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The fish fauna of the Iwokrama Forest

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ABSTRACT—Fishes were collected from the rivers in and around the Iwokrama Forest during January–February and November–December 1997. Four hundred species of fish were recorded from forty families in ten orders. Many of these fishes are newly recorded from Guyana and several are thought to be endemic. The number of species recorded for the area is surprising given the low level of effort and suggests that this area may be particularly important from a fish diversity perspective. This paper focuses on species of particular interest from a management perspective including those considered economically important, rare or endangered. The paper is also the basis for developing fisheries management systems in the Iwokrama Forest and Rupununi Wetlands.

INTRODUCTION

Fish are key components of Amazonian rain forest ecosystems (Barthem and Goulding 1997; Goulding 1983; Goulding et al. 1995; Lowe-McConnell 1995; Lundberg 2001). They are linked to forests through nutrient flows into wetlands and by migrations of fish through inundated forest ecosystems. In addition, fish are often critical traditional food sources that define human-forest relationships (Robinson & Redford 1991). Fish communities respond to changes in the physical and chemical characteristics of wetlands; in this context, human impacts through timber harvesting, road building, and mining can transform fish communities. Padoch et al. (1999) describe the effects of “boom and bust” natural resource economic cycles on varzea (flooded forests) and express the need for forest management to include sustainable fishing, habitat conservation and management of long range fish migrations.

The aquatic systems within and around the Iwokrama Forest are key components of the Iwokrama

Forest ecosystem. Local people have been long aware of the linkages between seasonal flooding and the feeding and spawning cycles of fishes in the Iwokrama Forest and Rupununi Wetlands (Forte et al. 1999). In addition, fishes are important resources for the indigenous communities of the North Rupununi (Forte, Janki et al. 1999) and several fishes (*Arapaima gigas*, *Cichla ocellaris*, and pimelodid catfishes) are sold commercially. These wetlands and their fish fauna are integral to deriving economic and social benefits from the Iwokrama Forest. Unfortunately, there have been few studies of the wetland resources in the Iwokrama Forest, or in Guyana as a whole (see Eigenmann 1912, Hardman et al. 2002; Lowe-McConnell 1964, 1967, 1969).

The Iwokrama Forest is drained by the Essequibo River and two smaller rivers, the Burro-Burro and Siparuni, that are briefly confluent before joining the Essequibo. It is bordered to the east by the Essequibo River and to the north and west by the Siparuni River. The Burro-Burro River runs through the central part of the Iwokrama Forest (Fig. 1).

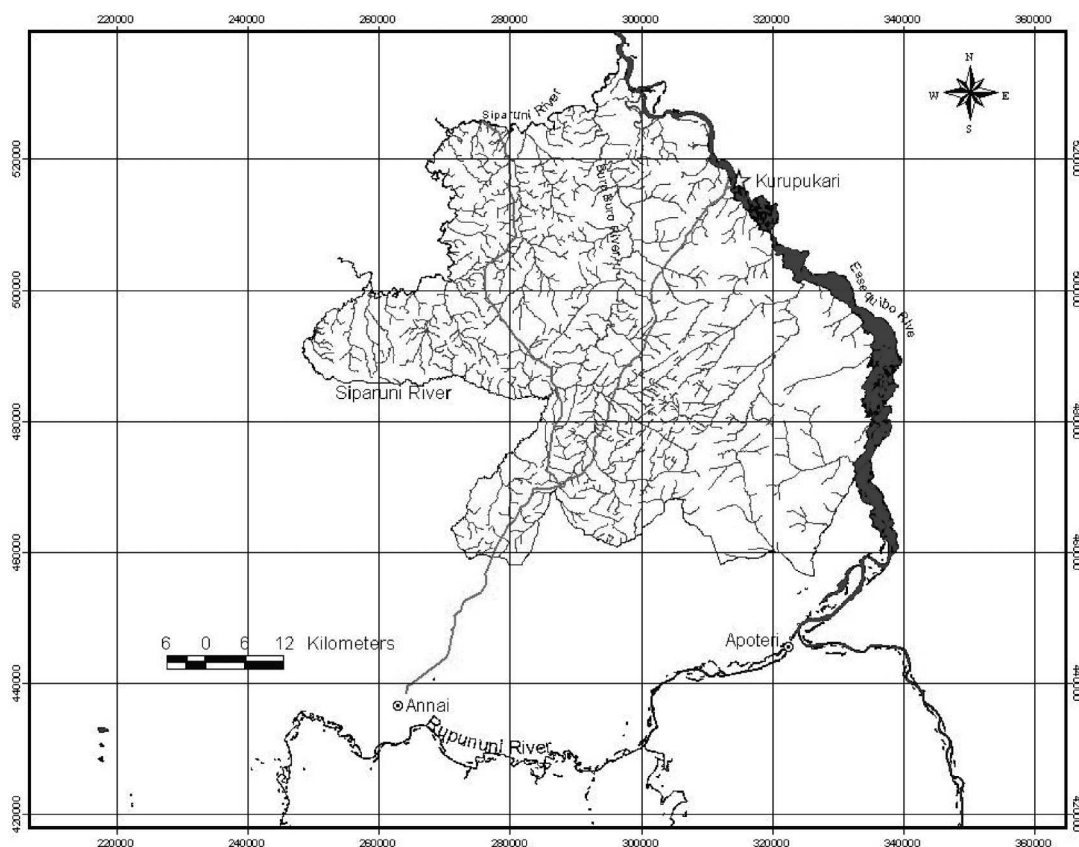


Fig. 1. The river systems in and around the Iwokrama Forest (coordinates in UTM).

Approximately, 1500 km² of the Iwokrama Forest drain directly to the Essequibo River, 1500 km² to the Burro-Burro and 900 km² to the Siparuni River (Hawkes & Wall 1993).

In the vicinity of the Iwokrama Forest the Essequibo River has main channels 250–500 metres wide and is at most approximately 1 km wide. It is characterized north of Kurupukari Falls by extensive sand bars that are visible during low water. In several places throughout the Iwokrama Forest, it is crossed by volcanic dykes that form rapids. The Essequibo has a probable maximum depth of 40 m (Hawkes & Wall 1993), and its banks are not high except where scouring has occurred (Hawkes & Wall 1993). The Essequibo drainage is seasonally linked to the Amazon drainage when the flooded savannas form a continuous expanse of water between the tributaries of the Rio Branco and the Rupununi River. The Burro-Burro and Siparuni Rivers are much smaller rivers with maximal widths of 100 m and 150 m respectively. As in the Essequibo, rapids are formed where the rivers cross over volcanic dykes. Both the Burro-Burro and Siparuni rivers are steep-sided, deep rivers with few sandbars, and little exposed shoreline. The Essequibo River has far more

sand and silt substrates than do either the Siparuni or Burro-Burro. The Burro-Burro River floods extensively into the forest during the rainy season.

