



## Study of ichthyofauna biodiversity of right bank of Pool Malebo (Congo River)

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### Abstract

Study ichthyofauna biodiversity of the right bank of Pool Malebo (between Kintélé and Brazzaville) were done from January 2010 to December 2011 as part of the inventory of fishes of major rivers on the right bank of the Congo Basin. The fishing was carried out with cast nets and gill nets. Median values of following physicochemical parameters: air and water temperature, pH, conductivity, TDS, show that there is little variation during the year. TDS and conductivity vary considerably with a minimum (0 ppm ; 2  $\mu$ S/cm) in February 2010 and a maximum in April 2011 (48 ppm ; 95.7 $\mu$ S/cm), the average of conductivity is 32.8  $\mu$ S/cm, average TDS is 16 ppm. Sampling done during two years permitted to identify 19317 specimens belonging to 163 species, 60 genera, 19 families and 8 orders. The Characiformes (43 species, 27%) and Osteoglossiformes (41 species, 25%) dominate the collection, followed by Siluriformes (28 species, 17%), the Perciformes (23 species, 14%) and the Cypriniformes (16 species, 10%). The most represented families are: Mormyridae (40 species, 25%), Alestidae, Distichodontidae and Cichlidae (19 species, 12%), Cyprinidae (16 species, 10%), Mockokidae (11 species, 7%). *Clypeobarbus pleuropholis* (3535 specimens, 18.3%), *Ctenochromis polli* (1956 specimens, 10%) are the most abundant species. Specific diversity is high with global Shannon index of 4.8 and equitability of 0.65. It means that the global population is slightly unbalanced. The fish population presented monthly a homogeneous distribution with equitability greater than or equal to 0.7, except in June and July 2011 where equitability is 0.63 and 0.5.

**Keywords:** Ichthyofauna, biodiversity, Shannon index, equitability, Pool Malebo.

### Introduction

Aquatic continental ecosystems have a great socio-economical, cultural and scientific importance for people<sup>1</sup>. They represent a natural asset and a generator of services, in terms of uses that are actually present or that could be done in futur<sup>2</sup>. Congo Brazzaville is one of Central Africa countries where biodiversity is less known<sup>3</sup>. Different protected areas created in the sub-region have placed particular emphasis on the study of big Mammals<sup>4</sup>. Studies of other zoological groups are few and fragmented, as is the case of diversity of freshwater ichthyofauna. Scientific knowledge of african ichthyofauna is new and is still an under-explored area<sup>5</sup>, it's the same situation for many countries like India<sup>6</sup>. Many rivers of Congo have not yet been explored and systematic ichthyological inventory of some rivers have not been realized, usually ichthyofauna of the right bank of Congo Basin (Republic of Congo) is extrapolated through that of the left bank of Congo Basin (Democratic republic of Congo). These results in fragmented data to the stream and start development work often without a real data base for ichthyofauna. Fishes are one of the best indicators of quality of any aquatic ecosystem and occupy a remarkable position from a socioeconomical point of view<sup>7</sup>. Moreover, the initiation of several projects (dams, roads, airports, and rail) will necessarily have an impact on aquatic ecosystems. A good knowledge of

fish populations is essential to have a typology of different rivers, for a best management of these aquatic ecosystems and for adopting suitable conservation measures<sup>8</sup>. Conservation is the only way that presently exist to save biodiversity<sup>9</sup>. It is imperative that investigations be carried out to provide informations on the ichthyofauna diversity of Congo Basin. The earliest study on Pool Malebo (Democratic Republic of Congo) was made on the left bank there is a fifty years<sup>10</sup>. In spite of his rich diversity, literature concerning studies of fish diversity of the right bank of Congo Basin is scarce<sup>11</sup>. The first study performed there is a dozen years on the right bank of Pool Malebo (Republic of Congo), was an inventory of Kintambo rapids fishes<sup>12</sup>. The second study on the right bank focused on the inventory of Kintele port fishes<sup>13</sup>. In this study, we completed the census by ecological data on fish populations on the right bank of the Congo River (species richness of orders and families, diversity indexes, specific relative abundance).

### Material and Methods

This study was realized on the right bank of Congo River (Pool Malebo) between Port Kintele and Port Leon in Brazzaville (Figure- 1). Fishes were captured with cast nets and gill nets. Specimens after fixation in formalin 10% are preserved in alcohol 70 . Fishes so collected are identified using different

keys available and classified by the Cloffa (Check-List of the Freshwater Fishes of Africa) classification scheme given<sup>14,15,16,17</sup>. The data collected allowed to establish the specific diversity index of Shannon<sup>18</sup>, the Pielou index or equitability<sup>19</sup>.

