*Original Research Article*

# Study on fish of Lomami National Parkand its hinterlands, Democratic Republicof the Congo


## ABSTRACT

This investigation deals with freshwater fish populations in thirteen sampling rivers of Lomami National Park(LNP) and its hinterlands. The study aimed to inventory the ichthyofauna in freshwater bodies of LNP and its hinterlands; determine fish species with high economic value according to preference by riparian communities; and assess the conservation status of fish species. Intensive fish sampling was conducted thirteen rivers of LNP and its hinterlands using gill nets with stretched mesh sizes of 9.5, 10, 12, 15and 20 mm in 2016. A surveyquestionnaire was administered to fishermen in order to determine fish species with high economic value. A total of 2985 fish were caught belonging to 129 species, 54 genera, 20 families and 8 orders. The family of Mormyridae dominated in the fish collection with 30 species followed by family of Alestidae with 23 species. *Clarias*spp., *Schilbe*spp., *Chrysichthys*spp., *Auchenoglanis occidentalis, Polypterus*spp., *Hydrocynus* spp., *Alestes*spp., *Parachana* spp.and species of Mormyridae were recorded as fish species with high economic value.The majority of species was least concerned, but one was reported as endangered species (*Nannothrissa sterwarti*) and another vulnerable (*Labeo rectipinnis*). Our findings provided valuable information for the conservation and management of fish species in the freshwater of Lomami National Park and its hinterlands.



*Keywords:Fishery resources;Rivers;Conservation status; Lomami National Park.*


## 1. INTRODUCTION

Fish form the most important group of vertebrates of planet earth with about 30,000 species that 41% live in freshwater [1]. Fishing and fish related activities are important for most riparian communities. The resource is not only an important protein source but also an important revenue earner for commercial fishers [2, 3].

Comment [A1]:

Comment [A2]:

Lomami National Park (LNP) is an area with high freshwater fish species. Unfortunately, there is very little information about the biodiversity and the distribution of freshwater fish of the LNP. However, there is considerable anthropogenic pressure due to deforestation, mining logging, hunting, fishing and polluted water untreated in the most part of Central Africa [3, 4, 5]. These effects are increased by climate change and population growth, which cause the increase of needs in natural resources, destruction of ecosystems and extinction of species. Furthermore, the conservation status of many freshwater fish from Lomami National Park cannot be assessed adequately due to lack of data.

Comment [A3]:

Thus, the knowledge of ichthyofauna, as well as behaviour, ecology and biology of reproduction of fish caught are vital prerequisites, and implementation of a good fish farming production, will widely contribute to the reduction of overexploitation of natural resources, profitability for hunters of commercial bushmeat and sustainable management of Lomami National Park and its hinterlands.

This investigation aimed to provide a list of fish species from freshwater bodies of LNP and its hinterlands; determine fish species with high economic value according to preference by riparian communities; and assess the conservation status of fish species.

## 2. MATERIALS AND METHODS

### 2.1. Area of investigation

Lomami National Park is located in eastern part of Central basin of Democratic Republic of the Congo. It is a vast forest area that extends between 1° and 3° S latitude and between 24.5° and 25.5° E longitude. This massif also includes the basins of Tshuapa River in the west and Congo River (Lualaba) in the east [6].Sampling was carried out in thirteen rivers in the southern part of Lomami National Park, including Amboko, Baleke, Emame, Lodja, Loidjo, Lomami, Nvul'elongo, Nyamatende, Onema, Petchi, Shingi, Wele and Yalo.

**2.2. Data collection procedure**

Intensive fish sampling was conducted using gill nets with stretched mesh sizes of 9.5, 10, 12, 15and 20 mm in 2016. Gill nets were set between 16H00 and 18H00 at strategic positions and retrieved the following morning between 06H30 and 08H30(Fig. 1). The collected fish specimens were counted, grouped according to the rivers and dates of sampling and placed in labelled plastic containers filled with 10% formalin to stop the digestion process postmortem. Samples were then transported to laboratory of Hydrobiology and Aquaculture, University of Kisangani for further processing.

**Fig. 1. Capture of fish in the rivers of Lomami National Park and its hinterlands**

A survey questionnaire was administered to riparian fishermen in order to record information on fish exploitation in the Lomami National Park and its hinterlands.

**2.3. Identification of fish**

In the laboratory, sampled fish were washed with running water and the taxonomic identification was initially determined based on individual morphology using the identification keys of Boulenger [7]; Poll [8, 9]; Matthes [10];Gosse [11]; Roberts et Stewart [12];Banister and Bailey [13];Teugels [14];Poll and Gosse [15];Tshibwabwa [16];Shumway *et al.*[17]; Mbenga et Teugels[18];Skelton [19] (2004);Stiassny *et al.*[20, 21]; AMNH lower Congo keys, FishBase[22]. As well as Sullivan *et al.*[23] and fish reference collection done by the same authors were also used.
An assessment according to Red List Categories of the International Union for Conservation of Nature (IUCN) was provided for each fish species where available referring to the Pan Africa Freshwater Fish Species List[24].

**2.4. Data analysis**

We performed biological diversity indices, including Shannon-Wiener and Simpson in terms of fish species richness abundance using PAST software. We computed the non-parametric Kruskal-Wallis test using Rcmdr package in R software to test the significance of fish species richness abundance among thirteen sampling rivers.

## RESULTS AND DISCUSSION

A total of 2985 fish individuals were caught in thirteen rivers belonging to 129 species, 54 genera, 20 families and 8 orders. It was observed that family of Mormyridae dominated in the collection with 13 genera and 30 species followed by family of Alestidae with 9 genera and 23 species (Table 1).