Amazonian and other South American river systems are often categorized as white, black, or clear waters. Similarly, Carter (1934) describes the rivers of Guyana as either black water or white water. Black waters are acidic, with high carbon dioxide and low oxygen content. White waters are turbid, with low carbon dioxide, high silica, and low acidity. The rivers near the Iwokrama Forest do not neatly fall into these categories. The Essequibo has high sediment loads and can be considered a white water river along its borders with the Iwokrama Forest. This is partly due to the fact that the white water Rupununi River drains into the Essequibo just south of the Iwokrama Forest. Secchi disc visibility ranges from approximately 0.2–1.0 m in the main channels. Despite this, water colour and turbidity change seasonally and spatially, with the result that the river sometimes appears much like what is considered to be black water. For example, south of the confluence between the Rupununi and Essequibo rivers, the upper Essequibo is considerably darker than the lower Essequibo. Changes in the relative

contributions from the different tributaries can substantially alter the waters of the Essequibo near the Iwokrama Forest. The Burro-Burro and Siparuni are predominantly black water rivers, with the Siparuni being slightly darker; however the transparency of these rivers is highly variable. All of the main rivers are fed by small third order creeks which are more readily defined either as black, white, or clear waters.

Mean annual rainfall at Kurupukari is approximately 3000 mm per year (Hawkes & Wall 1993). Annai and Apoteri have recorded mean annual rainfall of 1600 mm and 1900 mm respectively (Hawkes & Wall 1993). The Iwokrama Forest therefore has a rainfall gradient that decreases from north to south. Rains peak at both Kurupukari and Annai from May to September. However, in Annai there is generally only one rainy season—Kurupukari is affected by coastal weather patterns with a second shorter rainy season from December to January.

Essequibo River levels respond to seasonal patterns of rainfall over the whole Essequibo drainage of 50,000 km². The Burro-Burro and Siparuni however, have more immediate responses to local rainfall and extreme rises are restricted to the lower reaches of these rivers. River levels in the Siparuni and Burro-Burro are almost certainly affected by both rainfall in their catchments and changes in the levels of the Essequibo River. Waters in the Essequibo generally rise from April, and recede from August to October. In total, an average water-level change of six-metres occurs on an annual basis. These changes undoubtedly effect the migration, spawning, and feeding behaviour of fish communities in the Essequibo and possibly even in the systems of the Rupununi (Lowe-McConnell 1995) and Amazon (Barthem & Goulding 1997).

METHODS

Fishes were collected during two expeditions to the rivers in and around the Iwokrama Forest during January–February and November–December of 1997. During January–February, the Essequibo and Burro-Burro drainages were surveyed; in November–December the Essequibo, Burro-Burro, and Siparuni drainages were surveyed. In addition, data from earlier collections by the Royal Ontario Museum were used to develop a species list for the area.

Several survey methods were used (see Plate 1) and mostly included stationary and moving gill nets, seines, dip and hoop nets, hook and line, and chemo-fishing (Noxfish Fish Toxicant Liquid Emulsion—Rotenone). Hook and line were used extensively to record larger species. Rotenone was used for smaller species in the steep sided, deep sections

of the Burro-Burro and Siparuni Rivers where seines proved ineffective.

Due to time constraints and difficulty of access, only 41 sites were surveyed in the Burro-Burro and Siparuni drainages, while 84 were surveyed in the Essequibo. Sampling was restricted to the lower order rivers and creeks.

Specimens from collections were deposited at the Centre for the Study of Biological Diversity, University of Guyana, and the Academy of Natural Sciences, Philadelphia. Specimens collected in 1990 by personnel of the Royal Ontario Museum and Youth Challenge International were deposited at the Royal Ontario Museum. Several species were not collected because they were too large or protected in Guyana. These were *Brachyplatystoma vaillantii*, *Brachyplatystoma filamentosum*, *Zungaro zungaro*, and *Arapaima gigas*.

The Abundance-based Coverage and Incidence-based Coverage Estimators of species richness from the computer programme EstimateS.5 (Colwell 1997) were used to estimate fish species richness for the areas surveyed.

RESULTS

Four hundred species of fish were recorded (Appendix 1) from forty families in ten orders. Many of these fishes are newly recorded for Guyana and several are thought to be endemic.

Twenty percent of the sites surveyed contained over 30 species, and three sites contained over 50 species. The majority of these species-rich sites were either small creeks or sand bars in the Essequibo River.

EstimateS.5 (Colwell 1997) was used to estimate fish species richness for the areas surveyed. The Abundance-based Coverage Estimator of species richness estimates that the surveyed area contains 462 species; the Incidence-based Coverage Estimator estimates 747 species. Figure 2 represents the accumulated number of species found in collection lots (a lot is a set of specimens of the same species collected at any one field site over a specific time period), and supports estimate calculations as the number of species continues to increase throughout. The step-wise pattern of species accumulation in Figure 2 suggests the appearance of new species communities in newly sampled habitats.

DISCUSSION

Why So Many Species?

Fish species richness is unusually high in the rivers near the Iwokrama Forest. This is especially apparent when compared with other much larger Amazonian



Plate 1. Iwokrama field expedition members Errol McBirney (left) and David Agro with a recently captured fish and the bow and arrow used by Errol in its capture, September 1997. Photography by Robert M. Peck.

drainages (Rio Negro: 450 species, (Goulding 1988) Madeira River: 398 species, (Revenga et al. 2000)).

Two factors potentially cause this elevated diversity. The first factor is the wide range of habitats represented within the sampling area. This was suggested by Lowe-McConnell (1964) as a major cause of the high species richness in the Rupununi savannas. In the area, the large variety of habitats (flooded forests and savannas, rivers, creeks, ponds and oxbow lakes) can support a diverse assemblage of fishes. The second factor is that the Essequibo River is situated between three major ichthyofaunal regions: the Orinoco, eastern Guiana Shield, and Amazon. Flooding during the annual high water period enables an exchange in fish species between these three systems.

Distribution and Migration

The Siparuni, Burro-Burro and Essequibo Rivers are physically and chemically distinct, though vari-

able, and many creeks have distinct origins. Water transparency is an important predictor of fish community structure in Orinoco floodplain lakes (Rodriguez & Lewis 1997). In general, fish with sensory adaptations to low light such as Gymnotiformes and Siluriformes tend to be dominant in turbid lakes, whereas visually oriented fish such as Characiformes, Clupeiformes, and Perciformes tend to be dominant in transparent lakes. Similar patterns have been described in Amazonian systems (Lowe-McConnell 1995) and the Rupununi (Lowe-McConnell 1964). Turbid waters in the rivers near the Iwokrama Forest were dominated by catfish- 78 species of catfish were almost exclusively found in white waters as opposed to 18 species that were found most frequently in black and clear waters. Auchenipterids, pimelodids, loricariids, and doradids were regularly found in samples from white waters, while they were almost absent from black and clear waters. Seventy percent of the 63 species that were most frequently encoun-

