



## Preliminary biodiversity inventory of Ichthyofauna of Tsieme River, A tributary of Congo River (Pool-Malebo)

Olabi-Obath DBC<sup>1,2</sup>, Mady-Goma Dirat I.<sup>1</sup>, Mikia M.<sup>1,2</sup>, Tsoumou A.<sup>1,2</sup> and Voudibio J.<sup>2</sup>

<sup>1</sup>Research Laboratory of Animal Biology and Ecology, ENS, University Marien Ngouabi, PoB 69 Brazzaville, CONGO

<sup>2</sup>Faculty of Sciences and Techniques, University Marien Ngouabi, PoB 69 Brazzaville, CONGO

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### Abstract

The ichthyological inventory of Tsieme River (north of Brazzaville), a tributary of the right bank of Congo River (Pool Malebo) was performed at the upper and lower reaches, from February to July 2011. Physicochemical parameters vary stations: the average water temperature is 27.6 °C, the average conductivity is 75 µS/cm and the average TDS of 37.47 ppm and the average pH is 6.7. Sampling of ichthyofauna made with the castnet in three stations, permitted to identify 1299 specimens belonging to 47 species, 29 genera, 13 families and 5 orders. The Perciformes dominates with 31 %, followed by Siluriformes (26%) and Osteoglossiformes (20 %). Cichlidae (26%) are the most represented family, followed by Cyprinidae and Mormyridae (15%). The most representative species are: *Synodontis nummifer* (38%) and *Tilapia sp* (15%). The settlement of the station 1 seems richer and more diversified with 23 species, followed by station 3 with 21 species and the station 2 with 17 species. The comparison stands three stations show a great similarity between stations 2 and 3, station 1 is very different. The overall analysis of the results shows that the ichthyological population of Tsieme River is unbalanced (equitability = 0.59), although diversified ( $H' = 2.29$ ).

**Keywords:** Tsieme River, ichthyofauna, specific diversity, shannon Index, equitability.

### Introduction

Landscapes change slowly when not subject to significant impacts due to human activities. In recent decades, the significant increase in population, the use of new land and more effective technical means on the natural environment have taken an impact unprecedented<sup>1</sup>. Documentation of biodiversity has become very important aspect of science now a day due to various environmental influences<sup>2</sup>. Fishes are one of the best indicators of quality of any aquatic ecosystem and occupy a remarkable position from socioeconomic point of view. The fishes are very rich source of protein as well as vitamins and other minerals<sup>3</sup>. It is estimated that approximately 25 percent of all protein consumed by people comes from fish sources of both marine and fresh water ecosystem<sup>4</sup>. Fish, source of animal protein have a significant importance in the diet of a big part of the African population. Fish diversity of any regime has great significance in assessment of that zone reference to environment and pollution, as well as contributes to the necessary information for fisheries<sup>5</sup>. The tropical aquatic ecosystems in general and those of the Congo basin in particular, appear threatened. Indeed, it is estimated that thousands of plant and animal species disappear each year in the globe<sup>6</sup>. However, the rational management of inland waters are generally underdeveloped in the majority of African countries, the rational gestion of inland waters requires prior a better understanding of them<sup>7</sup>. The rivers on the right bank of the Pool Malebo have been the subjects of very little scientific studies like Karanja Reservoir in Northern Karnataka in India<sup>8</sup>, they need also

serious attention in their management and conservation of fishery resources. It is for this reason that we were inspired to conduct the current preliminary investigation of the Tsieme River ichthyofauna, was conducted from February to July 2011. Detailed studies on fish fauna of this tributary of right bank of the Congo River are still lacking.

### Material and Methods

Tsieme, tributary right bank of Congo River is a river located in the urban center. It is located between 4° and 9° 4 16 South latitude and between 15°12 and 15°18 East longitude. This river is 12.5 km long, rises in the Mfilou district and flows into the Congo River in the Talangaï district (figure 1).

Three sampling stations were established along Tsieme River from downstream to upstream. Stations 2 and 3 are upstream and the station 1 is downstream at the confluence of Tsieme River with Congo River. The fishes were caught by using castnets (5 millimeters square mesh, 4 meters and 3.5 meters drop). Several identification keys were used<sup>9-16</sup>. Fishes were photographed, counted and preserved in formalin 5% after fixation in 10% formalin. The physico- chemical parameters of surface water (pH, temperature, conductivity and TDS) were measured using a multiparameter brand (Amig). The specific diversity of fishes communities were calculated by Shannon Weaver index ( $H'$ )<sup>17</sup> and equitability<sup>18</sup>.

## Results and Discussion

Tsieme River waters have a pH close to neutral, with an average pH of 6.7, an average temperature of 27°6, an average conductivity of 75.86µS/m and an average TDS of 37.47ppm. Station 3 has the lowest pH is 6.08, while the highest pH of 7.15 at station 1. The lowest temperature is 27°3, registered at the station 3 and the highest is 28°2 Station 1. The conductivity shows the same trend, with a value of 20 uS/cm at station 3 and 143.25 µS/cm at station 1. Finally, the TDS is lower at station 3 (10 ppm) and highest at station 1 (70.75 ppm).

