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Composition, abundance and biomass of the benthic fish fauna from the Guaritico river of a Venezuelan floodplain

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Keywords : Fish composition, abundance, biomass, benthic fish, floodplain systems, Guaritico River, Venezuela.

The compositon, abundance and biomass of the benthic fish fauna were studied along a 6 km stretch of the Guaritico River. This water course is located in the western plains of Venezuela and belongs to the Apure River floodplain system. Monthly collections from June, 1990 to January, 1991 were made by means of a small trawling apparatus rigged to dugout canoes according to the design of López-Rojas et al. (1984). 42 fish species were identified with a dominance of species from the orders Siluriformes and Gymnotiformes. The fish assemblage differed markedly from other Venezuelan river systems. Seasonally, higher diversity and evenness were observed at the high water phase while the abundance, relative biomass and CPUE were higher at low water.

Composition, abondance et biomasse des poissons benthiques dans la rivière de plaine Guaritico du Vénézuela

Mots clés : Abondance, biomasse, poissons benthiques, système de plaine d'inondation, rivière Guaritico, Vénézuela.

La composition, l'abondance et la biomasse de la faune pisciaire benthique ont été étudiées sur un tronçon de 6 km de la rivière Guaritico. Ce système se situe dans les plaines occidentales du Vénézuela et appartient au réseau hydrographique de la rivière Apure. Des récoltes mensuelles de juin 1990 à janvier 1991 ont été faites à partir de pirogues équipées d'un chalut (modèle Lopez-Rojas et al. 1984).

Sur les 42 espèces de poissons identifiées prédominent les Siluriformes et Gymnotiformes. L'association pisciaire diffère nettement de celle des autres systèmes de rivière du Vénézuela. Les plus grandes diversité et équitabilité ont été observées pendant la période de hautes eaux alors que l'abondance, la biomasse relative et la capture par unité d'effort (CPUE) étaient les plus fortes en période d'étiage.

1. Introduction

The study of the fish communities associated with the main channel of Venezuelan rivers began in 1978 with the expedition of the research vessel « Eastward » to the Lower Orinoco. The results revealed the presence of a fish fauna practically unknown up to that time. During the expedition, a trawling apparatus was designed to sample in shallower areas. The results of the efficiency of this gear were published by López-Rojas et al. (1984). Similar collections were carried out in the Napo River (Ecuador) between 1981-1983 (Stewart et al. 1987). Collections were later made in the Orinoco River Delta using experimental trawling nets (Cervigón 1982, 1985, Cervigón & Novoa 1988, Novoa 1982, 1986, Novoa & Cervigón 1982, Ponte 1990, Ramos et al. 1982).

Systematic research on the taxonomic, ecological and fishery aspects of the benthic fish fauna of the Apure River began in 1983 (Castillo 1988, Machado-Allison 1987, Marrero 1984, 1990, Provenzano & Castillo 1984, Provenzano et al. 1984 a, b, c). This paper reports the results of the research carried out in the Guaritico River (Apure River basin). In 1989, the river was declared a part of a specially protected wildlife area. The objectives of our research were : 1) to determine the species composition of the

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fish fauna associated with the bottom of the river in order to make comparisons with other similar systems ; 2) to quantify the abundance, biomass, and catch per unit effort (CPUE) determined for the first time by means of the apparatus designed by López-Rojas et al. (1984).

2. Study area

The study was made on the last 6 km stretch of the Guaritico River (locally known as caño Guaritico) before its confluence with the Apure River (Fig. 1). The Guaritico River is located on the upper section of the Apure River Basin (Ramia 1972) in a

