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Preliminary assessment of fish diversity in Lowa River

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ABSTRACT

***Key words*: fish diversity, evaluation, Lowa basin**

During this study, nineteen species have been collected in Lowa River. All species belong to 6 orders (Siluriforms, Osteoglossiforms, Perciforms, Synbranchiforms, Cypriniforms and Characiforms) and 10 families: Clariidae, Schilbeidae, Bagridae, Claroteidae, Mormyridae, Cichlidae, Mastacembellidae, Cyprinidae, Alestidae and Distichodontidae. Eighteen genera are almost monospecific except the genus *Labeo*. The different species collected are *Clarias* sp., *Parauchenoglanis punctatus*, *Pollimyrus* sp., *Oreochromis niloticus*, *Mastacembellus congicus*, *Labeo lukulae*, *L. macrostomus*, '*Barbus'* sp., *Bryconaethiops boulengeri*, *Brycinus* aff. *poptae*, *Pareutropius debauwi*, *Bagrus bajad*, *Bathybagrus graueri*, *Mormyrus caballus*, *Myomyrus* aff. *macrops*, *Marcusenius* sp., *Raiamas* sp., *Micralestes humilis* and *Distichodus altus*. The species distribution in Lowa within the different habitats is driven by substratum habitats characteristics. The specimens of Clariidae, Claroteidae, Bagridae, Schilbeidae, Mormyridae have been collected in shallow with a silt-substratum and quite water. The Cyprinidae, Alestidae and Distichodontidae have a trend to colonize the station with an almost rapid-waters and close to the macrophytes roots. The Mastacembelidae specimens are distributed within the roots that submerged at the inshore stations. The Cichlidae was scarce in capture. Some species were limited by waterfall. For example, *Marcusenius* sp. and *Myomyrus* sp. can be only found in upstream of Boboro waterfall. The PCA showed an overlap between Lowa *Marcusenius* specimens and *Marcusenius intermedius*.

RESUME

***Mots-clés:* Diversité des poissons, évaluation, bassin de la Lowa**

Dans le cadre de ce travail, 19 espèces de poissons ont été collectées dans la rivière Lowa. Ces espèces appartiennent à 6 ordres (Siluriformes, Osteoglossiformes, Perciformes, Synbranchiformes, Cypriniformes et Characiformes) ; réparties en 10 familles (Clariidae, Schilbeidae, Bagridae, Claroteidae, Mormyridae, Cichlidae, Mastacembellidae, Cyprinidae, Alestidae et Distichodontidae). L'ichtyofaune est représentée par 18 genres comprenant chacun presque une espèce excepté le genre *Labeo*. Ces espèces sont *Clarias* sp., *Parauchenoglanis punctatus*, *Pollimyrus* sp., *Oreochromis niloticus*, *Mastacembellus congicus*, *Labeo lukulae*, *L. macrostomus*, '*Barbus'* sp., *Bryconaethiops boulengeri*, *Brycinus* aff. *poptae*, *Pareutropius debauwi*, *Bagrus bajad*, *Bathybagrus graueri*, *Mormyrus caballus*, *Myomyrus* aff. *macrops*, *Marcusenius* sp., *Raiamas* sp., *Micralestes humilis* et *Distichodus altus*. L'habitat semble être le facteur qui influence la distribution des espèces dans la Lowa. Les Clariidae, Claroteidae, Bagridae, Schilbeidae et Mormyridae ont été collectés à des sites moins profonds, calmes, caractérisés par le limon comme substrat. Les Cyprinidae, Alestidae et Distichodontidae étaient collectés sur des stations avec le courant d'eau rapide, et proche de racines des macrophytes alors que les Mastacembelidae étaient collectés au niveau des stations avec racines des plantes submergées à la côte. Le Cichlidae était rare dans les captures. Il semble que certaines espèces soient limitées par des chutes en aval des stations de pêche.

1. INTRODUCTION

The Congo basin is the second in the word, after the amazon basin according to its biodiversity and area. Its area is about 3,6 10^6 km^2 (Larake et al., 1993) with a particular endemicity.

Indeed, up to 2008, 3240 fish species have been recognized in Africa (Lévêque et al., 2008). In the Congo basin, Teugels & Guégan (1994) estimated the number of described species to about 696 species. At present, Snoeks et al. (2011) estimate to about 1250 the number of fish species in this region but this number should be more important according to the fact that some parts of the region never been investigated (Lévêque, 1997; Lévêque & Paugy, 2006; Stiassny et al., 2007a). The Congo basin belongs among the ichtyological region less known despite of his importance in endemicity rate and wide area (Teugels & Guégan, 1994; Lévêque, 1997; Lévêque & Paugy, 2006; Revenga & Kura, 2003 in Snoeks et *al*., 2011) in comparison of the western and lower Guinea ichtyofaunal provinces which are deeply known in Africa than other ichtyofaunal provinces (Paugy et *al*., 2003 a,b; Stiassny et *al*., 2007 a,b).

