainter dorsally to dorsal-fin base. Yellowish narrow vertical bars marginal to midlateral spot, ventrally to slightly below lateral band; duskied where crossed by lateral band.

Dorsal fin greyish with darker, brownish lappets; on soft part dense cross-series of hyaline spots on last 5 membranes and indistinct light spots basally on anterior membranes narrow dorsal margin of soft part white. Anal fin greyish brown with darker ventral edge; hyaline dots on last 2 membranes, dark spots on other membranes. Caudal fin damaged; caudal spot black, roundish, on upper 2/3 of dorsal lobe, not reaching edge of fin, anteriorly delimited by light stripe marking end of caudal peduncle, scaly fin base otherwise mottled light brown and dull yellowish; naked portion greyish with numerous hyaline spots in asymmetrical pattern except along hind edge, in other large specimens. Pelvic fin hyaline, gradually darkening to dark brown along leading edge.

Young *c.* 60 mm similar, but only a few light stripes on preorbital and no light frontal stripes (head colouration not sufficiently well preserved in larger specimens); lateral band less intense; caudal fin immaculate; posterior of bars margining midlateral spot often down to abdominal sides, and in smaller specimens usually both reaching dorsally to dorsal fin. In smaller specimens sides behind midlateral spot divided into 3, occasionally 4 vertical bars by narrow light bars. Preorbital stripe replaced by cheek spot at about 30 mm SL. Small specimens *c.* 15 mm and smaller show lateral band indistinct or not at all.

Life colours. Freshly caught, 117.7 mm specimen showed black lateral band, midlateral spot, cheek spot and caudal spot; midlateral spot separated from lateral band by silvery-golden bars; frontal stripes dark red; iris reddish brown; blue-green iridescence on head sides and flanks below lateral band, with dark red stripes on cheek and dark red dots on flank scale bases; lips dark; lower jaw light blue; abdominal and chest sides whitish blue with dark scale-base dots; unpaired fins yellowish red; dorsal fin with blue dots, caudal fin with light blue dots and dark dot interspaces, anal fin like caudal fin; pelvic fin white with dark, blue-tinged leading edge; caudal spot ventrally margined with blue, anteriorly by silvery golden. Blue colour of ventral half of body and dark red dots and lines very conspicuous.

Distribution (figs 5, 166)
Peruvian material all comes from near Jenaro Herrera except one old lot labeled 'Iquitos'. The known extralimital distribution includes the upper R. Negro at Marabitanas (type locality) and San Carlos, a large portion of the Orinoco drainage, as well as the Juruá system represented by one sample from near Carauari.

Ecology.
The only localities with habitat information are streams in the Jenaro Herrera region (see p. 18). *Aequidens diadema* occurs there in aguajal-like conditions, clear-water quebradas and black-water quebraditas. Large numbers of young were observed in very shallow stagnant shore waters in the Sapuena and Copal creeks. The only large adult obtained was taken by hand from deeper midstream water having, as it seemed, drifted toward the seine blocking the stream.

Notes

The Peruvian material cannot be effectively separated from *A. diadema* from the Negro, Orinoco or Jurua systems, despite that the locality plot (fig. 5) has a scattered appearance. What is interpreted as individual variation in Orinoco-Negro material in shape and colouration appears to exceed variation within Peruvian material, involving especially body depth, expression of cheek stripes, and presence/absence of cheek spot.

Aequidens diadema has been considered a synonym of *A. tetramerus* by most authors subsequent to Heckel. Of similar general appearance, the two species are easily distinguished by shape and colour features. Peruvian *A. diadema* are slenderer (cf. body depth and caudal peduncle measurements in Table 26), and narrower (head and interorbital width in Table 26) and have shorter pectoral fin (Table 26) than Peruvian *A. tetramerus*. In the colouration especially the iridescent lines on the head distinguish *A. diadema* from *A. tetramerus*.

Aequidens diadema may be more closely related to *A. patricki*, *A. metae*, and A. pallidus, and other undescribed species in clear/black waters of the Brazilian Amazon basin, these species having similarly compressed body, short pectoral fin, iridescent spots and stripes on the head, and a more dorsal position of the lateral band and caudal spot as compared to *A. tetramerus*.

The European aquarium stock of an *Aequidens* species identified as *A. diadema* is a mouth brooder (Prick 1978, Peters & Berns 1982). Other *Aequidens* species are substrate brooders or reproductive behaviour is unknown.

MATERIAL EXAMINED

For each sample is given (A) museum register number (acronyms explained in list below), (B) number of specimens, (C) length range if measured (in mm SL unless otherwise stated), (D) locality, for which first given national political division (departamento, estado, provincia, territorio or comisaria), (E) date of collection, (F) collector, (G) when known, collector's or station number in parenthesis, (H) note on type status. An asterisk (*) designates lots measured (Tables 2-19, 21-26); when only some specimens in a lot were measured, their number and SL range is given within parenthesis. The ordering of the species is the same as in the preceding descriptive section. For two collections, station number rather than names of collectors are given: *RPV* (R P Vari, S L Jewett, H Ortega T., R Crocroft), and *SOK* (station list on p. 20). The listing of the material of each species is according to country and river drainage, but random within drainage. Full label data for holotypes have been given in the descriptions of new species.

Museum acronyms

ANSP Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania, USA
BMNH British Museum (Natural History), London, UK
CAS California Academy of Sciences, San Francisco, California, USA
FMNH Field Museum of Natural History, Chicago, Illinois, USA
GNHM Göteborgs Naturhistoriska Museum, Gothenburg, Sweden
IRSNB Institut royal des Sciences naturelles de Belgique, Brussells, Belgium
IUM Indiana University Museum (now in CAS and USNM)
MCZ Museum of Comparative Zoology, Cambridge, Massachusetts, USA
MHNG Muséum d'Histoire naturelle de Genève, Geneva, Switzerland
MNHN Muséum national d'Histoire naturelle, Paris, France
MPM Milwaukee Public Museum, Milwaukee, Wisconsin, USA
MZUSP Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil
NMW Naturhistorisches Museum Wien, Vienna, Austria
NRM Swedish Museum of Natural History, Stockholm, Sweden

SMF Forschungsinstitut Senckenberg, Frankfurt/Main, FRG
UF Florida State Museum, Gainesville, Florida, USA
USNM National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA
ZFMK Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, FRG
ZMA Zoölogisch Museum, Amsterdam, Netherlands
ZMB Museum für Naturkunde, Berlin, GDR
ZMH Zoologisches Institut und Museum, Universität Hamburg, Hamburg, FRG
ZMK Universitetets Zoologiske Museum, Copenhagen, Denmark
ZUEC Departamento de Zoologia, Universidade Estadual de Campinas, Campinas, Brazil.

Cichla monoculus

Uncertain origin: MNHN A.9490. 2, 230.0-278.6. 'Amazone'. No date. F. de Castelnau. **Syntypes of** *Cycla toucounarai* Castelnau.
PERÚ. R. Ucayali drainage: USNM 167757. 1, 235. Loreto, Contamana. Aug 1920. W.R. Allen. (*ex* IUM 17730.) USNM 167756. 1, 163. Loreto, Yarina Cocha. Sep 1920. W.R. Allen. (*ex* IUM 17731.) NRM SOK/1983354.3680. 1*, 175.0. Loreto, Trueno Cocha. 1 Sep 1983. SOK 81. NRM SOK/1981357.3568. 1*, *c.*146.2 (distorted, mouth open). Loreto, R. Aucayacu. 30 Aug 1981. SOK 41. **R. Itaya drainage:** NRM SOK/1984297.3859. 1*, 138.0. Loreto, Quisto Cocha. 22 Jul 1984 SOK 84a. **R. Nanay drainage:** NRM SOK/1984325.3862. 1*, 210.8. Loreto, Llanchama Cocha. 10 Aug 1984. SOK 97. NRM SOK/1984325.3863. 1*, 295.5 (and 1, 300, not preserved). Same data as NRM SOK/1984325.3862. NRM SOK/1984-324.3858. 1*, 114.2. Loreto, left bank playa opposite Llanchama Cocha. 9 Aug 1984. SOK 96. NRM A84/1984214.3063. 2*, 74.5-74.6. Loreto, Quebrada Corrientillo where crossed by road Iquitos-Puerto Almendra. 24 May 1984. A. Urteaga C. ANSP 139117. 2. Loreto, just above Morona Cocha. 17 Oct 1955. Catherwood Exp. (Sta. 6). ANSP 139118. 4. Loreto, opposite Base Marina, backwater pools. 12 Oct 1955. Catherwood Exp. Not preserved - notes taken: 3, 290-305. Loreto, Puñuisiqui Cocha. 10-11 Aug 1984. SOK 98. **R. Napo drainage:** NRM SOK/1984-333.3861. 2*, 44.3-46.6. Loreto, Aucapoza Cocha. 15 Aug 1984. SOK 106. NRM SOK/1984334.3860. 1*, 93.6. Loreto, Yuto Cocha on right bank of R. Mazán. 16 Aug 1984. SOK 107.
ECUADOR. R. Napo drainage: BMNH 1970.4.3:97. 1, 282.1. Napo, Jatún Cocha. 1969. D. Kershaw. BMNH 1970.4.3:98. 1, *c.*30 cm. Same data as BMNH 1970.4. 3:97.
BRASIL. R. Solimões drainage: NRM 11309. 1, 248.0. Amazonas, R. Solimões system. No date. No leg. NRM 5579. 1, 343.9. Amazonas, Codajás. /1865-1866. Thayer Exp./ **R. Tefé drainage:** MZUSP 34817. 15, *c.*140-323.8 (7: 156.9-321.4). Amazonas, Jurupari. 31 Jul-2 Aug 1979. M. Goulding. MZUSP 34822. 4, *c.* 166-324.5 (1: 324.5). Amazonas, Vista Escura. 30 Jul-4 Aug 1979. M. Goulding. MZUSP 34818. 3, *c.* 99-335.4 (2: 303.6-335.4). Amazonas, Mucura. 30 Jul-15 Aug 1979. M. Goulding. MZUSP 34816. 2, *c.* 179-c. 285. Amazonas, Supião-pucu. 28 Jul 1979. MZUSP 34819. 3, *c.* 161-252. Amazonas, Resaca de Paula. 1 Aug 1979. M. Goulding. **R. Negro drainage:** NRM 6495. 1, 311.1. Amazonas, Manaus. Nov 1954. N. Färnström. **R. Oiapoque drainage:** ZMA 107.761. 2, 142.9-185.4. Amapá, Igarapé Jumina, savanna creek at Juminan (04°03'N 51°39'W). 20 Sep 1977. M.Fily.
BOLIVIA. R. Mamoré drainage: NRM A85/1985177.3133. 1, 108.8. Beni, Laguna Mocovi. 28 Apr 1985. G. Loubens. **R. Guaporé drainage:** NRM A85/1984355.3132. 1, 212.1. Beni, mouth of R. Machupo. 31 Aug 1984. G. Loubens. **R. Madre de Dios drainage:** NRM A85/1982203.3138. 2, 149.8-156.9. Pando, R. Madre de Dios near Riberalta. 18 May 1982. G. Loubens.

Astronotus ocellatus

PERÚ. Drainage unknown: ANSP 21286. 1, *c.*69.1. 'Peru'. 1873. J. Orton ('Coll. no. 1'). **Holotype of** *Acara hypostícta* Cope. ANSP 220099. 1,

c. 200. 'Peru or Ecuador.' No date. J. Orton or J. Hauxwell. **R. Ucayali drainage:** ANSP 73164. 2, 95.7-99.5. Loreto, Contamana. Jul-Aug 1937. W.C. Morrow. NRM SOK/1983354.3691. 2*, 166.0-169.9. Loreto, Trueno Cocha. 1 Sep 1983. SOK 81. NRM SOK/1981364.3591. 1*, 157.2. Loreto, Trueno Cocha. 3 Sep 1981. SOK 46a. ZMA unreg. 1*, 162.5. Same data as NRM SOK/1981364.3591. **R. Nanay drainage:** ANSP 13911. 1, *c.* 160. Loreto, R. Nanay just above Morona Cocha. 17 Oct 1955. Catherwood Exp. (Sta. 6). **R. Amazonas drainage:** NRM SOK/1983343.3697. 29, 28.4-44.2 (10: 29.0-44.2). Loreto, Quistococha, pond at UNAP fish farm. 24 Aug 1983. SOK 72. ZFMK 1678a. 1. Loreto, vicinity of Iquitos: R. Nanay or R. Itaya. Jun 1969. A. Hanrieder. ANSP 119853. 2, *c.* 175-*c.* 180. Loreto, Iquitos, market. 18 Jun 1968. E.J. Hugghins (H-69-1,2). ANSP 9041. 1, 180. Loreto, Pebas. No date. J. Hauxwell. ANSP 9040. 1, *c.* 117.0. Loreto, R. Ampiyacu. No date. J. Hauxwell. ANSP 9180. 1, *c.* 57.4. Loreto, R. Ampiyacu. No date. J. Hauxwell. **Lectotype of** *Acara compressus* Cope. ANSP 3936. 1, *c.* 50.5. Loreto, R. Ampiyacu. No date. /J. Hauxwell/. **Paralectotype of** *Acara compressus* Cope. NMW 24253-24255. 3. Loreto, Pebas. Reg. 1884. No leg. USNM 175895. 2, *c.*210-*c.*213. Loreto, R. Ampiyacu. 20 Oct 1935. W.G. Scherer.

Astronotus crassipinnis

PERÚ. R. Madre de Dios drainage: FMNH 93013. 1*, 159.4. Madre de Dios, mouth of R. Inambarí. 22 Sep 1958. E.R. Blake.

Chaetobranchus flavescens

PERÚ. R. Ucayali drainage: NRM unreg. 1*, 91.4. Ucayali, E affluent of Yarina Cocha. 28 Jul 1980. W. Staeck. ANSP 73171. 1. Loreto, Contamana. Jul-Aug 1937. W.C. Morrow. MNHN A.9487. 1*, 161.6. Loreto, Sarayacu. /Oct 1846./ F. de Castelnau. **Holotype of** *Chromys ucayalensis* Castelnau. NRM A83/1982095.3002. 1*, 156.7. Loreto, Supay Cocha. 5 Mar 1982. P. Padilla de Mori. NRM A83/1982447.3001. 3*, 148.0-151.8. Loreto, Supay Cocha. 7 Nov 1982. P. Padilla de Mori. NRM SOK/1981364.3592. 1*, 148.2. Loreto, Trueno Cocha. 3 Sep 1981. SOK 46a. MHNG 2233.14. 2*, 168.5-186.1. Same data as NRM SOK/1981364.3592. ZMA unreg. 1*, 163.9. Same data as NRM SOK/1981364.3592. **R. Nanay drainage:** NRM SOK/1981353.3498. 2, 82.9-88.3. Loreto, Vicente Cocha, just upstream of Bella Vista. 26 Aug 1981. SOK 36. **R. Amazonas drainage:** ANSP 9038. 1*, 112.3. Loreto, R. Ampiyacu. No date. J. Hauxwell. **Holotype of** *Geophagus baditipinnis* Cope. **R. Yavarí drainage:** NRM SOK/1984307.3896. 2*, 96.8-176.5. Loreto, small cocha on left bank of R. Yaquerana. 29 Jul 1984. SOK 86.

COLOMBIA. R. Amazonas drainage: ANSP 139826. 1. Amazonas, Leticia, Lagos de Leticia, backwater pond. Mar 1974. A. Keast (34A).

BRASIL. R. Guaporé drainage: NMW 32933. 1, 138.4. R. Guaporé. No date. J. Natterer (IX.96). **Syntype of** *Chaetobranchus flavescens* Heckel. NMW 32932. 1, 150.6. Same data as NMW 32933. **Syntype of** *Chaetobranchus flavescens* Heckel. NMW 32931. 1, 151.7. Same data as NMW 32933. **Syntype of** *Chaetobranchus flavescens* Heckel. NMW 58856. 1, *c.* 183. 'Matogrosso'. 1 Dec 1828. J. Natterer (104). Mounted. **Syntype of** *Chaetobranchus flavescens* Heckel. NMW 16172. 1, *c.* 245 mm TL. 'Mato grosso'. Dec 1828. J. Natterer (IX.104). Mounted. **Syntype of** *Chaetobranchus flavescens* Heckel. NMW 16428. 1, *c.* 210 mm TL. 'Mato Grosso'. 27 Aug 1828. J. Natterer (104). Mounted. **Syntype of** *Chaetobranchus flavescens* Heckel. NMW 76431. 1, *c.* 178. 'Mato Grosso'. 24 Oct 1828. J. Natterer (IX.104). Mounted. **Syntype of** *Chaetobranchus flavescens* Heckel. **R. Negro drainage:** NMW 32922. 1, 90.7. R. Negro. No date. J. Natterer (XI.15). **Syntype of** *Chaetobranchus flavescens* Heckel. NMW 32941. 1, 178.9. R. Negro. No date. J. Natterer (XI.5). **Holotype of** *Chaetobranchus bruneus* Heckel. **R. Solimões drainage:** NRM unreg. 1, 166.0. Tefé. /1865-1866. Thayer Exp./

Uncertain origin: BMNH 1961.12.18:1. 1, *c.* 190.1. 'South America'. No

date. R. Schomburgk. **Holotype of** *Chaetobranchus robustus* Günther.

Acaronia nassa

PERÚ. R. Ucayali drainage: ANSP 68681. 1*, 77.5. Loreto, Contamana. Jul-Aug 1937. W.C. Morrow. **Holotype of** *Apistogramma ambloplitoides* Fowler. ANSP 68682. 1, 76.5. Same data as ANSP 68681. **Paratype of** *Apistogramma ambloplitoides* Fowler. **R. Nanay drainage:** NRM SOK/1983337.3677. 13, 38.4-121.8 (10: 50.8-121.8). Loreto, small tahuampa cocha on left bank, second left bend above Mishana. 21 Aug 1983. SOK 71. NRM SOK/1984326.3872. 1, 43.1. Loreto, left bank sand playa opposite mouth of Quebrada Agua Negra. 11 Aug 1984. SOK 99. NRM SOK/1981325.3305. 12, 25.7-49.3 (4: 38.4-49.3). Loreto, Zúngaro Cocha. 7 Aug 1981. SOK 24. NRM SOK/1983334.3674. 2, 25.5-120.0 (1: 120.0). Loreto, Quebrada Corrientillo. 18 Aug 1983. SOK 67. NRM SOK/1981355.3509. 2*, 43.6-69.8. Loreto, temporarily isolated left bank marginal cocha a few km upstream from Santa Clara. 28 Aug 1981. SOK 37. NRM SOK/1981353.3501. 1*, 61.2. Loreto, Vicente Cocha, just upstream of Bella Vista. 26 Aug 1981. SOK 36. FMNH 84256*pt.* 2*, 45.0-54.1. Loreto, lake off R. Momón. 24 Jul 1975. D.W. Greenfield, G.S. Glodek (G-75-65). **R. Yavari drainage:** NRM THO/1971365.3243. 1*, 61.6. Loreto, Pau-mari, Caño Buraço da Lucia. 14 Sep 1971 /label data/ or Lago Matamata. 10 Sep 1971 /station data, VIT 6A/. T. Hongslo (label data = VIT 11, but station given = VIT 6A). NRM THO/1971366.3145. 1*, 63.3. Loreto, Lago Matamata. 11 Sep 1971. T. Hongslo (VIT 7B).

Crenicichla sedentaria

PERÚ. R. Ucayali drainage: NRM A83/1983254.3052. 2*, 69.1-75.0. Ucayali, farm Bella Vista, *c.* 10 km S Chicosa, R. Chinipo. 23 Jun 1983. W. Staeck, H. Linke (P5/83). **Paratypes.** NRM unreg. 1*, 45.3. Ucayali, R. Shahuaya near Alto Aruya. 15 Jul 1981. W. Staeck. **Paratype. R. Pachitea drainage:** USNM 229057. 1*, 104.4. Pasco, R. Yamushimas, tributary of R. Palcazú near San Pedro de Longín. 24 Jul 1981. P. Bayley. **Holotype.** USNM 229053. 1*, 172.0. Same data as USNM 229057. **Paratype.** CAS 57455*pt.* 1, 135.5. Pasco, creek at Puerto Bermúdez. Jul 1920. W.R. Allen. (Previously IUM 17772.) **Paratype.** ZFMK unreg. 1, 111.8. Huánuco, backwater pool of R. Pacal at Panguana. 11 Sep 1976. K.H. Lüling (PP1). **Paratype.** ZMH 6443. 2*, 79.2-144.7. Huánuco, Fundo Flor. 21 Dec 1978-17 Jan 1979. A. Regös. **Paratypes.** BMNH 1969.7.15:55. 1*, 211.5. Huánuco, Quebrada Alamiria at Popa de Lancha. 1968. Cambridge Veterinary Exp. (No. 50). **Paratype.** BMNH unreg. 1, *c.* 150. 'R. Pachitea - R. Ucayali'. No date. Cambridge Veterinary Exp. (No. 24). **Paratype. R. Aguaytia drainage:** MHNG 2205.24. 1, 59.0. Ucayali, Aguaytía, Pampa de Sacramento, Arroyo de Agua Negra. 7 Oct 1984. P. de Rham, H. Ortega T. (Sta. 2). **Paratype.** MHNG 2205.26. 2, 45.3-49.7. Ucayali, R. Huacamayo at Km 155 on road Pucallpa-Huánuco. 7 Oct 1984. P. de Rham, H. Ortega T. **Paratypes.** FMNH 84268. 3, 31.9-114.7 (1: 114.7). Ucayali, R. San Alejandro. 3 Aug 1975. D.W. Greenfield, G.S. Glodek (G-75-88). **Paratypes.** FMNH 84259*pt.* 2*, 76.8-101.9. Ucayali, R. San Alejandro, isolated pool off river. 1 Aug 1975. D.W. Greenfield, G.S. Glodek (G-75-80). **Paratypes. R. Huallaga drainage:** ANSP 139131. 1*, 221.0. Huánuco, vicinity of Tingo María. 27 Sep 1955. Catherwood Exp. (Sta. 1). **Paratype.** ANSP 139132 (8) and NRM A86/1955392.3557 (2). 10, 68.7-140.0 (9: 68.7-140.0). Same data as ANSP 139131. **Paratypes.** ANSP 139133. 37, 27.5-65.3 (4: 53.9-64.7). Same data as ANSP 139131. **Paratypes.** ANSP 139134. 2, 34.0-41.1. Same data as ANSP 139131. **Paratypes.** ANSP 139138. 1, 52.6. Same data as ANSP 139131. **Paratype.** ZFMK 2141. 1. Huánuco, tributary to R. Huallaga at Aspusana, *c.*70 km downstream of Tingo María. 19 Jun 1966. K.H. Lüling. **Paratype.** ZFMK 2142-2143. 2, *c.*160-*c.*195. Huánuco, tributary of R. Huallaga at Aspusana, *c.*70 km downstream of Tingo María. 19 Jun 1966. K.H. Lüling (No. 21). **Paratypes.**

ECUADOR. R. Napo drainage: MCZ 49326*pt*. 1*, 116.8. Napo, R. Payamino and small tributary about 3-4 mi upriver from the mouth of R. Payamino into R. Coca. 20 Nov 1967. T.R. Roberts *et al.* **Paratype.** ANSP 130460. 7, 48.9-56.8. Napo, R. Aguarico at Santa Cecilia. 21 Mar 1967. W.G. Saul (WGS 67-16). **Paratypes.** ANSP 130461. 1. Napo, R. Aguarico at Santa Cecilia. 17 Mar 1967. W.G. Saul, W.E. Duellman (WGS 67-2). **Paratype. R. Putumayo drainage:** ANSP 158168. 2, 41.1-47.6. Napo, R. Conejo at Santa Cecilia. 30 Jun 1967. W.G. Saul (WGS 67-38). **Paratypes.**

Crenicichla cyanonotus

PERÚ. R. Ucayali drainage: ZFMK 2251-2254*pt*. 3*, 130.3-135.2. Ucayali, Yarina Cocha. Jul 1966. K.H. Lüling (No. 128). **R. Amazonas drainage:** CAS 57454. 2*, 134.1-147.5. Loreto, Iquitos. 1922. Leg. P.S. Morris. (*ex* IUM 15986?) ANSP 9078. 1*, 117.5. Loreto, 'Upper Maranon, near Pebas'. No date. J. Hauxwell. **Holotype of** *Crenicichla cyanonotus* Cope.
BRASIL. R. Içá drainage: NRM THO/1971508.3264. 2, 81.2-*c*. 87 (1: 81.2). Amazonas, Cuiabá, harbour. 15 Dec 1971. T. Hongslo (VIT 33C).

Crenicichla reticulata

PERÚ. Drainage unknown: NMW 32835. 2*, 72.5-87.9. 'Hoch-Peru'. No date. No leg. Reg. 1874. **Syntypes of** *Crenicichla elegans* Steindachner.
COLOMBIA. R. Putumayo drainage: GNHM 2826. 2*, 160.0-172.9. Putumayo, R. Caucayá, Limón Cocha. 17 Dec 1953. R. Blomberg.

Crenicichla cincta

PERÚ. R. Amazonas drainage: USNM 163841. 1, *c*. 120. Loreto, Iquitos. Aug 1920. J.C. Bradley. (*ex* Cornell Univ. Mus. no. 2759.) ANSP 139121. 1*, 194.6. Loreto, vicinity of Iquitos. 17 Oct 1955. Catherwood Exp. (Sta. 6). ANSP 139122. 1*, 147.5. Loreto, vicinity of Iquitos. 14 Oct 1955. Catherwood Exp. USNM 175890. 1, *c*. 170. Loreto, Shanso Caño. 18 Jan 1935. W.G. Scherer. BMNH 1977.3.10:249. 1*, 127.7. Loreto, 'Bueno Caño', near Iquitos. 30 May 1974. M. Chapman. **R. Napo drainage:** MHNG 2233.15. 1*, 181.0. Loreto, Puerto Huamán, R. Yanayacu. 12-15 Oct 1980. C. Vaucher (PE 98).

Crenicichla johanna

PERÚ. Drainage unknown: ANSP 21279. 1, *c*. 125.5. Peru. 1877. J. Orton. **R. Ucayali drainage:** USNM 167760. 1, *c*.160. Loreto, R. Pacaya. Aug 1920. W.R. Allen. **R. Nanay drainage:** NRM SOK/1984325.3899. 1*, 240.9. Loreto, Puñuisiqui Cocha. 10-11 Aug 1984. SOK 98. FMNH 73523. 1*, 141.7. Loreto, Iquitos, San Juan, quebrada. 20 Oct 1956. C. Kalinowski. **R. Napo drainage:** NRM/SOK1984334.3898. 1*, 237.5. Loreto, Yuto Cocha on right bank of R. Mazán. 16 Aug 1984. SOK 107. **R. Amazonas drainage:** NRM SOK/1981333.3376. 1*, 146.5. Loreto, R. Ampiyacu a few km upstream of Pebas. 12 Aug 1981. SOK 26bis.

Crenicichla semicincta

PERÚ. R. Pilcopata drainage: ANSP 143555. 1*, 102.9. Cuzco, R. Hospital at 12° 53'S 71° 27'W. 12 Jul 1977. R. Horwitz (RH 1 HO 0120). ANSP 143554. 1*, 112.0. Cuzco, R. Hospital at 12°53'S 71°27'W. 11 Jul 1977. R. Horwitz (RH 1 HO 0820). ANSP 143556. 3*, 110.5-135.8. Cuzco, 12°50'S 71°25'W. 11 Jul 1977. R. Horwitz (RH 1 CB 0220). ANSP 143553. 1*, 38.6. Cuzco/Madre de Dios, 12°53'S 71°20'W. 18 Jul 1977. R. Horwitz (RH 1 CA 0020). **R. Inambarí drainage:** BMNH 1913.2.25:1-4. 2*, 142.7-146.6. 'R. Mambari, 1200 ft.' /R. Inambarí/. No date. Purchased of Rosenberg. /Leg. probably H. & C. Watkins./ FMNH 70456. 6, 68.8-171.2 (5: 68.8-115.3). Cuzco, Marcapata, Hacienda Cadena. 18 Feb 1949.

C. Kalinowski. BMNH 1911.12.20.37-39. 2*, 157.7-161.5. Puno, Uruhuasi. No date /probably 1910/. H. & C. Watkins. **R. Madre de Dios drainage:** NRM SOK/1983324.3676. 1*, 77.2. Madre de Dios, quebrada 8 km from airport road on road to Lago Túpac Amaru. 11 Aug 1983. SOK 60. NRM SOK/1983324.3654. 1*, 142.3. Madre de Dios, Lago Túpac Amaru. 11 Aug 1983. SOK 58. USNM 264096. 4*, 46.0-157.0. Madre de Dios, stream on S side of R. Madre de Dios *c.* 10 km downstream of mouth of R. Tampobata. 25 Aug 1983. RPV 83-41. NRM A85/1983344.3149. 2*, 59.4-100.1. Same data as USNM 264096. CAS 54637. 2*, 42.6-59.1. Madre de Dios, 14 km ENE Puerto Maldonado, Lago Sandoval. 5 Jun 1983. T. Iwamoto (TI83-15). **R. Tambopata drainage:** USNM 264095. 3*, 99.8-142.1. Madre de Dios, Reserva Natural de Tambopata, first stream down trail from Laguna Chica, where crossed by log bridge. 19 Aug 1983. RPV 83-29. USNM 264107. 2*, 125.6-157.9. Madre de Dios, stream entering R. Tambopata from S bank, *c.* 500 m downstream of Explorer's Inn boat landing. 23 Aug 1983. RPV 83-39. USNM 264098. 4*, 53.2-158.6. Madre de Dios, Reserva Natural de Tambopata, Laguna Cocococha, 5.1 km E of Explorer's Inn. 20 Aug 1983. RPV 83-32. USNM 264090. 1, 27.3. Madre de Dios, Reserva Natural de Tambopata, Laguna Chica, end opposite boat dock (farthest from trail leading to lodge). 19 Aug 1983. RPV 83-28. **Mislabeled material** *(see Notes)*: ZFMK 2137-2138*pt.* 1, 139.5. Ucayali, R. Ucayali system, Yarina Cocha. 19 Jul 1966. K.H. Lüling (No. 118).

Crenicichla proteus

PERÚ. R. Ucayali drainage: NRM A83/1983254.3071. 2, 26.0-26.8. Ucayali, farm Bella Vista, *c.* 10 km S Chicosa. 23 Jun 1983. W. Staeck, H. Linke (P5/83). NRM A85/1985314.3509. 1, 42.6. Ucayali, small forest river tributary to R. Utiquinia *c.* 12 km above mouth. 1 Aug 1985. W. Staeck, H. Linke (P3/85). NRM SOK/1981337.3431. 9, 30.4-107.2 (5: 46.5-107.2). Ucayali, Yarina Cocha, canal to Paca Cocha. 16 Aug 1981. SOK 29a. 1 specimen cleared and stained. ZFMK 2251-2254*pt.* 1*, 123.6. Ucayali, Yarina Cocha. Jul 1966. K.H. Lüling (No. 128). ZFMK 2304. 2, Ucayali, Yarina Cocha. 16 Jul 1966. K.H. Lüling. NRM A85/1984303.3101. 1, 103.0. Ucayali, caño between Yarina Cocha and Paca Cocha. 25 Jul 1984. W. Staeck (P1/84). NRM A85/1984323.3105. 3, 30.4-52.6. Ucayali, stagnant pool near Paca Cocha, E Yarina Cocha. 8 Aug 1984. W. Staeck (P9/84). NRM SOK/1981344.3481. 1*, 79.4. Ucayali, caño and associated flooded forest between Yarina Cocha and Cashibo Cocha, *c.* 8 km NW Puerto Callao. 20 Aug 1981. SOK 34. NRM unreg. 1*, 133.6. Ucayali, E tributary to Yarina Cocha. 28 Jul 1980. W. Staeck. MHNG 2205.16. 2*, 80.9-100.6. Ucayali, Tipishca Alejandria on the left bank of the R. Ucayali near Pucallpa. 3 Oct 1984. P. de Rham, H. Ortega T. MHNG 2205.13. 2, 34.1-59.4 (1: 59.4). Ucayali, R. Callaría near mouth, Cocha Tachsitea. 3 Oct 1984. P. de Rham, H. Ortega T. ANSP 68684. 1*, 146.1. Loreto, Contamana. Jul-Aug 1937. W.C. Morrow. **Holotype of** *Batrachops nemopterus* Fowler. ANSP 68685-68687. 3, 98.9-105.8. Same data as ANSP 68684. **Paratypes of** *Batrachops nemopterus* Fowler. NRM A85/1984313.3104. 1, 45.0. Loreto, laguna just behind village Monte Bello on left bank of R. Ucayali. 1 Aug 1984. W. Staeck (P4/84). MHNG 2233.17. 1*, 62.9. Loreto, Caño Tomasa, left bank tributary to R. Aucayacu. 13 Sep 1981. P. de Rham *et al.* (Sta. 26). **R. Pachitea drainage:** CAS 57456. 6, 43.1-77.4. Pasco, Puerto Bermúdez, creek. 13 Jul 1920. W.R. Allen. (Previously IUM 17768.) ANSP 119854. 1, c. 155. Huánuco, Quebrada Pijuayal, *c.* 1 km S Tournavista. 1 Aug 1968. E.J. Hugghins (H-69-78). NRM SOK/1981343.3457. 3, 34.1-37.5. Huánuco, drying pool *c.* 100 m from left bank of R. Pachitea, *c.* 1 km upstream of Tournavista. 19 Aug 1981. SOK 31. NRM SOK/1981343.3463. 1, 28.3. Huánuco, near mouth of quebrada tributary to the R. Pachitea on the right bank, 2-3 km downstream of Tournavista. 19 Aug 1981. SOK 32. **R. Aguaytía drainage:** ZMB 31569. 1, c. 59.5. Ucayali, R. Huacamayo. 13 Sep 1979. P. de Rham. FMNH 84259*pt.* 1*, 61.5. Ucayali, R. San Alejandro, isolated pool off river. 1 Aug 1975. D.W. Greenfield, G.S. Glodek (G-75-80). MHNG 2233.16. 1, 28.2. Ucayali, small tributary to R. Nes-

huya, 1 km S IVITA field station, 59 km SW Pucallpa along road to Tingo María. 21 Aug 1981. P. de Rham *et al.* (Sta. 2). **R. Amazonas drainage:** CAS 57453*pt.* 1, 88.9. Iquitos. 1922. P.S. Morris. (*ex* IUM 15986.) ANSP 9062-9067. 5, *c.*64.8-*c.*76.9. Loreto, R. Ampiyacu. No date. No leg. ANSP 9050. 1*, 135.1. Loreto, R. Ampiyacu. No date. Leg. J. Hauxwell. **Lectotype of** *Crenicichla proteus* Cope. ANSP 9051-9058. 8, 100.0-125.2 (1: 119.4). Same data as ANSP 9050. **Paralectotypes of** *Crenicichla proteus* Cope. ANSP 9059. 1*, 90.3. Same data as ANSP 9050. **Syntype of** *Crenicichla proteus argynnis* Cope. ANSP 14375. 1, 95.7*. Same data as ANSP 9050. **Syntype of** *Crenicichla proteus argynnis* Cope. ANSP 9060-9061. 2, 85.6-90.8. Same data as ANSP 9050. (*Crenicichla proteus* (var.β) Cope.) **Drainage uncertain:** ANSP 9077. 1, *c.* 75.8. 'Equador: tributaries of Upper Maranon.' No date. J. Hauxwell. ZMB 31570. 1, 43.2. Loreto, R. Ucayali system, Supay Cocha. 13 Sep 1979. P. de Rham. /Locality or date incorrect./ *Additional material (see Notes)*: ZFMK 2137-2138*pt.* 1, 99.9. Ucayali, R. Ucayali system, Yarina Cocha. 19 Jul 1966. K.H. Lüling. (No. 118).
ECUADOR. R. Napo drainage: MCZ 49320. 5*, 75.8-94.0. Napo, Manduro Cocha near Coca. 1 Dec 1971. T.R. Roberts. ANSP 119907. 1, 89.9. Napo, Limón Cocha. 7 Aug 1969. E.J. Hugghins (H 69-259). MHNG 2224.55. 2, 88.8-97.3. Napo, Hacienda Primavera. 3 Jan 1985. J.M. Touzet. **R. Putumayo drainage:** ANSP 130450. 23. Napo, lower lake at Santa Cecilia. 10 Jun 1967. W.G. Saul, G.R. Smith (WGS67-30).

Crenicichla lucius

PERÚ. R. Ucayali drainage: NRM SOK/1981357.3565. 1*, 84.8. Loreto, Quebrada Abrahancillo, left bank tributary of R. Aucayacu, 4 km S Supay Cocha. 30 Aug 1981. SOK 40. MHNG 2233.82. 2, 65.2-67.1. Same data as NRM SOK/1981357.3565. NRM SOK/1981364.3602. 1, *c.* 63.3. Loreto, Quebrada Espejo, tributary to Supay Cocha, near mouth. 3 Sep 1981. SOK 48. NRM SOK/1983355.3774. 1*, 65.0. Loreto, quebrada in arboretum at Km 3 on road Jenaro Herrera - Colonia Angamos. 2 Sep 1983. SOK 82. NRM SOK/1981364.3607. 2*, 105.6-116.1. Loreto, Km 3 on road Jenaro Herrera-Colonia Angamos, quebrada behind Centro Forestal de PARI. 3 Sep 1981. SOK 49. NRM SOK/1983353.3773. 1*, 167.9. Loreto, Quebrada Sapuena at Km 10 on road Jenaro Herrera - Colonia Angamos. 31 Aug 1983. SOK 79. NRM A83/1983262.3038. 1, 57.0. Loreto, small blackwater stream at km 13.5 on road Jenaro Herrera- Colonia Angamos. 28 Jun 1983. W. Staeck, H. Linke (P12/83). MHNG 2233.18. 2, 72.2-74.1. Loreto, near Jenaro Herrera (locality data mixed up, probably Quebrada Espejo). Sep 1981. P. de Rham. **R. Marañón drainage:** CAS 57457. 9, 53.1-147.5. Loreto, R. Morona. Oct 1920. W.R. Allen. (Previously IUM 17771.) **R. Nanay drainage:** NRM SOK/1983337.3679. 3*, 68.3-91.3. Loreto, small tahuampa cocha on left bank, second left bend above Mishana. 21 Aug 1983. SOK 71. NRM SOK/1983305.3777. 4, 40.0-79.8 (3: 59.9-79.8). Loreto, Caño Puñuisiqui. 29 Jul 1983. SOK 53. NRM SOK/1984326.4080. 1, 60.2. Loreto, R. Nanay left bank sand playa opposite mouth of Quebrada Agua Negra. 11 Aug 1984. SOK 99. NRM SOK/1981325.3303. 5, 47.1-60.6 (4: 50.2-60.6). Loreto, Zúngaro Cocha. 7 Aug 1981. SOK 24. NRM SOK/1981355.3513. 2*, 64.4-131.7. Loreto, marginal left bank cocha a few km upstream of Santa Clara. 28 Aug 1981. SOK 37. NRM SOK/1983336.3778. 1*, 69.3. Loreto, R. Nanay right bank at Puerto Almendra. 20 Aug 1983. SOK 69a. NRM SOK/1983334.3776. 5, 47.5-87.9 (2: 67.2-87.9). Loreto, Quebrada Corrientillo, 20 km from Iquitos on road to Puerto Almendra. 18 Aug 1983. SOK 67. 2 specimens cleared and stained. NRM SOK/1984344.4081. 1, 55.7. Loreto, Quebrada Corrientillo at bridge on road Iquitos - Puerto Almendra. 23 Aug 1984. SOK 113. NRM SOK/1983335.3779. 1*, 82.8. Loreto, Quebrada Pampachica at ENTEL station, 6 km from Iquitos. 19 Aug 1983. SOK 68. NRM SOK/1981353.3503. 1, 51.9. Loreto, Vincente Cocha, just upstream of Bella Vista. 26 Aug 1981. SOK 36. NRM A85/1985322.2536. 1, 48.7. Loreto, forest laguna *c.* 1000 m from R. Nanay between Iquitos and Santa Clara. 6 Aug 1985. W. Staeck, H. Linke (P9/85). **R. Napo drainage:** NRM SOK/1984333.4085. 1*, 146.0. Loreto, R. Napo, Cayapoza,

small laguna on left bank island. 15 Aug 1984. SOK 104. **Neotype of** *Crenicichla lucius* Cope. NRM SOK/1984333.4079. 5, 33.9-141.9 (3: 106.3-141.9). Same data as NRM SOK/1984333.4085. MHNG unreg. 1*, 97.2. Loreto, mouth of left bank tributary to R. Mazán downstream of R. Guano. 11 Oct 1980. C. Vaucher. **R. Amazonas drainage:** CAS 57453*pt*. 1, 109.3. Loreto, Iquitos. 1922. P.S. Morris. (*ex* IUM 15986.) NRM A85/1985323.3518. 1, 105.4. Loreto, tributaries of R. Manití, *c*. 50 km NE Iquitos. 7 Aug 1985. W. Staeck, H. Linke (P11/85). NRM SOK/1981333.3366. 3*, 87.9-147.2. Loreto, Quebrada Sacarita, a few km upstream of Pebas. 12 Aug 1981. SOK 26a. **R. Yavarí drainage:** NRM THO/1976311.1174. 1, 35.0. Loreto, San Sebastian, Caño do Comprido. 26 Jul 1976. T. Hongslo.
BRASIL. R. Içá drainage: NRM THO/1971518.3103. 2. Amazonas, Cuiabá, Cocha Simpatia. 21 Dec 1971. T. Hongslo (VIT 31B). NRM THO/1971459.3093. 1. Amazonas, near Cuiabá. 7-10 Dec 1971. T. Hongslo (VIT 34B).