### Results and Discussion

In order to characterize the biotope in which fishes live, physicochemical parameters of surface water (air temperature, surface water temperature, pH, conductivity and TDS) were measured (figure- 2).

Among these five parameters, only TDS and conductivity varies considerably with a minimum (0 ppm; 2 μS/cm) in February 2010 and a maximum in April 2011 (48 ppm; 95,7 μS/cm). The

pH of Congo River water has a neutral average value of 7,1 ; the minimal value of 6,44 was obtained in November and December 2010 and the maximal value (7,7) in June 2011. The average air temperature is 28 4C with a minimum of 26 7C (November 2011) and a maximum of 30 5 (March 2010). The surface water temperature varies between 26 6 (july 2010 et 2011) and 29 5 (March 2010), with a average of 28 4. Results are so very close to those of the two studies made in Congo River, with slight variations related to the environmental conditions<sup>20,21</sup>.

**Ichtyofauna composition:** The number of specimens obtained is 19 317 belonging to 163 species, 60 genera, 19 families and 8 orders (Table-1). Species are presented using their scientific and vernacular names.

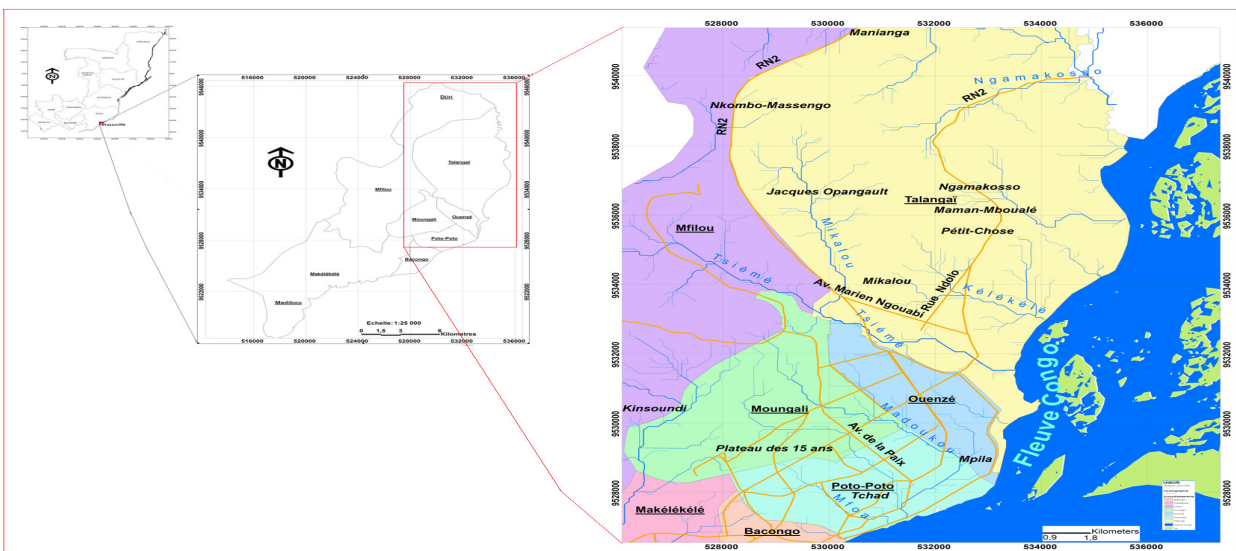


Figure-1  
 Map of study area

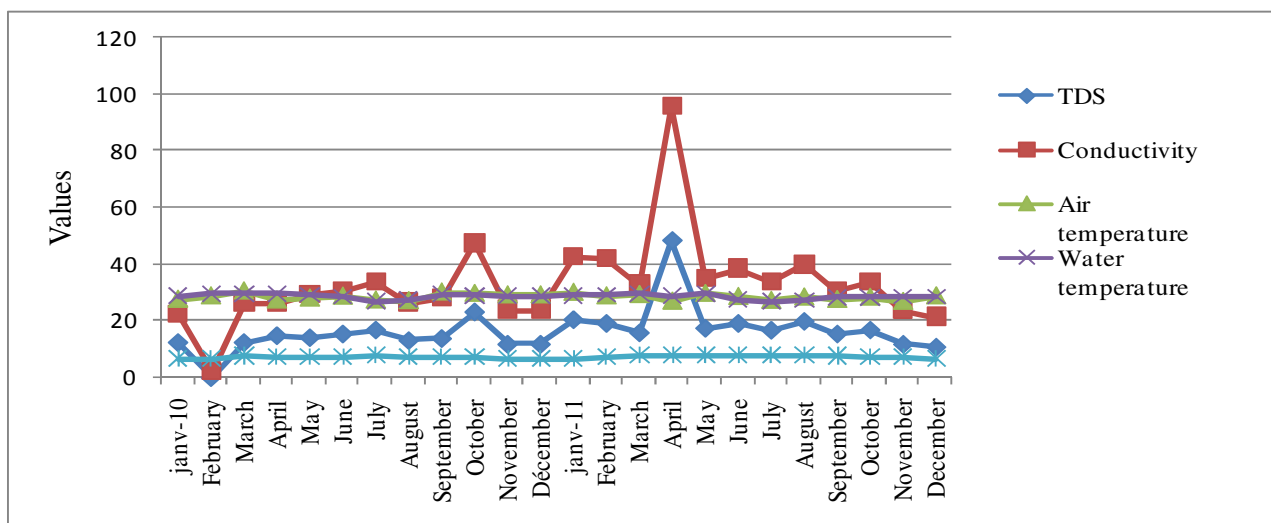


Figure-2  
 Physicochemistry of surface water

**Table-1**  
**List of species**

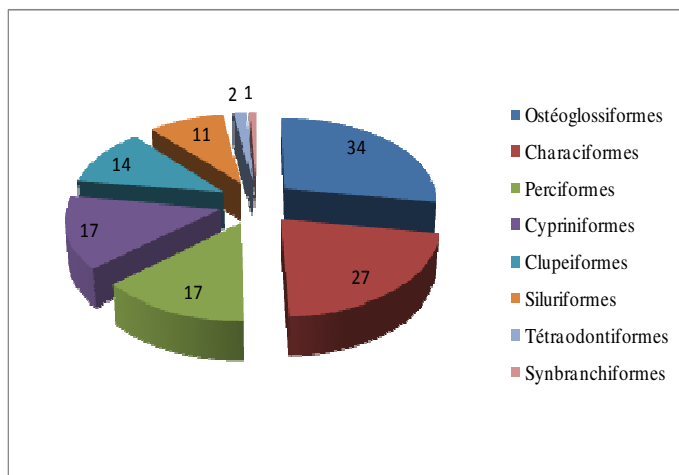
Order and Family	N	Name of species	Code	Number	Vernacular name	
					Lingala	Kikongo
<b>Osteoglossiformes</b>						
<b>Notopteridae</b>	1	<i>Xenomystus nigri</i>	XMN	12	Peke	Peko
<b>Mormyridae</b>	2	<i>Campylomormyrus elephas</i>	CME	1	Mpima	Mbese
	3	<i>Campylomormyrus ibis</i>	CMI	4	Mpima	Mbese
	4	<i>Campylomormyrus sp</i>	CMS	7	Mpima	Mbese
	5	<i>Campylomormyrus tamandua</i>	CLT	24	Mpima	Mbese
	6	<i>Cyphomyrus discorhynchus</i>	CMD	11	Mbese	Mbese
	7	<i>Cyphomyrus macrops</i>	CMM	402	Mbese	Mbese
	8	<i>Cyphomyrus psittacus</i>	CMP	74	Mbese	Mbese
