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JUVENILE FISH ASSEMBLAGES OF A TROPICAL FLOODPLAIN RIVER — THE CENTRAL DELTA OF NIGER, MALI — A PRELIMINARY STUDY

Vincent BÉNECH[1], Milan PEŇÁZ[2] and Jean WUILLOT[1]

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[1] Institut Français de Recherche Scientifique pour le Développement en Coopération (ORSTOM), Paris
[2] Institute of Systematic and Ecological Biology, Czechoslovak Academy of Sciences, Brno

Abstract

The species and size composition, relative abundance and biomass were studied in fish assemblages inhabiting various habitats of the Central Delta of the Niger River with a special regard to young-of-the-year fish. A beach fry seine, fine-meshed gill net and fry traps were used when sampling the fish in floodplain sectors Ouro Modi, Mopti and Walado Debo during November 1990, *i.e.* during just decreasing flood and beginning downstream migration of juvenile fish. The results of sampling were strongly dependent upon the types of habitat studied and fishing device used, as well as upon the day time during which the fishing action was performed. Altogether, 38 taxa were registered. The relative abundance and biomass (in terms of catch per one action of a 8-m beach seine) ranged 16 — 2,680 inds and 7 — 976 g, resp. The maximum values of both variables were found on a littoral shallow section of the main channel of the Niger near the village of Barigondaga. The small-sized species of fish, commercially insignificant and obviously competiting with juveniles of the valuable commercial fishes, were highly predominant in catches by seine and traps amounting 92.7 and 97.1 %, resp. On the contrary, in pooled catches with the 16-mm gill net, the YOY of commercially important fishes made up 70.1 % of all fish captured.

Introduction

The importance of floodplains and of their periodical inundation for fish reproduction, nursery of juveniles and, consequently, for the recruitment and production of fish populations is sufficiently known and emphasized in the literature on great alluvial rivers of Europe (Antipa 1928, Holčík & Bastl 1976, Amoros & Roux 1988, Copp 1989, Copp & al. 1991, Peňáz & al. 1991), America (Galagher & Conner 1980, Harrow & Schlesinger 1980, Bayley 1981, Cox-Fernandes 1989, Petry 1989, Bain & Boltz 1989), as well as Africa (Daget 1954, Durand 1970, Bénech & Quensière 1982, 1983a, 1983b, Welcomme 1986).

Also the Niger River creates a vast floodplain system — "The Central Delta of the Niger" — on the territory of Republic Mali with a special hydrological regimen. The fish catch harvested there by fishermen is closely dependent on the occurrence and strength of periodical floods usually appearing during the period July—January.

There exists a long-term tendency of decreasing rain intensity in West Africa, accompanied with the gradually diminishing discharge in the Niger and oher African rivers. This tendency culminated in 1972—1974 and led to catastrophic events called the "Sahelian Drought", characterized by the absence of flood and by subsequent considerable drop in the catches of some fish species (Dansoko & al. 1976, Bénech & Quensière 1982, 1983a, 1983b, 1987). Additionally, the situation was aggravated by the construction of large dams and reservoirs used for electricity and large-scale irrigation of fields. All this stimulated the fish and fisheries research activity aiming at investigating these problems.

Within the research project "Etudes halietiques du Delta Central du Niger", organized and financed by the ORSTOM (Institut Français de Recherche Scientifique pour le Développement en Coopération, Paris), in a cooperation with Institut d'Economie Rurale of Mali, special attention is also being paid to the complex research of reproduction, nursery and juvenile fish biology, especially of the 16 selected species most important from the commercial and/or biological viewpoints.

The main purpose of the present preliminary study, carried out within the mentioned project, was to prove the suitability, efficiency and economy of the methods used for collecting the juvenile fish in the most typical habitats of the Central Delta of Niger. Furthermore, regarding the dynamics, complexity and temporal dependence of the phenomena studied, we colected some informative data on the structure of those fish assemblages, constituted, in various extent, also by juvenile fish, and being related with a rather short period of the first two November decades. This period is distinctive by the just beginning decrease in the flood in the upper part of the floodplain (sector Ouro-Modi) and by its culminating in its central part (sector Walado Debo). Moreover, this period is also characterized by the onset of intensive migrations of young fish from marshes and inundated area, via marigots, to the main channel of the Niger.

