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Ichthyological Diversity Trend of Sélingué Hydroelectric Dam Lake in Mali

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ABSTRACT
Assessment of ichthyological biodiversity trend has become a necessity for the conservation of fish species. This study was carried out on the Sélingué Hydroelectric Dam Lake in Mali in order to contribute to sustainable management techniques of fishing activities. Five (5) sites were selected from the Lake area of influence. Purposive sampling technique enabled a survey of the local perception among the target population. Also, a systematic ichthyological inventory was conducted. The results show that the Sélingué Hydroelectric Dam contains 95 species of fish distributed in 23 families, including 13 migratory species. Local perception reveals 6 species of frequent or abundant fish in the past (15 to 30 years or more) but which have become rare in 2017. *Brycinus macrolepidatus* was the so-called rare species during this same period but is presently frequent. Eight (8) endemic fish families in Africa were found among the 23 fish families of the Lake. Of the threatened species, 10 species are endemic and 2 non-endemic species (*Aleste dentex* and *Citharinus latus*). Overfishing seems to be the cause decrease in the number of fishes and the disappearance of some species. A mechanism for sustainable participatory management of the Lake fishery could mitigate the effects of overfishing.

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1. INTRODUCTION

The conservation of aquatic biodiversity requires emergency measures around the world, including Africa, where the fauna of the Great Lakes of East Africa, for example, is currently highly threatened by human activities (Lévêque & Paugy, 2006 Paugy & Lévêque, 2006). For some authors, biodiversity is simply an opening towards the biology of conservation. Freshwater ecosystems provide essential ecosystem services, containing much of the species diversity that may decline more rapidly than the diversity of marine or terrestrial ecosystems (Taylor *et al.*, 2006).

Indeed, the lack of data and knowledge or the cost of biodiversity assessment limit efforts to manage the conservation and sustainable use of natural resources (FAO & MRC, 2003; FAO, 2011; FRB, 2011). In the field of ichthyology, only a few studies on fish have been undertaken in Mali. These are those of the Upper Niger Basin, the Baoulé and Bagoé rivers, the Manantali and Sélingué Lakes

(Daget, 1954; Benech & Dansoko, 1994; Paugy, 2001; Laë *et al.*, 2004; Kantoussan *et al.* 2007; Sanogo *et al.*, 2015). These studies do not specifically address changes induced by climate or anthropogenic pressure on fish diversity.

Mali is a continental country in the heart of West Africa, located between latitudes 10° and 25° north and between longitudes 4° east and 12° west. It covers an area of 1,241,238 km², which is about 1/24 of the total area of Africa (DNM, 2007). The main river that runs through the country is the Niger River, about 1,740 km long in Mali (PANGire, 2007) and seconded by the Senegal River over 800 km in length. The fishing industry plays an important role in Mali's agricultural economy (Kaushik, 2004). From 1994 to 1995, fish production reached nearly 100,000 tons, bringing in 30 billion CFA francs or about 50 million US dollars, including 4.2% of national wealth by comparing total GDP (Gross Domestic Product) (FAO 1996, DNH 2004). The fishing sub-sector employs about 500,000 people, or 7.2% of the Malian workforce (CPS, 2012). The country has 143 species of fish, including 24 endemic species (OSS & AEDD, 2013).

There are several fishing areas including the Sélingué Hydroelectric Dam built in the Sankarani River valley (subhumid zone) located in southern Mali, in the Upper Niger watershed (Kodio & Keïta, 1999, PANGire, 2007). Since the 1980s, a freshwater reservoir of 409 km² has been created following the construction of this dam in the Sankarani basin in Mali. According to Albert, (1996), the creation of such a freshwater reservoir would have consequences for the local ecosystem, human activities, and even the climate. Currently with climate change and anthropogenic pressure, some species of rare fish become frequent or abundant and vice versa. The fish species of Lake Sélingué are not immune to this phenomenon.

The purpose of this study was to evaluate the trend of the ichthyological diversity of the Sélingué Hydroelectric Dam Lake consequent upon climate change and anthropogenic pressure with a view to generating information towards sustainable exploitation of the fish.

2. MATERIALS AND METHOD/METHODOLOGY

2.1 Description of Study Area

Sankarani River has its source in the Republic of Guinea in the mountains of Fouta- Djallon. It flows for about 400 km before reaching the River Niger between the cities of Kangaba and Kéniéroba in Mali. Shortly before joining River Niger, the Sélingué hydroelectric dam was built on its bed in 1980. Its impoundment in 1981 created an artificial reservoir of water. Today, the basin area of the Sankarani River covers an area of 34.200 km² (Bamba *et al.*, 1996), or 25% of the Upper Niger Basin Guinean and Malian, at a maximum altitude of 1480m and a minimum of 250m.