The background knowledge of Congo basin fish started with the expedition made by Boulenger (1901). Since, it was the first database of ichtyological studies in whole Congo basin. Overall, in the three parts of the Congo River (lower, middle and upper flows), the studies are scarce, disparate and mainly old. Between 1936 - 1979, some ichtyological studies were carried out within the first and second parts of the basin (see Fowler, 1936; Gosse, 1963; De Kimpe, 1964; Matthes, 1964; Gosse, 1968; Poll & Gosse, 1963; Banister & Bailey, 1979). Even in lower Congo the fish studies were restarted by Roberts & Stewart (1976) studying the ecological and systematic of rapids of freshwater fishes of lower Congo. Later, Mutambue (1984, 1992) followed and worked on the systematic, biology and ecology of fishes of Luki River. However, in lower and middle flows, some updates ichtyological studies can be recorded since the end of 20^{th} century and the first decade of 21^{th} century. The study of Tshibwabwa (1997) on the systematic of *Labeo*, the thesis of Ibala (2010) and Wamuini (2010) as well as Mbadu (2011) in middle and lower Congo about the diversity of Luki, Inkisi River and the update of systematic and ecology of *Distichodus* species in pool Malebo respectively. However, none update study on the fish of the upper Congo has been made except the old data above mentioned. The same case is observed in Lowa basin in north-western of Goma town. Indeed, the Lowa basin rivers fish were not studied yet. Only during the Marlier (1954) study on the ecological characteristics of eastern tropical rivers, he attempted the record of some species in one of the second-level tributary of Lowa in the basin (Cinganda, tributary of Luwowo = tributary of Lowa). In the manuscript, he paraphrased the presence of specimens of *Varhicorinius*, *Clarias* and some species of *Barbus* in this river.

The case of Lowa River remains critically despite the fact that the Lowa River is the main large-river and the sole tributary of the Congo River which flows in North-Kivu ie at the limit with the Nile basin. In this region, the Lowa River is the main source of water resources and its fish fauna constitutes an important source of animal proteins for populations (Kisekelwa, 2012). In addition, the Lowa River could shelter some endemic fish species given the waterfall and rapids and the accidental topography that characterize the river (and its basin) and which constitute natural barriers of fish dispersion in the basin. Unfortunately, this aspect does not been investigated while the demographic pressure on the natural resources in the region increases considerably.

In this study we present the results from preliminary observations on fish diversity of the Lowa River for its good management. Indeed, the knowledge of the systematic of fishes is very important to solve questions of conservation and it is a key for the good management of the freshwater fish resources (McNeely, 2002).

2. MATERIAL AND METHODS

2.1. Study area

Samples were collected in Lowa basin (fig. 1). Lowa basin situated in Eastern of DRC shared between two provinces: (1) the North Kivu and (2) south Kivu provinces.

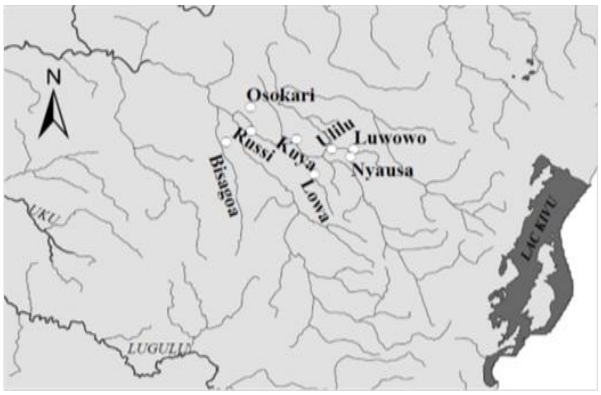

Fig. 1: Lowa basin structure, top of the map (map Kisekelwa & Darchambeau, unpublished data).

In the map above, we showed only the centre of the basin from Nyassi village (Luwowo river) up to Osokari village (Osokari river) on the Kisangani road. The territory of Walikale in North-Kivu contains the major of the Lowa basin and mainly the distance runs by the Lowa River. Lowa River is the right bank tributary of Congo River. It runs from mountain around Minova no far from South-Kivu and then flows in the forest of Masisi and Walikale in North-Kivu provinces. After, this river flows in the Congo River into Maniema province.

Samples of fish were collected in the Lowa River in Walikale city. Walikale territory has a wide and dense forest.

The climate conditions are mainly influenced by the dense wet-forest. Almost, it rains during all year but during the year, we have the period of more rains and the period of less rains. June-August is the dry season but the period with less rain is between February-April and the most rains are between October-December. However, during the dry season, it is possible to record some rains.

The sampling stations were situated in upstream of Boboro waterfall but between the upstream and downstream of Walikale city. Walikale city is among the cities densely populated in the territory with almost the half of 600000 populations recorded in 2000 (Anonyme, 2007). The populations of Walikale are mainly depending to natural activities for their livelihood. The fishing by crafted methods are used in the region: inappropriate fishnets, the fish-hooks, fish-traps and application of toxic product of native plants…Almost of these methods used belong among the threats of freshwater fishes of Walikale and mainly of Lowa River.

