



A checklist of chromosome numbers and karyotypes of Amazonian freshwater fishes

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RÉSUMÉ

CATALOGUE DES NOMBRES DE CHROMOSOMES ET CARYOTYPES DES POISSONS DU BASSIN AMAZONIEN

Une liste des nombres de chromosomes de 211 espèces de poissons du bassin amazonien est présentée. Ces espèces, appartenant à 5 ordres, sont caractérisées par une grande variabilité du nombre de chromosomes ($2n = 22$ à $2n = 134$), par la présence de chromosomes sexuels et de polymorphisme chromosomique chez certaines espèces, et enfin par une grande spécificité des bandes C et des sites des régions de l'organisateur du nucléole.

Mots clés : Chromosomes — Poissons — Eaux douces — Bassin amazonien.

ABSTRACT

A CHECKLIST OF CHROMOSOME NUMBERS AND KARYOTYPES OF AMAZONIAN FRESHWATER FISHES

A checklist of chromosome numbers of Amazonian freshwater fishes is presented. 211 nominal species belonging to 5 orders have had their haploid/diploid number listed. These species are characterized by a high karyotypic diversity including a wide chromosome number range ($2n=22$ to $2n=134$), different sex chromosomal mechanisms, chromosomal polymorphisms and nearly always a species-specific pattern of C-banding and nucleolar organizer regions.

KEY WORDS : Chromosomes — Fishes — Freshwaters — Amazon Basin.

RESUMEN

LISTA DE LOS NUMEROS CROMOSÓMICOS Y CARIOTIPOS DE PECES AMAZONICOS DE AGUA DULCE

Es presentada una lista con los datos cromosómicos de peces de la cuenca amazonica. 211 especies pertenecientes a 5 ordenes ya fueron estudiados citogeneticamente, determinandose por lo menos su numero cromosómico haploide/diploide. La variación del numero diploide va desde $2n=22$ hasta $2n=134$. Tambien fueron observado mecanismos cromosómicos sexuales y polimorfismos cromosómicos en algunas especies, seguido de padrones casi siempre especie-especificos de la banda-C y de las regiones organizadoras del nucleolo.

PALABRAS CLAVES : Cromosomos — Peces — Agua dulce — Cuenca amazonica.

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INTRODUCTION

In the neotropics, chromosomal data have contributed to the studies of the biology, genetics and systematics of fishes. This is particularly true with respect to species characterization and diagnosis (BERTOLLO, 1978; ALMEIDA-TOLEDO, 1978), detection of inter and intraspecific polymorphism (GIULIANO-CAETANO and BERTOLLO, 1988; OLIVEIRA *et al.*, 1990a), data on sex chromosome systems (MORAIRA FILHO *et al.*, 1980; GALETTI Jr. *et al.*, 1981; BERTOLLO *et al.*, 1983; GALETTI Jr. and FORESTI, 1986; FELDBERG *et al.*, 1987; FALCÃO, 1988), supernumerary chromosomes (FALCÃO *et al.*, 1984; PAULS, 1985; VENERE and GALETTI Jr., 1985; OLIVEIRA *et al.*, 1988b; FORESTI *et al.*, 1989; ERDTMAN *et al.*, 1990) and natural triploidy (ALMEIDA-TOLEDO *et al.*, 1985; VENERE and GALETTI Jr., 1985; GIULIANO-CAETANO and BERTOLLO, 1990). All of the above mentioned findings are important for the understanding of fish or even animal chromosomal evolution.

Checklists containing chromosome data of fish have been published since 1971 (GYLDENHOLM and SCHEEL, 1971; CHIARELLI and CAPANNA, 1973; DENTON, 1973; PARK, 1974; OJIMA *et al.*, 1976; GOLD *et al.*, 1980; SOLA *et al.*, 1981; OLIVEIRA *et al.*, 1988a). SOLA *et al.* (1981) stated that the elaboration of fish chromosome lists is important because they allow for easy access to condensed information and identification of the cytogenetic characters important for the elaboration of evolutionary and phylogenetic models.

The Amazon basin is an excellent field for ichthyogenetic study (ALMEIDA-VAL *et al.*, 1991) and we believe that a checklist of Amazonian fish chromosome data will contribute to a better understanding of the diversity of fish species.

CYTOGENETIC FEATURES OF AMAZONIAN FISHES

In 1988, OLIVEIRA *et al.* listed the chromosome formulae of 433 neotropical fish species. In this study the origin of 55 % of the fish is unknown, some of them undoubtedly obtained from aquarium dealers.

In elaborating our list, we attempted to identify, among the species of unknown origin, the Amazonian freshwater species, and we updated the taxonomic status of many species. Thus, we have listed species belonging to the Amazon basin based on the compilation of OLIVEIRA *et al.* (*op. cit.*), and new data obtained by us (Table I). For the taxonomy and origin of the species with diploid/haploid numbers

already determined, several papers were consulted: GOLDSTEIN (1973), GÉRY (1977), NIJSSEN and ISBRUCKER (1980), KULLANDER (1983, 1986), ORTEGA and VARI (1986), GOULDING *et al.* (1988), BURGESS (1989). The classification of the higher taxa of the listed species is arranged according to GREENWOOD *et al.* (1966) and LAUDER and LIEM (1983) with the exception of the Serrasalminae which is considered at a family level, according to GÉRY (1977).

211 nominal species belonging to the Amazonian ichthyofauna have had their diploid/haploid number determined. However, few of these species have had their karyotypes described. These listed species correspond to 49 % of the neotropical fish species listed by OLIVEIRA *et al.* (*op. cit.*). We also detected that a vast amount of cytogenetic data is available in abstracts of Brazilian scientific meetings and others not readily available sources.

Diploid numbers

Diploid numbers ($2n$) of Amazonian fishes range widely: $2n = 22$ (*Nannostomus unifasciatus*) to $2n = 134$ (*Corydoras aeneus*). Also, species differ in having single or multiple nucleolar organizer regions (NORs) as well as different sex chromosomal mechanisms, including multiple systems. This karyotype diversity is apparently correlated with the rich specific diversity of Amazonian ichthyofauna.

Karyologically, the characiforms are the most studied fish group of the Amazon, followed by siluriforms (including the gymnotoids - electric fishes), perciforms (cichlids) and then on a minor scale, osteoglossiforms (bonytongue fishes) and lepidosireniforms (lungfishes).