Lake Sélingué is an artificial reservoir of water storage about 80 km long and 50 km wide, with an area of 409 km² and a capacity of 2.7 billion m^3. Its maximum depth is 22 m at the dam (Laval, 2008, Laval *et al.*, 2012). To select the sub-basins that cover the Lake, the watershed of the river was divided into 55 sub-basins.

The selection of the study area was made on the sub-basins that have a direct outlet to the Lake. This corresponds to the study area, with an area of 5974.64 km², located between 10°47' and 11°50' north latitude and between 8°40' and 7°50' west longitude. It is divided between the sub-humid zone and the semi-arid dry zone (Figure 1).

The area consists of an alternation of plateau and almost flat relief, with altitudes ranging between 256 and 513 m (Ramsar, 2001). The climate is Sudano-Guinean with Six months of

the rainy season from May to October and maximum rainfall in August. Mean monthly temperatures range between 25 and 30°C, with little difference between day and night (DNM, 2007). According to the PIRT (1983) in the study area, there are Three main soil units: Alfisols, Entisols, and Ultisols. The vegetation formations are composed of forests, savannas, gallery forests, and hygrophilous formations, etc. (PIRL, 1991). The basin is drained by the rivers Sankarani and Wassoulou-Ballé (Karembé 2014).

In the study area, the population was 172506 inhabitants in 1998 with a density of 31 inhabitants per km² against 220971 inhabitants in 2009 at a density of 39 inhabitants per km², with an average annual growth rate of 2.5 % (INSTAT, 2011).

Economic activities are mainly agriculture, livestock, fishing, beekeeping, crafts, commerce, industry, tourism, hotels, and forestry (Hébert, 2009). Today, traditional and industrial mining is well developed in the area.

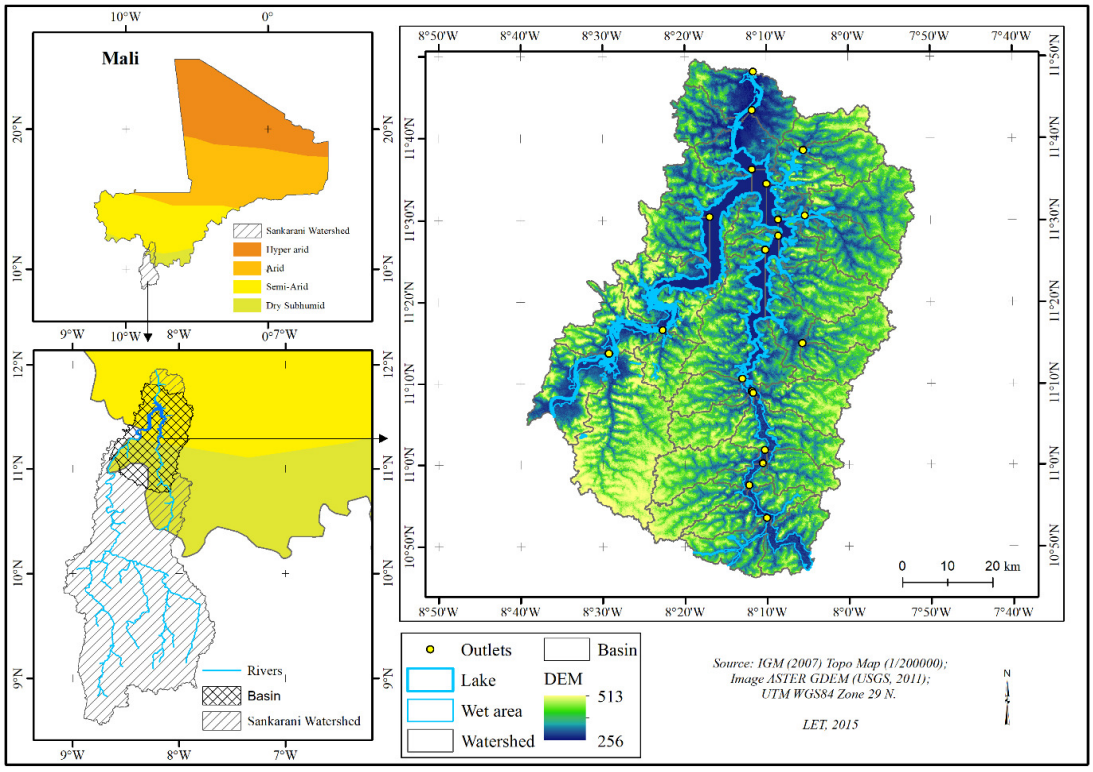

Figure 1 *Overview of the Study Area (Karembé, 2019)*

2.2 Tools

The fish inventory equipment were:

- Five gillnets of 10, 12, 15, 20, 25 mesh between the nodes, a length greater than 500 m and a drop of 1 m. These nets were set up once at each site in the afternoons and picked up the following morning for Three seasons: April-May; July-August and November-December;
- Two large-meshed hawk nets (20 mm mesh between nodes) were used to target large specimens;
- A small-meshed hawk net (mesh size 10 mm internode) was used for small and small size specimens;
- A small beach seine and nets were used to catch fry, juveniles and small species of small fish in open areas.