**Table 1. Systematic broad outline of fish captured in thirteen rivers of LNP and its hinterlands**

| Order | Family | Genus | Species |
|---|---|---|---|
| Characiformes | Alestidae | *Alestes* | *Alestes liebrechtsii* Boulenger, 1898 |
| | | | *Alestes macrophthalmus* Günther, 1867 |
| | | *Alestopetersius* | *Alestopetersius brichardi* Poll, 1967 |
| | | | *Alestopetersius* cfr *brichardi* |
| | | | *Alestopetersius compressus* (Poll & Gosse, 1963) |
| | | *Bathyaethiops* | *Bathyaethiops greeni*Fowler, 1949 |
| | | *Brachypetersius* | *Brachypetersius altus* (Boulenger, 1899) |
| | | | *Brachypetersius huloti* (Poll, 1954) |
| | | | *Brachypetersius pseudonummifer* Poll, 1967 |
| | | *Brycinus* | *Brycinus bimaculatus* (Boulenger, 1899) |
| | | | *Brycinus* cfr *bimaculatus* |
| | | | *Brycinus* cfr *grandisquamis* |
| | | | *Brycinus* cfr *macrolepidotus* |
| | | | *Brycinus* cfr *macrolepidotus* 2 |
| | | | *Brycinus grandisquamis* (Boulenger, 1899) |
| | | | *Brycinus imberi* (Boulenger, 1899) |
| | | *Bryconaethiops* | *Bryconaethiops boulengeri* Pellegrin, 1900 |
| | | | *Bryconaethiops macrops* Boulenger, 1920 |
| | | *Hydrocynus* | *Hydrocynus forskahlii* (Cuvier, 1819) |
| | | | *Hydrocynus vittatus* Castelnau, 1861 |
| | | *Micralestes* | *Micralestes acutidens* (Peters, 1852) |
| | | | *Micralestes* cfr *sardina* |
| | | *Phenacogrammus* | *Phenacogrammus polli* Lambert, 1961 |
| | Citharinidae | *Citharinus* | *Citharinus gibbosus* Boulenger, 1899 |
| | | | *Citharinus macrolepis* Boulenger, 1899 |
| | Distichodontidae | *Distichodus* | *Distichodus affinis* Günther, 1873 |
| | | | *Distichodus antonii* Schilthius, 1891 |
| | | | *Distichodus atroventralis* Boulenger, 1898 |
| | | | *Distichodus fasciolatus* Boulenger, 1898 |
| | | | *Distichodus lusosso* Schilthuis, 1891 |
| | | | *Distichodus noboli* Boulenger, 1899 |
| | | | *Distichodus sexefasciatus* Boulenger, 1897 |
| | | | *Distichodus* cfr *fasciolatus* |
| | | *Eugnathichthys* | *Eugnathichthys macroterolepis* Boulenger, 1899 |
| | | *Mesoborus* | *Mesoborus crocodilus* Pellegrin, 1900 |
| | | *Phago* | *Phago boulengeri* Schilthuis, 1891 |
| | | | *Phago intermedius* Boulenger, 1899 |
| | | *Xenocharax* | *Xenocharax spilurus* Günther, 1867 |
| | Hepsetidae | *Hepsetus* | *Hepsetus* sp. |
| Clupeiformes | Clupeidae | *Nannothrissa* | *Nannothrissa stewarti*Poll & Roberts, 1976 |
| Cypriniformes | Cyprinidae | *Enteromius* | *Enteromius miolepis* Boulenger, 1902 |
| | | *Labeo* | *Labeo cyclorhynchus* Boulenger, 1899 |
| | | | *Labeo greenii* Boulenger, 1902 |
| | | | *Labeo lineatus* Boulenger, 1898 |
| | | | *Labeo parvus* Boulenger, 1902 |

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| | | | *Labeo rectipinnis*Tshibwabwa, 1997 |
| | | | *Labeo* sp. |
| | | | *Labeo weeksii* Boulenger, 1909 |
| | | *Labeobarbus* | *Labeobarbus caudovittatus* (Boulenger, 1902 |
| | | *Raiamas* | *Raiamas buchholzi* (Peters, 1876) |
| Osteoglossiformes Mormyriformes | Arapaimidae | *Heterotis* | *Heterotis niloticus* (Cuvier, 1829) |
| | Mormyridae | *Campylomormyrus* | *Campylomormyrus elephas* (Boulenger, 1898 |
| | | | *Campylomormyrus numenius* (Boulenger, 1898) |
| | | *Cyphomyrus* | *Cyphomyrus psittacus* (Boulenger, 1897) |
| | | | *Cyphomyrus* sp. |
| | | | *Cyphomyrus wilverthi* (Boulenger, 1898) |
| | | *Genyomyrus* | *Genyomyrus donnyi* Boulenger, 1898 |
| | | *Gnathonemus* | *Gnathonemus petersii* (Günther, 1862) |
| | | *Hippopotamyrus* | *Hippopotamyrus weeksii* (Boulenger, 1902) |
| | | *Marcusenius* | *Marcusenius greshoffi* (Schilthius, 1891) |
| | | | *Marcusenius kutuensis* (Boulenger, 1899) |
| | | | *Marcusenius monteiri* (Günther, 1873) |
| | | | *Marcusenius moorii* (Günther, 1867) |
| | | | *Marcusenius* sp. |
| | | | *Marcusenius* sp.2 |
| | | *Mormyrops* | *Mormyrops anguilloides* (Linnaeus, 1758) |
| | | | *Mormyrops nigricans* Boulenger, 1899 |
| | | *Mormyrus* | *Mormyrus proboscirostris* |
| | | *Myomyrus* | *Myomyrus macrops* Boulenger, 1974 |
| | | *Oxymormyrus* | *Oxymormyrus boulengeri* |
| | | *Petrocephalus* | *Petrocephalus* cfr *binotatus* |
| | | | *Petrocephalus* cfr *boboto* |
| | | | *Petrocephalus* cfr *sauvagii* |
| | | | *Petrocephalus* cfr *sauvagii* 2 |
| | | | *Petrocephalus* cfr *valentini* |
| | | | *Petrocephalus christyi* Boulenger, 1920 |
| | | | *Petrocephalus sauvagii* (Boulenger, 1887) |
| | | *Pollimyrus* | *Pollimyrus osborni* (Nichols & Grisom, 1917) |
| | | | *Pollimyrus* sp. |
| | | *Stomathorinus* | *Stomathorinus corneti* Boulenger, 1899 |
| | | | *Stomathorinus kununguensis* Poll, 1945 |
| | Notopteridae | *Xenomystus* | *Xenomystus nigri* (Günther, 1868) |
| | Pantodontidae | *Pantodon* | *Pantodon buchholzi* Peters, 1877 |
| Perciformes | Anabantidae | *Ctenopoma* | *Ctenopoma* cfr *acutirostre* |
| | | | *Ctenopoma kingsleyae* Günther, 1896 |
| | | | *Ctenopoma ocellatum* Pelligrin, 1899 |
| | | | *Ctenopoma weeksii* Boulenger, 1896 |
| | Channidae | *Parachanna* | *Parachanna obscura* (Günther, 1861) |
| | Cichlidae | *Hemichromis* | *Hemichromis fasciatus* |
| | | *Lamprologus* | *Lamprologus mocquardi* Pellegrin, 1903 |
| | | *Tylochromis* | *Tylochromis lateralis* (Boulenger, 1898) |
| | | Unknown | Unknown |
| Polypteriformes | Polypteridae | *Polypterus* | *Polypterus delhezi* Boulenger, 1899 |
| | | | *Polypterus polli* Gosse, 1988 |
| Siluriformes | Bagridae | *Bagrus* | *Bagrus ubangensis* Boulenger, 1902 |
| | Clariidae | *Clarias* | *Clarias buthupogon* Sauvage, 1879 |
| | | | *Clarias camerunensis* Lönnberg, 1895 |
| | | | *Clarias pachynema* Boulenger, 1903 |