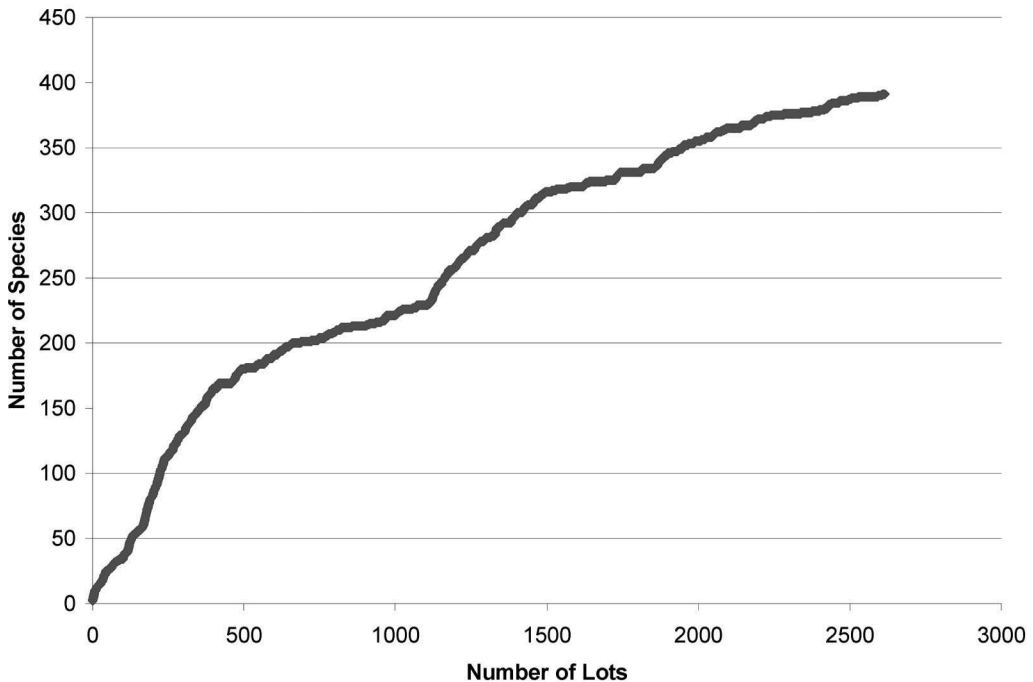


Fig. 2. Number of species recorded as the number of lots increases over time.

tered in black and clear waters were characoids or gymnotids.

As with Amazon and Orinoco fish communities, the key to understanding the Iwokrama Forest fish fauna is the migration, feeding, and spawning patterns that are controlled by seasonally changing water levels and availability of oxygen (Lowe-McConnell 1964, 1995; see Table 1). Many of the fish species in the Iwokrama Forest undertake trophic dispersals and spawning migrations based on changes in water levels. These changes in water levels seasonally modify the available habitats in the area (Table 1).

The majority of fishes in the Iwokrama Forest migrate in response to changing water levels. The dry season and the lower water levels have been described as a "physiological winter" for fish (Lowe-McConnell 1967). A general characteristic of lowland, low-nutrient forest waterways is that allochthonous fruit and leaves form the major food base. Food availability for fishes therefore increases in high water when flooded areas become accessible. To deal with this, fat reserves are built up during the rainy season in preparation for the dry season (Lowe-McConnell 1964). Oxygen levels and available habitats also decrease substantially during the dry season. Some species migrate back to the larger ponds and main rivers to avoid these harsh conditions; despite this many fishes are trapped in drying ponds. Consequently, several species have adaptations, such as air breathing (*Arapaima*, *Electrophorus*) and terrestrial locomotion (e.g., *Erythrinus*, *Hopler-*

ythrinus, and *Hoplosternum*). These drying ponds, particularly in the savannas, are thought to be ecologically important as a food base for wild cats, birds and other scavengers (personal observation, Watkins).

Lowe-McConnell (1964) observed upstream migrations of several species towards spawning sites in the headwaters of small creeks, at the confluences of rivers and creeks, and in the flooded savannas. These migrations occur when waters rise at the beginning of the rainy season. Fishes begin returning from the flooded areas at the end of the rainy season as waters recede. Exact migration movements are currently unknown, but it is thought that fish travel from the main rivers in the dry season, to adjacent ponds and creeks in the wet season.

The Rupununi River and the surrounding savannas are likely to be vital for the healthy maintenance of fish populations in the nutrient poor Essequibo. It is likely that food availability in the flooded Rupununi savanna drives much of the spawning and feeding movements in the Essequibo. Flooding along the Essequibo is much less extensive than in the Rupununi savannas; thus fishes moving into the Rupununi during the high water periods, unlock a much greater resource than is available in the Essequibo.

Fisheries Management

Several species in the Iwokrama Forest have economic and social values. Certain species have been

Table 1. Seasonal cycles in the Rupununi and Iwokrama Forest (after Lowe-McConnell 1977).

Month	Jan–Feb	Mar–Apr	May–July	Aug–Oct	Nov–Dec
Rainfall	Dry season		Rains		Dry season
Water levels	Low		High		Low
Land covered with water	Small	Expanding	Maximal	Declining	Low
Food levels		Nutrients washed in by first rains increase food and plant growth for cover	Access to flooded forest areas for food		
Reproductive strategy		Spawning and the growth of young	Feeding and growing	Beginning high mortality	Stranding and predation; de-oxygenation of pools
Fish movements	Confinement to pools	Lateral and longitudinal migrations up rivers and creeks	Dispersal on floodplains	Movements back to the river	Confinement to pools
Fishing	Catch fish in ponds—that are normally dry season refuges	Catch upstream migrants—before spawning	No fish available	Catch again as fish move back	Catch fish in ponds—that are normally dry season refuges

used locally for subsistence and commerce. For some, there is an urgent need to develop management systems, and there is now potential to develop other uses for fish including sport fishing and aquarium fisheries. The major commercial species in the area is Arapaima (*Arapaima gigas*). Populations of this species have declined dramatically since the 1960s when harvesting began in earnest for sale to Brazil. *Arapaima* is found mainly in lakes and large creek pools and is more abundant in the Rupununi and the Essequibo near the south-eastern border of the Iwokrama Forest. The Arowana (*Osteoglossum bicirrhosum*) is also an important subsistence and commercial fish that is relatively abundant in the area. It is important both for food and for the aquarium trade and is considered under some conservation threat in the area. The freshwater drum or Basaha (*Plagioscion squamosissimus*) is also an important commercial species that lives in deeper water and near falls and is thought to be declining close to villages. The erythrinids including Haimara (*Hoplias macrophthalmus*), Huri (*Hoplias malabaricus*), Yarrow (*Hoplerythrinus unitaeniatus*), and Bush Yarrow (*Erythrinus erythrinus*) are also important species for local subsistence, and the Haimara is also sold commercially. Of the pimelodid catfish, the Skeete or Banana Fish (*Phractocephalus hemioliopus*), Lao-Lao (*Brachyplatystoma filamentosum*), Blinka (*Bra-*

chyplatystoma vaillantii), Siana (*Zungaro zungaro*) and Jon-Jon (*Pinirampus pirinampu*) are the largest, but commercially exploited at lower levels than the Long Head Cullet (*Pseudoplatystoma tigrinum*) and the Short Head Cullet (*Pseudoplatystoma fasciatum*). The Baiaras (*Cynodon gibbus*, *Hydrolycus armatus*, *Hydrolycus tatauaia* and *Roestes ogilviei*), Lukanani (*Cichla ocellaris*), Yakutu (*Prochilodus rubrotaeniatus*), and Boots (*Trachycorystes trachycorystes*) are also important food fishes.