	9	<i>Cyphomyrus sp1</i>	CPM	17	Mbese	Mbese
	10	<i>Cyphomyrus sp2</i>	CPR	8	Mbese	Mbese
	11	<i>Genyomyrus donnyi</i>	GMD	3	Mbese	Mbese
	12	<i>Gnathonemus petersi</i>	GNP	30	Mpima	Mbese
	13	<i>Gnathonemus sp</i>	GNS	20	Mpima	Mbese
	14	<i>Marcusenius greshoffi</i>	MCG	123	Bosso	Mbese
	15	<i>Marcusenius intermedius</i>	MCI	13	Bosso	Mbese
	16	<i>Marcusenius kutuensis</i>	MCK	4	Bosso	Mbese
	17	<i>Marcusenius m. angolense</i>	MMA	9	Bosso	Mbese
	18	<i>Marcusenius moorii</i>	MCM	88	Bosso	Mbese
	19	<i>Marcusenius schultuisiae</i>	MST	28	Bosso	Mbese
	20	<i>Marcusenius sp</i>	MSP	4	Bosso	Mbese
	21	<i>Marcusenius stanleyanus</i>	MSL	45	Bosso	Mbese
	22	<i>Mormyrops anguilloides</i>	MMA	8	Mbese	Ndzanda
	23	<i>Mormyrops sp</i>	MMR	4	Mbese	Ndzanda
	24	<i>Mormyrus bombanus</i>	MMB	1	Mbese	Mbese
	25	<i>Mormyrus caballus</i>	MMC	2	Mbese	Mbese
	26	<i>Mormyrus longirostris</i>	MML	1	Mbese	Mbese
	27	<i>Mormyrus ovis</i>	MMO	9	Mbese	Mbese
	28	<i>Mormyrus sp</i>	MMU	1	Mbese	Mbese
	29	<i>Myomurus macrodon</i>	MMD	4	Mpima	Mbese
	30	<i>Petrocephalus balayi</i>	PPB	6	Mbese	Mbese
	31	<i>Petrocephalus bane</i>	PCB	1	Mbese	Mbese
	32	<i>Petrocephalus chrysti</i>	PCC	530	Mbese	Mbese
	33	<i>P. microphthalmus</i>	PCM	226	Mbese	Mbese
	34	<i>Petrocephalus sauvagi</i>	PTS	6	Mbese	Mbese
	35	<i>Petrocephalus simus</i>	PCS	210	Mbese	Mbese
	36	<i>Petrocephalus sp1</i>	PCP	35	Mbese	Mbese
	37	<i>Petrocephalus sp2</i>	PTC	24	Mbese	Mbese
	38	<i>Pollimyrus nigripinnis</i>	PMP	18	Mbese	Mbese
	39	<i>Pollimyrus sp</i>	PMS	52	Mbese	Mbese
	40	<i>Stomatorhinus fuliginosus</i>	STF	1	Mbese	Mbese
	41	<i>Stomatorhinus sp</i>	STS	1	Mbese	Mbese
	<b>Clupeiformes</b>					
<b>Clupeidae</b>	42	<i>Microthrissa congica</i>	MTC	181	Nsangi	-
	43	<i>Microthrissa sp</i>	MTS	21	Nsangi	-
	44	<i>Odaxothrissa sp</i>	OTS	2	Nsangi	-
	45	<i>Pellonulla leonensis</i>	PNL	282	Nsangi	-
	46	<i>Pellonulla vorax</i>	PNV	71	Nsangi	-
<b>Gonorhynchiformes-</b>						
<b>Chanidae</b>	47	<i>Parachanna insignis</i>	PCI	43	Ntsinga	Mongusu

