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Présentation de mes résultats de recherches sur la biodiversité des  
Mormyridae du fleuve Niger au Bénin

**Thème:**

**Biodiversity and Community Structure of Mormyridae (Pisces: Teleostei:  
Osteoglossiformes) from Niger River in Northern Benin: Threats, Conservation  
and Valorization Perspectives**

**Présenté par:**

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# Introduction

- Fish is a rich and a great source of easily digested nutrients containing amino acids, essential fats (e.g. long-chain omega-3 fatty acids), vitamins (D, A and B), and minerals (including calcium, iodine, zinc, iron and selenium).
- Fish provides health benefits in protection against cardiovascular diseases and assists in development of the brain and nervous system in the foetus and infants (FAO, 2016).
- The Mormyridae is a family of freshwater fishes, endemic to African riverine ecosystem with a high commercial and economical importance.
- This family is the most speciose among the Osteoglossiformes comprising 22 genera and about 229 species.
- the Mormyrids are widely distributed in Africa occurred in rivers, streams, lakes and creek except the Sahara, the Maghreb zone bordering the Mediterranean, and the Cape zone in South Africa.

# Introduction

- The fish is mostly favoured by the inhabitants probably because the flesh, though oily is quite tasty and of high flavor (Nwani et al., 2006)
- Mormyrid fishes possess an electric organ that enable a weak electric discharge used for sex and species identification, communication, orientation and prey detection (Hopkins et al., 1986).
- The mormyrid cerebellum in particular is so large that, relative to body size, it is roughly the same size as that of humans.
- In the Niger River in Benin in particular, the elephant fishes represented 12.65% of the commercial catches and appeared to be the second family most prominent in this northern riverine water (Koba, 2005).

# Introduction

- In contrast with the Southern-Benin, this aquatic ecosystems from the Northern region have not received intensive fisheries research and bioecological studies on key family such as Cichlidae, Claroteidae, Siluridae, Osteoglossidae, Mochokidae, Mormyridae etc. are scant
- Notwithstanding their great importance in artisanal fisheries, nothing is known about the fish fauna and community structure of the elephant fishes.
- This fisheries ecological survey in the Niger River in northern Benin aimed to document Mormyrids fish biodiversity in order to improve habitat protection, species conservation and valorization so as to integrate them to aquaculture.

# Material and Methods

## ▶ **Study location**

- The study area is Malanville town (North-East Benin) situated at latitude  $11^{\circ}52'216''\text{N}$ , longitude  $3^{\circ}21'111''\text{E}$ , around the Niger River that serves as frontier between Niger and Benin countries.
- Malanville town extended on  $3.016 \text{ km}^2$  and human population reached 168,641 people.
- The Northern Benin exhibited a soudano-sahelian climate and is characterized by a rainy season from May to July, a flood season from August to September and a long dry period occurring October-April (PDC Malanville, 2006).