Many of the fish species found in the Iwokrama Forest play important and complex ecological roles. Whereas little is known about the role of fishes in Guianan terrestrial ecosystems, Goulding (1983) has argued that characoids and catfish play important roles in Amazonian flooded forests as fruit eaters and dispersers; and fish distributions could readily affect forest plant distributions, in particular palms and other key flooded forest species. Characoids tend to be seed predators because of their well developed teeth, whereas catfish tend to be good seed dispersers. In particular, characoid genera such as *Myleus*, *Serrasalmus*, *Pygocentrus*, *Brycon*, *Leporinus* and *Triportheus* may be important seed-eaters and dispersers. The Siluriformes like *Phractocephalus*, *Oxydoras*, *Trachycorystes*, *Pimelodus*, *Pimelodella*, and *Zungaro* are seed-dispersers in Amazonian waterways (Goulding 1983) and are likely to be so in the Iwokrama

Forest. Clearly, gaining an understanding of the biology, in particular diet and seed-dispersal capacities, of these species in the Iwokrama Forest will help in making sound management decisions.

CONCLUSIONS

The Iwokrama Forest has a fish fauna of global significance. The high diversity and pristine condition of the ecosystem makes this area a refuge for large numbers of Amazonian fishes threatened elsewhere. Due to the long distance migrations of fish in the Burro-Burro, Siparuni and Essequibo River watersheds, management of fisheries in the Rupununi wetlands is likely to be important to the management of fisheries in the Iwokrama Forest. Clearly, fish migration, spawning, and feeding strategies are complex and may have far reaching terrestrial and aquatic ecosystem consequences. Successful management of the fisheries of the Iwokrama Forest will therefore require effort to understand migration, spawning and feeding. For example, the major fish harvest periods currently include the spawning runs and the periods when ponds are drying.

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Appendix 1. Fish of the Iwokrama Forest showing numbers recorded at different locations. Nomenclature follows Reis et al. (2003).

Order, Family, Genus and Species	Authority	Essequibo	Siparuni	Burro-Burro
ELASMOBRANCHII				
MYLIOBATIFORMES				
POTAMOTRYGONIDAE				
<i>Potamotrygon orbignyi</i>	(Castelnau, 1855)	1	0	0
<i>Potamotrygon</i> sp		1	0	1
OSTEICHTHYES				
OSTEOGLOSSIFORMES				
OSTEOGLOSSIDAE				
<i>Arapaima gigas</i>	(Cuvier, 1829)	1	1	1
<i>Osteoglossum bicirrhosum</i>	(Cuvier, 1829)	1	1	1
CLUPEIFORMES				
CLUPEIDAE				
ENGRAULIIDIDAE				
<i>Anchoviella jamesi</i>	(Jordan & Seale, 1926)	1	0	0
<i>Anchoviella guianensis</i>	(Eigenmann, 1942)	1		1
<i>Anchoviella</i> sp		1	1	1
<i>Jurengraulis</i> sp		1	0	0
CHARACIFORMES				
ACESTRORHYNCHIDAE				
<i>Acestrorhynchus falcatus</i>	(Bloch, 1794)	1	1	1
<i>Acestrorhynchus falcirostris</i>	(Cuvier, 1819)	1	1	0
<i>Acestrorhynchus heterolepis</i>	(Cope, 1878)	1	0	0
<i>Acestrorhynchus microlepis</i>	(Schomburgk, 1841)	1	1	1
<i>Acestrorhynchus nasutus</i>	Eigenmann, 1912	1	0	0
<i>Acestrorhynchus</i> sp		0	1	1
ANOSTOMIDAE				
<i>Anostomus anostomus</i>	(Linnaeus, 1758)	0	1	1
<i>Anostomus plicatus</i>	Eigenmann, 1912	1	0	1
<i>Anostomus ternetzi</i>	Fernández-Yépez, 1949	1	0	0
<i>Laemolyta proxima</i>	(Garman, 1890)	1	0	0
<i>Leporinus alternus</i>	Eigenmann, 1912	1	0	0
<i>Leporinus arcus</i>	Eigenmann, 1912	1	1	1
<i>Leporinus fasciatus</i>	(Bloch, 1795)	1	0	1
<i>Leporinus friderici</i>	(Bloch, 1794)	1	1	1
<i>Leporinus maculatus</i>	Müller & Troschel, 1844	0	1	1
<i>Leporinus nigrotaeniatus</i>	(Jardine, 1841)	1	1	1
<i>Leporinus pellegrini</i>	Steindachner, 1910	1	1	1
<i>Pseudanos irinae</i>	Winterbottom, 1980	1	0	0
<i>Pseudanos trimaculatus</i>	(Kner, 1858)	0	1	0
<i>Schizodon fasciatus</i>	Spix & Agassiz, 1829	1	0	0
CHARACIDAE				
<i>Acanthocharax microlepis</i>	Eigenmann, 1912	1	0	0
<i>Agoniates halecinus</i>	Müller & Troschel, 1845	1	1	1
<i>Aphyocharax erythrurus</i>	Eigenmann, 1912	1	0	0
<i>Aphyocharax</i> sp		1	0	0
<i>Aphyodite grammica</i>	Eigenmann, 1912	1	0	0
<i>Aphyodite</i> sp		1	0	0
<i>Astyanax bimaculatus</i>	(Linnaeus, 1758)	0	0	1
<i>Astyanax guianensis</i>	Eigenmann, 1909	1	1	0
<i>Brachybalcinus orbicularis</i>	(Valenciennes, 1850)	0	1	1
<i>Brycon falcatus</i>	Müller & Troschel, 1844	1	1	1
<i>Brycon pesu</i>	Müller & Troschel, 1845	1	1	0
<i>Bryconamericus hyphesson</i>	Eigenmann, 1909	1	0	0
<i>Bryconamericus</i> sp		0	0	1
<i>Bryconops affinis</i>	(Günther, 1864)	1	1	1
<i>Bryconops alburnoides</i>	Kner, 1858	1	0	0
<i>Bryconops caudomaculatus</i>	(Günther, 1864)	1	1	1

Appendix 1. (continued)