2.3 Site Selection and Sample

For the choice of sites, the study area was divided into strata (sub-basins) between the Sankarani river and its confluence Wassoulou-Ballé (W-Ballé). Among these sub-basins, a sample of 5 sub-basins was chosen reasonably. The criteria for localization of the sub-basin are as follows: the first site (Fanzan) is after the dam, the second site is the dam (Kangaré), the third site (Faraba) in the middle of Lake Sankarani, the fourth (Kabaya) and the fifth (Yanfolila) upstream, respectively on the Sankarani River and the Wassoulou-Ballé River

The study carried out a reasoned sampling of choices to cover all the households of the different study sites. However, the selection criteria were to have at least 15 to 30 years of residence or more and ownership of a canoe. From there, an inventory sheet and a questionnaire were drawn up and sent to the respondents. The fish species inventory period was spread over the three seasons of the year as follows: the hot season in April and May, the rainy season in July and August and the cold season in November and December. Inventory and investigations began in February 2017 and ended in December 2018.

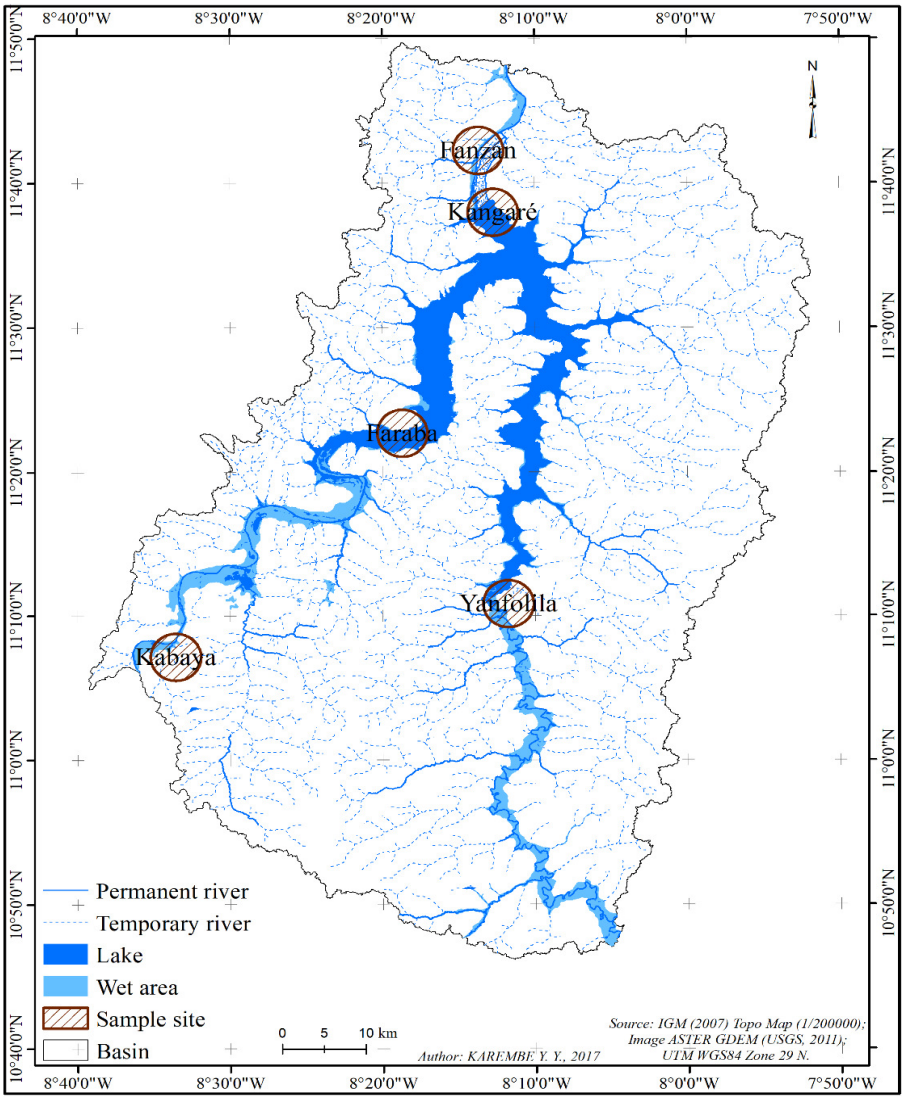

Figure 2: *Site Location (Karembé, 2019)*

2.4 Fish inventory

At each site, all species of fish caught by fishermen and supplemented by catches from experimental fisheries were inventoried. The collection of data on the local perception of fish diversity and their trend of Lake Sélingué was carried out on the basis of the survey sheet submitted to the focus group of fishing camps at Kangaré, Yanfolila, Kabaya, Faraba, and Fanzan. The systematic identification of fish was conducted in the field using identification keys from Paugy et al., (2003a; 2003b). This method was equally used by Sanogo *et al.*, (2015).