Cypriniformes							
Cyprinidae	48	<i>Clypeobarbus pleuropholis</i>	CBP	3535	-	-	
	49	<i>Labeo cyclorhynchus</i>	LCR	18	Munganza	Monganza	
	50	<i>Labeo greeni</i>	LGN	19	Moumpongo	Mompongo	
	51	<i>Labeo lineatus</i>	LLT	306	Munganza	Monganza	
	52	<i>Labeo lualuabaensis</i>	LBL	2	Munganza	Monganza	
	53	<i>Labeo nasus</i>	LNS	14	Munganza	Monganza	
	54	<i>Labeo parvus</i>	LBP	13	Munganza	Monganza	
	55	<i>Labeo sp1 noir</i>	LBC	1	Munganza	Monganza	
	56	<i>Labeo sp2</i>	LBN	1	Munganza	Monganza	
	57	<i>Labeo sp3</i>	LBO	6	Munganza	Monganza	
	58	<i>Labeo velifer</i>	LVF	6	Nvulu	Mompongo	
	59	<i>Labeo weeksi</i>	LWK	90	Ntsuele	Mombete	
	60	<i>Leptocypris lujae</i>	LCL	85	-	-	
	61	<i>Leptocypris weeksi</i>	LCW	154	-	-	
62	<i>Raïamas buchholzi</i>	RAB RAB	74	Mulima	-		
63	<i>Raïamas chrysti</i>	RAC	21	Mulima	-		
Characiformes							
Alestidae	64	<i>Alestes liebrechtsi</i>	ALT	35	-	Mokobe	
	65	<i>Alestopetersius sp</i>	APS	26	-	Mokobe	
	66	<i>Brycinus comptus</i>	BCP	1144	Nsangi ya kual	-	
	67	<i>Brycinus imberi</i>	BCI	202	Nsangi ya kual	-	
	68	<i>Brycinus macrolepidotus</i>	BML	35	Mouba	Mapoyo	
	69	<i>Brycinus poptae</i>	BPP	11	Nsangi ya kual	-	
	70	<i>Brycinus sp</i>	BCS	2	Nsangi ya kual	-	
	71	<i>Bryconaethiops macrops</i>	BAC	56	Nsuele	-	
	72	<i>Bryconaethiops microstoma</i>	BAM	9	Nsuele	-	
	73	<i>Duboisialestes bifascatus</i>	DAB	34	-	-	
	74	<i>Duboisialestes tumbense</i>	DAT	65	-	-	
	75	<i>Hydrocynus forskali</i>	HCF	4	Mbenga	Mbenga	
	76	<i>Hydrocynus vittatus</i>	HCV	20	Mbenga	Mbenga	
	77	<i>Micralestes acutidens</i>	MAT	1635	Munduku	-	
	78	<i>Micralestes occidentalis</i>	MCO	10	Munduku	-	
	79	<i>Micralestes stormsi</i>	MSM	14	Munduku	-	
	80	<i>Micralestes sp</i>	MAS	14	Munduku	-	
	81	<i>Phenacogrammus interruptus</i>	PGI	198	-	-	
	Citharinidae	82	<i>Citharinus congicus</i>	CTC	2	Yanga	Liyanga
		83	<i>Citharinus gibbosus</i>	CTG	10	Yanga	Liyanga
84		<i>Citharinus latus</i>	CTL	1	Yanga	Liyanga	
85		<i>Citharinus macrolepis</i>	CTM	1	Yanga	Liyanga	
86		<i>Citharinus sp</i>	CTS	20	Yanga	Liyanga	
Distichodontidae	87	<i>Belanophago hutsebauti</i>	BPH	4	-	-	
	88	<i>Belanophago tinanti</i>	BPT	7	-	-	
	89	<i>Distichodus atroventralis</i>	DCA	8	Mbutu	Mboto	
	90	<i>Distichodus affinis</i>	DCF	23	Mbutu	Mboto	
	91	<i>Distichodus altus</i>	DCT	23	Mbutu	Mboto	
	92	<i>Distichodus antonii</i>	DCN	20	Mbutu	Mboto	
	93	<i>Distichodus fasciolatus</i>	DCC	16	Mbutu	Mboto	
	94	<i>Distichodus lussosso</i>	DCL	1	Mbutu	Mboto	
	95	<i>Distichodus notospilus</i>	DCO	11	Mbutu	Mboto	
	96	<i>Distichodus sexfasciatus</i>	DCS	76	Mbutu	Mboto	
	97	<i>Distichodus sp</i>	DCP	2	Mbutu	Mboto	
	98	<i>Hemistichodus sp</i>	HSM	1	-	-	
	99	<i>Non identifié</i>	NIF	1	-	-	