In the characiforms, the diploid numbers vary from $2n = 22$ to $2n = 102$. However, in the families Anostomidae, Curimatidae, Prochilodidae, Hemiodidae and Chilodidae the chromosome numbers and karyotype morphology are very similar, usually with $2n = 54$, and meta-submetacentric (M-SM) chromosomes in their karyotypes and single NORs. On the other hand, there are karyotypically divergent families such as the Erythrinidae, Lebiasinidae, Characidae and Serrasalminae each of which shows diversification in their diploid numbers, karyotype morphologies and multiple NORs. Erythrinidae, Lebiasinidae, Characidae plus Ctenopomidae are characterized by diploid numbers smaller than $2n = 54$ (considered primitive in characiforms). Serrasalminae, on the other hand, contains species with diploid numbers equal to or greater than $2n = 54$. This cytogenetic feature of serrasalmids ($2n = 54$) has lead AREFJEV (1989) and PORTO *et al.* (1989, 1991) to consider them a distinct group at a family level, and not a

subfamily of Characidae, as postulated by some authors.

In the siluriforms, different from characiforms, there are few cytogenetic studies, although this group also has a large number of species in the Amazon basin. Diploid numbers of siluriforms vary from $2n=24$ to $2n=134$. The available data indicate that they are characterized by high karyotypic diversity, especially the families Callichthyidae (Siluroidei) and Sternopygidae (Gymnotoidei). It should be pointed out that the karyotypic diversity detected in Callichthyidae is related to gene duplication and/or polyploid events (OLIVEIRA *et al.*, *op. cit.*).

In the perciforms, especially the cichlids, the diploid numbers vary from $2n=38$ ($n=19$) to $2n=60$. Almost all species present $2n=48$, dominated by subtelo-acrocentric (ST-A) chromosomes, although there are some different diploid numbers and karyotype morphologies in this group, for example $2n=60$ predominating M-SM chromosomes.

Finally, in the osteoglossiforms, three species of osteoglossids were karyotyped and their diploid numbers vary from $2n=54$ to $2n=56$. In lepidosireniformes, a single species was karyotyped and a small diploid number ($2n=38$) was detected, with enormous chromosomes and an extremely high DNA value.

Nucleolar organizer region (NOR)

The NOR chromosome data from Amazonian freshwater fish families presented in Table I makes it possible to detect three groups in terms of patterns of specific localization of NORs sites: 1) single NORs, 2) multiple NORs, and 3) both single and multiple NORs. In the first group, the following families can be listed: Osteoglossidae, Anostomidae, Curimatidae, Prochilodidae, Hemiodidae, Pimelodidae, Aptereronotidae, Sternopygidae and Cichlidae; in the second group: Serrasalminidae and Lebiasinidae; and in the third group: Erhythrinidae, Characidae and Callichthyidae.

C-banding

Most of the species analyzed thus far present C-bands at, or around, the centromeres (centro/pericentromeric band). Less frequently they occur at the chromosome tips (telomeric band). Positive C-bands can also be found associated with NOR regions (in almost all of the serrasalminid species) or along chromosome arms (interstitial band) or as entirely heterochromatic short or long chromosome arms (particularly the sex chromosomes). All types of C-

bands can occur in the same species. Thus, when different species are compared, almost always a species-specific pattern of constitutive heterochromatin distribution is apparent.

Sex chromosomes

Based on cytological heteromorphy, heterologous sex chromosomes (ZZ/ZW and XX/XY₁Y₂ types) have been described for 6 Amazonian species, corresponding to 2.8 % of the total number of species listed. The occurrence of the same kind of sex chromosome mechanisms (ZZ/ZW) in different genera (*Triporthus*, *Semaprochilodus* and *Eigenmannia*) shows that this kind of heterogamety has evolved several times among the Amazonian Ostariophysi fishes. FALCÃO (1988) suggests that in *Triporthus*, the W chromosome differentiated through a heterochromatinization process, followed by deletions.

Hibridization and Triploidy

Artificial crossing has shown that serrasalminid species, *Mylossoma duriventris* X *Colossoma macropomum* and *Piaractus brachipomus* X *Colossoma macropomum*, have a capacity to hybridize even when the taxa belongs to distinct genera (KOSSOWSKI *et al.*, 1983 and NAKAYAMA *et al.*, *pers. comm.*, respectively).

In the Amazon basin two cases of natural triploidy have been reported in fish: *Eigenmannia* sp. and *Hoplerethinus unilaenialis*. In both cases diploid and triploid forms were found. The fertilization of a non-reduced ovule by a haploid spermatozoon was considered to be the most probable origin of the triploids observed (ALMEIDA-TOLEDO *et al.*, 1985; GIULIANO-CAETANO and BERTOLLO, 1990).

CONCLUSION

There still are too few cytogenetic data on Amazonian fishes. The lack of published karyograms or metaphase photographs as well as the problem of taxonomic determination and origin of analyzed material constitute the main problems in the cytogenetic study of Amazonian fishes, especially in the characiforms whose cytogenetic data forms a substantial part of the checklist. Thus, these data must be considered with care.

Considering the existence of approximately 3000 species in the Amazon Basin and the high karyotypic diversity detected so far, cytogenetic studies of

Amazonian fishes should be carried out preferably on monophyletic groups of fishes, taking into account their biogeography and the utilization of high resolution chromosome banding. In this way, it will be possible to determine the karyotypic characters that better elucidate the taxonomic and evolutionary problems.