Order, Family, Genus and Species	Authority	Essequibo	Siparuni	Burro-Burro
<i>Bryconops melanurus</i>	(Bloch, 1794)	1	1	1
<i>Bryconops</i> sp 1		1	0	0
<i>Bryconops</i> sp 2		0	1	0
<i>Catoprion mento</i>	(Cuvier, 1819)	1	0	0
<i>Chalceus macrolepidotus</i>	Cuvier, 1816	1	1	1
<i>Charax gibbosus</i>	(Linnaeus, 1758)	1	1	0
<i>Charax hemigrammus</i>	(Eigenmann, 1912)	1	0	0
<i>Creagrutus melanzonus</i>	Eigenmann, 1909	1	0	0
<i>Creagrutus</i> sp		1	0	0
<i>Ctenobrycon spilurus</i>	(Valenciennes, 1850)	1	1	1
<i>Cynopotamus essequeibensis</i>	Eigenmann, 1912	1	0	1
<i>Gnathocharax steindachneri</i>	Fowler, 1913	1	0	0
<i>Hemigrammus analis</i>	Durbin, 1909	1	0	0
<i>Hemigrammus belottii</i>	(Steindachner, 1882)	1	1	1
<i>Hemigrammus cylindricus</i>	Durbin, 1909	1	0	0
<i>Hemigrammus gracilis</i>	(Lütken, 1875)	1	0	0
<i>Hemigrammus guyanensis</i>	Géry, 1959	0	0	1
<i>Hemigrammus iota</i>	Durbin, 1909	1	0	0
<i>Hemigrammus levis</i>	Durbin, 1908	1	0	0
<i>Hemigrammus ocellifer</i>	(Steindachner, 1882)	1	1	1
<i>Hemigrammus ocellifer-gr</i>	(Steindachner, 1882)	1	0	0
<i>Hemigrammus orthus</i>	Durbin, 1909	1	0	0
<i>Hemigrammus schmardae</i>	(Steindachner, 1882)	1	0	0
<i>Hemigrammus</i> sp		1	0	0
<i>Heterocharax macrolepis</i>	Eigenmann, 1912	1	0	0
<i>Hyphessobrycon gr. agulha</i>	Fowler, 1913	1	0	0
<i>Hyphessobrycon bentosi</i>	Durbin, 1908	1	0	1
<i>Hyphessobrycon gr. bentosi</i>	Durbin, 1908	0	1	0
<i>Hyphessobrycon bentosi-rosaceus</i>	Durbin, 1909	1	1	1
<i>Hyphessobrycon eos</i>	Durbin, 1909	1	1	0
<i>Hyphessobrycon minimus</i>	Durbin, 1909	1	0	0
<i>Hyphessobrycon minor</i>	Durbin, 1909	1	0	0
<i>Hyphessobrycon rosaceus</i>	Durbin, 1909	1	0	0
<i>Hyphessobrycon</i> sp		1	0	1
<i>Iguanodectes spilurus</i>	(Günther, 1864)	1	0	1
<i>Jupiaba abramoides</i>	(Eigenmann, 1909)	1	1	1
<i>Jupiaba essequeibensis</i>	(Eigenmann, 1909)	1	1	1
<i>Jupiaba pinnata</i>	(Eigenmann, 1909)	0	1	1
<i>Jupiaba polylepis</i>	(Günther, 1864)	1	1	1
<i>Jupiaba potaroensis</i>	(Eigenmann, 1909)	0	0	1
<i>Knodus heteresthes</i>	(Eigenmann, 1908)	1	0	0
<i>Knodus</i> sp		1	1	0
<i>Metynnis argenteus</i>	Ahl, 1923	1	0	0
<i>Metynnis hypsauchen</i>	(Müller & Troschel, 1844)	1	0	0
<i>Metynnis luna</i>	Cope, 1878	1	0	0
<i>Microschemobrycon casiquiare</i>	Böhlke, 1953	1	0	1
<i>Microschemobrycon geisleri</i>	Géry, 1973	0	1	1
<i>Microschemobrycon</i> sp		1	0	0
<i>Moenkhausia chrysargyrea</i>	(Günther, 1864)	1	1	1
<i>Moenkhausia gr. chrysargyrea</i>	(Günther, 1864)	1	0	0
<i>Moenkhausia collettii</i>	(Steindachner, 1882)	1	1	1
<i>Moenkhausia copei</i>	(Steindachner, 1882)	1	1	1
<i>Moenkhausia cotinho</i>	Eigenmann, 1908	1	0	0
<i>Moenkhausia dichrourea</i>	(Kner, 1859)	1	0	0
<i>Moenkhausia georgiae</i>	Géry, 1965	0	1	1
<i>Moenkhausia grandisquamis</i>	(Müller & Troschel, 1845)	1	0	0
<i>Moenkhausia lepidura</i>	(Kner, 1858)	1	1	1

Appendix 1. (continued)

Order, Family, Genus and Species	Authority	Essequibo	Siparuni	Burro-Burro
<i>Moenkhausia megalops</i>	Eigenmann, 1907	1	0	1
<i>Moenkhausia oligolepis</i>	(Günther, 1864)	1	1	1
<i>Moenkhausia shideleri</i>	Eigenmann, 1909	0	1	0
<i>Moenkhausia surinamensis</i>	Géry, 1965	0	1	0
<i>Moenkhausia</i> sp 1		1	0	0
<i>Moenkhausia</i> sp 2		1	0	0
<i>Moenkhausia</i> sp 3		1	0	0
<i>Moenkhausia</i> sp 4		1	0	0
<i>Myleus rhomboidalis</i>	(Cuvier, 1818)	1	1	1
<i>Myleus rubripinnis</i>	(Müller & Troschel, 1844)	1	0	1
<i>Myleus torquatus</i>	(Kner, 1858)	1	0	1
<i>Myleus</i> sp		1	1	1
<i>Oxybrycon</i> sp		1	0	0
<i>Parapristella aubynei</i>	Eigenmann, 1909	1	0	0
<i>Phenacogaster megalostictus</i>	Eigenmann, 1909	1	1	1
<i>Phenacogaster microstictus</i>	Eigenmann, 1909	1	0	0
<i>Phenacogaster</i> sp		1	0	1
<i>Piaractus brachypomus</i>	(Cuvier, 1818)	1	0	0
<i>Poptella compressa</i>	(Günther, 1864)	1	0	1
<i>Pristella maxillaries</i>	(Ulrey, 1894)	1	0	0
<i>Pristobrycon</i> sp		1	0	0
<i>Pristobrycon striolatus</i>	Steindachner, 1908	1	1	1
<i>Pygocentrus nattereri</i>	Kner, 1858	1	0	0
<i>Pygopristis denticulate</i>	(Cuvier, 1819)	1	0	0
<i>Roeboides thurni</i>	Eigenmann, 1912	1	1	0
<i>Serrasalmus rhombeus</i>	(Linnaeus, 1766)	1	0	1
<i>Serrasalmus serrulatus</i>	(Valenciennes, 1850)	1	1	1
<i>Serrasalmus</i> sp		1	1	1
<i>Tetragonopterus argenteus</i>	Cuvier, 1816	1	0	1
<i>Tetragonopterus chalceus</i>	Spix & Agassiz, 1829	1	0	1
<i>Thrissobrycon</i> sp	Böhlke, 1953	1	0	0
<i>Triportheus angulatus</i>	(Spix & Agassiz, 1829)	1	0	0
<i>Triportheus rotundatus</i>	(Jardine, 1841)	1	1	1
Unidentified		1	1	0
CHILODONTIDAE				
<i>Caenotropus labyrinthicus</i>	(Kner, 1859)	1	0	0
<i>Caenotropus maculosus</i>	(Eigenmann, 1912)	1	0	1
<i>Chilodus punctatus</i>	Müller & Troschel, 1844	1	0	0
CRENUCHIDAE				
<i>Ammocryptocharax lateralis</i>	(Eigenmann, 1909)	0	1	1
<i>Ammocryptocharax vintonae</i>	(Eigenmann, 1909)	1	1	1
<i>Characidium gr. fasciatum</i>	Reinhardt, 1866	0	1	1
<i>Characidium pteroides</i>	Eigenmann, 1909	1	0	0
<i>Characidium steindachneri</i>	Cope, 1878	1	0	0
<i>Crenuchus spilurus</i>	Günther, 1864	1	1	1
<i>Leptocharacidium</i> sp		0	1	0
<i>Melanocharacidium blennioides</i>	(Eigenmann, 1909)	1	1	1
<i>Melanocharacidium dispilomma</i>	Buckup, 1993	0	1	1
<i>Microcharacidium eleotrioides</i>	(Géry, 1960)	0	1	1
<i>Microcharacidium</i> sp		1	1	0
CTENOLUCIIDAE				
<i>Boulengerela cuvieri</i>	(Agassiz, 1829)	1	0	0
CURIMATIDAE				
<i>Curimata cyprinoides</i>	(Linnaeus, 1766)	1	0	0
<i>Curimata roseni</i>	Vari, 1989	1	0	0
<i>Curimata vittata</i>	(Kner, 1858)	1	0	0
<i>Curimatella immaculate</i>	(Fernández-Yépez, 1948)	1	0	0