**Table- 1**  
**Physicochemical analysis of surface water**

Parameters	Sampling stations			moyenne
	Station 1	Station 2	Station 3	
pH	7,15	6,88	6,08	6,70
Température (°C)	28°2	27°5	27°27	27°65
Conductivité (µS/cm)	143,25	64,33	20	75,86
TDS(ppm)	70,75	31,66	10	37,47

Tsieme River waters have a pH close to neutral with a mean of 6.7, the average conductivity is 75.86 µS/cm and the average TDS of Tsieme River is 37.47 ppm. Contrary, in Djiri River<sup>19</sup>, the values found showed a slightly acidic pH, around 5.80; the conductivity is 7.50 µS /cm and TDS is very low with 3.13 ppm and the average temperature is 25,47 °C. However, in Mfilou River<sup>20</sup>, a basic average pH equal to 8.01 and an average conductivity equal to 95.20 µS / cm. The average TDS of Mfilou River is 89.50 ppm.

**Fish species richness of Tsieme:** In total 1299 specimens belonging to 47 species, 29 genera, 13 families and 5 orders were captured during our inventories. Table II lists the captured in ascending order of the evolutionary lineage species<sup>21,22</sup>.

**Specific richness of orders:** The proportions of the different orders following the number of species are indicated in the figure 2.

It appears that the Perciformes is the most represented order in Tsieme River with 14 species or 31 %, followed Siluriformes with 12 species or 26%, and Osteoglossiformes with 9 species or 20%, Cypriniformes have 7 species representing 16% and Characiformes 5 species or 11%.

These five representative orders are the same as those found in the Congo Basin<sup>6</sup>, with different proportions: Siluriformes (23.5%), Perciformes (18.7%), Osteoglossiformes (16.5%), Cypriniformes (16.3%) and Characiformes (14.3%). The same observations were made in the course of the right bank of Pool Malebo<sup>23</sup>, the five orders found are in the following proportions: Osteoglossiformes (24.04 %), Siluriformes (22.95%), the Characiformes (19.12 %), Perciformes (14.75%) and

Cypriniformes (10.38%). The ichtyofauna inventory of Mfilou River showed also the presence of these most represented orders<sup>20</sup>: Perciformes (34%), Cypriniformes (22%) and Characiformes (16%). The Osteoglossiformes and Siluriformes were 11% respectively. The order of Perciformes is the most diversified in Tsieme River and Mfilou River. In other cases, the prevailing orders following different streams.

**Specific richness of families:** The figure 3 shows the proportional representation of specific richness of families.

It appears that in Tsieme River, Cichlidae is the most represented family, 26% followed by Cyprinidae and Mormyridae with 7 species or 15%. Alestidae, Clariidae and Mochokidae have each 4 species or 9%. The families found are similar to those of Mfilou River<sup>20</sup> with a predominance of Cichlidae, which tolerate pollution. These results may be explained by the localization of these two urban rivers which receive wastewater from different districts they cross.

**Global relative abundance:** The figure 4 shows the global relative abundance of Tsieme River.

It appears that five species abound in Tsieme River: *Synodontis nummifer*, *Tilapia sp*, *Oreochromis niloticus*, *Tilapia tholloni* and *Brycinus comptus*. The distribution of fish communities in the station shows that station 1 has the largest number of species (23). This abundance can be explained by the fact that the station is in direct contact with the Congo River. Station 3 is represented by 21 species and station 2 is less diverse with 17 species. Specific point of view, *Synodontis nummifer* is the most abundant species of Tsieme with 38% of the total number of captured specimens, followed by *Tilapia spp.* (15%), *Oreochromis niloticus* (12%). Note that all these species are characterized by small size allows them to colonize shallow water.

**Spatial and temporal variation of Shannon index:** The spatial and temporal variation of Shannon index is indicated in the figure 5.

The Shannon index decreases from upstream (station 3) to downstream (station 1), whatever the season. It means that specific diversity increases from downstream to upstream contrary to Hugueny theory,<sup>24</sup> which says that specific diversity increases from upstream to downstream. It may be explained by the household products discharged in the river between station 1 and station 2. However, in the dry season the Shannon index is very low in the two first stations and raised in the station 3. In the rainy season, whatever the station, the Shannon index is high and varies between 1.5 and 2.5; the station 3 has the highest Shannon index (2.29).

**Spatial and temporal variation of equitability:** A spatial and temporal variation of equitability is observed in the study area (figure 6).

In dry season, the equitability increase from downstream (station 1) to upstream (station 3) is low in the first two stations (less than 0.5). In rainy season, the higher equitability is observed in station 3 (superior to 0.7), which is in perfect balance, whatever the season.

The spatiotemporal variation in species diversity varies among stations and seasons. It is greater than 1 (rich and diversified environment) in the three stations in the rainy season and less than 1 in the first two stations in the dry season. In general the

population of the ichthyofauna Tsieme River is unbalanced ( $E = 0.59$ ).