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|---|---|---|---|
| | | | *Clarias gariepinus (Burchell, 1822)* |
| | | | *Clarias* sp. |
| | | *Heterobranchus* | *Heterobranchus longifilis* Valenciennes, 1840 |
| | Claroteidae | *Auchenoglanis* | *Auchenoglanis occidentalis* (Valenciennes, 1840) |
| | | | *Auchenoglanis* cfr *occidentalis* |
| | | *Chrysichthys* | *Chrysichthys brevibarbis* (Boulenger, 1899 |
| | | | *Chrysichthys habereri* Steindachner, 1912 |
| | | | *Chrysichthys longipinnis* (Boulenger, 1899) |
| | Malapteruridae | *Malapterurus* | *Malapterurus microstoma* Poll & Gosse, 1969 |
| | Mochokidae | *Synodontis* | *Synodontis alberti* Schilthuis, 1891 |
| | | | *Synodontis angelicus* Schilthius, 1891 |
| | | | *Synodontis batesii* Bouulenger, 1907 |
| | | | *Synodontis* cfr *pleurops* |
| | | | *Synodontis congicus* Poll, 1971 |
| | | | *Synodontis contractus* Vinciguerra, 1928 |
| | | | *Synodontis decorus* Boulenger, 1899 |
| | | | *Synodontis flavitaenitus* Boulenger, 1919 |
| | | | *Synodontis greshoffi* Schilthius, 1891 |
| | | | *Synodontis nigriventis* David, 1936 |
| | | | *Synodontis notatus* Vaillant, 1893 |
| | | | *Synodontis pleurops* Boulenger, 1899 |
| | | | *Synodontis schoutedeni* David, 1936 |
| | | | *Synodontis* sp. |
| | Schilbeidae | *Pareutropius* | *Pareutropius debauwi* (Boulenger, 1900) |
| | | *Parailia* | *Parailia congica* Boulenger, 1899 |
| | | *Schilbe* | *Schilbe congensis* (Leach, 1818) |
| | | | *Schilbe grenfelli* (Boulenger, 1900) |
| | | | *Schilbe intermedius* Rüppell, 1832 |
| | | | *Schilbe laticeps* (Boulenger, 1899) |
| | | | *Schilbe marmoratus* Boulenger, 1911 |
| | | | *Schilbe yangambianus* (Poll, 1954) |

As shown in the Table 2 and Fig. 2a, many fish species were caught in the Lomami river with 66species, followed by the Amboko River(62species), Lodja river (60 species) and Yalo River (58species). The lowest number of fish species (11species) was recorded in the Wele River.We experienced identification problems for Cichlid specimens caught in the Nvul'elongo River, which were not identified to genus or species levels.

The highest relative abundance was reported in the Lomami and Loidjo Rivers with 16.60% and 16.19%, respectively (Fig.2b), andthe Kruskal–Wallis test showed statistical differences among sampling rivers (*P = 0.0000*).