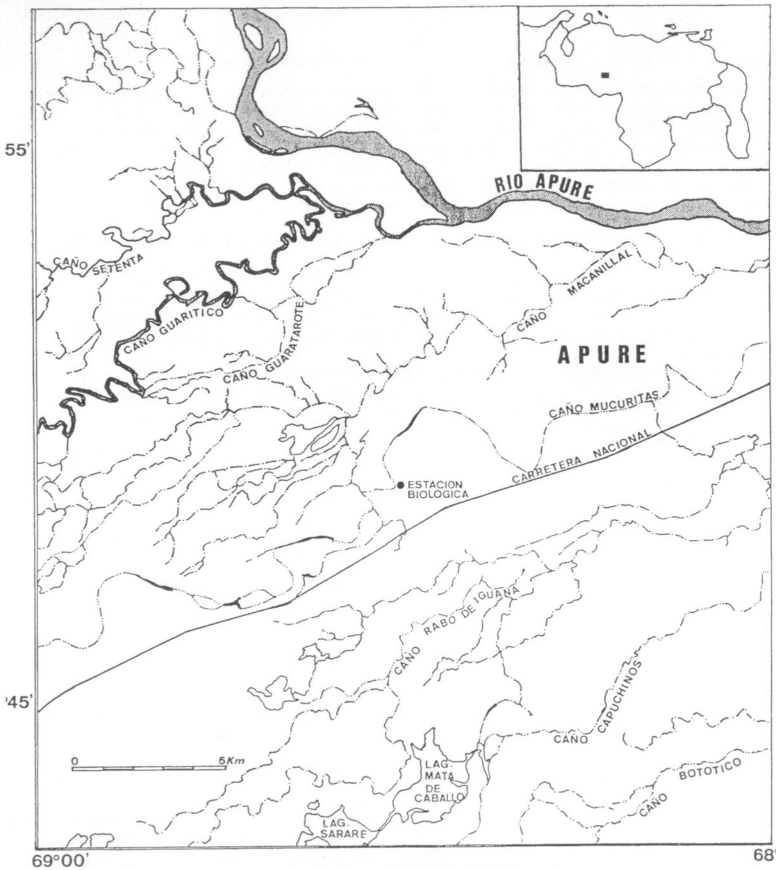

Fig. 1. Study area (dots indicate the studied river section).
Fig. 1. Carte du réseau hydrographique du Rio Apure avec, en pointillés, la section de rivière étudiée.

region of seasonally flooded savannas (Scharger & González 1973, Welcomme 1979). The climatology of the area shows two contrasting periods ; the dry season, which extends from November to April and the rainy season, which extends from May to October. These climatic conditions lead to two hydrometric periods : low waters (December-May) and high waters (June-November) (Fig. 2). In this study, collections of fish were made during both periods.

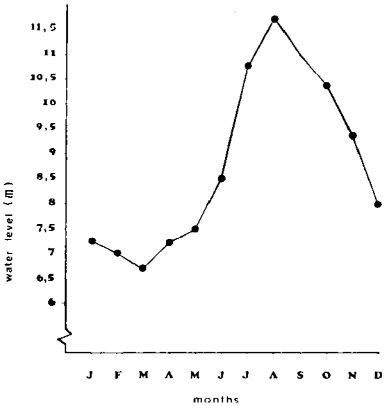

Fig. 2. Water level variations of the Guaritico River (1990).
Fig. 2. Variations du niveau de l'eau de la rivière Guaritico (1990).

During 1990, mean monthly air temperature ranged between 25.1 ° C (July) and 28.9 ° C (April). The Guaritico River supports a seasonally inundated gallery forest. The most representative tree species are *Nectandria pichurini* (H.B.K.) Mez. and *Dugnetia riberensis* Arist. On the river side next to the gallery forest, there is also a tree community known locally as « mangle », dominated by *Coccoloba obtusifolia* Jacq. (Castroviejo & López 1985). According to Sioli's classification of Amazonian river waters, the Guaritico River shows clear-waters characterized by a smaller concentration of suspended solids and a higher water transparency than white-waters. Ranges for pH, water temperature, and conductivity were : 6.0-7.8 pH units ; 28-32 ° C ; and 19.4-21.9 μS.cm^{-1}, respectively. Water transparency (Secchi) showed seasonal oscillations during the year and was generally higher near the confluence of the Guaritico with the Apure River. Water transparency was 25 cm at the end of the dry season and 20 cm at the beginning of the rainy season. The bottom of the channel showed the two types of clays (grey and red) described by Marrero (1990) for the Apure River.

3. Materials and Methods

Monthly collections were made during the high and low water periods between June 1990 and January 1991. Collections were made with a trawling fishing apparatus adapted to dugout canoes according to the design made by López-Rojas et al. (1984). Each trawling lasted for 10 min, covering a mean distance of 147 m., at depths ranging from 2-10 m (Table 1). Catches were preserved with formaldehyde in the field. At the laboratory, fishes were identified, weighed and measured. Species abundance was estimated with respect to the total fishes caught monthly. Diversity (H') was calculated by the Shannon-Weaver index (1949) and the evenness (V') was determined as the inverse value of H' max. Species biomass was calculated as the percentage in weight with respect to the total fish caught and also in terms of kg.ha^{-1}. The latter value and density (ind. ha^{-1}) refer to the area covered by a 10 min trawling effort. The CPUE is expressed as kg.ha.hour^{-1}.

4. Results

4.1. Fish species

42 species from 5 orders, 13 families and 38 genera were identified (Table 2). With 26 spp (61 %) the Siluriformes were the best represented group, followed by the Gymnotiformes (11 spp., 26.2 %), and by the Rajiformes, Perciformes, and Pleuronectiformes which together represented 12 % (5 spp.) of the identified species (Table 3). The dominant families were the Loricariidae, Pimelodidae, and Apteronotidae with 10,9 and 7 species, respectively. Four taxa were identified only to the generic level (*Potamotrygon* sp., *Hemiancistrus* sp., *Duopalatinus* sp., and *Rhamphichthys* sp.). A new genus and species from the family Loricariidae was recorded (Provenzano F., pers. comm.) as well as a new species from the genus *Porotergus* (Apteronotidae). *Aphanoturulus frankei* (Loricariidae) represents a new record for the Venezuelan fish fauna. Before our report, this species was known only from the Ucayali River Basin in Peru.

Table 1. Total number of trawls, effective trawls and time of trawling .Period : June, 1990 - January, 1991.
Tableau 1. Nombre total de chaluts, chaluts efficaces, et durée de chalutage. Période : juin 1990 - janvier 1991.