The diversity of fish and their trend of Sélingué Lake were analysed by comparing the results of the inventory with the perception of the fishermen. Inventory analysis for the identification of rare species was based on descriptive statistics. Inventoried species whose frequency is less than 1% are classified as rare, this method was used by Kantoussan *et al*. (2007).

3. RESULT AND DISCUSSION

3.1 Results

3.1.1 Fish diversity in Sélingué Lake

In total, the study inventoried 95 fish species in Sélingué Lake, out of which 37 main fish species constituted 38.95%. The analysis in Table 1 shows that resident fish species outnumber migratory species, with 82 species (86.31%) and 13 species (13.68%), respectively. In this second case, 8 species belong to the main fish species: *Alestes dentex; Hydrocynus brevis; Citharinus citharus; Citharinus latus; Synodontis batensoda; Heterotis niloticus; Schilbe intermedius et Schilbe mystus*.

Table 1: *List of Fish Species Sampled in Lake (Karembé, 2019)*

Families	Genus	Species	Presence	Main species	Author and year of description (Paugy et al., 2003a 2003b)
Alestidae	*Alestes*	*baremoze*	2		Joannis, 1835
		dentex	2	3	Linnaeus, 1758
	Brycinus	*leuciscus*	1	3	Günther, 1867
		macrolepidotus	1	3	Valenciennes, 1849
		nurse	1	3	Ruppell, 1832
	Hydrocynus	*brevis*	2	3	Günther, 1864
		forskalii	2		Cuvier, 1819
	Micralestes	*elongatus*	1		Daget, 1957
		occidentalis	1		Günther, 1899
Anabantidae	*Ctenopoma*	*kingsleyae*	1		Günther, 1896
		petherici	1		Günther, 1864
Aplocheilidae	*Epiplatys*	*bifasciatus*	1		Steindachner, 1881
		spilargyreius	1		Duméril, 1861
Bagridae	*Auchenoglanis*	*biscutatus*	1	3	Geoffroy Saint-Hillaire, 1808
		occidentalis	1	3	Valenciennes, 1840
	Bagrus	*bajad*	1	3	Forskål, 1775
		docmak	1	3	Forskål, 1775
		filamentosus	1	3	Pellegrin, 1924
	Chrysichthys	*auratus*	1	3	Geoffroy Saint-Hillaire, 1808
		nigrodigitatus	1	3	Lacépède, 1803
Centropomidae	*Lates*	*niloticus*	1	3	Linnaeus, 1762