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TABLE I (I)

ORDER	NOR										CBA				
FAMILY															
Species	n	2n	KF	numb	pair	type	am	location	I	P	T	HSex	reference		
OSTEOGLOSSIFORMES															
ARAPAIMIDAE															
<i>Arapaima gigas</i>	-	56	4M+12SM-ST+40T	-	-	-	-	-	-	-	-	-	Urushido <i>et al.</i> (1975)		
OSTEOGLOSSIDAE															
<i>Osteoglossum bicirrhosum</i>	27	-	-	-	-	-	-	-	-	-	-	-	Hinegardner & Rosen (1972)		
<i>O. bicirrhosum</i>	-	56	1SM+1ST+54A	-	-	-	-	-	-	-	-	-	Uyeno (1973)		
<i>O. bicirrhosum</i>	-	56	3ST+53A	2	-	ST,A	p	TERM	-	-	-	-	Suzuki <i>et al.</i> (1982)		
<i>O. ferreirai</i>	-	54	2M+4SM+14ST+34A	-	-	-	-	-	-	-	-	-	Suzuki <i>et al.</i> (1982)		
CHARACIFORMES															
ANOSTOMIDAE															
<i>Abramites hypselonotus</i>	27	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>Anostomus anostomus</i>	27	-	-	-	-	-	-	-	-	-	-	-	Hinegardner & Rosen (1972)		
<i>A. anostomus</i>	27	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>A. anostomus</i>	27	54	54M-SM	-	-	-	-	-	-	-	-	-	Ojima <i>et al.</i> (1976)		
<i>A. anostomus</i>	-	54	54M-SM	-	-	-	-	-	-	-	-	-	Cestari <i>et al.</i> (1990)		
<i>A. ternetzi</i>	27	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>Leporinus affinis</i>	-	54	54M-SM	-	-	-	-	-	-	-	-	-	Venere (1988)		
<i>L. brunneus</i>	-	54	54M-SM	2	-	-	-	-	-	-	-	-	Venere & Galetti Jr.(1986b)		
<i>L. cylindriciformes</i>	-	54	54M-SM	2	-	-	-	-	-	-	-	-	Venere & Galetti Jr.(1986b)		
<i>L. friderici</i>	-	54	32M+22SM	2	2	M	p	TERM.	X	X	-	-	Galetti Jr. <i>et al.</i> (1991)		
<i>L. ortomaculatus</i>	-	54	-	2	-	-	-	-	-	-	-	-	Venere & Galetti Jr.(1986b)		
<i>L. tigrinus</i>	-	54	-	-	-	-	-	-	-	-	-	-	Venere (1988)		
<i>Rhytidodus microlepis</i>	-	54	-	-	-	-	-	-	-	-	-	-	Bertollo <i>et al.</i> (1980)		
<i>Schizodon fasciatus</i>	-	54	54M-SM	-	-	-	-	-	-	-	-	-	Mestriner & Galetti Jr.(1987)		
<i>S. fasciatus</i>	-	54	28M+26SM	2	12	M	q	TERM.	-	X	X	-	Galetti Jr. <i>et al.</i> (1991)		
<i>Schizodon sp.</i>	-	54	54M-SM	2	-	-	-	-	-	-	-	-	Venere & Galetti Jr. (1986a)		
CHARACIDAE															
BRYCONINAE															
<i>Brycon cf.cephalus</i>	-	50	20M+22SM+8ST	2	-	ST	q	TERM.	X	X	X	-	Santos <i>et al.</i> (1985)		
<i>B. cf. erythropterus</i>	-	50	20M+22SM+8ST	2	-	ST	q	TERM.	X	X	X	-	Santos <i>et al.</i> (1985)		
<i>B. cf. pesu</i>	-	50	20M+22SM+8ST	2	-	ST	q	TERM.	X	X	X	-	Feldberg <i>et al.</i> , unpubl.		
CHALCIDIINAE															
<i>Chalceus macrolepidotus</i>	-	54	32M+22ST	-	-	-	-	-	-	-	-	-	Muramoto <i>et al.</i> (1968)		
<i>C. macrolepidotus</i>	-	52	44M-SM+8ST-T	-	-	-	-	-	-	-	-	-	Ojima <i>et al.</i> (1976)		
CHEIRODONTINAE															
<i>C. troemneri</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>Megalomphodus megalopterus</i>	24	-	-	-	-	-	-	-	-	-	-	-	Post (1965)		
<i>M. megalopterus</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>M. sweglesi</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>Microschemobrycon casiquiare</i>	21	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>Paracheirodon axelrodi</i>	24	-	-	-	-	-	-	-	-	-	-	-	Post (1965)		
<i>P. axelrodi</i> ¹	-	52	-	-	-	-	-	-	-	-	-	-	Scheel & Christensen (1970)		
<i>P. axelrodi</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>P. innesi</i>	-	36	-	-	-	-	-	-	-	-	-	-	Lueken & Foerster (1969)		
<i>P. innesi</i>	-	32	-	-	-	-	-	-	-	-	-	-	Scheel & Christensen (1970)		
<i>P. innesi</i>	16	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>P. simulans</i> ²	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>P. simulans</i>	-	50	-	-	-	-	-	-	-	-	-	-	Scheel (1972)		
<i>Pristella riddlei</i>	24	-	-	-	-	-	-	-	-	-	-	-	Post (1965)		
<i>P. riddlei</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
IGUANODECTINAE															
<i>Iguanodectes spilurus</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
STETHAPRIONINAE															
<i>Poptella compressa</i> ³	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
TETRAGONOPTERINAE															
<i>Bryconella palidifrons</i> ⁴	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>Ctenobrycon aff. hauxwellianus</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>Exodon paradoxus</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>Hemigrammus analis</i>	27	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)		
<i>H. erythrozonus</i>	-	48	-	-	-	-	-	-	-	-	-	-	Lueken & Foerster (1969)		

TABLE I (2)