MONTHS	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY
Number of trawls	13	9	18	12	12	18	11	9
Number of efective trawls	12	9	18	11	11	16	11	8
t total trawls (minutes)	120	90	180	110	110	160	110	80

Table 2. List of fish species associated with the bottom of the Guaritico River.
Tableau 2. Liste d'espèces de poissons benthiques de la rivière Guaritico.

RAJIFORMES
POTAMOTRYGONIDAE
01 *Potamotrygon orbignyi* (Castelnau) 1885
02 *Potamotrygon* sp.
SILURIFORMES
AGENEIOSIDAE
03 *Ageneiosus brevifilis* Cuvier & Valenciennes 1840
04 *Ageneiosus ucayalensis* Castelnau 1855
CETOPSIDAE
05 *Cetopsis coecutiens* (Lichtenstein) 1819
DORADIDAE
06 *Leptodoras linnelli* Eigenmann 1940
07 *Megalodoras irwini* Eigemann 1925
08 *Pterodorus apurensis* (Fernández-Yépez) 1965
HYPOPHTHALMIDAE
09 *Hypophthalmus edentatus* Spix 1829
LORICARIIDAE
10 *Aphanotorulus frankei* Isbrucker y Nijssen 1985
11 *Hemiancistrus* sp.
12 *Limatulichthys punctatus* (Regan) 1904
13 *Loricaria cataphracta* Linnaeus 1758
14 *Loricarichthys maculatus* (Bloch) 1794
15 *Panaque nigrolineatus* (Peters) 1877
16 *Pseudohemiodon laticepts* (Regan) 1904
17 *Pterygoplichthys multirradiatus* (Hancock) 1824
18 *Sturisoma rostratumes* (Spix) 1829
19 Loricariidae gen. et sp. nov.
PIMELODIDAE
20 *Callophysus macropterus* (Lichtenstein) 1819
21 *Duopalatinus* sp.
22 *Hemisorubim platyrhynchos* (Cuvier & Valenciennes) 1890
23 Pimelodidae gen. et sp. nov.
24 *Pimelodella gracilis* (Cuvier & Valenciennes) 1890
25 *Pimelodus blochii* Valenciennes 1840
26 *Pimelodus altissimus* Eigenmann & Pearson 1942
27 *Pinirampus pinirampu* (Spix) 1829
28 *Pseudoplatystoma fasciatum* (Linnaeus) 1766
GYMNOTIFORMES
APTERONOTIDAE
29 *Adontosternarchus devenanzii* Mago-Leccia, Lündber y Baskin, 1985
30 *Adontosternarchus sachsi* (Peters) 1877
31 *Apteronotus bonapartii* (Castelnau) 1855
32 *Porotergus* sp. nov.
33 *Sternarchogiton porcinum* Eigenmann & Allen 1842
34 *Sternarchorhamphus muelleri* (Steindachner) 1881
35 *Sternarchorhynchus curvirostris* (Boulenger) 1877
RHAMPHICHTHYIDAE
36 *Rhamphichthys* sp.
STERNOPYGIDAE
37 *Distocyclus conirostris* Eigenman & Allen 1942
39 *Rhabdolichops eatswardi* Lündberg & Mago-Leccia, 1985
PERCIFORMES
CICHLIDAE
40 *Geophagus altifrons* Heckel 1840
SCIAENIDAE
41 *Plagioscion squamosissimus* (Heckel) 1840
SOLEIDAE
42 *Hypoclinemus mentalis* (Günther) 1862

Table 3. Families, genera, and species for each of the orders from the Guaritico River.
Tableau 3. Nombres de familles, de genres et d'espèces de chaque ordre de la rivière Guaritico.

ORDER	FAMILIES	GENERA	SPECIES/ORDER	%
RAJIFORMES	1	1	2	4,8
SILURIFORMES	6	24	26	61,9
GYMNOTIFORMES	3	10	11	26,2
PERCIFORMES	2	2	2	4,8
PLEURONECTIFORMES	1	1	1	2,4
TOTAL	13	38	42	100

4.2. Diversity and abundance

Highest diversity values were recorded between June and September with a maximum in August (Fig. 3). Diversity decreased between October and January with lowest values in December. Species richness values were highest in June (21 ssp.) and lowest in January (13 ssp.). Evenness showed a similar trend to diversity. Highest equity values were recorded in August while lowest values were recorded in December.

Considering the collections for the entire sampling period, the Siluriformes was the most abundant order (53.3 %) followed by the Gymnotiformes (44.7 %). The remaining orders represented only 2 %. Except in October and November, the Siluriformes was the dominant group throughout the sampling period. In December, this group represented almost 100 % of the catches (Fig. 4). Except for the Gymnotiformes, the contribution of the other groups was small. In June, however, abundance of the Perciformes reached 20 %. Figures 5 a-c show the monthly relative abundance of each species.

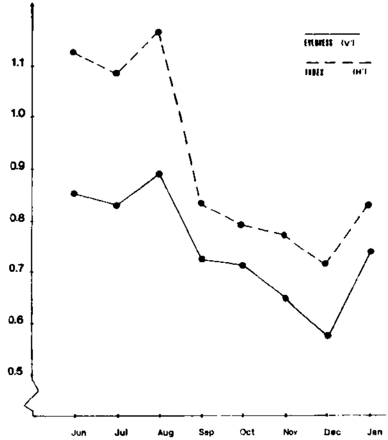

Fig. 3. Variations of fish diversity (H') and evenness.
Fig. 3. Variations de la diversité (H') et de l'équitabilité pisciaires.