Crenicichla anthurus

PERÚ. R. Ucayali drainage: NRM unreg. 4*, 51.0-81.2. Ucayali, R. Shahuaya near Alto Aruya. 15 Jul 1981. W. Staeck. NRM A85/1985314.3508. 1*, 68.0. Ucayali, small forest tributary of R. Utiquinia, *c*. 12 km from mouth. 1 Aug 1985. W. Staeck, H. Linke (P3/85). NRM SOK/1983351.3775. 1*, 52.7. Loreto, Quebrada Copal at Km 15 on road Jenaro Herrera - Colonia Angamos. 29-30 Aug 1983. SOK 78. NRM A85/1984321.3103. 1, 35.8. Loreto, Quebrada Copal at Km 15 on road Jenaro Herrera - Colonia Angamos. 6 Aug 1984. W. Staeck (P7/84). NRM SOK/1981363.3577. 1*, 76.0. Loreto, Quebrada Sapuena at Km 10 on road Jenaro Herrera-Colonia Angamos. 2 Sep 1981. SOK 45. MHNG 2233.19. 2, 30.0-33.1. Loreto, forest creeks at right bank of Quebrada Carahuayte, *c*. 35 km SE Jenaro Herrera. 8-10 Sep 1981. P. de Rham, H. Nijssen (HN 22a). ZMA unreg. 1*, 56.7. Same data as MHNG 2233.19. MHNG 2233.20. 3, 23.3-35.9. Loreto, forest creeks at left bank of Quebrada Carahuayte, *c*. 30 km SE Jenaro Herrera. 11 Sep 1981. P. de Rham, H. Nijssen (HN 22b). **R. Aguaytía drainage:** MHNG 2205.22. 2, 32.4-111.7 (1: 111.7). Ucayali, IVITA, fish pond no. 4. 11 Oct 1984. H. Ortega T., I. Samánez. MHNG 2205.12. 1, 223.8. Ucayali, IVITA, Limonal. 19 Oct 1984. P. de Rham, H. Ortega T. **R. Huallaga system:** ANSP 139123. 1*, 128.5. Huánuco, vicinity of Tingo Maria. 29 Sep 1955. Catherwood Exp. (Sta. 2). **R. Aguaytía/R. Pachitea drainage:** NRM A85/1985325.3524. 2*, 53.0-63.6. Ucayali/Huánuco, forest stream at Km 7 or Km 18.5 on road from Km 85 on Pucallpa-Tingo María road toward Puerto Inca. 9 Aug 1985. W. Staeck, H. Linke (P15-16/85). **R. Amazonas drainage:** ANSP 9074-9076. 3*, 78.4-118.4. Loreto, R. Ampiyacu. No date. J. Hauxwell. **Syntypes of** *Crenicichla anthurus* Cope.
ECUADOR. R. Napo drainage: MHNG 2224.54. 1, 73.4. Napo, R. Aguarico, San Pablo Kantesiya. 1 Mar 1985. J.M. Touzet (296). **R. Putumayo drainage:** ANSP 130453. 2*, 50.5-86.9. Napo, R. Conejo at Santa Cecilia. 30 Jun 1967. W.G. Saul (WGS 67-38).

Crenicichla sp. cf. *anthurus*

PERÚ: ANSP 21103. 1, *c*. 150. San Martín, R. Huallaga system, R. Cachiyacu near Moyobamba. 1873. J. Orton. ANSP 9068-9073. 6, *c*. 120-*c*. 170. Loreto, R. Ampiyacu. No date. J. Hauxwell.
COLOMBIA: GNHM 2825. 2, *c*. 69. 'La Apaya, R. Putumayo' /? depto Putumayo, Quebrada La Paya/. 29 Dec 1953. R. Blomberg.

Crenicichla sp. aff. *anthurus*

ECUADOR. MNHN 1971-132. 1, *c*. 142.5. R. Pastaza drainage, R. Llushin, right bank tributary to R. Pastaza, N Arapicos. No date. Hoffstetter. BMNH 1898.12.31:37. 1, 155.4. Morona-Santiago, R. Zamora. No date. E. Festa. MCZ 49321. 1, 95.7. Morona-Santiago, R. Zamora drainage, Arroyo Chinbuza, 56 km

NE Zamora. 10 Nov 1971. T.R. Roberts *et al.* MCZ 49323. 30, juvs. Same data as MCZ 49321. MCZ 49317. 1, 197.0. Morona-Santiago, R. Zamora 43 km NE Zamora. 11 Nov 1971. T.R. Roberts *et al.* NRM unreg. 1, *c.*108.0. 'Rio Pastaza'. 1937. R. Blomberg. BMNH 1880.12.8:108-109. 2, 97.0-119.0. Pastaza, R. Pastaza drainage, Canelos. No date. C. Buckley. GNHM unreg. 5, 83.5-121.6. Pastaza, R. Tigre drainage, R. Conambo. 2-3 Jun 1955. R. Olalla.

Geophagus proximus

PERÚ. R. Ucayali drainage: MNHN A.9510. 2*, 141.5-167.8. Loreto, Sarayacu, lake near R. Ucayali. No date. F. de Castelnau. **Syntypes of** *Chromys proxima* Castelnau.

BRASIL. R. Solimões drainage: MZUSP unreg. 1*, 225.3. Amazonas, R. Japurá, Lago Amanã. No date. R. Best (No. 39). MZUSP unreg. 8 (5: 129.7-167.8). Amazonas, R. Japurá, Lago Amanã. May 1980. R. Best (Nos. 8-14). MZUSP 34856. 1. Amazonas, R. Tefé, lago at Mucura. 30 Jul 1979. M. Goulding. MZUSP 34857. 13. Amazonas, R. Tefé, Ressaca de Paula. 1 Aug 1979. M. Goulding. MZUSP 34858. 7 (6: 157.6-187.4). Amazonas, R. Tefé, Mastro, beira do rio. 6 Aug 1979. M. Goulding. MZUSP 34859. 21. Amazonas, R. Tefé, Jurupari, praia. 31 Jul 1979. M. Goulding. MZUSP 34860. 1. Amazonas, R. Tefé, Vista Escura, lago. 30 Jul 1979. M. Goulding. NRM SOK/1980383.3191. 2, 19.1-124.9. Amazonas, L. Janauacá. 17 Sep 1980. S.O. Kullander *et al.* (SOK 11). **R. Amazonas drainage:** MZUSP unreg. 1. Para, R. Trombetas, beira do rio, 20 km upstream of mouth. Oct-Nov 1983. M. Goulding.

Biotodoma cupido

PERÚ. Drainage unknown: ANSP 21204-21205. 2. Peru. 1873-1877. J. Orton. **R. Ucayali drainage:** ANSP 88186. 6. Loreto, Contamana. Jul-Aug 1937. W.C. Morrow. NRM SOK/1981357.3569. 1*, 83.1. Loreto, R. Aucayacu, shore opposite mouth of Quebrada Abrahancillo. 20 Aug 1981. SOK 41. NRM SOK/1981364.3593. 3*, 51.3-63.3. Loreto, Trueno Cocha. 3 Sep 1981. SOK 46a. **R. Pacaya drainage:** CAS 57459. 1, 55.1-63.4. Loreto, Yarina Cocha. Aug 1920. W.R. Allen. (Previously IUM 17765.) **R. Itaya drainage:** CAS 57458. 1, 69.6. Loreto, R. Itaya above Iquitos. Sep 1920. W. R. Allen. (Previously IUM 17764.) **R. Nanay drainage:** NRM SOK/1983336.3796. 4, 45.1-61.6 (2: 52.3-61.6). Loreto, left bank playa near caño from Cocha Yarana, second left bend above Mishana. 20-21 Aug 1983. SOK 70. NRM SOK/1983337.3794. 40, 24.1-76.0 (5: 42.8-61.2). Loreto, small tahuampa cocha on left bank second left bend above Mishana. 21 Aug 1983. SOK 71. NRM SOK/1983305.3795. 1*, 66.2. Loreto, Tinaja, left bank playa. 29 Jul 1983. SOK 52. NRM SOK/1984325.3903. 1*, 48.6. Loreto, Puñuisiqui Cocha. 10-11 Aug 1984. SOK 98. NRM SOK/1984324.3905. 1*, 51.7. Loreto, R. Nanay left bank sand playa opposite Llanchama Cocha. 9 Aug 1984. SOK 96. NRM SOK/1984326.3906. 1, 34.6. Loreto, R. Nanay left bank sand playa opposite mouth of Quebrada Agua Negra. 11 Aug 1984. SOK 99. NRM A85/1985322.3516. 1, 71.4. Loreto, small tributary of R. Nanay near Santa Clara. 6 Aug 1985. W. Staeck, H. Linke (P10/85). NRM A85/1985322.3530. 1, 63.9. Loreto, forest laguna *c.* 1000 m from R. Nanay between Santa Clara and Iquitos. 6 Aug 1985. W. Staeck, H. Linke (P9/85). ANSP 139115. 2. Loreto, just above Morona Cocha. 17 Oct 1955. Catherwood Exp. (Sta. 6). ANSP 139113. 3. Same data as ANSP 139115. ANSP 149404. 1. Loreto, backwater pools opposite Base Marina. 12 Oct 1955. Catherwood Exp. ANSP 139148. 19. Same data as ANSP 149404. **R. Napo drainage:** NRM SOK/1984322.3908. 4, 40.7-68.3 (3: 62.0-68.3). Loreto, R. Mazán right bank cocha 2 h upstream of Puerto Alegre. 14 Aug 1984. SOK 100. NRM SOK/1984334.3904. 1, 22.0. Loreto, Yuto Cocha on right bank of R. Mazán. 16 Aug 1984. SOK 107. NRM SOK/1984332.3907. 1, 23.1. Loreto, R. Mazán, boat landing of Puerto Alegre. 14 Aug 1984. SOK 103. **R. Amazonas drainage:** CAS 57460. 1, 89.8. Loreto, Iquitos, brooks and ponds. Sep 1920. W.R. Allen. (Previously IUM 17766.) NRM SOK/1981333.3336. 6, 47.5-59.3 (5: 47.5-59.3). Loreto, quebrada tributary to the R. Yaguasyacu and adjacent river playa just below

village Esperanza. 12 Aug 1981. SOK 25b. 1 specimen cleared and stained. USNM 175491. 1. Loreto, Pebas Caño. 2 Sep 1935. W.G. Scherer. USNM 175930. 1. Loreto, R. Ampiyacu. 15 Dec 1934. W.G. Scherer. USNM 175925. 1. Loreto, Pebas Caño. 15 Aug 1935. W.G. Scherer. **R. Yavarí drainage:** NRM THO/1981372.3385. 2*, 69.6-96.9. Loreto, R. Yavarí /near 4°12'S 70°30'W./ 14 Sep 1971. T. Hongslo (VIT 10). NRM THO/1971374.3444. 1*, 70.2. Loreto, near Pau-mari, Caño Daudea. 16 Sep 1971. T. Hongslo (VIT 14).

Acarichthys heckelii

PERÚ. R. Itaya drainage: NRM SOK/1981354.3640. 1*, 61.3. Loreto, Quisto Cocha. 27 Aug 1981. SOK 23c. NRM SOK/1984342.3879. 2*, 63.7-70.0. Loreto, Quisto Cocha W margin. 21 Aug 1984. SOK 112.

Crenicara punctulatum

PERÚ. R. Pachitea drainage: ZMH 3239*pt*. 3, 30.5-32.4. Huánuco, logging road R. Pachitea - Tournavista, pool. 20 or 25 Aug 1964. A.J. Klee. **R. Ucayali drainage:** NRM SOK/1983347.3681. 1*, 100.9. Loreto, isolated pool at left bank of Quebrada Carahuayte at Km 20 on road Jenaro Herrera - Colonia Angamos. 28 Aug 1983. SOK 75. NRM SOK/1981357.3564. 1*, 61.0. Loreto, Quebrada Abrahancillo, left bank tributary to the R. Aucayacu, *c.* 4 km S Supay Cocha. 30 Aug 1981. SOK 40. MHNG unreg. 1*, 42.3. Loreto, Tiriri Caño, tributary to Supay Caño. 4 Sep 1981. P. de Rham *et al.* (Sta. 21). **R. Marañón drainage:** USNM 167835. 10, 27.5-55.7 (1: 55.7). Loreto, R. Morona, creek. Oct 1920. W.R. Allen. **Paratypes of** *Aequidens hercules* Allen. (*ex* IUM 17736.) **R. Nanay drainage:** NRM SOK/1983334.3682. 3*, 42.9-64.1. Loreto, Quebrada Corrientillo, 20 km from Iquitos on road to Puerto Almendra. 18 Aug 1983. SOK 67. NRM SOK/1983337.3684. 16, 19.1-51.1 (6: 24.9-51.1). Loreto, small tahuampa cocha on left bank, second left bend above Mishana. 21 Aug 1983. SOK 71. NRM SOK/1981355.3511. 4*, 28.7-33.1. Loreto, isolated cocha a few km upstream of Santa Clara. 28 Aug 1981. SOK 37. NRM SOK/1981355.3544. 1*, 34.8. Loreto, R. Nanay left bank sandy beach *c.* 15 min by boat upstream of Santa Clara. 28 Aug 1981. SOK 38. FMNH 73523. 1*, 54.0. Loreto, Auca Cocha. 18 Nov 1956. C. Kalinowski. ANSP 139140. 1. Loreto, R. Nanay opposite base marina, backwater pools. 12 Oct 1955. Catherwood Exp. NRM SOK/1984344.3909. 1, 66.0. Loreto, Quebrada Corrientillo at bridge on road Iquitos-Puerto Almendra. 23 Aug 1984. SOK 113. NRM SOK/1984326.3910. 7, 30.8-66.7. Loreto, left bank sand playa opposite mouth of Quebrada Agua Negra. 11 Aug 1984. SOK 99. NRM A85/1985322.3534. 1, 29.5. Loreto, forest laguna *c.* 1000 m from R. Nanay between Iquitos and Santa Clara. 6 Aug 1981. W. Staeck, H. Linke (P9/85). NRM A85/1985322.3515. 1, 48.3. Loreto, small tributary near Santa Clara. 6 Aug 1985. W. Staeck, H. Linke (P10/85). **R. Amazonas drainage:** CAS (SU) 36774. 1, 55.1. Loreto, Pebas Caño. 28 Dec 1936. W.G. Scherer. CAS (SU) 36775. 7, 32.4-61.2. Loreto, R. Ampiyacu, vicinity of Pebas. 4 Sep 1940. W.G. Scherer. CAS (SU) 36776. 2, 53.2-58.9. Loreto, vicinity of Pebas. 1936 or 1937. W.G. Scherer. **R. Yavarí drainage:** NRM SOK/1984305.3911. 1, 37.3. Loreto, Colonia Angamos, quebrada separating civil and military parts of village, behind school building. 27-28, 30 Jul, 2 Aug 1984. SOK 85. NRM THO/1971365.3134. 1*, 50.4. Loreto, Lago Matamata. 10 Sep 1971. T. Hongslo (VIT 6A). NRM THO/1971356.3005. 2*, 26.7-39.1. Loreto, Lago Matamata. 4 Sep 1971. T. Hongslo (VIT 1A). NRM THO/1971366.3177. 1*, 57.3. Loreto, Lago Matamata, caño no. 2. 11 Sep 1971. T. Hongslo (VIT 7A). NRM THO/1976311.1169. 3, 25.3-29.8. Loreto, San Sebastian, Caño do Comprido. 26 Jul 1976. T. Hongslo. NRM THO/1976312.0925. 1, 31.7. Loreto, San Sebastian, Caño do Comprido. 27 Jul 1976. T. Hongslo. **R. Tambopata drainage:** USNM 264086. 1*, 64.6. Madre de Dios, Reserva Natural de Tambopata, first stream down trail to Laguna Chica, where crossed by log bridge. 19 Aug 1983. RPV 83-29. USNM 264076. 2*, 43.1-49.8. Madre de Dios, Reserva Natural de Tambopata, Laguna Cocococha, 5.1 km E of Explorers Inn. 20 Aug 1983. RPV 83-32. USNM 263878. 1*, 67.1. Same

data as USNM 264076. NRM A85/1983336.3146. 1*, 42.7. Same data as USNM 264076. **BRASIL. R. Javari drainage:** NRM THO/1971372.3363. 1*, 46.0. Amazonas, Lago Guariba, Caño de Guariba no. 2. 13 Sep 1971. T. Hongslo (VIT 9). **R. Içá drainage:** NRM THO/1971462.3250. 1*, 82.7. Amazonas, Cuiabá, Cocha Terrafirm. 16 Nov 1971. T. Hongslo (VIT 30).
COLOMBIA. R. Amazonas drainage: NRM THO/1976303.1611. 1, 81.3. Amazonas, near Puerto Nariño, Pueblo Mocagua, Quebrada Pajarito. 21 Jul 1976. T. Hongslo. NRM THO/1976306.1031. 1, 31.0. Amazonas, Puerto Nariño, Finca La Merced, small Laguna. 24 Jul 1976. T. Hongslo.

Satanoperca jurupari

PERÚ. R. Ucayali drainage: NRM unreg. 3, 89.3-116.3. Ucayali, Laguna Pumancai, north of Iparia. 3 Aug 1980. W. Staeck. NRM SOK/1981337.3416. 9, 71.3-101.1 (5: 83.2-101.1). Ucayali, Yarina Cocha along shore. 16 Aug 1981. SOK 28b. NRM SOK/1981345.3445. 1, 62.0. Ucayali, Yarina Cocha, caño to Paca Cocha. 21 Aug 1981. SOK 29b. ANSP 96064. 23. Loreto, Contamana. Jul-Aug 1937. W.C. Morrow. ZMA unreg.*pt.* 1, 16.3. Loreto, Caño Tomasa on left bank of R. Aucayacu. 13 Sep 1981. P. de Rham, H. Nijssen, C. Villanueva, L. Mori P. (Sta. 26). NRM SOK/1981364.3594. 3*, 95.3-110.0. Loreto, Trueno Cocha. 3 Sep 1981. SOK 46a. MHNG 2233.21. 1*, 90.7. Same data as NRM SOK/1981364.3594. NRM SOK/1983354.3752. 14, 13.0-155.9 (1: 50.1). Loreto, Trueno Cocha. 1 Sep 1983. SOK 81. 2 specimens cleared and stained. MHNG 2233.22. 1, 21.7. Loreto, Sahua Cocha. 20 Jun 1978. P. de Rham (R.49). **R. Itaya drainage:** NRM A85/1985321.3513. 1, 41.8. Loreto, shore of Quisto Cocha. 5 Aug 1985. W. Staeck, H. Linke (P7/85). **R. Nanay drainage:** NRM SOK/1983306.3753. 1, 14.0. Loreto, pool on right bank playa near Shiriyana. 30 Jul 1983. SOK 55bis. NRM SOK/1983335.3746. 2, 11.4-*c.*13. Loreto, Quebrada Pampachica at ENTEL station, 6 km from Iquitos. 19 Aug 1983. SOK 68. NRM SOK/1983334.3745. 8, 45.2-88.0 (4: 45.2-85.5). Loreto, Quebrada Corrientillo, 20 km from Iquitos on road to Puerto Almendra. 18 Aug 1983. SOK 67. NRM SOK/1983306.3750. 10, 50.9121.7 (3: 65.6-78.9). Loreto, right bank playa near Shiriyana. 30 Jul 1983. SOK 55. NRM SOK/1981325.3302. 5, 45.0-104.8. Loreto, Zúngaro Cocha. 7 Aug 1981. SOK 24. NRM SOK/1981355.3543. 2, 42.5-46.6. Loreto, left bank sandy beach *c.* 15 min upstream of Santa Clara. 28 Aug 1981. SOK 38. FMNH 84233. 2, 15.8-17.1. Loreto, lake off R. Momón. 24 Jul 1975. D.W. Greenfield, G.S. Glodek (G-75-65). NRM SOK/1983337.3748. 15, 27.3-67.2. Loreto, small tahuampa cocha on left bank, second left bend above Mishana. 21 Aug 1983. SOK 71. NRM SOK/1983305.3751. 55, 45.5-124.2 (2: 62.1-104.4). Loreto, Tinaja, left bank playa. 29 Jul 1983. SOK 52. NRM SOK/1983334.3744. 1*, 80.9. Loreto, Quebrada Shushuna on road Quistococha-Puerto Almendra, 16 km from Iquitos. 18 Aug 1983. SOK 66. NRM SOK/1981353.3500. 4, 51.3-85.4. Loreto, Vincente Cocha, just upstream of Bella Vista. 26 Aug 1981. SOK 36. NRM SOK/1981371.3618. 2, 58.5-61.8. Loreto, unnamed quebrada close to Santa Clara. 7 Sep 1981. SOK 51. NRM SOK/1983336.3747. 1, 115.4. Loreto, R. Nanay left bank, near caño to Cocha Yarana, at second left bend above Mishana. 20-21 Aug 1983. SOK 70. NRM SOK/1981356.3516. 6, 52.8-81.8 (3: 62.4-72.7). Loreto, left bank cocha a few km upstream of Santa Clara. 28 Aug 1981. SOK 37. NRM SOK/1984326.3913. 2, 43.0-50.0. Loreto, R. Nanay left bank sand playa opposite mouth of Quebrada Agua Negra. 11 Aug 1984. SOK 99. NRM SOK/1984324.3919. 1, 125.7. Loreto, R. Nanay, left bank sand playa opposite Llanchama Cocha. 9 Aug 1984. SOK 96. NRM SOK/1984325.3916. 1, 45.5. Loreto, Puñuisiqui Cocha. 10-11 Aug 1981. SOK 98. NRM A84/1984214.3067. 1, 50.5. Loreto, Quebrada Corrientillo where crossed by road Iquitos-Puerto Almendra. 24 May 1984. A. Urteaga C. NRM SOK/1984344.3917. 9, 25.4-151.0. Loreto, Quebrada Corrientillo at bridge on road Iquitos-Puerto Almendra. 23 Aug 1984. SOK 113. ANSP 139142. 8. Loreto, backwater pools off cocha opposite Base Marina, 4 mi above R. Amazonas. 12 Oct 1955. Catherwood Exp. ANSP 139147. 21. Same data as ANSP 139142. ANSP 139139. 16. Same data as ANSP 139142. ANSP 139137. 2. Loreto, R. Nanay just above Morona Cocha. 17 Oct 1955. Catherwood Exp. (Sta. 6). ANSP 139135. 1. Same data as ANSP 139137. ANSP

139136. 4. Loreto, R. Nanay just above Morona Cocha. 19 Oct 1955. Catherwood Exp. **R. Napo drainage:** NRM SOK/1984332.3912. 2, 17.2-18.3. Loreto, R. Mazán right bank cocha 2 h upstream of Puerto Alegre. 14 Aug 1984. SOK 100. NRM SOK/1984332.3915. 1, 54.6. Loreto, R. Mazán, boat landing of Puerto Alegre. 14 Aug 1984. SOK 103. NRM SOK/1984332.3943. 1, 55.9. Same data as NRM SOK/1984332.3915. NRM SOK/1984333.3922. 2, 21.8-25.3. Loreto, Cayapoza, small laguna on left bank island. 15 Aug 1984. SOK 104. NRM SOK/1984334.3918. 7, 37.5-157.0 and several larvae, *c.* 6. Loreto, Yuto Cocha on right bank of R. Mazán. 16 Aug 1984. SOK 107. MHNG 2233.23. 4, 56.7-81.6. Loreto, mouth of left bank tributary to R. Mazán downstream of mouth of R. Guano. 11 Oct 1980. C. Vaucher. **R. Amazonas drainage:** ANSP 9092-9093. 2. Loreto, R. Ampiyacu. No date. J. Hauxwell. **R. Yavarí drainage:** NRM THO/1971356.3090. 1*, 54.1. Loreto, Lago Matamata. 4 Sep 1971. T. Hongslo (VIT 1A). NRM SOK/1984312.3914. 2, 53.1-55.7. Loreto, quebrada left bank tributary to R. Gálvez *c.* 25 min upstream of Colonia Angamos (30 hp deslizador). 31 Jul 1984. SOK 89. NRM SOK/1984307.3921. 3, 88.6-98.9. Loreto, small cocha on left bank of R. Yaquerana *c.* 2 h upstream of Colonia Angamos, 30 min upstream of Cocha Palometal (30 hp deslizador). 29 Jul 1984. SOK 86. NRM THO/1976311.1176. 1, 57.1. Loreto, San Sebastian, Caño do Comprido. 26 Jul 1976. T. Hongslo. **R. Madre de Dios drainage:** NRM SOK/1983324.3749. 37, 12.1-37.8 (2: 35.0-37.8). Madre de Dios, Lago Túpac Amaru. 11 Aug 1983. SOK 58. USNM 264091. 2*, 51.0-59.8. Madre de Dios, stream on S side of R. Madre de Dios, *c.* 10 km downstream of mouth of R. Tambopata. 25 Aug 1983. RPV 83-41. FMNH 70154. 1*, 99.6. Madre de Dios, R. Inambarí. 29 Sep 1958. E.R. Blake. CAS 57254. 5, 12.0-20.2. Madre de Dios, 14 km ENE of Puerto Maldonado, Lago Sandoval. 5 Jun 1983. T. Iwamoto (TI83-15). ANSP 143549. 2, 29.5-*c.*49.2. Madre de Dios, R. Madre de Dios system at 12°33'S 69°13'W. 15 Aug 1977. R. Horwitz (RH 5MD 0151). **R. Tambopata drainage:** USNM 266796. 16, 17.7-124.5 (7: 32.7-124.5). Madre de Dios, Reserva Natural de Tambopata, Laguna Cocococha, 5.1 km E Explorers Inn. 20 Aug 1983. RPV 83-32. USNM 266792. 5, 16.2-27.9. Same data as USNM 266796. USNM 264082. 1*, 50.0. Madre de Dios, Reserva Natural de Tambopata, first stream down trail from Laguna Chica, where crossed by log bridge. 19 Aug 1983. RPV 83-29. USNM 263884. 4*, 36.2-150.0. Madre de Dios, Reserva Natural de Tambopata, Laguna Chica, end opposite boat dock (farthest from trail leading to lodge). 19 Aug 1983. RPV83-28. USNM 264065. 1*, 70.2. Madre de Dios, stream entering R. Tambopata from S bank *c.* 500 m downstream of Explorers Inn boat landing. 23 Aug 1983. RPV 83-39.

BRASIL. R. Javari drainage: NRM SOK/1984317.3920. 1, 70.2. Amazonas, R. Javari sand playa opposite civil village of Colonia Angamos. 5 Aug 1984. SOK 95. **R. Juruá drainage:** MZUSP 33.034. 1, 72.2. Acre, R. Tarauacá drainage, Tarauacá, Lago da Esperança. 1 Aug 1984. M. Goulding.

COLOMBIA. R. Amazonas drainage: NRM THO/1971386.3511. 1*, 81.9. Amazonas, Leticia, Lagos de Leticia. 25 Sep 1971. T. Hongslo (VIT 15). ANSP 158169. 2. Amazonas, rainforest pond 6-7 mi W of Leticia. Feb 1974. A. Keast (31). ANSP 149369. 2. Amazonas, Lagos de Leticia, backwater area cut off from R. Amazonas. Mar 1977. A. Keast (28). **R. Putumayo drainage:** GNHM 2832. 1, 81.9. Putumayo, R. Caucayá, Limón Cocha. 8-9 Dec 1953. R. Blomberg. GNHM 2831. 1, 159.5. Putumayo, R. Caucayá, /illegible/ Cocha. 7 Dec 1953. R. Blomberg.

BOLIVIA. R. Madre de Dios drainage: NRM A84/1982202.3115. 3, 66.6-144.5. Pando, Laguna San Luis, *c.* 90 km upstream of Riberalta. 18 May 1982. G. Loubens, L. Lauzanne.

Apistogramma eunotus

PERÚ. Drainage unknown: ANSP 21439-21440. 2, 26.9-36.4. Peru. 1873-1877. J. Orton. **R. Aguaytía drainage:** MHNG 2233.32. 2, 24.1-25.2. Ucayali, IVITA, Limonal. 19 Oct 1984. P. de Rham, H. Ortega T. MHNG 2205.17. 5, 19.9-46.3. Ucayali, IVITA, pond no. 4. 11 Oct 1984: H. Ortega T., I. Samánez. **R. Ucayali drainage:** NRM unreg. 4, 22.7-29.3. Ucayali, R. Shahuaya near Alto Aruya. 15 Jul 1981. W. Staeck. ZFMK 10722. 1, 49.9. Ucayali, 'Dunkelwasser'

at Campo Verde. 3 Sep 1978. K.H. Lüling (Sta. PU2). **Holotype of** *Apistogramma eunotus* Kullander. ZFMK 10773-10774. 2, 14.2-35.7. Same data as ZFMK 10772. **Paratypes of** *Apistogramma eunotus* Kullander. FMNH 84235. 13, 14.4-41.2. Ucayali, 3.4 km from Pucallpa on road to Lima, 1st bridge over stream. 27 Jul 1975. D.W. Greenfield, G.S. Glodek (G-75-68). MZUSP unreg. Several. Ucayali, Pucallpa. 15 Mar 1979. C. Villanueva. BMNH 1913.7.30:56-57. 2, 35.8-39.8. 'R. Ucayali'. No date. W. Mounsey. **Paratypes of** *Apistogramma eunotus* Kullander. NRM SOK/1981342.3450. 12, 14.9-45.7. Ucayali, aguajal pool at Km 6 on road Campo Verde - Tournavista. 18 Aug 1981. SOK 30. NRM SOK/1981343.3470. 1, 29.7. Ucayali, quebrada at km 15 on road Campo Verde-Tournavista. 19 Aug 1981. SOK 33. NRM A85/1985314.3510. 2, 24.6-27.9. Ucayali, tributary river of R. Utiquinia, *c.*12 km from mouth. 1 Aug 1985. W. Staeck, H. Linke (P3/85). NRM A85/1985315.3506. 12, 19.4-35.4. Ucayali, laguna on R. Utiquinia, *c.* 15 km from mouth. 2 Aug 1985. W. Staeck, H. Linke (P4/85). MZUSP unreg. 2. Ucayali, Pucallpa. 16 Dec 1974. H. Ortega. MZUSP unreg. 1. Ucayali, Pucallpa. 17 Dec 1974. H. Ortega. MZUSP unreg. 3. Ucayali, 'Lobococha-Masisea, Pucallpa'. 27 Feb 1976. H. Ortega. NRM A85/1984313.3111. 4, 12.6-29.3. Loreto, laguna just behind village Monte Bello on left bank of R. Ucayali. 1 Aug 1984. W. Staeck (P4/84). NRM SOK/1981362.3575. 2, 16.4-19.9. Loreto, Quebrada Copal at Km 15 on road Jenaro Herrera-Colonia Angamos. 1 Sep 1981. SOK 44. NRM SOK/1983347.3755. 2, 23.3-24.2. Loreto, isolated pool at right bank of Quebrada Carahuayte at Km 20 on road Jenaro Herrera-Colonia Angamos. 28 Aug 1983. SOK 75. NRM SOK/1983351.3754. 7, 16.8-33.1. Loreto, Quebrada Copal at Km 15 on road Jenaro Herrera-Colonia Angamos. 29-30 Aug 1983. SOK 78. NRM SOK/1981364.3602. 2, 33.7-41.1. Loreto, near mouth of Quebrada Espejo, small affluent of Supay Cocha. 3 Sep 1981. SOK 48. ZMA unreg.*pt.* 5, 21.0-32.2. Loreto, Caño Tomasa on left bank of R. Aucayacu. 13 Sep 1981. P. de Rham *et al.* (Sta. 26). MHNG 2233.24. 1, 25.9. Loreto, forest creeks on right bank of Quebrada Carahuayte, *c.* 35 km SE Jenaro Herrera. 8-10 Sep 1981. Leg. P. de Rham, H. Nijssen (Sta. 22a). MHNG 2233.25. 1, 25.4. Loreto, forest creeks on left bank of Quebrada Carahuayte, *c.* 30 km SE Jenaro Herrera. 11 Sep 1981. P. de Rham, H. Nijssen (Sta. 22b). MHNG 2233.26. 1, 29.4. Loreto, Quebrada Abrahancillo, left bank tributary to R. Aucayacu. 30 Sep 1981. (Sta. 13). MHNG 2233.27. 1, 23.1. Loreto, Caño Tiriri, tributary to Caño Supay. 4 Sep 1981. P. de Rham, L. Mori P. (Sta. 21a). MHNG 2233.28. 1, 18.1. Loreto, Sahua Cocha. 20 Jun 1978. Leg. P. de Rham (R.49). MHNG 2233.31. 1, 50.1. Loreto, Quebrada 'Túpac Amaru', *c.* 14 km from Jenaro Herrera on road to Colonia Angamos. 6 Jun 1977. P. de Rham (R.98). MHNG 1583.50. 1, 21.0. Loreto, Jenaro Herrera. 18 Oct 1977. P. de Rham. MZUSP unreg. 2. Loreto, Jenaro Herrera. 22 Sep 1978. Leg. H. Ortega. **R. Pacaya drainage:** MHNG 2233.30. 18, 13.6-23.9. Loreto, drying stream close to R. Pacaya and Cahuana station. 7 Jul 1980. P. de Rham (R. 135). **R. Tigre drainage:** MHNG 2233.29. 1, 20.1. Loreto, Nueva York. Jul 1979. P. de Rham. **R. Itaya drainage:** NRM SOK/1981324.3297. 8, 9.0-18.7. Loreto, Quisto Cocha, shore at Parque Zoológico. 6 Aug 1981. SOK 23a. **R. Nanay drainage:** MPM unreg. 1, 24.8. Loreto, small tributary of R. Nanay at Mishana. 6 Nov 1974. Spieler, Poncho (RES-13-74). ANSP 139145. 1. Loreto, backwater pools opposite Base Marina. 12 Oct 1955. Catherwood Exp. **R. Amazonas drainage:** NRM SOK/1981333.3404. 14, 12.0-33.2. Loreto, R. Ampiyacu system, Sacarita del Tuyé, opposite Pebas, floating meadow near mouth. 12 Aug 1981. SOK 27b. NRM SOK/1981333.3381. 23, 10.7-33.4. Same data as NRM SOK/1981333.3404, but station SOK 27a. 2 specimens cleared and stained. ANSP 9265-9269. 5, *c.* 31.5-52.5. Loreto, R. Ampiyacu. No date. J. Hauxwell. ANSP 9110-9111. 2, *c.*35.4-*c.*44.3. Loreto, R. Ampiyacu. No date. J. Hauxwell. USNM 177727. 1, 21.6. Loreto: Pebas Caño. No date. W.G. Scherer. **R. Yavarí drainage:** NRM THO/1976312.0914-0923. 10, 18.3-23.5. Loreto, San Sebastian, Caño do Comprido. 27 Jul 1976. T. Hongslo. **Paratypes of** *Apistogramma eunotus* Kullander. NRM THO/1976311.1164-1168. 5, 19.8-31.7. Loreto, San Sebastian, Caño do Comprido. 26 Jul 1976. T. Hongslo. **Paratypes of** *Apistogramma eunotus* Kullander. NRM THO/1971365.3507. 1, 20.4. Loreto, Lago Matamata. 10 Sep 1971.

T. Hongslo (VIT 6A). (Previous reg. no. NRM 11284.) **Paratype of** *Apistogramma eunotus* Kullander.
COLOMBIA. R. Amazonas drainage: NRM A84/1983423.3009. 5, 22.3-34.0. Amazonas, Leticia, small swamp. 19 Oct 1983. S. Nilsson. UF 26221. 3, 15.9-20.6. Amazonas, Tsaliki's nursery just N of Leticia. 16 Jan 1973. J.D. Williams *et al.* ANSP 158170. 1. Amazonas, rain-forest pond 6-7 mi W of Leticia. Feb 1974. A. Keast (31). ANSP 135999. 7, 13.0-48.4. Amazonas, Leticia, backwater area cut-off from R. Amazonas. Mar 1977. A. Keast (33).
BRASIL. R. Solimoes drainage: MCZ 15807. 2, 34.0-40.6. Amazonas, Tabatinga. /Sep.-Oct. 1865/. Thayer Exp. **Paratypes of** *Apistogramma eunotus* Kullander. **R. Japurá drainage:** MZUSP unreg.*pt.* 5, 27.6-36.0. Amazonas, Paraná do Amanã, Lago Amanã. Oct 1980. R. Best.

Apistogramma cruzi

PERÚ. R. Napo drainage: NRM SOK/1984332.3941. 1*, 25.9. Loreto, lower course of quebrada right bank tributary to R. Mazán nearly 2 h upstream of Puerto Alegre. 14 Aug 1984. SOK 102. **Holotype.** NRM SOK/1984332.3924. 2, 11.4-26.3 (1: 26.3). Same data as NRM SOK/1984332.3941. **Paratypes.**
COLOMBIA. R. Putumayo drainage: GNHM 2821. 22, 13.4-21.6 (2: 16.8-21.6). Putumayo, R. Caucayá, Limón Cocha. 10 Dec 1953. R. Blomberg. **Paratypes.** GNHM 2820. 3*, 21.6-30.0. Putumayo, R. Caucayá, Limón Cocha. 8 Dec 1953. R. Blomberg. **Paratypes.** GNHM 2822. 4*, 17.3-34.6. Putumayo, R. Caucayá, Limón Cocha. 11 Dec 1953. R. Blomberg. **Paratypes. R. Caquetá drainage:** GNHM 2823. 1*, 50.5. Caquetá, R. Caguán. 28 Mar 1953. R. Blomberg. Paratype.
ECUADOR. R. Napo drainage: MHNG 2233.93. 2, 30.0-32.8. Napo, San Pablo de Kantesiya, R. Caimito. 1 Mar 1985. J.M. Touzet (306). **Paratypes.**
Note: GNHM catalogue nos. received late, no fault of GNHM; 'unreg.' refers to GNHM 2820 in fig. 50, GNHM 2822 in Pl. XVI, fig. 3, GNHM 2823 in Pl. XVI, fig. 4.

Apistogramma urteagai

PERÚ. R. Madre de Dios drainage: NRM SOK/1983324.3930. 1*, 28.3. Madre de Dios, Lago Túpac Amaru, clayey shore. 11 Aug 1983. SOK 58. **Holotype.** NRM SOK/1983324.3653. 7, 20.9-25.1 (4: 20.9-25.1). Same data as holotype, **Paratypes.** USNM 264079. 57, 12.2-40.6. Madre de Dios, stream on S side of R. Madre de Dios *c.* 10 km downstream of mouth of R. Tambopata. 25 Aug 1983. RPV 83-41. **Paratypes.** CAS 57286. 10, 13.7-22.9. Madre de Dios, 14 km ENE Puerto Maldonado, *c.*1.5 mi NNW by trail from Cuzco Amazónica Lodge, swamp. 12 Jun 1983. T. Iwamoto (TI83-22). **Paratypes.** CAS 54635. 9, 13.3-35.5. Madre de Dios, 14 km ENE Puerto Maldonado, 1.5 mi NNW along trail from Cuzco Amazónica Lodge, swampy. 2 Jun 1983. T. Iwamoto (TI83-10). **Paratypes.** CAS 54636. 1, 36.9. Madre de Dios, 14 km ENE Puerto Maldonado, slough on trail to Lago Sandoval from Río Madre de Dios, swampy area. 5 Jun 1983. T. Iwamoto (TI83-14). **Paratypes.** ANSP 144075. 1, 14.5. Madre de Dios, 12º 32' S, 69º 16.5' W. 18 Aug 1977. R. Horwitz (RH 6MD 00154). **Paratype. R. Tambopata drainage:** NRM SOK/1983325.3652. 13, 16.7-27.4 (5: 22.4-27.4). Madre de Dios, Quebrada San Roque at Km 11 on road Puerto Maldonado - Cuzco. 12 Aug 1983. SOK 61. **Paratypes.** NRM SOK/1983331.3673. 10, 11.9-20.6. Madre de Dios, quebrada at Km 14 on road Puerto Maldonado - Cuzco. 15 Aug 1983. SOK 64. **Paratypes.** USNM 264075. 6, 21.7-36.1. Madre de Dios, Reserva Natural de Tambopata, first stream down trail from Laguna Chica, where crossed by log bridge. 19 Aug 1983. RPV 83-29. **Paratypes.**. USNM 264083. 5, 20.2-37.8. Madre de Dios, second stream entering R. Tambopata on SW shore, upstream of mouth of R. La Torre. 23 Aug 1983. RPV 83-37. **Paratypes.** USNM 264071. 4, 26.8-36.8. Madre de Dios, stream 200 m above R. La Torre. 21 Aug 1983. RPV 83-35. **Paratypes.** USNM 264074. 11, 16.7-23.8. Madre de Dios, Reserva Natural de Tambopata, second stream down trail from Laguna Chica and upstream swamp. 19 Aug 1983. RPV 83-30. **Paratypes.** USNM 263873 (100) and NRM A85/1983336.3147

(4). 104, 10.3-37.9. Madre de Dios, Reserva Natural de Tambopata, Laguna Cococha, 5.1 km E Explorers Inn. 20 Aug 1983. RPV 83-32. **Paratypes.**

Apistogramma moae

BRASIL. R. Juruá drainage: IRSNB 586. 1, 49.9. Acre, mun. Cruzeiro do Sul, Igarapé São Salvador, left bank tributary of R. Moá. 30 Nov 1967. S.M. Léopold III, J.-P. Gosse (Sta. 187). **Holotype of** *Apistogramma moae* Kullander. IRSNB 587. 1, 46.5. Same data as IRSNB 586. **Paratype of** *Apistogramma moae* Kullander. ZUEC 734. 1*, 31.9. Acre, mun. Cruzeiro do Sul, Vila Militar, igarapé. 10 May 1982. G.V. Andrade, J.R. Santos. ZUEC 1375-1377. 3*, 27.2-29.5. Acre, mun. Cruzeiro do Sul, riachos near Igarapé Formoso. 2 Jan 1982. C.F.B. Haddad, J.R. Santos.