**Specific affinities between stations:** The dendrogram of specific affinities between stations shows a distribution of species into two groups (figure 7). Thus, station 1 is isolated from the two other stations (2 and 3). However, there are affinities between station 2 and station 3.

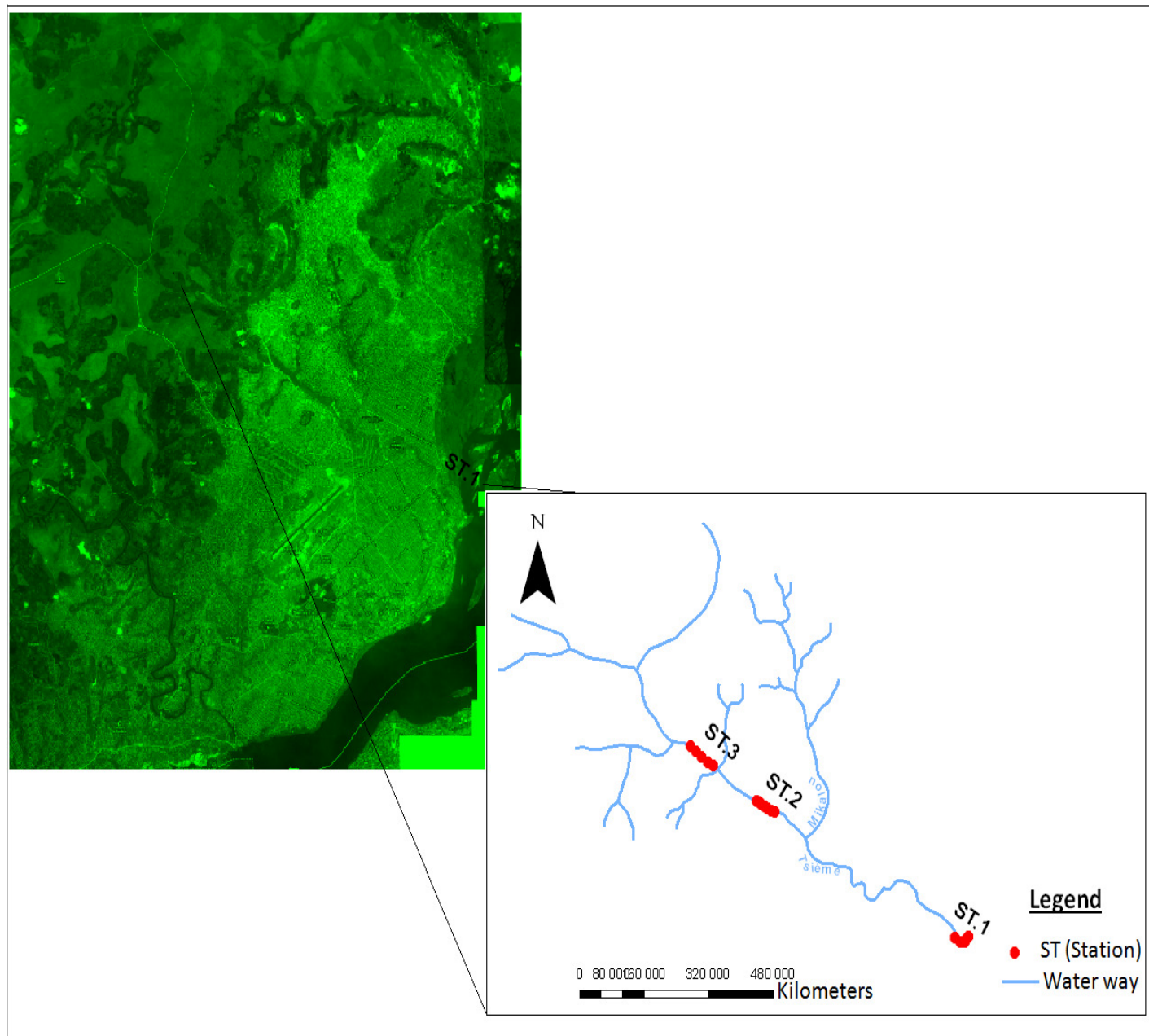


Figure-1  
Sampling Area

Table-2  
 List of species

Orders and Families	Species	Station 1	Sattion 2	Station 3	Local name	
					Lingala	Kikongo
Lepidosireniformes						
Protopteridae	<i>Protopterus dolloi</i>	+	-	-	Ndzombo	Ndzomo
Polypteriformes						
Polypteridae	<i>Polypterus retropinnis</i>	-	-	+	Mokongo	Moukoua
Osteoglossiformes						
Pantodontidae	<i>Pantodon buchholzi</i>	-	-	+	-	-
Notopteridae	<i>Xenomystus nigri</i>	-	+	+	Peke	Peko
Mormyridae	<i>Cyphomyrus discorhyncus</i>	+	-	-	Mbese	Mbese
	<i>Gnathonemus petersii</i>	-	-	+	Mbese	Boso
	<i>Marcusenius sp</i>	-	-	+	Mbese	Mbese
	<i>Marcusenius kutuensis</i>	+	-	-	Mbese	Mbese
	<i>Marcusenius angolensis</i>	-	-	+	Mbese	Boso
	<i>Marcusenius moorii</i>	-	-	+	Mbese	Mbese
	<i>Mormyrops boulengeri</i>	-	-	+	Mbese	Mbese
	<i>mormyrops zanclirostris</i>	-	-	+	Mbese	Mbese
	<i>Pollimyrus nigripinnis</i>	-	-	+	Mbese	Mbese
	<i>Petrocephalus chrystyi</i>	-	-	+	Mbese	Mbese
	<i>Petrocephalus microphthalmus</i>	+	-	-	Mbese	Mbese
	<i>Petrocephalus simus</i>	+	-	-	Mbese	Mbese
	<i>Stomatorhinus sp</i>	-	-	+	Mbese	Mbese
Aplocheilidae	<i>Epiplatys</i>	-	-	+	-	-
Cypriniformes						
Cyprinidae	<i>Labeo sp</i>	+	-	-	Mongaza	-
	<i>Labeo parvus</i>	+	-	-	Mongaza	Mubiri
	<i>Leptocypris lujae</i>	+	-	-	-	-
	<i>Leptocypris weeksii</i>	+	-	-	-	Mulima
	<i>Raŕamas buchholzi</i>	+	+	-	-	Mulima
	<i>Raŕamas chrystyi</i>	-	-	+	-	Mulima
	<i>Raŕamas sp</i>	-	+	-	-	Mulima
Alestidae	<i>Brycinus comptus</i>	+	+	-	Mapoyo	Sangu za n'kuala