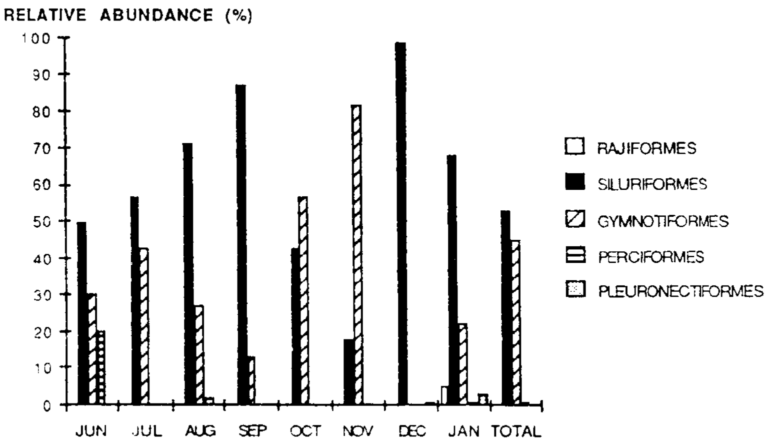

Fig. 4. Monthly relative abundance of each fish order.
Fig. 4. Abondance mensuelle relative des 5 ordres de poissons.

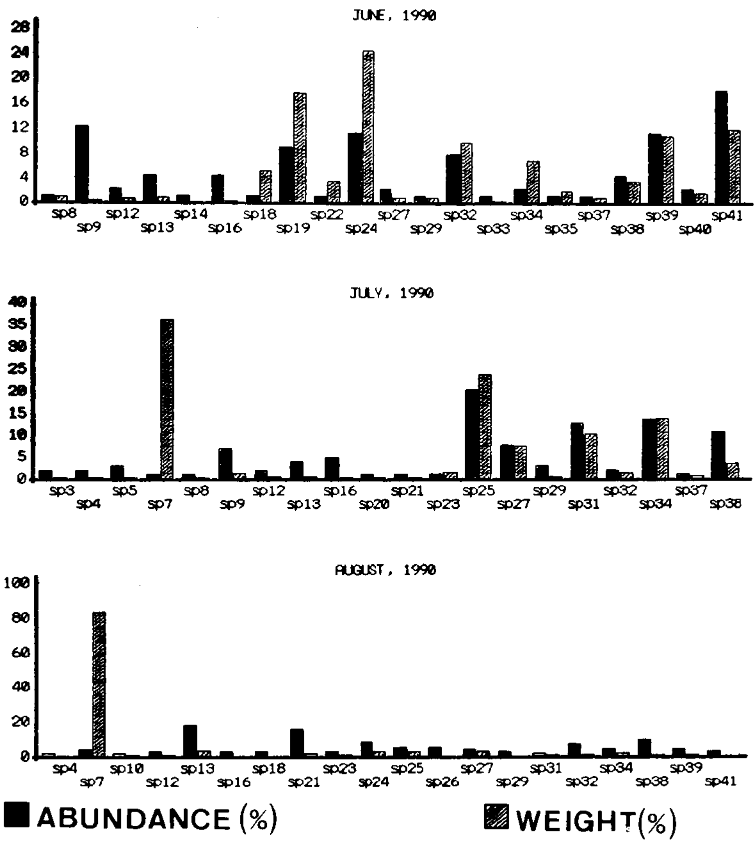

Fig. 5 a. Relative abundance and biomass of fish species for June-August, 1990 (codes on Table 2).

Fig. 5 a. Abondance relative et biomasse des différentes espèces de poissons en juin-août 1990 (code-chiffres : tableau 2).

June was the only month in which the most abundant species (*Plagioscion squamossisimus*, 17.8 %) did not belong to the Siluriformes or Gymnotiformes. This species was followed by *Hypophthalmus edentatus* (12.2 %). In July, *Pimelodus blochii* showed a 20.4 % abundance followed by *Sternarchorhamphus muelleri* with 13.6 %. In August, abundance was similar among species except for *Loricaria cataphracta* and *Duopalatinus* sp. which dominated with 17.7 % and 15.2 %, respectively. *P. blochii* was again the most abundant species (35.7 %) in September, followed by *Pimelodella gracilis*