Area of Investigation

We collected the fish on altogether 8 stations in three floodplain sectors (Ouro Modi, Mopti and Walado Debo), as indicated on Fig. 1 and Tab. 1.

Three main types of habitats (*cf.* Daget 1954, Welcomme 1986, Quensière 1990) were studied during our survey:

A, shallow, littoral parts of permanent streams (main channel of the Niger and Bani rivers).

B, intermittent streams, "marigots", (temporary side arms and tributaries of the Niger);

C, inundated marshes, belonging to diverse vegetation formations, namely the "bourgoutière" (*Echinochloa stagnina* and/or *Vossia cuspidata*), the *Oryzaidae* (*Oryza longistaminata* which is the wild perennial rice), the cultivated rice fields (*O. sativa* or *O. globerrima*), pools with *Nymphaea* spp. and/or *Nymphoides* spp. and forested area (*Acacia kirkii*).

The significance of different vegetation types occurring in the flooded zone of the CDN for the spawning of fish and nursery of juveniles was

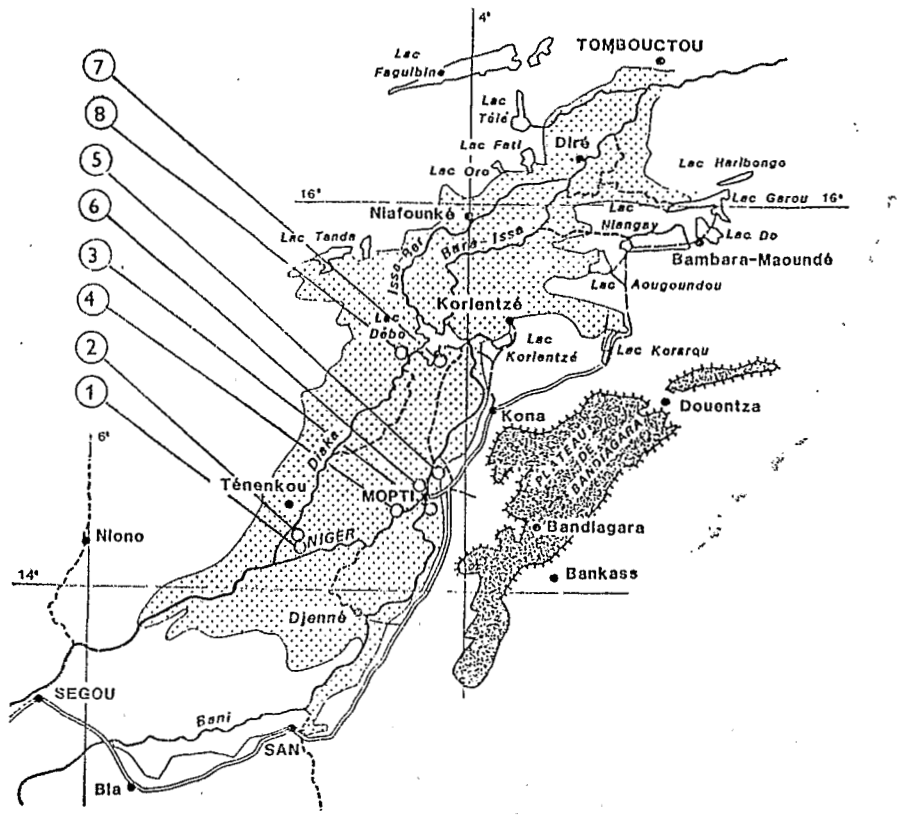

Fig. 1. Central Delta of the Niger; inundated zone is dotted, the circles and numbers indicate the stations investigated. For details see Tab. 1.

the subject of a more detailed research and some preliminary results are discussed by W u i l l o t & K a n t a (1991).