	<i>Brycinus imberi</i>	-	+	-	Mapoyo	Sangu za n'kuala
	<i>Micralestes acutidens</i>	+	-	-	Mapoyo	Sangu za n'kuala
	<i>Phenacogrammus interrreptus</i>	+	-	-	-	-
Citharinidae	<i>Citharinus macrolepis</i>	+	-	-	Liyanga	Yanga
Distichodontidae	<i>Distichodus antonii</i>	-	-	+	Mboto	Mbutu
Siluriformes						
Claroteidae	<i>Chrysichthys punctatus</i>	-	-	+	Kamba	Suaro
	<i>Parauchenoglanis punctatus</i>	-	-	+	-	Ke
Schilbeidae	<i>Schilbe grenfelli</i>	+	-	-	Lilangwa	Langwa
	<i>Schilbe intermedius</i>	+	-	-	Lilangwa	Langwa
Clariidae	<i>Chanallabes apus</i>	-	+	-	Ngabili	N'tondia
	<i>Clarias buthupogon</i>	-	-	+	Libongo	Ngola
	<i>Clarias gariepinus</i>	+	-	-	Ngolo	Ngola
	<i>Clarias sp1</i>	-	-	+	Ngolo	Ngola
	<i>Clarias sp2</i>	-	+	-	Ngolo	Ngola
	<i>Clarias sp3</i>	-	+	-	Ngolo	Ngola
Mochokidae	<i>Synodontis nigriventris</i>	+	-	-	Likoko	Nkoko
	<i>Synodontis notatus</i>	+	-	-	Likoko	Nkoko

	<i>Synodontis nummifer</i>	+	-	-	Likoko	Nkoko
	<i>Synodontis centralis</i>	-	-	+	Likoko	Nkoko
	<i>Synodontis sp</i>	-	-	+	Likoko	Nkoko
Perciformes						
Cichlidae	<i>Ctenochromis polli</i>	+	-	-	Libundu	Kingulu
	<i>Hemichromis stellifer</i>	+	+	+	Libundu	Kingulu
	<i>hemichromis elongatus</i>	+	+	+	Libundu	Kingulu
	<i>Oreochromis niloticus</i>	-	+	+	Libundu	Bundu
	<i>Pelmatochromis sp1</i>	-	-	+	Libundu	Bundu
	<i>Pelmatochromis sp2</i>	-	+	+	Libundu	Bundu
	<i>Sarotherodon boulengeri</i>	+	+	-	Libundu	Bundu
	<i>Sarotherodon galilaeus</i>	-	+	-	Libundu	Bundu
	<i>Tilapia sp</i>	+	+	+	Libundu	Bundu
	<i>Tilapia tholloni</i>	+	+	+	Libundu	Bundu
	<i>Tilapia zillii</i>	-	-	+	Libundu	Bundu
	<i>Tylochromis lateralis</i>	+	-	-	Libundu	Bundu
Anabantidae	<i>Microctenopoma nanum</i>	+	-	-	Libundu	Bundu
Gonorhynchiformes						
Channidae	<i>Parachanna insignis</i>	-	+	-	Mungusu	Nsinga
Phractoleamidae	<i>Phractoleamus ansorgii</i>	-	-	+	Mokisi	-
Total	64	27	17	30		