Apistogramma luelingi

PERÚ. R. Madre de Dios drainage: CAS 57252. 9, 8.7-24.0. Madre de Dios, 14 km ENE Puerto Maldonado, 1.5 mi NNW along trail from Cuzco Amazónica Lodge, swampy. 2 Jun 1983. T. Iwamoto (TI83-10). CAS 54640. 7, 12.0-28.7. Madre de Dios, 14 km . ENE Puerto Maldonado, *c.* 1.5 mi NNW by trail from Cuzco Amazónica Lodge, swamp. 12 Jun 1983. T. Iwamoto (TI83-22). NRM A85/1983237.3463. 2, 22.2-24.4. Same data as CAS 54640. CAS 54633. 1, 21.7. Madre de Dios, 14 km ENE Puerto Maldonado, *c.* 1.5 mi NNW along trail from Cuzco Amazónica Lodge, swampy. 2 Jun 1983. T. Iwamoto (TI83-9). CAS 54639. 1, 16.4. Madre de Dios, 14 km ENE Puerto Maldonado, *c.* 1.5 mi NNW by trail from Cuzco Amazónica Lodge. 7 Jun 1983. G. Hunter/Edelbrock (TI83-19). **R. Tambopata drainage:** USNM 284068. 2*, 26.1-27.7. Madre de Dios, stream entering R. Tambopata from south bank, *c.* 500 m downstream from Explorer's Inn boat landing. 23 Aug 1983. RPV 83-39. USNM 266790. 2*, 27.4-32.6. Madre de Dios, Reserva Natural de Tambopata, Laguna Cococha, 5.1 km E of Explorers Inn. 20 Aug 1983. RPV 83-32. USNM 264080. 4, 23.3-25.6 (3: 23.3-25.6). Madre de Dios, Reserva Natural de Tambopata, stream *c.* 3.0 km from lodge on trail to Laguna Cococha. 20 Aug 1983. RPV 83-31. USNM 263889. 2, 16.8-24.2 (1: 24.2). Madre de Dios, Reserva Natural de Tambopata, stream which crosses main trail, 2.5 km from Explorer's Inn. 8 Sep 1983. RPV 83-43. USNM 264069. 5, 12.6-26.9 (1: 26.9). Madre de Dios, Reserva Natural de Tambopata, forest stream 2.2 km from Explorer's Inn on trail to Laguna Cococha. 21 Aug 1983. RPV 83-38. NRM A85/1983337.3148. 2, 16.9-23.5 (1: 23.5). Same data as USNM 264069. **R. Manú drainage:** MHNG 1583.35-36. 2, 23.0-27.6. Madre de Dios, Parque Nacional de Manú, R. Manú. 17 Sep 1977. P de Rham (No. 18). ZMA 115.210. 1, 27.6. Same data as MHNG 1583.35-36. MHNG 1583.37-38. 2, 16.6-16.7. Madre de Dios, Parque Nacional de Manú, R. Manú. 9 Sep 1977. P de Rham.

Apistogramma juruensis

BRASIL. R. Juruá drainage: ZUEC 1374. 1*, 41.3. Acre, mun. Cruzeiro do Sul, riacho near Igarapé Formoso. 2 Jan 1982. C.F.B. Haddad, J.R. Santos. **Holotype.** ZUEC 1378-1380. 2*, 19.6-20.0. Same data as ZUEC 1374. **Paratypes.** NRM A85/1982006.3541. 1*, 21.0. Same data as ZUEC 1374. **Paratype.** MZUSP 32692. 2*, 23.3-24.3. Acre, R. Tarauacá, igapó pool at Tarauacá. 31 Jul 1984. M. Goulding. **Paratypes.**

Apistogramma cacatuoides

Uncertain origin: ZMA 100.033A. 1, 37.9. 'Amazone'. Aquarium specimen. Imported April 1950. **Holotype of** *Apistogramma cacatuoides* Hoedeman. ZMA 100.033B. 1, 32.6. 'Amazone'. Aquarium specimen. Imported April 1950. **Paratype of** *Apistogramma cacatuoides* Hoedeman.

PERÚ. Drainage uncertain: NRM A85/1985325.3525. 1, 50.3. Ucayali/Huánuco, stream at Km 7 or Km 18.5 on road to Puerto Inca from Km 85 on Pucallpa-Tingo

María road. 9 Aug 1985. Leg. W. Staeck, H. Linke (P15-16/85). **R. Pachitea drainage:** ZMH 3239A,D. 2, 34.2-40.9. Huánuco, logging road R. Pachitea-Tournavista, pool. 20 or 25 Aug 1964. A.J. Klee. **R. Ucayali drainage:** NRM unreg. 2, 15.8-20.8. Ucayali, pool near E shore of Yarina Cocha. 18 Jul 1981. W. Staeck. MHNG 2233.34. 2, 11.2-22.7. Ucayali, Yarina Cocha, pool near Lobo Caño. 1978. P. de Rham. MHNG 2233.35 1, 21.2. Loreto, Caño Tiriri, tributary to Caño Supay. 4 Sep 1981. P. de Rham, L. Mori P. (Sta. 21a). MHNG 2233.36. 5, 18.4-39.9. Loreto, Quebrada Abrahancillo, left bank tributary to R. Aucayacu. 30 Aug 1981. P. de Rham *et al.* (Sta. 13). MHNG 2233.38. 3, 14.1-28.3. Loreto, forest pool *c.* 100 m from Sahua Cocha. 20 Jun 1978. P. de Rham (R.36). NRM SOK/1981342.3451. 3, 21.7-36.0. Ucayali, aguajal pool at Km 6 on road Campo Verde-Tournavista. 18 Aug 1981. SOK 30. NRM A85/1984323.3108. 8, 17.5-22.4. Ucayali, stagnant pool near Paca Cocha E Yarina Cocha. 8 Aug 1984. W. Staeck (P9/84). ZMA unreg.*pt.* 1, 22.2. Loreto, Caño Tomasa on left bank of R. Aucayacu. 13 Sep 1981. P. de Rham *et al.* (Sta. 26). NRM A85/1984313.3110. 9, 11.9-26.7. Loreto, laguna just behind village Monte Bello on R. Ucayali left bank. 1 Aug 1984. W. Staeck (P4/85). NRM A85/1985315.3505. 10, 15.7-31.2. Ucayali, laguna on R. Utiquinia, *c.* 15 km from mouth. 2 Aug 1985. W. Staeck, H. Linke (P4/85). NRM A85/1985324.3519. 13, 17.1-30.3. Ucayali, laguna at Paca Cocha. 8 Aug 1985. W. Staeck, H. Linke (P13/85). **R. Aguaytía drainage:** MHNG 2233.39. 8, 21.9-47.0. Ucayali, Bosque Nacional Alexandre von Humboldt, small forest stream close to forestry research station. 25 Jun 1978. P. de Rham (R.24). MHNG 1583.71-75. 5, 22.6-32.3. Ucayali, Bosque Nacional Alexandre von Humboldt. 19 May 1977. P. de Rham (No. 13). ZMA 115.208. 2, 28.8-31.9. Same data as MHNG 1583.71-75. MHNG 2205.18. 1, 22.4. Ucayali, IVITA, embalse no. 4. 11 Oct 1984. H. Ortega T., I. Samánez. NRM A85/1985325.3527. 9, 27.1-44.0. Ucayali, stream widening 3 km from Km 85 on road Pucallpa-Tingo María, on road to Puerto Inca. 9 Aug 1985. W. Staeck, H. Linke (P14/85). **R. Samiria drainage:** MHNG 2233.40. 24, 13.3-23.2. Loreto, caño close to Chinguito Cocha on right bank of R. Samiria, *c.* 2 km downstream of biological research station Pithecia. 7 Oct 1979. P. de Rham (R.115). **R. Amazonas drainage:** MHNG 2233.37. 4, 22.7-32.4. Loreto, Padre Isla, Cocha Largo. 14 Jul 1980. P. de Rham (R.151). NRM SOK/1981333.3403. 1, 21.7. Loreto, Sacarita del Tuyé, opposite Pebas, floating meadow near mouth. 12 Aug 1981. SOK 27bis. ANSP 9270-9271. 2, *c.*27-*c.*34. Loreto, R. Ampiyacu. No date. J. Hauxwell. USNM 177867. 1. Near Iquitos. No date. R. Socolof. **R. Yavarí drainage:** NRM THO/1971366.3175. 2, 32.3-32.5. Loreto, Lago Matamata, caño. 11 Sep 1971. T. Hongslo (VIT 7A). (Previously NRM 11281.) NRM THO/1971361.3503. 2, 22.7-26.2. Loreto, Caño Piranha. 6 Sep 1971. T. Hongslo (VIT3). (Previously NRM 11282.)

COLOMBIA, R. Amazonas drainage: NRM A84/1983422.3013. 1, 18.8. Amazonas, Leticia, Los Lagos, small brook. 18 Oct 1983. S. Nilsson. USNM 179808. 4. Near Leticia. 1959. R. Socolof. ANSP 135998. 4. Amazonas, island *c.* 60 km upstream from Leticia. Feb 1974. A. Keast (No. 66). MCZ 51721. 1, 14.7. Amazonas, Isla Santa Sofía, isolated pool. Jul 1972. R.A. Mittermeier. MCZ 51748. 16, 12.6-41.1. Same data as MCZ 51721. NRM THO/1976306.1026. 3, 10.0-13.9. Amazonas, Puerto Nariño, Finca Merced, small laguna. 24 Jul 1976. T. Hongslo.

BRASIL. R. Solimões drainage: MCZ 15802*pt.* 1, 24.4. Amazonas, Tabatinga. /1865-1866./ Thayer Exp. MCZ 56216. 2, 19.7-23.0. Same data as MCZ 15802*pt.* MCZ 56213. 7, 17.4-35.8. Same data as MCZ 15802*pt.* MCZ 56228. 1, 21.5. Same data as MCZ 15802*pt.*

Apistogramma payaminonis

ECUADOR. R. Napo drainage: FMNH 96564. 1*, 39.6. Napo, R. Payamino drainage, Quebrada Ahuano, above Ahuanopaccha, headwaters of R. Tutapishcu. 15 Nov 1983. D.J. Stewart, M. Ibarra, R. Barriga, A. Echeverria (DJS 83-75). **Holotype.** FMNH 96564*pt.* 1*, 30.8. Same data as holotype. **Paratype.** MCZ 49327. 15, 15.8-39.6 (8: 28.539.6). Napo, 1 mi upriver from mouth of R. Payamino at Puerto Coca, forest brook. 25 Nov 1971. T. Roberts. **Paratypes.**

Apistogramma nijsseni

PERÚ. R. Ucayali drainage: MHNG 12595.82. 1, 30.7. Loreto, unnamed quebradita tributary to Quebrada Copal 200 m N road at Km 14 on road Jenaro Herrera - Colonia Angamos. 18 Oct 1977. P. de Rham. **Holotype of** *Apistogramma nijsseni* Kullander. MHNG 1595.83-85. 3, 24.2-27.0. Same data as MHNG 1595.82. **Paratypes of** *Apistogramma nijsseni* Kullander. (1 specimen to be deposited in ZMA 116.054.) MHNG 1595.86-88. 3, 20.5-26.6. Locality as MHNG 1595.82. 6 Jun 1977. P. de Rham. **Paratypes of** *Apistogramma nijsseni* Kullander. NRM 11298. 1, 29.2. Same data as MHNG 1595.86-88. **Paratype of** *Apistogramma nijsseni* Kullander. (Previously MHNG 1595.89.) NRM SOK/1981362.3570. 2, *c.* 26.8-32.6. Locality as MHNG 1595.82. 1 Sep 1981. SOK 43. MHNG 2094.44. 1, 52.4. Same data as MHNG 1595.86-88, but not type. Kept in aquarium for about 2 years. MHNG 2094.39-43. 4, 22.6-28.8. Locality as MHNG 1595.82. 12 Mar 1980. P. de Rham (R.129). MHNG 2094.38. 1, 17.9. Loreto, small stream crossing road at *c.* Km 13 on road Jenaro Herrera-Colonia Angamos. 12 Mar 1980. P. de Rham (R.164). MHNG 2094.34-37. 3, 20.9-26.8. Loreto, forest creeks at right bank of Quebrada Carahuayte, *c.* 35 km SE Jenaro Herrera. 8-10 Sep 1981. P. de Rham, H. Nijssen (Sta. 22a). MHNG 2094.45-46. 2, 25.0-26.5. Same data as MHNG 2094.34-37. MHNG 2094.32-33. 4, 15-0-31.3. Loreto, creeks along road between Jenaro Herrera and Quebrada Carahuayte. 8-15 Sep 1981. P. de Rham *et al.* NRM SOK/1983351.3699. 1, 21.4. Loreto, quebradita tributary to Quebrada Carahuayte at Km 18 on road Jenaro Herrera-Colonia Angamos. 29 Aug 1983. SOK 77. ZMA unreg. 5, 25.4-39.2. Same data as MHNG 2094.34-37. ZMA unreg. 2, 19.4-36.4. Loreto, forest creeks at right bank of Quebrada Copal, 16-17 km from Jenaro Herrera on road to Colonia Angamos. 12-14 Sep 1981. P. de Rham *et al.* (Sta. 25). ZMA unreg. 2, 28.4-37.1. Loreto, near Jenaro Herrera, locality data lost. Sep 1981. P. de Rham, H. Nijssen.

Apistogramma agassizii

PERÚ. R. Ucayali drainage. MHNG 1583.49-50*pt.* 1, 32.8. Loreto, Jenaro Herrera. 18 Oct 1977. P. de Rham (No. 4). MHNG 1583.62-66. 5, 17.2-25.0. Loreto, Jenaro Herrera. 1977. P. de Rham (No. 2). ZMA 115.209. 2, 22.7-25.8. Loreto, 'Quebrada Túpac Amaru', near mouth into Quebrada Copal. 6 June 1977. P. de Rham. NRM SOK/1981361.3645. 2, 22.6-29.3. Loreto, quebrada at Km 3 on road Jenaro Herrera - Colonia Angamos. 31 Aug 1981. SOK 42. NRM SOK/1981357.3566. 7, 19.1-26.4. Loreto, Quebrada Abrahancillo, left bank tributary to R. Aucayacu. 30 Aug 1981. SOK 40. MHNG 2233.43. 15, 18.5-29.7. Same data as NRM SOK/1981357.3566. NRM SOK/1981364.3598. 11, 18.8-26.3. Loreto, near mouth of unnamed quebrada, small affluent of Supay Cocha. 3 Sep 1981. SOK 47. NRM SOK/1981364.3638. 1, 20.1. Data as NRM SOK/1981364.3598, dead in aquarium at NRM Sep 1981. NRM SOK/1983347.3702. 4, 20.5-38.5. Loreto, isolated pool at left bank of Quebrada Carahuayte at km 20 on road Jenaro Herrera-Colonia Angamos. 28 Aug 1983. SOK 75. NRM SOK/1983353.3756. 10, 15.7-28.1. Loreto, Quebrada Salomé, tributary to Quebrada Sapuena, at Km 9 on road Jenaro Herrera-Colonia Angamos. 31 Aug 1983. SOK 80. NRM SOK/1983353.3757. 20, 17.6-36.7. Loreto, Quebrada Sapuena at Km 10 on road Jenaro Herrera-Colonia Angamos. 31 Aug 1983. SOK 79. NRM SOK/1981363.3578. 13, 15.0-30.2. Loreto, Quebrada Sapuena at Km 10 on road Jenaro Herrera-Colonia Angamos. 2 Sep 1981. SOK 45. MHNG 2233.41. 3, 15.3-23.1. Same data as NRM SOK/1981363.3578. ZMA unreg. 3, 11.8-19.6. Same data as NRM SOK/1981363.3578. MHNG 2233.42. 1, 25.8. Loreto, small stream affluent of fish pond Embalse del Potrero 20 at Centro Ganadero 2, *c.* 3 km S Km 4 on road Jenaro Herrera - Colonia Angamos, close to lateral road to R. Parnayari. 11 Mar 1980. P. de Rham (R.HS.1). NRM SOK/1983355.3759. 107, 12.3-40.9. Loreto, quebrada in arboretum at Km 3 on road Jenaro Herrera-Colonia Angamos. 2 Sep 1983. SOK 82. NRM A85/1984322.3107. 6, 18.7-19.4. Loreto, Quebrada Sapuena at Km 10 on road Jenaro Herrera - Colonia Angamos. 7 Aug 1984. W. Staeck (P8/84). NRM A85/1984317.3109. 6, 13.2-23.8. Loreto, small quebrada just northeast of Requena. 5 Aug 1984. W. Staeck (P6/84). NRM A85/1984321.3106. 2, 17.4-19.9. Loreto, Quebrada Copal at Km 15 on road Jenaro

Herrera-Colonia Angamos. 6 Aug 1984. W. Staeck (P7/84). **R. Itaya drainage:** NRM SOK/1981367.3608. 3, 12.2-15.5. Loreto, Quisto Cocha, pool close to lake on shore opposite Parque Zoológico. 6 Sep 1981. SOK 50. MHNG 2233.44. 3, 13.4-19.6. Loreto, Quisto Cocha, Alcántara Caño. 27 Aug 1981. P. de Rham *et al.* (Sta. 10). **R. Nanay drainage:** NRM SOK/1981371.3617. 1, 25.0. Loreto, unnamed quebrada *c.* 200 m to the left of the road from Iquitos, just before Santa Clara. 7 Sep 1981. SOK 51. NRM A85/1985322.3537. 3, 25.2-29.4. Loreto, forest laguna *c.* 1000 m from R. Nanay between Iquitos and Santa Clara. 6 Aug 1985. W. Staeck, H. Linke (P9/85). **R. Amazonas drainage:** NRM A85/1985323.3540. 5, 22.2-33.5. Loreto, tributary of R. Manití near mouth. 7 Aug 1985. W. Staeck, H. Linke (P11/85). NRM SOK/1981333.3380. 1, 25.6. Loreto, little upstream from Pebas, Sacarita del Tuyé, right bank tributary of the R. Ampiyacu, floating meadow near mouth. 12 Aug 1981. SOK 27a. NRM unreg. 1, 29.3. Loreto, vicinity of Iquitos. 1981. H.J. Mayland. UF 33096. 1, 37.4. Loreto: within 30 mi of Iquitos, Ríos 'Auigon', Manití, Napo, Itaya, 'Neuse'. *c.* 1960. C. Preutice. **R. Yavari drainage:** NRM THO/1971365.3508. 4, 23.9-30.6. Loreto, Lago Matamata. 10 Sep 1971. T. Hongslo (VIT 6A). (Previously NRM 11276; erroneously labeled as from Pau-mari 14 Sep 1971.) NRM THO/1971361.3055. 1, 31.1. Loreto, Caño Piranha. 6 Sep 1971. T. Hongslo (VIT 3). (Previously NRM 11274.) NRM THO/1971356.3037. 17, 15.7-28.9. Loreto, Lago Matamata. 4 Sep 1971. T. Hongslo (VIT 1A). (Previously NRM 11275.) NRM THO/1976311.1168. 1, 18.7. Loreto, San Sebastian, Caño do Comprido. 26 Jul 1976. T. Hongslo. NRM THO/1976312.0924. 1, 16.7. Loreto, San Sebastian, Caño do Comprido. 27 Jul 1976. T. Hongslo. NRM SOK/1984312.3881. 1, 23.3. Loreto, quebrada left bank tributary to R. Gálvez, *c.* 20 min upstream of Colonia Angamos (30 hp deslizador). 31 Jul 1984. SOK 90. NRM SOK/1984311.3878. 3, 11.1-23.8. Loreto, Quebrada de la Piscigranja at Km 2 on road Colonia Angamos - Jenaro Herrera, upstream of fish pond. 30 Jul 1984. SOK 87. NRM SOK/1984313.3880. 1, 35.7. Loreto, Colonia Angamos, quebrada in civil village intended for fish pond, close to source. 1 Aug 1984. SOK 92. NRM SOK/1984312.3883. 38, 8.9-26.4. Loreto, quebrada left bank tributary to R. Gálvez, *c.* 25 min upstream of Colonia Angamos (30 hp deslizador). 31 Jul 1984. SOK 89.

COLOMBIA. R. Amazonas drainage: NRM THO/1976303.1361. 16, 14.9-33.4. Amazonas, Pueblo Mocagua, Quebrada Pajarito. 21 Jul 1976. T. Hongslo. NRM THO/1976306.1026. 2, 18.2-31.8. Amazonas, Puerto Nariño, Finca Merced, small laguna. 24 Jul 1976. T. Hongslo. NRM THO/1976305.1247. 7, 15.7-32.6. Amazonas, Quebrada de Retén, tributary to R. Amacayacu. 23 Jul 1976. T. Hongslo. NRM A84/1983422.3012. 18, 15.2-22.9. Amazonas, Leticia, Los Lagos, small stream. 18 Oct 1983. S. Nilsson. UF 36124. 2, 32.6-35.8. Amazonas, Tsaliki's nursery just N Leticia. 16 Jan 1973. J.D. Williams *et al.*

BRASIL. R. Javari drainage: NRM THO/1971371.4277. 3, 21.5-27.7. Amazonas, Lago Guariba, Caño de Guariba no. 1. 13 Sep 1971. T. Hongslo (VIT 8). (Previously NRM 11277.) **R. Solimões drainage:** MZUSP unreg.*pt.* 6, 14.2-24.8. Amazonas, R. Japurá system, Paraná do Amanã, Lago Amanã. Oct 1980. R. Best. MCZ 15803. 2, 34.7-37.1. Amazonas, Tabatinga /1865-1866. Thayer Exp./ MCZ 15802. 22, 21.7-37.1. Same data as MCZ 15803. MCZ 15804. 11, 15.2-31.7. Same data as MCZ 15803. MCZ 15801. 24, 13.2-26.6. Same data as MCZ 15803. MCZ 15805. 1, 18.9. Same data as MCZ 15803. SMF unreg. 27, 19.2-35.2. Amazonas, Igarapé Preto. Dec 1960. H. Schultz.

Apistogramma bitaeniata

PERÚ. R. Tigre drainage: MHNG 2233.45. 4, 15.6-22.1. Loreto, Nueva York. Jul 1979. P. de Rham. **R. Nanay drainage:** NRM SOK/1984344.3885. 1, 25.0. Loreto, Quebrada Corrientillo at bridge on road Iquitos - Puerto Almendra. 23 Aug 1984. SOK 113. NRM SOK/1983306.3700. 4, 20.2-24.1. Loreto, pool on right bank playa near Shiriyana. 30 Jul 1983. SOK 55bis. NRM SOK/1984325.3887. 4, 20.8-26.0. Loreto, Puñuisiqui Cocha. 10-11 Aug 1984. SOK 98. NRM SOK/1983305.3701. 1, 25.3. Loreto, Tinaja, left bank playa. 29 Jul 1983. SOK

52. NRM SOK/1984326.3886. 8, 18.4-31.7. Loreto, R. Nanay left bank playa opposite mouth of Quebrada Agua Negra. 11 Aug 1984. SOK 99. NRM SOK/1983305.3698. 4, 21.9-29.9. Loreto, Caño Puñuisiqui. 29 Jul 1983. SOK 53. NRM SOK/1983337.3758. 15, 19.6-28.3. Loreto, small tahuampa cocha on left bank, second left bend above Mishana. 21 Aug 1983. SOK 71. NRM SOK/1981371.3642. 1, 31.4. Loreto, unnamed quebrada, *c.* 200 m to the left from road from Iquitos, just before Santa Clara. 7 Sep 1981. SOK 51. (Died in aquarium, Sep 1981.) NRM SOK/1981371.3635. 2, 19.9-36.9. Data as NRM SOK/1981371.3642, but died in transport alive Iquitos-Stockholm 8 Sep 1981. NRM SOK/1981325.3306. 88, 16.8-28.3. Loreto, Zúngaro Cocha. 7 Aug 1981. SOK 24. NRM SOK/1981347.3514. 12, 20.6-28.9. Loreto, temporarily isolated marginal cocha a few km upstream of Santa Clara. 28 Aug 1981. SOK 37. NRM SOK/1981323.3283. 15, 11.3-27.2. Loreto, Km 13 on road Iquitos-Quistococha, stagnant pool remaining of quebrada effluent of fish ponds of IMARPE. 5 Aug 1981. SOK 19. ANSP 139141. 3. Loreto, backwater pools opposite Base Marina. 12 Oct 1955. Catherwood Exp. ANSP 149370. 1. Data as ANSP 139141. ANSP 139144. 2. Data as ANSP 139141. NRM A85/1985322.3535. 42, 17.3-30.7. Loreto, forest laguna *c.* 1000 m from R. Nanay between Iquitos and Santa Clara. 6 Aug 1985. W. Staeck, H. Linke (P9/85). **R. Napo drainage:** NRM SOK/1984332.3879. 2, 23.6-33.3. Loreto, R. Mazán right bank cocha 2 h upstream from Puerto Alegre. 14 Aug 1984. SOK 100. NRM SOK/1984334.3882. 3, 15.0-31.9. Loreto, Yuto Cocha on right bank of R. Mazán. 16 Aug 1984. SOK 107. NRM SOK/1984334.3884. 58, 9.8-36.0. Loreto, Quebrada de Yuto Cocha on right bank of R. Mazán. 16 Aug 1984. SOK 108. NRM SOK/1984334.3923. 2, 12.1-14.6. Loreto, quebrada left bank tributary to R. Mazán, *c.* 20 min upstream from Puerto Alegre. 16 Aug 1984. SOK 109. **R. Amazonas drainage:** NRM unreg. 11, 25.0-30.7. Loreto, vicinity of Iquitos. 1981. H.J. Mayland. UF 36125. 2, 26.6-36.7. Loreto: within 30 mi of Iquitos, Rios 'Auigon', Manití, Napo, Itaya, 'Neuse'. *c.* 1960. C. Preutice.
COLOMBIA. R. Amazonas drainage: NRM A84/1983423.3010. 5, 19.0-25.2. Amazonas, Leticia, small swamp. 19 Oct 1983. S. Nilsson. USNM 190295. 3. Leticia. No date. R. Socolof.
BRASIL. R. Solimões drainage: IRSNB 18.597. 17, 13.8-31.6. Amazonas, Lago Tefé, Igarapé do Ananas. 19 Nov 1962. J.-P. Gosse, Léopold III (Sta. 13). SMF 5526. 1, 32.5. Amazonas, Igarapé Preto. Dec 1960. H. Schultz. **Holotype of** *Apistogramma klausewitzi* Meinken. SMF 5527-5531. 5, 24.4-28.5. Same data as SMF 5526. **Paratypes of** *Apistogramma klausewitzi* Meinken.
Origin unknown: USNM 199593. 1, 46.5. '(Peru?): From the middle or northern part of upper Amazon'. 1964. Ded. S.H. Weitzman. **Holotype of** *Apistogramma kleei* Meinken. USNM 199594. 2, 30.2-44.5. Same data as USNM 199593. **Paratypes of** *Apistogramma kleei* Meinken. MNHN 35-34. 1, 36.7. 'Rio Madeira (Brésil)'. No date. Rabot /probably A. Rabaut/. Ded. Fumerand. **Lectotype of** *Apistogramma pertense* var. *bitaeniata* Pellegrin. MNHN 35-35. 1, 32.2. Data as MNHN 35-34. **Paralectotype of** *Apistogramma pertense* var. *bitaeniata* Pellegrin.

Apistogrammoides pucallpaensis

PERÚ. R. Ucayali drainage: SMF 7565. 1, 25.6. Ucayali, stream at Pucallpa. Aug 1964. A.J. Klee. **Holotype of** *Apistogrammoides pucallpaensis* Meinken. SMF 7566-7568. 3, 20.0-23.4. Same data as SMF 7565. **Paratypes of** *Apistogrammoides pucallpaensis* Meinken. NRM A85/1985315.3504. 3, 12.8-24.4. Ucayali, laguna on R. Utiquinia, *c.* 15 km from mouth. 2 Aug 1985. W. Staeck, H. Linke (P4/85). NRM A85/1985324.3520. 7, 17.2-22.8. Ucayali, laguna at Paca Cocha. 8 Aug 1985. W. Staeck, H. Linke (P13/85). NRM A85/1985312.3521. 16, 12.4-27.3. Ucayali, backwater *c.* 350 m W La Cabaña on Yarina Cocha. 30 Jul 1985. W. Staeck, H. Linke (P1/85). NRM A85/1984315.3112. 25, 10.0-22.6 (3: 18.2-22.6). Loreto, R. Pacaya drainage, near Estacion Experimental (SW Bretaña, W Canal de Puinahua). 3 Aug 1984. W. Staeck (P5/84). MHNG 2233.46. 4, 15.7-21.8 (1: 21.8). Ucayali, pool near Lobo Caño at E extremity of Yarina Cocha. 1978. P. de Rham. **R. Amazonas drainage:** NRM SOK/1981333.3379. 5,

18.7-26.2 (3: 22.5-26.2). Loreto, Sacarita del Tuyé, opposite Pebas, floating meadow near mouth. 12 Aug 1981. SOK 27a. NRM SOK/1981.333,3405. 3, 14.7-17.3. Same data as NRM SOK/1981333.3379 but SOK 27b.
COLOMBIA. R. Amazonas drainage: MCZ 51736. 1, 25.9. Amazonas, isolated pool 30 km upstream of Leticia. Jul 1972. R.A. Mittermeier. MCZ 51748. 1, 20.0. Amazonas, isolated pool on Isla Santa Sofía. Jul 1972. R.A. Mittermeier. **Origin obscure:** SMF 12635*pt*. 1, 33.1. 'Mittleren Amazonas'. Ded. H. Meinken, April 1974 (aquarium specimen). NRM unreg. 4, 21.7-37.6. Aquarium. Ded. M. McMaster.

Mesonauta insignis

PERÚ. R. Ucayali drainage: NRM A85/1985315.3528. 1, 44.5. Loreto, shore of Yarina Cocha near La Cabaña. 2 Aug 1985. W. Staeck, H. Linke (P5/85). NRM SOK/1981345.3444. 14, 33.3-60.7. Ucayali, Yarinacocha, caño to Paca Cocha. 21 Aug 1981. SOK 29b. NRM SOK/1981344.3480. 5, 37.7-46.3. Ucayali, caño betweeen Yarina Cocha and Cashibo Cocha, *c.* 8 km NW Puerto Callao. 20 Aug 1981. SOK 34. MHNG 2233.47. 5, 17.1-20.1. Loreto, Supay Cocha. 20 Jun 1978. P. de Rham (R.48). NRM SOK/1981357.3561. 1*, 67.2. Loreto, Quebrada Abrahancillo, left bank tributary of the R. Aucayacu. 30 Aug 1981. SOK 40. NRM SOK/1981337.3428. 13, 42.8-77.7 (5: 50.8-77.7). Ucayali, Yarina Cocha, caño to Paca Cocha. 16 Aug 1981. SOK 29a. ANSP 68680. 1. Loreto, Contamana. Jul-Aug 1937. W.C. Morrow. MHNG 2205.14. 1, 32.6. Ucayali, Cocha Tachsitea at mouth of R. Callaría. 3 Oct 1984. P. de Rham, H. Ortega T. **R. Pacaya drainage** : USNM 167763. 6. Loreto, Yarina Cocha. /Aug 1920./ W.R. Allen. **R. Itaya drainage:** NRM A85/1985321.3514. 1, 39.4. Loreto, shore of Quisto Cocha. 5 Aug 1985. W. Staeck, H. Linke (P7/85). NRM SOK/1983343.3768. 2, 30.1-31.1. Loreto, Quisto Cocha, lake shore. 24 Aug 1983. SOK 73a. NRM SOK/1984342.3891. 2, 49.4-52.6. Loreto, Quisto Cocha W margin. 21 Aug 1984. SOK 112. **R. Nanay drainage:** NRM A85/1985322.3532. 1, 33.1. Loreto, forest laguna *c.* 1000 m from R. Nanay between Iquitos and Santa Clara. 6 Aug 1985. W. Staeck, H. Linke (P9/85). NRM SOK/198333.3770. 3, 26.4-47.1. Loreto, Quebrada Pampachica at ENTEL station, 6 km from Iquitos. 16 Aug 1983. SOK 68. NRM SOK/1983305.3769. 6, 43.5-65.0. Loreto, R. Nanay, Tinaja, left bank playa. 29 Jul 1983. SOK 52. NRM SOK/198334.3766. 9, 23.2-42.9. Loreto, Quebrada Corrientillo, 20 km from Iquitos on road to Puerto Almendra. 18 Aug 1983. SOK 67. NRM SOK/1981371.3619. 1, 32.5. Loreto, unnamed quebrada close to Santa Clara. 7 Sep 1981. SOK 51. NRM SOK/1981325.3301. 45, 13.1-51.4. Loreto, Zúngaro Cocha. 7 Aug 1981. SOK 24. NRM SOK/1981355.3515. 36, 19.7-47.7. Loreto, left bank cocha a few km upstream of Santa Clara. 28 Aug 1981. SOK 37. 5 specimens cleared and stained. NRM SOK/1981353.3504. 9, 42.5-63.2 (5: 43.3-63.2). Loreto, Vincente Cocha, just upstream from Bella Vista. 26 Aug 1981. SOK 36. NRM SOK/1983354.3771. 37, 39.2-86.2 (5: 61.8-86.2). Loreto, Bella Vista, Vieja Cocha. 4 Sep 1983. SOK 83. ANSP 139146. 5. Loreto, backwater pools Nos. 1 and 2 opposite Base Marina. 12 Oct 1955. Catherwood Exp. NRM SOK/1984325.3893. 18, 18.7-53.1. Loreto, Puñuisiqui Cocha. 10-11 Aug 1984. SOK 98. NRM SOK/1984324.3888. 1, 96.6. Loreto, R. Nanay left bank sand playa opposite Llanchama Cocha. 9 Aug 1984. SOK 96. NRM SOK/1984344.3890. 1, 36.8. Loreto, Quebrada Corrientillo at bridge on road Iquitos-Puerto Almendra. 23 Aug 1984. SOK 113. **R. Amazonas drainage:** NRM SOK/1981333.3377. 3, 27.3-29.6. Loreto, R. Ampiyacu system, Sacarita del Tuyé, opposite Pebas, floating meadow. 12 Aug 1981. SOK 27a. NRM SOK/1981333.3402. 2, 23.2-24.2. Loreto, R. Ampiyacu system, Sacarita del Tuyé, opposite Pebas, floating meadow. 12 Aug 1981. SOK 27b. NRM SOK/1981333.3363. 21, 30.0-70.2 (5: 51.4-70.2).. Loreto, R. Ampiyacu system, Quebrada Sacarita, a few km upstream of Pebas. 12 Aug 1981. SOK 26. USNM 175927. 3. Loreto, Pebas Caño. 1 May 1935. W.G. Scherer. USNM 175923. 4. Loreto, R. Ampiyacu system, Tuyé Cocha. 12 Jan 1935. W.G. Scherer. USNM 175885. 1, Loreto, R. Ampiyacu system, Tuyé Cocha. 12 Oct 1933. W.G. Scherer. NMW 24385. 5. 'Iquitos'. Staudinger. Reg. 1885. **R. Yavarí drainage:** NRM THO/1971356.3004. 10, 34.7-72.5 (4: 49.7-72.5). Loreto, Lago Matamata. 4 Sep 1971. T. Hongslo (VIT 1A). NRM

THO/1976311.1175. 1, 26.4. Loreto, San Sebastian, Caño do Comprido. 26 Jul 1976. T. Hongslo. **R. Napo drainage:** MHNG 2233.48. 5, 35.6-66.9. Loreto, mouth of left bank tributary to R. Mazán downstream of mouth of R. Guano. 11 October 1980. C. Vaucher. NRM SOK/1984333.3892. 5, 18.6-67.4. Loreto, Aucapoza Cocha. 15 Aug 1984. SOK 106. NRM SOK/1984332.3889. 3, 13.1-51.2. Loreto, R. Mazán right bank cocha 2 h upstream of Puerto Alegre. 14 Aug 1984. SOK 100. NRM SOK/1984334.3894. 15, 17.2-81.8. Loreto, Yuto Cocha on right bank of R. Mazán. 16 Aug 1984. SOK 107. NRM SOK/1984333.3895. 84, 14.8-65.0. Loreto, Cayapoza, small laguna on left bank island. 15 Aug 1984. SOK 104.
COLOMBIA. R. Amazonas drainage: NRM THO/1976301.1173. 1, 19.1. Amazonas, Isla Mocagua, Laguna Resaca. 19 Jul 1976. T. Hongslo. **R. Putumayo drainage:** GNHM 2830. 1, 28.7. Putumayo, R. Caucayá, Limón Cocha. 9 Dec 1953. R. Blomberg.

Mesonauta festivus

PERÚ. R. Madre de Dios drainage: ANSP 143550. 2*, 61.2-78.3. Madre de Dios, 69016.5'W 12032'S. 18 Aug 1977. R. Horwitz (RH 6 MD 0066). CAS 54638. 1, 27.1. Madre de Dios, 14 km ENE Puerto Maldonado, Lago Sandoval. 5 Jun 1983. T. Iwamoto (TI83-15). **R. Tambopata drainage:** NRM SOK/1983331.3767. 12, 18.0-43.5 (2: 40.8-43.5). Madre de Dios, Quebrada and roadside pools at Km 14 on road Puerto Maldonado-Cuzco. 15 Aug 1983. SOK 64. NRM SOK/1983325.3772. 8*, 60.2-73.7. Madre de Dios, Quebrada San Roque at Km 8 on road Puerto Maldonado-Cuzco. 12 Aug 1983. SOK 61. USNM 263855. 14, 16.4-68.6 (6: 45.5-68.6). Madre de Dios, Reserva Natural de Tambopata, Laguna Cocococha, 5.1 km E of Explorers Inn. 20 Aug 1983. RPV 83-32. USNM 264087. 9, 13.9-72.6 (7: 49.5-72.6). Madre de Dios, Reserva Natural de Tambopata, Laguna Chica, end opposite boat dock (farthest from trail leading to lodge). 19 Aug 1983. RPV 83-28. USNM 266789. 3, *c.* 8.5. Same data as USNM 264087.

Pterophyllum scalare

PERÚ. R. Ucayali drainage: NRM SOK/1981364.3590. 1*, 65.6. Loreto, Trueno Cocha, just S Supay Cocha. 3 Sep 1981. SOK 46a. NRM SOK/1981357.3557. 1*, 43.9. Loreto, mouth of Supay Caño into R. Ucayali, *c.* 4 km upstreams of Jenaro Herrera. 30 Aug 1981. SOK 39. NRM SOK/1981337.3429. 6, 42.8-45.8 (3: 44.5-45.8). Ucayali, canal between Yarina Cocha and Paca Cocha. 16 Aug 1981. SOK 29a. 2 specimens cleared and stained. ZMA unreg. 35, 37.1-52.7 (3: 45.0-48.5). Loreto, Caño Tomasa, left bank tributary to R. Aucayacu. 13 Sep 1981. P. de Rham *et al.* (Sta. 26). NRM SOK/1983354.3717. 1, 74.6. Loreto, Trueno Cocha. 1 Sep 1983. SOK 81. NRM A85/1984303.3102. 1, 41.3. Ucayali, caño between Yarina Cocha and Paca Cocha. 25 Jul 1984. W. Staeck (P1/84). **R. Aguaytía drainage:** ZMA unreg. 3*, 33.8-45.8. Ucayali, R. Aguaytía system, R. Neshuya, 60 km SW Pucallpa, along road to Tingo María. 21 Aug 1981. Leg. P. de Rham *et al.* (Sta. 3). **R. Pacaya drainage:** MHNG 2233.49. 11, 25.3-41.4. Loreto, Tipishca Cahuana, in front of Cahuana guard post. 8 Aug 1980. P. de Rham (R.144). **R. Nanay drainage:** NRM SOK/1983357.3692. 4*, 50.6-71.1. Loreto, Bella Vista, Vieja Cocha. 4 Sep 1983. SOK 83. NRM SOK/1981353.3502. 1*, 43.4. Loreto, Vicente Cocha just upstreams of Bella Vista. 26 Aug 1981. SOK 36. NRM SOK/1983335.3718. 15, 25.0-54.7 (4: 36.4-54.7). Loreto, Quebrada Pampachica at ENTEL station, 6 km from Iquitos. 19 Aug 1983. SOK 68. NRM SOK/1981365.3512. 1, 42.1. Loreto, temporarily isolated left bank cocha a few km upstream of Santa Clara. 28 Aug 1981. SOK 37. ANSP 139107. 1. Loreto, R. Nanay opposite Base marina, backwater pools. 12 Oct 1955. Catherwood Exp. **R. Amazonas drainage:** ANSP 139106. 1. Loreto, R. Amazonas near Iquitos, 'within one mile of the central station'. Oct 1955. Catherwood Exp. ANSP 9081-9084. 4. Loreto, Pebas. No date. No leg. ANSP 9085-9090. 6. Loreto, Pebas. No date. No leg. **R. Napo drainage:** NRM SOK/1984333.3901. 7, 18.6-75.0. Loreto, Aucapoza Cocha. 15 Aug 1984. SOK 106. **R. Yavarí drainage:** NRM SOK/1984307.3902. 4, 35.1-40.2. Loreto, small cocha on left bank of R. Yaquerana, *c.* 2 h

upstream of Colonia Angamos, 30 min upstream of Cocha Palometal (30 hp deslizador). 29 Jul 1984. SOK 86. 1 specimen cleared and stained.
BRASIL. R. Javari drainage: NRM THO/1976312.2217. 1, 41.0. Amazonas, Lago Arara. 27 Jul 1976. T. Hongslo. NRM THO/1971363.3074. 9, 42.4-69.8 (5: 44.2-69.8). Amazonas, Lago Piranha. 8 Sep 1971. T. Hongslo (VIT 5A).