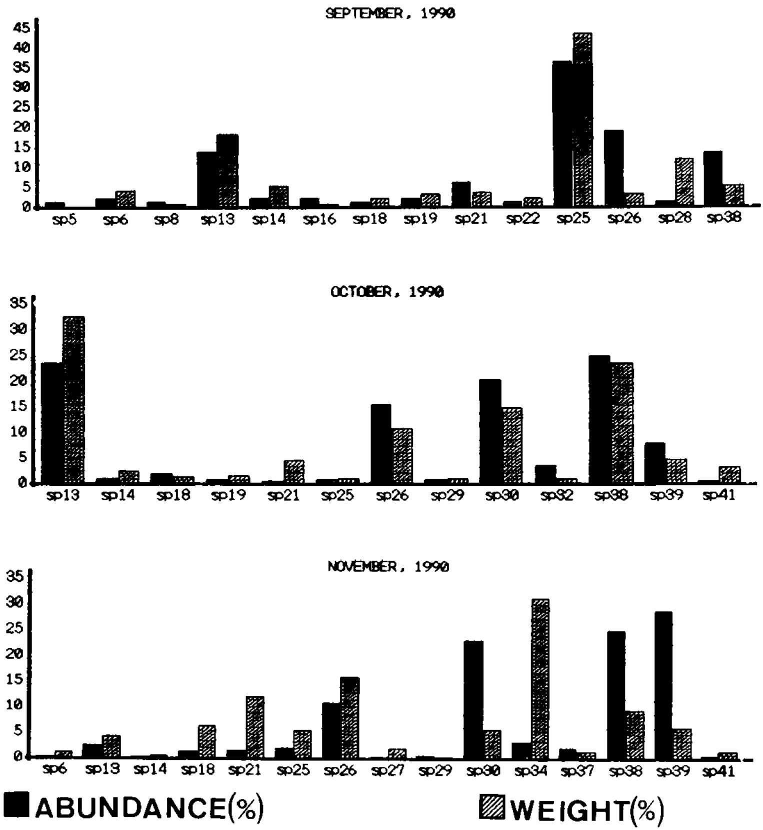

Fig. 5 b. Relative abundance and biomass of fish species for September-November, 1990 (codes on Table 2).
Fig. 5 b. Abondance relative et biomasse des différentes espèces de poissons en septembre-octobre 1990 (code-chiffres : tableau 2).

(18.4 %). In October, a Gymnotiform (*Eigenmannia macrops*) showed highest abundance values (24.9 %) for the first time. This species was followed by *L. cataphracta* (23.4 %). The Gymnotiformes clearly dominated in November (*Rhabdolichops eastwardi*, 28.6 % ; *E. macrops*, 24.9 %). In December, *L. cataphracta* and *P. blochii* showed again highest abundance (60.8 % for both species). Finally, in January, *P. blochii* was again dominant (32.7 %).

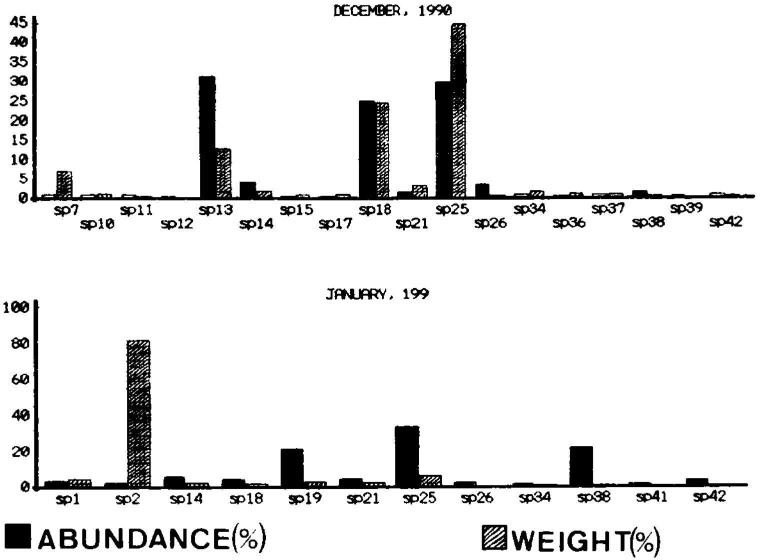

Fig. 5 c. Relative abundance and biomass of fish species for December (1990)-January (1991) (codes on Table 2).
Fig. 5 c. Abondance relative et biomasse des espèces de poissons en décembre 1990-janvier 1991 (code-chiffres : tableau 2).

In terms of ind. ha^{-1}, lowest values were recorded between June and September with minimum values in August (115 ind. ha^{-1}). Highest values were recorded between October and January (maximum of 870 ind. ha^{-1} in December (Fig. 6).

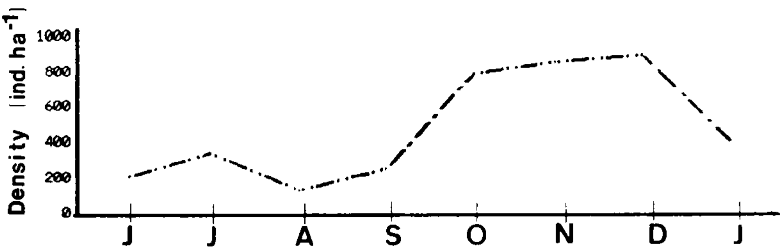

Fig. 6. Monthly fish abundance variations (ind. ha^{-1}).
Fig. 6. Variations mensuelles d'abondance pisciaire (ind. ha^{-1}).