<i>H. erythrozonus</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. gracilis</i> ⁵	24	48	-	-	-	-	-	-	-	-	-	-	Post (1965)
<i>H. hyanuary</i>	-	52	22M-SM+30ST-A	-	-	-	-	-	-	-	-	-	Arefjev(1990b)
<i>H. marginatus</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. micropterus</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. ocellifer</i>	24	48	-	-	-	-	-	-	-	-	-	-	Post (1965)
<i>H. ocellifer</i>	19	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. pulcher</i>	24	-	-	-	-	-	-	-	-	-	-	-	Post (1965)
<i>H. pulcher</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. rhodostomus</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. aff. rhodostomus</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. aff. rodwayi</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. aff. schmardae</i>	-	52	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. aff. schmardae</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. stictus</i> ⁶	-	52	-	-	-	-	-	-	-	-	-	-	Scheel & Christensen (1970)
<i>H. stictus</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. unilineatus</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. vorderwinkleri</i>	24	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Hyphessobrycon agulha</i>	24	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. aff. agulha</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. belloti</i>	24	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. bentosi bentosi</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. aff. copelandi</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. erythrostigma</i> ⁷	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. haraldschultzi</i>	24	-	-	-	-	-	-	-	-	-	-	-	Post (1965)
<i>H. heterorhabdus</i>	24	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. loretoensis</i>	24	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. peruvianus</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. pulchripinnis</i>	24	-	-	-	-	-	-	-	-	-	-	-	Post (1965)
<i>H. pulchripinnis</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. scholzei</i>	-	50	8M+20SM+8ST+14A	-	-	-	-	-	-	-	-	-	Arefjev (1990b)
<i>H. serpae</i>	24	-	-	-	-	-	-	-	-	-	-	-	Post (1965)
<i>H. serpae</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. stictus</i>	-	52	-	-	-	-	-	-	-	-	-	-	Gyldenholm & Scheel (1971)
<i>H. stictus</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. tropis</i>	23	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Inpaichthys kerri</i>	-	52	12M+26SM+14ST-A	-	-	-	-	-	-	-	-	-	Arefjev (1989)
<i>Moenkhausia colleti</i>	24	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>M. oligolepis</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Thayeria boehkei</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>T. obliqua</i>	24	-	-	-	-	-	-	-	-	-	-	-	Post (1965)
TRIPORTHEINAE													
<i>Triportheus albus</i>	-	52	14M+20SM+14ST+4A	1-4	6,11	ST	p	SUB,TER	-	X	X	ZW	Falcão (1988)
<i>T. culter</i>	-	52	14M+16SM+16ST+6A	-	-	-	-	-	-	-	-	-	Falcão (1988)
<i>T. elongatus</i>	-	52	22M+12SM+16ST+2A	1-4	3,11	ST	p	TERM.	-	X	X	ZW	Falcão (1988)
<i>T. flavus</i>	-	52	22M+14SM+12ST+4A	1-4	6,7	M,ST	p,q	SUB,INT	-	X	X	ZW	Falcão (1988)
<i>T. pictus</i>	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
CHILODIDAE													
<i>Chilodus punctatus</i>	27	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. punctatus</i>	-	54	54M,SM	-	-	-	-	-	-	-	-	-	Cestari <i>et al.</i> (1990)
CTENOLUCIIDAE													
<i>Boulengerella sp</i>	-	36	-	-	-	-	-	-	-	-	-	-	Porto <i>et al.</i> , unpubl.
CURIMATIDAE													
<i>Curimata cyprinoides</i>	-	54	44M+10SM	2	3	M	q	TERM.	-	X	X	-	Feldberg <i>et al.</i> (1992)
<i>C. kneri</i>	-	54	40M+12SM+2ST	2	15	ST	p	TERM.	-	X	X	-	Feldberg <i>et al.</i> (1992)
<i>C. inornata</i>	-	54	40M+14SM	2	4	SM	p	INTERST.	-	X	X	-	Feldberg <i>et al.</i> (1992)
<i>C. ocellata</i>	-	56	40M+16SM	2	22	SM	p	INTERST.	-	-	-	-	Feldberg <i>et al.</i> (1992)
<i>C. vittata</i>	-	54	42M+12SM	1	9	SM	q	TERM.	-	-	-	-	Feldberg <i>et al.</i> (1992)
<i>Curimatella alburna</i>	-	54	46M+8SM	2	14	M	q	TERM.	-	X	X	-	Feldberg <i>et al.</i> (1992)
<i>C. meyeri</i>	-	54	46M+8SM	2	9	M	q	TERM.	-	X	X	-	Feldberg <i>et al.</i> (1992)
<i>Curimatopsis</i> aff. <i>macrolepis</i> (CYT A)	26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. aff. macrolepis</i> (CYT B)	23	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Cyphocharax cf. spilura</i>	-	54	-	2	10	M	q	TERM.	-	-	-	-	Venere & Galetti Jr.(1989)
<i>Potamorhina altamazonica</i>	51	102	2M+2SM+98A	2	5	A	q	TERM.	X	X	X	-	Feldberg <i>et al.</i> (in press)
<i>P. latior</i>	-	56	58M+2SM+2ST	2	27	M	q	TERM.	X	X	X	-	Feldberg <i>et al.</i> (in press)
<i>P. pristigaster</i>	-	54	42M+12SM	2	16	SM	q	TERM.	-	X	-	-	Feldberg <i>et al.</i> (in press)
<i>Psectrogaster rutiloides</i>	-	54	42M+12SM	2	11	M	q	TERM.	X	X	X	-	Feldberg <i>et al.</i> (1992)
<i>Steindachnerina leuciscus</i>	-	54	48M+6SM	2	16	M	q	TERM.	-	-	-	-	Feldberg <i>et al.</i> (1992)
ERYTHRINIDAE													
<i>Erythrinus erythrinus</i>	-	52	-	1-8	-	M	q,p	TERM.	-	-	-	-	Bertollo (1988)
<i>Hoplerhyrinus unitaeniatus</i>	-	48	48M-SM	-	-	-	-	-	-	-	-	-	Giuliano-Caetano (1986)

TABLE I (3)