# Material and Methods

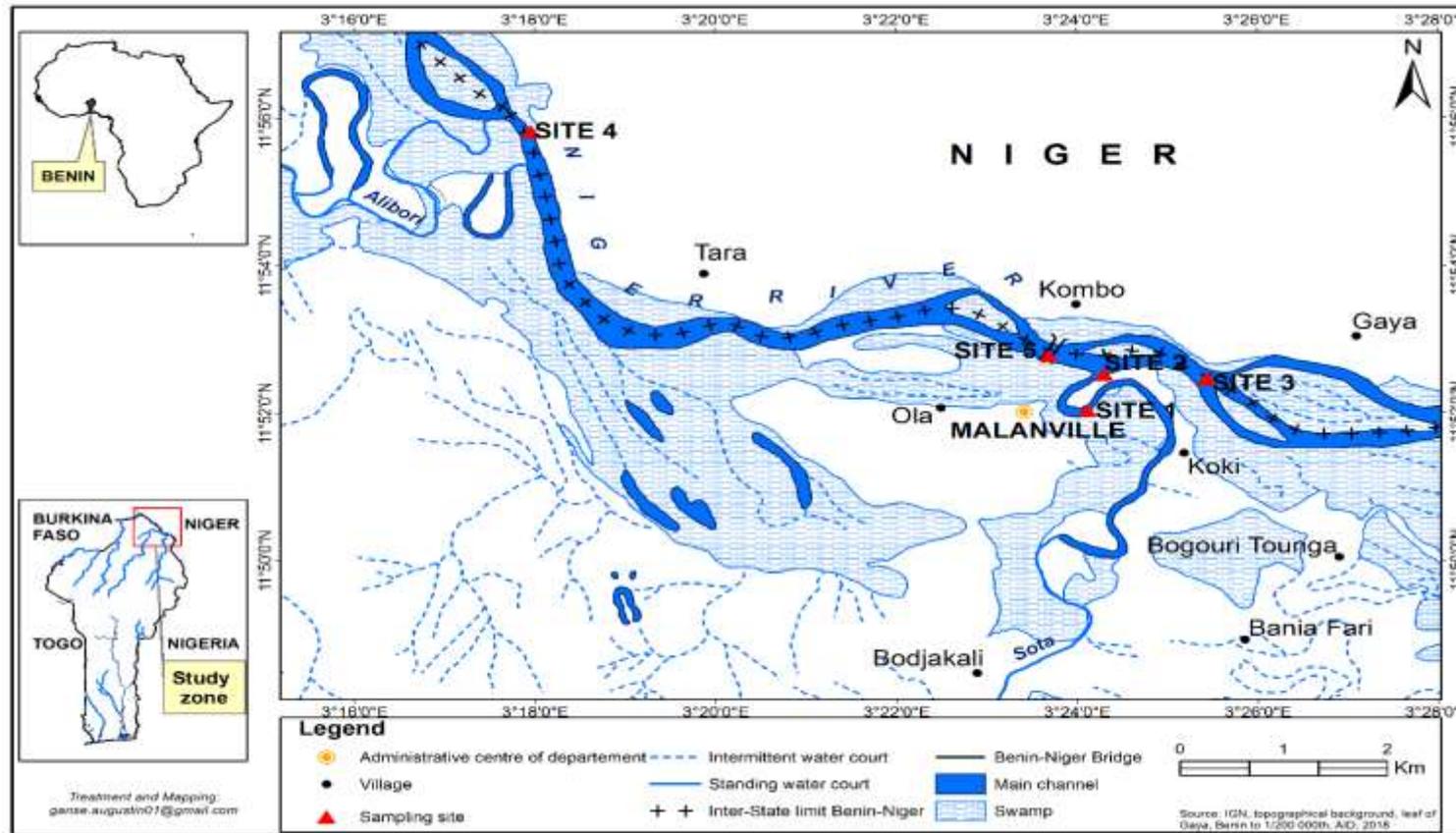
- In Benin, the Niger river displayed three (3) tributaries, Alibori (338 km), Mekrou (410 km) and Sota (250 km) that crossed Malanville and other towns of North Benin such Karimama.
- Dominant aquatic plants species were *Eichornia crassipes*, *Echinochloa stagnina*, *Pistia stratiotes*, *typha australis*, *Mimosa sp*, *Mimosa pigra*, *paspalum serobiculatum*, *Ipomoea aquatica*, *Cyperus cyperoides*, *Ipomoea asarifolia*, *Senna occidentalis*, *Ludwigia senegalensis*, *Ludwigia abyssinica*, *Ludwigia adscendens*, *Ludwigia erecta*, *Achyranthes aspera*, *Azolla africana* etc.

# Material and Methods

## ▶ **Sampling sites**

- In this study, five sampling locations were identified for the evaluation of the water quality and for Mormyrid collections.
- Site1 and Site2 were located on Sota stream. Site 1 was covered by dense vegetation where domestic wastes were rejected whereas Site2, located at Tounga village, was polluted by bathing, dishes and clothe washings. In addition, due to the proximity of rice farming, Site2 was under chemical pollution because of the use of fertilizers and pesticides.
- Site3 was situated on the main channel at Gaya village in Niger Republic. The substratum of this site was rocky with rotten trees that constituted a good habitat for Mormyrids.
- Site4 is located at Money village, on the main channel and communicate with Alibori stream. This site was less degraded and fishing activities were intense during the dry season.
- Site5 was located under Benin-Niger Bridge and also located on the main channel of Niger River. This site was polluted and degraded because of intense anthropogenic disturbances. At the five sites, samplings were performed in the “aquatic vegetation habitat” at the edge of the stream as well as in the “open water habitat” exempt of vegetation (Figure 1).