4.3. Biomass and CPUE

With respect to the total catch, the relative biomass indicated a dominance of the Siluriformes (64.9 %) followed by the Rajiformes (21.5 %), and Gymnotiformes (12.9 %). The Perciformes and the Pleuronectiformes together indicated biomass values < 1 %. During the 8 months sampling period, biomass of the Siluriformes was the highest during 6 months (65 %). Only in November and January, was this group displaced by the Gymnotiformes (52.9 %) and by the Rajiformes (85.1 %), respectively (Fig. 7). The relative biomass values for each species are shown in Figures 5 a-c. In June the relative biomass value for *Pimelodus altissimus* was 24.2 % while a new genus and species (Loricariidae) had a value of 17.4 %. In July-August, *Megalodoras irwini* had the highest biomass values (36.6 % and 82.8 %, respectively). Only in September, did we observe highest abundance values corresponding to highest biomass values for one species (*P. blochii*, relative biomass : 42.9 %). In October, *L. cataphracta* was first (32.3 %) followed by *E. macrops* (32.5 %). In November, a Gymnotiform (*Sternarchorhamphus muelleri*) showed the highest biomass values (3.0 %). *P. blochii* (44.7 %) and *Sturisoma rostrata* (24.3 %) represented the most important species in December. Highest biomass of the Rajiformes (81.3 %) was observed in January for the first time.

In terms of $kg.ha^{-1}$, the lowest biomass value was recorded in June (1.7 $kg.ha^{-1}$). In July-August, biomass increased slightly to 9.6 $kg.ha^{-1}$ and then decreased in September-November. Highest values were observed in December-January (26.3 $kg.ha^{-1}$ in January) (Fig. 8). The CPUE showed a similar pattern to biomass. Lowest values corresponded to June (10.6 $kg.ha^{-1}$) and highest values to January (164.4 $kg.ha^{-1}$). (Fig. 9).

5. Discussion

Most of the species from the Guaritico River belong to the Orders Siluriformes and Gymnotiformes (88.1 %). This situation contrasts with records from other neotropical freshwater ecosystems characterized by the dominance of characoid fishes

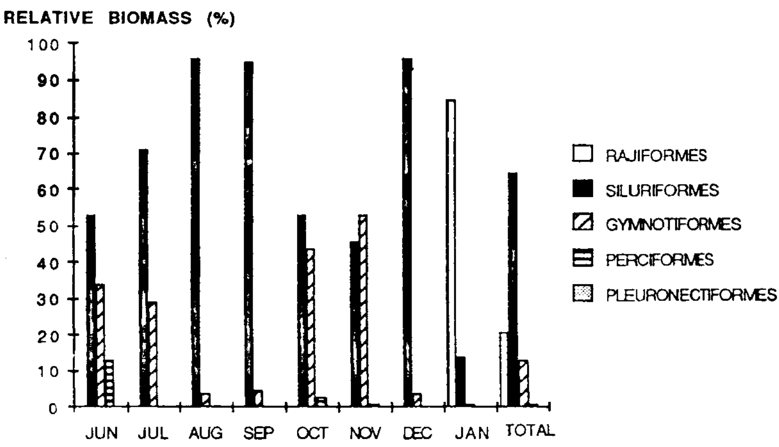

Fig. 7. Monthly variations of the relative biomass of fish order.
Fig. 7. Variations mensuelles de la biomasse relative des 5 ordres de poissons.

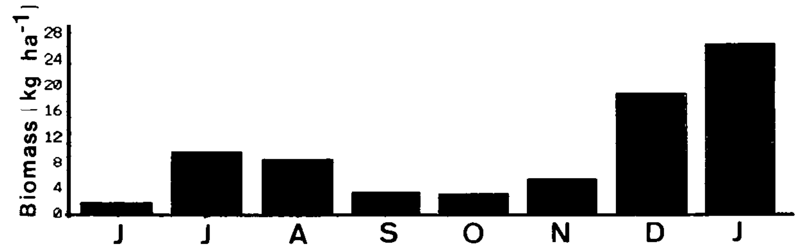

Fig. 8. Monthly fish biomass variations (kg.ha^{-1}).
Fig. 8. Variations mensuelles de la biomasse de poisson (Kg. ha^{-1}).

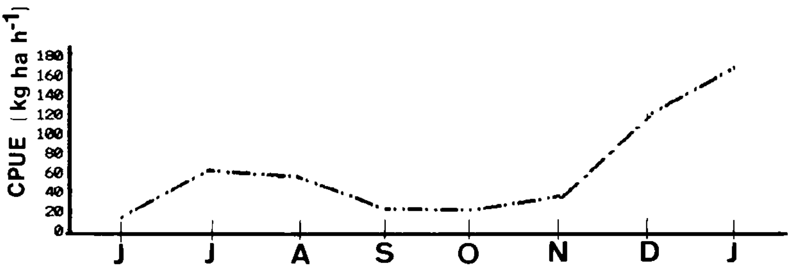

Fig. 9. CPUE variations (kg.ha.h^{-1}).
Fig. 9. Variations de la capture par unité d'effort : CPUE (Kg.ha.h^{-1}).

(Lowe-McConnel 1975, 1987 ; Lowe-McConnell & Howes 1981). Similar results have been reported for the benthic fish communities of the Apure River (Provenzano & Castillo 1984 ; Provenzano et al. 1984 a, b, c) and of the Orinoco River Delta (López-Rojas et al. 1984 ; Ramos et al. 1982). In the lower Orinoco River, López-Rojas et al. (1984) distinguished two fish assemblages ; one assemblage in the deepest sections of the main channel dominated by Gymnotiformes, and another one in adjacent shallower areas dominated by high richness of characoid fishes. In the Guaritico River, however, characoids specially the « piranhas » (*Pygocentrus* and *Serrasalmus*) represent accessory species. Their presence in our catches may be considered accidental as they were caught in the net while preying on other fishes.