	100	<i>Ichthyborus ornatus</i>	IBO	94	-	-
	101	<i>Mesoborus crocodilus</i>	MSC	10	Minkari nkari	-
	102	<i>Nannocharax macropterus</i>	NCM	1	Kaki	-
	103	<i>Nannocharax sp</i>	NCX	35	Kaki	-
	104	<i>Nannocharax gracilis</i>	NCG	7	Kaki	-
	105	<i>Phago boulengeri</i>	PBL	214	Mutitikiri	-
	106	<i>Xenocharax sp</i>	XCS	1	-	-
<b>Siluriformes</b>						
<b>Claroteidae</b>	107	<i>Auchenoglanis occidentalis</i>	AGO	3	Mbuka	Mboka
	108	<i>Chrysichthys longibarbis</i>	CIL	4	Wukutu ou Suaro	Lisuaro
	109	<i>Chrysichthys ornatus</i>	CIO	29	Wukutu ou Suaro	Lisuaro
	110	<i>Chrysichthys punctatus</i>	CIP	10	Wukutu ou Suaro	Lisuaro
	111	<i>Chrysichthys sp 1(t. pl)</i>	CIS	30	Wukutu ou Suaro	Lisuaro
	112	<i>Chrysichthys sp2 (t ét )</i>	CIT	16	Wukutu ou Suaro	Lisuaro
	113	<i>Chrysichthys thoneri</i>	CIH	153	Wukutu ou Suaro	Lisuaro
	114	<i>Parauchenoglanis sp</i>	PCG	1	Ke	-
<b>Schilbeidae</b>	115	<i>Parailia congica</i>	PLC	358	Malewa	-
	116	<i>Schilbe grenfelli</i>	SGF	17	Langwa	Lilangwa
	117	<i>Schilbe intermedius</i>	SIT	1389	Langwa	Lilangwa
<b>Amphiliidae</b>	118	<i>Belanoglanis tenius</i>	BGT	12	Mutitikiri	-
<b>Clariidae</b>	119	<i>Clarias gariepinus</i>	CGP	1	Ngola	Ngolo
	120	<i>Clarias sp1</i>	CRS	7	Ngola	Ngolo
	121	<i>Clarias sp2</i>	CRP	1	Ngola	Ngolo
<b>Malapteruridae</b>	122	<i>Malapterurus electricus</i>	MPE	5	Tsula	Nina
	123	<i>Malapterurus microstoma</i>	MPM	15	Tsula	Nina
	124	<i>Malapterurus sp</i>	MPS	3	Tsula	Nina
<b>Mockokidae</b>	125	<i>Microsynodontis sp</i>	MSD	2	-	-
	126	<i>Synodontis alberti</i>	SDA	124	Nkoko	Likoko
	127	<i>Synodontis caudalis</i>	SCD	1	Nkoko	Likoko
	128	<i>Synodontis congicus</i>	SDG	1	Nkoko	Likoko
	129	<i>Synodontis decorus</i>	SDD	6	Nkoko	Likoko
	130	<i>Synodontis nigriventris</i>	SNV	231	Nkoko	Likoko
	131	<i>Synodontis notatus</i>	SNT	10	Yabala	Likoko
	132	<i>Synodontis nummifer</i>	SNM	464	Nkoko	Likoko
	133	<i>Synodontis schoutedeni</i>	SST	66	Nkoko	Likoko
	134	<i>Synodontis sp1</i>	SDC	8	Nkoko	Likoko
	135	<i>Synodontis sp2</i>	SDS	6	Nkoko	Likoko
<b>Synbranchiformes</b>						
<b>Mastacembelidae</b>	136	<i>Mastacembelus congicus</i>	MCC	4	Mumfulantsie	-
<b>Perciformes</b>						
<b>Centropomidae</b>	137	<i>Lates niloticus</i>	LNT	1	« Capitaine »	Nzabé
<b>Cichlidae</b>	138	<i>Ctenochomis polli</i>	CCP	1956	Kaki	-
	140	<i>Ctenochromis sp</i>	CCS	10	Kaki	-
	141	<i>Hemichromis elongatus</i>	HCE	324	Tsingulu	-
	143	<i>Hemichromis sp</i>	HCM	17	Tsingulu	-
	144	<i>Hemichromis stellifer</i>	HCS	68	Tsingulu	-
	145	<i>Lamprologus mocquardi</i>	LPM	129	Kaki	-
	146	<i>Lamprologus casuerus</i>	LPC	5	Kaki	-
	147	<i>Lamprologus sp1</i>	LPS	17	Kaki	-
	149	<i>Lamprologus sp2</i>	LPL	5	Kaki	-
	150	<i>Nannochromis sp</i>	NCS	35	Kaki	-
	151	<i>Sarotherodon boulengeri</i>	STB	733	Bundu	Libunbu
	152	<i>Sarotherodon galileus</i>	STG	63	Bundu	Libunbu
	153	<i>Sarotherodon sp</i>	STD	2	Bundu	Libunbu