2.2. Sampling program, data collection and statistical analysis

2.2.1. Sampling program

Samples were collected in February, July and September 2009 corresponding to small rain season, dry season and rain season. In this paper, we have not taken care of the temporal variation, but the overall diversity.

2.2.2. Samples collection, samples field and lab treatments

Fishnets, fish-traps, fish-hooks and craft tools of fishing have been used to collect fish samples (fig. 3). Different stations were chosen according to diversity of habitat in the region in order to collect the possible maximum of diversity (fig. 2). Overall, we found four main habitat types in the Lowa River. The first characterised by shallow water with a silt substratum and the quite water, the second characterised by rapid waters, stations near of macrophytes' roots and the station which is characterised by the mixing of sand and stony habitat. After each expedition and fishing, specimens of fish were selected among all fishes collected and then classified by family or genus. After, each group was kept in a jar containing formalin 10% for the preservation.

Fig. 2: General view of fishing stations in Lowa River

In lab, the first attempt of identification was carried out at Unité d'Enseignement et de Recherche en Hydrobiologie Appliquée (UERHA/ISP/Bukavu). The final identification has been possible at Royal Museum of Central Africa (RMCA) Tervuren Belgium. Different keys were used for identification (Thys Van Den Audernaede, 1964; Poll, 1967; Poll & Taverne, 1967; Paugy, 1986; Teugels, 1986 Poll & Gosse, 1995; Tshibwabwa, 1997; De Vos, 199 ; Vreven , 2001; Norris, 2002; Geerinckx et *al.*, 2004; Ibala, 2010; Stiassny et al., 2007).

We needed the details comparison between the specimens of *Marcusenius* collected in Lowa River and some valid species housed in RMCA in Belgium. So, according to Boden et al. (1997) twelve meristics counts and twenty seven measurements were taken in each specimen included in the comparison. However, one meristic count was incomplete and removed in the final analysis. The meristic counts are: (1) the number of scales on lateral line which included the dark vertical band (SDB) running between dorsal and anal fins. The number of dorsal-fin rays (DFR), anal-fin rays (AFR), pelvic-fin rays (PLFR), pectoral-fin rays (PCFR), both branched and unbranched rays have been gathered during the counting. Also, scales have been counted. The number of scales on the lateral line (SLL), we also verify whether the number of the scales around the caudal peduncle (SCP) is eight for each specimen. Three additional counts of scales were added. The number of scales rowed between the anterior base of the dorsal fin and the anterior base of the anal-fin (SDA), the number of scales rowed between anterior base of the dorsal-fin and the lateral line (SDL); the pierced scale of lateral line is not including. Finally, the number of scale rowed between the anterior base of the pelvic-fin to up, but the lateral line scale is excluded (SPL). The teeth in upper (TUJ) and lower jaws (TLJ) were counted. For the definition of the morphometric measurements, see Boden et al (1997).

Fig. 3. Fishing gears (fishnets and fish-trap) used during the sampling of fishes in Lowa River.

2.2.3. Data statistical analysis

All data were submitted to Principal Component Analysis (ACP) for the comparison. The covariance matrix was used for the metric data after logarithmic transformation while the correlation matrix was used for the untransformed meristic counts data.

As the first component is the size factor, we left it and then considered now the second and the third components which are shape factor (Humphries et al. 1981; Bookstein et al., 1985). About untransformed data, only the first and second components were taken in comparison (Boden et al., 1997).

3. RESULTS

3.1. Specific fish composition

From 1474 specimens collected, nineteen species have been recognized. They belong to 7 orders (Siluriforms, Synbranchiforms, Osteoglossiforms, Perciforms, Cypriniforms and Characiforms) and 10 families: Clariidae, Schilbeidae, Bagridae, Claroteidae, Mastacembellidae, Mormyridae, Cichlidae, Alestidae, Cyprinidae and Distichodontidae (table 1).

Table 1: Specific composition of fishes in Lowa River

Order	Familly	Genus	Species
Siluriforms	Clariidae	*Clarias*	*Clarias* sp.
	Schilbeidae	*Pareutropius*	*Pareutropius debauwi* (Boulenger, 1900)
	Bagridae	*Bagrus*	*Bagrus bajad* (Forsskål, 1775)
	Claroteidae	*Parauchenoglanis*	*Parauchenoglanis punctatus* (Boulenger, 1902)
		Bathybagrus	*Bathybagrus graueri* (Steindachner, 1911)
Osteoglossiforms	Mormyridae	*Pollimyrus*	*Pollimyrus* sp.
		Mormyrus	*Mormyrus caballus* Boulenger, 1898
		Myomurus	*Myomurus* sp. aff. *macrops* Boulenger, 1914
		Marcusenius	*Marcusenius* sp.
Perciforms	Cichlidae	*Oreochromis*	*Oreochromis niloticus niloticus* (Linnaeus, 1758)
Synbranchiforms	Mastacembellidae	*Mastacembellus*	*Mastacembellus congicus* Boulenger, 1896
Cypriniforms	Cyprinidae	*Labeo*	*Labeo lukulae* Boulenger, 1902
			*Labeo macrostomus*Boulenger, 1898
		Barbus	*'Barbus'* sp.
		Raiamas	*Raiamas* sp.
Characiforms	Alestidae	*Bryconaethiops*	*Bryconaethiops boulengeri*Pellegrin, 1900
		Brycinus	*Brycinus affinis poptae* (Pellegrin, 1906)
		Micralestes	*Micralestes humilis*Boulenger, 1899
	Distichodontidae	*Distichodus*	*Distichodus altus* Boulenger, 1899

