



Ichthyofaunal diversity of Lower Kouilou (Republic of Congo)

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Abstract

This fish survey was carried out at Lower Kouilou at the confluence with Atlantic Ocean, this site which is located 50km from the town of Pointe Noire, between 8 and 10 September 2018. Fishing with cast nets and gillnets allowed to collect 769 specimens distributed as follows: 26 species, 21 genera, 16 families and 10 orders. The order of Siluriformes corresponds to the most abundant and diversified and the family of Claroteidae is the most abundant in this fishing site. *Chrysichthys auratus* is the majority species with a specific relative abundance of 33.6%. The global population is diversified ($H' = 2.77$) and unbalanced ($E = 0.59$).

Keywords: Kouilou River, Ichthyofauna, numerical abundance, Diversity indices

Introduction

Fish constitutes an important source of protein which provides food security and provides employment for more than a billion people worldwide (FAO, 2002; Dugan et al., 2010). Aquatic ecosystems provide many goods and services that are often not properly appreciated (Brummett et al., 2008). The consequences of intensive captures, the use of chemical substances in agriculture, the construction of hydroelectric dams and irrigation dams, the forest destruction

and the introduction of new fish species strongly disrupt aquatic ecosystems and pose real threats of disappearance on many species of fish (Kamdem and Teugels, 1998; Gourène et al., 1999). It is therefore necessary to carry out studies for taxonomic knowledge of fish and a good understanding of their bioecology, in order to take conservation measures. The continental waters of the Republic of Congo are divided into two ichthyological provinces: the Congo Basin and Lower Guinea (Teugels et al., 1994). The first ichthyological studies of Lower Guinea began

with Daget (1961) who described the Kouilou-Niari fish caught between the localities of the Niari-bridge and Loudima. A few years later, Daget and Stauch (1968) inventoried the fish of the lower Kouilou, the Noubi basin and the lower and middle Loémé.

Then, Teugels and Mamonékéné (1991) carried out a mission in the lower Kouilou to the Sounda gorges, which contributed to the increase in the number of fish species never before known. Teugels et al. (1991) carried out a study of the ichthyofauna of the Lower Kouilou basin; subsequently, followed the studies of freshwater fish in the Dimonika biosphere reserve by Mamonékéné and Teugels (1993), Teugels and Guégan (1994), Mamonékéné and Maloueki (1997), Mamonékéné (1998), Lake Loufouléba by Ibala (2004), Mayombe, the Niari and Chaillu

basins by Mamonékéné and Stiasny (2012) and Kouilou, Noubi and small coastal basin systems by Walsh et al. (2014). Walsh. Currently, very little data is available on the ichthyofauna of brackish waters. It is in this context that a study of the ichthyofauna of the lower course of the Kouilou River was carried out.

Materials and Methods

Sampling site

Sampling was carried out on the left bank on either side of the bridge over the Kouilou River (Figure 1). The geographical coordinates of the site are as follows: 4°21'67" South latitude and 11° 42'83" East longitude. The study area is where the Kouilou River, bordered by degraded mangroves, flows into the Atlantic Ocean.



Figure 1: Location of sampling site (IRF, 2018)

Treatment of ecological data

Three diversity index were used to do quantitative assess of the structure and composition of organism communities: the species richness (S), the Shannon index (H') and the Pielou evenness index (E).

Species richness (S)

The species richness S designates the number of species present in the considered space, i.e. characterizes the presence of species in a biotope.

Shannon index (H')

This index makes it possible to quantify the biodiversity heterogeneity of a study environment and therefore to observe an evolution over time(Shannon, 1948). This index always varies from 0 to lnS (or log S or log₂ S, depending on the logarithm base choosen) and given by the following formula:

$$H' = -\sum pi \text{Log}_2 pi$$

Where, pi = ni/N; pi is the relative abundance of each species; niis the number of individuals of species i;N is the total number of individuals.