The precipitation and hydrological regimes at the station of Mopti, as registered during the current (= 1990) and two preceding years (1988, 1989), are presented in Fig. 2 and Fig. 3, resp.

Materials and Methods

Three types of fishing devices were applied during our survey:

(a) Fry beach-seine, 8 m in length, 100 cm in depth, with a bag 100 cm long. It is made of a green mosquito net with mesh size 1.5 × 1.5 mm. The mean size of the area swept during one action was c. 30 m^2. A device applicable in shallow and littoral parts of the main channel and marigots which are free of macrovegetation and other obstacles. It provides, with some limitations, data on relative abundance and biomass. Compared

Tab. 1. Sectors and stations of the Central Niger Delta studied during present survey

Sector	Station	Date	Type of habitat[1])			Type of fishing device		
			A	B	C	seine	gill-net	traps
OURO-MODI	1. marigot, central part	5—6 NOV		*		*	*	
	2. marigot, upper part	7—8 NOV		*	*	*	*	*
MOPTI	3. Bani River, Mopti	3 NOV	*			*		
	4. Niger, Amont	5 NOV	*			*		
	5. Niger, Barigondaga	11 NOV	*			*		
	6. Niger, Nantaka	11 NOV	*		*	*		
WALADO DEBO	7. Walado Debo, Dentaka	12—14 NOV		*	*	*	*	*
	8. Diaka, Banadje	14—16 NOV		*	*	*	*	*

[1]) Type of habitat:
A — main channel of permanent rivers shallow and littoral parts only)
B — intermittent streams (marigots)
C — inundated plain (grown with aquatic macrovegetation and/or forested)

with the gill-net, it seems to be a less selective fishing gear as far as the species of the fish and their size is concerned (Tab. 2). The catches obtained by the seine differ substantially between the day and night.

(b), Gill net ("Lundgrens", a floating, surface type), 20 m in length, 130 cm in depth, mesh size 16 × 16 mm (between knots), made of monofilament, a device used in deeper lentic or slowly running sections of various habitats. The net was usually exposed for 24 hours (from sunset to sunset), with two controls made separately for day and night. The size range (SL) of the captured fish was markedly lower than that of both other fishing devices used (Tab. 2).

(c), Fry trap, a modified local type caled "papolo", with dimensions 100 × 30 × 30 cm, with 10 conical apertures 30 to 30 mm, consisting of a wooden frame covered by a mosquito net. A modification has recently been made, consisting in ataching two pairs of 1-m wingles, similar to those suggested by B r e d e r (1960), aiming at increasing the entrapment efficiency. The traps proved to be efficient for a wide range of fish sizes. Their application is possible in almost all types of habitats, however, they appeared to be the most practicable fishing device in marshes densely grown by macrovegetation. Usually 20 traps were laid for c. 24 hours and controlled once, at the end of their exposure.

During our excursions (November 1990), all the fish caught were found in an advanced stage of juvenile life history period and they could be identified without difficulties down to the species level with small excep-