**Table 2. List showing the presence (+) or absence (-) of fish species captured in thirteen sampling rivers**

| Fish species | Sampling rivers | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Amboko | Baleke | Emame | Lodja | Loidjo | Lomami | Nvul'elongo | Nyamatende | Onema | Petchi | Shingi | Wele | Yalo |
| *Alestes liebrechtsii* | + | - | - | + | - | - | - | - | - | - | - | - | + |
| *Alestes macrophthalmus* | - | - | - | - | - | - | - | - | - | - | - | - | + |
| *Alestopetersius brichardi* | + | + | - | + | - | - | + | + | + | + | + | - | + |
| *Alestopetersius* cfr *brichardi* | - | + | - | - | - | - | - | - | - | - | + | - | - |
| *Alestopetersius compressus* | - | + | - | + | + | - | - | + | + | + | + | - | - |
| *Auchenoglanis* cfr *occidentalis* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Auchenoglanis occidentalis* | + | - | - | - | - | + | + | - | - | - | - | - | + |
| *Bagrus ubangensis* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Bathyaethiops greeni* | - | - | - | - | + | - | - | + | - | - | - | - | - |
| *Brachypetersius altus* | + | - | - | + | + | + | + | + | + | + | + | - | + |
| *Brachypetersius huloti* | + | - | - | + | - | - | - | - | - | - | - | - | + |
| *Brachypetersius pseudonummifer* | - | - | - | - | + | - | - | + | - | - | - | - | - |
| *Brycinus bimaculatus* | + | - | - | + | + | - | - | + | - | - | - | - | + |
| *Brycinus* cfr *bimaculatus* | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Brycinus* cfr *grandisquamis* | + | - | - | - | - | + | - | - | - | - | - | - | - |
| *Brycinus* cfr *macrolepidotus* | + | - | - | - | + | - | - | - | - | - | - | - | - |
| *Brycinus* cfr *macrolepidotus* 2 | + | - | - | + | - | - | - | - | - | - | - | - | + |
| *Brycinus grandisquamis* | + | - | - | + | - | + | - | - | - | - | - | - | + |
| *Brycinus imberi* | + | - | - | + | - | + | - | - | - | + | + | + | + |
| *Bryconaethiops boulengeri* | + | - | - | + | + | + | + | - | - | - | - | - | - |
| *Bryconaethiops macrops* | + | - | - | - | - | + | - | - | - | - | - | - | - |
| *Campylomormyrus elephas* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Campylomormyrus numenius* | - | - | - | + | - | - | - | - | - | - | - | - | - |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Chrysichthys brevibarbis* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Chrysichthys habereri* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Chrysichthys longipinnis* | + | - | - | - | - | + | - | - | - | - | - | - | + |
| *Citharinus gibbosus* | + | - | - | + | - | + | - | - | - | - | - | - | + |
| *Citharinus macrolepis* | - | - | - | + | - | + | - | - | - | - | - | - | + |
| *Clarias buthupogon* | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Clarias camerunensis* | - | - | - | - | + | - | + | - | + | - | + | - | + |
| *Clarias gariepinus* | - | - | - | - | - | - | + | - | + | - | - | - | - |
| *Clarias pachynema* | - | - | - | - | - | - | - | - | - | + | - | - | - |
| *Clarias* sp. | - | - | - | - | - | - | + | - | - | - | - | - | - |
| *Ctenopoma cfr acutirostre* | + | - | - | - | - | - | - | - | - | - | - | - | - |
| *Ctenopoma kingsleyae* | - | - | - | - | + | - | - | - | - | - | + | - | + |
| *Ctenopoma ocellatum* | + | - | - | + | - | - | - | - | - | - | - | - | + |
| *Ctenopoma weeksii* | - | - | - | + | - | - | - | - | - | - | - | - | + |
| *Cyphomyrus psittacus* | + | - | - | + | - | + | - | - | - | - | - | - | + |
| *Cyphomyrus* sp. | + | - | - | - | - | - | - | - | - | - | - | - | - |
| *Cyphomyrus wilverthi* | + | - | - | - | - | - | - | - | - | - | - | - | - |
| *Distichodus affinis* | + | - | - | + | - | + | - | - | - | - | - | - | + |
| *Distichodus antonii* | + | - | - | + | - | + | - | - | - | - | - | - | + |
| *Distichodus atroventralis* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Distichodus fasciolatus* | + | - | - | + | - | + | - | - | - | - | - | - | + |
| *Distichodus lusosso* | - | - | - | + | - | + | - | - | - | - | - | - | + |
| *Distichodus noboli* | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Distichodus sexefasciatus* | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Distichodus* cfr *fasciolatus* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Enteromius miolepis* | - | + | + | + | + | - | + | + | + | + | + | - | - |
| *Eugnathichthys macroterolepis* | + | - | - | + | - | + | - | - | - | - | - | - | + |
| *Genyomyrus donnyi* | + | - | - | + | - | - | + | - | - | - | - | - | + |
| *Gnathonemus petersii* | + | + | + | + | - | + | + | - | - | + | + | - | + |
| *Hemichromis fasciatus* | + | + | + | + | + | - | + | + | + | + | + | + | + |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hepsetus* sp. | - | + | + | + | + | + | + | + | + | + | + | + | + |
| *Heterobranchus longifilis* | - | - | - | - | - | - | + | - | - | - | - | - | - |
| *Heterotis niloticus* | - | - | - | - | - | - | + | - | - | - | - | - | - |
| *Hippopotamyrus weeksii* | - | - | - | + | - | - | - | - | - | - | - | - | - |
| *Hydrocynus forskahlii* | - | - | - | + | - | + | - | - | - | - | - | - | - |
| *Hydrocynus vittatus* | + | - | - | + | - | + | - | - | - | - | - | - | - |
| Unknown | - | - | - | - | - | - | + | - | - | - | - | - | - |
| *Labeo cyclorhynchus* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Labeo greenii* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Labeo lineatus* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Labeo parvus* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Labeo rectipinnis* | - | - | - | - | - | + | + | - | - | - | - | - | - |
| *Labeo* sp. | - | - | - | - | - | - | + | - | - | - | - | - | - |
| *Labeo weeksii* | - | - | - | - | - | + | - | - | - | - | - | - | + |
| *Labeobarbus caudovittatus* | - | - | - | - | - | - | + | - | - | - | - | - | - |
| *Lamprologus mocquardi* | - | - | - | - | - | - | - | - | + | - | - | - | - |
| *Malapterurus microstoma* | + | - | - | + | - | - | - | - | - | - | - | - | - |
| *Marcusenius greshoffi* | + | - | - | + | - | + | - | - | - | - | - | + | + |
| *Marcusenius kutuensis* | + | - | + | + | + | + | + | - | - | - | + | + | + |
| *Marcusenius monteiri* | + | - | - | + | - | + | - | - | - | - | - | + | + |
| *Marcusenius moorii* | + | - | + | + | + | + | + | + | + | + | + | - | + |
| *Marcusenius* sp. | - | + | - | + | - | + | - | + | - | + | - | - | - |
| *Marcusenius* sp.2 | + | + | + | + | + | + | + | + | + | + | + | - | + |
| *Mesoborus crocodilus* | + | - | - | + | - | - | - | - | - | - | - | - | - |
| *Micralestes acutidens* | + | - | - | + | - | + | - | - | - | - | - | + | + |
| *Micralestes* cfr *sardina* | + | - | - | - | - | - | - | - | - | - | - | - | - |
| *Mormyrops anguilloides* | + | - | - | + | - | - | - | - | - | - | - | - | + |
| *Mormyrops nigricans* | - | - | - | + | - | - | - | - | - | - | - | - | + |
| *Mormyrus proboscirostris* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Myomyrus macrops* | - | - | - | - | - | + | - | - | - | - | - | - | - |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Nannothrissa stewarti* | + | - | - | - | - | + | - | - | - | - | - | - | + |
| *Oxymormyrus boulengeri* | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Pantodon buchholzi* | - | + | + | + | + | - | - | - | - | + | - | - | - |
| *Parachanna obscura* | - | - | - | - | - | - | - | - | - | - | - | - | + |
| *Pareutropius debauwi* | - | + | - | + | + | - | - | + | - | + | + | - | - |
| *Parailia congica* | + | - | - | - | - | - | - | - | - | - | - | - | + |
| *Petrocephalus* cfr *binotatus* | + | - | - | + | - | - | - | - | - | - | - | - | + |
| *Petrocephalus* cfr *boboto* | + | - | - | - | + | + | - | + | - | - | - | - | + |
| *Petrocephalus* cfr *sauvagii* | - | - | - | - | + | + | - | + | - | - | - | - | - |
| *Petrocephalus* cfr *valentini* | - | - | + | + | - | - | - | + | - | - | + | - | - |
| *Petrocephalus christyi* | + | - | - | + | + | + | - | + | - | - | + | + | + |
| *Petrocephalus sauvagii* | + | + | + | + | + | + | + | + | + | + | + | + | + |
| *Petrocephalus* cfr *sauvagii* 2 | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Phago boulengeri* | + | - | - | + | - | - | - | - | - | - | - | - | + |
| *Phago intermedius* | + | - | - | - | - | + | - | - | - | - | - | - | + |
| *Phenacogrammus polli* | + | + | - | - | - | + | + | - | + | + | + | - | - |
| *Pollimyrus osborni* | + | + | + | + | + | + | - | + | + | + | + | - | + |
| *Pollimyrus* sp. | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Polypterus delhezi* | - | - | - | - | + | - | - | - | - | - | + | - | - |
| *Polypterus polli* | + | - | + | - | - | - | - | - | - | - | - | - | + |
| *Raiamas buchholzi* | + | - | - | + | - | + | - | - | - | - | - | - | + |
| *Schilbe congensis* | - | + | - | - | - | - | - | - | + | - | - | - | - |
| *Schilbe grenfelli* | - | - | - | - | - | + | - | - | + | + | - | - | - |
| *Schilbe intermedius* | + | + | - | + | - | + | - | - | - | - | - | - | + |
| *Schilbe laticeps* | - | + | - | + | + | - | + | + | - | - | + | - | - |
| *Schilbe marmoratus* | + | + | - | + | + | + | + | - | - | + | - | + | + |
| *Schilbe yangambianus* | - | + | + | + | + | - | + | + | + | + | + | - | - |
| *Stomathorinus corneti* | - | - | - | - | - | - | - | - | - | - | + | - | - |
| *Stomathorinus kununguensis* | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Synodontis alberti* | + | - | - | - | - | - | - | - | - | - | - | - | + |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Synodontis angelicus* | + | - | - | - | - | - | - | - | - | - | - | - | + |
| *Synodontis batesii* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Synodontis* cfr *pleurops* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Synodontis congicus* | + | - | - | + | - | - | - | - | - | - | - | - | + |
| *Synodontis contractus* | - | - | + | - | + | - | - | + | - | - | + | - | - |
| *Synodontis decorus* | + | - | - | - | - | + | - | - | - | - | - | - | - |
| *Synodontis flavitaenitus* | + | - | - | - | - | - | - | - | - | - | - | - | - |
| *Synodontis greshoffi* | + | + | + | + | + | + | + | + | + | - | - | + | + |
| *Synodontis nigriventis* | - | - | - | - | + | - | - | - | - | - | - | - | - |
| *Synodontis notatus* | - | - | - | - | - | + | - | - | - | - | - | - | - |
| *Synodontis pleurops* | + | - | - | - | - | + | - | - | - | - | - | - | + |
| *Synodontis schoutedeni* | - | - | - | - | - | - | - | - | - | - | - | - | + |
| *Synodontis* sp. | - | - | + | - | - | - | - | - | - | - | - | - | - |
| *Tylochromis lateralis* | + | - | - | + | - | + | - | - | - | - | - | - | - |
| *Xenocharax spilurus* | + | - | - | + | + | + | - | - | - | - | - | - | + |
| *Xenomystus nigri* | + | - | + | + | + | + | - | + | - | - | + | - | + |