Regularity index of Pielou

The regularity index of Pielou (1966), also called Pielou evenness index or equidistribution, is the ratio of real diversity to maximum diversity. The equitability value (E) varies from 0 to 1. When E is equal or greater than 0.7, the population is balanced and the specific distribution is homogeneous. Consequently, when this value is less than 0.7, the population is unbalanced and its

specific distribution is heterogeneous. It is given by the following formula:

$$E = \frac{H'}{H'max}$$

Where E is the equitability; H'max is the logarythme of S; H' is the real diversity ; H'max : maximal diversity ; S represent the number of found species.

Results and Discussion

Specific composition

During this study, 769 specimens were recorded, they are divided into 26 species belonging to 21 genera, 15 families and 10 orders (Table 1). Images of some species are recorded in Figure 2.The 15 families identified were listed in the lower course of the Ogooué by Mbega and Teugels (2003), 10 families out of 18 identified by Teugels and al. (1991) at the confluence of the Kouilou and the ocean. All these differences can be explained by their total absence in the sampled environment or because of seasonal factors.

Table 1: List of inventoried species

Ordres	Familles	Genres	Espèces	Ni
Clupeiformes	Clupeidae	Pellonula	<i>Pellonula vorax</i> , Günther ,1868	132
		Ethmalosa	<i>Ethmalosa fimbriata</i> , Bowdich, 1825	1
Characiformes	Hepsetidae	Hepsetus	<i>Hepsetus lineatus</i> , (Pellegrin, 1926)	9
Siluriformes	Claroteidae	Chrysichthys	<i>Chrysichthys auratus</i> , Valenciennes, 1836	258
Cyprinodontiformes	Poeciliidae	Aplocheilichthys	<i>Aplocheilichthys spilauchen</i> , Duméril, 1861	2
Perciformes	Carangidae	Lichia	<i>Lichia cf amia</i>	2
		Trachynotus	<i>Trachynotus teraia</i> , Cuvier, 1832	1
	<i>Trachynotus sp</i>		2	
	Lutjanidae	Lutjanus	<i>Lutjanus dentatus</i> , Duméril ,1861	1
	Haemilidae	Pomadasys	<i>Pomadasys jubelini</i> , Cuvier,1830	13
	Monodactylidae	Monodactylus	<i>Monodactylus sebae</i> , Cuvier,1829	3
Mugilidae	Liza	<i>Liza falcipinnis</i> , Geoffroy, 1808	163	
Anabantiformes	Channidae	Parachanna	<i>Parachanna obscura</i> , Günther, 1861	1

Gobiiformes	Gobiidae	Periophthalmus	<i>Periophthalmus barbarus</i> , Linnaeus ,1766	1
		Sicydium	<i>Sicydium crenilabrum</i> , Harrison ,1993	1
	Eleotridae	Eleotris	<i>Eleotris vittata</i> , Duméril,1858	10
		Bostrychus	<i>Bostrychus africanus</i> , Steindachner,1880	4
	Coptodon		<i>Coptodon tholloni</i> , Sauvage, 1884	102
			<i>Coptodon guineensis</i> , Bleeker, 1862	15
			<i>Coptodon nyongana</i> , Thys van den Audenaerde, 1971	6
			<i>Coptodon cabrae</i> , Boulenger,1899	6
	Hemichromis		<i>Hemichromis fasciatus</i> , Peters, 1852	15
			<i>Hemichromis elongatus</i> , Guichenot, 1861	6
Pleuronectiformes	Bothidae	Citharichthys	<i>Citharichthys stampflii</i> , Steindachner,1895	13
Syngnathiformes	Syngnathidae	Microphis	<i>Microphisbrachyurus</i> (Bleeker, 1853)	1
10	15	21	26	769



View of the bridge on left bank of the Kouilou River



Whaling on the Kouilou River



Pellonula vorax



Aplocheilichthys spilauchen



Chrysichthys auratus



Liza falcipinnis



Monodactylus sebae



Parachanna obscura



Citharichthys stampflii



Hemichromis elongatus



Trachynotus teraia



Trachynotus sp

Figure 2 : Images of the bridge and some species captured at Bas-Kouilou

Numerical abundance of orders

The distribution of orders by numerical abundance reveals that out of 768 specimens recorded in Bas-Kouilou, the orders of Siluriformes (34%), Perciformes (24%), Labriformes (20%) and Clupeiformes (17%) are the most represented. In Noubi, Walsh et al. (2014) showed that Perciformes (35%), Siluriformes (17%) and Characiformes (13%) represent the most abundant orders. The abundance of Siluriformes in Bas-Kouilou unlike Noubi is explained by the fact that this site is an

area with mesohaline waters favorable for *Chrysichthys auratus* reproduction.