Except the genus *Labeo*, the other genera currently contain each one species. Within species *Parauchenoglanis punctatus* was the most abundant species in the capture. However, other species like *Bagrus bajad*, *Bathybagrus graueri*, *Marcusenius* sp. and *Mastacembellus* were very scarce during the sampling work.

Among the 7 orders collected, the Siluriforms were the most diversified with 40 % of the families. The Characiforms represented 20 % of the families. The Osteoglossiforms, Perciforms, Synbranchiforms and Cypriniforms have only 10 % of the families which is the equivalent of 1 family by order (fig. 4).

Within the ten families, the Mormyridae have 4 genera (24%), Alestidae have 3 genera (18%), Claroteidae with 2 genera (12%) while the other families were represented by only one genus (fig. 4).

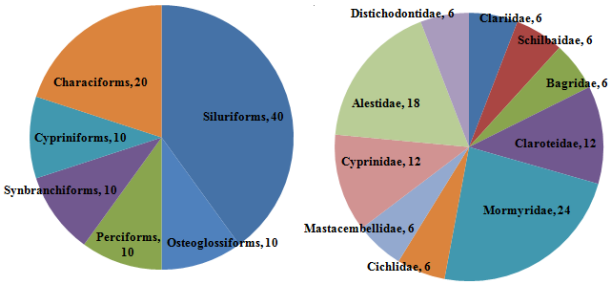

Fig. 4. Proportional representation of each order and -family

On the other hand, the pattern of family distribution within the stations is driven by the diversity of habitat (table 2).

Table 2: General characteristics of habitats of the Lowa River and trend of distribution pattern of the taxa

Taxon	Characteristics of habitats
Clariidae	Shallow with a silt-substratum and quite water
Claroteidae	
Bagridae	
Schilbeidae	
Mormyridae	
Cyprinidae	Rapidwaters, close to the macrophytes roots and in sand-stony habitats
Alestidae	
Distichodontidae	
Mastacembelidae	Habitats near the roots of macrophytes
Cichlidae	Scare in frequency

Indeed, Lowa River is among the large and turbulent river in the region. All Siluriforms (Clariidae, Claroteidae, Bagridae, Schilbeidae) shared the almost the same habitat as well as the Mormyridae fish. They have been collected in shallow with a silt-substratum and quite water. The Cyprinidae, Alestidae and Distichodontidae were distributed within the habitats which are in general similar.

Their trend was to colonize the stations with almost rapid waters and near to the macrophytes roots as well as the Mastacembelidae fish which was restricted almost near from the macrophytes station. The Cichlidae however, were scarce in capture and difficult then to be characterised by the simple method used in this study.

3.2. Taxonomic details analysis of *Marcusenius* sp.

The taxonomic identification of some species like *Marcusenius*, *Myomyrus* as well as the specimens of large *Brycinus* was fussy and more details analysis was required. In this study we attempted only details comparison between the specimens of *Marcusenius* collected in Lowa and some valid species of *Marcusenius* with eight large circumpeduncular scales housed in Royal Museum of Central Africa (RMCA) Belgium Tervuren because of the time available.

The morphometric comparison between the *Marcusenius* specimens of Lowa River and specimens of *Marcusenius intermedius* (Pellegrin, 1924) as well as *Marcusenius moorii* (Günther, 1867) when we considered the variance-covariance matrix showed the overlap between the three groups (fig. 5). It means that the general shape of the three groups may be similar. Nevertheless, this trend changed when we have considered the first *vs* second components (fig. 6).

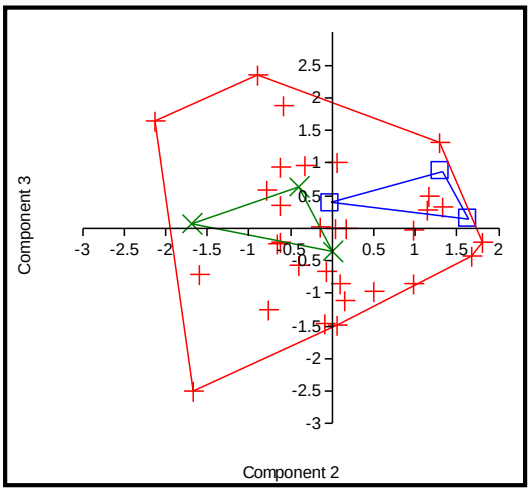

Fig. 5: Scatplot of component 2 vs component 3 of log-transformed metric data in percentage of all specimens of *Marcusenius* sp. (+), *Marcusenius intermedius* (X) and *Marcusenius moorii* (□).