Cichlidae	*Chromidotilapia*	*guntheri guntheri*	1		Sauvage, 1882
	Hemichromis	*bimaculatus*	2		Gill, 1862
		fasciatus	1	3	Peters, 1852
	Limbochromis	*cf.cavalliensis*	1		Audenaerde & Loiselle, 1971
	Oreochromis	*aureus*	1		Steindachner, 1864
		niloticus	1		Linnaeus, 1758
	Sarotherodon	*galilaeus*	1		Linnaeus, 1758
	Tilapia	*dageti*	1		Thys van den Audenaerde, 1971
		zillii	1	3	Gervais, 1848
Citharinidae	*Citharinus*	*citharus*	2	3	Geoffroy Saint-Hillaire, 1809
		latus	2	3	Muller et Troschel, 1845
Clariidae	*Clarias*	*anguillaris*	1	3	Linnaeus, 1758
	Heterobranchus	*bidorsalis*	1		Geoffroy Saint-Hillaire, 1809
		longifilis	1		Valenciennes, 1840
Claroteidae	*Auchenoglanis*	*biscutatus*	1		Geoffroy Saint-Hilaire, 1809
		occidentalis	1		Valenciennes, 1840
	Chrysichthys	*auratus*	1		GeoffroySaint-Hilaire, 1809
		nigrodigitatus	1		Lacépède, 1803
	Clarotes	*laticeps*	1	3	Rüppell, 1829
Clupeidae	*Pellonula*	*leonensis*	1		Boulenger, 1916
		vorax	1		Günther, 1868
Cyprinidae	*Barbus*	*ablabes*	1		Bleeker, 1863
		bynni occidentalis	1		Boulenger, 1911
		macrops	1		Boulenger, 1911
		pobeguini	1		Pellegrin, 1911
		sublineatus	1		Daget, 1954
	Garra	*waterloti*	1		Pellegrin, 1935
	Labeo	*coubie*	1	3	Rüppell, 1832
		roseopunctatus	1	3	Guégan and Agnèse, 1990
		senegalensis	1	3	Valenciennes, 1842
	Raiamas	*nigeriensis*	2		Daget, 1959
		senegalensis	2		Steindachner, 1870
Distichodontidae	*Distichodus*	*brevipinnis*	1	3	Günther, 1864
		engycephalus	1	3	Günther, 1865
		rostratus	1	3	Günther, 1866
Gymnarchidae	*Gymnarchus*	*niloticus*	1	3	Cuvier, 1829
Hepsetidae	*Hepsetus*	*odoe*	1	3	Bloch, 1794
Malapteruridae	*Malapterurus*	*electricus*	1	3	Gmelin, 1789
Mochokidae	*Synodontis*	*batensoda*	1	3	Rüppell, 1832
		clarias	1		Linnaeus, 1758
		filamentosus	1		Boulenger, 1901
		membranaceus	1		Geoffroy Saint-Hilaire, 1809

		nigrita	1		Valenciennes, 1840
		ocellifer	1		Boulenger, 1900
		schall	1	3	Bloch et Schneider, 1801
		sorex	1		Günther, 1864
Mormyridae	*Campylomormyrus*	*tamandua*	2		Günther, 1864
	Cyphomyrus	*psittacus*	1		Boulenger, 1897
	Hippopotamyrus	*pauqyi*	1		Lévêque & Bigorne, 1985
		pictus	1		Marcusen, 1864
	Hyperopisus	*bebe*	1		Lacépède, 1803
	Marcusenius	*mento*	1		Boulenger, 1890
		senegalensis	1		Steindachner, 1870
	Mormyrops	*deliciosus*	1	3	Leach, 1818
		anguilloïdes	1	3	Linnaeus, 1758
	Mormyrus	*hasselquistii*	1		Valenciennes, 1847
		macrophthalmus	1		Günther 1866
		rume	1	3	Valenciennes, 1846
	Petrocephalus	*ansorgii*	1		Boulenger, 1903
		bovei	1		Valenciennes, 1846
		soudanensis	1		Bigorne & Paugy, 1990
		tenuicauda	1		Steindachner, 1895
	Pollimyrus	*petricolus*	1		Daget, 1954
Osteoglossidae	*Heterotis*	*niloticus*	2	3	Cuvier, 1829
Poecilidae	*Poropanchax*	*normani*	1		Ahl, 1928
Polypteridae	*Polypterus*	*bichir lapradei*	1		Steindachner, 1869
		endlicheri	1		Heckel, 1847
		senegalus	1	3	Cuvier, 1829
Protopteridae	*Protopterus*	*annectens*	1		Owen, 1839
Schilbeidae	*Parailia*	*pellucida*	1		Boulenger, 1901
	Schilbe	*intermedius*	2	3	Rüppell, 1832
		mystus	2	3	Linnaeus, 1758
	Siluranodon	*auritus*	1		Geoffroy Saint-Hilaire, 1809
Tetraodontidae	*Tetraodon*	*lineatus*	1		Linnaeus, 1758
23	***49***	***95***	**13/82**	**37**	

Legend: *1= Resident, 2= Migratory, 3=Main species,*

3.1.2 Period of Presence of Migratory Fish Species at the Sélingué Hydroelectric Dam

The arrival and departure periods of migratory fish are reported in Table 2. The analysis in Table 2 indicates that 13 species of fish have a period of arrival and departure.

The ichthyological fauna of the Sélingué hydroelectric dam Lake is rich and varied. The number of fish and species richness change according to the season, however. This is due to the fluctuation of migratory species in open areas. Because the arrival of certain species corresponds to the departure of others and vice

versa (Table 2). However, it should be noted that the main period of species occurrence is from December to June. This period corresponds to the stability of the water level and the recession of Lake Sélingué and the end of the breeding period, which is generally linked to the lateral and sometimes longitudinal migration depending on the species.