Species richness of orders

In the lower Kouilou, the Perciformes constitute the richest order with 8 species, or 31% (Figure 3). This order is followed by the Labriformes (6 species; 23%); Gobiiformes (4 species; 15%); Clupeiformes (2 species; 7%). Characiformes, Siluriformes, Cyprinodontiformes, Anabantiformes, Pleuronectiformes and Syngnathiformes each have one species, or 4%. At the lower Kouilou, Teugels et al. (1991) found Siluriformes

represents the richest order with 18%, followed by Cypriniformes and Labriformes (15%), Characiformes and Perciformes (10%) and Clupeiformes (8%). Teugels and Guegan (1994) showed that in Lower Guinea, the distribution of orders is as follows: Cyprinodontiformes (21.5),

Siluriformes (19%), Cyriniformes (15.6%), Characiformes (14.6%), Perciformes (12.6%), Osteoglossiformes (12.1%), Synbranchiformes (2.8%), Polypteriformes (0.8%) and Lepidosireniformes (0.3%).

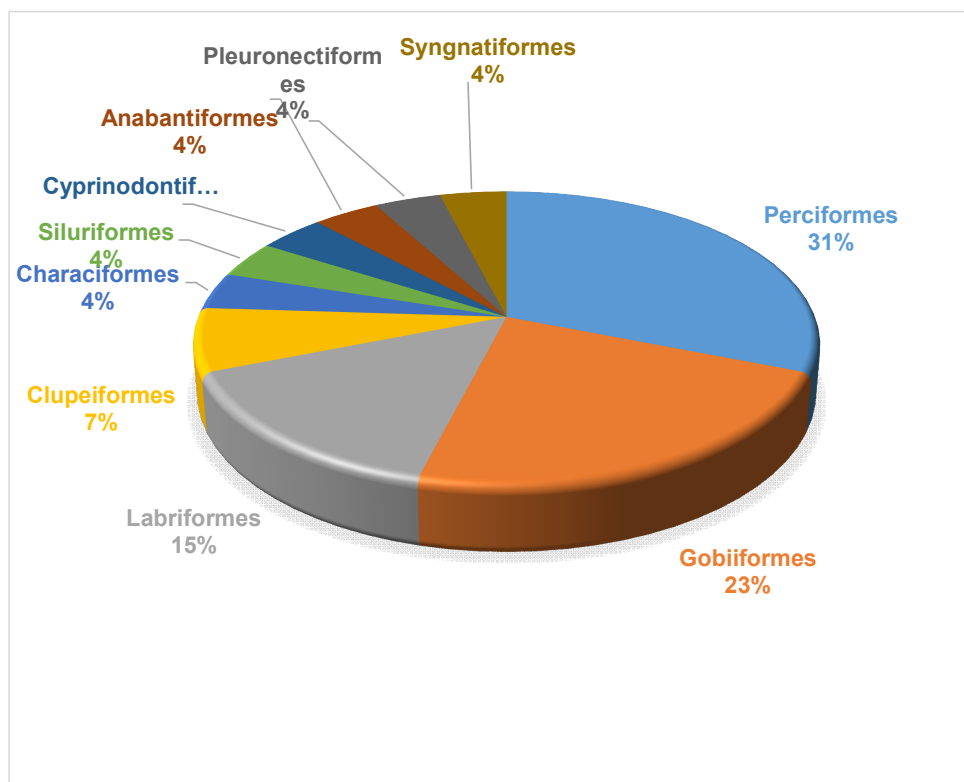


Figure 3 : Species number of orders

Numerical abundance of families

The family Claroteidae has the highest numerical abundance (258 specimens, 34%), followed by Mugilidae (163 specimens, 21%), Cichlidae (150 specimens, 19%), Clupeidae (133 specimens, 17%) and other families represent 9%.