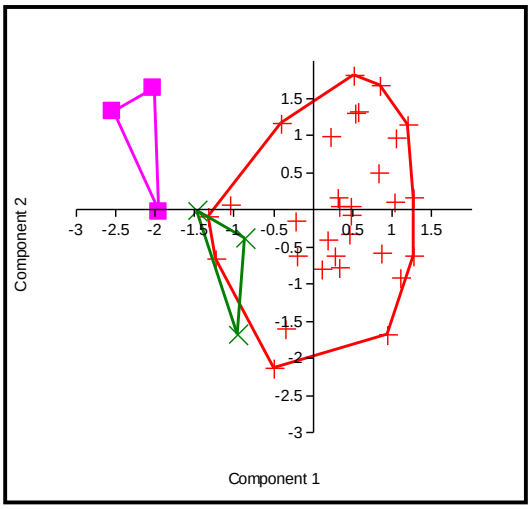

Fig. 6: Scatplot of component 1 vs component 2 of log-transformed metric data in percentage of all specimens of *Marcusenius* sp. (+), *Marcusenius intermedius* (X) and *Marcusenius moorii* (□).

However, the combination together of both the thirst and second components, shown an allometric difference (Fig. 6). Indeed, low morphometric difference in shape than in length between both the three groups was recorded. According to the figure 6, *Marcusenius* of Lowa River and *M. intermedius* overlapped while *M. moorii* was isolated. The explanation of this trend is that the size of *M. moorii* is greater than the specimens of Lowa River.

The analysis we made in correlation matrix of untransformed meristic data shown three different groups (fig. 7). The group one was the *Marcusenius* of Lowa River which took the positive and negative sides of second component, even the negative side of the first component. The both remain two groups; i.e *M. intermedius* as well as *M. moorii* were in negative side of first component.

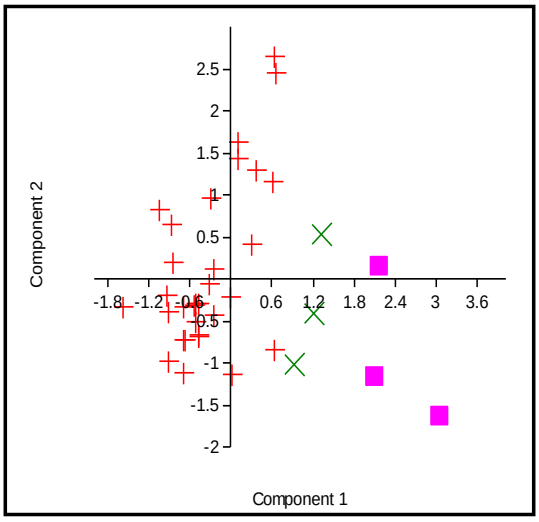

Fig. 7: Scatplot of firts and second component of untransformed meristic data performed on *Marcusenius* sp. specimens (+), *M. intermedius* (X) and *M. moorii* (▪).

Finally, the difference between Lowa *Marcusenius* specimens and the both valid specimens, i.e *M. intermedius* and *M. moorii*, might be possible. However, more analysis must be performed on the three groups in order to detect where difference can be located. We are going to carry out other details analysis in this case. Nevertheless, the difference in meristic count could be explained by the difference interval of scale number in lateral line, the number of dorsal-fin rays as well as the number of anal-fin rays; while the morphometric could probably be different in the body height.

4. DISCUSSION

During this study, 19 species were recognized. The number of species collected in Lowa River during this study was lower when we compared to other rivers of the Congo basin region like Inkisi with 61 species (Wamuini, 2010) and more than one 100 species in Lefini river (Ibala, 2010) within the Congo basin. The low number of our data is explained by the longer distance between our stations and the mouth of the Lowa River in Congo River. Marlier (1954) affirmed the richness of fish in tropical rivers. However, the diversity decreases when we attempt to reach the upstream. The migration of fish is usually from large River to their tributaries.

The distance of the sampling stations from the Congo River can explain the low number of species.

The accidental topography of Lowa basin could be an obstacle against the fish migration. Many waterfalls are distributed along the Lowa River course. According to the information collected to the fishermen, in Lowa course, no far from the sampling stations we can find two waterfalls. The first is situated in Boboro village and the second in Kanyama at around 75 km from our stations. The discontinuity created by the different waterfalls, is in the origin of the difference in characteristics of the up and down-streams which may change the diversity of fish in each side (Lévêque & Paugy, 2006). The same authors said, the difference in species is possible in up or down-streams and the endemism of species may be possible in upstream. Indeed, according to the importance of the waterfall, the fishes which developed in downstream could not reach up the upstream because of the presence of the waterfall (Lévêque & Paugy, 2006). Sometimes however, some species can escape the waterfall during the floodwater (Vreven, pers. com). According to own observations and fishermen experiences, *Marcusenius* sp. and *Myomyrus aff. macrops* can be only found in upstream of Boboro waterfall while the specimens of *Synondontis* and *Malapterurus* (not caught in upstream of Boboro waterfall) can be only collected in downstream.The number of species was important in Inkisi and Léfini, probably because of the increasing of number of habitats and an important gear net used during the sampling expeditions. In addition, we doubt the fact that we can find waterfall along the course of the rivers sampled before their mouths in Congo River. We hope that in the next the number of sheltered species in Lowa basin will increase as we are going to improve the sampling gears which have not used yet.