Heros appendiculatus

PERÚ. R. Ucayali drainage: MNHN A.9483. 1*, *c.* 128. Peru: 'l'Ucayale'. No date. F. de Castelnau. **Holotype of** *Chromys appendiculata* Castelnau. NRM SOK/1981337.3430. 2*, 53.4-58.0. Ucayali, Yarina Cocha, caño to Paca Cocha. 16 Aug 1981. SOK 29a. NRM SOK/1981337.3415. 1*, 108.6. Ucayali, Yarina Cocha along shore S of La Cabaña. 16 Aug 1981. SOK 28b. NRM SOK/1981344.3482. 1*, 40.1. Ucayali, caño between Cashibo Cocha and Yarina Cocha. 20 Aug 1981. SOK 34. NRM unreg. 1, *c.* 65.8. Ucayali, E affluent of Yarina Cocha. 28 Jul 1980. W. Staeck. USNM 167759. 4. Loreto, Lago Cashiboya. Aug 1920. W.R. Allen. (*ex* IUM 17787.) ANSP 84190. 2. Loreto, Contamana. Jul-Aug 1937. W.C. Morrow. NRM SOK/1981357.3560. 1*, 64.0. Loreto, Quebrada Abrahancillo, left bank tributary to the R. Aucayacu. 30 Aug 1981. SOK 40. MHNG 2233.50. 2*, 22.4-23.0. Loreto, Sahua Cocha. 20 Jun 1978. P. de Rham (R.48). CAS 57462. 1, 111.2. Loreto, Lago Cashiboya. Aug 1920. W.R. Allen. (Previously IUM 17791.) **R. Itaya drainage:** NRM SOK/1981324.3637. 2, 18.4-28.8 (1: 28.8). Loreto, Quisto Cocha. 6 Aug 1981. SOK 23a. NRM A85/1985321.3512. 1, 80.1. Loreto, shore of Quisto Cocha. 5 Aug 1985. W. Staeck, H. Linke (P7/85). **R. Nanay drainage:** NRM SOK/1981325.3331. 2, 97.7-101.9 (1: 97.7). Loreto, Zúngaro Cocha. 7 Aug 1981. SOK 24. NRM SOK/1981355.3510. 2*, 44.0-52.8. Loreto, left bank isolated cocha a few km upstream from Santa Clara. 28 Aug 1981. SOK 37. NRM SOK/1983334.3672. 2*, 45.0-62.0. Loreto, Quebrada Corrientillo, 20 km from Iquitos on road to Puerto Almendra. 18 Aug 1983. SOK 67. NRM SOK/1983335.3675. 1*, 63.9. Loreto, Quebrada Pampachica at ENTEL station, 6 km from Iquitos. 19 Aug 1983. SOK 68. FMNH 84267. 1, 19.9. Loreto, R. Nanay system, lake off R. Momón. 24 Jul 1975. D.W. Greenfield, G.S. Glodek (G-75-65). NRM SOK/1981353.3499. 6*, 62.1-116.4. Loreto, Vicente Cocha, just upstream from Bella Vista. 26 Aug 1981. SOK 36. NRM SOK/1983357.3678. 2*, 92.8-97.0. Loreto, Bella Vista, Vieja Cocha. 4 Sep 1983. SOK 83. **R. Amazonas drainage:** CAS 57461. 4, 43.9-73.0. Loreto, Iquitos. 1922. P.S. Morris. (Previously IUM 15989.) NRM SOK/1981333.3335. 1*, 59.5. Loreto, R. Ampiyacu system, R. Yaguasyacu, quebrada and adjacent river playa just below village Esperanza. 12 Aug 1981. SOK 25b. NRM SOK/1981333.3378. 1*, 50.7. Loreto, R. Ampiyacu system, Sacarita del Tuyé, opposite Pebas, floating meadow near mouth. 12 Aug 1981. SOK 27a. ANSP 9049. 1*, 52.8. Loreto, R. Ampiyacu. No date. Leg. J. Hauxwell. **Holotype of** *Uarus centrarchoides* Cope. USNM 175951. 1. Loreto, Pebas Caño. 1 May 1935. W.G. Scherer. **R. Napo drainage:** NRM SOK/1984333.3870. 3, 22.5-132.1. Loreto, Aucapoza Cocha. 15 Aug 1984. SOK 106. NRM SOK/1984334.3869. 2, 28.4-121.8. Loreto, Yuto Cocha on left bank of R. Mazán. 16 Aug 1984. SOK 107. MHNG 2233.51. 1, 16.3. Loreto, Cocha Yuracyacu. 21 October 1980. C. Vaucher. **R. Yavarí drainage:** NRM THO/1976311.1173. 1, 27.8. Loreto, San Sebastian, Caño do Comprido. 26 Jul 1976. T. Hongslo. NRM THO/1976312.0927. 3, 39.9-45.0. Loreto, San Sebastian, Caño do Comprido. 27 Jul 1976. T. Hongslo.
BRASIL. R. Javari drainage: NRM THO/1971373.3405. 1*, 38.1. Amazonas, Lago Guariba. 15 Sep 1971. T. Hongslo (VIT 12A). **R. Içá drainage:** NRM THO/1971426.3062. 1, 64.1. Amazonas, Cuiabá, Cocha Simpatia. 23 Oct 1971. T. Hongslo (VIT 23). NRM THO/1971504.3063. 1, 92.5. Amazonas, Cuiabá, Cocha Comprido. 16 Dec 1971. T. Hongslo (VIT 36).
ECUADOR. R. Napo drainage: MNHN 1971-131. 1, 79.0. Napo, /R./ Lagartococha. No date. Ded. R. Hoffstetter.
COLOMBIA. R. Amazonas drainage: ANSP 139341. 1. Amazonas, Lagos de Leticia. Mar 1977. A. Keast (109). NRM THO/1976306.1420. 1, 101.9. Amazonas, Puerto Nariño, Laguna Tarapoto. 24 Jul 1976. T. Hongslo. **R. Putumayo drainage:**

GNHM 2828. 1, 43.6. Putumayo, R. Caucayá, Limón Cocha. 8-9 Dec 1953. R. Blomberg. GNHM 2827. 1, 112.4. Putumayo, R. Caucayá, Limón Cocha. No date /probably Dec 1953/. R. Blomberg. GNHM 2829. 2, 23.4-32.1. Putumayo, La Apaya. 29 Dec 1953. R. Blomberg.

Symphysodon aequifasciatus

PERÚ. R. Putumayo drainage: USNM 179076. 2, 71.8-73.2. Peru: 'Putu Mayo, nr. Colombia.' Feb 1963. J. Roberts. **Origin uncertain:** NRM SOK/1981325.3332. 1, 110.7. Ornamental fish collector at Santa Clara on the R. Nanay near Iquitos. 7 Aug 1981. S.O. Kullander *et al.* NRM SOK/1983311.3837. 1, 112.3. Ornamental fish exporter in Iquitos. 1 Aug 1983. S.O. Kullander *et al.* NRM SOK/1984341.3900. 1, 87.1. Ornamental fish exporter in Iquitos. 20 Aug 1984. S.O. Kullander.

BRASIL. R. Solimões drainage: USNM 179829. 1*, 112.9. Amazonas, Benjamin Constant. No date. H.R. Axelrod. **Holotype of** *Symphysodon aequifasciata haraldi* Schultz. NRM THO/1971425.3070. 2*, 66.5-73.6. Amazonas, Cuiabá, Cocha Comprido. 22 October 1971. T. Hongslo (VIT 22). NRM THO/1971518.4071. 4, 77.2-*c.* 87.5 (3: 77.2-86.5). Amazonas, Cuiabá, Cocha Comprido or Igarapé Comprido. 16 or 24 Dec 1971. T. Hongslo (VIT 37). MZUSP 33.063. 1*, 68.0. Amazonas, R. Tefé, Vista Escura. 4 Aug 1979. M. Goulding. MNHN 02-134-135. 2*, 90.6-122.5. Amazonas, Tefé. No date. Jobert. **Syntypes of** *Symphysodon discus* var. *aequifasciata* Pellegrin. NMW 24502-24503. 3. Amazonas, Tefé. /1865-1866. Thayer Exp./ USNM 224863. 8. Amazonas, Lago Tefé. No date. H.R. Axelrod. MZUSP 33.062. 4*, 112.5-137.2. Amazonas, Lago Amanã. No date. R. Best.

Hypselecara temporalis

PERÚ. Drainage unknown: ANSP 112721. 2, 58.5-74.8. Peru. 1877. J. Orton. **R. Ucayali drainage:** MHNG 2233.53. 2, 56.2-73.5. Loreto, Jenaro Herrera area /locality data mixed up, probably from Quebrada Espejo/. Sep 1981. P. de Rham. NRM SOK/1981344.3483. 1*, 40.4. Ucayali, caño between Yarina Cocha and Cashibo Cocha. 20 Aug 1981. SOK 34. NRM SOK/1981357.3562. 1*, 79.4. Loreto, Quebrada Abrahancillo, left bank tributary to the R. Aucayacu. 30 Aug 1981. SOK 40. MHNG 2233.54. 1*, 63.7. Same data as NRM SOK/1981357.3562. MHNG 2233.55. 4, 36.8-65.8 (2: 59.8-65.8). Loreto, Sahua Cocha. 20 Jun 1978. P. de Rham (R. 47). NRM SOK/1981364.3604. 1*, 50.4. Loreto, Quebrada Espejo, tributary to Supay Cocha. 3 Sep 1981. P. de Rham (SOK 48). FMNH 84270. 2*, 40.3-81.2. Ucayali, 3.4 km from Pucallpa on road to Lima, first bridge over stream. 27 Jul 1975. D.W. Greenfield, G.S. Glodek (G-75-68). **R. Pacaya drainage:** MHNG 2233.52. 1*, 41.5. Loreto, Tipishca Cahuana. 8 Aug 1980. P. de Rham (R. 143). NRM A85/1984315.3113. 1, 74.8. Loreto, near Estacion Experimental (SW Bretaña, W Canal de Puinahua). 3 Aug 1984. W. Staeck (P5/84). ZFMK 1127. 1. Loreto, Caño Yarina. 31 Aug 1959. K.H. Lüling. **R. Itaya drainage:** NRM SOK/1981324.3295. 5, 14.1-28.2. Loreto, along shore of Quisto Cocha. 6 Aug 1981. SOK 23a. NRM SOK/1984342.2873. 1, 17.5. Loreto, Quisto Cocha. 21 Aug 1984. SOK 112. NRM A85/1985321.3511. 2, 33.8-81.4. Loreto, shore of Quisto Cocha. 5 Aug 1985. W. Staeck, H. Linke (P7/85). **R. Nanay drainage:** NRM SOK/1983334.3762. 8, 39.0-58.1 (6: 39.0-58.1). Loreto, Quebrada Corrientillo, 20 km from Iquitos on road to Puerto Almendra. 18 Aug 1983. SOK 67. **R. Napo drainage:** NRM SOK/1984333.3871. 5, 26.5-92.6. Loreto, R. Napo system, Aucapoza Cocha. 15 Aug 1984. SOK 106. **R. Amazonas drainage:** NRM SOK/1981333.3383. 11, 49.0-137.2 (10: 52.7-137.2). Loreto, R. Ampiyacu system, Sacarita del Tuyé, opposite Pebas, floating meadow. 12 Aug 1981. SOK 27a. ANSP 21459. 1, 112.3. Loreto, R. Ampiyacu. 1877. J. Hauxwell.

COLOMBIA. R. Amazonas drainage: ANSP 149406. 1. Amazonas, island in middle of R. Amazonas some 60 mi upstream from Leticia. Sep 1974. Leg. A. Keast (34). ANSP 149408. 1. Amazonas, Leticia, Lagos de Leticia. Mar 1977. A. Keast (150B).

BRASIL. R. Içá drainage: NRM THO/1971518.3102. 2, 97.1-114.6. Amazonas, Cuiabá, Cocha Simpatia. 19 and 21 Dec 1971. T. Hongslo (VIT 31A and VIT 31B). **R. Javari drainage:** NRM THO/1971371.3321. 1, 61.7. Amazonas, Pau-Mari, Caño Guariba. 13 Sep 1971. T. Hongslo (VIT 8).

Bujurquina cordemadi

PERÚ. R. Madre de Dios drainage: NRM SOK/1983324.3800. 1*, 61.8. Madre de Dios, quebrada 8 km from airport road on road to Lago Túpac Amaru. 11 Aug 1983. SOK 60. **Holotype.** NRM SOK/1983324.3998. 1*, 50.4. Same data as NRM SOK/1983324.3800. **Paratype.** USNM 264061. 1*, 32.0. Madre de Dios, stream on S side of R. Madre de Dios about 10 km downstream from mouth of R. Tambopata. 25 Aug 1983. RPV 83-41. **Paratype.**

Bujurquina tambopatae

PERÚ. R. Tambopata drainage: NRM SOK/1983325.3822. 1*, 75.2. Madre de Dios, R. Tambopata system, Quebrada San Roque at Km 11 on Puerto Maldonado-Cuzco road. 12 Aug 1983. SOK 61. **Holotype.** NRM SOK/1983325.3823. 9, 36.4-81.5 (8: 36.4-81.5). Same data as NRM SOK/1983325.3822. **Paratypes.** (Also eggs, larvae and small juveniles, free or within oropharyngeal cavity of adults, in this lot.)

Bujurquina eurhinus

PERÚ. R. Pilcopata drainage: ANSP 158173. 1*, 80.1. Cuzco, R. Hospital at 71° 27'W 12° 53'S. 11-14 Jul 1977. R. Horwitz (RH 1 HO OX06). **Holotype.** ANSP 143559. 2*, 46.9-81.9. Same data as ANSP 158173. **Paratypes.** ANSP 143566. 1, 39.8. Cuzco, R. Hospital at 71°27'W 12°53'S. 10 Jul 1977. R. Horwitz (RH 1 HO 0006). **Paratype.** ANSP 143567. 1*, 49.0. Cuzco, R. Hospital at 71° 27'W 12° 53'S. 10 Jul 1977. R. Horwitz (RH 1 HO 0606). **Paratype.** ANSP 143558. 1*, 73.3. Cuzco, R. Pilcopata at 71°24'W 12°56.5'S. 16-17 Jun 1977. R. Horwitz (RH 1 PI 0606). **Paratype.** ANSP 143557. 1*, 80.5. Cuzco, 71° 20'W 12° 53'S. 15 Jul 1977. R. Horwitz (RH 1 CA 0306). **Paratype.** ANSP 143560. 9, 18.5-75.6 (6: 53.8-75.6). Cuzco, R. Grande at 71°21.5'W 12°55'S. 18 Jun 1977. R. Horwitz (RH 1 RG 0206). **Paratypes.** ANSP 143565. 4, 24.8-67.9 (1: 67.9). Madre de Dios, 70°58'W 12°19.5'S. 5 Aug 1977. R. Horwitz (RH 3MD 0306). **Paratypes.** ANSP 143563. 4, 21.5-47.4. Madre de Dios, 71°17'W 12°40'S. 20 Jun 1977. R. Horwitz (RH 1 MD 0106). **Paratypes.** ANSP 143564. 1, 48.4. Cuzco, Asunción, 71°25.5'W 12°57.5'S. 5 Jul 1977. R. Horwitz (RH 1 AS 0106). **Paratype.** ANSP 143568. 9, 20.0-39.3. Madre de Dios, 71° 20'W 12° 53'S. 18 Jul 1977. R. Horwitz (RH 1 CA 0006). **Paratypes. R. Manú drainage:** ANSP 143561. 1, 17.4. Madre de Dios, 71°08'W 12°03.5'S. 10 Aug 1977. R. Horwitz (RH 6 MA 0106). **Paratype. R. Madre de Dios drainage:** ANSP 119912. 1, *c.*80.0. Madre de Dios, R. Colorado. 11 Jun 1969. E.J. Hugghins (H-69-122). **Paratype. R. Inambarí drainage:** FMNH 70475. 10*, 45.0-82.5. Cuzco, Marcapata, Hacienda Cadena. 18 February 1949. C. Kalinowski. **Paratypes.** FMNH 71978. 4, 57.7-70.8. Cuzco, Marcapata. Jul 1950. /C. Kalinowski./ **Paratypes.** NRM A84/1977375.3085. 1, *c.* 88.5. Cuzco, Quebrada Yanamayo near Quincemil. 16 Sep 1977. B. Jacobi. **Paratype.** BMNH 1913.2.25:5-8. 4, 52.1-61.4. Puno, /R./ Yahuarmayo. No date. Purchased of Rosenberg /leg. probably H. & C. Watkins/. **Paratypes.**

Bujurquina robusta

PERÚ. R. Ucayali drainage: NRM A83/1983254.3086. 1*, 79.0. Ucayali, Bella Vista farm, *c.* 10 km S Chicosa. 23 Jun 1983. W. Staeck, H. Linke (P5/83). **Holotype.** NRM A83/1983254.3051. 6*, 25.7-87.6. Same data as NRM A83/1983254.3086. **Paratypes.** NRM A83/1983252.3043. 1, 32.8. Ucayali, Ahiriya, village on the R. Ahiriya, *c.* 4-5 km NW of Atalaya. 21 Jun 1983.

Leg. W. Staeck, H. Linke (P2/83). Not type.

Bujurquina labiosa

PERÚ. R. Ucayali drainage: NRM A83/1983254.3070. 1*, 55.4. Ucayali, Bella Vista farm, *c.* 10 km S Chicosa. 23 Jun 1983. W. Staeck, H. Linke (P5/83). **Holotype.** NRM A83/1983254.3087. 1, *c.* 27.0. Same data as holotype. **Paratype.**

Bujurquina apoparuana

PERÚ. R. Ucayali drainage: NRM SOK/1981343.3471. 1*, 51.5. Ucayali, Quebrada at Km 15 on road Campo Verde - Tournavista. 19 Aug 1981. SOK 33. **Paratype.** NRM A85/1980142.3088. 2*, 45.6-56.3. Ucayali, R. Amaquiria. 1 April 1980. W. Staeck. **Paratypes.** NRM A85/1981293.3089. 6, 43.6-54.9 (5: 43.6-54.9). Ucayali, R. Shahuaya near Alto Aruya. 15 Jul 1981. W. Staeck. **Paratypes.** 1 specimen cleared and stained. FMNH 84269. 1*, 77.0. Ucayali, 3.4 km from Pucallpa on road to Lima, first bridge over stream, 27 Jul 1975. D.W. Greenfield, G.S. Glodek (G75-68). **Holotype.** NRM 11299. 1*, 56.1. Ucayali, 'Dunkelwasser'. at Campo Verde. 3 Sep 1978. K.H. Lüling (PU2). **Paratype.** ZFMK unreg. 4*, 26.1-71.0. Same data as NRM 11299. **Paratypes.** FMNH 84269*pt.* 13, 17.8-66.6 (3: 62.3-66.0). Same data as FMNH 84269. **Paratypes.**

Bujurquina hophrys

PERÚ. R. Pachitea drainage: NRM SOK/1981343.3462. 1*, 68.5. Huánuco, quebrada tributary to the R. Pachitea on the right bank, 2-3 km downstream of Tournavista. 19 Aug 1981. SOK 32. **Holotype.** NRM SOK/1981343.3999. 2, 21.6-22.7. Same data as NRM SOK/1981343.3462. **Paratypes.** ANSP 119857. 1, 79.7. Huánuco, R. Pachitea, Iparia reserve 1 km SE Tournavista. 2 Aug 1982. E.J. Hugghins (90). **Paratype.** MHNG 2233.63. 2, 21.7-45.6 (1: 45.6). Huánuco, R. Pachitea, backwater at road from forestry research station of Bosque Nacional Alejandro von Humboldt to Palcazú. 22 Aug 1981. P. de Rham *et al.* (Sta. 4). **Paratypes.** MHNG 2233.64. 2, 25.0-31.1. Huánuco, R. Macuya, *c.* 12 km S forestry research station of Bosque Nacional Alejandro von Humboldt. 22 Aug 1981. P. de Rham *et al.* (Sta. 5). **Paratypes.** BMNH 1969.7.15:51-53. 3, 62.6-84.7. 'Rio Pachitea'. 1968. Cambridge Veterinary Peru Exp. ZMH 6436. 4*, 41.2-59.3. Huánuco, Fundo Flor. 21 Dec 1978-17 Jan 1979. J. Regös. **Paratypes.** ZMH 4799. 3*, 44.3-70.3. Huánuco, R. Pacal near Panguana. Sep 1973. Villwock. **Paratypes.** MHNG 2233.65. 1*, 47.4. Same data as ZMH 4799. **Paratype. R. Aguaytía drainage:** ZMA 115.212. 1*, 68.0. Ucayali, Bosque Nacional von Humboldt, R. Capirona. 31 May 1977. P. de Rham (No. 15). **Paratype. Drainage uncertain:** NRM A85/1985325.3523. 3*, 45.9-70.5. Huánuco, stream at Km 7 or 18.5 on road from Km 85 on road Pucallpa-Tingo María to Puerto Inca. 9 Aug 1985. W. Staeck, H. Linke (P15-16/85).

Bujurquina megalospilus

PERÚ. R. Pachitea drainage: NRM SOK/1981343.3456. 1*, 75.7. Huánuco, R. Pachitea system, drying pool *c.*100 m from the R. Pachitea and *c.*1 km upstream from Tournavista. 19 Aug 1981. SOK 31. **Holotype.** NRM SOK/1981343.4000. 2*, 32.9-46.1. Same data as NRM SOK/1981343.3456. **Paratypes. R. Aguaytía drainage:** MHNG 2205.21. 5*, 29.9-50.2. Ucayali, IVITA, fish pond no. 4. 11 Oct 1984. H. Ortega T., I. Samánez. **Paratypes.** NRM A85/1981414.3090. 1*, 53.8. Same data as MHNG 2205.21. **Paratype.**

Bujurquina huallagae

PERÚ. R. Huallaga drainage: ANSP 158171. 1*, 75.4. Huánuco, vicinity of

Tingo María, *c.* 1/4 mi above R. Huallaga. 30 Sep 1955. Catherwood Exp. (Sta. 3). **Holotype.** ANSP 158172. 9, 25.4-75.4 (6: 4.0-75.4). Same data as ANSP 158171. **Paratypes.** ANSP 139112. 3, 60.7-66.7 (2: 65.7-66.7). Huánuco, vicinity of Tingo María. 29 Sep 1955. Catherwood Exp. (Sta. 2). **Paratypes.** ANSP 139109. 1, 15.4. Same data as ANSP 139112. **Paratype.** ANSP 139110. 11, 19.9-54.8 (3: 34.5-54.8). Huánuco, vicinity of Tingo María. 27 Sep 1955. Catherwood Exp. (Sta. 1). **Paratypes.** ANSP 139143. 1*, 46.1. Same data as ANSP 139110. **Paratype.** ANSP 139114. 5, 13.1-33.8. Same data as ANSP 139110. **Paratypes.** ANSP 139116. 3, 12.0-22.1. Huánuco, vicinity of Tingo María. 24 Sep 1955. Catherwood Exp. **Paratypes.** MHNG 2233.66. 1*, 71.8. Huánuco, R. Huallaga at Tingo María, backwater. 21 Aug 1981. P. de Rham, H. Nijssen (Sta. 6b). **Paratype.** ZFMK 2152-2168. 17, 13.9-82.8 (4: 61.7-82.8). Huánuco, R. Subte, *c.* 1 km upstream from mouth, *c.* 2 km downstream from Tingo María. 30 Jun 1966. K.H. Lüling. **Paratypes.** ZFMK 2184-2187. 4, 55.6-61.7 (2: 58.3-61.7). Huánuco, gravel shore on lower R. Monzón, *c.* 10 km from Tingo María. 3 Jun 1966. K.H. Lüling. **Paratypes.** ZFMK 2318. 1*, 64.5. Huánuco, stream at Tingo María, near hospital, *c.* 500 m from mouth. 2 Jun 1966. K.H. Lüling (Sta. 5). **Paratypes.** ZFMK 8659-8664. 6, 34.9-80.9 (3: 36.380.9). Huánuco, Tingo María, stream at hospital. 12 Dec 1974. K.H. Lüling. **Paratypes.** MHNG 2205.01. 4, 17.4-32.3. San Martín, Arroyo Ahuashiyacu, Tarapoto. 14 Oct 1984. P. de Rham, H. Ortega T. **Paratypes.** MHNG 2205.06. 4*, 53.5-61.7. San Martín, R. Cumbaza, Tarapoto. 30 Aug 1984. P. de Rham, H. Ortega T. **Paratypes.** NRM A85/1984354.3094. 1*, 60.6. Same data as MHNG 2205.06. **Paratype.** ZFMK 2190. 1. Huánuco, left bank of R. Huallaga opposite Tingo María. 22 Jun 1966. K.H. Lüling. **Paratype.** ZMK 53284. 1, 54.0. Huánuco, R. Subte. 1953. N. Chirichigno F. **Paratype.**

Bujurquina ortegai

PERÚ. R. Huallaga drainage: MHNG 2205.27. 1*, 110.1. San Martín, Moyobamba, Puerto Juan Antonio, R. Mayo. 9 Sep 1984. P. de Rham, H. Ortega T. **Holotype.** MHNG 2233.67. 1*, 63.1. Same data as MHNG 2205.27. **Paratype.** MHNG 2205.08. 1*, 62.5. San Martín, Moyobamba, Burrococha, united to R. Mayo. 11 Sep 1984. P. de Rham, H. Ortega T. **Paratype.** NRM A85/1984372.3095. 1*, 70.7. Same data as MHNG 2205.08. **Paratype.** MHNG 2205.11. 1*, 60.4. San Martín, near Rioja, R. Yuracyacu. 12 Sep 1984. P. de Rham, H. Ortega T. **Paratype.**

Bujurquina syspilus

PERÚ. R. Pacaya drainage: CAS 57448. 2, 63.9-68.0. Loreto, Yarina Cocha, Aug 1920. W.R. Allen. (Previously IUM 17734.) **R. Ucayali drainage:** NRM SOK/1981357.3559. 1*, 64.7. Loreto, Quebrada Abrahancillo, left bank tributary to the R. Aucayacu. 30 Aug 1981. SOK 40. **R. Itaya drainage:** CAS 57450. 1, 103.0. Loreto, R. Itaya above Iquitos. Sep 1920. W.R. Allen. (Previously IUM 17747.) **R. Napo drainage:** NRM SOK/1984333.3945. 2, 32.3-56.6 (1: 56.6). Loreto, Cayapoza, small laguna on left bank island. 15 Aug 1984. SOK 104. **R. Amazonas drainage:** NRM SOK/1981333.3363. 7, 52.4-77.4 (5: 52.4-77.4). Loreto, Quebrada Sacarita, a few km upstream of Pebas. 12 Aug 1981. SOK 26. ANSP 21430-21433. 4, *c.*26.0-*c.*36.4. Loreto, R. Ampiyacu. No date. J. Hauxwell. **Syntypes of** *Acara syspilus* Cope. **R. Yavarí drainage:** NRM THO/1971362.3067. 2*, 54.2-67.6. Loreto, R. Yavarí near Pau-mari. 6 Sep 1971. T. Hongslo (VIT 4A). NRM THO/1971357.3014. 4, 51.5-*c.*87.6 (2: 60.1-62.3). Loreto, R. Yavarí /near 4°12'S 70°30'W/. 5 Sep 1971. T. Hongslo (VIT 2).

Bujurquina peregrinabunda

PERÚ. R. Amazonas drainage: NRM SOK/1981333.3337. 1*, 78.3. Loreto, R. Ampiyacu system, quebrada and adjacent river playa of the R. Yaguasyacu just below the village Esperanza. 12 Aug 1981. SOK 25bis. **Holotype.** NRM

SOK/1981333.4001. 2*, 63.2-66.2. Same data as NRM SOK/1981333.3337. **Paratypes.**
BRASIL. R. Solimões drainage: NMW 33856-33858. 3*, 58.2-93.6. Amazonas, Codajás. /1865-1866. Thayer Exp./ **Paratypes.** NMW 33866-33869. 4*, 77.9-101.7. Same data as NMW 33856-33858. **Paratypes.**

Bujurquina cf. *peregrinabunda*

PERÚ. Drainage uncertain: FMNH 71977. 7, 53.0-106.8. Peru: 'Iquitos San Luisa'. 20 Oct 1956. No leg.
COLOMBIA. R. Caquetá drainage: ANSP 80497. 1, 42.7. Caquetá, R. Orteguasa system, Florencia. 1932. N. María. ANSP 84151. 5, *c.* 35.0-85.0. Caquetá, R. Orteguasa system, Morelia. 1945. K. von Sneidern.

Bujurquina moriorum

PERÚ. R. Ucayali drainage: NRM SOK/1983346.3791. 12, 11.1-40.6 (1: 40.6). Loreto, Quebrada Carahuayte at km 20 on road Jenaro Herrera-Colonia Angamos. 27-28 Aug 1983. SOK 74. **Paratypes.** NRM SOK/1983347.3942. 1*, 85.2. Loreto, Quebrada Carahuayte, first bend downstream of Km 20 on road Jenaro Herrera-Colonia Angamos. 28 Aug 1983. SOK 76. **Holotype.** NRM SOK/1983347.3792. 6, 7.8-92.3 (3: 34.8-92.3). Same data as NRM SOK/1983347.3942. **Paratypes.** NRM SOK/1983351.3793. 50, 6.0-97.1 (9: 27.9-97.1). Loreto, Quebrada Copal at Km 15 on road Jenaro Herrera-Colonia Angamos. 29-30 Aug 1983. SOK 78. **Paratypes.** NRM SOK/1981362.3574. 3*, 31.0-50.1. Loreto, Quebrada Copal at Km 15 on road Jenaro Herrera - Colonia Angamos. 1 Sep 1981. SOK 44. **Paratypes.** MHNG 2233.68. 3, 22.7-57.0. Loreto, Quebrada Copal, little downstream of Km 15 on road Jenaro Herrera-Colonia Angamos. 12 Mar 1980. P. de Rham (R. 162). **Paratypes.** MHNG 2233.69. 3, 15.7-24.1. Same data as MHNG 2233.68. **Paratypes.** ZMB 31572. 2, 71.0-89.9. Loreto, Quebrada Copal. 22 Sep 1979. Kept in aquarium, ded. H.-J. Franke. **Paratypes.** MHNG 2233.70. 4, 16.4-28.3. Loreto, forest creeks at right bank of Quebrada Carahuayte, *c.* 30 km SE Jenaro Herrera. P. de Rham, H. Nijssen (Sta. 22b). **Paratypes.** MHNG 2233.71. 4, 23.0-46.7 (2: 44.8-46.7). Loreto, forest creeks at right bank of Quebrada Carahuayte, *c.* 35 km SE Jenaro Herrera. P. de Rham, H. Nijssen (Sta. 22a). **Paratypes.** MHNG 1583.59-60. 2, 42.2-50.2 (1: 50.2). Loreto, Quebrada Copal. 18 Oct 1977. P. de Rham (No. 4). **Paratypes. R. Napo drainage:** NRM SOK/1984332.3944. 16, 14.7-72.9 (5: 45.7-72.9). Loreto, R. Mazán, boat landing of Puerto Alegre. 14 Aug 1984. SOK 103. **Paratypes.** NRM SOK/1984333.3997. 3, 13.6-37.3. Loreto, Aucapoza Cocha. 15 Aug 1984. SOK 106. **Paratypes.**

Bujurquina cf. *moriorum*

ECUADOR. R. Napo drainage: ANSP 119911. 1, 87.8. Napo, R. Aguarico near Santa Cecilia. 1 Aug 1969. E.J. Hugghins (H-69-237). ANSP 119900. 1, 56.1. Same data as ANSP 119911 (H-69-236). ANSP 130455. 7, 37.0-51.1. Napo, R. Aguarico at Santa Cecilia. 21 Mar 1967. W.G. Saul (WGS 67-18).
COLOMBIA. R. Amazonas drainage: NRM A84/1983423.3011. 1, 22.2. Amazonas, Leticia, small swamp. 19 Oct 1983. S. Nilsson.

Tahuantinsuyoa macantzatza

PERÚ. R. Aguaytía drainage: MZUSP 16212. 1*, 74.4. Ucayali, R. Huacamayo. 13 Sep 1979. H. Ortega, J. Guevara, P. de Rham. **Holotype.** MZUSP unreg. 6, 27.4-39.1. Same data as MZUSP 16212. **Paratypes.** NRM A85/1979262.3096. 1*, 61.9 + 5 alevins. Ucayali, R. Huipoca. 26 Jun 1979. P. de Rham. **Paratypes.** MZUSP unreg. 2, 60.5-*c.*62.8. Same data as NRM A85/1979262.3096. **Paratypes** ZMK P.53285. 1, 50.5. Ucayali, R. Negro. 1953. N. Chirichigno F. **Paratype.** MHNG unreg. 1*, 67.4. Ucayali, R. Huacamayo. Sep 1979. P. de Rham

(R.94). **Paratype.** MHNG unreg. 2*, 63.6-70.6. Ucayali, R. Huacamayo at road Pucallpa-Tingo María, *c.* 8 km NE Aguaytía. 18 Sep 1981. P. de Rham *et al.* (sta. 30). **Paratypes.** MHNG 2205.10. 7, 17.1-37.6. Ucayali, Aguaytía, Pampa de Scaramento, stream tributary to R. Negro. 7 Oct 1984. P. de Rham, H. Ortega T. **Paratypes.** MHNG 2205.23. 3*, 45.7-66.4. Ucayali, Pampa de Sacramento, Caserío El Triunfo, black-water stream. 7 Oct 1984. P. de Rham, H. Ortega T. **Paratypes.** MHNG 2205.25. 11, 18.5-62.5 (3: 58.1-62.5). Ucayali, R. Huacamayo at Km 155 on road Pucallpa-Huánuco. 7 Oct 1984. P. de Rham, H. Ortega T. **Paratypes.** NRM A85/1984407.3097. 5, 19.5-63.6 (2: 53.6-63.6). Same data as MHNG 2205.25. **Paratypes.** 1 specimen cleared and stained. MHNG 2205.05. 8, 17.2-59.4 (1: 59.4). Ucayali, R. Huacamayo at Km 155 on road Pucallpa - Huánuco. 6 Oct 1984. P. de Rham, H. Ortega T. **Paratypes. R. Pachitea drainage:** FMNH 84273. 1, 29.6. Huánuco, R. Pachitea at Puerto Inca. 29 Jul 1975. D.W. Greenfield, G.S. Glodek (G-75-70). **Paratype.**

Laetacara thayeri

PERÚ. R. Ucayali drainage: NRM SOK/1981357.3563. 1*, 45.8. Loreto, Quebrada Abrahancillo, left bank tributary of the R. Aucayacu. 30 Aug 1981. SOK 40. MHNG unreg. 4*, 33.4-62.6. Same data as NRM SOK/1981357.3563. NRM SOK/1981363.3601. 1*, 64.5. Loreto, Quebrada Espejo, affluent of Supay Cocha, near mouth. 3 Sep 1981. SOK 48. MHNG 2233.56. 1*, 20.2. Loreto, small backwater pool in forest, *c.* 100 m from margin of Sahua Cocha. 20 Jun 1978. P. de Rham (R.42). MHNG 2233.57. 2, 57.6-58.1. Loreto, Jenaro Herrera area. 1979. P. de Rham (R.97). Kept in aquarium. MHNG 2233.58. 1, 56.1. Loreto, near Jenaro Herrera /locality data mixed up/. Sep 1981. P. de Rham. **R. Tigre drainage:** MHNG unreg. 1, 32.4. Loreto, Nueva York. Jul 1979. P. de Rham. **R. Nanay drainage:** NRM A85/1985322.3531. 1, 45.8. Loreto, forest laguna *c.* 1000 m from R. Nanay between Iquitos and Santa Clara. 6 Aug 1985. W. Staeck, H. Linke (P9/85). **R. Amazonas drainage:** NMW 33724-33725. 2. 'Iquitos'. Registered 1883. Ded. F. Steindachner. **R. Yavarí drainage:** NRM THO/1971366.3173. 3*, 37.0-55.2. Loreto, Lago Matamata, caño no. 2. 11 Sep 1971. T. Hongslo (VIT 7A). NRM THO/1971365.3126. 2*, 32.5-36.7. Loreto, Lago Matamata. 10 Sep 1971. T. Hongslo (VIT 6A). NRM THO/1971356.3008. 1*, 36.7. Loreto, Lago Matamata. 4 Sep 1971. T. Hongslo (VIT 1A). NRM THO/1971372.3357. 5*, 35.2-63.6. Loreto, Caño Buraço da Lucía. 14 Sep 1971. T. Hongslo (VIT 11; but sta. label in jar VIT 9 = Brasil, est. Amazonas, R. Javari system, Lago Guariba, Caño de Guariba no. 2. 13 Sep 1971). NRM THO/1976311.1170. 3, 27.4-28.6. Loreto, San Sebastian, Caño do Comprido. 26 Jul 1976. T. Hongslo. NRM THO/1976312.0931. 1, 28.5. Loreto, San Sebastian, Caño do Comprido. 27 Jul 1976. T. Hongslo.

Laetacara flavilabris

PERÚ. Drainage unknown: ANSP 158175. 5, 50.6-60.5. Peru. 1873. J. Orton. ANSP 22028-22047. 16, *c.* 34-54. 'Peru or Ecuador. Orton or Hauxwell.' **R. Ucayali drainage:** NRM A83/1983262.3096. 1*, 78.4. Loreto, small black-water stream crossing Jenaro Herrera- Colonia Angamos road 13.5 km E Jenaro Herrera. 28 Jun 1983. W. Staeck, H. Linke (P12/83). NRM SOK/1983355. 3719. 4*, 52.2-71.2. Loreto, quebrada in arboretum at Km 3 on road Jenaro Herrera-Colonia Angamos. 2 Sep 1983. SOK 82. NRM SOK/1983353.3720. 1*, 68.2. Loreto, Quebrada Sapuena at Km 10 on road Jenaro Herrera-Colonia Angamos. 31 Aug 1983. SOK 79. NRM SOK/1983347.3721. 1*, 67.2. Loreto, isolated pool, at left bank of Quebrada Carahuayte at Km 20 on road Jenaro Herrera-Colonia Angamos. 28 Aug 1983. SOK 75. NRM SOK/1981363.3579. 4*, 39.1-66.7. Loreto, Quebrada Sapuena at Km 10 on road Jenaro Herrera-Colonia Angamos. 2 Sep 1981. SOK 45. 1 specimen cleared and stained. NRM SOK/1981362.3571. 4*, 23.7-57.1. Loreto, nameless quebrada tributary to Quebrada Copal at *c.* 15 km from Jenaro Herrera on road to Colonia Angamos. 1 Sep 1981. SOK 43. NRM SOK/1981361.3646. 1*, 64.8. Loreto, quebrada at Km 3 on road Jenaro Herrera - Colonia Angamos. 31 Aug 1981. SOK

42. MHNG 1583.47. 1, 36.7. Loreto, Jenaro Herrera. 18 Oct 1977. P. de Rham (No. 3). MHNG 2233.60. 4, 30.6-64.0. Loreto, quebrada at Km 3 on road Jenaro Herrera - Colonia Angamos. 15 Sep 1981. P. de Rham, H. Nijssen (Sta. 29). MHNG 2233.61. 1, 17.5. Loreto, Quebrada Copal shortly downstream of bridge at Km 15 on road Jenaro Herrera - Colonia Angamos. 12 March 1980. P. de Rham (R.162). MHNG 2233.62. 8, 21.4-42.6. Loreto, small stream *c.* 3 km S of Km 4 on road Jenaro Herrera-Colonia Angamos, close to lateral road to R. Parnayari. 11 March 1980. P. de Rham (R. HS.1). **R. Aguaytía drainage:** MHNG 2233.59. 5*, 39.9-69.3. Ucayali, small forest stream near forestry research station of Bosque Nacional Alexandre von Humboldt, left side of road Pucallpa-Tingo María at Km 86. 25 Jun 1978. P. de Rham (No. 23). **R. Huallaga drainage:** CAS 57447. 16, 32.5-69.0. Loreto, R. Huallaga system, creeks near Yurimaguas. Nov 1920. W.R. Allen. (Previously IUM 17749.) **R. Itaya drainage:** NRM SOK/1981354.3495. 2*, 37.9-47.6. Loreto, Quistococha, Alcántara Caño. 27 Aug 1981. SOK 35c. **R. Amazonas drainage:** ANSP 9157. 1*, 81.7. Loreto, R. Ampiyacu. No date. J. Hauxwell. **Lectotype of** *Acara frentiferus* Cope. (*ex* ANSP 9157-9179.) ANSP 9158-9164. 7, 32.3-70.6. Same data as ANSP 9157. **Paralectotypes of** *Acara frentiferus* Cope. (*ex* ANSP 9157-9179.) ANSP 9156. 1*, 67.7. Same data as ANSP 9157. **Holotype of** *Acara flavilabris* Cope. ANSP 9184. 1, *c.* 32.7. Loreto, R. Ampiyacu. No date. J. Hauxwell. **R. Yavarí drainage:** NRM SOK/1984311.4102. 2, 38.8-44.8. Loreto, Quebrada de la Piscigranja, at km 2 on road Colonia Angamos-Jenaro Herrera, upstream and downstream of fish pond. 30 Jul 1984. SOK 87. NRM THO/1971372.3359. 1*, 65.7. Loreto, Caño Buraço da Lucía. 14 Sep 1971. T. Hongslo (VIT 11; but sta. label in jar VIT 9 = Brasil, est. Amazonas, R. Javari system, Lago Guariba, Caño de Guariba no. 2. 13 Sep 1971).
ECUADOR. R. Napo drainage: MCZ 49316. 1*, 55.4. Napo, R. Coca at Puerto Coca. 25 Nov 1971. T.R. Roberts, H. Pauker. **R. Putumayo drainage:** ANSP 119906. 1. Napo, Santa Cecilia, quebrada tributary to R. Conejo. 4 Aug 1969. E.J. Hugghins (H-69-249). ANSP 130463. 2. Napo, Santa Cecilia, stream tributary to R. Conejo. 8 Jun 1968. W.G. Saul, F.B. Cross (WGS 68-21).
BRASIL. R. Juruá drainage: ZUEC 735-737. 3, 27.3-33.2. Acre, mun. Cruzeiro do Sul, Igarapé Formoso. 1 Jun 1982. G.V. Andrade, C. Sandoval.