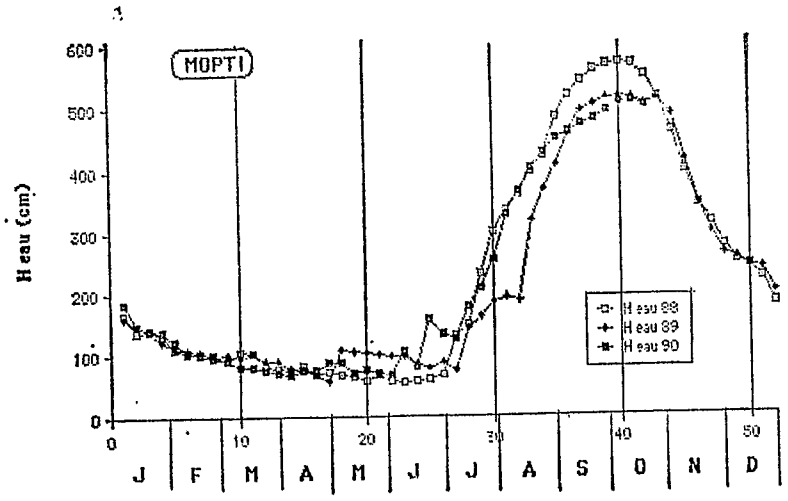

Fig. 2. Fluctuation of water level in the Central Delta of the Niger (Hydrometeorological Station at Mopti) during 1988—1990.

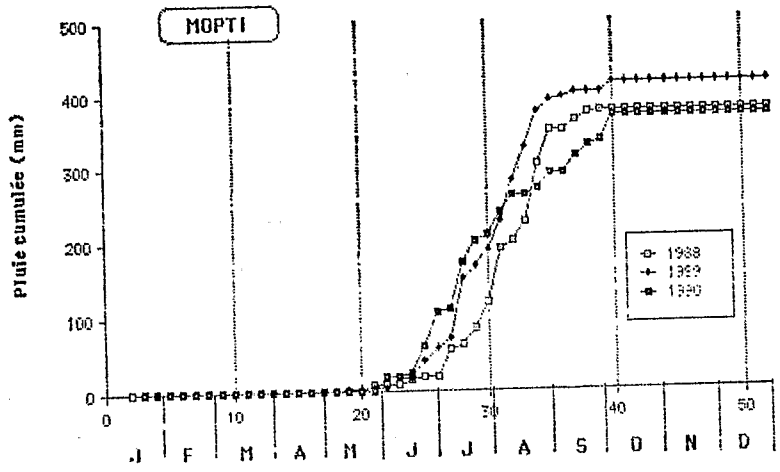

Fig. 3. Cumulative amount of rainfalls in the Central Delta of the Niger (station Mopti) during 1988—1990.

tions only (genera *Barbus* and *Synodontis*), after preservation in 4% formol and followin the identification keys by D a g e t (1954), L é v e q u e & P a u g y (1984) and L é v e q u e & al. (1990). After being identified, all fish were counted, individually measured for SL and, by species, bulk weighed. The results were expressed as the catch per unit of fishing effort (CPUE), *i.e.* in numbers and weights per one action of the seine (Tab. 3), per half-day of the gill-net exposure (Tab. 4) and per trap/day (Tab. 5),

Tab. 2. Size characteristics (mm of SL) of the fish caught with different sampling devices

Species	Seine			Gill net			Traps			** MAS
	Min.	Med.*	Max.	Min.	Med.*	Max.	Min.	Med.	Max.	
Pellonula leonensis	14	27	37	—	—	—				87
Marcusenius senegalensis		(68)		118	—	166				321
Petrocephalus bovei	25	—	44	—	—	—				100
Brycinus leuciscus	29	56	81	90	94	98	15	25	60	119
Brycinus nurse	44	98	120	95	103	124				218
Hydrocynus brevis	—	—	—		(140)					800
Hydrocynus forskalii	—	—	—		(175)					780
Micralestes elongatus	12	26	44	—	—	—				48
Nannocharax ansorgii	23	—	26	—	—	—				38
Barbus macrops	25	—	51	—	—	—				70
Barbus perince	15	—	41	—	—	—				89
Barbus sp.	14	—	30	—	—	—				—
Chalaethiops bibie	10	28	42	—	—	—				43
Leptocypris niloticus	10	30	42	—	—	—				95
Auchenoglanis occidentalis		(75)		—	—	—				475
Chrysichthys auratus	—	—	—	106	—	118				250
Schilbe mystus	40	73	105	110	121	132	10	70	100	283
Clarias anguillaris	—	—	—	117	150	185	20	100	135	—
Clarias gariepinus	—	—	—	122	—	150				1100
Sarotherodon galilaeus	27	46	75	68	70	71				314
Oreochromis niloticus	29	44	72	63	71	77	10	30	35	376
Oreochromis aureus	42	—	52	—	—	—				—
Tilapia zillii	13	38	100	64	69	79	10	25	45	300
Hemichromis fasciatus	30	—	54	—	—	—				
Hemichromis letourneauxi		(35)		—	—	—				
Cyprinodontidae	9		27	—	—	—				