In spite of the absence of complete fish lists, we compared the preliminary fish inventories of benthic species of the Guaritico and Apure rivers and of the Orinoco Delta. This comparison revealed a higher similarity between the Apure and the Guaritico River. The basic difference between these two rivers was the absence of certain genera in the Guaritico River : Aspredinidae (*Xyliphius*), Cetopsidae (*Pseudocetopsis*), Pimelodidae (*Megalonema, Pimelodina, Platysilurus, Pseudopimelodus*), Loricariidae (*Apistoloricaria, Dentectus, Farlowella, Lamontichthys, Paraloricaria, Spatuloricaria*). Apteronotidae (*Sternarchella*, plus two new genera) (Provenzano F., pers. comm.). The presence of other species from the Rajiformes, Clupeiformes, Perciformes, and Pleuronectiformes recorded by us in the Guaritico River and not yet recorded from the

Table 4. Accompanying fish species found during the trawling of the bottom of the Guaritico River.

Tableau 4. Espèces de poissons accompagnants trouvées pendant le chalutage du fond de la rivière Guaritico.

CLUPEIFORMES
CLUPEIDAE
Pellona flavipinnis (Valenciennes) 1839
CHARACIFORMES
ANOSTOMIDAE
Leporinus fasciatus (Bloch) 1794
CHARACIDAE
Acestrocephalus sp.
Galeocharax gulo (Cope) 1870
Knodus breviceps (Eigenmann) 1908
Mylossoma duriventris (Cuvier) 1818
Pygocentrus caribe (Valenciennes) 1849
Roeboides affinis (Günther) 1868
Serrasalmus altuvei Ramirez 1965
Serrasalmus irritans Peters 1877
Serrasalmus medinai Ramirez 1965
CURIMATIDAE
Curimata sp.
Steindachnerina argentea (Gill) 1858
Steindachnerina sp.
HEMIODONTIDAE
Hemiodus unimaculatus (Bloch) 1794

Apure River, is most probably due to the absence of more conclusive fish inventories than to the absence of these orders in the latter. With regard to the benthic fish fauna of the Orinoco River (excluding typically estuarine species), some genera are found in this region which have not yet been recorded from the Guaritico River : Engraulidae (*Anchovia, Lycengraulis*), Aspredinidae (*Hoplomyzon, Platystacus*), Doradidae (*Opsodoras*), Pimelodidae (*Nannorhanmdia, Perugia*), Hypopomidae (*Steatogenys*), Soleidae (Apionichthys).

The difference in the number of fish species from different rivers has been related to the size of the drainage surface and length of the main river channel (Welcomme 1985). This observation may explain the lower absolute number of fish species (alpha diversity according to Lowe-McConnell 1987) recorded from the Guaritico River in comparison to the Apure River and the Orinoco Delta (Table 5). The lower number of fish species from the Guaritico may also be the result of the smaller transects sampled by us (some 6 km) compared to the transects sampled in the Apure River and Orinoco Delta. Another factor to consider in explaining the diversity and distribution of fish species of the Guaritico River is the type of water. The clear waters of this river differ from the white waters of the Apure and Orinoco rivers. The importance of water types on the distribution and diversity of neotropical fishes has previously been discussed (Weitzman & Weitzman 1982). In the Apure River, the type of substratum has also been linked to the distribution of some Siluriform and Gymnotiform fish species (Provenzano & Castillo 1984, Provenzano et al. 1984 a, b, c). In our study, the available data do not allow us to consider yet any possible relationships between the type of substrata and fish species.

In the Guaritico River, diversity and evenness showed a similar temporal pattern. Highest values were observed at high waters rather than low waters. A group of fish species was observed during both periods (Table 6) and at least 10 species of catfishes (Siluriformes) were collected exclusively at high waters. These species may be migrating from the Apure River into the Guaritico River.

Table 5. Comparison among the number of fish species from each order from the Guaritico River, Apure and Orinoco River Delta.

Tableau 5. Comparaison des nombres d'espèces de chaque ordre dans les rivières Guaritico et Apure et dans le delta de l'Orénoque.

RIVERS	GUARITICO		APURE		ORINOCO	DELTA
ORDERS	ssp.	(%)	ssp.	(%)	spp.	(%)
RAJIFORMES	**2**	**4,8**	—	—	—	
SILURIFORMES	**26**	**61,9**	**54**	71,0	25	42,4
GYMNOTIFORMES	11	26,2	22	29,0	25	42,4
PERCIFORMES	2	4,8	—	—	3	5,1
PLEURONECTIFORMES	1	2,4	—	—	1	1,7
OTHERS (Clupeiformes and Characiformes)	—	—	—	—	5	8,4
TOTAL	42	100	76	100	59	100

Table 6. Presence and size range (mm) of the species collected in the Guaritico River. Measurements for the Gymnotiformes = total length ; for the Rajiformes = discal width ; other orders = standard length.