Cichlasoma amazonarum

For type material listed with complete data in Kullander (1983), only collecting locality is given here. Full data is given only for new material (non types).
PERÚ. Drainage unknown: 'Otocoro stream'; 'Otocoro R.'. **R. Tambo drainage:** NRM A83/1983253.3022. 7, 33.7-57.9. Junín, Rateri, small clear-water river. 22 Jun 1983. W. Staeck, H. Linke (P4/83). **R. Ucayali drainage:** E affluent of Yarina Cocha; Yarina Cocha; Paca Cocha and Yarina Cocha; quebrada near Yarina Cocha; Pucallpa; bank of R. Ucayali opposite Pucallpa; Chauahuan Cocha upstreams of Pucallpa; caño between Yarina Cocha and Paca Cocha; Cashibo Cocha; Yarina Cocha, pool near Lobo Caño; caño between Yarina Cocha and Cashibo Cocha; Km 3.4 on road Pucallpa - Lima, first bridge over stream; aquajal brook on the road Campo Verde - Tournavista; R. Shahuaya near Alto Aruya; Contamana; Caño Tiriri, small tributary to Caño Supay; Caño Supay near mouth. NRM A83/1983254.3050. 4, 40.8-77.5. Ucayali, R. Chinipo, Bella Vista farm, *c.* 10 km S Chicosa. 23 Jun 1983. W. Staeck, H. Linke (P5/83). NRM A85/1985312.352. 2, 36.4-52.1. Ucayali, backwater area *c.* 350 m W La Cabaña on Yarina Cocha. 30 Jul 1985. W. Staeck, H. Linke (P1/85). MHNG 2205.15. 1, 92.3. Ucayali, Cocha Tachsitea at mouth of R. Callaría. 3 Oct 1984. P. de Rham, H. Ortega T. **R. Pachitea drainage:** about 1 km upstreams of Tournavista, drying pool *c.* 100 m from the left bank of the R. Pachitea; Km 6 on road Campo Verde - Tournavista, pool or quebrada in aguajal. **R. Aguaytia drainage:** small tributary to the R. Neshuya, 1 km S IVITA field station, 59 km SW Pucallpa, along road to Tingo María; Bosque Nacional Alexandre von Humboldt. MHNG 2205.20. 2, 27.7-44.8. Ucayali, IVITA, fish pond no. 4. 11 Oct

1984. H. Ortega T., I Samanez. **R. Pacaya drainage:** Caño Yarina. **R. Huallaga drainage:** Yurimaguas. MHNG 2205.02. 6, 14.5-31.1. San Martín, Morroyacu, R. Huascayo, tributary to R. Mayo. 10 Sep 1984. H. Ortega T., P. de Rham. MHNG 2205.04. 8, 33.0-50.3. San Martín, R. Negro, a tributary to R. Mayo, on road Yuracyacu - Tambo. 12 Sep 1984. H. Ortega T., P. de Rham. MHNG 2205.07. 2, 87.2-87.5. San Martín, Moyobamba, Burrococha on right bank of R. Mayo. 11 Sep 1984. P. de Rham, H. Ortega T. **R. Itaya drainage:** Quisto Cocha; Quisto Cocha, Alcántara Caño near mouth. NRM SOK/1983343.3704. 57, 14.0-55.6. Loreto, Quistococha, pond at UNAP fish farm. 24 Aug 1983. SOK 72. NRM SOK/1983333.3723. 20, 13.4-33.6. Loreto, Quebrada Guayabamba at km 2 on road Iquitos-Quistococha. 17 Aug 1983. SOK 65. **R. Nanay drainage:** Km 13 on road Iquitos - Nauta, IMARPE; R. Nanay on sand-bar inside of curve at Mishana. **R. Napo drainage:** NRM SOK/1984333.3874. 1, 28.1. Loreto, R. Napo, Cayapoza, small laguna on left bank island. 15 Aug 1984. SOK 104. **R. Amazonas drainage:** Sacarita del Tuyé, right bank tributary of the R. Ampiyacu, little upstreams of Pebas, floating meadow near mouth. Holotype and 6 paratypes; 'Pevas Caño'; 'Lehmig-schlammiges Ufer des Amazonas, oberhalb Iquitos'; 'Iquitos'. **R. Yavarí drainage:** NRM SOK/1984313.3875. 1, 65.7. Loreto, Colonia Angamos, quebrada in civil village intended for fish pond, close to source. 1 Aug 1984. SOK 92.

COLOMBIA. R. Amazonas drainage: Leticia, backwater area ('The Lakes') cut off from R. Amazonas; island (0.5 X 0.25 miles) in middle of R. Amazonas, *c.* 60 km upstream from Leticia. NRM A84/1983423.3008. 4, 18.7-30.1. Amazonas, Leticia, small swamp. 19 Oct 1983. S. Nilsson.

BRASIL. R. Solimões drainage: Tabatinga; Tonantins. **R. Juruá drainage:** Furo of Lago São Francisco, left bank of R. Juruá above mouth of R. Moa (nontypes). MZUSP 32745. 3, 46.9-79.7. Acre, Tarauacá, R. Tarauacá, Igarapé da Entendencia. 1 Aug 1984. M. Goulding.

Cichlasoma boliviense

PERÚ. R. Manú drainage: ANSP 158174. 1, 20.9. Madre de Dios, R. Manu at 71°08'W 12°3.5'S. 10 Aug 1977. R. Horwitz (RH 6 MA 01150). **R. Madre de Dios drainage:** CAS 54632. 2, 47.8-74.3. Madre de Dios, 14 km ENE Puerto Maldonado, pool behind cookhouse at Albergue Cuzco Amazonico. 26 May 1983. T. Iwamoto (TI83-2). CAS 54634. 1, 20.1. Madre de Dios, 14 km ENE Puerto Maldonado, *c.* 1.5 mi NNW along trail from Cuzco Amazonico lodge. 2 Jun 1983. T. Iwamoto (TI83-9). ZFMK 13461-13465*pt.* 1, 28.5. Madre de Dios, Puerto Maldonado. 6 Apr 1981. E. Lenkenhoff. Paratype. NRM SOK/1983324.3722. 231, 7.5-52.4. Madre de Dios, Lago Túpac Amaru. 11 Aug 1983. SOK 58. **R. Tambopata drainage:** USNM 264084, 3, 71.7-75.7. Madre de Dios, Reserva Natural de Tambopata, Laguna Chica, end opposite boat dock (farthest from trail leading to lodge). 19 Aug 1983. RPV 83-28. USNM 264085. 8, 44.2-86.2 Madre de Dios, Reserva Natural de Tambopata, first stream down trail from Laguna Chica, where crossed by log bridge. 19 Aug 1983. RPV 83-29. USNM 264088. 2, 69.4-69.4. Madre de Dios, Reserva Natural de Tambopata, second stream down trail from Laguna Chica and upstream swamp. 19 Aug 1983. RPV 83-30. USNM 266794. 7, 34.4-94.3. Madre de Dios, Reserva Natural de Tambopata Laguna Cocococha, 5.1 km to E of Explorers Inn. 20 Aug 1983. RPV 83-32. USNM 266795. 1, 20.4. Same data as USNM 266794. USNM 266797. 1, 46.9. Madre de Dios, stream entering Río Tambopata from south bank, approx. 500 m downstream of Explorer's Inn boat landing. 23 Aug 1983. RPV 83-39. ZFMK 13461-13465*pt.* 4, 44.3-70.1. Madre de Dios, R. Tambopata, Puerto Maldonado. 25-28 Apr 1981. E. Lenkenhoff. NRM SOK/1983331.3705. 1, 46.4. Madre de Dios, roadside pools at km 14 on road Puerto Maldonado-Cuzco. 15 Aug 1983. SOK 64. NRM SOK/1983331.3703. 8, 9.8-107.5. Same data as NRM SOK/1983331.3705.

Aequidens tetramerus

PERÚ. Drainage unknown: ANSP 21160. 1, 102.5. Peru. 1873-1877. J. Orton

(coll. no. 1). ANSP 22028-22031. 4, *c.* 52-66. Peru. No date. J. Orton or J. Hauxwell. NRM A85/1985325.3526. 5, 50.2-78.8. Huánuco, brook at Km 7 and Km 18.5 on road to Puerto Inca from Km 85 on Pucallpa - Tingo María road. 9 Aug 1985. W. Staeck, H. Linke (P15-16/85). **R. Tambo drainage:** NRM A83/1983253.3031. 1*, 54.7. Junín, Rateri, small clearwater river tributary to R. Tambo. 22 Jun 1983. W. Staeck, H. Linke (P4/83). **R. Ucayali drainage:** NRM A83/1983263.3030. 2*, 62.2-66.2. Ucayali, stream in Paca Cocha area near Yarina Cocha. 29 Jun 1983. W. Staeck, H. Linke (P13/83). MHNG 2233.76. 1, 47.5. Ucayali, pool, probably part of small caño at high water, near Lobo Caño, at E extremity of Yarina Cocha. 1978. P. de Rham. NRM SOK/1981357.3558. 3*, 53.6-105.2. Loreto, Quebrada Abrahancillo, left bank tributary of the R. Aucayacu. 30 Aug 1981. SOK 40. MHNG 2233.78. 1*, 83.1. Same data as NRM SOK/1981357.3558. MHNG 2233.79. 3, 51.2-64.0 (2: 57.9-64.0). Loreto, Caño Tomasa, left bank tributary to R. Aucayacu. 13 Sep 1981. P. de Rham *et al.* (Sta. 26). NRM SOK/1983347.3760. 1*, 125.0. Loreto, isolated pool at left bank of Quebrada Carahuayte at Km 20 on road Jenaro Herrera - Colonia Angamos. 28 Aug 1983. SOK 75. MNHN A.9481. 2, *c.*53.7-*c.*135.5. Loreto, R. Ucayali at Sarayacu. 1847 (?). F. de Castelnau. **Syntypes of** *Chromys uniocellata* Castelnau. MHNG 2233.80. 4, 37.8-72.9 (2: 54.1-72.9). Loreto, Tiriri Caño, tributary to Caño Supay. 4 Sep 1981. P. de Rham, L. Mori P. (Sta. 21a). NRM SOK/1981364.3605. 6, 51.8-80.6 (4: 51.8-80.6). Loreto, near mouth of Quebrada Espejo, affluent of Supay Cocha. 3 Sep 1981. SOK 48. 1 specimen cleared and stained. NRM SOK/1981344.3479. 6, 34.8-57.8 (2: 48.1-57.8). Ucayali, caño between Yarina Cocha and Cashibo Cocha, *c.* 8 km NW Puerto Callao. 20 Aug 1981. SOK 34. 1 specimen cleared and stained. MHNG 2233.81. 3, 68.3-70.5. Loreto, Jenaro Herrera area /locality data mixed up, probably Quebrada Espejo/. Sep 1981. P. de Rham. NRM SOK/1983354.3799. 2, 12.1-23.0. Loreto, Trueno Cocha. 1 Sep 1983. SOK 81. MHNG 2233.82. 2, 19.2-20.2. Ucayali, pool, probably part of small caño at high water, near Lobo Caño, at E extremity of Yarina Cocha. 1978. P. de Rham. BMNH 1913.7.30:49-55. 8, 43.1-61.8. 'R. Ucayali'. No date. W. Mounsey. **R. Aguaytía drainage:** MHNG 2205.19. 1, 22.6. Loreto, IVITA, fish pond no. 4. 11 Oct 1984. H. Ortega T., I. Samanez. **R. Pacaya drainage:** NRM A85/1984315.3114. 1, 17.2. Loreto, R. Pacaya drainage, near Estacion Experimental (SW of Bretaña, W of Canal de Puinahua). 3 Aug 1984. W. Staeck (P5/84). **R. Tigre drainage:** MHNG 2233.77. 4, 27.6-43.3. Loreto, R. Tigre system, Nueva York. Jul 1979. P. de Rham. **R. Itaya drainage:** NRM SOK/1983333.3761. 1*, 117.4. Loreto, Quebrada Guayabamba at Km 2 on road Iquitos-Quistococha. 17 Aug 1981. SOK 65. NRM SOK/1984342.4096. 4, 18.5-57.7. Loreto, Quisto Cocha W margin. 21 Aug 1984. SOK 112. NRM SOK/1981357.3489. 3, 14.1-18.0. Loreto, Alcántara Caño, tributary to Quisto Cocha. 23 Aug 1981. SOK 35a. NRM SOK/1981324.3296. 2, 19.6-35.8. Loreto, along shore of Quisto Cocha. 6 Aug 1981. SOK 23a. MHNG 2222.83. 1, 20.1. Loreto, Alcántara Caño, tributary of Quisto Cocha. 27 Aug 1981. P. de Rham *et al.* (Sta. 10). **R. Nanay drainage:** NRM SOK/1983337.3724. 8*, 75.2-161.6. Loreto, small tahuampa cocha on left bank, second left bend above Mishana. 21 Aug 1983. SOK 71. NRM SOK/1983336.3725. 2*, 74.1-80.0. Loreto, left bank playa, second left bend above Mishana. 20-21 Aug 1983. SOK 70. NRM SOK/1981353.3650. 1*, 136.4. Loreto, Vicente Cocha, just upstream of Bella Vista. 26 Aug 1981. SOK 36. NRM SOK/1983354.3834. 1*, 64.4. Loreto, Bella Vista, Vieja Cocha. 4 Sep 1983. SOK 83. NRM SOK/1981325.3330. 1*, 108.9. Loreto, Zúngaro Cocha, purchased from angling boys. 7 Aug 1981. SOK 24. NRM SOK/1983334.3835. 2, 39.3-42.0. Loreto, Quebrada Corrientillo, 20 km from Iquitos on road to Puerto Almendra. 18 Aug 1983. SOK 67. ZFMK 8665-8666*pt.* 1. Loreto, aguajal on road Iquitos-Quistococha, Quebrada Pucayacu. 29 Jul 1974. K.H. Lüling. MPM unreg. 1*, 99.8. Loreto, Mishana, small tributary of R. Nanay. 5 Nov 1974. Spieler, Poncho. NRM SOK/1981353.3497. 1*, 118.4. Loreto, Vicente cocha, just upstream of Bella Vista. 26 Aug 1981. SOK 36. NRM SOK/1981371.9649. 1, 50.6. Loreto, unnamed quebrada close to Santa Clara. 7 Sep 1981. SOK 51; died in aquarium Sep 1981. NRM SOK/1981325.3304. 1*, 34.2. Loreto, Zúngaro Cocha. 7 Aug 1981. SOK 24. NRM SOK/1984344.4100. 3, 31.6-37.8. Loreto, Quebrada Cor-

rientillo at bridge on road Iquitos-Puerto Almendra. 23 Aug 1984. SOK 113. NRM SOK/1981323.3644. 1, 16.1. Loreto, Km 13 on road Iquitos-Quistococha, IMARPE, stagnant pool remaining of quebrada effluent of fish ponds. 5 Aug 1981. SOK 19. NRM A85/1985322.3529. 8, 21.1-90.7. Loreto, forest laguna *c.* 1000 m from R. Nanay between Iquitos and Santa Clara. 6 Aug 1985. W. Staeck, H. Linke (P9/85). **R. Amazonas drainage:** USNM 167768. 2*, 82.8-92.9. Loreto, Iquitos. 1922. P. Morris. **Paratypes of** *Acaronia trimaculata* Allen. NRM SOK/1981333.3365. 2*, 57.4-98.0. Loreto, R. Ampiyacu system, Quebrada Sacarita, a few km upstream of Pebas. 12 Aug 1981. SOK 26a. ANSP 9138-9139. 2, *c.*119-*c.*138. Loreto, R. Ampiyacu. No date. J. Hauxwell. ANSP 9154-9155. 2. Loreto, Pebas. No date. No leg. USNM 175949. 1, 96.7. Loreto, Pebas caño. 15 Jul 1937. W.G. Scherer. **R. Napo drainage:** NRM SOK/1984334.4095. 13, 17.8-72.6. Loreto, Yuto Cocha on right bank of R. Mazán. 16 Aug 1984. SOK 107. NRM SOK/1984333.4097. 22, 36.1-67.0. Loreto, R. Napo system, Cayapoza, small laguna on left bank island. 15 Aug 1984. SOK 104. **R. Yavarí drainage:** NRM THO/1976311.1177. 1, 58.9. Loreto, San Sebastian, Caño do Comprido. 26 Jul 1976. T. Hongslo. NRM THO/1971365.3086. 1, 38.8. Loreto, Lago Matamata. 10 Sep 1971. T. Hongslo (VIT 6). NRM SOK/1984305.4101. 1, 33.3. Loreto, Colonia Angamos, quebrada separating civil and military parts of village, behind school building. 27-28, 30 Jul, 2 Aug 1984. SOK 85. NRM SOK/1984307.4099. 1, 41.5. Loreto, small cocha on left bank of R. Yaquerana, *c.* 2 h upstream of Colonia Angamos, 30 min upstream of Cocha Palometal (30 hp deslizador). 29 Jul 1984. SOK 86. NRM SOK/1984311.4098. 1, 33.8. Loreto, Quebrada de la Piscigranja, at Km 2 on carretera Colonia Angamos-Jenaro Herrera, upstream and downstream of fish pond. 30 Jul 1984. SOK 87. **R. Manú drainage:** ANSP 143552. 5, 19.2-27.2. Madre de Dios, R. Manu system at 71°08'W 12°3.5'S. 10 Aug 1977. R. Horwitz (RH 6 MA 01150). ZMA 115.211. 1*, 71.9. Madre de Dios, Párque Nacional de Manú, R. Manú. 18 Sep 1977. P. de Rham (No. 20). MHNG 1583.39-40. 2*, 42.9-50.7. Same data as ZMA 115.211. **R. Madre de Dios drainage:** NRM SOK/1983324.3797. 14, 13.5-23.5. Madre de Dios, R. Madre de Dios system, quebrada 8 km from airport road on road to Lago Túpac Amaru. 11 Aug 1983. SOK 60. ANSP 143551. 9*, 90.0-110.2. Madre de Dios, R. Madre de Dios at 69°16.5'W 12°32'S. 18 Aug 1977. R. Horwitz (RH 6MD 0064). **R. Tambopata drainage:** NRM SOK/1983325.3798. 5*, 109.4-138.2. Madre de Dios, Quebrada San Roque at Km 11 on road Puerto Maldonado - Cuzco. 12 Aug 1983. SOK 61. USNM 266793. 4*, 41.5-61.4. Madre de Dios, Reserva Natural de Tambopata, Laguna Cocococha, 5.1 km E of Explorers Inn. 20 Aug 1983. RPV 83-32. USNM 266791. 1, 24.7. Same data as USNM 266793. USNM 264093. 2, 24.5-25.1. Same data as USNM 266793. USNM 264081. 2*, 49.0-57.6. Madre de Dios, stream entering R. Tambopata from south bank *c.* 500 m downstream of Explorers Inn boat landing. 23 Aug 1983. RPV 83-39.

BRASIL. R. Içá drainage: NRM THO/1971518.3101. 2, 105.2-109.4. Amazonas, Cuiabá, Cocha Simpatia. 21-22 Dec 1971. T. Hongslo (VIT 31C). **R. Juruá drainage:** IRSNB unreg. 1, 78.0. Acre, Cruzeiro do Sul, furo of Lago São Francisco, on left bank of R. Juruá, above mouth of R. Moá. 1 Dec 1967. Léopold III, J.-P. Gosse (Sta. 188).

ECUADOR. R. Napo drainage: MCZ 49325. 2, 33.4-40.9. Napo, Manduro Cocha near Coca. 1 Dec 1971. T.R. Roberts. ANSP 145983. 2. Napo, small stream *c.* 15 mi downstream from Missahualli. 24 Aug 1980. A. Mack. ANSP 119922. 1. Napo, R. Aguarico near Santa Cecilia. 2 Aug 1969. E.J. Hugghins (H-69-243). ANSP 119908. 1. Napo, Limón Cocha. 9 Aug 1969. E.J. Hugghins (H-69-269). ANSP 119903. 1. Napo, Limón Cocha. 7 Aug 1969. E.J. Hugghins (H-69-260). MHNG 2224.51. 2, 98.1-108.9. Napo, Hacienda Primavera. 1 January 1985. J.M. Touzet (81). MHNG 2224.50. 1, 69.6. Same data as MHNG 2224.51, but collector's no. 71. **R. Putumayo drainage:** USNM 130458. 6. Napo, lower lake at Santa Cecilia. 24 Jun 1967. W.G. Saul (WGS 67-30). ANSP 130459. 1. Napo, lower lake at Santa Cecilia. 10 Jun 1967. W.G. Saul (WGS 67-30). ANSP 119914. 2. Napo, tributary to R. Conejo at Santa Cecilia. 4 Aug 1969. E.J. Hugghins (H-69-250-251).

Aequidens patricki

PERÚ. R. Pachitea drainage: ZFMK 10766-10767. 2, 97.7-104.5. Huánuco, arm of Quebrada Pacal near Panguana. 11 Sep 1976. K.H. Lüling (Sta. PP1). **Paratypes of** *Aequidens patricki* Kullander. NRM A82/1976376.3458. 1, 93.8. Same data as ZFMK 10766-10767. (Previously ZFMK 10768.) **Paratype of** *Aequidens patricki* Kullander. ZFMK 10769. 1, 37.6. Huánuco, quebrada near Panguana. 10 Sep 1976. K. H. Lüling (Sta. PB1). **Paratype of** *Aequidens patricki* Kullander. ZFMK 10770-10771. 2, 17.9-*c*. 20.2. Huánuco, Cerro Sira, quebrada tributary to R. Llullapichis. 17 Sep 1976. W. Foersch, A. Hanrieder. **Paratypes of** *Aequidens patricki* Kullander. ZMH 6427. 1, 109.6. Huánuco, Panguana, pool in forest. 17 Dec 1977. A. Schlüter. **Paratype of** *Aequidens patricki* Kullander. ZMH 6435. 2, 46.7-68.6. Huánuco, Panguana, stream on pasture. 18 Jun 1981. L. Meckling. **Paratypes of** *Aequidens patricki* Kullander. CAS 57455*pt*. 1, 14.8. Pasco, creek at Puerto Bermúdez. Jul 1920. W.R. Allen. CAS 57452. 70 (10 examined: 26.5-91.1). Pasco, creek at Puerto Bermúdez. Jul 1920. W.R. Allen. (Previously IUM, reg.no. lost.) **R. Aguaytía drainage:** MHNG 2205.09. 6, 21.6-38.7. Ucayali, Aguaytía, Pampa de Sacramento, stream tributary to R. Negro. 7 Oct 1984. P. de Rham, H. Ortega. MHNG 2163.93. 1, 116.2. Ucayali, small stream draining drying swamp, tributary to R. Aguaytía on road Pucallpa - Tingo María, 15 km W from Aguaytía. 24 Aug 1981. P. de Rham *et al*. (Sta. 7b). **Holotype of** *Aequidens patricki* Kullander. MHNG 2163.94. 1, *c*. 19.3. Same data as MHNG 2163.93. **Paratype of** *Aequidens patricki* Kullander. IRSNB 700. 1, 103.4. Ucayali, small stream between Boquerón del Padre Ábad and Aguaytía. 22 Nov 1965. J.-P. Gosse & Léopold III (Sta. 150). **Paratype of** *Aequidens patricki* Kullander.

Aequidens diadema

PERÚ. Drainage unknown: NMW 33793-33794. 2*, 82.0-83.5. 'Iquitos'. Registered 1884. No leg. **R. Ucayali drainage:** NRM SOK/1981363.3576. 1*, 117.7. Loreto, Quebrada Sapuena at Km 10 on road Jenaro Herrera-Colonia Angamos. 2 Sep 1981. SOK 45. NRM SOK/1981363.4183. 29, 24.4-43.1. Same data as NRM SOK/1981363.3576. 2 specimens cleared and stained. MHNG 2233.84. 3, 33.5-37.2. Same data as NRM SOK/1981363.3576. ZMA unreg. 4, 30.5-36.3. Same data as NRM SOK/1981363.3576. NRM SOK/1981364.3606. 2, 57.0-58.0. Loreto, Km 3 on road Jenaro Herrera-Colonia Angamos, quebrada behind the Centro Forestal de PARI. 3 Sep 1981. SOK 49. MHNG 2233.85. 2, 30.1-49.1 (1: 49.1). Loreto, Quebrada Saponilla at Km 7 on road Jenaro Herrera-Colonia Angamos. 14 Sep 1981. P. de Rham, H. Nijssen (Sta. 27). MHNG 2233.86. 1, 24.9. Loreto, forest creeks at right bank of Quebrada Carahuayte, *c*. 35 km SE of Jenaro Herrera. 8-10 Sep 1981. P. de Rham, H. Nijssen (Sta. 22a). MHNG 2233.87. 7, 16.9-42.9. Loreto, forest creeks at right bank of Quebrada Copal, 16-17 km from Jenaro Herrera on road to Colonia Angamos. 12-14 Sep 1981. P. de Rham *et al*. (Sta. 25). ZMB 31571. 3, 37.1-49.4. Loreto, Quebrada Copal. 22 Sep 1979. H.-J. Franke. MHNG 2233.88. 7, 28.9-81.0. Locality data lost. 1978. P. de Rham. MHNG 2233.89. 1, 41.4. Loreto, Quebrada Copal at Km 15 on road Jenaro Herrera-Colonia Angamos. 12 Mar 1980. P. de Rham (R.162). MHNG 2233.90. 3, 22.0-28.0. Loreto, quebrada of fish breeding pond Embalse del Potrero 20, *c*. 3 km S of Km 4 on road Jenaro Herrera-Colonia Angamos, close to lateral road to R. Parnayari. 11 March 1980. P. de Rham (R.HS.1). NRM A83/1983262.3037. 1, 34.7. Loreto, small quebrada crossing road 13.5 km E of Jenaro Herrera on road to Colonia Angamos. 28 Jun 1983. W. Staeck, H. Linke (P12/83). NRM SOK/1983351.3782. 70, 8.4-31.8. Loreto, quebrada tributary to Quebrada Carahuayte at Km 18 on road Jenaro Herrera-Colonia Angamos. 29 Aug 1983. SOK 77. NRM SOK/1983353.3781. 5, 12.2-38.4. Loreto, Quebrada Salomé, tributary to Quebrada Sapuena at Km 9 on road Jenaro Herrera-Colonia Angamos. 31 Aug 1981. SOK 80. NRM SOK/1983355.3780. 8, 40.4-62.3 (5: 54.5-62.3). Loreto, quebrada in arboretum at Km 3 on road Jenaro Herrera-Colonia Angamos. 2 Sep 1983. SOK 82. NRM SOK/1983353.3783. 50, *c*.12-44.0. Loreto, Quebrada Sapuena at Km 10 on road Jenaro Herrera-Colonia Angamos. 31 Aug 1983. SOK 79. MHNG 2233.91. 2, 58.5-91.7 (1: 91.7). Loreto, near

Jenaro Herrera /locality data mixed up/. Sep 1981. P. de Rham.
BRASIL. R. Juruá drainage: BMNH 1979.3.20: 226-227. 2, 57.6-81.0. Amazonas, stream near Carauari. 1978. P. Leigh.

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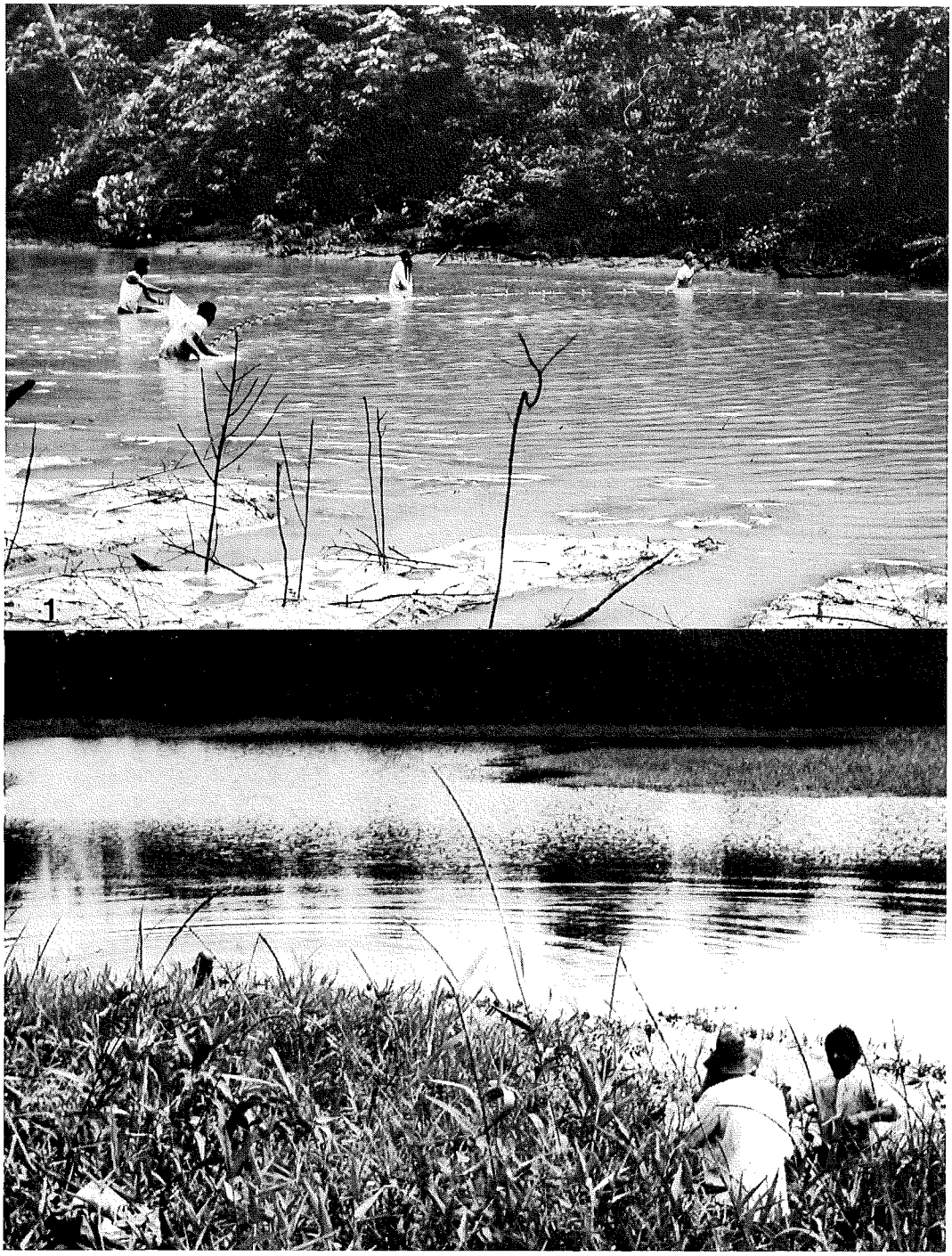


PLATE I

1. Seine fishing in a drying-up cocha on the margin of the R. Yaquerana, field station SOK 86, 29 July 1984.
2. Seine fishing in a palometal (floating meadow) in a laguna on a sand island in the lower R. Napo, field station SOK 104, 15 August 1984.

PLATE II

1. Seine fishing in the Quebrada Corrientillo, a black water stream tributary to the R. Nanay, field station SOK 113, 23 August 1984.
2. Quebrada Copal near Jenaro Herrera at the peak of low water, numerous logs on the bottom exposed; field station SOK 78, 30 August 1983.

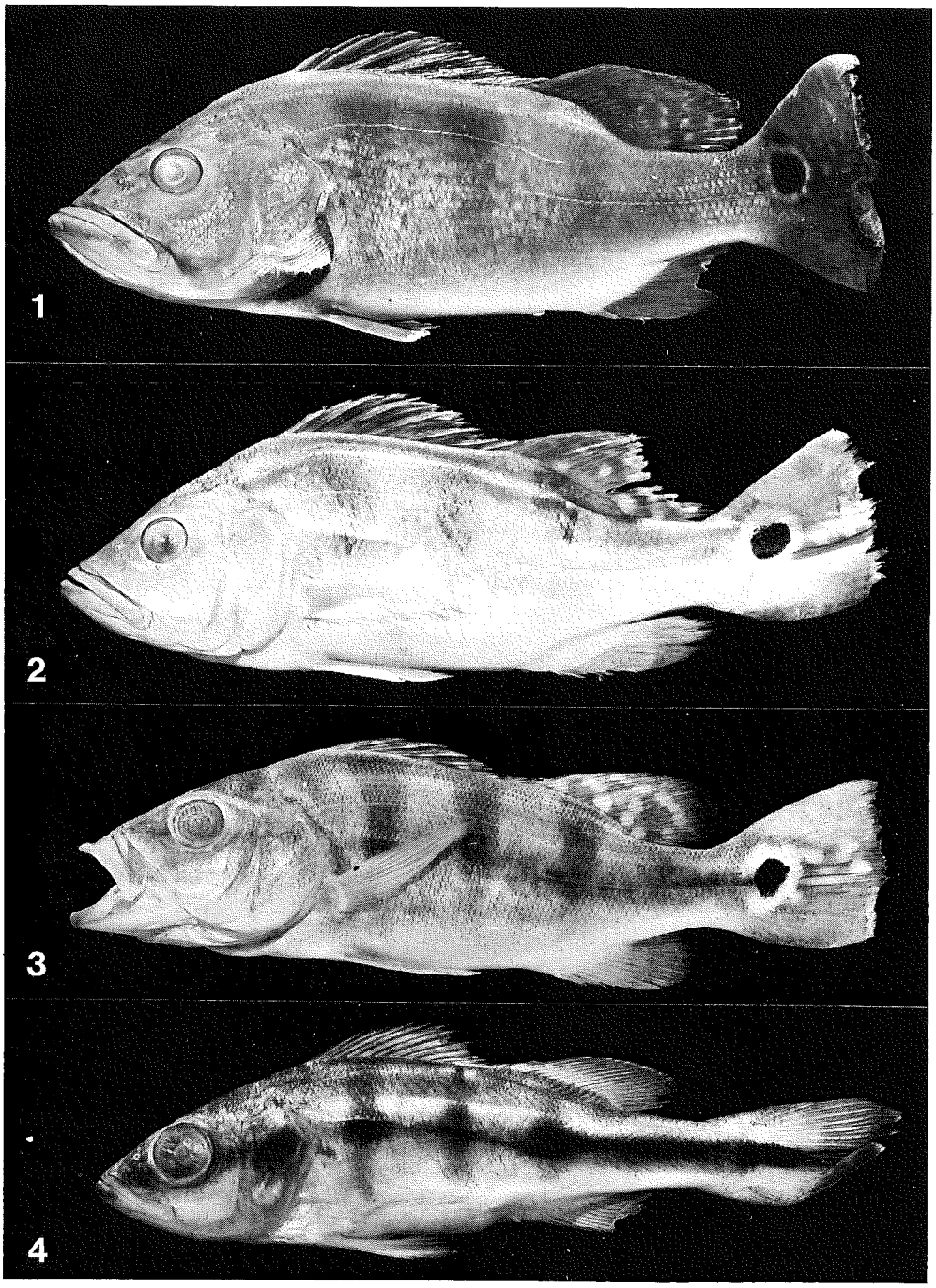


PLATE III

1. *Cichla monoculus*, female, 210.8 mm SL, NRM SOK/1984325.3862, from Llanchama Cocha.
2. *Cichla monoculus*, female, 275.0 mm SL, NRM SOK/1983354.3680, from Trueno Cocha.
3. *Cichla monoculus*, young female, 114.2 mm SL, NRM SOK/1984324.3858, from lower R. Nanay.
4. *Cichla monoculus*, young, 46.6 mm SL, NRM SOK/1984333.3861, from Aucapoza Cocha, lower R. Napo.

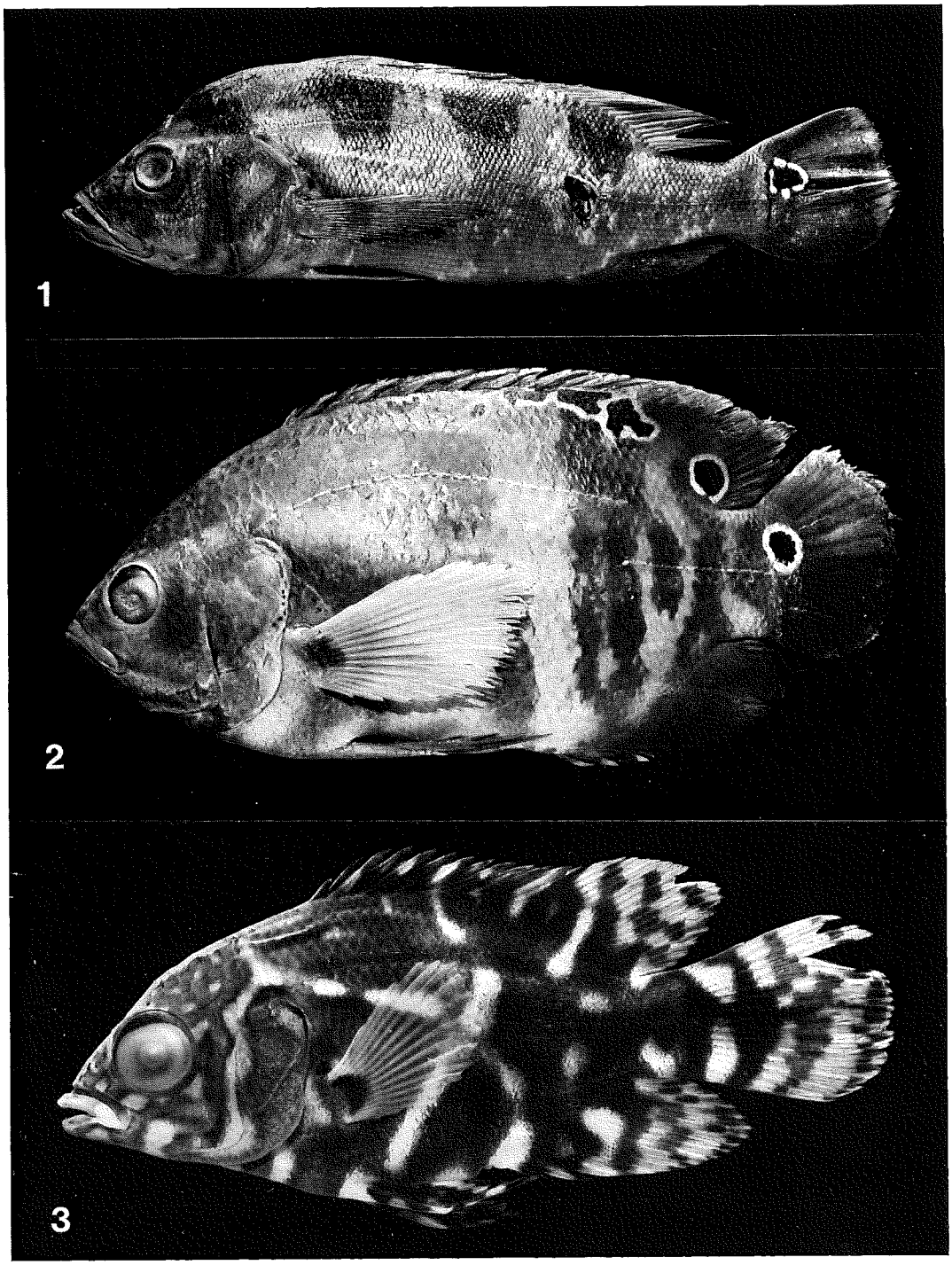


PLATE IV

1. *Cichla monoculus*, adult male, 278.6 mm SL, MNHN A.9490, in breeding colouration, syntype of *Cychla toucounarai*.
2. *Astronotus ocellatus*, adult female, 169.9 mm SL, NRM SOK/19833$5^4$.3691, from Trueno Cocha.
3. *Astronotus ocellatus*, young, 30.8 mm SL, NRM SOK/19833$4^3$.3697, from fish pond, Quistococha.

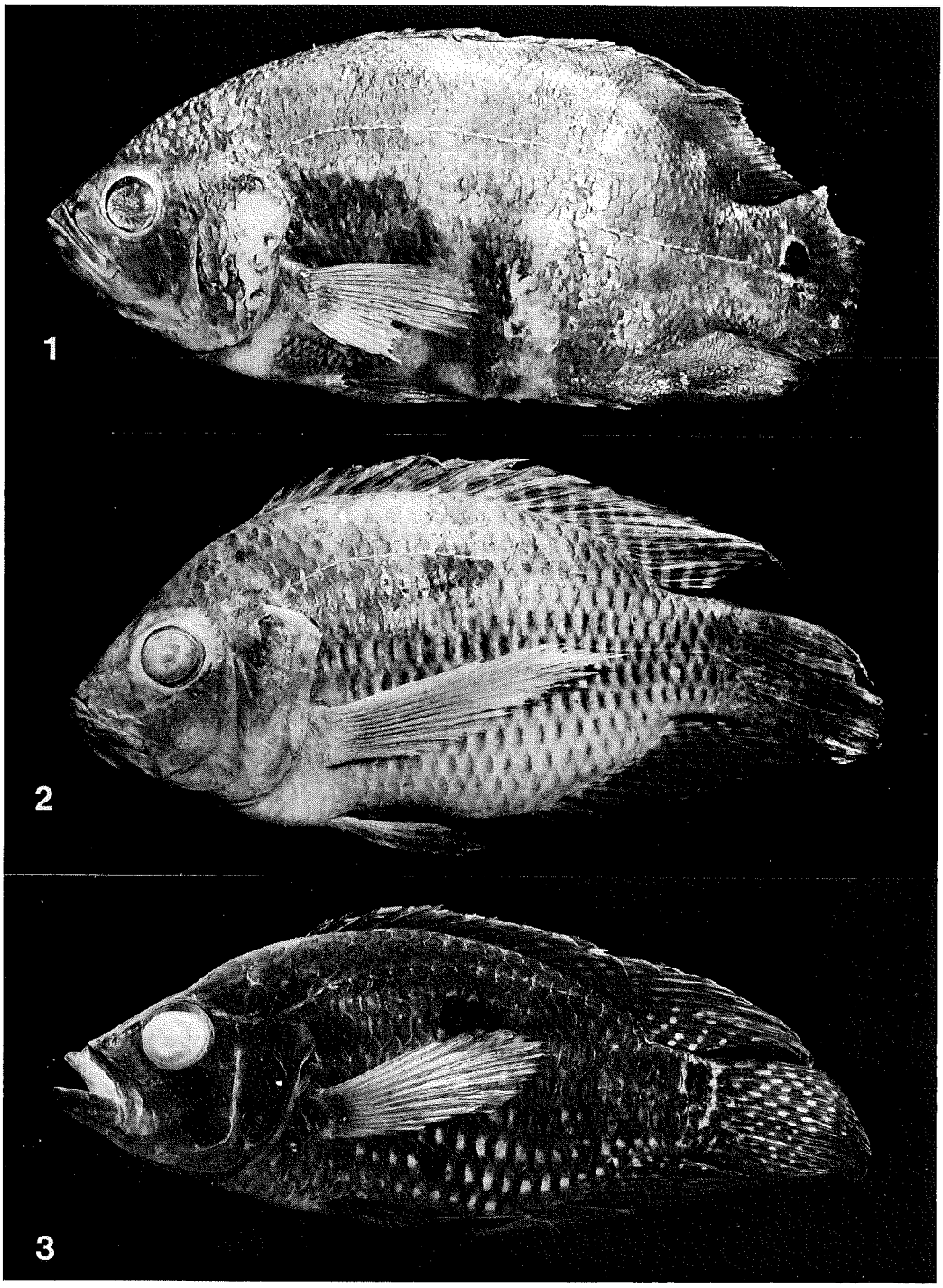


PLATE V

1. *Astronotus crassipinnis*, 159.4 mm SL, FMNH 93013, from R. Inambarí.
2. *Chaetobranchus flavescens*, adult female, 176.5 mm SL, NRM SOK/1984307. 3896, from the lower R. Yaquerana drainage.
3. *Acaronia nassa*, adult female, 120.0 mm SL, NRM SOK/1983334.3674, from Quebrada Corrientillo near Iquitos.