In addition, among the migratory species, 6 rare species (46%) have been identified. These are: *Alestes baremoze* ; *Alestes dentex* ; *Hemichromis bimaculatus* ; *Citharinus latus* ; *Raiamas senegalensis* and *Campylomormyrus tamandua*

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Table 2: *Time of Arrival and Departure of Migratory Species (Karembé, 2019)*

Species	***Arrival period at open areas***	***Departure period for closed areas***
Alertes baremoze	Beginning of cold season	End of cold season
Alestes dentex	Beginning of cold season	End of cold season
Hydrocynus brevis	Cold season	End of hot season
Hydrocynus forskalii	Cold season	End of hot season
Hemichromis bimaculatus	End of cold season	Beginning of rain season
Citharinus citharus	Mid- Cold season	Beginning of rain season
Citharinus latus	Mid- Cold season	Beginning of rain season
Raiamas senegalensis	Beginning of cold season	End of hot season
Synodontis batensoda	Beginning of rain season	End of cold season
Campylomomyrus tamandua	Beginning of rain season	End of cold season
Heterotis niloticus	End of rain season	Cold season
Schilbe intermedius	End of cold season	Middle of rain season
Schilbe mystus	Beginning of rain season	Beginning of hot season

3.1.3 *Rare Species of the Sélingué Hydroelectric Dam Lake*

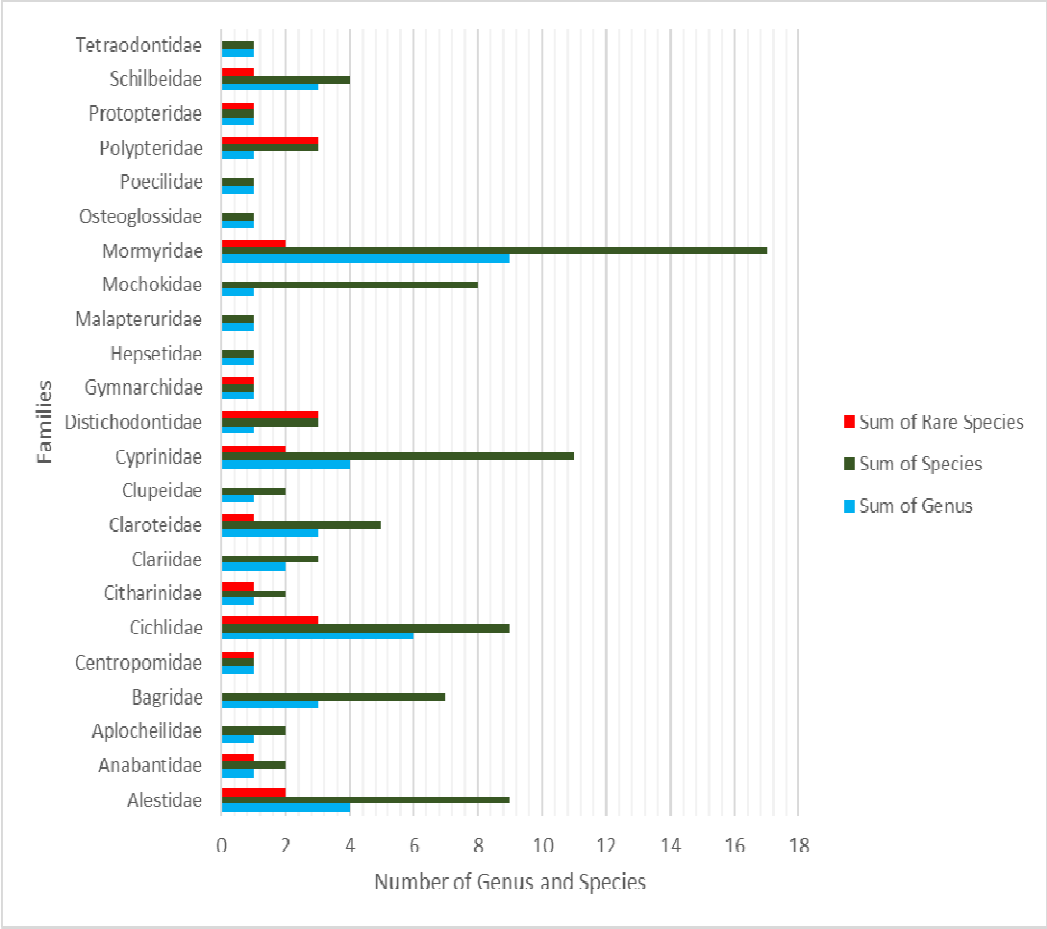

Figure 3: *Different Families of Fish Species in Sélingué Lake (Karembé, 2019)*

Figure 3 illustrates the number of fish families recorded in the lake. The analysis in Figure 3 shows that the number of species varies from one family to another and within the same family from one genus to another. The number of genus varied from 1 to 9 genus per family and species have also varied from 1 to 17 species per family, which indicates that the species richness is high in the lake. The rare species from the main species of the lake are *Alestes dentex, Brycinus macrolepidatus, Clarotes laticeps, Lates niloticus, Hemichromis fasciatus, Citharinus latus, Distichodus brevipinnis, Distichodus engycephalus, Distchodus rostratus, Gymnarchus niloticus* and *Polypterus senegalus senegalus*.