<i>H. unitaeniatus</i> (CYT A)	24	48	48M-SM	-	-	-	-	-	-	-	-	-	Giuliano-Caetano (1986)
<i>H. unitaeniatus</i> (CYT B)	24	48	46N-SM+2ST-A	3-4	-	M,A	q	INTERST.	-	-	-	-	Giuliano-Caetano (1986)
<i>H. unitaeniatus</i> (CYT C)	24	48	46N-SM+2ST-A	2	-	M	q	TER,INT.	X	X	X	-	Giuliano-Caetano (1986)
<i>H. unitaeniatus</i> (CYT D)	24	48	47M-SM+1ST-A	4	-	M,A	q	INTERST.	X	X	X	-	Giuliano-Caetano (1986)
<i>H. unitaeniatus</i> (Triploid)	-	72	69M-SM+3ST-A	3	-	M-SM	q	TERM.	-	-	-	-	Giuliano-Caetano (1986)
<i>Hoplias malabaricus</i>	-	40	-	-	-	-	-	-	-	-	-	-	Bertollo <i>et al.</i> (1980)
<i>Hoplias</i> sp.	20/ 21	41	29M+11SM+1A (M)	-	-	-	-	-	-	-	XY ₁	Y ₂	Bertollo <i>et al.</i> (1983)
	-	40	30M+10SM (F)	-	-	-	-	-	-	-	-	XX	Bertollo <i>et al.</i> (1983)
<i>Hoplias</i> sp.	-	50	-	-	-	-	-	-	-	-	-	-	Bertollo & Moreira F ^o (1983)
GASTEROPELECIDAE													
<i>Carnegiella strigata</i>	25/ 26	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. strigata</i>	24	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Gasteropelecus sternicla</i>	27	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
HEMIODIDAE													
ANODINAE													
<i>Anodus elongatus</i>	-	54	24M+26SM+4ST	2	26	ST	q	TERM.	-	-	-	-	Porto (1992)
<i>Anodus melanopogon</i>	-	54	20M+28SM+6ST	2	25	ST	q	TERM.	-	-	-	-	Porto (1992)
<i>Anodus</i> sp.	-	54	24M+24SM+6ST	2	25	ST	q	TERM.	-	-	-	-	Porto (1992)
BIVIBRANCHIINAE													
<i>Argonectes scapularis</i>	-	54	50M-SM+4ST	2	-	ST	q	TERM.	-	-	-	-	Porto, unpubl.
HEMIODINAE													
<i>Hemiodus immaculatus</i>	27	54	22M+26SM+6ST	2	25	ST	q	TERM.	-	-	-	-	Porto (1992)
<i>H. cf. microlepis</i>	-	54	20M+30SM+4ST	2	-	SM	q	TERM.	-	-	-	-	Porto (1992)
<i>H. ocellatus</i>	27	54	26M+24SM+4ST	2	15	SM	q	SUBT.	-	-	-	-	Porto (1992)
<i>H. unimaculatus</i>	27	54	26M+24SM+4ST	2	17	SM	q	TERM.	-	-	-	-	Porto (1992)
LEBIASINIDAE													
<i>Copeina guttata</i>	21	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Copella arnoldi</i> (CYT A)	22	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Copella arnoldi</i> (CYT B)	22	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Copella nattereri</i>	18	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Nannostomus beckfordi</i> (CYT A)	22	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>N. beckfordi</i> (CYT B)	18	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>N. beckfordi</i> (CYT C)	-	42	2M+40A	-	-	-	-	-	-	-	-	-	Arefjev (1990a)
<i>N. erythrus</i>	23	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>N. marginatus</i>	21	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>N. trifasciatus</i> (CYT A)	19	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>N. trifasciatus</i> (CYT B)	15	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>N. trifasciatus</i> (CYT C)	12	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>N. eques</i> ⁸	-	34	34A	-	-	-	-	-	-	-	-	-	Arefjev (1990a)
<i>N. harrisoni</i> ⁹	20	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>N. unifasciatus</i> ¹⁰	11	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Pyrhulina</i> sp	-	42	2M+2SM+38ST-A	-	-	-	-	-	-	-	-	-	Oliveira & Falcão (1992)
<i>Pyrhulina</i> sp	-	42	-	2-4	-	-	-	-	-	-	-	-	Sanguino & Falcão (1992)
PROCHILODIDAE													
<i>P. nigricans</i>	-	54	40M+14SM	2	2	M	q	INTERST.	-	X	-	-	Pauls & bertollo (1990)
<i>Semaprochilodus insignis</i>	27	54	40M+14SM	2	3	M	p	INTERST.	-	X	-	-	Feldberg <i>et al.</i> (1987)
<i>S. taeniurus</i>	27	54	40M+14SM	2	3	M	p	INTERST.	X	X	X	ZW	Feldberg <i>et al.</i> (1987)
SERRASALMIDAE													
<i>Catoprion mento</i>	-	60	-	-	-	-	-	-	-	-	-	-	Porto <i>et al.</i> , unpubl.
<i>Colossoma macropomum</i> ¹¹	27	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. macropomum</i>	-	54	-	-	-	-	-	-	-	-	-	-	Bertollo <i>et al.</i> (1980)
<i>C. macropomum</i>	-	54	18M+36SM	-	-	-	-	-	-	-	-	-	Kossowski <i>et al.</i> (1983)
<i>C. macropomum</i>	-	54	20M+34SM	1-4	-	M	q	TERM.	-	X	X	-	Almeida-Toledo <i>et al.</i> (1987)
<i>C. macropomum</i>	-	54	26M+28SM	1-4	-	M	q	TER,INT	-	X	X	-	Nakayama <i>et al.</i> (1990)
<i>Metynnis argenteus</i>	31	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>M. lippincottianus</i>	-	62	30M+30SM+2A	-	-	-	-	-	-	-	-	-	Arefjev (1989)
<i>M. schreitmueelleri</i> ¹²	-	62	60M-SM+2ST	-	-	-	-	-	-	-	-	-	Ojima <i>et al.</i> (1976)
<i>M. sp.</i>	-	62	54M-SM+8ST-A	3-4	-	ST-A	q	INTERST.	-	-	-	-	Porto <i>et al.</i> (1989;1991)
<i>Mylesinus paraschomburgkii</i>	-	58	-	6-12	-	ST-A	p	TERM.	-	-	-	-	Porto <i>et al.</i> (1989;1991)
<i>Myleus pacu</i>	-	58	40M-SM+18ST-A	5-9	-	ST-A	p	TERM.	-	-	-	-	Porto <i>et al.</i> (1989;1991)
<i>M. rubripinnis</i>	-	58	-	5-8	-	ST-A	p	TERM.	-	-	-	-	Porto <i>et al.</i> (1989;1991)
<i>M. shomburgkii</i>	-	58	42M-SM+16ST-A	5-8	-	ST-A	p	TERM.	-	-	-	-	Porto <i>et al.</i> (1989;1991)
<i>Mylossoma aureum</i>	-	54	54M-SM	6-14	-	M,SM	p,q	TERM.	-	-	-	-	Porto <i>et al.</i> (1989;1991)
<i>M. duriventris</i>	-	54	50M-SM+4T	-	-	-	-	-	-	-	-	-	Ojima <i>et al.</i> (1976)
<i>M. duriventris</i>	-	54	18M+34SM+2A	-	-	-	-	-	-	-	-	-	Kossowski <i>et al.</i> (1983)
<i>M. duriventris</i>	-	54	54M-SM	6-14	-	M,SM	p,q	TERM.	-	-	-	-	Porto <i>et al.</i> (1989;1991)
<i>n. gen.</i> 1 ¹³	-	58	42M-SM+16ST-A	6-12	-	ST-A	p	TERM.	-	X	-	-	Porto <i>et al.</i> (1989;1991)