During the sampling expedition, the specimens of *Parauchenoglanis punctatus* (Siluriforms, Claroteidae) were abundant in number of capture. It appears that, this species has a large distribution in Lowa basin and her speciation may be comparable to *Clarias gariepinus* (siluriforms: Clariidae), the one which has a large distribution in the whole Congo basin probably because of her speciation in the whole basin (Chocha, 2010).

The specimens of fish collected in Lowa were represented by the orders usually collected in the tropical rivers (Mc Connell, 1987). The Siluriforms, Osteoglossiforms, Cypriniforms, Characiforms etc. belong among the most and abundant orders in the tropical rivers. The Mormyridae was more diversified than other families with 4 genera. The Mormyridae are among the important families and endemic fish in Africa (Hopkins et al., 2007).

The orders composition can be comparable to Ogooué basin as has been found by Mbega (2003). However, in this case, the Perciforms were among the more diversified order probably because of the number of lentic ecosystems which have been explored in his study.

The Mormyridae and Alestidae were diversified in number of genus. The both families are among the abundant family in the world (Mbega, 2003).

The details analysis about *Marcusenius* sp. specimens showed difference between specimens of *M. moorii* and very close to *M. intermedius*. The PCA performed on metric and meristic data show an overlap between the three species. However, we cannot now confirm whether the Lowa specimens belong to another new species. Indeed, the overall shape shows that, *Marcusenius* sp. of Lowa could be similar to *Marcusenius intermedius*. Indeed, *M. intermedius* was described by Pelligrin since 1924 and only one specimen was only used during the description of this species. If the result in this paper is later conformed, it is possible to update the taxonomy status of *M. intermedius*. Boden et al. (1997) doubt with the systematic status of *M. intermedius* because of the low number of recognized specimens of this species.

Finally, the pattern of conservation must be established according to different recognized species in the region and the pattern of habitat occupation. We must before all attempt of conservation, recognize the fact that some species like *Marcusenius* sp., *Myomyrus aff. macrops*, *Bagrus bajad* and *Bathybagrus graueri*, were scarce in the capture. The restriction of these species for their conservation must be applied in case of emergency.

We had no data about the correlation between the habitat and each species, so we cannot suggest a better pattern of conservation. However, we are sure that, in the future we will provide the best model of conservation according to the data of species richness and habitat occupation. The specific status of some species must be confirmed in this context for more conclusions.

As said Mc Neely (2002), a better collaboration must be established between taxonomists and conservationists. Then, the conservationists can suggest the pattern of conservation according to the results of taxonomy.

5. CONCLUSION

During this study, nineteen species were collected belonging to 6 orders, 10 families and 18 genera. Almost of all the genera were monospecific except the genus *Labeo* and probably the *Barbus* group. The different species collected are *Clarias* sp., *Parauchenoglanis punctatus*, *Pollimyrus* sp., *Oreochromis niloticus*, *Mastacembellus congicus*, *Labeo lukulae*, *L. macrostomus*, '*Barbus'* sp., *Bryconaethiops boulengeri*, *Brycinus aff. poptae*, *Pareutropius debauwi*, *Bagrus bajad*, *Bathybagrus graueri*, *Mormyrus caballus*, *Myomyrus aff. macrops*, *Marcusenius* sp., *Raiamas* sp., *Micralestes humilis* and *Distichodus altus*. The species richness appears to be relatively low.

The habitats characteristics and waterfalls are the factors which drive the distribution of the fishes in Lowa River.

The taxonomic status of some species as *Marcusenius* sp. required more details analysis to confirm her specific membership. The PCA performed on *Marusenius* specimen of Lowa River, *M. intermedius* and *M. moorii*, allowed the likeness between *Marcusenius* specimens of Lowa River and *M. intermedius*. Other analysis are needed and then apply on the both groups in order to locate where difference could be found between them.

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REFERENCES

Anonyme (2007) . Cahier de charges des communautés locales du territoire de Walikale à présenter à la conférence sur la paix, la sécurité et le développement des provinces du Nord-Kivu et du Sud-Kivu. Goma-Nord-Kivu, RDC, 47P.

Banister K. E & Bailey R. G. (1979) . Fishes collected by the Zaïre river expedition 1974-1975. *Zool. J. Linn. Soc*., 66(3): 205-249.

Bookstein F., Chernoff B., Elder R., Humphries J., Smith, G. & Strauss, R. (1985) . Morphometrics in Evolutionary Biology. Philadelphia: *Academy of Natural Sciences of Philadelphia Special Publication* 15.