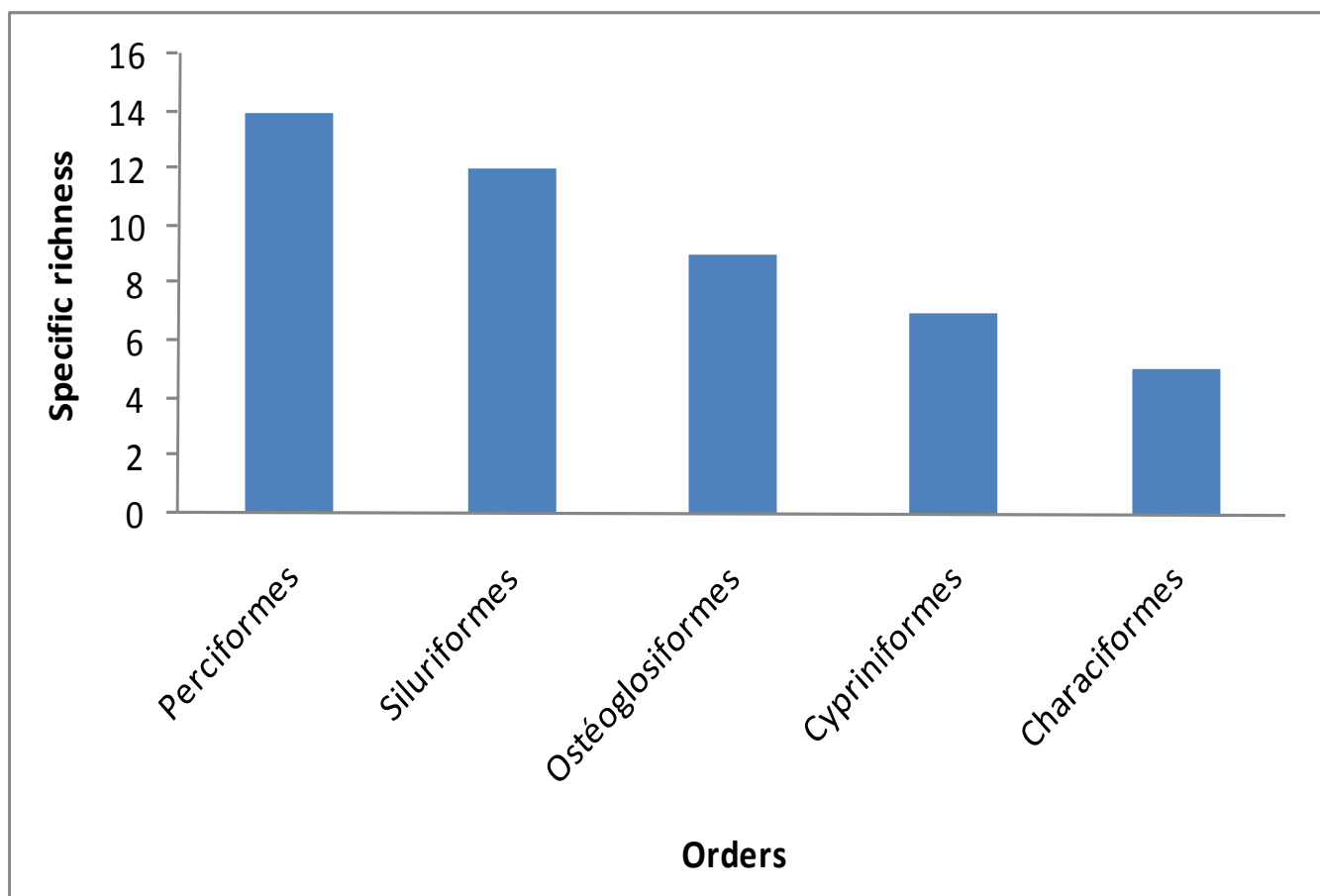


Figure-2  
 Specific richness of orders

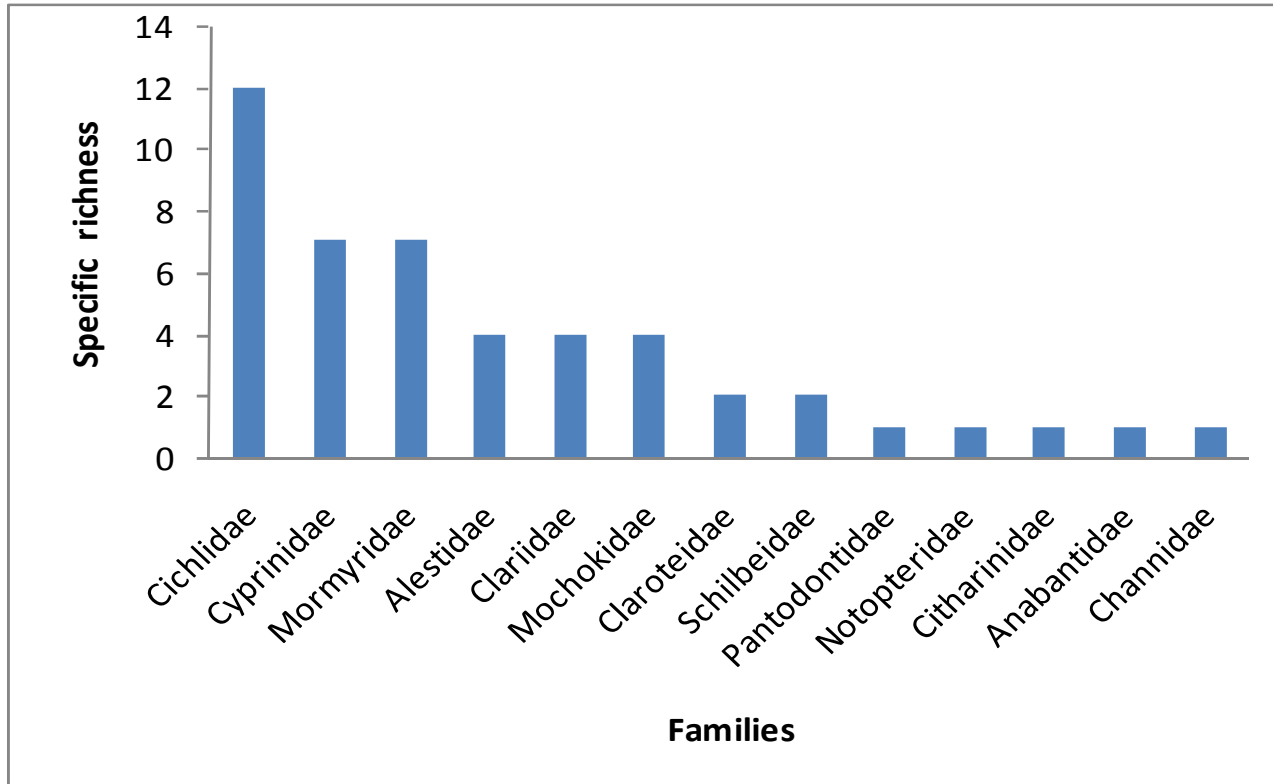


Figure-3  
 Specific richness of families

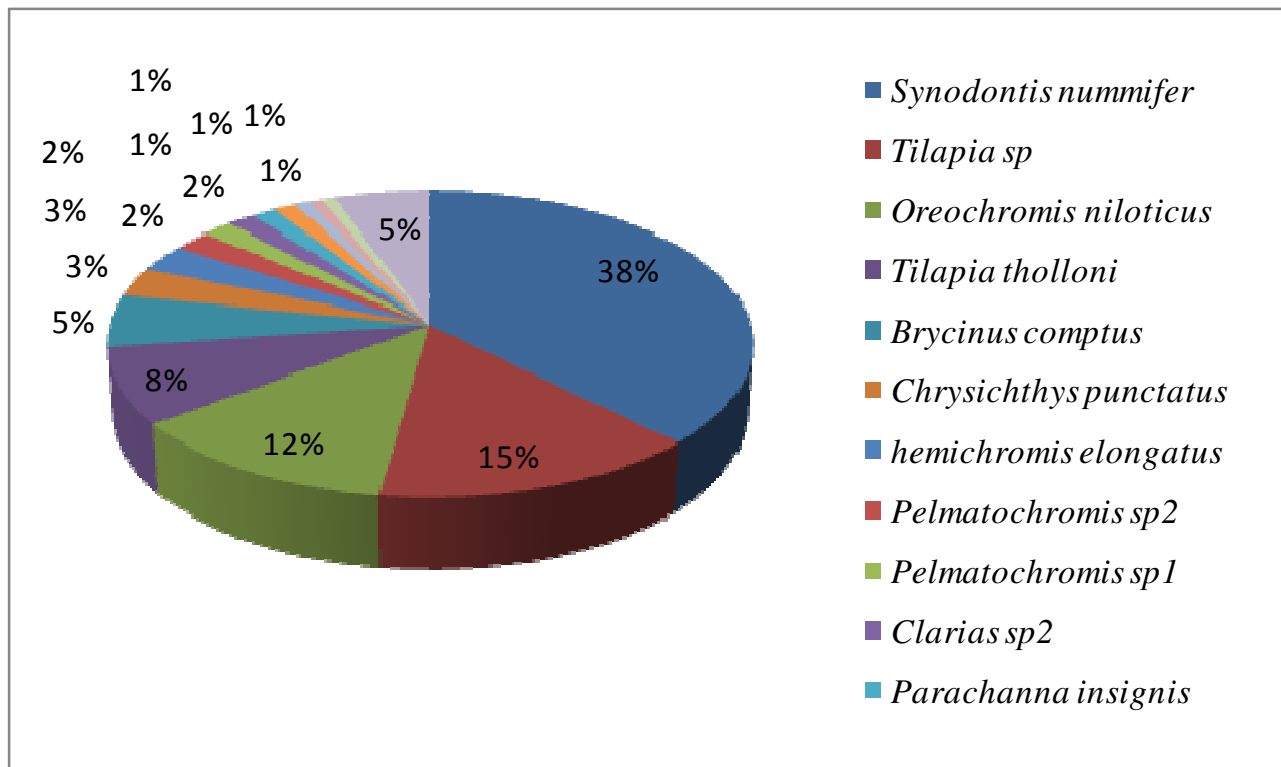


Figure-4  
 Global relative abundance