TABLE I (4)

<i>Piaractus brachypomus</i>	-	54	34M+20SM	3-6	-	M,SM	p,q	TERM.	X	X	X	-	Nakayama <i>et al.</i> (1990)
<i>Pristobrycon eigenmanni</i>	-	60	44M-SM+16ST-A	-	-	-	-	-	X	X	X	-	Porto <i>et al.</i> (1989; 1991)
<i>P. serrulatus</i>	-	60	44M-SM+16ST-A	6-10	-	ST-A	p	TERM.	-	X	X	-	Porto <i>et al.</i> (1989; 1991)
<i>P. striolatus</i>	-	62	46M-SM+16ST-A	6-7	-	ST-A	p	TERM.	-	-	-	-	Porto <i>et al.</i> (1989; 1991)
<i>Pristobrycon</i> sp.	-	60	48M-SM+12ST-A	6-10	-	ST-A	p	TERM.	-	-	-	-	Nakayama <i>et al.</i> (1988a)
<i>P. sp.</i>	-	60	50M-SM+10ST-A	6-8	-	ST-A	p	TERM.	-	-	-	-	Nakayama <i>et al.</i> (1988a)
<i>Pygocentrus nattereri</i>	-	60	50M-SM+10ST-A	6-8	-	ST-A	p	TERM.	X	X	X	-	Nakayama <i>et al.</i> (1988a,b)
<i>Serrasalmus altuvei</i>	-	60	46M-SM+14ST-A	-	-	-	-	-	-	-	-	-	Nakayama <i>et al.</i> , unpubl.
<i>S. elongatus</i>	-	60	40M-SM+20ST-A	6-12	-	ST-A	p	TERM.	-	X	X	-	Nakayama <i>et al.</i> (1986,1988b)
<i>S. hollandi</i>	-	64	-	-	-	-	-	-	-	-	-	-	Muramoto <i>et al.</i> (1968)
<i>S. manuellii</i>	-	60	44M-SM+16ST-A	6-10	-	ST-A	p	TERM.	-	X	X	-	Porto <i>et al.</i> (1991)
<i>S. rhombus</i>	-	60	44M-SM+16ST-A	-	-	-	-	-	-	-	-	-	Nakayama <i>et al.</i> (1992)
<i>Serrasalmus</i> sp.1	-	58	46M-SM+12ST-A	4-8	-	ST,A	p	TERM.	X	X	X	-	Nakayama <i>et al.</i> (1992)
<i>Serrasalmus</i> sp.2	-	60	46M-SM+14ST-A	-	-	-	-	-	-	X	X	-	Nakayama <i>et al.</i> (1988b)
<i>S. spilopleura</i>	-	60	44M-SM+16ST-A	6-10	-	ST-A	p	TERM.	-	X	X	-	Porto <i>et al.</i> (1991)
SILURIFORMES													
SILUROIDEI													
AGENEIOSIDAE													
<i>Ageneiosus brevifilis</i>	-	56	-	-	-	-	-	-	-	-	-	-	Fennocchio & Bertollo (1987)
<i>Ageneiosus</i> sp.	-	54	-	-	-	-	-	-	-	-	-	-	Fennocchio & Bertollo (1987)
AUCHENIPTERIDAE													
<i>Parauchenipterus cf. galeatus</i>	-	58	-	-	-	-	-	-	-	-	-	-	Fennocchio & Bertollo (1987)
CALlichthyidae													
<i>Brochis splendens</i> 14	49	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>B. splendens</i>	-	100	18M+18SM+20ST+44A	4	-	SM,ST	q	TERM.	-	X	-	-	Oliveira <i>et al.</i> (1990b)
<i>Callichthys callichthys</i>	-	52	-	2	-	SM,ST	p	TERM.	-	-	-	-	Porto & Feldberg (1992b)
<i>C. callichthys</i>	-	54	46M-SM+8ST-A	3	-	SM,ST	p	TERM.	-	-	-	-	Porto & Feldberg (1988)
<i>C. callichthys</i>	-	58	-	-	-	-	-	-	-	-	-	-	Porto & Feldberg (1992b)
<i>Corydoras aeneus</i> 15	-	132	-	-	-	-	-	-	-	-	-	-	Scheel <i>et al.</i> (1972)
<i>C. aeneus</i>	66	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Corydoras aeneus</i>	60	-	-	-	-	-	-	-	-	-	-	-	Hinegardner & Rosen (1972)
<i>C. aeneus</i> 16	-	58	-	-	-	-	-	-	-	-	-	-	Scheel <i>et al.</i> (1972)
<i>C. aeneus</i>	29	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. aeneus</i>	-	134	-	-	-	-	-	-	-	-	-	-	Turner <i>et al.</i> (1992)
<i>C. aeneus</i>	-	56	-	-	-	-	-	-	-	-	-	-	Turner <i>et al.</i> (1992)
<i>C. agassizii</i>	-	98	-	-	-	-	-	-	-	-	-	-	Scheel <i>et al.</i> (1972)
<i>C. agassizii</i>	49	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. arcuatus</i>	-	46	-	-	-	-	-	-	-	-	-	-	Scheel <i>et al.</i> (1972)
<i>C. arcuatus</i>	23	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. elegans</i>	-	50	-	-	-	-	-	-	-	-	-	-	Scheel <i>et al.</i> (1972)
<i>C. elegans</i>	25	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. elegans</i>	25	-	-	-	-	-	-	-	-	-	-	-	Hinegardner & Rosen (1972)
<i>C. melanistus</i>	-	46	-	-	-	-	-	-	-	-	-	-	Scheel <i>et al.</i> (1972)
<i>C. melanistus</i>	23	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. melanistus</i>	24	-	-	-	-	-	-	-	-	-	-	-	Hinegardner & Rosen (1972)
<i>C. punctatus</i>	22-23	-	-	-	-	-	-	-	-	-	-	-	Hinegardner & Rosen (1972)
<i>C. aff. punctatus</i>	-	102	8M+14SM+20ST+60A	2	-	SM	p	TERM.	-	X	X	-	Oliveira (1987)
<i>C. rabauti</i>	-	58	-	-	-	-	-	-	-	-	-	-	Scheel <i>et al.</i> (1972)
<i>C. rabauti</i>	29	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. reticulatus</i>	-	74	16M+20SM+12ST+26A	2-3	-	A	q	TERM.	-	X	X	-	Oliveira (1987)
<i>C. schwartzi</i>	-	46	-	-	-	-	-	-	-	-	-	-	Scheel <i>et al.</i> (1972)
<i>C. schwartzi</i>	23	-	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>C. schwartzi</i>	-	46	32M+14SM	2	-	M	p	TERM.	-	-	-	-	Oliveira (1987)
<i>Dianema longibarbis</i>	-	60	-	-	-	-	-	-	-	-	-	-	Hudson (1976)
<i>D. longibarbis</i>	-	60	8M-SM+52ST-A	2	-	SM	p	INTERST.	-	-	-	-	Marcon <i>et al.</i> (1992)
<i>D. urostriatum</i> 17	-	62	8M+4SM+4ST+46A	2	-	A	p	TERM.	-	X	X	-	Oliveira <i>et al.</i> (1990b)
<i>D. urostriatum</i>	-	62	6M-SM+56ST-A	2	-	ST	p	TERM.	-	-	-	-	Marcon <i>et al.</i> (1992)
<i>H. littorale</i>	-	60	8M-SM+52ST-A	2	-	A	q	TERM.	-	-	-	-	Porto & Feldberg (1992b)
<i>H. thoracatum</i>	-	64	30M-SM+34ST-A	2	-	A	q	TERM.	-	-	-	-	Porto & Feldberg (1992b)
<i>H. aff. thoracatum</i>	-	66	-	-	-	-	-	-	-	-	-	-	Porto & Feldberg (1992a)
<i>H. sp.</i>	-	62	8M-SM+54ST	4	-	M-SM	p	TERM.	-	-	-	-	Porto & Feldberg (1992a)
DORADIDAE													
<i>Opsodoras humeralis</i>	-	58	-	-	-	-	-	-	-	-	-	-	Della-Rosa <i>et al.</i> (1980)
<i>Pseudodoras niger</i>	-	58	58M-SM-ST-A	-	-	-	-	-	-	-	-	-	Venere (1988)
LORICARIIDAE													
<i>Pterygoplichthys multiradiatus</i>	-	52	-	-	-	-	-	-	-	-	-	-	Della-Rosa <i>et al.</i> (1980)
<i>Loricaria</i> sp.	-	62	-	-	-	-	-	-	-	-	-	-	Della-Rosa <i>et al.</i> (1980)