Boulenger G. A. (1901) . Les poissons du bassin du Congo. Publications de l'Etat indépendant du Congo, 532P.

Chocha M. A. (2010) . Evolutionary genetics of the catfish *Clarias gariepinus* (Burchell, 1822) in the Congo basin. Ph D thesis, *FUNDP*, 115P.

De Kimpe P. (1964) . Contribution à l'étude hydrobiologique du Luapula-Moero. *Ann. Mus.r. Afr. centr.*, in 8°, 12, 238P.

De Vos L. (1995). A systematic revision of the African Schilbeidae (Teleostei, Siluriformes). *Musée Royale de l'Afrique Centrale de Tervuren et Annales des sciences zoologique*, N° 271, P. 450.

Fowler H. W. (1936). Zoological results of the George Vanderbilt African expedition of 1934. III. The fresh-water fishes. *Proc. Acad. Nat. Sci*. Philad., 88 : 243-335.

Geerinckx T., Adriaens D., Teugels G. G. & Verraes W. (2004) . A systematic revision of the African catfish genus *Parauchenoglanis* (Siluriformes: Claroteidae). *Journal of Natural History*, 38, 775-803.

Gosse J. P. (1963) . Le milieu aquatique et l'écologie des poissons dans la région de Yangambi. *Ann. Mus. r. Afr. centr., Sci. Zool.*, 116 : 113-271.

Gosse J. P. (1968) . Les poissons du bassin de l'Ubangui. *Ann. Mus. r. Afr. centr., Doc. Zool.*, 13 : 1-56.

Hopkins C. D., Lavoué S. & Sullivan J. P. (2007) . Mormyridae, pp. 220-234. *In*: Stiassny L.J.M., Teugels G.G. & Hopkins D.C., eds. *Poissons d'eaux douces et saumâtres de la basse Guinée, ouest de l'Afrique Centrale*, Vol. 1. Institut de recherche pour le développement (IRD) (Paris, France), Musée national d'histoire naturelle (MNHN) (Paris, France) & Musée Royal de l'Afrique Centrale (MRAC) (Tervuren, Belgium), 800 p.

Humphries J. M., Bookstein F. L., Chernoff C., Smith G. R., Elder R. L. & Poss S. G. (1981). Multivariate discrimination by shape in relation to size. *Systematic Zoology* 30, 291– 308.

Ibala Z. A. (2010) . Faune des poissons des rivières Luki et Lefini : Diversité et écologie. Thèse de Doctorat, *K.U. L*., PP1-100.

Kisekelwa T. (2012) . Contribution à la connaissance de l'ichtyofaune des rivières Lowa et Elila à l'Est de la RDC. Mémoire Master, *Université du Burundi*, 58P.

Lalarque A., Bricquet J. P., Olivry J. C. & Berthelot M. (1993) . Export of matter from the Congo River (PEGI Programme). First intern. *Symp. on Perspectives for Environnemental Geochemistry in Tropical Countries*, Niteroï, Brazil. 13P.

Lévêque C. & Paugy D. (2006) . Les poissons des eaux continentales africaines: diversité, écologie et utilisation par l'homme. *IRD*, Paris, 564P.

Lévêque C. (1997). Biodiversity dynamics and conservation : the freshwater fish of tropical Africa, *Cambridge University Press*, New York, 438P.

Lévêque C., Oberdorff T., Paugy D., Stiassny M. L. J. & Tedesco P. A. (2008) . Global diversity of fish (Pisces) in freshwater. *Hydrobiology*, 595, 547-567.
Marlier G. (1954). Recherches hydrobiologiques dans les rivières du Congo orientale. Institut pour la Recherches Scientifiques en Afrique Centrale, 40P.

Matthes H. (1964). Les poissons du lac Tumba et de la région d'Ikela. *Ann. Mus. r. Afr. centr. Sc. Zool*., 126, 204 p.

Mbadu Z. (2011). Diversité des espèces du genre *Distichodus* du Pool Malebo (Fleuve Congo) et mécanismes d'exploitation de leurs niches trophiques. Thèse de Doctorat, *Université de Kinshasa*, 362P.

Mbalassa M. (2008) . An ecology study of fish Ishasha river in the Virunga park , Albertine Rift Valley (Eastern DR Congo) Master, *Makerere University*, pp 1-90.

Mbega J. (2003) . Biodiversité des poissons du basin inférieur de l'Ogooué. Thèse de doctorat, FUNDP, *Namur*, PP 1-324.

Mc Neely J. A. (2002) . The role of taxonomy in conserving biodiversity. J. Nat. of Cons., 10. 145-153.

Mc Connell L.R.E. (1987) . Ecological Studies in Tropical Communities. *Cambridge University Press*, 1-382 pp.

Mutambue S. (1984) . Contribution à l'étude de l'écologie de la rivière Luki (sous-affluent du Fleuve Zaïre) : Bassin versant Poissons. Thèse de doctorat 3ème Cycle : Université Paul Sabatier, Toulouse (France), 213P.