	154	<i>Tilapia tholloni</i>	TTL	1504	Bundu	Libunbu
	155	<i>Tilapia sp</i>	TLS	3	Bundu	Libunbu
	156	<i>Tylochromis lateralis</i>	TCL	276	Bundu	Libunbu
	157	<i>Tilapia zilli</i>	TTZ	56	Bundu	Libunbu
	158	<i>Tylochromis sp</i>	TCS	37	Bundu	Libunbu
<b>Anabantidae</b>	159	<i>Ctenopoma acutirostre</i>	CPA	1	Tsimpete tsia nkuku	Mukengue
	160	<i>Ctenopoma nebulosum</i>	CPN	1	Tsimpete tsia nkuku	Mukengue
<b>Tetraodontiformes</b>						
<b>Tetraodontidae</b>	161	<i>Tetraodon mbu</i>	TOB	1	Fuula or Mbumbi	Mbulitsui
	162	<i>Tetraodon miurus</i>	TOM	6	Fuula or Mbumbi	Mbulitsui
	163	<i>Tetraodon sp.</i>	TOS	1	Fuula or Mbumbi	Mbulitsui

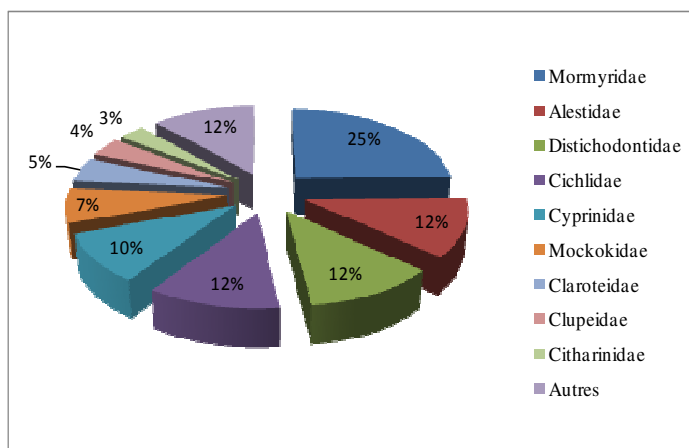
**Specific richness of orders:** Fishes identified belong to 8 orders, two orders dominate (Figure- 3): Characiformes (43 species, 27%) and Osteoglossiformes (41 species, 25%), followed by Siluriformes (28 species, 17%) the Perciformes (23 species, 14%), the Cypriniformes (16 species, 10%). The three orders are less represented Clupeiformes (6 species, 4%), Tetraodontiformes (3 species, 2%) and Synbranchiformes (1 species, 1%). These results show that the same orders prevail in the Congo Basin<sup>2</sup>, but in a different order: Siluriformes (23.5%), Perciformes (19%), Osteoglossiformes (16.5%), Cypriniformes (16.3%) and Characiformes (14.3%). The same orders were also identified in different proportion<sup>3,22,23,24</sup> in Congo River, Mambili River, Alima River and Lefini River.