# Material and Methods



**Figure 1:** Map showing River Niger at Malanville (North-Benin) and the five study locations; 1= Sota Stream (DP) ; 2= Tounga; 3= Gaya (Niger Country) ; 4=Money; 5= Benin-Niger Bridge (BNB)

# Material and Methods

## ► Fish collection

- Specimens of Mormyrids were monthly sampled from February 2015 to July 2016 at all sampling sites
  - In the “aquatic vegetation” habitat and in the “open water” habitat
  - using various fishing gears such as seine (6.15 m × 2 m, 16 mm-mesh), cast nets (6 m-diameter, 20 mm-mesh), experimental gill net (50 m × 1 m, 40 mm-mesh; 50 × 1 m, 30 mm-mesh; 50 m × 1 m, 20 mm-mesh) and traps.
- Also, samplings were made in artisanal captures of local fishermen to add species that were not caught during experimental samplings (Hauber *et al.*, 2011a).

# Material and Methods

- The fish individuals were then preserved in 10% formalin and transported to the “Laboratoire d’Ecologie et de Management des Ecosystèmes Aquatiques (LEMEA)” of the Faculty of Sciences to confirm identifications.
- After collection, the fish individuals were identified in situ using references such as (Nelson, 2006), (Paugy *et al.*, 2003), (Reed *et al.*, 1967) and (Van Thielen *et al.*, 1987).
- Scientific names were confirmed using <http://www.fishbase.org>. In the lab, each fish individual was measured, weighted and latter preserved in 70% ethanol for further biological observations.
- The relative abundance of each mormyrid was computed using the numerical abundance of each species in the fish assemblage and presented in Table 2.

# Results

**Table 1.** Mormyrids fish species inventoried by sampling site in the Niger River at Malanville.

Genera	Species	GAY A	MONEY	PBN	TOUNGA	Dry Port
<u>Marcusenius</u>	<i>Marcusenius senegalensis</i> (Steindachner, 1870)	+	+	+	+	+
<u>Mormyrus</u>	<i>Mormyrus macrophthalmus</i> (Günther, 1866)	+	+	+	+	
	<i>Mormyrus rume</i> (Valenciennes, 1847)	+	+	+	+	
	<i>Mormyrus hasselquisti</i> (Valenciennes, 1847)	+			+	
<u>Hyperopisus</u>	<i>Hyperopisus bebe</i> (Lacepède, 1803)	+	+	+	+	+
<u>Petrocephalus</u>	<i>Petrocephalus bovei</i> (Valenciennes, 1847)	+	+		+	+
<u>Hippopotamyrus</u>	<i>Hippopotamyrus psittacus</i> (Boulenger, 1897)	+	+		+	
<u>Pollimyrus isidori</u>	<i>Pollimyrus isidori</i> (Valenciennes, 1847)	+	+		+	+
<u>Brienomyrus</u>	<i>Brienomyrus niger</i> (Günther, 1866)	+	+		+	+
<u>Mormyrops</u>	<i>Mormyrops anguilloides</i> (Linnaeus, 1758)	+	+		+	
<u>Campylomormyrus</u>	<i>Campylomormyrus tamandua</i> (Günther, 1864)	+	+			
	<b>Number of genera : 09</b>					
	<b>Number of species : 11</b>					

Photos of Mormyrid fishes caught in Niger River at Malanville



*Marcusenius senegalensis* (Steindachner, 1870)



*Mormyrus macrophthalmus* (Günther, 1866)



*Mormyrus rume* (Valenciennes, 1847)



*Mormyrus hasselquisti* (Valenciennes, 1847)