Mutambue S. (1992) . Le bassin de la Luki (Zaïre) et son aménagement. Systématique, biologie et écologie de sa faune piscicole. Thèse de doctorat : Université Paul Sabatier, Toulouse (France), 335P.

Norris S. M. (2002) . A revision of African electric catfishes, family Malapteruridae (Teleostei, Siluriformes), with erection of a new genus and descriptions of fourteen new species, and an annotated bibliography. *Ann. Zool*. du MRAC-Tervuren, Belgique, 155 p.

Paugy D. (1986) . Révision systématique des Alestes et *Brycinus* africains (Pisces, Characidae). Collection Etudes et thèses, *ORSTOM*, Paris, 295P.

Paugy D., Lévêque C., & Teugels G. G. (2003) . The fresh and brackish water fishes of west Africa. [Poissons d'eaux douces et saumâtres de l'Afrique de l'Ouest.]. The fresh and brackish water fishes of west Africa v. 1: 1-457.

Paugy D. Lévêque C. & Teugels G. G. (2003). The fresh and brackish water fishes of West Africa. [Poissons d'eaux douces et saumâtres de l'Afrique de l'Ouest.]. The fresh and brackish water fishes of west Africa v. 2: 1-815.

Pelligrin J. (1924) . Description de Mormyridés nouveaux récoltés au Congo Belge par le Dr. Schouteden. *Rev. Zool. Afr*., XII. 1.

Poll M. & Gosse J. P. (1963) . Contribution à l'étude systématique de la faune ichtyologique du Congo central, *Ann. Mus. Roy. Afr. Cent*., n°116, Tervuren, pp: 45 – 110.

Poll M. (1967) . Révision des Characidae nains Africains. MRAC, Tervuren, Ann. Série 8, Sciences zoologiques n° 162, P. 158.

Poll M. & Taverne L. (1967) . Description d'une espèce nouvelle de *Myomyrus* du Bas-Congo. Rév. Zool. Bot. Afr., 76, 1-2.

Poll M. & Gosse J. P. (1995) . Genera des poissons d'eau douce de l'Afrique. Académie royale de Belgique, Classe des Sciences, Tom IX, 3ème série.

Roberts T. R. & Stewart D. J. (1976) . An Ecological and Systematic survey of Fishes in rapids of the lower Zaïre or Congo River, *Bull. Mus. Comp. Zool.*, 147 (6): 239-317.

Snoeks J., Harrison I. J. & Stiassny M. L. J. (2011) . The status and distribution of freshwater fishes, pp 42-91 in Darwall W., Smith K., Allen D., Holland R., Harrison I. et Brooks E. ed.: The Diversity of life in African Freshwaters: Underwat er, under threat; An analysis of the status and distribution of freshwater species throughout mainland Africa. Red List, IUCN, 364P.

Stiassny M. L. J., Teugels G. G & Hopkins C. D. (2007) . Poissons d'eaux douces et saumâtres de la basse Guinée, ouest de l'Afrique centrale. Vol. 1, IRD, MNHN, MRAC, col. Faune et flore. 42, 800P.

Stiassny L. J. M., Teugels G.G. et Hopkins D.C. (2007). Poissons d'eaux douces et saumâtres de la basse Guinée, ouest de l'Afrique Centrale, Vol. 2. Institut de recherche pour le développement (IRD) (Paris, France), Musée national d'histoire naturelle (MNHN) (Paris, France) et Musée Royal de l'Afrique Centrale (MRAC) (Tervuren, Belgium), 603P.

Teugels G.G. (1986) . A systematic revision of the African species of the genus *Clarias* (Pisces; Clariidae). *Mus. Afr. Cent, sc. Zool*., 199P.

Teugels G.G. & Guegan J. F. (1994) . Diversité biologique des poissons d'eaux douces de la basse Guinée et de l'Afrique Centrale in Teugels et al. (eds). Diversité biologique des poissons des eaux douces et saumâtres d'Afrique. Synthèses géographiques. Symposium Paradis. *Ann. Mus. Roy. Afr. Centr., Zool*., 275 : 67 – 85.

Thys Van Den Audernaede D. F. E. (1964) . Révision systématique des espèces congolaises du genre Tilapia (Pisces, Cichlidae). Ann. Ser. In -8°, n° 124, *MRAC*, P. 155.

Tshibwabwa S. (1997). Systématique des espèces africaines du genre *Labeo* (Teleostei, Cyprinidae) dans les régions ichtyologiques de basse Guinée et du Congo, TOME I , Thèse de doctorat , *Namur* , pp 1-310

Vreven E. (2001) . A systematic revision of the African spiny-eels (Mastacembelidae; Synbrachiformes). Thèse de doctorat, *KUL*, Volume 1-7, 1-2000 pp.

Wamuini-Lunkayilakio S. (2010) . Ichtyofaune de l'Inkisi (Bas-Congo / RDC): diversité et écologie. Thèse de doctorat, *Académie Universitaire Wallonie-Europe-Ulg*, 304P.