Mulangu [25] identified 27 species in the Lubilanji River and its two tributaries. Among them, 5 species were reported in the Lomami National Park and its hinterlands, including *Petrocephalus christyi*, *Tylochromis lateralis*, *Auchenoglanis occidentalis*, *Clarias gariepinus*, and *Schilbe grenfelli*. He found also that Mormyridae was abundant in his collection. Tumitu and Mambo [26] identified 102 species in the Lomami National Park, however 47 species of them were not found in the checklist of fish collected in 2016, including*Bathyaethiops caudomaculatus*, *Bryconaethiops microstoma*, *Hydrocynus goliath*, *Micralestes humilis*, *Micralestes stormsi*, *Micralestes* sp., *Nanopetersius ansorgii*, *Citharinus congicus*, *Distichodus altus*, *Distichodus* sp.1, *Distichodus* sp.2, *Eugnathichthys eetveldii*, *Ichthyborus besse congolensis*, *Poecilothrissa centralis*, *Nannothrissa parva*, *Microthrissa congica*, *Barbus holotaenia*, *Barbus* sp., *Clypeobarbus congicus*, *Chelaethiops congicus*, *Campylomormyrus mirus*, *Campylomormyrus* sp., *Campylomormyrus curvirostris*, *Campylomormyrus alces*, *Campylomormyrus tamandua*, *Hippopotamyrus psittacus*, *Mormyrops attenuatus*, *Mormyrus caballus*, *Petrocephalus* sp., *Petrocephalus grandoculis*, *Petrocephalus microphthalmus*, *Pollimyrus isidori*, *Stomathorinus* sp., *Microctenopoma* sp., *Tylochromis robertsi*, *Tilapia* sp., *Polypterus* sp., *Clarias angolensis*, *Chrysichthys longibarbis*, *Chrysichthys ornatus*, *Chrysichtys* sp, *Parauchangolanis punctatus*, *Malapterurus electricus*, *Synodontis acanthomias*, *Synodontis nummifer*, *Schilbe debauwi*, and *Mastacembelus congicus*. The family of Mormyridae dominated in their checklist. Kisekelwa *et al.*[27] collected 4 Mormyrid species and 3 Alestid species in the Lowa River, Walikale territory. Among them, 2 Mormyrid species included *Pollimyrus* sp., *Marcusenius* sp. and 1 Alestidae species *Bryconaethiops boulengeri*were identified in our checklist.They reported that Alestidae species prefer torrential locations. Byanikiro *et al.*[28] collected 9 species of Mormyridae in their study on characterization and ecology of stands of Mormyrids in the Reserve of Yoko. Among them, one species *Cyphomyrus psittacus* was identified in our collection. Decru *et al.*[29] identified 320 species belonging to 28 families in the Itimbiri, Aruwimi, and Lindi/Tshopo Rivers. Among them, Mormyridae was the most dominant family in all three rivers. Of Mormyrid species, 17 were found in the Lomami National Park and its hinterlands, including *Campylomormyrus elephas*, *Campylomormyrus numenius*, *Cyphomyrus psittacus*, *Cyphomyrus wilverthi*, *Genyomyrus donnyi*, *Gnathonemus petersii*, *Hippopotamyrus weeksii*, *Marcusenius greshoffi*, *Marcusenius kutuensis*, *Marcusenius monteiri*, *Marcusenius moorii*, *Mormyrops anguilloides*, *Mormyrops nigricans*, *Myomyrus macrops*, *Petrocephalus christyi*, *Petrocephalus sauvagii*, and *Pollimyrus osborni*. Kisekelwa *et al.*[30] collected 13 Mormyrid species in the river systems draining the Kahuzi-Biega National Park. Among them, 5 species were found in our checklist, including *Gnathonemus petersii*, *Marcusenius greshoffi*, *Marcusenius monteiri*, *Myomyrus macrops*, and *Pollimyrus osborni*.