Tableau 6. Présence et taille moyenne (mm) des espèces récoltées dans la rivière Guaritico. Mensurations pour les Gymnotiformes = longueur totale ; pour les Rajiformes = largeur du disque ; autres ordres = longueur stardard.

SIZE RANGES (mm)

SPECIES	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY
Potamotrygon orbignyi								122-125
Potamotrygon sp.								330-430
Ageneiosus brevifilis		37-63						
A. ucayalensis		43-59	108					
Cetopsis coecutiens		36-39		37				
Leptodoras linnelli				120-146		145		
Megalodoras irwini		430	400-540				185-271	
Pterodoras apurensis	65	66		53				
Hypophthalmus edentatus	36-38	71-100						
Aphanotorulus frankei			115				59-155	
Hemiancistrus sp.							79-81	
Limatulichthys punctatus	28-84	114-128	114-145				128	
Loricaria cataphracta	62-69	48-81	72-188	88-224	56-124	75-191	80-210	
Loricarichthys maculatus	56			118-190	98-114	102	63-162	164-181
Panaque nigrolineatus							260	
Pseudohemiodon laticeps	33-34	48-75	60-61	45-92				
P. multirradiatus						119		
Sturisoma rostratum	223		88-86	159	75-113	184-227	108-235	176-214
New genus and species	162-166			71-177	123-127			101-182
Callophysus macropterus		83						
Duopalatinus sp.		29	51-150	56-145	165	141-190	142-196	124-159
Hemisorubim platyrhynchos	130			132				
New genus and species		164	42-129					
Pimelodella gracilis			54-62	52-64	43-74	72-40	52-73	55-57
Pimelodus altissimus	112-127		120-135	53-156				
Pimelodus blochii		72-45	77-133	53-156	56-75	62-122	62-135	66-137
Pinirampus pinirampu	62-67	49-248	61-200					
Pseudoplatystoma fasciatum				250				
A. devenanzi	138	64-121	83-84		115-124	92-111		
A. sachsi					93-147	93-139		
Apteronotus bonapartii		54-318	279					
Porotergus sp. n.	179-218	236-260	69-164		56-93			
Sternarchogiton porcinum	88							
S. muelleri	104-390	150-253	146-349					
S. curvirostri	270							
Rhamphichthys sp.							324	
Distociclus conirostris	223	261				283	285-299	
Eigenmannia macrops	205-229	155-244	75-184	96-264	48-259	90-264	75-216	86-120
Rhabdolichops catswardi	180-280		174-243		56-217	57-205	105	
Geophagus altifrons	25							
Plagioscion squamossisimus	35-39		62-66		125	105-194		16
Hypoclinemus mentalis							62-80	45-50

The overall fish abundance was higher at low water and lower at high water A similar trend has been reported for Gymnotiform and Loricariidae fishes from the Apure River (Provenzano F., unpublished). During the dry season, water level and current are reduced. At the onset of the rains and the subsequent increase in water level, water depth and water current are increased. These conditions may explain the smaller fish abundance. In our case, however, the smallest fish density was recorded at low water (January). However, biomass values during this month were highest due to the presence of Rajiform fishes (low abundance and high biomass).

Similar to reports for the Orinoco River Delta (López-Rojas et al. 1984), we did not find a clear relationship between the CPUE and other variables (time of collections, lengths of trawling distances, depth of trawlings, type of substrata). There was, however, a relationship between the CPUE and the period of the year. Highest CPUE values were recorded at low water. Collections of fishes in the Guaritico River with the same fishing gear ranged between 1-130 individuals per trawl. In the Orinoco Delta, the number of fishes caught per trawl was always higher than 100. This information is indicative of the high abundance and fish biomass found in the Orinoco Delta with respect to the Guaritico River. The selectivity of the fishing apparatus, favouring the catch of smaller fishes, was observed in our work where we caught specimens ranging from 33 mm to 540 mm standard length (*Megalodoras irwini*) and 430 mm discal width (*Potamotrygon* sp.) (Table 6). The bottom of the Guaritico River showed an assemblage of fish species in different developmental stages ; species which inhabit the bottom for a period of their life-cycles (i.e. benthonic young stages of Siluriforms) or which inhabit the bottom through most of their developmental stages (Table 7).

Comparing our data with the information provided by Machado-Allison (1987) and by Penczak & Lasso (1991), the highest biomass value (26.3 Kg. ha $^{-1}$) recorded for the Guaritico River is low compared to mean values for other tropical freshwater river systemps.

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Table 7. Species and month of collection of juvenile stages associated with the bottom of the Guaritico River.
Tableau 7. Espèces et mois de capture des stades jeunes récoltés sur le fond de la rivière Guaritico.

MONTHS	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY
A. brevifilis		X						
A. ucayalensis		X						
C. coecutiens		X	X					
P. apurensis	X	X	X					
H. edentatus	X	X						
A. frankei							X	
P. laticeps	X	X						
C. macropterus		X						
Duopalatinus sp		X	X					
P. altissimus				X				
P. blochii				X	X			
P. fasciatum				X				
P. pinirampu	X							
G. altifrons	X							
P. squamossisimus	X		X					X

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