* Expressed only for abundant species
** The maximum attainable size (SL) according to Daget (1954) and Léveque & al. (1990)

respectively. Diversity and equitability were computed according to Shannon & Weaver (1949), using the abundance data.

We are most indebted to Dr. C. Léveque for his inspiring contribution in organising and supervising of the current research. Dr. Daniel Dansoko and J. Quensière provide the best conditions for our research. Dr. J. Holčík, CSc., with his valuable critical comments, contributed considerably to the definite interpretation of our results. The field work be unimaginable without the sacrificing assistance of technicians, Mr. Kaye Coumare and Mr. Moussa Kanta. We wish to express our gratitude to all these persons.

Results and Discussion

Species richness and diversity

Altogether 38 taxa of fishes were recorded during our study focussed for collecting juvenile specimens in three typical floodplain sectors (Tabs. 3, 4 and 5).

Except for juveniles, adults of some small-sized fishes (*i.e.*, those with the maximum SL $<$ 100 mm, e.g. *Pelonulla leonensis, Micralestes elongatus, Nannocharax ansorgii, Barbus* sp., *Chalaethiops bibie, Leptocypris niloticus, Cyprinodontidae, etc.)* and inhabiting the same microhabitats as juveniles, constituted a considerable part of our catches, mainly those obtained by seine and traps. Because complex trophic and competitive interactions occur in these assemblages, attention has been paid to both the qualitative and quantitative analyses of their composition.

In experimental catches obtained with fry seine, altogether 28 taxa were registered, but at most 14 species were recorded in individual stations (the upper part of the Ouro Modi marigot, st. 2 B). The highest species diversity was found in the Diaka marigot (st. 8 B; $H' = 1.58$) and in the main channel of the Bani River at Mopti (st. 3 A; $H' = 1.53$). The small-sized species (their maximum attainable sizes are indicated in Tab. 2), *e.g., Micralestes elongatus* with a relative abundance amounting 43.2 %, *Chalaethiops bibie* (15.1 %) and *Pellonula leonensis* (12.5 %), were absolutely predominant. The juveniles of commercially important species formed only 7.3 % of the total amount of the fish caught by seine. A considerable spatial and nutritional competition could be thus expected between the juveniles of commercial fishes and adult small-sized fishes. However, this competition, because of the rather rapid growth of most species belonging to the former fish group, is apparently of transient nature only and related to the short period after spawning.

In catches provided by the gill net, the most diverse species composition was also found in the Diaka marigot (st. 8 B; species richness = 5, $H' = 1.27$). The highest relative proportion in the catches in the gill net consisted of *Clarias anguillaris* (30.6 %), *Tilapia zillii* (19.4 %) and *Schilbe mystus* (14.2 %). The commercially important fishes made up almost 70.1 % of the total bag.

The traping by "papolo", performed solely in the growths of aquatic macrophytes, resulted in the registration of 16 taxa. Cyprinodont *Micropanchax pfaffi* (62.9 %) and *Barbus* sp. (26.1 %) were highly predominating. The commercial fish reached only 2.9 % of the total number of fish in the bag.