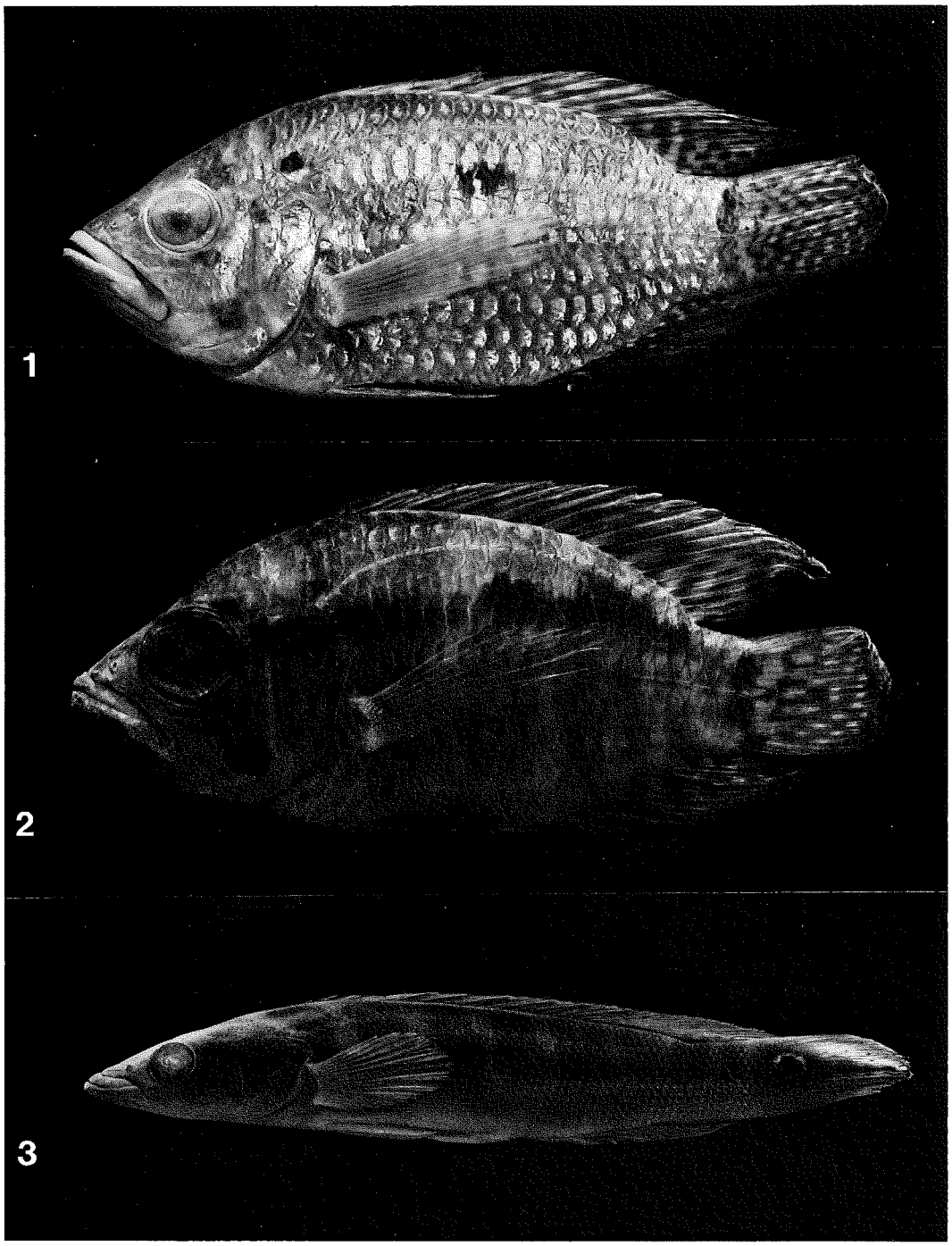


PLATE VI

1. *Acaronia nassa*, adult female, 121.8 mm SL, NRM SOK/1983337.3677, from tahuampa backwater lake near Mishana.
2. *Acaronia nassa*, young male, 63.3 mm SL, NRM THO/1971366.3145, from the lower Yavarí.
3. *Crenicichla sedentaria*, holotype, probably a male, 104.4 mm SL, USNM 229057, from R. Yamushimas, upper R. Pachitea drainage.

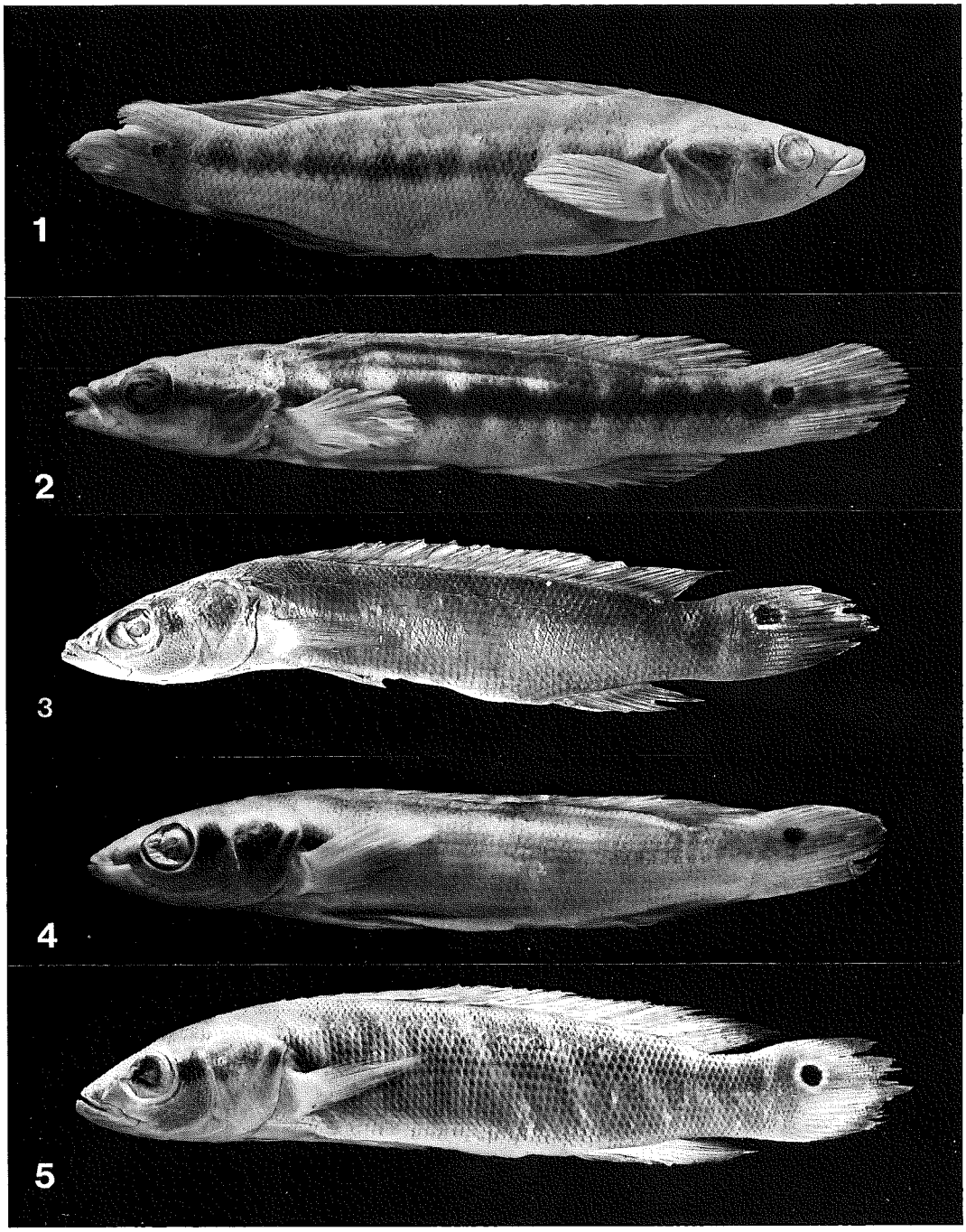


PLATE VII

1. *Crenicichla sedentaria*, male paratype, 138.7 mm SL, ANSP 139132, from near Tingo María.
2. *Crenicichla sedentaria*, young paratype, 45.3 mm SL, NRM unreg., from near Alto Aruya.
3. *Crenicichla cyanonotus*, holotype, 117.5 mm SL, ANSP 9078.
4. *Crenicichla cyanonotus*, young female, 81.2 mm SL, NRM THO/1971508. 3264, from Cuiabá, Brazil.
5. *Crenicichla reticulata*, 89.9 mm SL, NMW 32835, syntype of *C. elegans*.

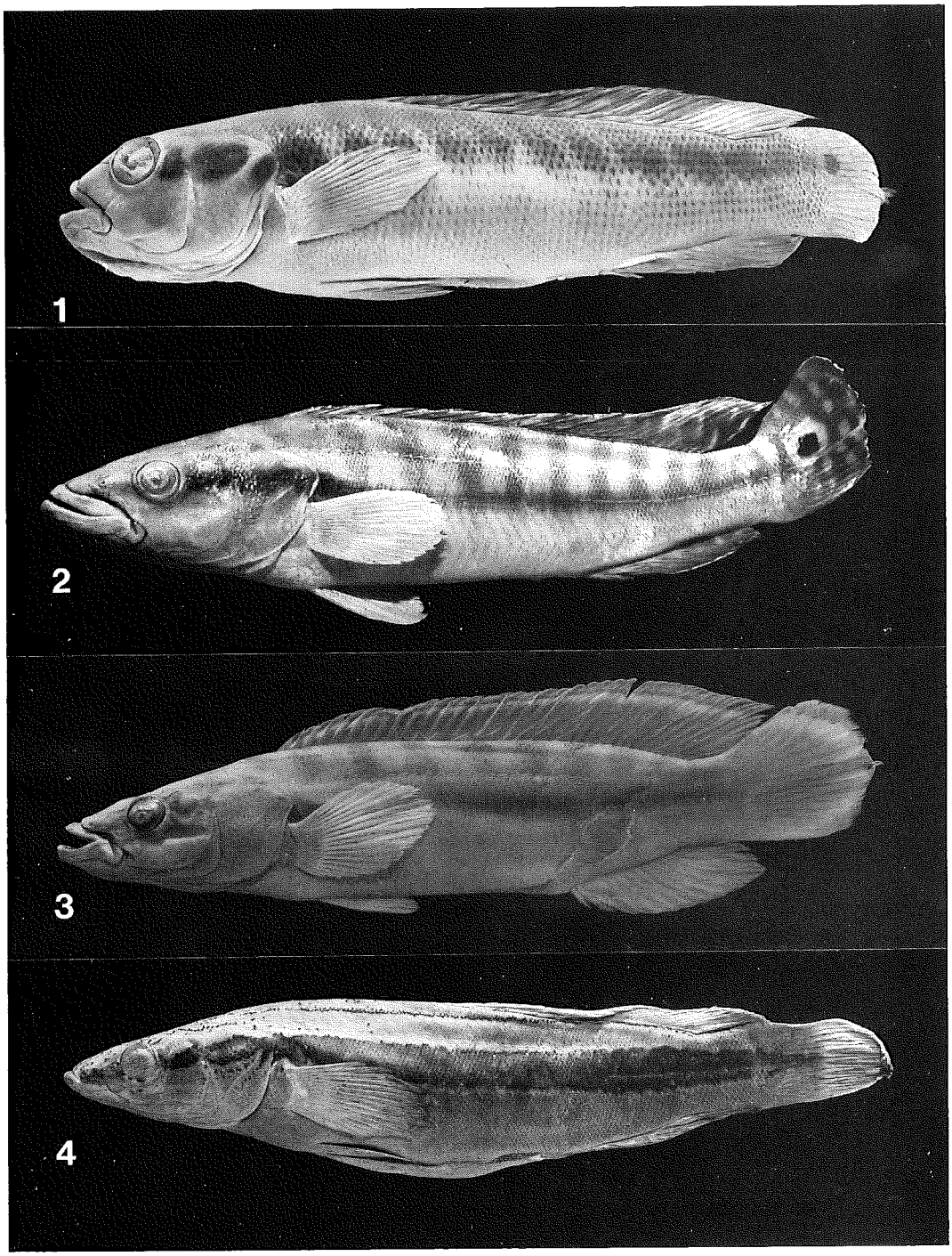


PLATE VIII

1. *Crenicichla reticulata*, adult male, 172.9 mm SL, GNHM unreg., from R. Caucayá, Colombia.
2. *Crenicichla cincta*, 181.0 mm SL, MHNG 2233.15, from Puerto Huamán.
3. *Crenicichla johanna*, young female, 146.5 mm SL, NRM SOK/1981333.3376, from the lower R. Ampiyacu.
4. *Crenicichla johanna*, young specimen, 141.7 mm SL, FMNH 73523, from near Iquitos.

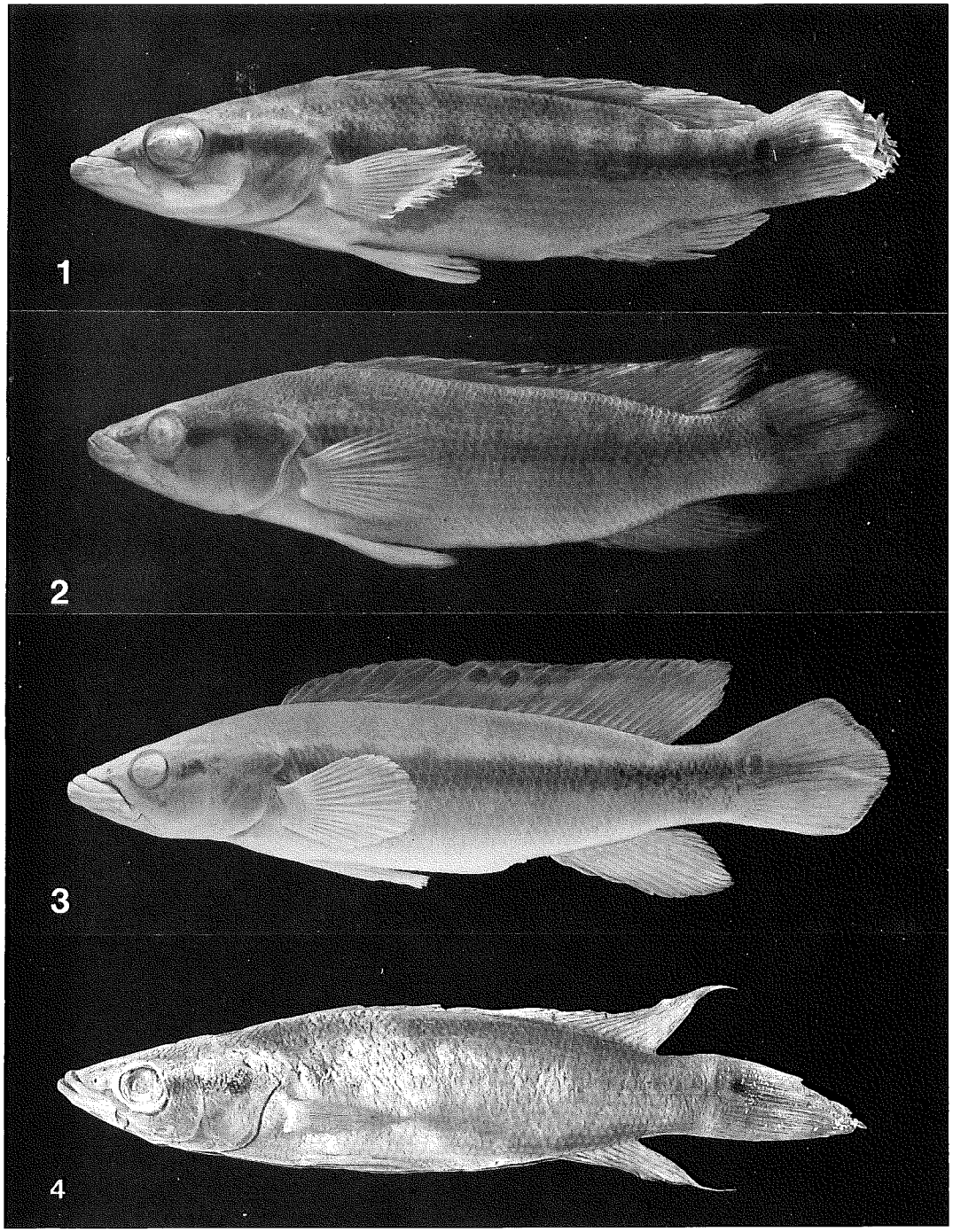


PLATE IX

1. *Crenicichla semicincta*, male, 77.2 mm SL, NRM SOK/1983324.3676, from near Lago Tupac Amaru.
2. *Crenicichla semicincta*, adult female, 142.1 mm SL, USNM 2264095 from the Reserva Natural de Tambopata.
3. *Crenicichla semicincta*, adult female, 135.8 mm SL, ANSP 143556 from the R. Pilcopata drainage, showing contrasting lateral band.
4. *Crenicichla proteus*, lectotype, 135.1 mm SL, ANSP 9050, from R. Ampiyacu.

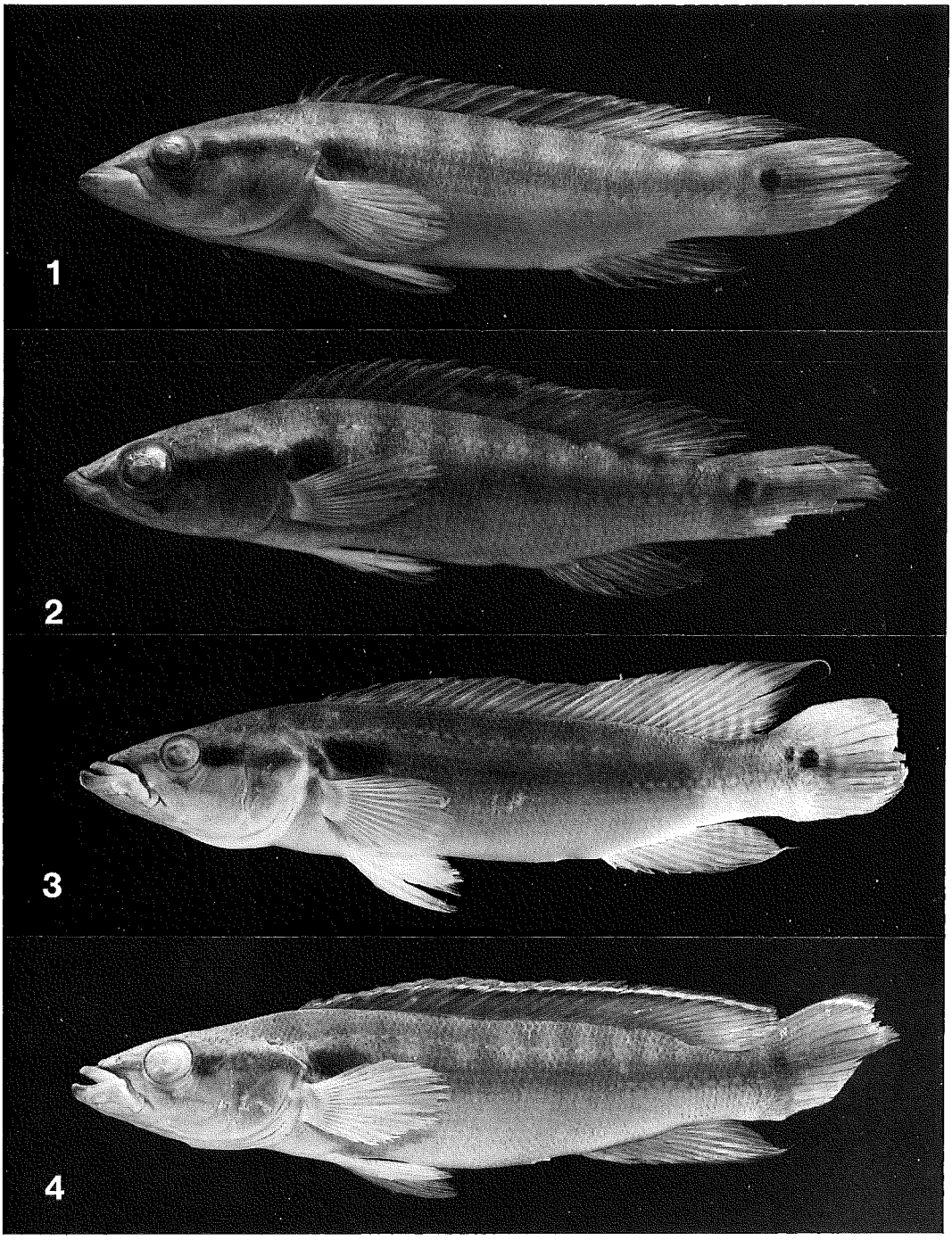


PLATE X

1. *Crenicichla proteus*, male, 107.2 mm SL, NRM SOK/1981337.3431, from Yarina Cocha.
2. *Crenicichla proteus*, young female, 55.6 mm SL, NRM SOK/1981337.3431, from Yarina Cocha, with dorsal-fin ocellus.
3. *Crenicichla lucius*, neotype, adult male, 146.0 mm SL, NRM SOK/1984333.4085, from Cayapoza, lower R. Napo.
4. *Crenicichla lucius*, adult female, 116.9 mm SL, NRM SOK/1984333.4079, from Cayapoza, lower R. Napo, taken together with neotype.

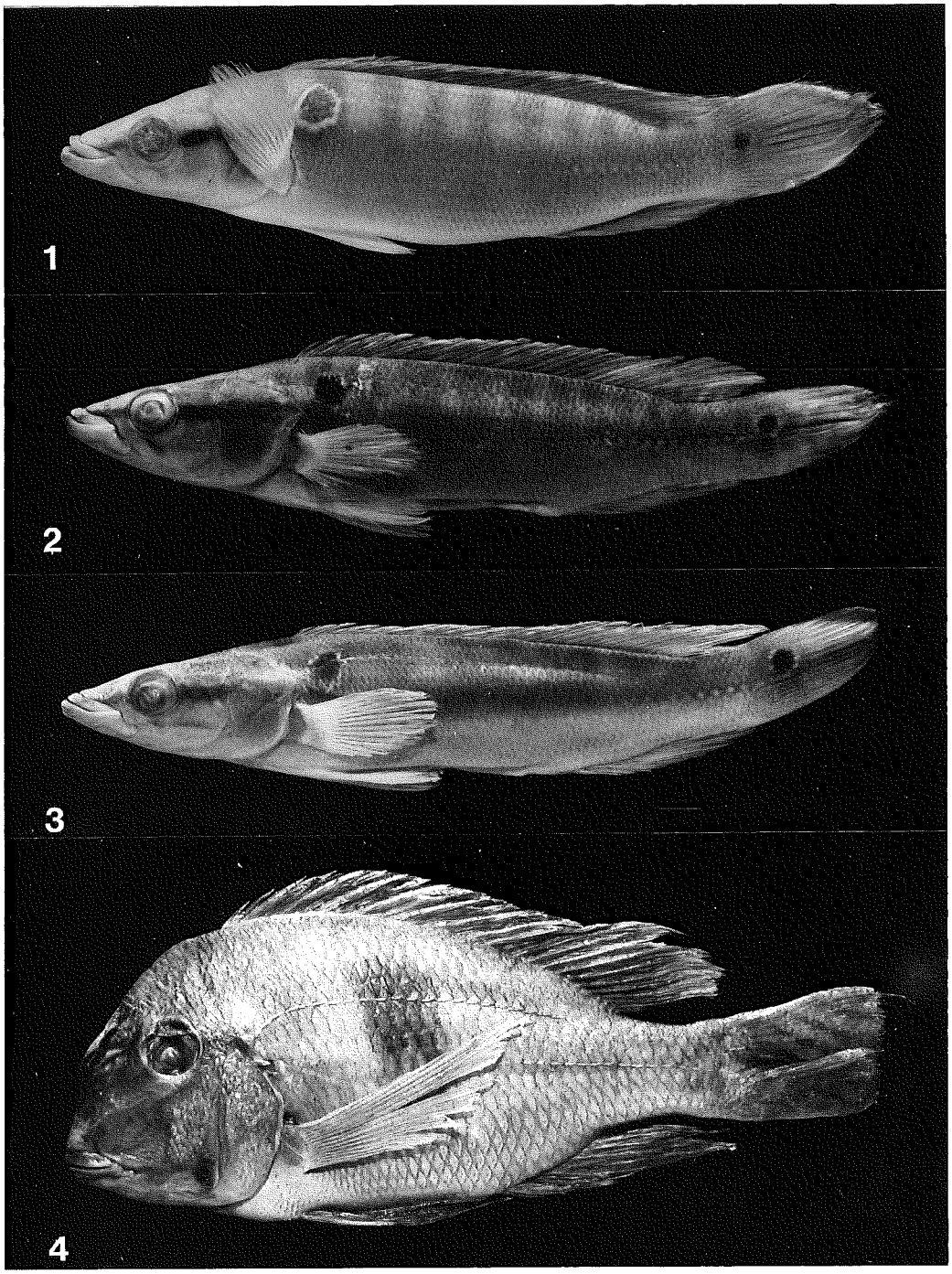


PLATE XI

1. *Crenicichla anthurus*, female, 111.7 mm SL, MHNG 2205.22, from near Pucallpa.
2. *Crenicichla anthurus*, male?, 81.2 mm SL, NRM unreg., from Alto Aruya.
3. *Crenicichla anthurus*, male, 86.9 mm SL, ANSP 130453, from near Santa Cecilia, Ecuador.
4. *Geophagus proximus*, adult male, 185.0 mm SL, MZUSP 34858, from Mastro, R. Tefé, Brazil.

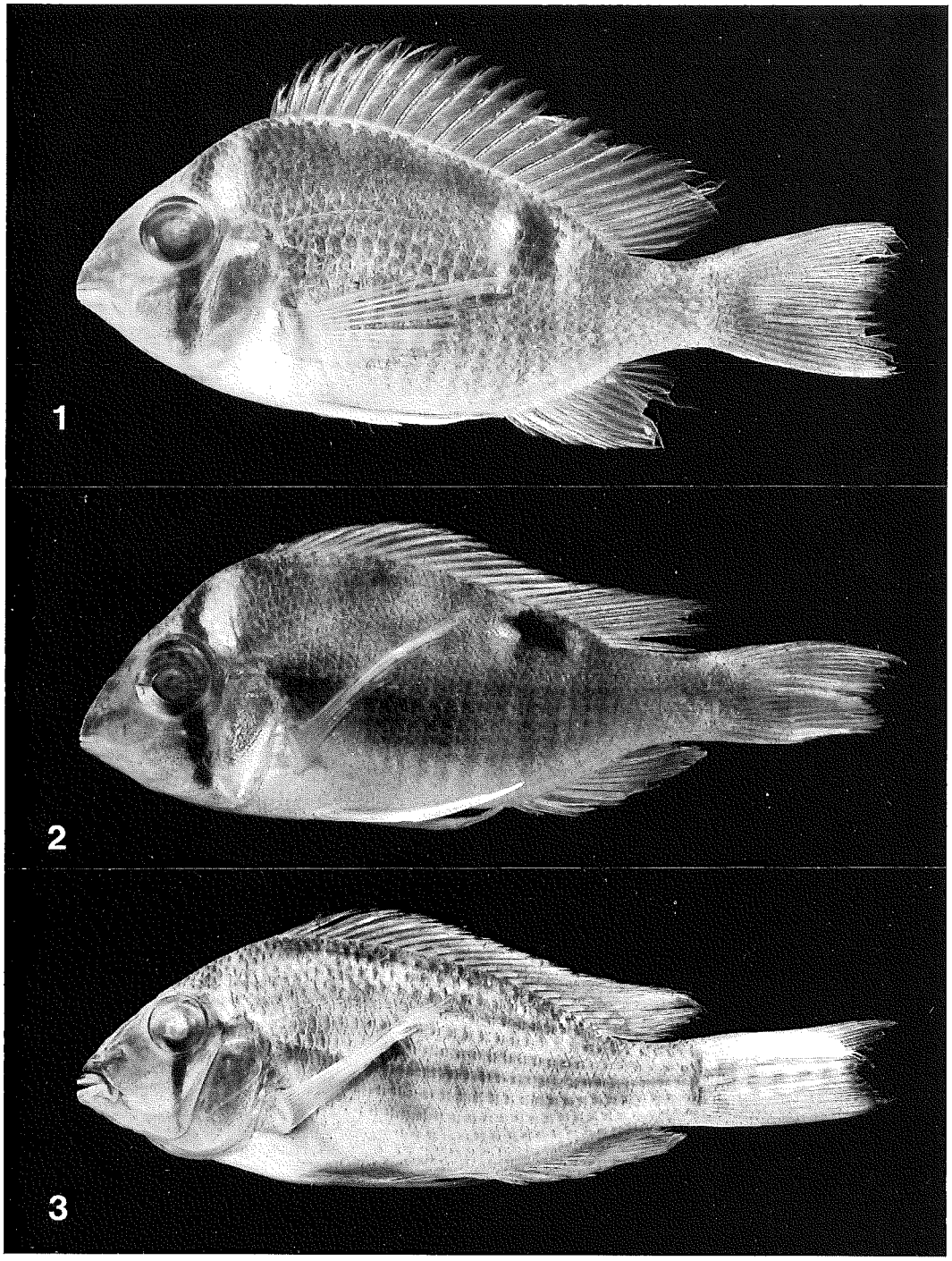


PLATE XII

1. *Biotodoma cupido*, adult female, 83.1 mm SL, NRM SOK/1981357.3569, from R. Aucayacu near Jenaro Herrera.
2. *Biotodoma cupido*, female, 61.2 mm SL, NRM SOK/1983337.3794, from near Mishana, with midlateral spot entirely dorsal to lateral line.
3. *Acarichthys heckelii*, young male, 70.0 mm SL, NRM SOK/1984342.3897, from Quisto Cocha.

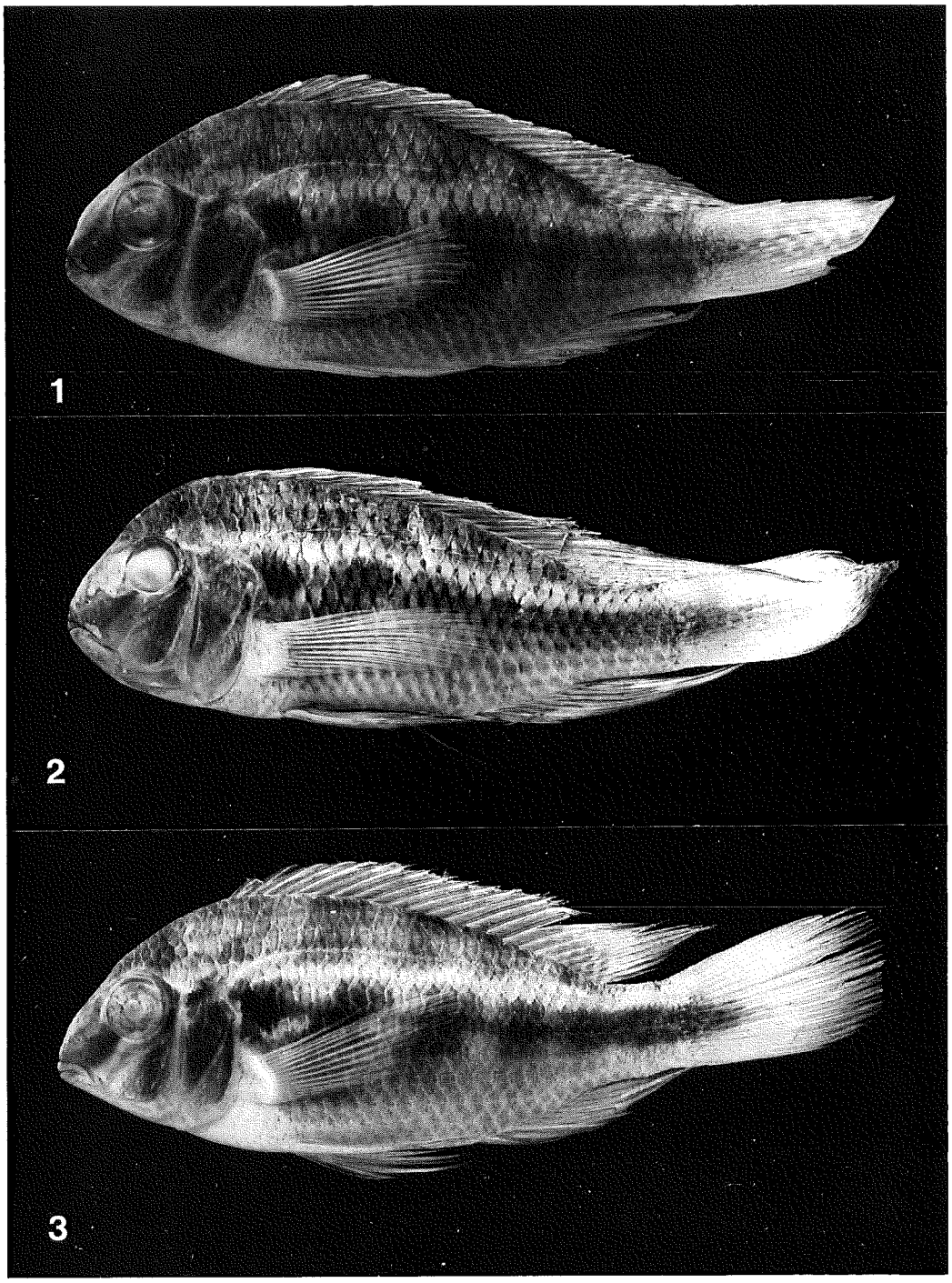


PLATE XIII

1. *Crenicara punctulatum*, male, 64.1 mm SL, NRM SOK/1983334.3682, from Quebrada Corrientillo near Iquitos.
2. *Crenicara punctulatum*, largest known specimen, a male, 100.9 mm SL, NRM SOK/1983347.3681, from Quebrada Carahuayte.
3. *Crenicara punctulatum*, male, 64.6 mm SL, USNM 264086, from Reserva Natural de Tambopata.

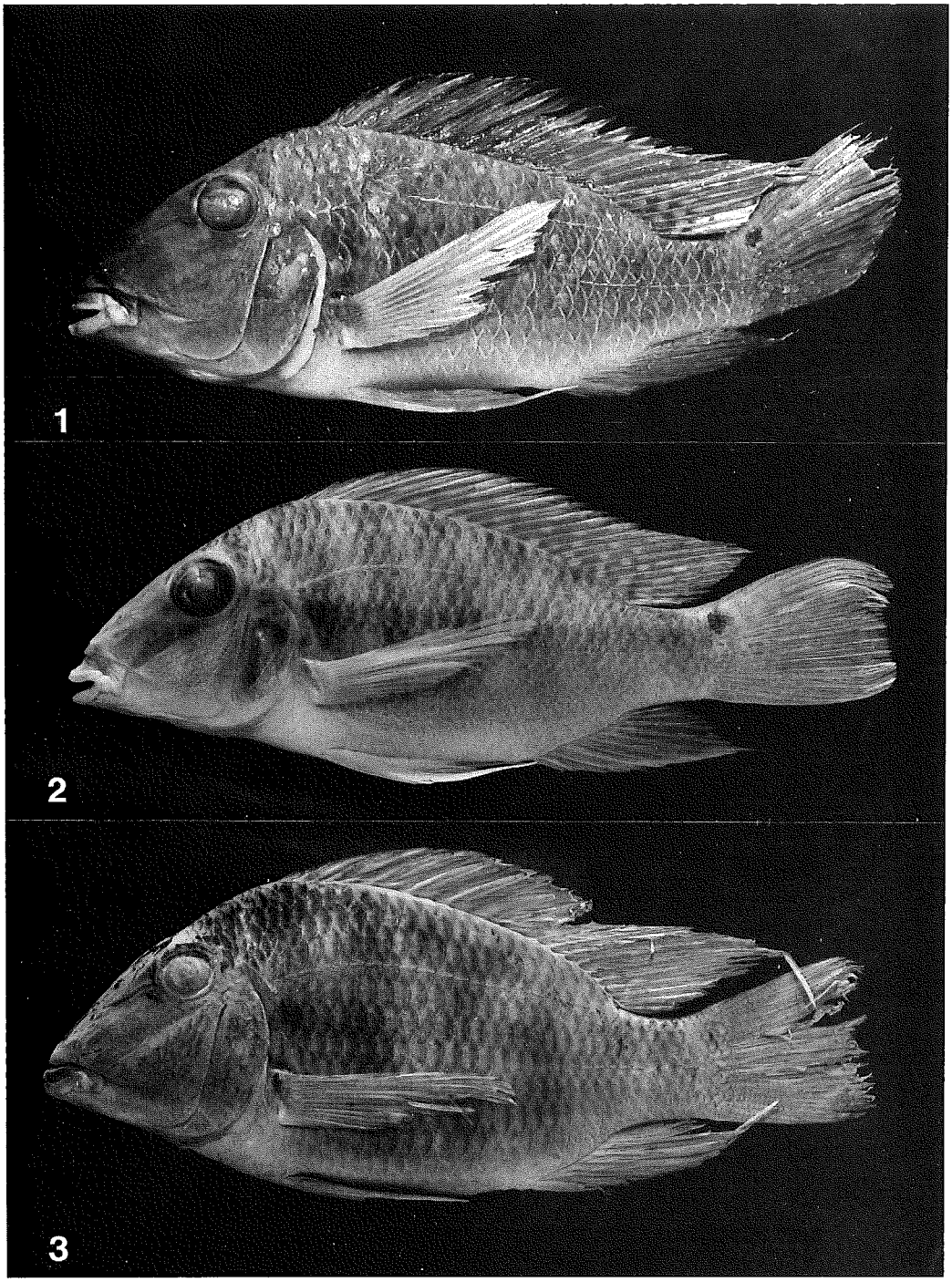


PLATE XIV

1. *Satanoperca jurupari*, adult female, 147.6 mm SL, NRM SOK/1984334.3918, from Yuto Cocha, lower R. Mazán.
2. *Satanoperca jurupari*, young, 70.2 mm SL, NRM SOK/1984317.3920, from the R. Yavarí at Colonia Angamos.
3. *Satanoperca jurupari*, adult female, 124.5 mm SL, USNM 264093, from Laguna Cococha, R. Tambopata system.

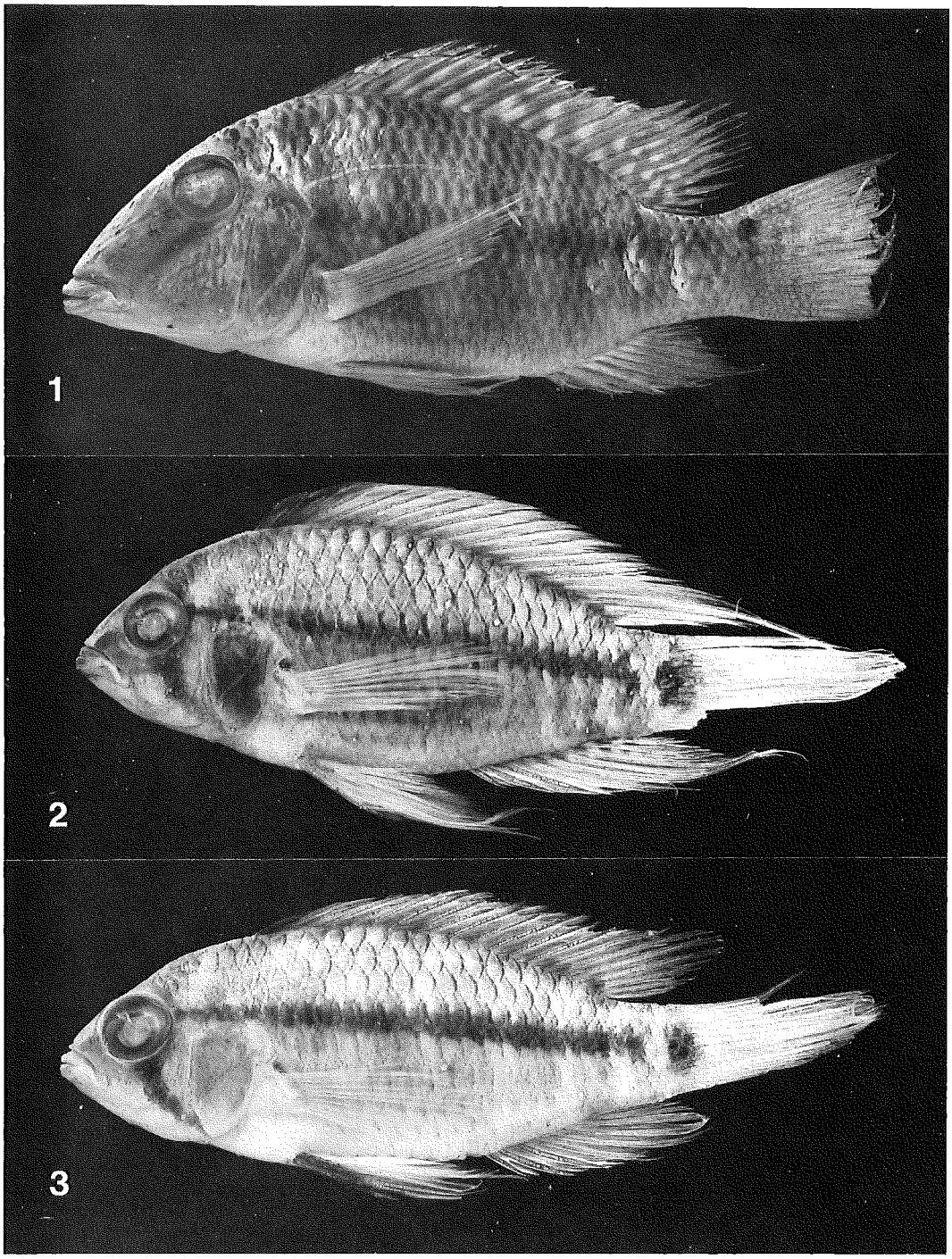


PLATE XV

1. *Satanoperca jurupari*, young specimen, 70.2 mm SL, USNM 264065, from R. Tambopata system.
2. *Apistogramma eunotus*, adult male, 45.2 mm SL, NRM SOK/1981342.3450, from aguajal at Km 6 on road Campo Verde-Tournavista.
3. *Apistogramma eunotus*, adult female, 34.5 mm SL, NRM SOK/1981342.3450, from aguajal at Km 6 on road Campo Verde-Tournavista.