The family Mormyridae, endemic to sub-Saharan Africa, dominates in African rivers in terms of specific diversity [31, 32, 33, 34] and here more particularly in the upstream part of the small tributary rivers of the Congo River [28]. Some can measure up to 1.5 m in length although the majority are between 9 and 50 cm in size [28]. These fish are often found together, forming groups in the turbid waters of rivers. This behavior and adaptation are probably favored by the very particular physiology of their sensory organs [28, 33].

Indeed, the dominance of the Mormyriform fishes is not coincidental, as they are also the largely dominant order in Africa [35]. Our findings agreed with those found by Mbega [36] in the lower Ogooué basin. Note that the families of fishes of the Lomami National Park and its hinterlands are among the families with a wide distribution in the freshwaters of Africa[37], including the families of Clariidae, Schilbeidae, Bagridae, Claroteidae, Mormyridae, Cichlidae, Mastacembellidae, Cyprinidae, Alestidae and Distichodontidae [28].

The Fig.2c&d displayed that in the Lomami National Park and its hinterlands, all rivers are diverse with a minimum observed in the Onema River. The probability of catching two individuals of different species in the same river is high in all rivers, but it is higher in the Amboko, Lodja, Lomami and Yalo Rivers (96%); and it is slightly low in the Onema River (73%).

**Comment [A4]:**

**Comment [A5]:**

**Comment [A6]:**

**Comment [A7]:**

**Comment [A8]:**

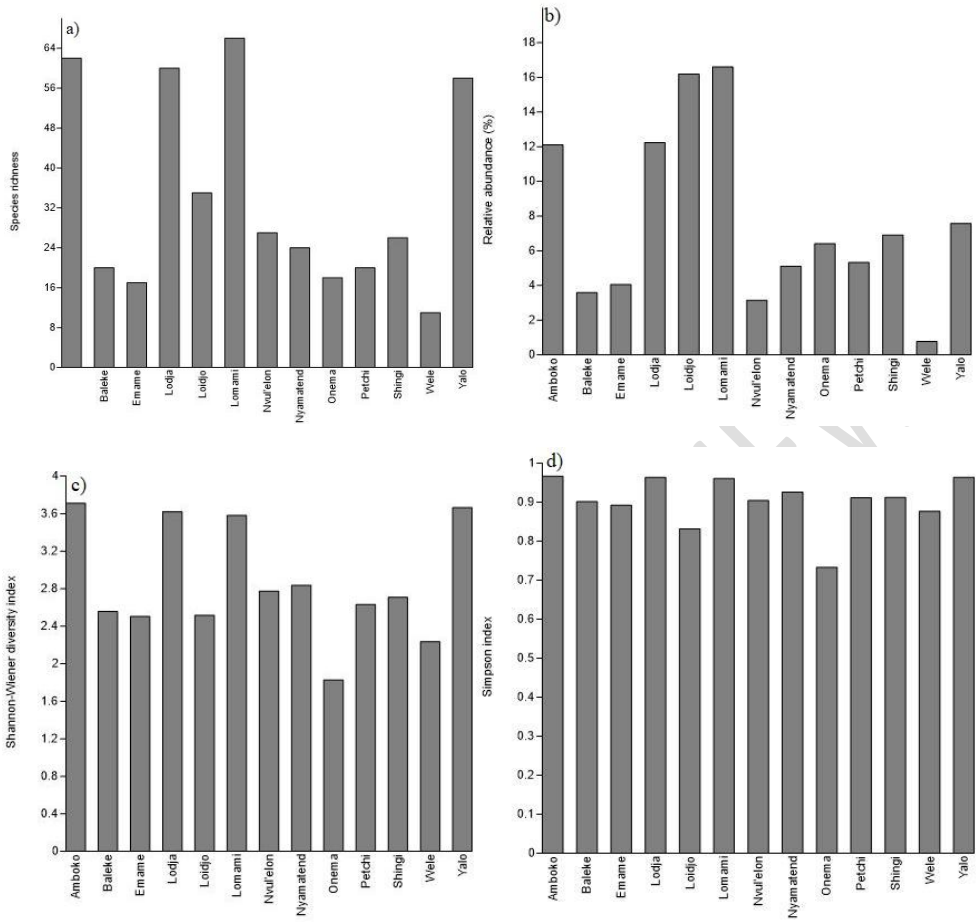


**Fig. 2. Species richness (a), Relative abundance (b), Shannon-Wiener's index (c), and Simpson's index (d) for thirteen sampling rivers**