Spatial distribution

As to the abundance of the fish (evaluated on the basis of seine catches), its CPUE values ranged 16 — 2,680 inds. The latter absolutely maximum value was found in the main channel of the Niger, in the village of Barigondaga (st. 5 A). Small-sized adults of *Micralestes elongatus, Chalaethiops bibie* and *Pelonulla leonensis* were the most abundant species in the main channel of permanent rivers, making up 96.2 % of the total number

Tab. 3. Results of experimental seining for juvenile fish in different habitats of the Central Delta of Niger, Mali

Floodplain sector	OURO MODI			MOPTI						WALADO DEBO					Total	
Station No. (see Tab. 1)	1 B	2 B		3 A	4 A		5 A	5 C	6 A	7 C		8 B				
	Abundance (%)														N	%
Clupeidae																
Pellonula leonensis	6.7			32.6	31.5	13.9	10.0	11.0	10.2	90.9	3.1			0.1	1847	12.5
Mormyridae																
Marcusenius senegalensis			0.3												1	+
Petrocephalus bovei	3.3	0.2	0.9						0.0			0.3			7	+
Characidae																
**Brycinus leuciscus*	3.3		56.0	3.1		2.1	4.3	0.1	2.2		9.4				406	2.7
Brycinus nurse		0.2	8.2												29	0.2
**Hydrocynus brevis*				0.3											3	+
Micralestes elongatus	3.3		6.7	29.4	14.1	70.4	50.8	50.7	66.3	0.8			41.2	0.1	6415	43.2
Characidae sp.								+							2	+
Distichodontidae																
Nannocharax ansorgii												0.3	1.1		3	+
Cyprinidae																
Barbus perince	33.3	79.2	5.2		0.3	10.4			11.6	4.0	40.6		1.7	8.9	1017	6.9
Barbus macrops	6.7	0.8	0.3						0.7					0.1	29	0.2
Barbus sp.				17.1			31.5	4.9							1206	3.1
Chalaethiops bibie				14.9	4.0	2.4	3.1	32.4	1.7			85.5	46.9	2.5	2343	15.1
Leptocypris niloticus				2.2	50.2	0.6				0.8		11.2	1.7	40.1	687	4.6
Bagridae																
**Auchenoglanis occidentalis*			0.3												1	+
Schilbeidae																
Schilbe mystus		0.6	4.4				0.1		3.7						128	0.9

Clariidae																
**Clarias anguillaris*			0.3												1	+
Mochokidae																
Hemisynodontis membranaceus			0.3												1	+
Cyprinodontidae																
Epiplatys bifasciatus		0.2													1	+
Aphyosemion guinense		0.2													1	+
Micropanchax pfaffi	43.3	11.0	12.5							0.8		2.8	4.5		150	1.0
Cichlidae																
**Sarotherodon galilaeus*			2.9											14.8	118	0.8
**Oreochromis niloticus*				0.1					0.5		18.7			2.2	37	1.2
**Oreochromis aureus*							0.1		0.1						6	+
**Tilapia zillii*		7.8	1.7	0.1					2.9	2.4	28.1		2.8	31.0	387	2.6
Hemichromis fasciatus						0.3									1	+
Hemichromis letourneauxi														0.1	1	+
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	14828	100
Number of seinings	1	2	3	3	1	1	1	4	2	2	2	6	2	3	33	
Number of fish per 1 action	30	332	114	228	654	338	2680	1253	1418	128	16	65	88	243	449.3	
Weight of fish per 1 action	7	150	611	61	318	73	976	273	974	25	41	31	33	342	270.8	
Diversity H'	1.27	0.75	1.09	1.53	1.13	0.96	0.83	1.11	1.10	0.41	1.36	0.51	1.58	1.43	1.79	
Equitability J'	0.65	0.34	0.40	0.70	0.70	0.49	0.43	0.69	0.46	0.23	0.85	0.32	0.81	0.62	0.54	
Day/Night	D	D	N	D	D	D	D	D	D	D	N	D	D	N		

* Species selected for a detailed monitoring within the ORSTOM Project D.C.N.