Species richness of families

The distribution of species by family shows that the Cichlidae family has 6 species (23%); followed by the Carangidae (3 species, 12%), Clupeidae, Eleotridae and Gobiidae each contain 2 species, or 8%. Claroteidae, Hepsetidae, Channidae, Bothidae, Mugilidae, Poecilidae, Lutjanidae, Haemulidae, Sciaenidae,

Monodactylidae and Syngnathidae each have respectively 1 species, or 4%, (Figure 4). Teugels *et al.* (1991) in the lower reaches of the Kouilou River found that the families Cyprinidae and Cichlidae dominate with 15%, followed by Claroteidae (10%) Clupeidae, Alestidae and Schilbeidae (8%); Mormyridae and Eleotridae (5%), the rest of the families have less than 5%. In Lower Guinea, Teugels and Guegan (1994) found that the Cyprinodontidae family represents 21.5% of the species recorded, followed by the Cyprinidae (15.6%), the Cichlidae (11.5%), the Mormyridae (11.3%); the Alestidae (8.2%) and the Distichodontidae (6.2), the other families have a specific richness less than or equal to 5%.

Diversity index

The lower course of the Kouilou River presents a very diverse fish population with a Shannon index (H') equal to 2.77. The population is

heterogeneous and the specific distribution is unbalanced, with an equitability (E) of 0.59 (Figure 6).

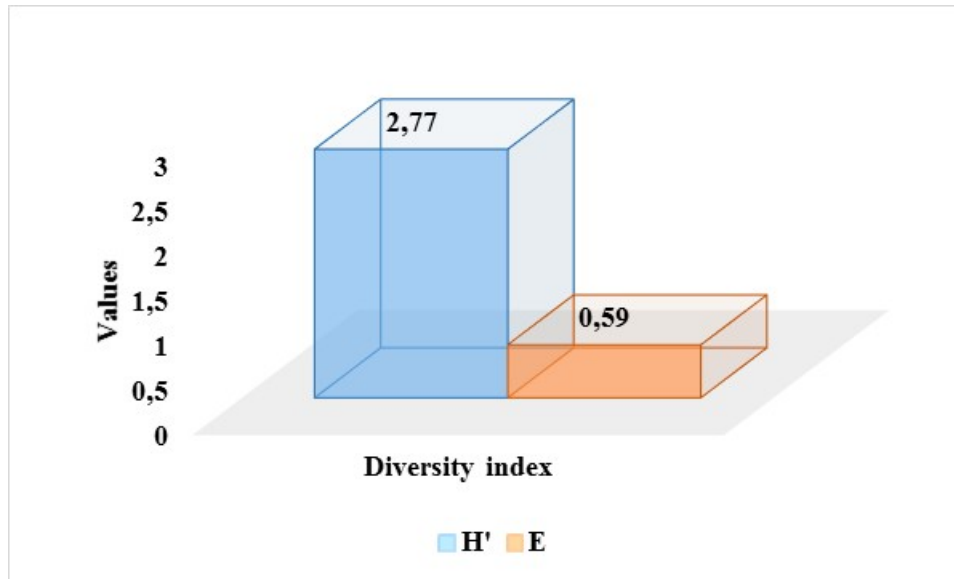


Figure 6: Diversity index values

Conclusion

The study of the ichthyofauna of Bas-Kouilou showed that the order of Siluriformes has the highest species richness; the Claroteidae family is the most representative and most diversified at the surveyed site. *Chrysichthys auratus* is the most abundant species in Lower Kouilou. The Shannon index (H') and equitability (E) values show that the population is very diverse and unbalanced. The lower course of Kouilou River is an important brackish area to preserve, because it is bordered by mangroves. This study must be completed by studies carried out over a longer period using various fishing techniques and deep surface water analysis, ecotoxicological studies for assessing water pollution and spatiotemporal settlement studies.

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Conflict of Interest

There are no conflicts of interest declared by the authors.

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