Fishing for this group of fish must be controlled to give them a biofeedback time. In the Sélingué Lake basin, 100% of the people interviewed indicated that overfishing is the main cause of species scarcity. The rare migratory species that make up the main species of the fisheries encountered are: *Alestes dentex and Citharinus latus*, threatened in the area surveyed.

Table 3 reports rare species for 15 to 30 years or more and in 2017-2018. According to the local perception and the result of the inventories carried out between 2017 and 2018, the study has identified 29 species of rare fish. Among them, certain species known

as rare nowadays according to the local perception are frequent according to the result of the ichthyological inventories (*Hemichromis fasciatus, Synodontis filamentosus, S. nigrita, S. ocellifer* and *Hyperopisus bebe*). This divergence is explained by the level of appreciation of the local population on fish rarity. However, the inventory analysis was performed on a statistical basis and the species found in this lot showed a low frequency according to the statistical analysis of the inventories.

Table 3: *Rare Species (Karembé, 2019)*

Family	***Rares Species***	***Local Perception***		***Inventory***		
		Before (15-30 Y)	**Nowadays (2017)**		**Manger**	**Cultural**
Alestiidae	*Alestes baremoze*	1	1	1	Not appreciated	Speed
	Alestes dentex	1	1	1	Not appreciated	Speed
	Brycinus macrolepidatus	1	2	2	Little appreciated	*
Anabantidae	*Ctenopoma kingsleyae*	*	*	1	Appreciated	*
Bagridae	*Clarotes laticeps*	2	1	1	Very appreciated	*
Centropomidae	*Lates niloticus*	2	1	1	Very appreciated	Early ejaculation
Cichlidae	*Chromidotilapia guentheri quentheri*	1	1	1	Very appreciated	*
	Hemichromis bimaculatus	1	1	1	Very appreciated	*
	Hemichromis fasciatus	1	1	2	Very appreciated	*
	Oreochromis aureus	1	1	1	Very appreciated	*
Citharinidae	*Citharinus latus*	1	1	1	Very appreciated	*
Clariidae	*Heterobranchus bidorsalis*	Rare in the Lake but not in the basin			Appreciated	Nobility
	Heterobranchus longifilis				Appreciated	Nobility
Cyprinidae	*Barbus bynni occidentalis*	1	1	1	Very appreciated	*
	Raiamas senegalensis	1	1	1	Very appreciated	*
Distichodontidae	*Distichodus brevipinnis*	2	1	1	Very appreciated	*
	Distichodus engycephalus	2	1	1	Very appreciated	*
	Distchodus rostratus	2	1	1	Very appreciated	*
Gymnarchidae	*Gymnarchus niloticus*	1	1	1	Very appreciated	*
Mochokidae	*Synodontis filamentosus*	1	1	2	Little appreciated	*
	Synodontis nigrita	1	1	2	Little appreciated	*
	Synodontis ocellifer	1	1	2	Very appreciated	*
Mormyridae	*Campylomormyrus*	1	1	1	Little	*

	tamandua				appreciated	
	Hippopotamyrus harringtoni	1	1	1	Little appreciated	*
	Hyperopisus bebe	1	1	2	Little appreciated	*
	Petrocephalus tenuicauda	1	1	1	Little appreciated	*
Polypteridae	*Polypterus senegalus senegalus*	2	1	1	Appreciated	Against urine in bed
Protopteridae	*Protopterus annectens*	1	1	1	Little appreciated	Against Asthma and breast enlargement
Schilbeidae	*Parailia pellucida*	1	1	1	Little appreciated	*

Legend 1=*Rare, 2= Frequent or abundant,* *=*Not found*

According to the people surveyed, rare fish species began 15 to 30 years or older and frequent or abundant during the study period included: *Brycinus macrolepidatus, Hemichromis fasciatus, Synodontis filamentosus, S. nigrita, S. ocellifer, Hyperopisus bebe*.