TABLE I (5)

PIMELODIDAE												
<i>Callophysus macropterus</i>	-	50	-	2	-	ST-A	p	TERM	-	-	-	Ramirez-Gil & Feldberg, 1992
<i>Pimelodus blochii</i>	-	58	-	-	-	-	-	-	-	-	-	Della-Rosa <i>et al.</i> (1980)
<i>Pseudoplatystoma fasciatum</i>	-	56	-	2	-	ST-A	p	-	-	-	-	Fennocchio & Bertollo (1992)
<i>P. tigrinum</i>	-	56	-	2	-	ST-A	p	-	-	-	-	Fennocchio & Bertollo (1992)
<i>Sorubim lima</i>	-	56	-	2	-	ST-A	p	-	-	-	-	Fennocchio & Bertollo (1992)
TRICHOMYCTERIDAE												
<i>Vandellia cirrhosa</i>	32	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
GYMNOTOIDEI												
APTERONOTIDAE												
<i>Apteronotus albifrons</i>	11	-	-	-	-	-	-	-	-	-	-	Hinegardner & Rosen (1972)
<i>A. albifrons</i>	-	24	14M+2SM+2ST+6T	-	-	-	-	-	-	-	-	Howell (1972)
<i>A. albifrons</i>	-	24	12M+4SM+2ST+6A	2	4	SM	q	INTERST.	X	X	-	Almeida-Toledo <i>et al.</i> (1981)
GYMNOTIDAE												
<i>Gymnotus carapo</i>	-	42	32M-SM+10ST-A	-	-	-	-	-	-	-	-	Foresti <i>et al.</i> (1984)
<i>G. carapo</i>	-	48	34M-SM+14ST-A	-	-	-	-	-	-	-	-	Foresti <i>et al.</i> (1984)
<i>G. carapo</i>	19	-	-	-	-	-	-	-	-	-	-	Hinegardner & Rosen (1972)
HYPOPOMIDAE												
<i>Hypopomus brevirostris</i>	-	36	4M+2SM+8ST+22A	-	-	-	-	-	-	-	-	Almeida-Toledo (1978)
<i>H. artedi</i>	-	38	32M-SM+6ST-A	-	-	-	-	-	-	-	-	Oliveira <i>et al.</i> (1988a)
<i>Hypopigus lepturus</i>	-	50	16M+20SM+10ST+4A	-	-	-	-	-	-	X	-	Almeida-Toledo (1978)
RHAMPHICHTHYDAE												
<i>Ramphichthys cf. pantherinus</i>	-	52	38M+10SM+4ST	-	-	-	-	-	-	-	-	Almeida-Toledo (1978)
STERNOPYGIDAE												
<i>Eigenmannia humboldti</i>	-	40	8M-SM+32ST-A	2	3	M-SM	p	TERM.	-	-	-	Foresti (1987)
<i>Eigenmannia</i> sp. (Triploid)	-	46	20M-SM+26ST-A	3	4	M-SM	p	TERM.	-	-	-	Almeida-Toledo <i>et al.</i> (1985)
<i>Eigenmannia</i> sp. (CYT-1)	-	31/32	12/13M-SM+18/20ST-A	2	4	M-SM	p	TERM.	-	-	-	Almeida-Toledo <i>et al.</i> (1985)
<i>Eigenmannia</i> sp. (CYT-2)	-	29/30	6/8M-SM+22/24ST-A	2	11	ST-A	q	INTERST.	-	-	-	Foresti (1987)
<i>Eigenmannia</i> sp. (CYT-1)	-	31/32	11/12M-SM+18/20ST-A	2	4	M-SM	p	TERM.	-	-	-	Foresti (1987)
<i>Eigenmannia</i> sp. (CYT-1)	-	31/32	12M-SM+18/20ST-A	2	4	M-SM	p	TERM.	-	-	-	Foresti (1987)
<i>Eigenmannia</i> sp. (CYT-1)	-	30	12M-SM+18ST-A	2	4	M-SM	p	TERM.	-	-	-	Foresti (1987)
<i>Eigenmannia</i> sp. (CYT-3)	-	28	14M-SM+14ST-A	2	3	ST-A	q	TERM.	-	X	X	Foresti (1987)
<i>Eigenmannia</i> sp. (CYT-B)	-	38	17M-SM+21ST-A (F)	2	6	M-SM	p	TERM.	-	X	X	ZW
	-	38	16M-SM+22ST-A (M)	2	6	M-SM	p	TERM.	-	X	X	ZZ
<i>Sternopygus macrurus</i>	-	46	46M-SM	2	1	M-SM	q	INTERST.	-	-	-	Foresti (1987)
<i>S. macrurus</i>	-	46	-	-	-	-	-	-	-	-	-	Bertollo <i>et al.</i> (1980)
PERCIFORMES												
CICHLIDAE												
<i>Acarichthys heckeli</i>	-	48	6M-SM+42ST-T	-	-	-	-	-	-	-	-	Thompson (1979)
<i>Apistogramma agassizi</i>	20	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>A. agassizi</i>	-	46	24M-SM+22ST-T	-	-	-	-	-	-	-	-	Thompson (1979)