The Table 3 shows that the majority of species was least concerned, but reportsthat one was endangered species (*Nannothrissa sterwarti*) and another vulnerable (*Labeo rectipinnis*).The results of Micha *et al.*[38] showed the overfishing of *Nannothrissa stewarti* in the Lake Maï-Ndombe was due to the use of the purse beach seine with mosquito nets, a prohibited fishing gear, which leads to the scarcity and disappearance of *Nannothrissa stewarti* of that lake.

**Table 3. Conservation status of species Red List Category of IUCN (International Union for Conservation of Nature)**

| N° | Species | IUCN Status |
|---|---|---|
| 1 | *Alestes liebrechtsii* | LC |
| 2 | *Alestes macrophthalmus* | LC |
| 3 | *Alestopetersius brichardi* | LC |
| 4 | *Alestopetersius* cfr *brichardi* | - |
| 5 | *Alestopetersius compressus* | LC |

| | | |
|---|---|---|
| 6 | *Auchenoglanis* cfr *occidentalis* | - |
| 7 | *Auchenoglanis occidentalis* | LC |
| 8 | *Bagrus ubangensis* | LC |
| 9 | *Bathyaethiops greeni* | LC |
| 10 | *Brachypetersius altus* | LC |
| 11 | *Brachypetersius huloti* | LC |
| 12 | *Brachypetersius pseudonummifer* | LC |
| 13 | *Brycinus bimaculatus* | LC |
| 14 | *Brycinus* cfr *bimaculatus* | - |
| 15 | *Brycinus* cfr *grandisquamis* | - |
| 16 | *Brycinus* cfr *macrolepidotus* | - |
| 17 | *Brycinus* cfr *macrolepidotus* 2 | - |
| 18 | *Brycinus grandisquamis* | LC |
| 19 | *Brycinus imberi* | LC |
| 20 | *Bryconaethiops boulengeri* | LC |
| 21 | *Bryconaethiops macrops* | LC |
| 22 | *Campylomormyrus elephas* | LC |
| 23 | *Campylomormyrus numenius* | LC |
| 24 | *Chrysichthys brevibarbis* | LC |
| 25 | *Chrysichthys habereri* | LC |
| 26 | *Chrysichthys longipinnis* | LC |
| 27 | *Citharinus gibbosus* | LC |
| 28 | *Citharinus macrolepis* | LC |
| 29 | *Clarias buthupogon* | LC |
| 30 | *Clarias camerunensis* | LC |
| 31 | *Clarias gariepinus* | $LC^{RG}$ |
| 32 | *Clarias pachynema* | LC |
| 33 | *Clarias* sp. | - |
| 34 | *Ctenopoma cfr acutirostre* | - |
| 35 | *Ctenopoma kingsleyae* | LC |
| 36 | *Ctenopoma ocellatum* | LC |
| 37 | *Ctenopoma weeksii* | LC |
| 38 | *Cyphomyrus psittacus* | LC |
| 39 | *Cyphomyrus* sp. | - |
| 40 | *Cyphomyrus wilverthi* | LC |
| 41 | *Distichodus affinis* | LC |
| 42 | *Distichodus antonii* | LC |
| 43 | *Distichodus atroventralis* | LC |
| 44 | *Distichodus fasciolatus* | LC |
| 45 | *Distichodus lusosso* | LC |
| 46 | *Distichodus noboli* | LC |
| 47 | *Distichodus sexefasciatus* | LC |

| | | |
|---|---|---|
| 48 | *Distichodus* cfr *fasciolatus* | - |
| 49 | *Enteromius miolepis* | NE |
| 50 | *Eugnathichthys macroterolepis* | LC |
| 51 | *Genyomyrus donnyi* | LC |
| 52 | *Gnathonemus petersii* | LC |
| 53 | *Hemichromis fasciatus* | LC |
| 54 | *Hepsetus* sp. | - |
| 55 | *Heterobranchus longifilis* | LC |
| 56 | *Heterotis niloticus* | LC |
| 57 | *Hippopotamyrus weeksii* | NE |
| 58 | *Hydrocynus forskahlii* | LC |
| 59 | *Hydrocynus vittatus* | LC |
| 60 | Unknown | |
| 61 | *Labeo cyclorhynchus* | LC |
| 62 | *Labeo greenii* | LC |
| 63 | *Labeo lineatus* | LC |
| 64 | *Labeo parvus* | LC |
| 65 | *Labeo rectipinnis* | VU |
| 66 | *Labeo* sp. | - |
| 67 | *Labeo weeksii* | LC |
| 68 | *Labeobarbus caudovittatus* | LC |
| 69 | *Lamprologus mocquardi* | LC |
| 70 | *Malapterurus microstoma* | LC |
| 71 | *Marcusenius greshoffi* | LC |
| 72 | *Marcusenius kutuensis* | LC |
| 73 | *Marcusenius monteiri* | LC |
| 74 | *Marcusenius moorii* | LC |
| 75 | *Marcusenius* sp. | - |
| 76 | *Marcusenius* sp.2 | - |
| 77 | *Mesoborus crocodilus* | LC |
| 78 | *Micralestes acutidens* | LC |
| 79 | *Micralestes* cfr *sardina* | - |
| 80 | *Mormyrops anguilloides* | LC |
| 81 | *Mormyrops nigricans* | LC |
| 82 | *Mormyrus proboscirostris* | NE |
| 83 | *Myomyrus macrops* | LC |
| 84 | *Nannothrissa stewarti* | EN |
| 85 | *Oxymormyrus boulengeri* | LC |
| 86 | *Pantodon buchholzi* | LC[RG] |
| 87 | *Parachanna obscura* | LC[RG] |
| 88 | *Pareutropius debauwi* | LC |
| 89 | *Parailia congica* | LC |