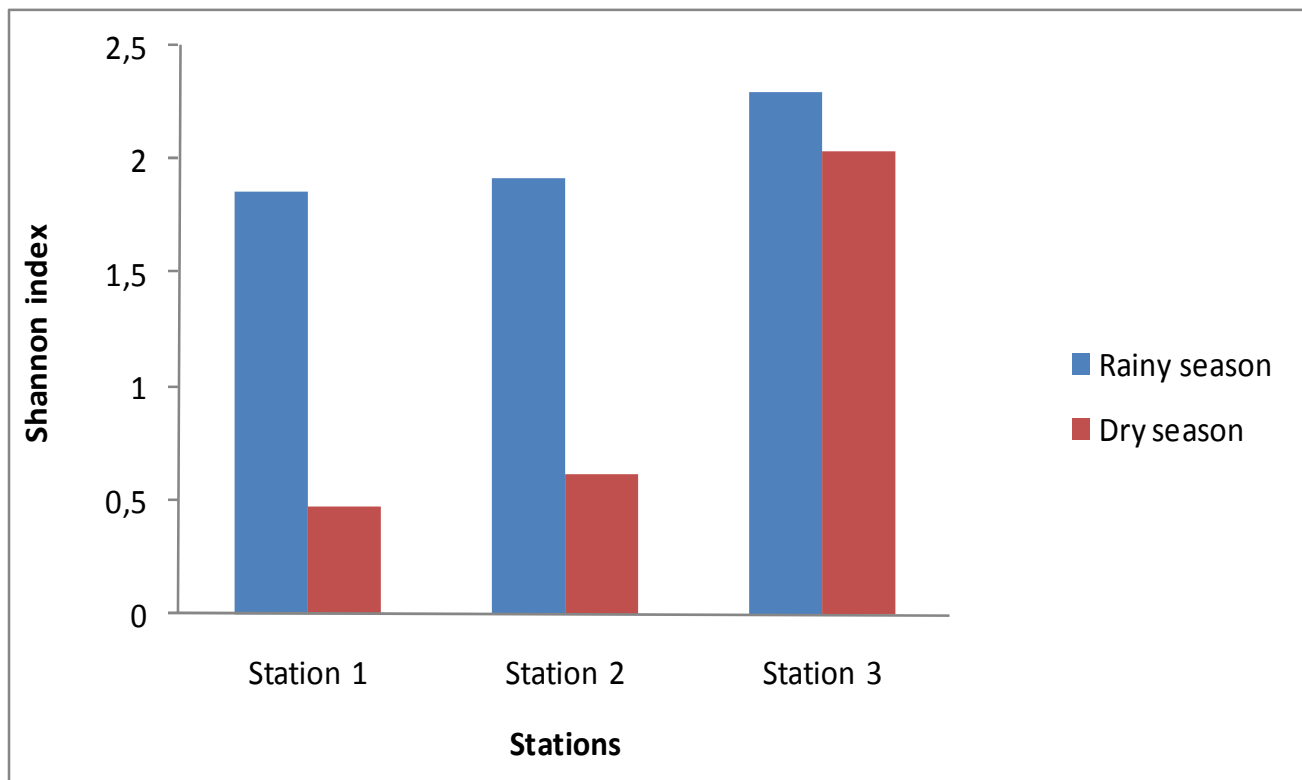


Figure-5  
Spatiotemporal variation of Shannon index

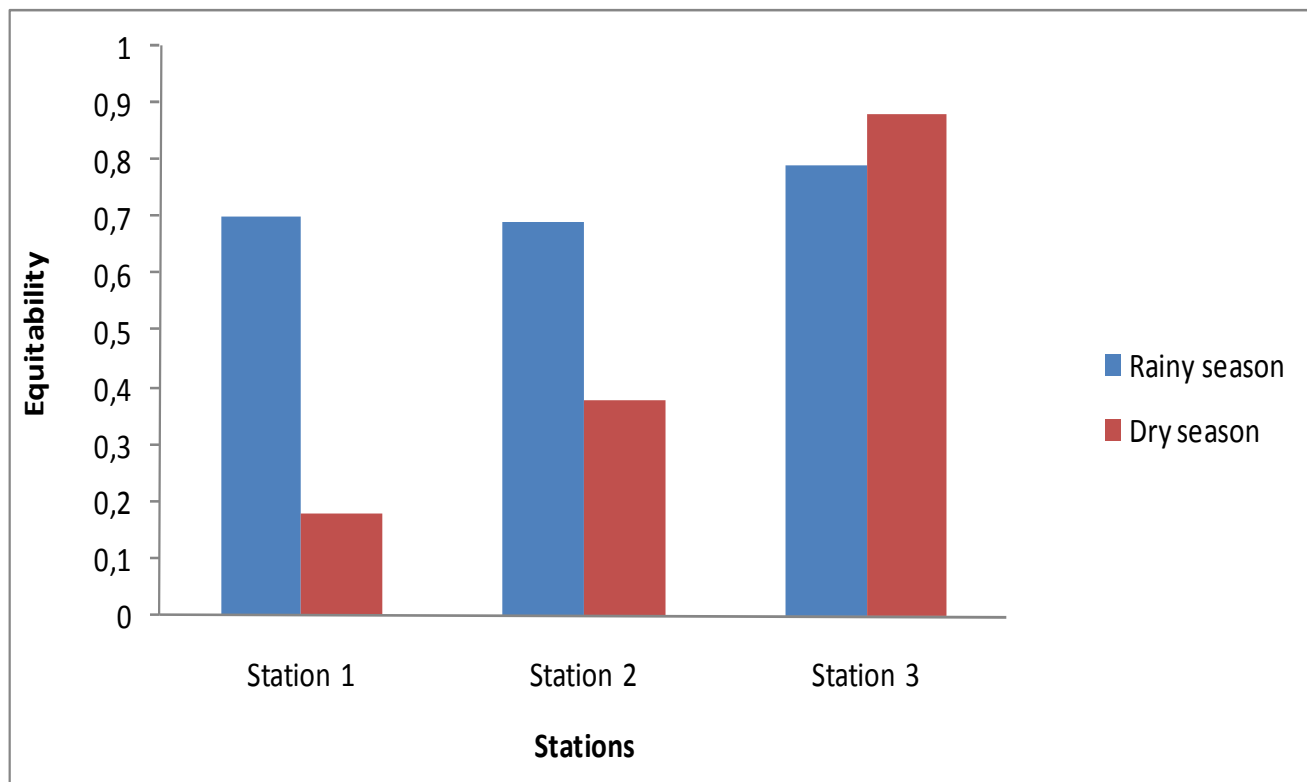
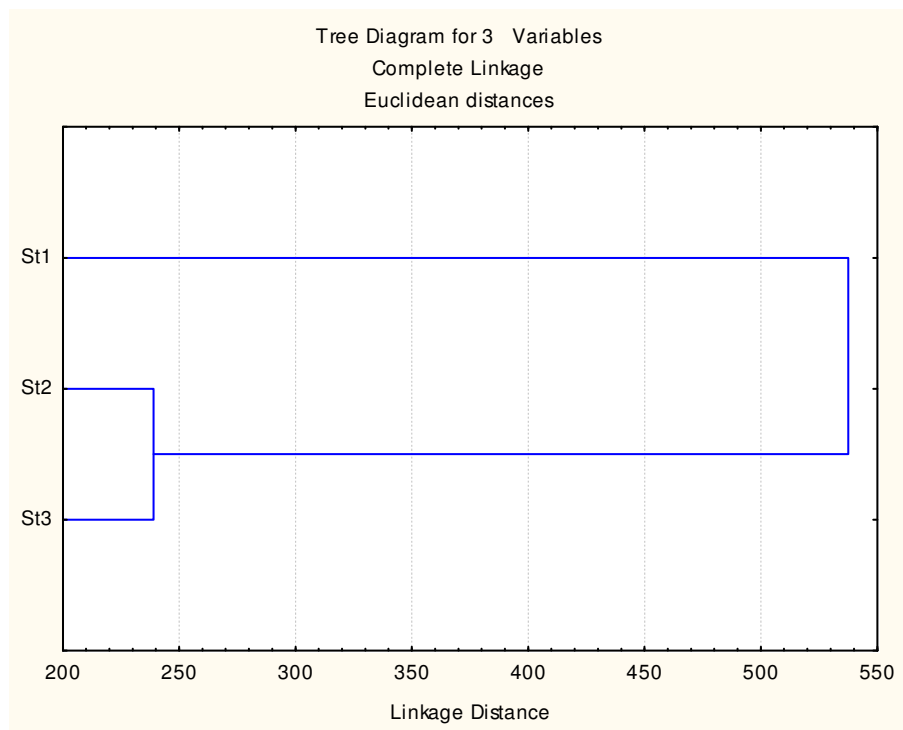


Figure-6  
Spatiotemporal variation of equitability



**Figure-7**  
**Dendrogram specific affinities of fish populations**

## Conclusion

The ichthyofauna of Tsieme River is rich with 47 species belonging to 29 genera, 13 families and 5 orders. Specific diversity is important in view of the diversity index calculated for its location. The longitudinal distribution is characterized by a decrease from downstream to upstream. This study is the first on the Tsieme River allowed us firstly to determine the water quality secondly to establish the profile of ichthyofauna.

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