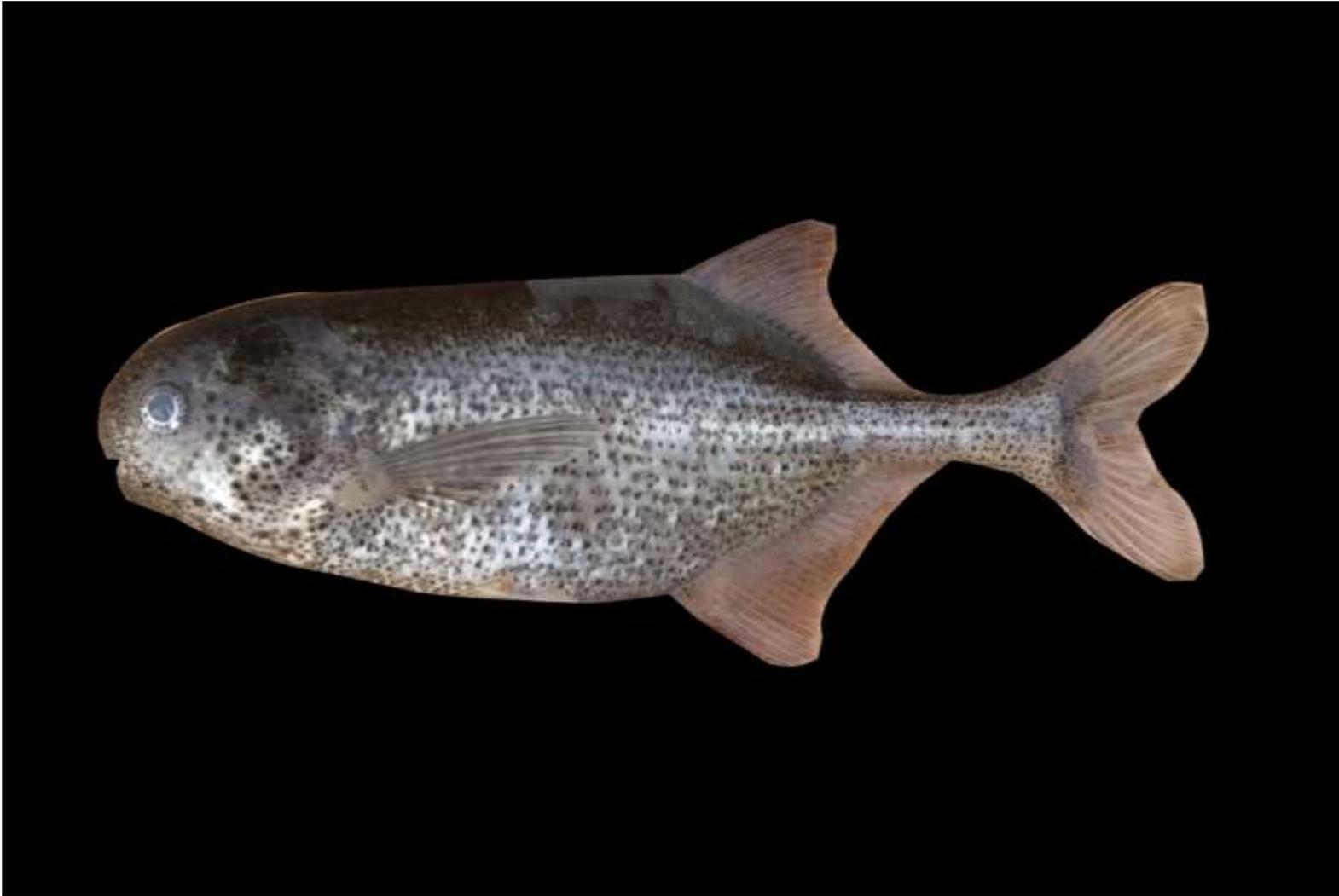
*Hyperopisus bebe* (Lacepède, 1803)



*Petrocephalus bovei* (Valenciennes, 1847)



*Hippopotamyrus pssittacus* (Boulenger, 1897)



*Pollimyrus isidori* (Valenciennes, 1847)



*Brienomyrus niger* (Günther, 1866)



*Mormyrops anguilloides* (Linnaeus, 1758)



*Campylomormyrus tamadua* (Günther, 1864)

# Results

**Table 2:** Fish species composition: Abundance, mean size and weight, size and weight range of the fish in the Niger River at Malanville (North Benin)

Species	Abundance	Relative Abundance %	Mean SL (cm)	Range SL (cm)	Means Weight (g)	Range Weight (g)	Total Weight (g)	Percentage Weight
<i>Brienomyrus niger</i>	139	2.04	8.58	5.7-15.5	8.97	2.5-32.9	1246.10	0.85
<i>Campylomormyrus tamandua</i>	11	0.16	21.25	16.5-24.3	94.32	46-116.5	1037.50	0.70
<i>Hyperopisus bebe</i>	780	11.43	16.16	5.8-35.9	35.92	3.6-380.5	28017.72	19.03
<i>Hippopotamyrus pssittacus</i>	320	4.69	8.56	4.8-15.2	9.84	1.8-37.6	3150.20	2.14
<i>Marcusenius senegalensis</i>	2985	43.74	11.28	6.0-23.6	18.15	3.9-220.1	54370.20	36.92
<i>Mormyrops anguilloides</i>	64	0.94	17.88	7.7-44.7	69.60	5.0-859	4454.59	3.02
<i>Mormyrus hasselquisti</i>	9	0.13	17.68	8.7-21.1	69.84	6.9-112.7	628.60	0.43
<i>Mormyrus macrophthalmus</i>	1015	14.87	10.75	5.6-22.8	12.97	2.4-129.7	13169.00	8.94
<i>Mormyrus rume</i>	583	8.54	17.83	10.0-42.1	63.43	6.7-611	36979.60	25.11
<i>Petrocephalus bovei</i>	765	11.21	6.45	4.7-12.5	4.94	1.4-22.2	3781.20	2.57
<i>Pollimyrus isidori</i>	154	2.26	5.46	3.8-7.9	2.80	1.0-6.0	431.20	0.29
	6825	100					147265.91	100