Appendix 1. (continued)

Order, Family, Genus and Species	Authority	Essequibo	Siparuni	Burro-Burro
<i>Curimatopsis crypticus</i>	Vari, 1982	1	0	0
<i>Cyphocharax festivus</i>	Vari, 1992	1	1	0
<i>Cyphocharax microcephalus</i>	(Eigenmann & Eigenmann, 1889)	1	0	0
<i>Cyphocharax spilurus</i>	(Günther, 1864)	1	1	1
<i>Cyphocharax</i> sp 1		1	0	0
<i>Cyphocharax</i> sp 2		1	0	0
<i>Psectrogaster ciliata</i>	(Müller & Troschel, 1844)	1	0	0
<i>Psectrogaster essequeibensis</i>	(Günther, 1864)	1	1	0
<i>Steindachnerina bimaculata</i>	(Steindachner, 1876)	1	0	0
<i>Steindachnerina planiventris</i>	Vari & Vari, 1989	1	0	0
CYNODONTIDAE				
<i>Cynodon gibbus</i>	Spix & Agassiz, 1829	0	1	1
<i>Hydrolycus armatus</i>	(Jardine & Schomburgk, 1841)	1	0	0
<i>Hydrolycus tatauaia</i>	Toledo-Piza, Menezes & Santos, 1999	1	1	0
<i>Roestes molossus</i>	(Kner, 1858)	1	0	0
<i>Roestes ogilviei</i>	(Fowler, 1914)	1	0	0
ERYTHRINIDAE				
<i>Erythrinus erythrinus</i>	(Bloch & Schneider, 1801)	1	1	1
<i>Hoplerythrinus unitaeniatus</i>	(Agassiz, 1829)	1	1	1
<i>Hoplias macrophthalmus</i>	(Pellegrin, 1907)	1	1	1
<i>Hoplias malabaricus</i>	(Bloch, 1794)	1	1	1
<i>Hoplias</i> sp		1	1	1
GASTEROPELECIDAE				
<i>Carnegiella strigata</i>	(Günther, 1864)	1	1	1
HEMIODONTIDAE				
<i>Argonectes longiceps</i>	(Kner, 1858)	1	0	0
<i>Bivibranchia bimaculata</i>	Vari, 1985	1	0	0
<i>Bivibranchia fowleri</i>	Steindachner, 1908	1	0	0
<i>Hemiodus argenteus</i>	(Pellegrin, 1908)	1	0	0
<i>Hemiodus gracilis</i>	Günther, 1864	1	0	0
<i>Hemiodus gr. gracilis</i>	Günther, 1864	1	0	0
<i>Hemiodus microlepis</i>	(Kner, 1858)	1	0	0
<i>Hemiodopsis</i> sp 1		1	0	0
<i>Hemiodopsis</i> sp 2		1	0	0
<i>Hemiodus quadrimaculatus</i>	Pellegrin, 1908	1	1	1
<i>Hemiodus gr. semitaeniatus</i>	Kner, 1858	0	0	1
<i>Hemiodus unimaculatus</i>	(Bloch, 1794)	1	0	1
LEBIASINIDAE				
<i>Nannostomus eques</i>	Steindachner, 1876	1	1	0
<i>Nannostomus harrisoni</i>	Eigenmann, 1909	0	0	1
<i>Nannostomus marginatus</i>	Eigenmann, 1909	1	1	1
<i>Nannostomus minimus</i>	Eigenmann, 1909	1	1	1
<i>Nannostomus trifasciatus</i>	Steindachner, 1876	1	0	0
<i>Nannostomus unifasciatus</i>	Steindachner, 1876	1	0	0
<i>Pyrrhulina filamentosa</i>	Valenciennes, 1847	1	1	1
<i>Pyrrhulina stoli</i>	Boeseman, 1953	1	0	0
<i>Pyrrhulina</i> sp		1	0	0
PARODONTIDAE				
<i>Parodon guyanensis</i>	Géry, 1959	0	1	1
PROCHILODONTIDAE				
<i>Prochilodus rubrotaeniatus</i>	Jardine & Schomburgk, 1841	1	1	0
SILURIFORMES				
ASPREDINIDAE				
<i>Bunocephalus amaurus</i>	Eigenmann, 1912	1	0	0
<i>Bunocephalus coracoideus</i>	Cope, 1874	1	1	0
<i>Bunocephalus verrucosus</i>	(Walbaum, 1792)	1	1	0

Appendix 1. (*continued*)

Order, Family, Genus and Species	Authority	Essequibo	Siparuni	Burro-Burro
AUCHENIPTERIDAE				
<i>Ageneiosus inermis</i>	(Linnaeus, 1766)	1	0	1
<i>Ageneiosus pardalis</i>	Lütken, 1874	1	0	1
<i>Ageneiosus piperatus</i>	(Eigenmann, 1912)	1	0	0
<i>Auchenipterus demerarae</i>	Eigenmann, 1912	0	1	0
<i>Auchenipterus nuchalis</i>	(Spix & Agassiz, 1829)	1	0	0
<i>Centromochlus heckelii</i>	(De Filippi, 1853)	1	0	0
<i>Centromochlus schultzi</i>	Rössel, 1962	1	0	0
<i>Centromochlus</i> sp		1	0	0
<i>Pseudauchenipterus nodosus</i>	(Bloch, 1794)	1	0	1
<i>Pseudauchenipterus</i> sp		1	0	0
<i>Tatia aulopygia</i>	(Kner, 1858)	1	0	0
<i>Tatia creutzbergi</i>	(Boeseman, 1953)	0	1	0
<i>Tatia</i> sp 1		1	0	0
<i>Tatia</i> sp 2		1	1	1
<i>Trachylopterus galeatus</i>	(Linnaeus, 1766)	1	0	0
<i>Trachycorystes trachycorystes</i>	(Valenciennes, 1840)	1	0	0
<i>Trachycorystes</i> sp		1	0	0
Unidentified		0	0	1
CALLICHTHYIDAE				
<i>Callichthys callichthys</i>	(Linnaeus, 1758)	1	0	0
<i>Corydoras melanistius</i>	Regan, 1912	1	1	1
<i>Corydoras punctatus</i>	(Bloch, 1794)	1	0	0
<i>Corydoras gr. simulatus</i>	Weitzman & Nijssen, 1970	1	1	0
<i>Corydoras</i> sp		1	0	0
<i>Megalechis thoracata</i>	(Valenciennes, 1840)	1	1	1
CETOPSIDAE				
<i>Helogenes marmoratus</i>	Günther, 1863	1	1	1
<i>Pseudocetopsis minuta</i>	(Eigenmann, 1912)	1	0	0
Unidentified		0	1	0
DORADIDAE				
<i>Acanthodoras cataphractus</i>	(Linnaeus, 1758)	1	1	0
<i>Acanthodoras spinosissimus</i>	(Eigenmann & Eigenmann, 1888)	1	0	1
<i>Amblyodoras affinis</i>	(Kner, 1855)	1	1	1
<i>Doras carinatus</i>	(Linnaeus, 1766)	1	1	1
<i>Doras micropoeus</i>	(Eigenmann, 1912)	1	0	0
<i>Hassar orestis</i>	(Steindachner, 1875)	1	0	0
<i>Leptodoras basemani</i>	(Steindachner, 1915)	1	0	0
<i>Leptodoras linnelli</i>	Eigenmann, 1912	1	0	0
<i>Nemadoras leporhinus</i>	(Eigenmann, 1912)	1	0	0
<i>Oxydoras niger</i>	(Valenciennes, 1821)	1	1	0
<i>Physopyxis lyra</i>	Cope, 1871	1	1	1
<i>Platydoras</i> cf. <i>costatus</i>	(Linnaeus, 1758)	0	1	0
<i>Trachydoras</i> cf. <i>brevis</i>	(Kner, 1853)	1	0	0
<i>Trachydoras microstomus</i>	(Eigenmann, 1912)	1	0	0
HEPTAPTERIDAE				
<i>Brachyglanis frenata</i>	Eigenmann, 1912	1	0	0
<i>Chasmocranus brevior</i>	Eigenmann, 1912	1	0	0
<i>Chasmocranus longior</i>	Eigenmann, 1912	1	1	1
<i>Chasmocranus</i> sp		0	1	0
<i>Goeldiella eques</i>	(Müller & Troschel, 1848)	1	0	1
<i>Heptapterus</i> sp 1		0	0	1
<i>Heptapterus</i> sp 2		1	1	0
<i>Heptapterus</i> sp 3		1	0	0
<i>Pimelodella cristata</i>	(Müller & Troschel, 1848)	1	1	1
<i>Pimelodella macturki</i>	Eigenmann, 1912	1	0	0
<i>Pimelodella megalops</i>	Eigenmann, 1912	1	0	0