**Figure-3**  
 Proportional repartition of specific richness of orders

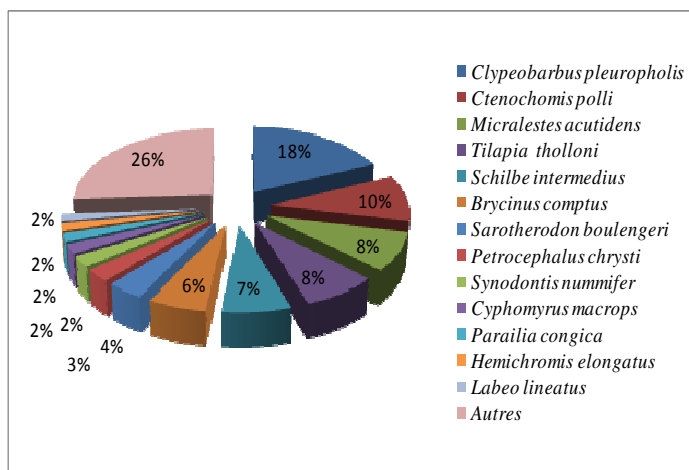
**Specific richness of families:** The fish species identified belonging to 19 families (Figure- 4), the most represented are: Mormyridae (40 species, 25%), Alestidae, Distichodontidae, Cichlidae (19 species, 12%) and Cyprinidae (16 species, 10%). These families are followed by Mockokidae (11 species, 7%), Claroteidae (8 species, 5%), Clupeidae (6 species, 4%), Citharinidae (5 species, 3%), Tetraodontidae, Schilbeidae, Malapteruridae and Clariidae (3 species, 2%), Anabantidae (2 species, 1%), Amphiliidae, Centropomidae, Channidae,

Notopteridae and Mastacembelidae (one species, %). The Mormyridae are the dominant family in the Congo Basin<sup>3,22,23,24</sup>.



**Figure-4**  
 Proportional repartition of specific richness of families

**Relative specific abundance:** The relative specific abundance is shown in Figure-5.



**Figure-5**  
 Specific relative abundance

The six most abundant species are: *Clypeobarbus pleuropholis* (3535 individuals, or 18.3%); *Ctenochromis polli* (1956 individuals, 10%); *Micralestes acutidens* (1635 individuals, 8.5%); *Tilapia tholloni* (1504 individuals, representing 8%); *Schilbe intermedius* (1389 individuals, or 7.2%); *Brycinus comptus* (1144 individuals, 6%).

and the lowest value were obtained in June and July respectively 3 and 2.8. The values of the equitability (E) throughout the month show homogeneous distribution of fishes populations. However, a slight unbalance is observed in June 2011 (0.63). In July 2011, the distribution of population is unbalanced, with an equitability of 0.5.

**Specific diversity:** For the entire stretch of Pool Malebo withheld during this study (between the port Kintele and port Leon), the fishes populations are very diversified, Shannon index is 4.8, equitability is 0.65. It means that the population is slightly unbalanced. Diversity index vary monthly (Figure- 6), the highest Shannon index was recorded in January 2010 (4.7)

The Shannon index and equitability show a seasonal variation (Figure- 7). Whatever the season, specific diversity is high (greater than 4). The equitability equal to 0.67 in the rainy season, the population distribution is homogeneous so well balanced, dry season equitability is slightly lower, equal to 0.63, the population distribution is slightly unbalanced.