# Results

- Numerically, *Marcusenius senegalensis* was the most abundant species and made 43.74% of the mormyrid sub-community followed by *Mormyrus macrophthalmus* (14.87%), *Hyperopisus bebe*, (11.43%), *Petrocephalus bovei* (11.21%), *Mormyrus rume* (8.54%) and *Hippopotamyrus pssittacus* (4.69%).
- *Mormyrus hasselquisti* (9 specimens) have been recorded at Gaya and Tounga while *Campylomormyrus tamandua* (11 specimens) was found only at Gaya and Money.

# Results

## Degradation factors affecting mormyrids biodiversity in the Niger river

Major degradation factors of the Niger River at Malanville were:

- ❖ climate change;
- ❖ intense human's activities in and around the river (sand dredging, human waste dumpings, ditch cleanings, clothe washings, bathings, irrigation, the use of synthetic fertilizers and pesticides for adjacent agriculture);
- ❖ invasion of floating plants (*Echhornia crassipes*, *Pistia stratiotes*, *Nymphaea sp*);
- ❖ the use of detrimental fishing gears causing overfishing, biodiversity loss;
- ❖ the destruction of spawning and nursery grounds of many species greatly affected the water quality.



**Riverbank erosion**



“Barrage” system using Malian traps



Massive capture of juveniles Mormyrids fish



Sand dredging and paddy fields installed in the floodplain where synthetics fertilizers are used

# Discussion

- Degraded sites such as Sota stream ( $4.15 \pm 1.16$  mg/l) and in Benin-Niger Bridge ( $4.83 \pm 1.24$  mg/l) show respectively low dissolved oxygen and low water transparencies averaging  $17.78 \pm 17.79$  cm and  $18.94 \pm 18.34$  cm.
- Also, water temperatures at Money and Sota Stream sites were high and reached  $35.6^\circ\text{C}$  and  $34.5^\circ\text{C}$ , respectively.
- This trends were critical for the optimal growth of some fishes. The proliferation of water hyacinth (*Echornia crassipes*) in these sites, in addition of reducing the primary production, caused the reduction of dissolved oxygen (Liu *et al.*, 2017).
- As reported by Hugueny *et al.*, (1996), Mormyrid fishes are intolerant to pollution and their scarcity (**five and four species**), respectively, may be the result of the high pollution observed in these locations.

## Discussion

- However, the others less degraded sites (Gaya, Money and Tounga) present a relatively good condition and harbored 11, 10 and 10 species respectively.
- With regard to season, the dry season was more speciose than the others season with respective species richness of 11, 10 and 10 species.
- This trend because in the dry season many vegetations areas dried up, water level decreased, evaporation are high due to drought and the fish was concentrated in one place.
- So they are easily caught

# Conclusion

- This ichthyological investigation revealed that the Niger River in Northern-Benin harbored about eleven (11) Mormyrid fish species belonging to nine (9) genera.
- Major degradation factors such the non-respect of fishing regulation, climate changes, intense human's activities leading to pollution, the use of controversial fishing gears causing overfishing and the loss of spawning/nursery grounds constituted the major threats of the elephant fishes.
- To conserve biodiversity and promote its sustainable use, it is necessary to know the species and the value they value or services they provide us.
- A holistic management scheme of the Niger River is required for a sustainable exploitation of the fish fauna, including Mormyrids species.

The image shows two fish, likely catfish, resting on a white ceramic plate. The plate features a faint floral pattern and a dark brown, irregular border. The fish are positioned horizontally, one above the other. The top fish is lighter in color, with a yellowish-brown hue, while the bottom fish is darker, appearing almost black. The text "Merci de votre aimable attention" is overlaid in yellow, centered between the two fish.

Merci de votre aimable attention