Tab. 4. Results of experimentai gill-net fishing for juveniles in different sectors and

Floodplain sector	OURO MODI					
Station No. (see Tab. 1)	1 B		2 B			
Number/Weight (g)	N	W	N	W	N	W
MORMYRIDAE						
Marcusenius senegalensis						
CHARACIDAE						
**Brycinus leuciscus*						
Brycinus nurse			12	289		
**Hydrocynus brevis*			1	30		
Hydrocynus forskalii						
BAGRIDAE						
Chrysichthys auratus						
SCHILBEIDAE						
Schilbe mystus					2	50
Siluranodon auritus	1	5				
MOCHOKIDAE						
Synodontis nigrita					2	6
**Hemisynodontis membranaceus*						
CLARIIDAE						
**Clarias anquillaris*	10	380			26	1020
**Claria gariepinus*	2	100			16	560
CICHLIDAE						
**Sarotherodon galilaeus*	1	14	1	14		
**Oreochronis niloticus*			6	90		
**Tilapia zillii*	22	280	36	460	4	54
TOTAL	36	779	56	883	50	1690
Day/Night	N		D		N	
Diversity H'	1.04		1.01		1.17	
Equitability J'	0.65		0.63		0.73	

* Species selected for a detailed monitoring within the project D.C.N.

and 94.3 % of the total biomass in some cases (*e.g.*, station 3 a), while *Brycinus leuciscus, Cichlidae (Tilapia zillii, Oreochromis niloticus, Sarotherodon galilaeus)* and *Barbus* sp. highly predominated in inundated biotopes and in some more remote from the main channel parts of the marigots. Of the 16 species, selected for a deeper study within the ORSTOM research project, only 10 (indicated by asterisks in Tabs. 3 and 4) were caught during our survey. These species represent only 7.3 % of the corresponding overall number of the fish caught with the seine, but 69.7 % of the fish caught with the gill-net.

The fish biomass, expressed equally in terms of CPUE on the basis of seine catches, fluctuated between 7 and 976 g. Its maximum value, similarly as the corresponding number, was also observed in the Niger River at Barigondaga (st. 5 A).

habitats of the 'Central of Niger Delta, Mali

WALADO DEBO												TOTAL			
7 C						8 B									
N	W	N	W	N	W	N	W	N	W	N	W	N	%	W	%
1	21	3	58			1	20			1	30	6	2.8	129	2.6
						2	41	4	92			6	2.8	133	2.7
2	56	1	24			2	57	1	32			18	8.8	456	9.3
								1	35			2	0.9	65	1.3
				1	55							1	0.5	55	1.1
3	80											3	1.4	80	1.6
1	21	16	350			7	160	1	29	4	84	31	14.6	694	14.2
												1	0.5	5	0.1
		1	14									3	1.4	22	0.5
		1	21									1	0.5	21	0.5
						1	29			2	65	39	18.4	1.494	30.6
												18	8.5	660	13.5
1	10											3	1.4	38	0.8
												6	2.8	90	1.8
12	156											74	34.9	950	19.4
20	344	22	467	1	55	13	307	7	188	7	179	212	100	4.892	100
N		N		D		N		D		N					
1.27		0.96		0		1.27		1.29		0.95		1.98			
0.71		0.60		0		0.79		0.93		0.86		0.73			

Diel changes in catch results

Substantial differences were found between diurnal and nocturnal samples, both in the catches obtained by the seine and by the gill-net. The differences are apparent in the species composition and diversity of the catches as well as in the numbers and weights of the fish. As can be seen in Tab. 6, almost identical numbers of fish were always caught during the daytime and night, both by the seine and gillnet. On the contrary, the weight and species diversity were always higher in the night catches. *Micralestes elongatus, Chalaethiops bibie* and *Barbus* spp. were the most abundant species in the diurnal catches with the seine; *Tilapia zillii* and *Brycinus nurse,* in catches with the gill net. In nocturnal catches performed with the seine, *Cichlidae* and *Brycinus leuciscus* were the predominating species, while *Clarias anguillaris, C. gariepinus* and *Schilbe mystus* pre-

Tab. 5. Results of fishing on juvenile fish by traps obtained in two sectors of inundated plain of the Central Niger Delta