<i>Apistogramma ortmanni</i>	19	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>A. ortmanni</i>	-	46	24M-SM+22ST-T	-	-	-	-	-	-	-	-	Thompson (1979)
<i>A. pertensis</i> 18	24	-	-	-	-	-	-	-	-	-	-	Post (1965)
<i>Astronotus ocellatus</i>	24	48	12M-SM+36ST-A	2	1	M-SM	p	INTERST.	-	-	-	Feldberg & Bertollo (1985ab)
<i>Cichla temensis</i>	-	48	48ST-T	-	-	-	-	-	-	-	-	Thompson (1979)
<i>Cichla</i> sp.	-	48	48ST-T	-	-	-	-	-	-	-	-	Venere (1988)
<i>Crenicichla strigata</i>	-	48	6M-SM+42ST-T	-	-	-	-	-	-	-	-	Thompson (1979)
<i>C. lucius</i>	-	48	-	-	-	-	-	-	-	-	-	Thompson (1979)
<i>Dicrossus filamentosus</i> 19	-	46	12M-SM+34ST-T	-	-	-	-	-	-	-	-	Thompson (1979)
<i>D. maculata</i> 20	23	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Geophagus altifrons</i> 21	24	48	4M-SM+44ST-A	2	1	M-SM	p	INTERST.	-	-	-	Feldberg & Bertollo (1985ab)
<i>Guinacara</i> sp.	-	48	4M-SM+44ST-A	2	1	M-SM	p	INTERST.	-	X	-	Feldberg <i>et al.</i> (1990)
<i>Heros severus</i> 22	24	-	-	-	-	-	-	-	-	-	-	Post (1965)
<i>H. severus</i>	24	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>H. severus</i>	-	48	4M-SM+44ST-T	-	-	-	-	-	-	-	-	Thompson (1979)
<i>Hypselaacara coryphaenoides</i> 23	-	48	6M-SM+42ST-T	-	-	-	-	-	-	-	-	Thompson (1979)
<i>Laetacara curviceps</i> 24	19	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>Pterophyllum eimekei</i>	24	-	-	-	-	-	-	-	-	-	-	Post (1965)
<i>P. scalare</i>	24	-	-	-	-	-	-	-	-	-	-	Scheel (1973)
<i>P. scalare</i>	-	48	4M-SM+44ST-T	-	-	-	-	-	-	-	-	Thompson (1979)
<i>Satanoperca jurupari</i> 25	-	48	-	-	-	-	-	-	-	-	-	Moreira F ^o <i>et al.</i> (1980a)
<i>Symphysodon aequifasciatus</i> 26	-	60	44M+16A	-	-	-	-	-	-	-	-	Ohno & Atkin (1966)
<i>S. aequifasciatus</i>	30	-	-	-	-	-	-	-	-	-	-	Scheel (1973)

TABLE I (6)

<i>S. aequifasciatus</i>	-	60	58M-SM+2ST-T	-	-	-	-	-	-	-	-	-	Thompson (1979)
<i>Uaru amphiacanthoides</i>	-	46	8M-SM+38ST-T	-	-	-	-	-	-	-	-	-	Thompson (1979)
LEPIDOSIRENIFORMES													
LEPIDOSIRENIDAE													
<i>Lepidosiren paradoxa</i>	-	38	38M	-	-	-	-	-	-	-	-	-	Ohno & Atkin (1966)
<i>L. paradoxa</i>	-	38	38M-SM-ST	-	-	-	-	-	-	-	-	-	Oliveira <i>et al.</i> (1988a)

1 = *Cheirodon axelrodi*
5 = *Hemigrammus gracilis*
9 = *P. harrisoni*
13 = *Utiaitichthys* sp
17 = *Dianema urostriata*
21 = *Geophagus surinamensis*
25 = *Geophagus jurupari*

2 = *Hyphessobrycon simulans*
6 = *Hemigrammus stictus*
10 = *P. unifasciatus*
14 = *Brochis coeruleus*
18 = *Apistogramma pertense*
22 = *Cichlasoma severum*
26 = *Symphysodon aequifasciata*

3 = *Poptella orbicularis*
7 = *Hyphessobrycon erythrostigma*
11 = *Piaractus nigripinnis*
15 = *Corydoras aneus*
19 = *Crenicara filamentosa*
23 = *Cichlasoma coryphaenoides*

4 = *Bryconella palifrons*
8 = *Poecilobrycon oques*
12 = *Metynnis hypsauchen*
16 = *Corydoras schultzei*
20 = *Crenicara maculatus*
24 = *Aequidens curviceps*