Appendix 1. (*continued*)

Order, Family, Genus and Species	Authority	Essequibo	Siparuni	Burro-Burro
<i>Pimelodella</i> sp		0	1	0
<i>Rhamdia laukidi</i>	Bleeker, 1858	0	1	1
<i>Rhamdia quelen</i>	(Quoy & Gaimard, 1824)	1	1	1
<i>Rhamdia</i> sp		1	0	0
LORICARIIDAE				
<i>Ancistrus hoplogenyis</i>	(Günther, 1864)	0	1	0
<i>Ancistrus lithurgicus</i>	Eigenmann, 1912	1	0	1
<i>Ancistrus temmincki</i>	(Valenciennes, 1840)	1	0	0
<i>Ancistrus</i> sp		0	1	0
<i>Cteniloricaria platystoma</i>	(Günther, 1868)	1	1	1
<i>Cteniloricaria</i> sp		1	0	0
<i>Dasylicaria</i> sp		0	1	0
<i>Farlowella amazona</i>	(Günther, 1864)	1	0	0
<i>Farlowella nattereri</i>	Steindachner, 1910	0	0	1
<i>Farlowella rugosa</i>	Boeseman, 1971	0	1	0
<i>Farlowella</i> sp 1		1	0	0
<i>Farlowella</i> sp 2		1	0	0
<i>Farlowella</i> sp 3		1	0	0
<i>Hemiodontichthys acipenserinus</i>	(Kner, 1853)	1	0	0
<i>Hypoptopoma guianense</i>	Boeseman, 1974	1	0	1
<i>Hypoptopoma</i> sp		1	0	0
<i>Hypostomus hemiurus</i>	(Eigenmann, 1912)	1	0	0
<i>Hypostomus plecostomus</i>	(Linnaeus, 1758)	1	0	0
<i>Hypostomus watwata</i>	(Hancock, 1828)	1	1	0
<i>Limatulichthys griseus</i>	(Eigenmann, 1909)	1	0	0
<i>Limatulichthys</i> sp		1	1	0
<i>Lithoxus lithoides</i>	Eigenmann, 1910	1	1	1
<i>Loricaria cataphracta</i>	Linnaeus, 1758	1	0	0
<i>Loricaria</i> sp 1		1	0	0
<i>Loricaria</i> sp 2		1	0	0
<i>Loricariichthys brunnea</i>	(Hancock, 1828)	1	0	0
<i>Loricariichthys</i> sp		1	0	0
<i>Oxyropsis carinata</i>	(Steindachner, 1879)	1	0	0
<i>Parotocinclus britskii</i>	Boeseman, 1974	1	1	1
<i>Parotocinclus collinsae</i>	Schmidt & Ferraris, 1985	1	1	1
<i>Pseudacanthicus leopardus</i>	(Fowler, 1914)	1	0	0
<i>Pseudancistrus barbatus</i>	(Valenciennes, 1840)	1	1	1
<i>Pseudancistrus nigrescens</i>	Eigenmann, 1912	1	0	1
<i>Pseudancistrus</i> sp 1		1	1	1
<i>Rineloricaria</i> sp 1		1	0	1
<i>Rineloricaria</i> sp 2		1	0	0
<i>Rineloricaria fallax</i>	(Steindachner, 1915)	1	0	0
<i>Rineloricaria platyura</i>	(Müller & Troschel, 1848)	1	1	0
<i>Rineloricaria stewarti</i>	(Eigenmann, 1909)	0	1	0
PIMELODIDAE				
<i>Brachyplatystoma filamentosum</i>	(Lichtenstein, 1819)	1	0	0
<i>Brachyplatystoma vaillantii</i>	(Valenciennes, 1840)	1	1	1
<i>Hemisorubim platyrhynchos</i>	(Valenciennes, 1840)	1	1	0
<i>Leiarius marmoratus</i>	(Gill, 1870)	1	1	0
<i>Megalonema platycephalum</i>	Eigenmann, 1912	1	0	0
<i>Phractocephalus hemiliopterus</i>	(Bloch & Schneider, 1801)	1	0	0
<i>Pimelodus albofasciatus</i>	Mees, 1974	1	0	0
<i>Pimelodus blochii</i>	Valenciennes, 1840	0	0	1
<i>Pimelodus blochii</i> - gr. A	Valenciennes, 1840	1	1	1
<i>Pimelodus blochii</i> - gr. B	Valenciennes, 1840	1	1	0
<i>Pimelodus ornatus</i>	Kner, 1858	0	1	1
<i>Pirinampus pirinampu</i>	(Spix & Agassiz, 1829)	0	1	0

Appendix 1. (*continued*)