Frequent or abundant species 15-30 years or older and rare during the study period were: *Clarotes laticeps, Lates niloticus, Distichodus brevipinnis, D. engycephalus, D. rostratus, Polypterus senegalus senegalus*. These species are very popular in the consumer market.

Brycinus macrolepidatus was said to be rare for 15 to 30 years ago, but was frequent during the study period according to the local population and confirmed by the results of the inventories. The observation is that the species is not appreciated in the consumer market but the catches are generally consumed by fishermen.

3.1.4 Threatened fish of Sélingué hydroelectric dam Lake

The hydroelectric dam lake had 23 fish families of which 8 families are endemic in Africa. These are Alestidae, Citharinidae, Claroteidae, Distichodontidae, Gymnarchidae, Hepsetidae, Mochokidae and Mormyridae. The results of the ichthyological inventory also made it possible to discover in the lake 22 rare species distributed in 13 families which are Alestidae with *Alestes baremoze and Aleste dentex*, Anabantidae with *Ctenopoma kingsleyae*, Centropomidae with *Lates niloticus*, Cichlidae with *Chromidotilapia guntheri guntheri, Hemichromis bimaculatus* and *Oreochromis aureus*, Citharinidae with *Citharinus latus,* Claroteidae with *Clarotes laticeps*, Cyprinidae with *Barbus bynni occidentalis B. macrops*, Distichodontidae with *Distichodus brevipinnis, D. engycephalus* and *D. rostratus*, Gymnarchidae with *Gymnarchus niloticus*, Mormyridae with *Campylomormyrus tamandua and Petrocephalus tenuicauda*, Polypteridae with *Polypterus bichir lapradei, P. endlicheri and P. senegalus senegalus,* Protopteridae with *Protopterus annectens*, and Schilbeidae with *Parailia pellucida*.

In the lake, 3 fish families are monospecific and are threatened, namely Centropomidae, Gymnarchidae and Protopteridae.

3.2 Discussion

The Sélingué hydroelectric dam has 95 fish species in 23 families. This result corroborates with that of Kantoussan et al., (2007). However, *Hippopotamyrus harringtoni* was not found in the inventories or in the experimental fisheries of our study. Also, some species of fish called rare in our study were found frequent by Kantoussan et al., (2007). These are *Dentex Alestes, Lates niloticus, Hemichromis bimaculatus, Distichodus brevipinnis, Distichodus*

engycephalus and *Distchodus rostratus*. The species *Hemichromis fasciatus* less frequent in 2007 was abundant in the period of our study.

The species richness is high, but the gradual change in the composition of fish species in Sélingué Lake from one season to another or from one year to another has been reported by Laë et al. (2004). According to these authors, the change is due to variations in the hydrological cycle which influences the fish stock of the River Niger. The number of families encountered in the Lake is more than half of the 36 families reported on the River Niger by Lévêque and Paugy (2006). Of the 15 endemic fish families reported in Africa by Lévêque and Paugy (2006), 8 families or 53.33% are present in the Lake.

In the Sélingué hydroelectric dam, Lake, migration, and reproduction of migratory fish species are disrupted by the construction of micro-dams in the Sankarani River basin. This phenomenon of disturbance was equally reported by Agostinho et al. (2005) and IRD (2005). The use of all kinds of illegal fishing net during the whole period of the year has led to overfishing in Lake Sélingué, which is against the United Nations Sustainable Development Goals (SDGs) which set a target (14.4) for fisheries. This target recommends that by 2020 fisheries should effectively be regulated; put an end to overfishing; illegal fishing; unreported and unregulated and destructive fishing practices and implement science-based management plans (FAO, 2018). Overfishing is a significant factor that degrades the ichthyological diversity of Lake Sélingué. To these, is added the degradation of fish habitats through the reduction of gallery forests and the quality of water by gold miners (drag). This behaviour of the riparian populations has led to the depletion of the Lake of Sélingué in fishery resources. Our findings on this corroborate that of Badahoui et al., (2010) on Lake Ahémé and its channels.

4. CONCLUSION

The Sélingué hydroelectric dam has a significant richness of fish species with 23 families, of which 34.78% of families are endemic in Africa. It, however, shows changes in frequency or abundance of species from One season to another and from one period to another. *Hemichromis fasciatus*, a rare species formerly has become very common nowadays. Frequent or abundant species (*Clarotes laticeps, Lates niloticus, Distichodus brevipinnis, Distichodu sengycephalus, Distchodus rostratus, Polypterus senegalus senegalus*) 30 years ago have become rare, but very popular in the consumer market. They seem to be suffering from overfishing.
In view of this trend, a holistic sustainable management system will be required to regulate fishing techniques to mitigate the effects of overfishing.

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