| | | |
|---|---|---|
| 90 | *Petrocephalus* cfr *binotatus* | - |
| 91 | *Petrocephalus* cfr *boboto* | - |
| 92 | *Petrocephalus* cfr *sauvagii* | - |
| 93 | *Petrocephalus* cfr *valentini* | - |
| 94 | *Petrocephalus christyi* | LC |
| 95 | *Petrocephalus sauvagii* | LC |
| 96 | *Petrocephalus* cfr *sauvagii 2* | - |
| 97 | *Phago boulengeri* | LC |
| 98 | *Phago intermedius* | LC |
| 99 | *Phenacogrammus polli* | LC |
| 100 | *Pollimyrus osborni* | NE |
| 101 | *Pollimyrus* sp. | - |
| 102 | *Polypterus delhezi* | LC |
| 103 | *Polypterus polli* | LC |
| 104 | *Raiamas buchholzi* | LC |
| 105 | *Schilbe congensis* | LC |
| 106 | *Schilbe grenfelli* | LC |
| 107 | *Schilbe intermedius* | LC |
| 108 | *Schilbe laticeps* | LC |
| 109 | *Schilbe marmoratus* | LC |
| 110 | *Schilbe yangambianus* | LC |
| 111 | *Stomathorinus corneti* | NE |
| 112 | *Stomathorinus kununguensis* | NE |
| 113 | *Synodontis alberti* | LC |
| 114 | *Synodontis angelicus* | LC |
| 115 | *Synodontis batesii* | LC |
| 116 | *Synodontis* cfr *pleurops* | - |
| 117 | *Synodontis congicus* | LC |
| 118 | *Synodontis contractus* | LC |
| 119 | *Synodontis decorus* | LC |
| 120 | *Synodontis flavitaenitus* | LC |
| 121 | *Synodontis greshoffi* | LC |
| 122 | *Synodontis nigriventis* | LC |
| 123 | *Synodontis notatus* | LC |
| 124 | *Synodontis pleurops* | LC |
| 125 | *Synodontis schoutedeni* | LC |
| 126 | *Synodontis* sp. | - |
| 127 | *Tylochromis lateralis* | LC |
| 128 | *Xenocharax spilurus* | NE |
| 129 | *Xenomystus nigri* | LC |

LC = Least Concern, EN = Endangered, NE = Not Evaluated, VU = Vulnerable (Darwall, 2011)

The Table 4 indicates that nine taxa were identified as fish with high economic due to their preference by local populations. The mean price per Kg of fishery products at the local scale was of 1,500FC (or US$ 1.5). A total of 23 riparian fishermen were interviewed; 78.26% of them said that the main destinations of fishery resources from LNP were Kindu and Lodja cities located in Democratic Republic of the Congo. While 21.74% reported that fish caught were locally sold and consumed. Local fishermen of the LNP and its hinterlands reported that the main fishing materials used were gill nets of 10 mm, 15 mm, 20 mm, 25 mm, 30 mm, 40 mm, 60 mm and 100 mm of mesh; cast nets of 10 mm, 20 mm and 30 mm of mesh; hooks (N° 1, 2, 4, 6, 8, 10, 14 and 16); hand-line; traps; and planked canoes. 95.65% of riparian fishermen were the owners of these fishing gears used in the LNP and its hinterlands.

**Table 4. Scientific and local names of the most preferred fish species**

| N° | Scientific name | Local name |
|---|---|---|
| 1 | *Clarias* spp. | Samba, Kambale, Ngolo |
| 2 | *Schilbe* spp. | Mpendakula |
| 3 | *Chrysichthys* spp. | Kalimba, Nyuvi |
| 4 | *Auchenoglanis occidentalis* | Feke |
| 5 | *Polypterus* spp. | Mokonga ou Mukunga |
| 6 | *Hydrocynus* spp. | Manda |
| 7 | *Parachanna* spp. | Mongusu, Singa |
| 8 | *Alestes* spp. | Pungululu, Mandekibere |
| 9 | Species of Mormyridae | Mipoto, Tale, Pono |

## CONCLUSION

This study was mainly focused on ichthyofauna of Lomami National Park and its hinterlands. The findings showed that 129 fish species were caught during this investigation in the southern part of Lomami National Park. Mormyridae dominated in the collection with 13 genera and 30 species followed by family of Alestidae with 9 genera and 23 species. There was a possibility to have new species in some genera, such as *Marcusenius, Brycinus* and *Petrocephalus*.It is reported that *Labeo rectipinnis* is vulnerable species and *Nannothrissa stewarti* is endangered species.Note that fish species with high economic value have been recorded, including *Clarias*spp*., Schilbe*spp*., Chrysichthys*spp*., Auchenoglanis occidentalis, Polypterus*spp*., Hydrocynus*spp*., Alestes*spp*., Parachanna* spp.and species of Mormyridae.

81% of fishermen recorded reported that the number of fishermen is currently increasing. This leads to the decline of fish caught. However fish has long been a major source of livelihood for most riparian communities. From the results stressed above of this study, we recommend to promoteintegrated fish farming in the villages surroundings theLomami National Park in order to increase food security and reduce the pressure exerted by the fishermen on fishery resources of LNP and its hinterlands;study the biology and ecology of fish species with high economic value identified in this survey in view of their possible domestication in the fish farming. This will enable the fish farming to be sustainable; and conductfurther monitoringon vulnerable and endangered species.

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