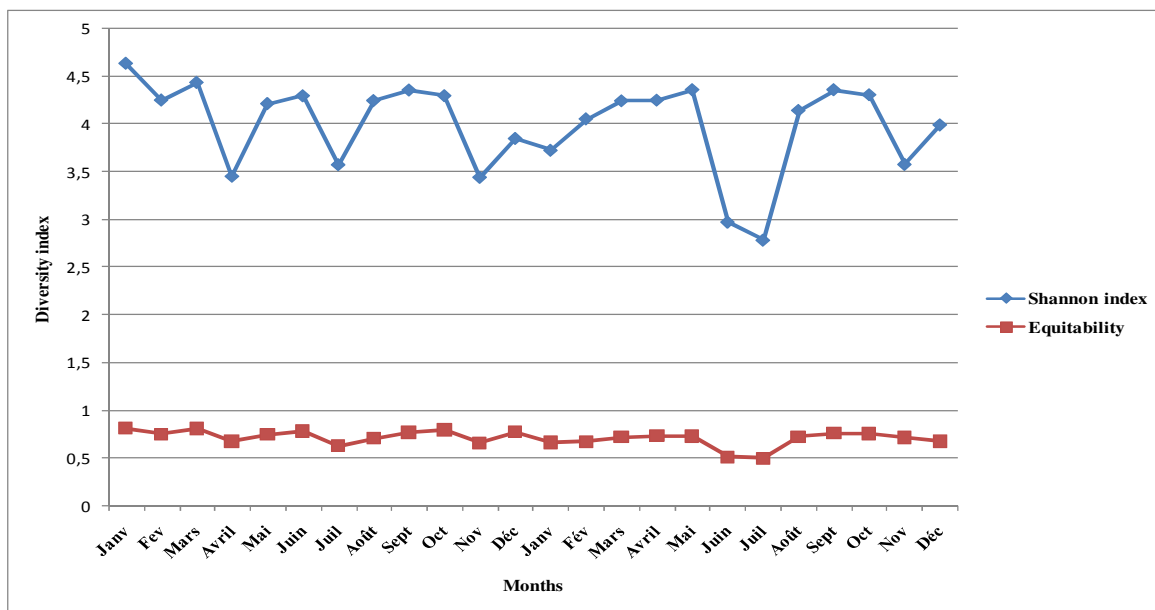


Figure-6  
 Monthly variation of Shannon index and equitability

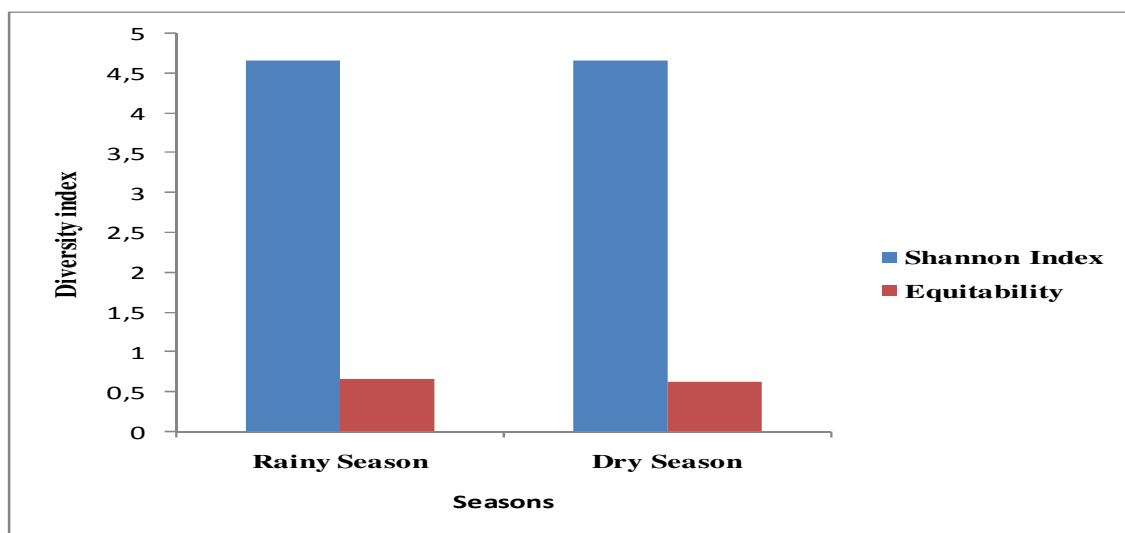


Figure-7  
 Seasonal variation of Shannon index and equitability

## Conclusion

The ichthyofauna of the right bank of Malebo Pool (Congo River) collected showed great richness with 163 species belonging to 60 genera, 19 families and 8 orders. Biodiversity is important in terms of diversity index calculated during the two years of sampling, the populations of fishes of Pool Malebo right bank is slightly unbalanced because the value of equitability is fewer than 0.7. There is a decrease of equitability in July 2010, in June and July 2011 which indicate a heterogeneous distribution of fishes communities during these months. We have noticed the important relative specific abundance of *clypeobarbus pleuropholis*. The results of these investigations will give ichthyological reference data of the ichthyofauna of right bank of Pool Malebo (Congo River) and enrich the national directory of ichthyofauna.

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