Order, Family, Genus and Species	Authority	Essequibo	Siparuni	Burro-Burro
<i>Pseudoplatystoma fasciatum</i>	(Linnaeus, 1766)	1	1	0
<i>Pseudoplatystoma tigrinum</i>	(Valenciennes, 1840)	1	0	0
<i>Sorubim lima</i>	(Bloch & Schneider, 1801)	1	0	0
<i>Zungaro zungaro</i>	(Humboldt, 1821)	1	0	0
PSEUDOPIMELODIDAE				
<i>Batrachoglanis raninus</i>	(Valenciennes, 1840)	1	1	1
<i>Microglanis poecilus</i>	Eigenmann, 1912	1	0	1
<i>Pseudopimelodus</i> sp		0	1	0
TRICHOMYCTERIDAE				
<i>Haemomaster</i> sp		1	0	0
<i>Henonemus punctatus</i>	Boulenger, 1887	1	0	0
<i>Homodiaetus</i> sp 1		1	0	0
<i>Homodiaetus</i> sp 2		1	0	0
<i>Ituglanis gracilior</i>	(Eigenmann, 1912)	1	0	0
<i>Ochmacanthus</i> sp 1		1	0	0
<i>Ochmacanthus</i> sp 2		1	0	0
<i>Ochmacanthus</i> sp 3		1	0	0
<i>Stegophilus</i> sp		1	0	0
<i>Trichomycterus</i> sp		0	0	1
<i>Vandellia beccarii</i>	Di Caporiacco, 1935	1	0	0
<i>Vandellia cirrhosa</i>	Valenciennes, 1846	1	0	0
<i>Vandellia</i> sp		1	0	0
GYMNOTIFORMES				
APTERONOTIDAE				
<i>Apteronotus albifrons</i>	(Linnaeus, 1766)	0	1	1
<i>Apteronotus leptorhynchus</i>	(Ellis, 1912)	1	0	0
<i>Apteronotus</i> sp		0	0	1
<i>Porotergus gimbeli</i>	Ellis, 1912	1	0	0
<i>Porotergus gymnotus</i>	Ellis, 1912	1	0	0
<i>Sternarchorhynchus oxyrhynchus</i>	(Müller & Troschel, 1849)	1	0	0
GYMNOTIDAE				
<i>Electrophorus electricus</i>	(Linnaeus, 1766)	1	1	1
<i>Gymnotus anguillaris</i>	Hoedeman, 1962	1	1	1
<i>Gymnotus carapo</i>	Linnaeus, 1758	1	1	1
<i>Gymnotus</i> sp		1	0	1
HYPOPOMIDAE				
<i>Brachyhypopomus beebei</i>	(Schultz, 1944)	1	1	1
<i>Brachyhypopomus</i> sp		1	0	0
<i>Hypopomus artedi</i>	(Kaup, 1856)	0	1	1
<i>Hypopomus</i> sp 1		0	0	1
<i>Hypopomus</i> sp 2		1	0	0
<i>Hypopomus</i> sp 3		1	0	0
<i>Hypopomus</i> sp 4		1	0	0
<i>Hypopygus lepturus</i>	Hoedeman, 1962	1	1	1
<i>Hypopygus</i> sp 1		1	0	0
<i>Hypopygus</i> sp 2		1	0	0
<i>Microsternarchus</i> sp 1		1	1	0
<i>Microsternarchus</i> sp 2		1	0	0
<i>Platyrosteronarchus macrostomus</i>	(Günther, 1870)	1	0	0
<i>Steatogenys elegans</i>	(Steindachner, 1880)	1	0	1
RHAMPHYCHTHYIDAE				
<i>Gymnorhamphichthys rondoni</i>	(Miranda-Ribeiro, 1920)	1	0	1
<i>Gymnorhamphichthys</i> sp		1	0	0
STERNOPYGIDAE				
<i>Distocyclus conirostris</i>	(Eigenmann & Allen, 1942)	1	0	0
<i>Eigenmannia limbata</i>	(Schreiner & Miranda-Ribeiro, 1903)	0	1	1
<i>Eigenmannia macrops</i>	(Boulenger, 1897)	1	0	0

Appendix 1. (*continued*)

Order, Family, Genus and Species	Authority	Essequibo	Siparuni	Burro-Burro
<i>Eigenmannia virescens</i>	(Valenciennes, 1842)	1	1	1
<i>Eigenmannia</i> sp		0	0	1
<i>Rhabdolichops</i> sp		1	0	0
<i>Sternopygus macrurus</i>	(Bloch & Schneider, 1801)	1	1	1
CYPRINODONTIFORMES				
POECILIIDAE				
<i>Poecilia reticulata</i>	Peters, 1859	1	0	0
RIVULIDAE				
<i>Rivulus waimacui</i>	Eigenmann, 1909	1	0	0
<i>Rivulus</i> sp		1	1	1
BELONIFORMES		0	0	0
BELONIDAE		0	0	0
<i>Potamorhaphis guianensis</i>	(Jardine, 1843)	1	1	1
<i>Pseudotylorus microps</i>	(Günther, 1866)	1	0	0
SYNBRANCHIFORMES				
SYNBRANCHIDAE				
<i>Synbranchus marmoratus</i>	Bloch, 1795	1	1	0
PERCIFORMES				
CICHLIDAE				
<i>Acaronia nassa</i>	(Heckel, 1840)	1	0	0
<i>Aequidens tetramerus</i>	(Heckel, 1840)	1	1	1
<i>Apistogramma ortmanni</i>	(Eigenmann, 1912)	1	1	1
<i>Apistogramma steindachmeri</i>	(Regan, 1908)	1	1	1
<i>Biotodoma cupido</i>	(Heckel, 1840)	1	0	1
<i>Chaetobranchus flavescens</i>	Heckel, 1840	1	0	0
<i>Cichla ocellaris</i>	Bloch & Schneider, 1801	1	0	1
<i>Crenicichla alta</i>	Eigenmann, 1912	1	1	1
<i>Crenicichla Johanna</i>	Heckel, 1840	1	1	1
<i>Crenicichla lugubris</i>	Heckel, 1840	1	1	1
<i>Crenicichla strigata</i>	Günther, 1862	0	0	1
<i>Crenicichla wallacei</i>	Regan, 1905	1	0	1
<i>Crenicichla gr. wallacei</i>	Regan, 1905	0	1	0
<i>Crenicichla</i> sp		1	1	1
<i>Geophagus brachybranchus</i>	Kullander & Nijssen, 1989	1	0	0
<i>Geophagus surinamensis</i>	(Bloch, 1791)	1	1	0
<i>Guianacara geayi</i>	(Pellegrin, 1902)	1	0	0
<i>Guianacara owroewefi</i>	Kullander & Nijssen, 1989	1	1	1
<i>Heros efasciatus</i>	Heckel, 1840	1	0	0
<i>Heros severus</i>	Heckel, 1840	1	0	0
<i>Mesonauta festivus</i>	(Heckel, 1840)	1	0	0
<i>Mesonauta cf. insignis</i>	(Heckel, 1840)	1	0	0
<i>Pterophyllum scalare</i>	(Schultze, 1823)	1	0	0
<i>Satanoperca jurupari</i>	Heckel, 1840	1	0	0
<i>Satanoperca leucosticta</i>	(Müller & Troschel, 1849)	1	1	1
SCIAENIDAE				
<i>Pachypops trifilis</i>	(Müller & Troschel, 1849)	1	0	0
<i>Pachypops</i> sp		1	0	0
<i>Pachyurus</i> sp		1	0	0
<i>Petilipinnis grunniens</i>	(Jardine, 1843)	1	1	0
<i>Plagioscion squamosissimus</i>	(Heckel, 1840)	1	1	1
PLEURONECTIFORMES				
ACHIRIDAE				
<i>Hypoclinemus mentalis</i>	(Günther, 1862)	1	0	0
<i>Soleonasmus finis</i>	Eigenmann, 1912	1	0	0
TETRAODONTIFORMES				
TETRAODONTIDAE				
<i>Colomesus asellus</i>	(Müller & Troschel, 1849)	1	1	1