Species	OURO MODI[1]		WALADO DEBO[2]	
	N	A[3]	N	A[3]
PROTOPTERIDAE				
Protopterus annectens	1	0.2		
CLUPEIDAE				
Pellonula leonensis			1	0.7
MORMYRIDAE				
Brienomyrus niger	1	0.2	2	1.4
Petrocephalus bovei	7	1.6	3	2.1
Pollimyrus isidori	3	0.7	5	3.5
CHARACIDAE				
Brycinus leuciscus	2	0.4	3	2.1
Micralestes elongatus	6	1.3		
DISTICHODONTIDAE				
Paradistichodus dimidiatus			6	4.2
CYPRINIDAE				
Barbus sp.	78	17.5	76	53.1
Labeo senegalensis	1	0.2		
SCHILBEIDAE				
Schilbe mystus	7	1.6	5	3.5
CLARIIDAE				
Clarias anguillaris	4	0.9	1	0.7
CYPRINODONTIDAE				
Micropanchax pfaffi	335	75.1	36	25.2
CICHLIDAE				
Oreochromis niloticus			1	0.7
Tilapia zillii	1	0.2	3	2.1
Hemichromis letourneauxi			1	0.7
Total	446	100	143	100
CPUE	22.30		4.21	

[1] Total of 20 trap/days
[2] Total of 34 trap/days
[3] Relative abundance in %

Tab. 6. Number *(N)*, weight *(W)* and species diversity *(H')* of the fish collected during separately performed diurnal and nocturnal samplings (derived from Tabs. 3 and 4)

Fishing device	Day/Night	*N*	*W*	*H'*
Seine*	Day	128.60	49.20	0.90
	Night	124.33	331.33	1.29
Gill-net**	Day	23.55	375.33	0.77
	Night	24.67	627.67	1.11

* Catch expressed per one action of the net; only stations of Ouro Modi and Walado Debo are included
** Catch expressed per 12 h exposure of 1 gill net

dominated in catches with the gill net. All these facts, beyond doubt connected with the diel activity and behaviour patterns, have to be considered during future research.

Trophic characteristics of fishes

As for the pertinence to trophic guilds (using the classification of Welcomme 1986), the absolute majority of fish species, including the most abundant and commercially important ones, belongs to guilds 2 — "generalised feeders" *(Brycinus leuciscus, B. nurse, Clarias anguillaris, C. gariepinus).* In the main channel and large marigots, however, this trophic guild is mainly represented by such commercially unimportant species as *Pelonulla leonensis* and *Chalaethiops bibie.* Guild 6 — "generalised predators" (feeding on small fish, crustaceans and insect larvae) is represented by *Schilbe mystus, Leptocypris niloticus* and two rare cichlids, *Hemichromis fasciatus* and *H. letourneauxi.* "Top predators" (guild 7), represented by *Hydrocynus brevis* and *H. forskalii,* were only rarely recorded during our survey in catches with the gill net.

A similar analysis, concerning the pertinence to reproductive guilds (Balon 1975), would also be of great importance. Unfortunately, knowledge of the reproductive biology and strategy of the fishes in the Niger River system is still insufficient.

Perspectives

As already stressed in the Introduction, we are fully aware of the complex and dynamical character of the problems under study. Our results pertain to only an instant of the rich temporal sequence owing to the seasonal dynamics of the structure, growth, migration activity patterns *etc.* existing in the juvenile fish assemblages within a tropical floodplain ecosystem, as also suggested by Daget (1952) and in other African tropical river systems, as stated by Durand (1970) and Bénech & Quensière (1987). The planned continuation of investigations into the juvenile fish biology in the Central Niger Delta will therefore address the aforementioned diachronic complexity.

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Authors' addresses:

Dr. Vincent BÉNECH and Dr. Jean WUILLOT,
ORSTOM, B.P. 2528, Bamako, République du Mali,

Ing. Milan PEŇÁZ,
Institute of Systematic and Ecological Biology, Czechoslovak Academy of Sciences, Květná 8, 603 65 Brno, Czechoslovakia.