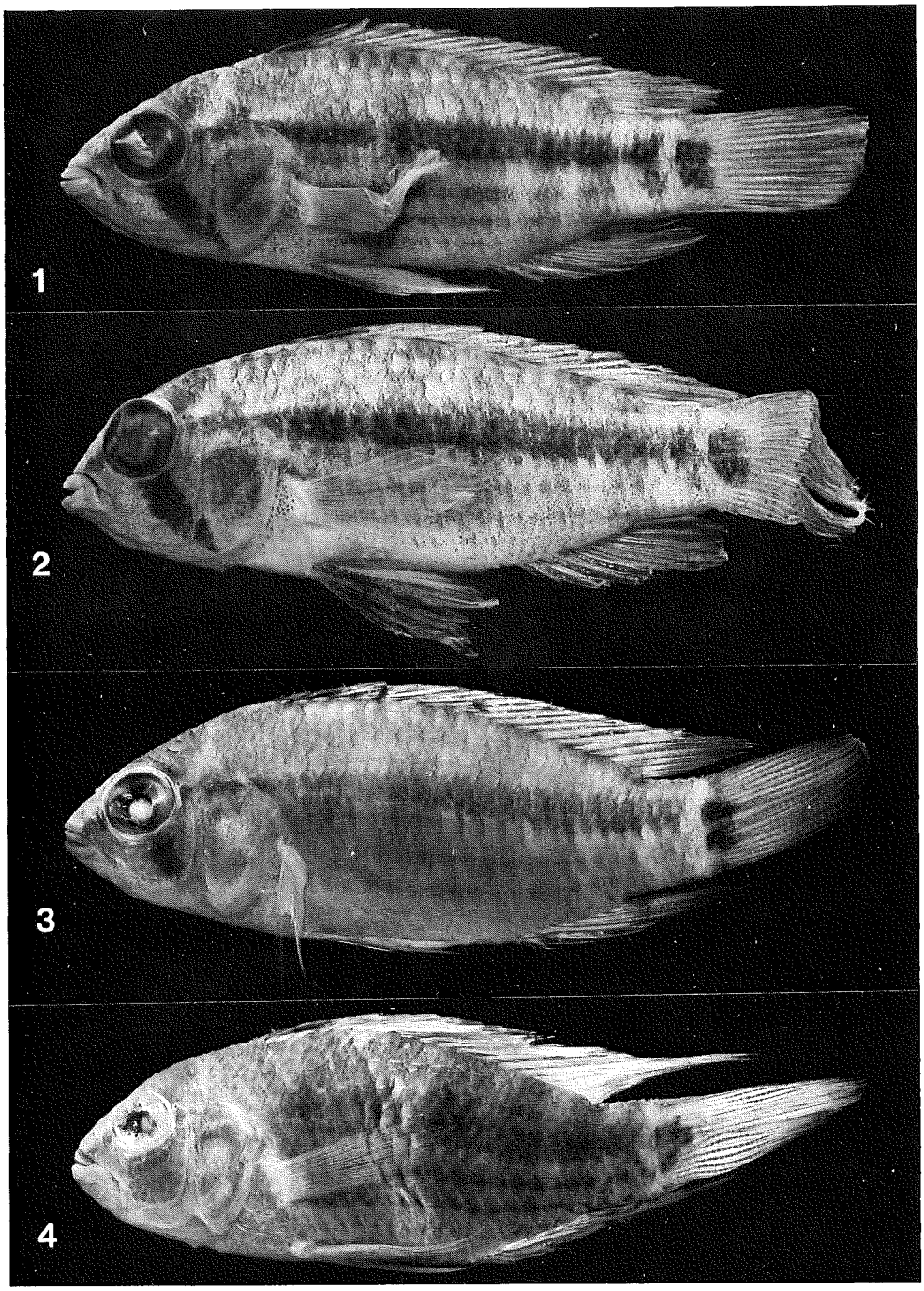


PLATE XVI

1. *Apistogramma cruzi*, holotype, a male, 26.3 mm SL, NRM SOK/1984332.3941, from a tributary to the R. Mazán near Puerto Alegre.
2. *Apistogramma cruzi*, female topoparatype, 25.6 mm SL, NRM SOK/1984332. 3924.
3. *Apistogramma cruzi*, paratype, male, 34.6 mm SL, GNHM unreg., from R. Caucaya, Colombia.
4. *Apistogramma cruzi*, paratype, male, 50.5 mm SL, GNHM unreg., from R. Caguan, Colombia.

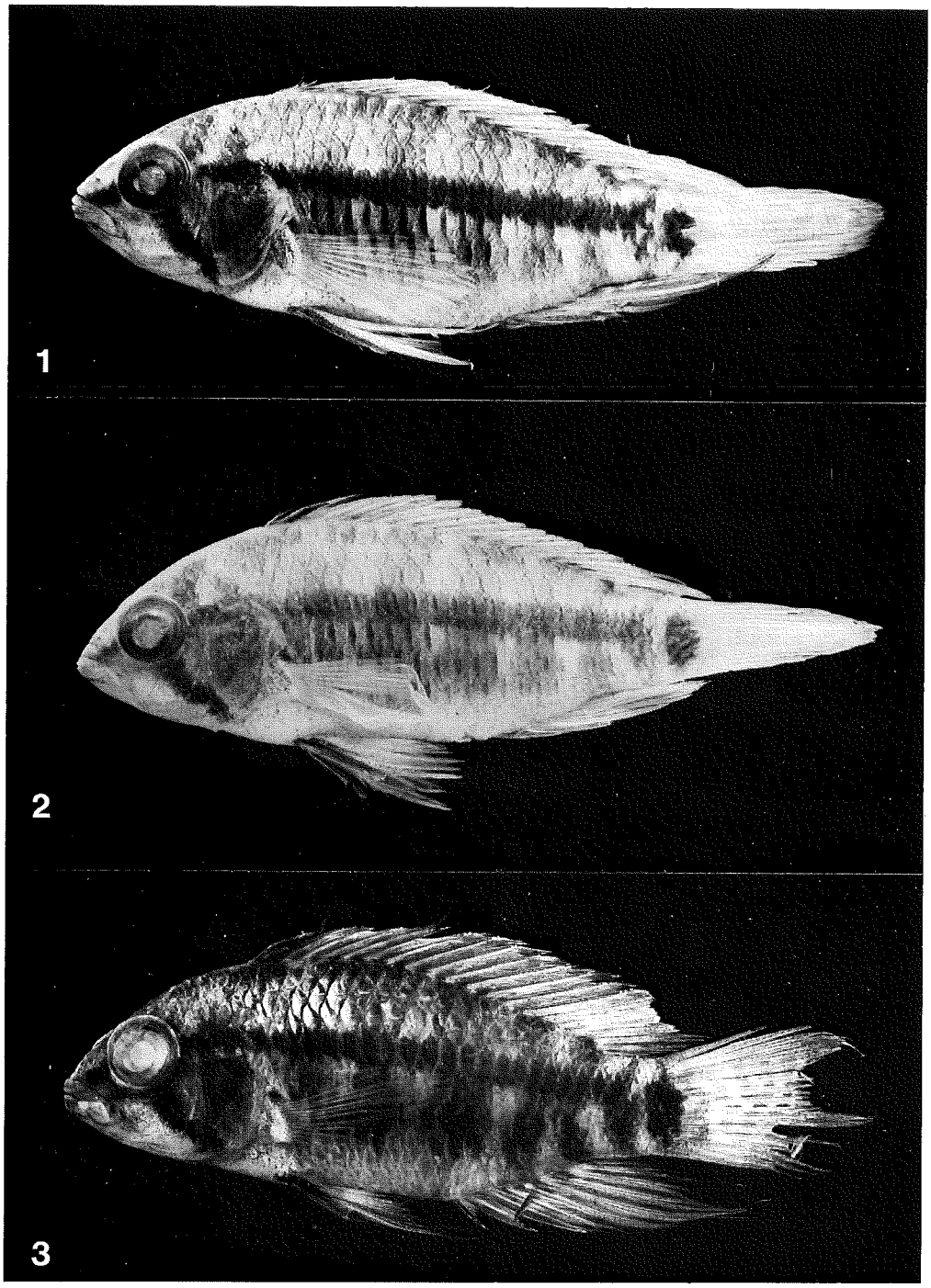


PLATE XVII

1. *Apistogramma urteagai*, holotype, a male, 28.3 mm SL, NRM SOK/1983324.3930, collected in Lago Tupac Amaru near Puerto Maldonado.
2. *Apistogramma urteagai*, female topoparatype, 25.1 mm SL, NRM SOK/1983324.3653.
3. *Apistogramma urteagai*, male paratype, 37.8 mm SL, USNM 264083, from stream tributary to R. Tambopata, exhibiting duskied lower flanks typical of large specimens of the species.

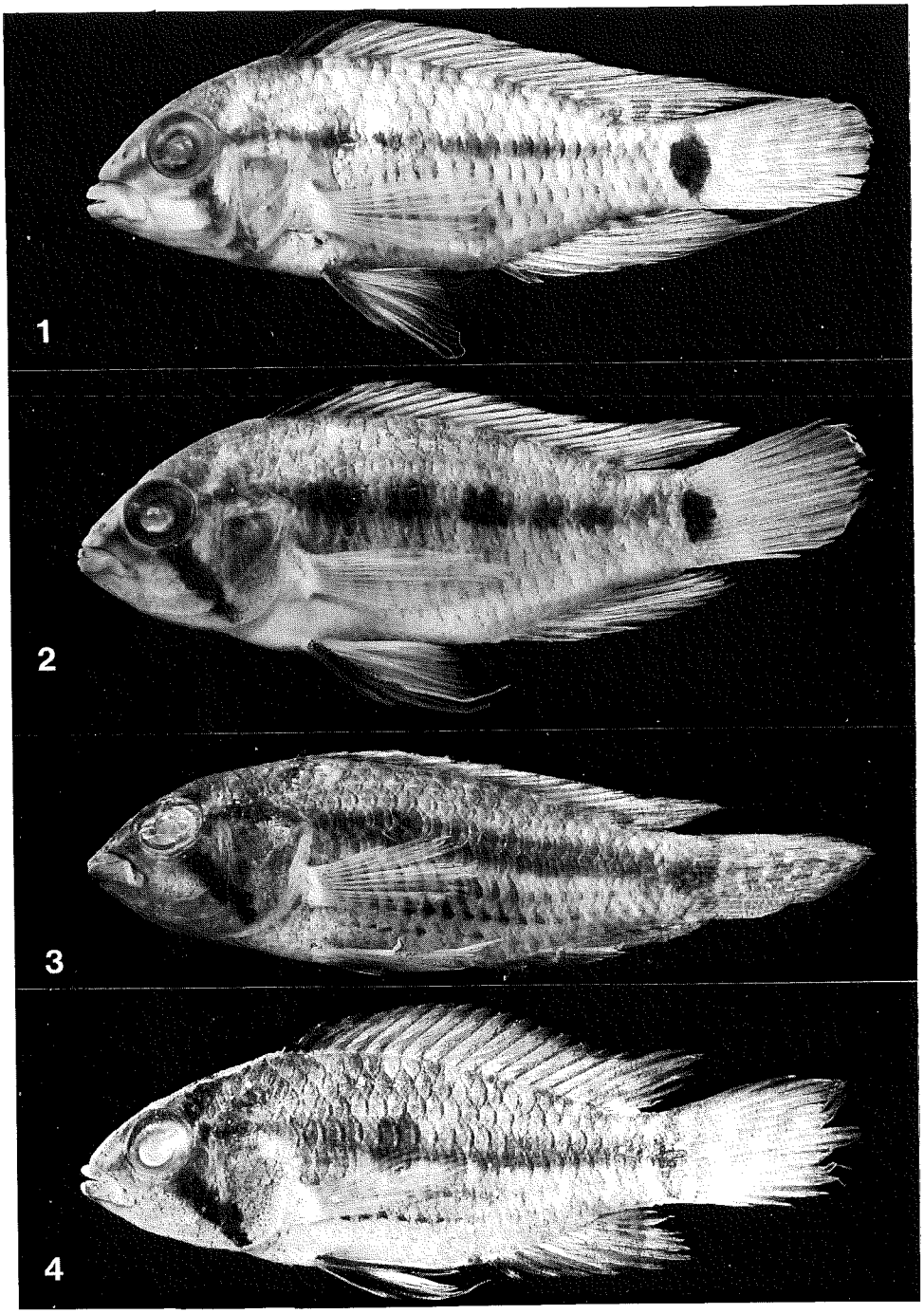


PLATE XVIII

1. *Apistogramma resticulosa*, adult male, 36.6 mm SL, USNM 235635, from the R. Guaporé drainage in Brazil, for comparison with *A. urteagai*, Pl. XVII.
2. *Apistogramma moae*, female, 31.9 mm SL, ZUEC 734, from Vila Militar, Brazil.
3. *Apistogramma luelingi*, male, 27.4 mm SL, USNM 266790, from Laguna Cocococha.
4. *Apistogramma luelingi*, female, 24.0 mm SL, CAS 54640, from 14 km ENE Puerto Maldonado.

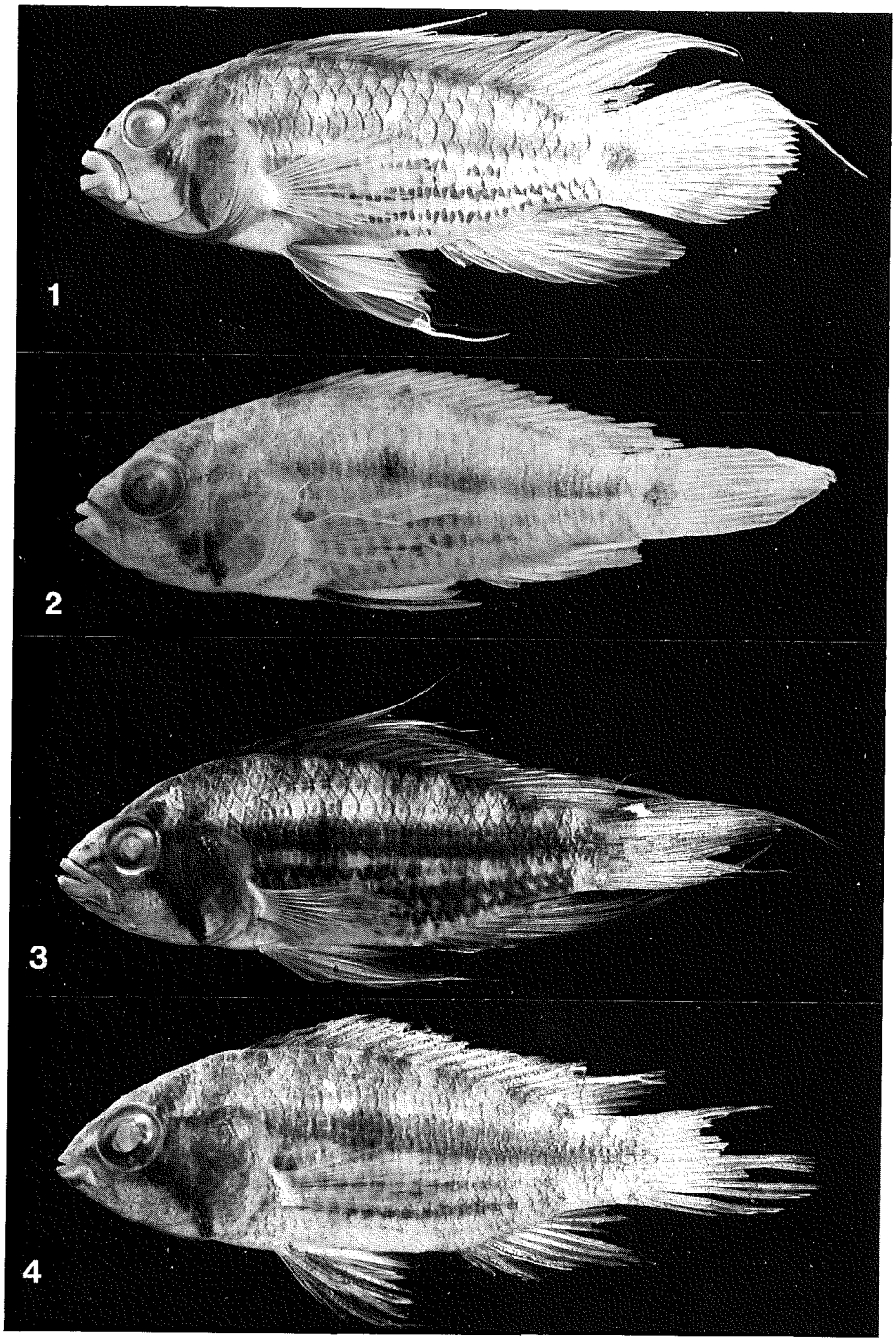


PLATE XIX

1. *Apistogramma juruensis*, holotype, a male, 41.3 mm SL, ZUEC 1374, from Igarapé Formoso near Cruzeiro do Sul, Brazil.
2. *Apistogramma juruensis*, female topoparatype, 20.0 mm SL, ZUEC 1378-1380.
3. *Apistogramma cacatuoides*, adult male, 39.9 mm SL, MHNG 2233.36, from Quebrada Abrahancillo.
4. *Apistogramma cacatuoides*, adult female, 21.3 mm SL, MHNG 2233.36, from Quebrada Abrahancillo.

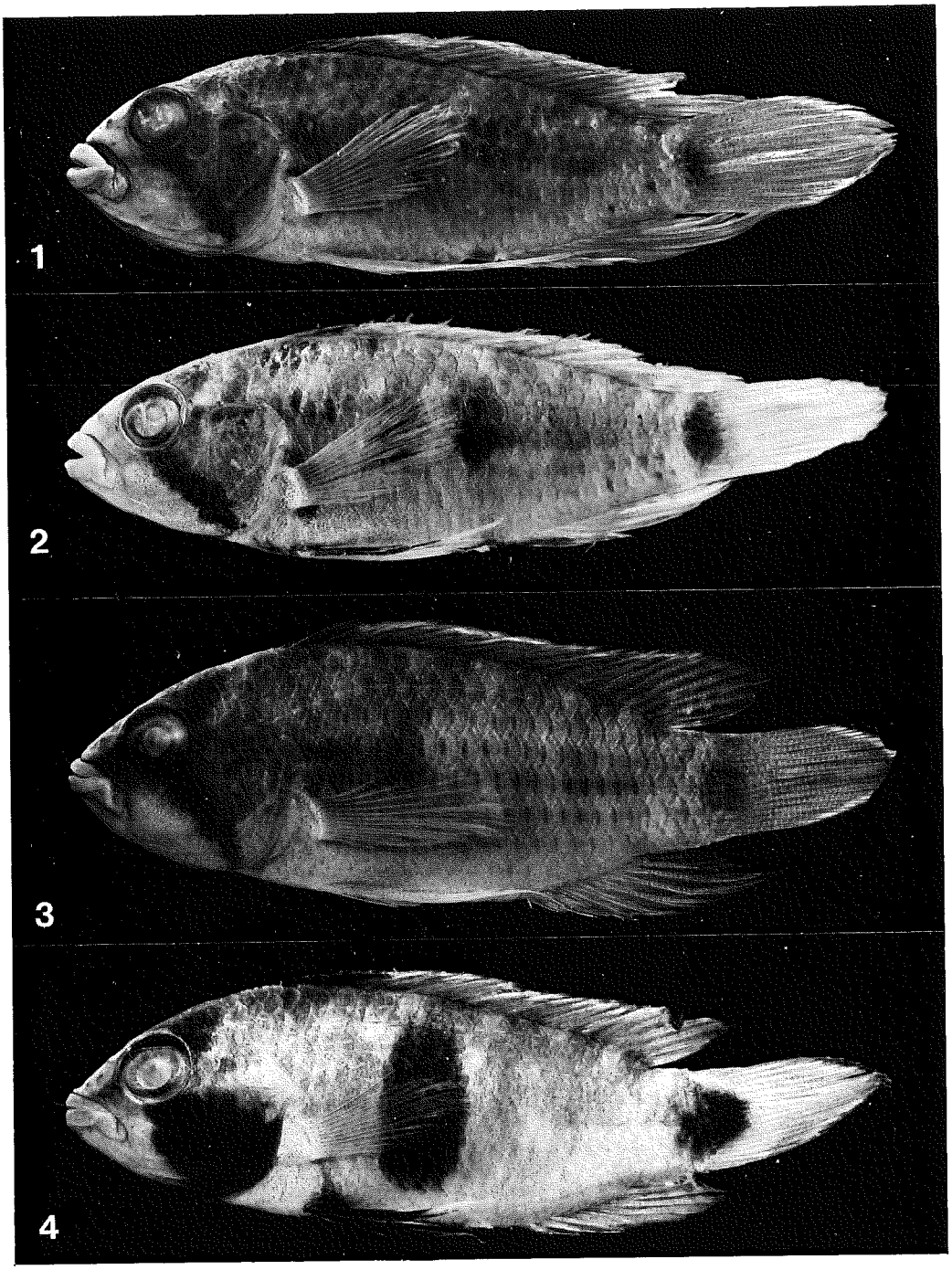


PLATE 44

1. *Apistogramma payaminonis*, holotype, an adult male, 39.6 mm SL, FMNH 96564, from the Quebrada Ahuano.
2. *Apistogramma payaminonis*, adult female topoparatype, 30.8 mm SL, FMNH 96564*pt*.
3. *Apistogramma nijsseni*, adult male, 32.6 mm SL, NRM SOK/1981362.3570, from Jenaro Herrera.
4. *Apistogramma nijsseni*, adult female paratype, 29.2 mm SL, NRM 11298, from Jenaro Herrera.

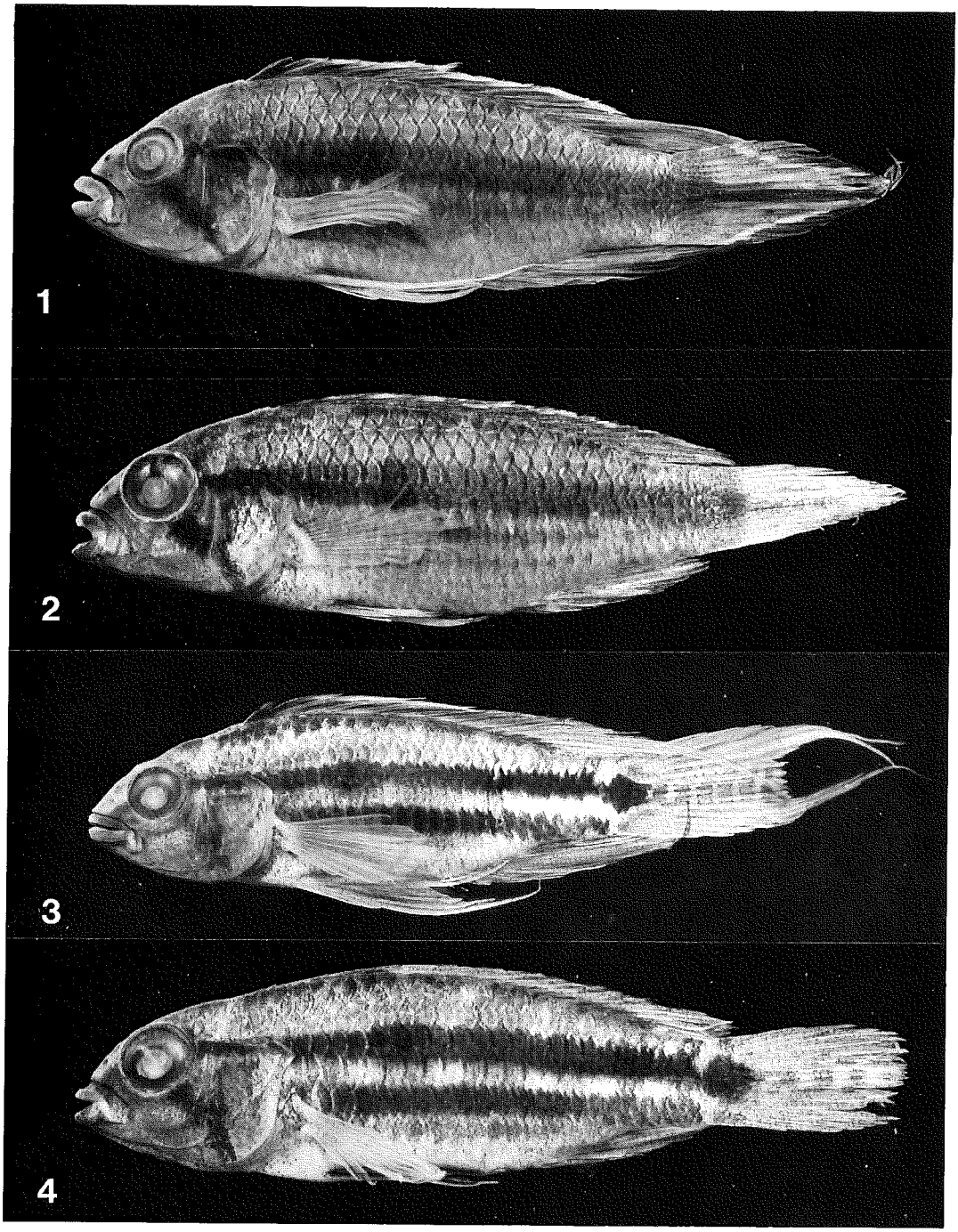


PLATE XXI

1. *Apistogramma agassizii*, adult male, 40.9 mm SL, NRM SOK/1983355.3759, from Jenaro Herrera.
2. *Apistogramma agassizii*, adult female, 26.7 mm SL, NRM SOK/1983355.3759, from Jenaro Herrera.
3. *Apistogramma bitaeniata*, adult male, 32.6 mm SL, NRM SOK/1984334.3884, from R. Mazán.
4. *Apistogramma bitaeniata*, adult female, 25.4 mm SL, NRM SOK/1984334. 3884, from R. Mazán.

PLATE XXII

1. *Apistogrammoides pucallpaensis*, adult male, 26.2 mm SL, NRM SOK/1981333.3379, from near Pebas.
2. *Apistogrammoides pucallpaensis*, young female, 17.3 mm SL, NRM A85/1984315.3112, from near Bretaña.
3. *Mesonauta insignis*, adult female, 81.8 mm SL, NRM SOK/1984324.3894, from Yuto Cocha near Mazán.
4. *Mesonauta festivus*, adult male, 71.3 mm SL, NRM SOK/1983325.3772, from Quebrada San Roque near Puerto Maldonado.

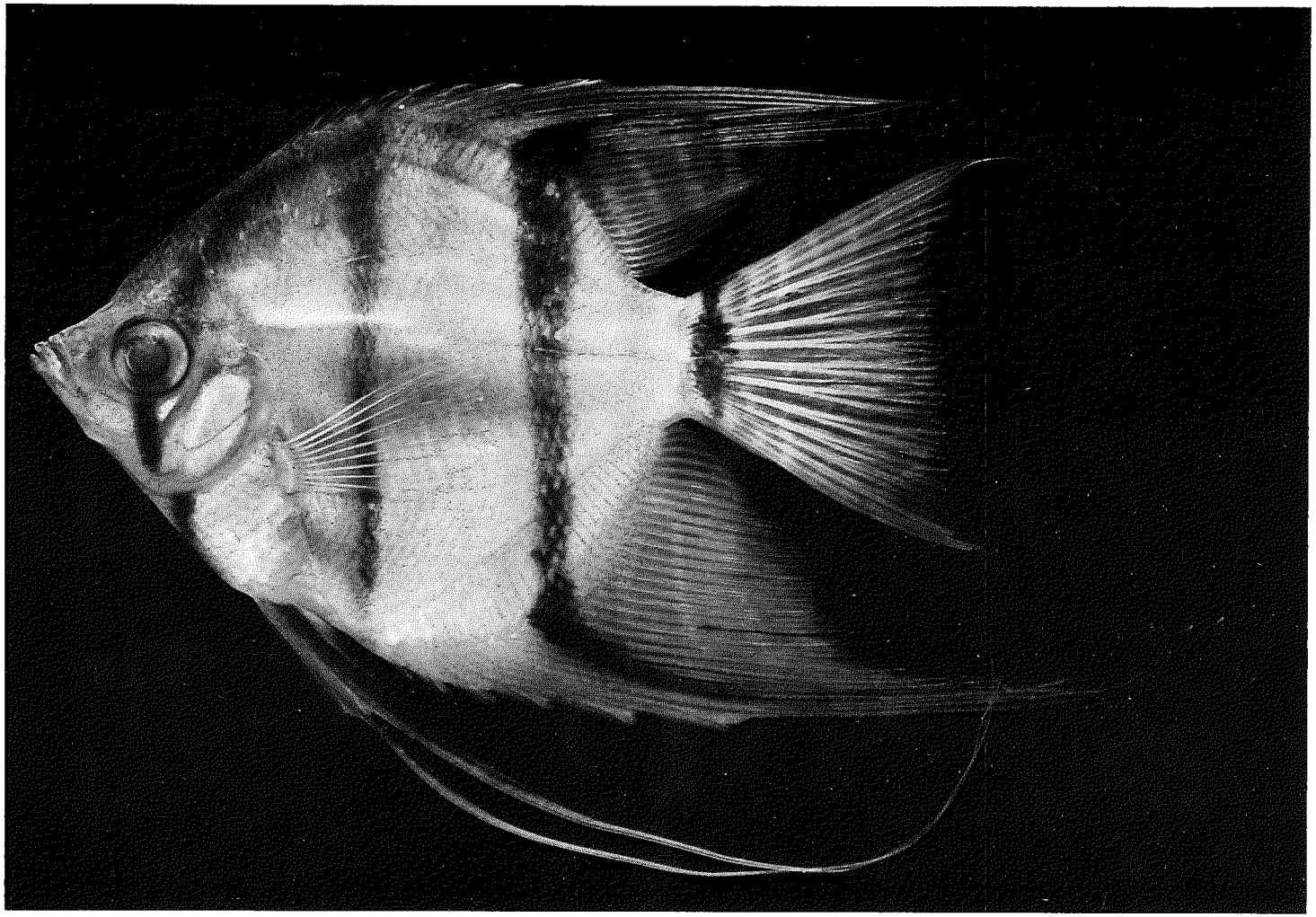
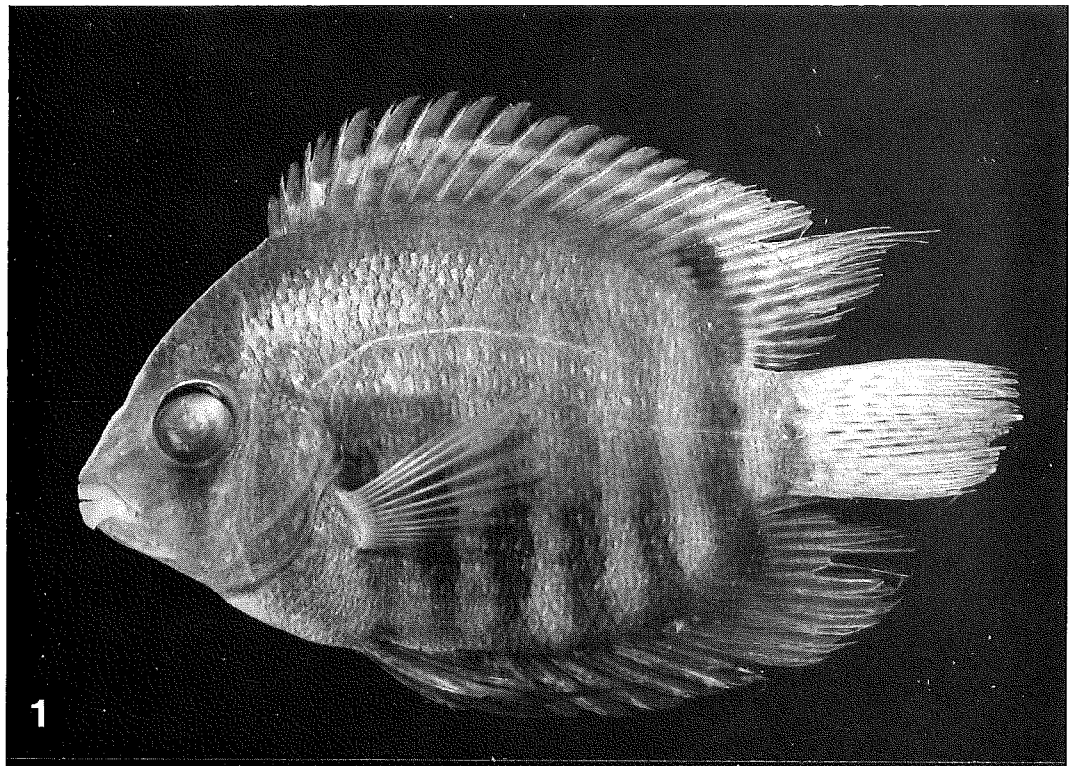


PLATE XXIII

Pterophyllum scalare, 54.7 mm SL, NRM SOK/1983335.3718, from Quebrada Pampachica near Iquitos.



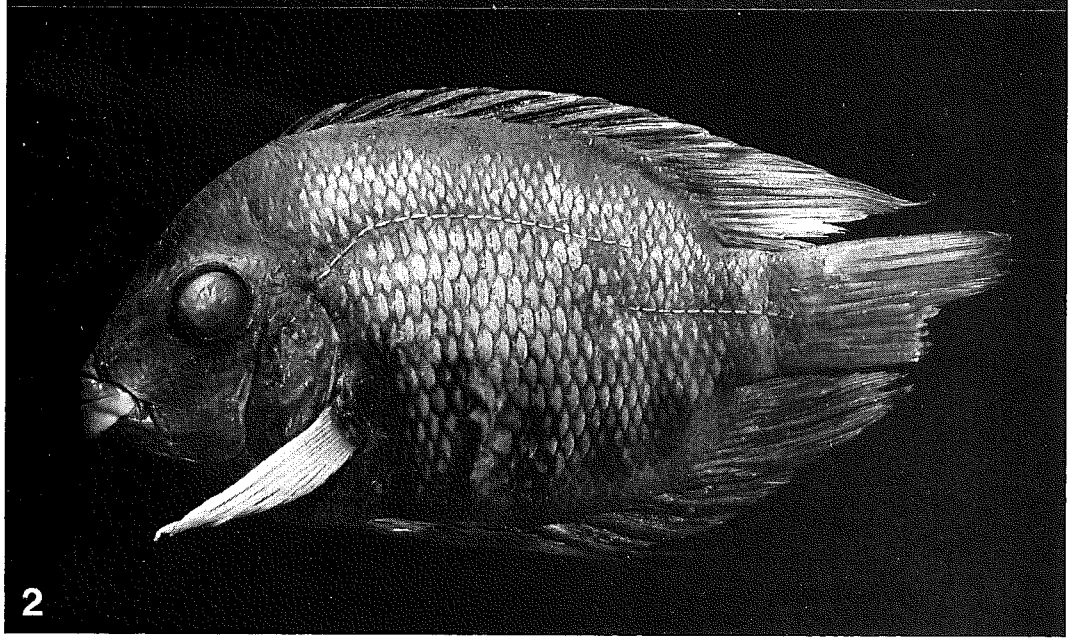


PLATE XXIV

1. *Heros appendiculatus*, young specimen, 64.0 mm SL, NRM SOK/1981357.3560, from Quebrada Abrahancillo near Jenaro Herrera.
2. *Heros appendiculatus*, adult female, 121.8 mm SL, NRM SOK/1984334.3869, from Yuto Cocha, R. Mazán. (In air.)

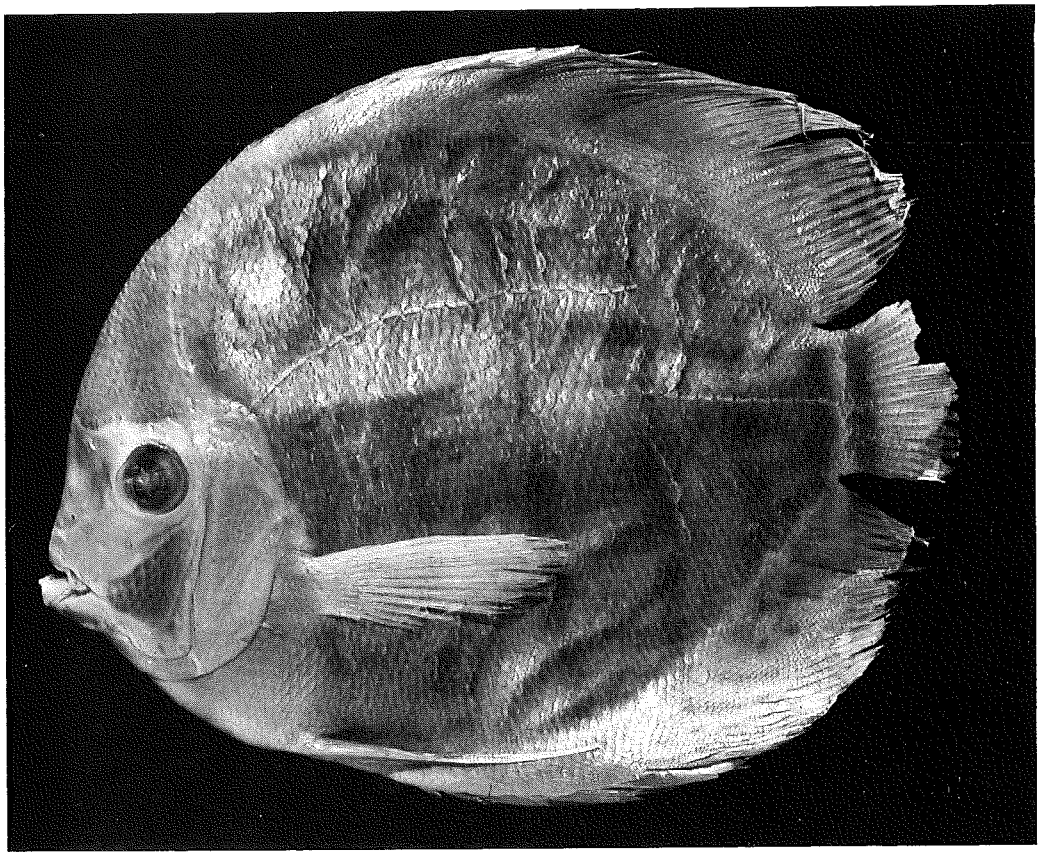


PLATE XXVI

Symphysodon aequifasciatus, syntype, 122.5 mm SL, MNHN 02-134-135, from Tefé, Brazil. (In air.)

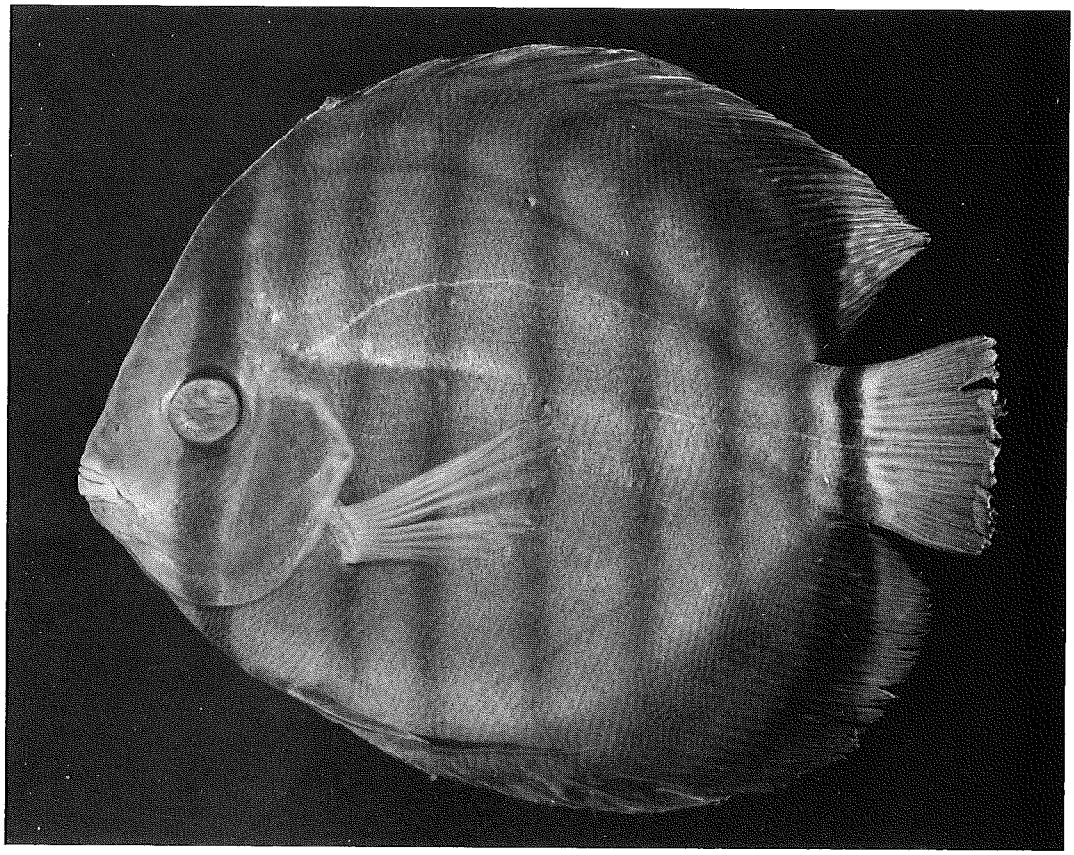


PLATE XXV

Symphysodon aequifasciatus, young, 77.2 mm SL, NRM THO/1971518.4071, from Cuiabá, Brazil.

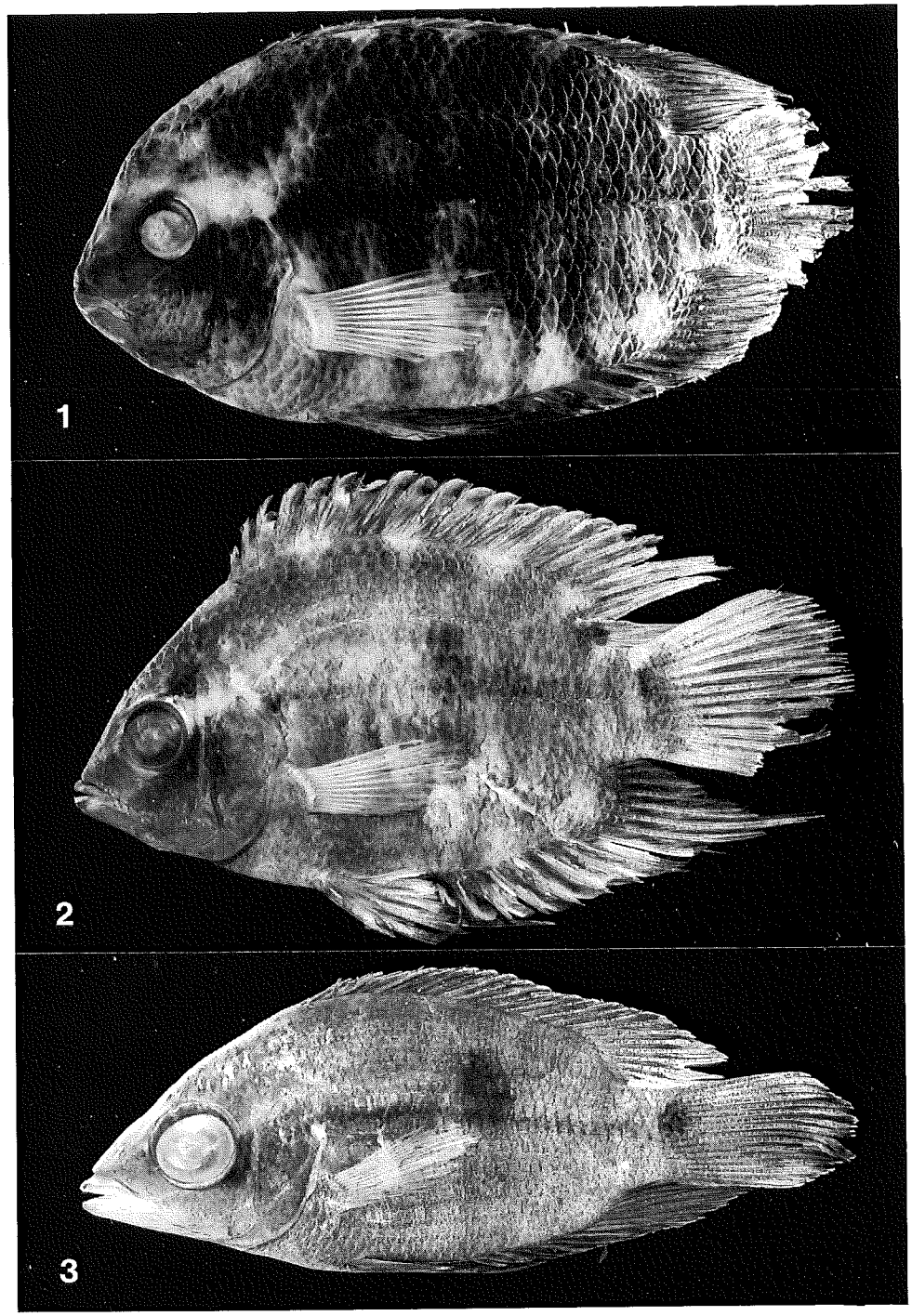


PLATE XXVII

1. *Hypselecara temporalis*, adult male, 137.2 mm SL, NRM SOK/1981333.3383, from near Pebas.
2. *Hypselecara temporalis*, young male, 52.7 mm SL, NRM SOK/1981333.3383,. from near Pebas.
3. *Hypselecara temporalis*, young, 40.9 mm SL, NRM SOK/1983334.3762, from Quebrada Corrientillo.

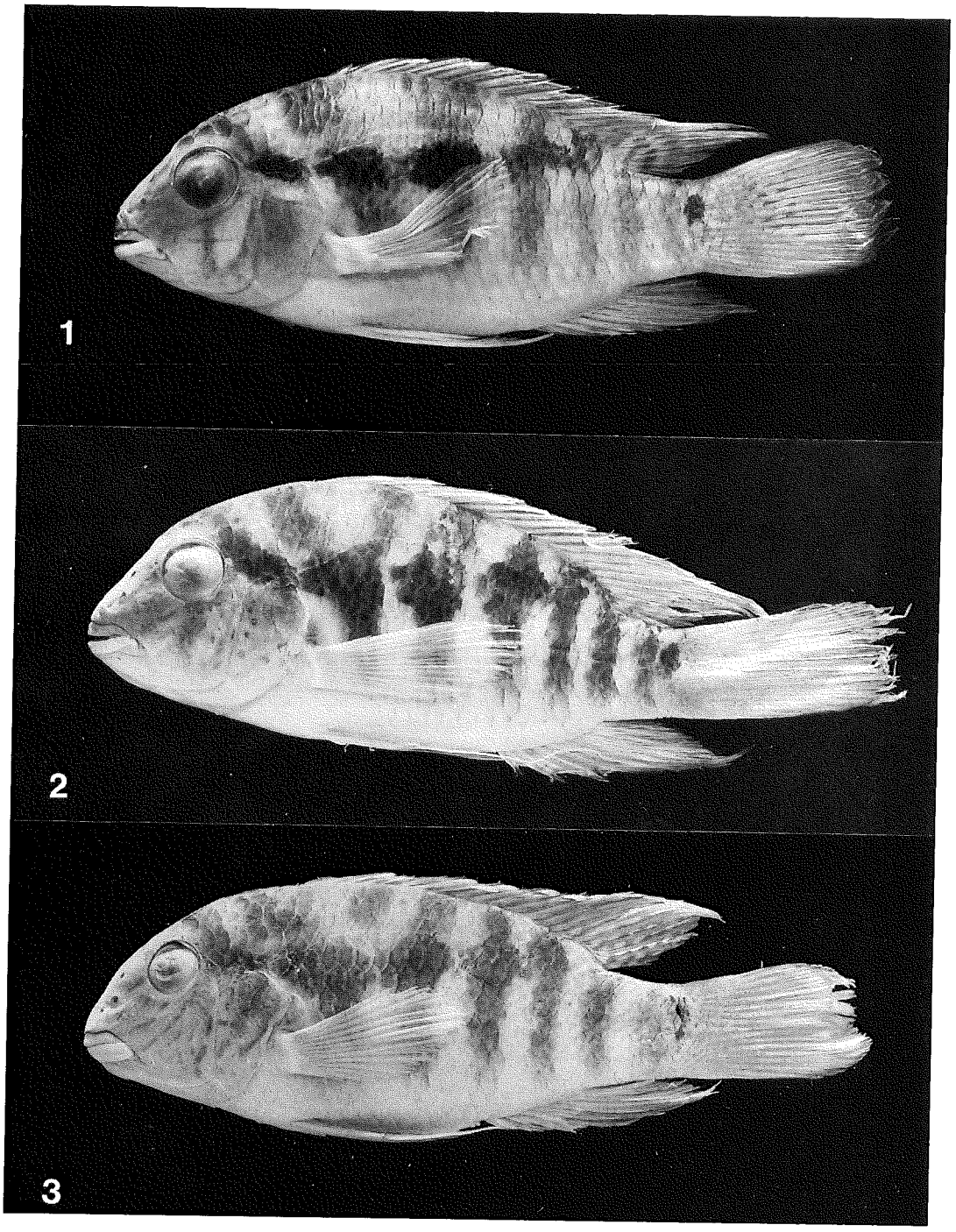


PLATE XXVIII

1. *Bujurquina cordemadi*, holotype, a young male, 61.8 mm SL, NRM SOK/ 1983324.3800, from a quebrada near Puerto Maldonado.
2. *Bujurquina tambopatae*, holotype, an adult male 75.2 mm SL, NRM SOK/ 1983325.3822, from Quebrada San Roque near Puerto Maldonado.
3. *Bujurquina eurhinus*, holotype, adult female, 80.1 mm SL, ANSP 158173, from the R. Hospital.

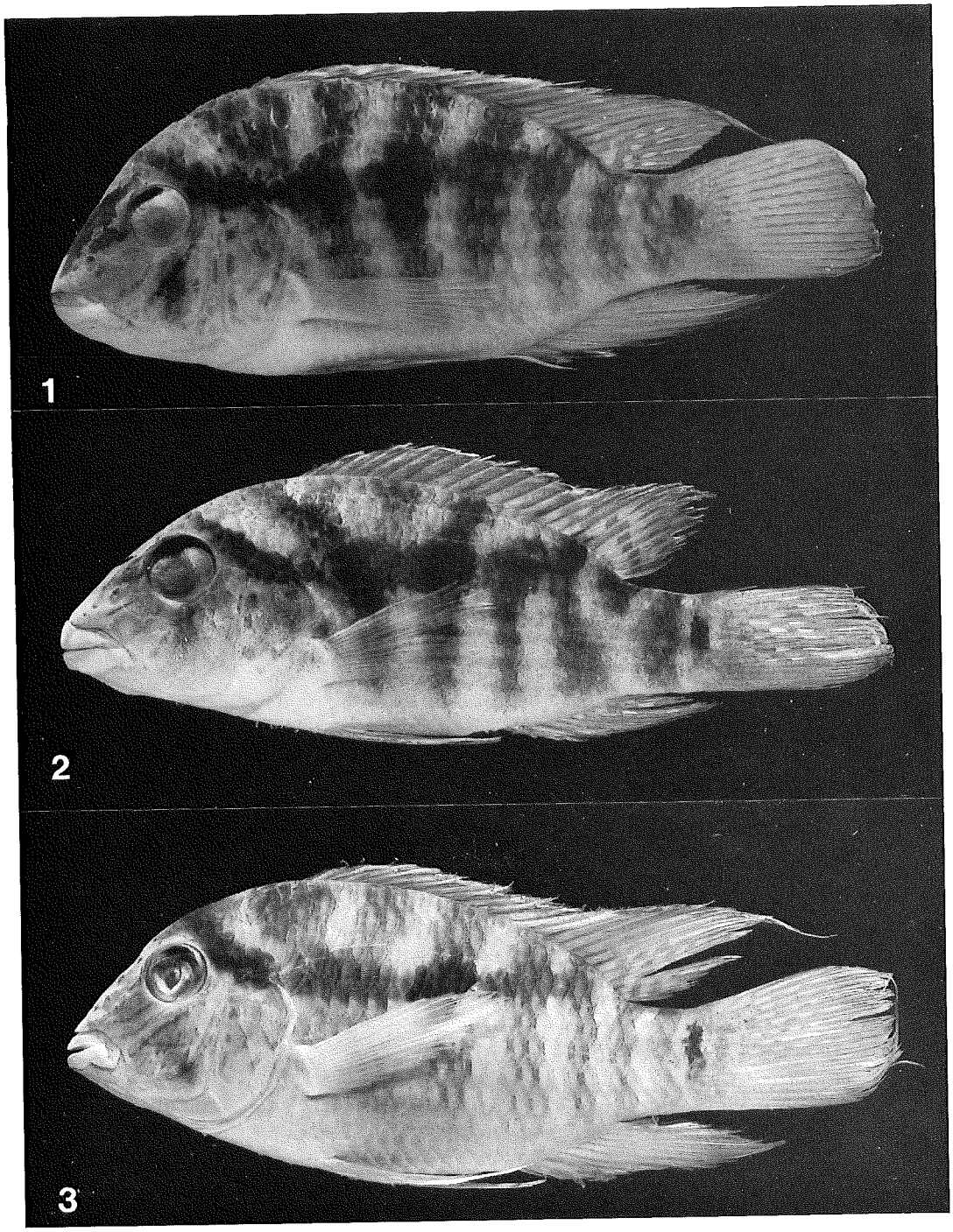


PLATE XXIX

1. *Bujurquina robusta*, holotype, adult male, 79.0 mm SL, NRM A83/1983254. 3086, from near Chicosa.
2. *Bujurquina labiosa*, holotype, a female, 55.4 mm SL, NRM A83/1983254. 3070, from near Chicosa.
3. *Bujurquina apoparuana*, holotype, an adult male, 77.0 mm SL, FMNH 84269, from near Pucallpa.

PLATE XXX

1. *Bujurquina apoparuana*, female paratype, 51.5 mm SL, NRM SOK/1981343.3471, from a stream between Campo Verde and Tournavista.
2. *Bujurquina hophrys*, holotype, an adult female, 68.5 mm SL, NRM SOK/1981343.3462, from near Tournavista.
3. *Bujurquina hophrys*, paratype, adult male, 70.3 mm SL, ZMH 4799, from near Panguana.

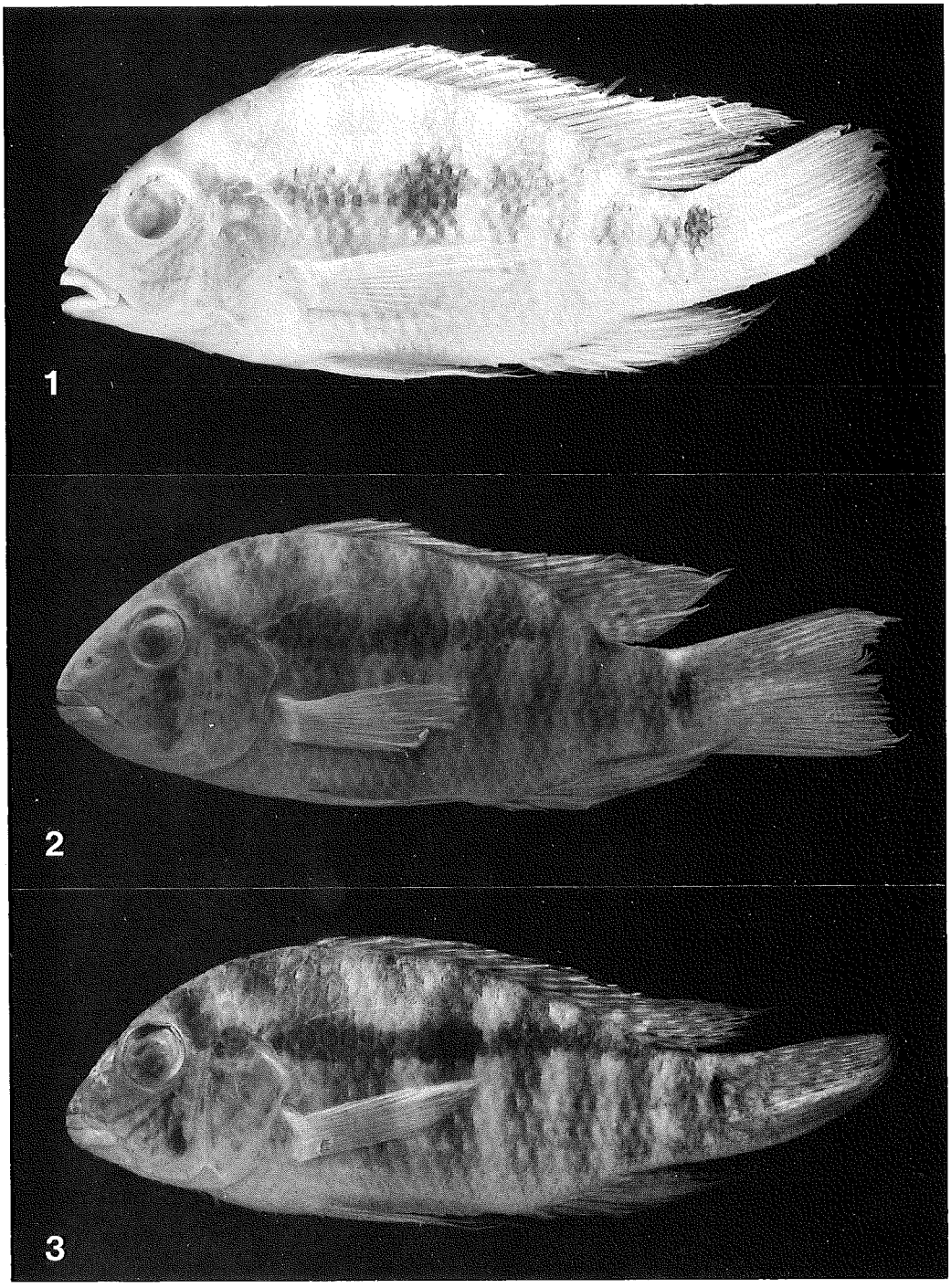


PLATE XXXI

1. *Bujurquina megalospilus*, holotype, an adult female, 75.7 mm SL, NRM SOK/1981343.3456, from near Tournavista.
2. *Bujurquina huallagae*, holotype, an adult male, 75.4 mm SL, ANSP 158171, from near Tingo María.
3. *Bujurquina huallagae*, paratype, 60.6 mm SL, NRM A85/1984354.3094, from Tarapoto.

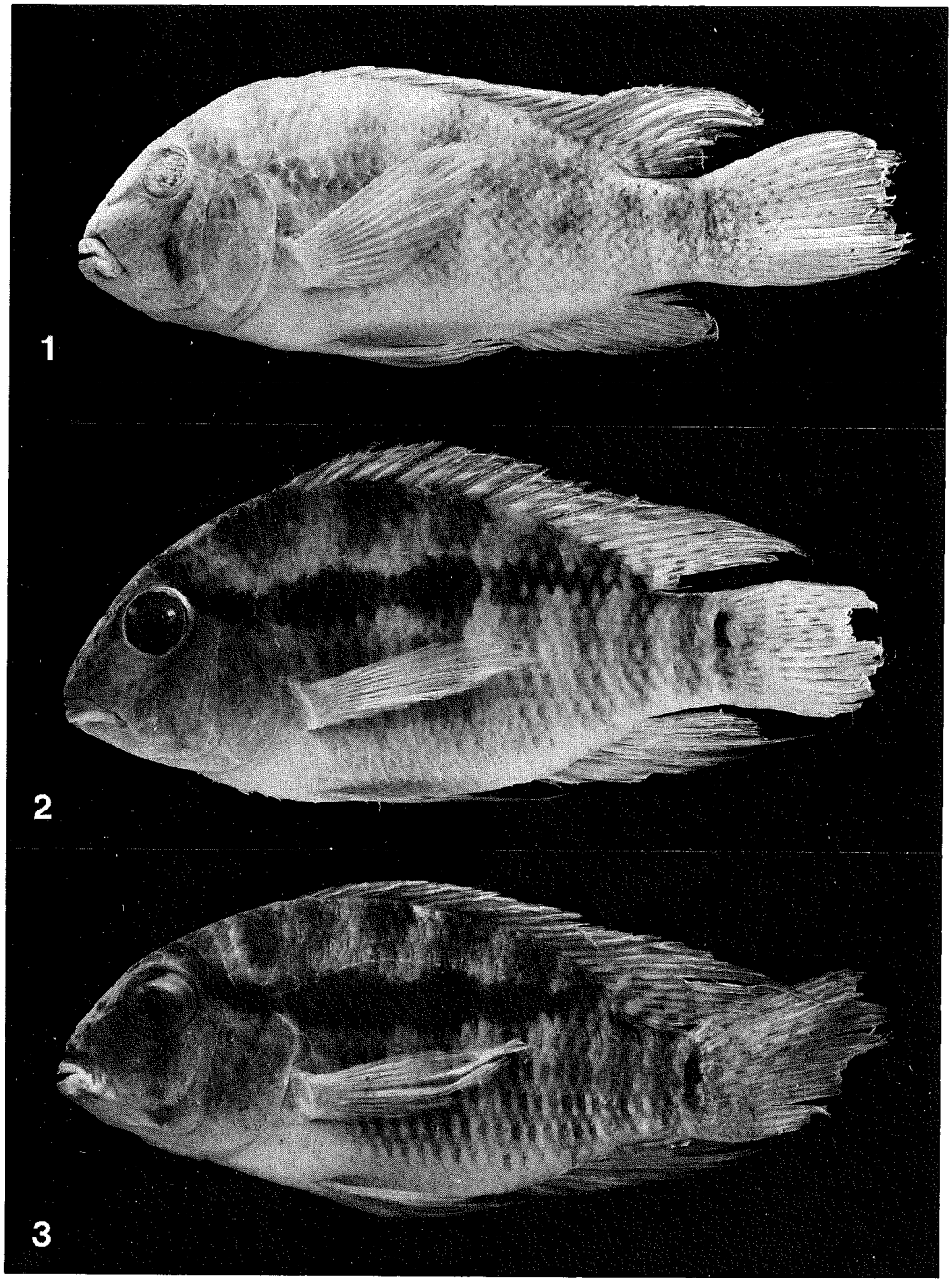


PLATE XXXII

1. *Bujurquina ortegai*, holotype, an adult male, 110.1 mm SL, MHNG 2205.27, from Moyobamba.
2. *Bujurquina syspilus*, female, 77.4 mm SL, NRM SOK/1981333.3363, from near Pebas.
3. *Bujurquina syspilus*, 56.6 mm SL, NRM SOK/1984333.3945, from the lower R. Napo near Mazán.

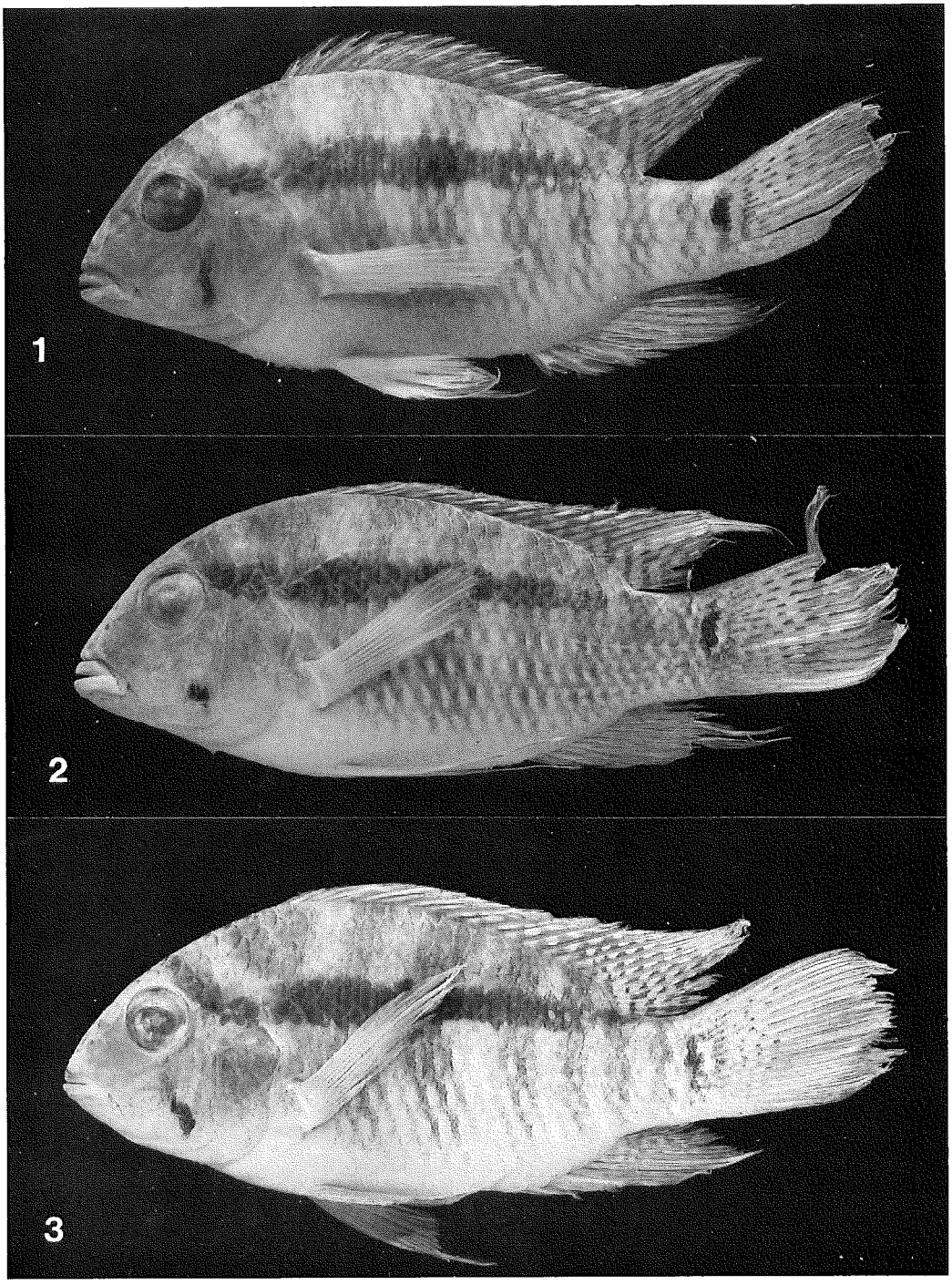


PLATE XXXIII

1. *Bujurquina peregrinabunda*, holotype, a female, 78.3 mm SL, NRM SOK/1981333.3337, from R. Yaguasyacu.
2. *Bujurquina moriorum*, holotype, a female, 85.2 mm SL, NRM SOK/1983347.3942, from Quebrada Carahuayte.
3. *Bujurquina moriorum*, paratype, 72.9 mm SL, NRM SOK/1984332.3944, from R. Mazán.

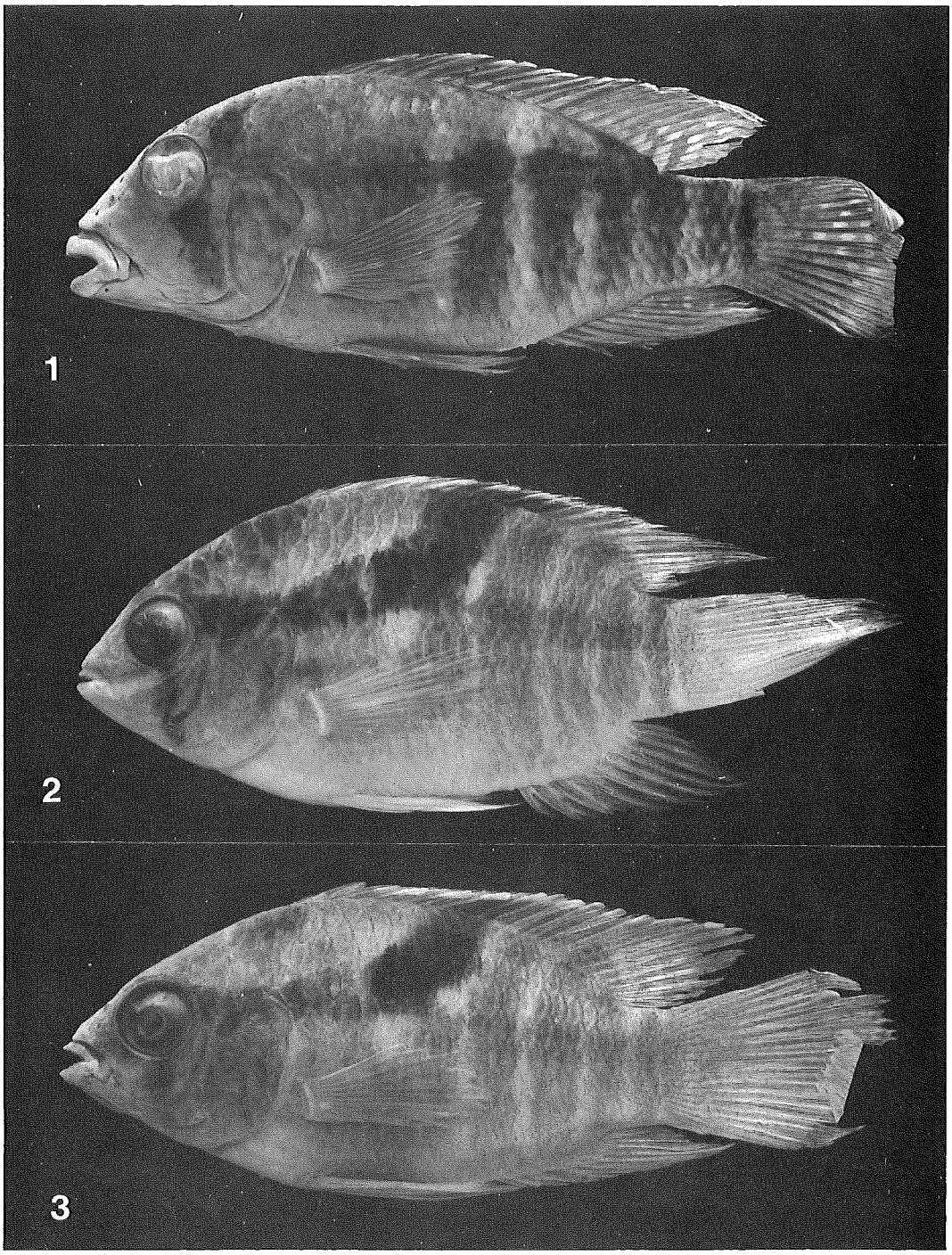


PLATE XXXIV

1. *Tahuantinsuyoa macantzatza*, holotype, an adult male, 74.4 mm SL, MZUSP 16212, from R. Huacamayo.
2. *Laetacara thayeri*, young male, 45.8 mm SL, NRM SOK/1981357.3563, from Quebrada Abrahancillo near Jenaro Herrera.
3. *Laetacara thayeri*, young, 32.4 mm SL, MHNG unreg., from Nueva York.

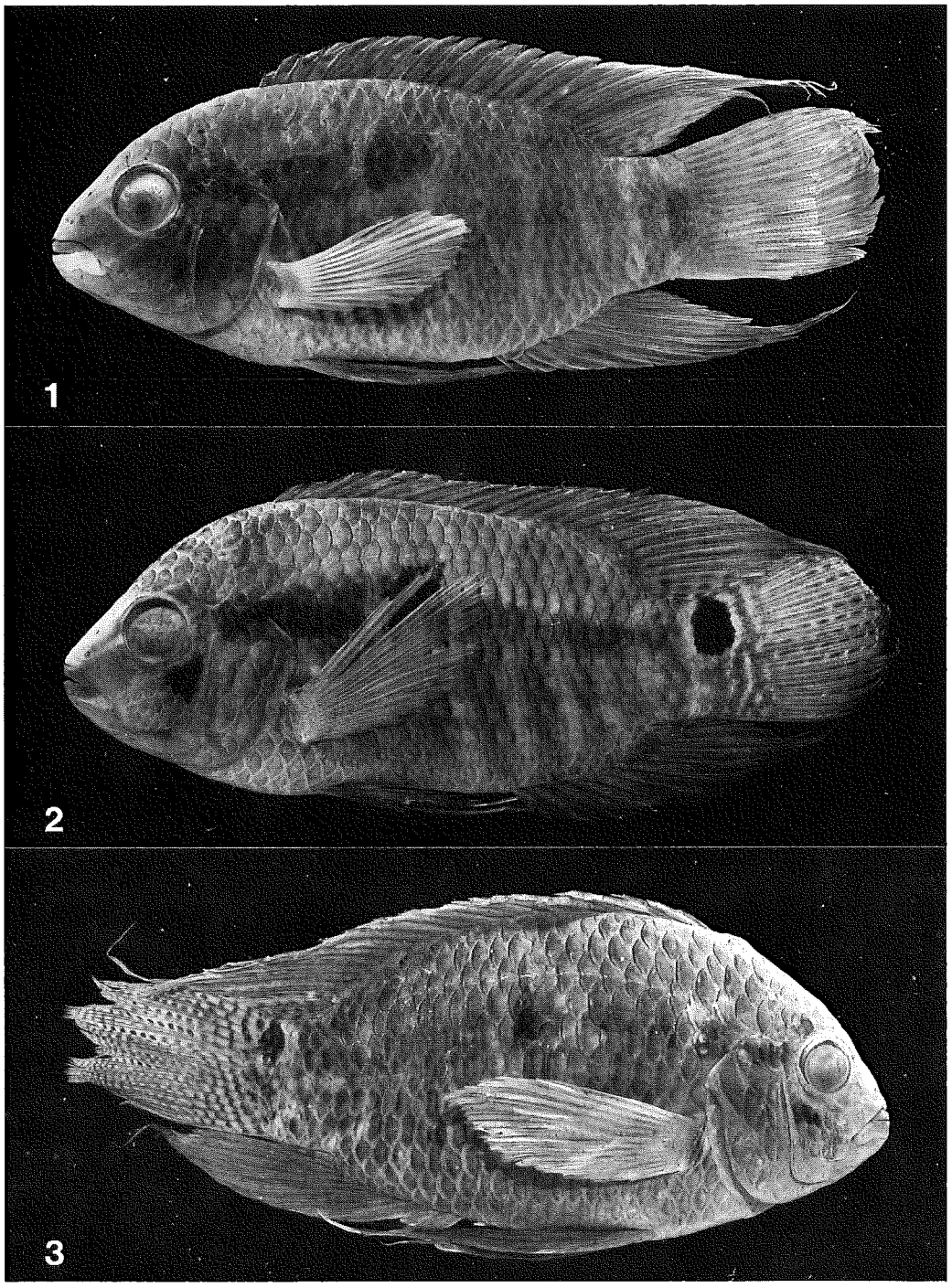
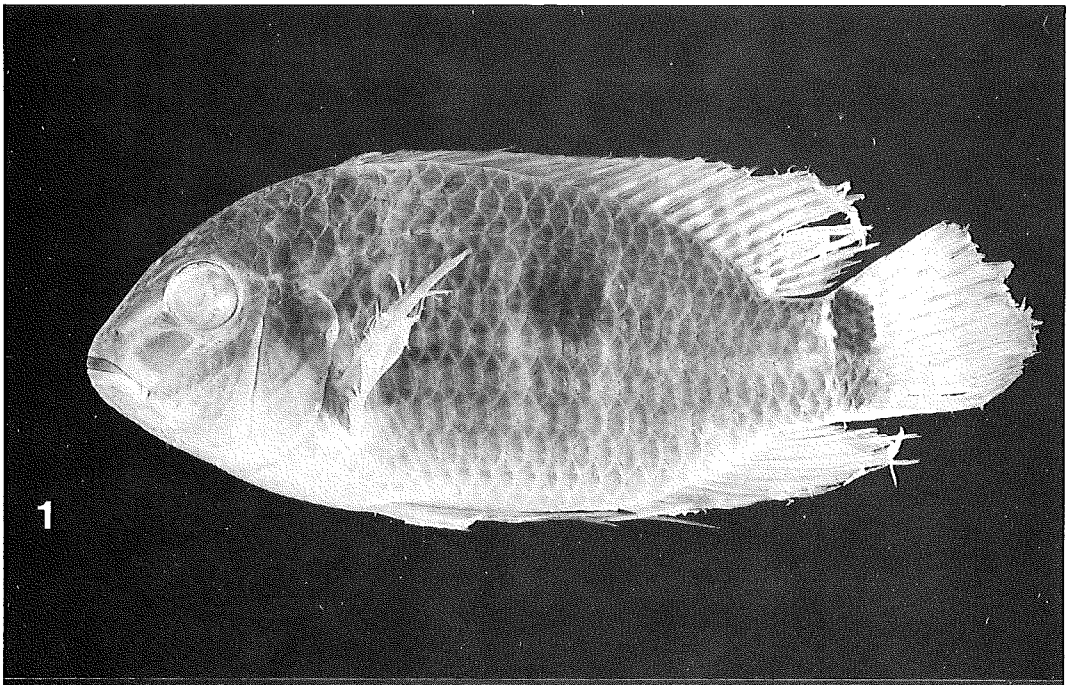


PLATE XXXV

1. *Laetacara flavilabris*, adult male, 69.2 mm SL, NRM SOK/1983355.3719, from near Jenaro Herrera.
2. *Cichlasoma amazonarum*, 77.5 mm SL, NRM A83/1983254.3050, from near Chicosa.
3. *Cichlasoma boliviense*, 107.5 mm SL, NRM SOK/1983331.3703, from near Puerto Maldonado.

PLATE XXXVI

1. *Aequidens tetramerus*, female, 83.1 mm SL, MHNG 2233.78, from the Supay system.
2. *Aequidens tetramerus*, male, 118.4 mm SL, NRM SOK/1981353.3497, from Vicente Cocha, with cheek stripe characteristic of Itaya and Nanay material.



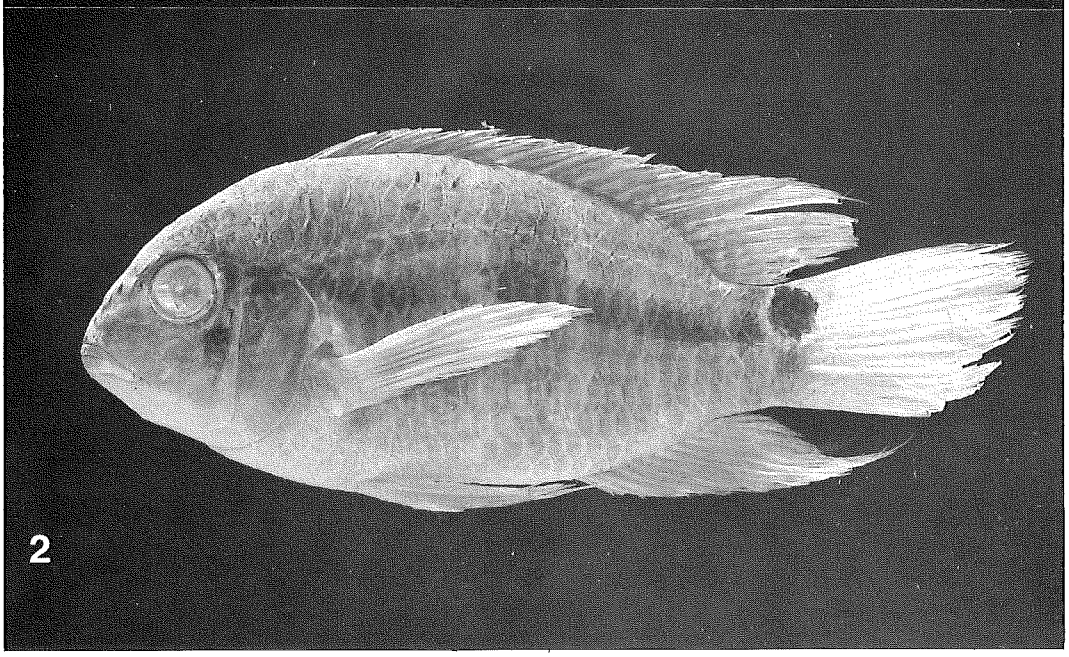


PLATE XXXVII

1. *Aequidens tetramerus*, female, 126.5 mm SL, NRM SOK/1983337.3724, from near Mishana.
2. *Aequidens tetramerus*, male, 132.5 mm SL, NRM SOK/1983325.3798, from Quebrada San Roque near Puerto Maldonado.

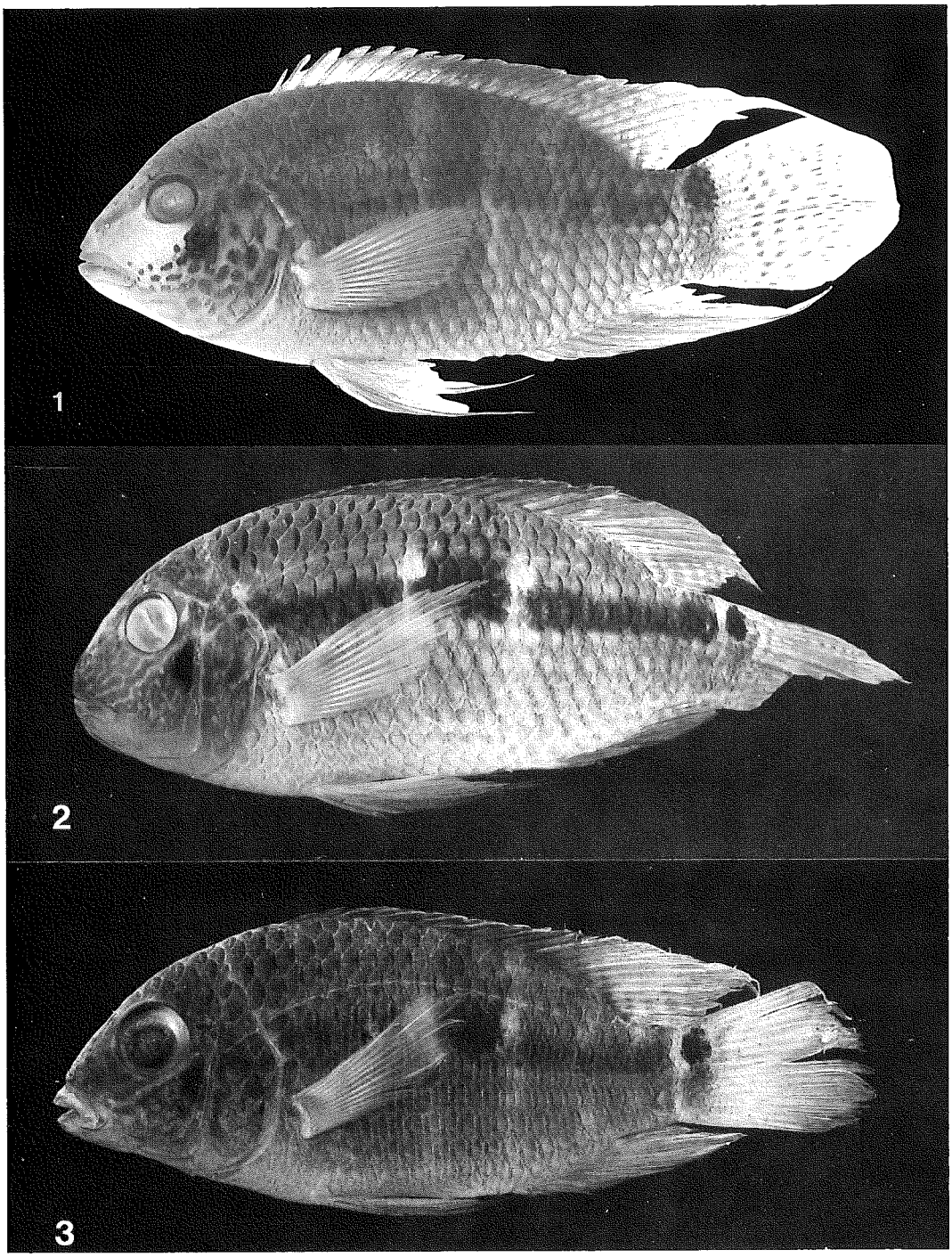


PLATE XXXVIII

1. *Aequidens patricki*, holotype, adult female, 116.2 mm SL, MHNG 2163.93, from the Aguaytía drainage.
2. *Aequidens diadema*, adult male, 117.7 mm SL, NRM SOK/1981363.3576, from Quebrada Sapuena near Jenaro Herrera.
3. *Aequidens diadema*, young female, 56.7 mm SL, NRM SOK/1983355.3780, from near Jenaro Herrera.