Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2023; 11(4): 08-18

Received: 07-04-2023
Accepted: 11-05-2023

Muzumani Risasi Donatien
Department of Biology, Centre De Recherche En Hydrobiologie CRH-Uvira, Uvira, BP 73 Uvira, DR Congo

Safari Rukahusa Ruffin
Département De Biologie, Centre De Recherche En Hydrobiologie CRH-Uvira, Uvira, BP 73 Uvira, DR Congo.

Maliyamungu Malk Makubuli
Département De Biologie, Institut Supérieur Pédagogique d'Uvira, Uvira, DRC, BP 2316 Bujumbura Burundi

Bugabanda Nabintu Noëlla
Département De Biologie, Centre De Recherche En Hydrobiologie CRH-Uvira, Uvira, BP 73 Uvira, DR Congo

Tomombwa Kumbusa Patient
Département De Biologie, Centre De Recherche en Hydrobiologie CRH-Uvira, Uvira, BP 73 Uvira, DR Congo

Corresponding Author:
Muzumani Risasi Donatien
Department of Biology, Centre De Recherche En Hydrobiologie CRH-Uvira, Uvira, BP 73 Uvira, DR Congo

Preliminary study of the aquatic biodiversity of the Katobo Dam pond (middle flats of Uvira, DR Congo)

Muzumani Risasi Donatien, Safari Rukahusa Ruffin, Maliyamungu Malk Makubuli, Bugabanda Nabintu Noëlla and Tomombwa Kumbusa Patient

DOI: https://doi.org/10.22271/j.ento.2023.v11.i4a.9209

Abstract
A recent study (2021) of biodiversity in Katobo dam pond, western part of the Albertine Rift, the middle flats of the Mitumba Mountains chain in Uvira territory, revealed presence of 20 genera of phytoplankton representing 10 families; 5 genera of zooplankton in 3 families; 15 species of macro invertebrates grouped into 13 families and; two introduced Cichlid fish species representing two genera. Planktonic and benthic macro-invertebrate species are less diversified in the Katobo dam pond, compared to the result early found in low-altitude similar ecosystems; also planktons are evenly distributed in the surface waters of the pond as are benthic macro-invertebrates in stations of collection. More, two fish species were introduced under *Coptodon rendalli* species name; as *Oreochromis upembae* species was not yet described before 1964. Finally, the physico-chemical characteristics testify low water temperature, low acidity and conductivity, and oxygen saturation.

Keywords: Albertine Rift, bentic macro invertebrates, Cichlid fishes, Lake Tanganyika, Mitumba Mountains, Planktons

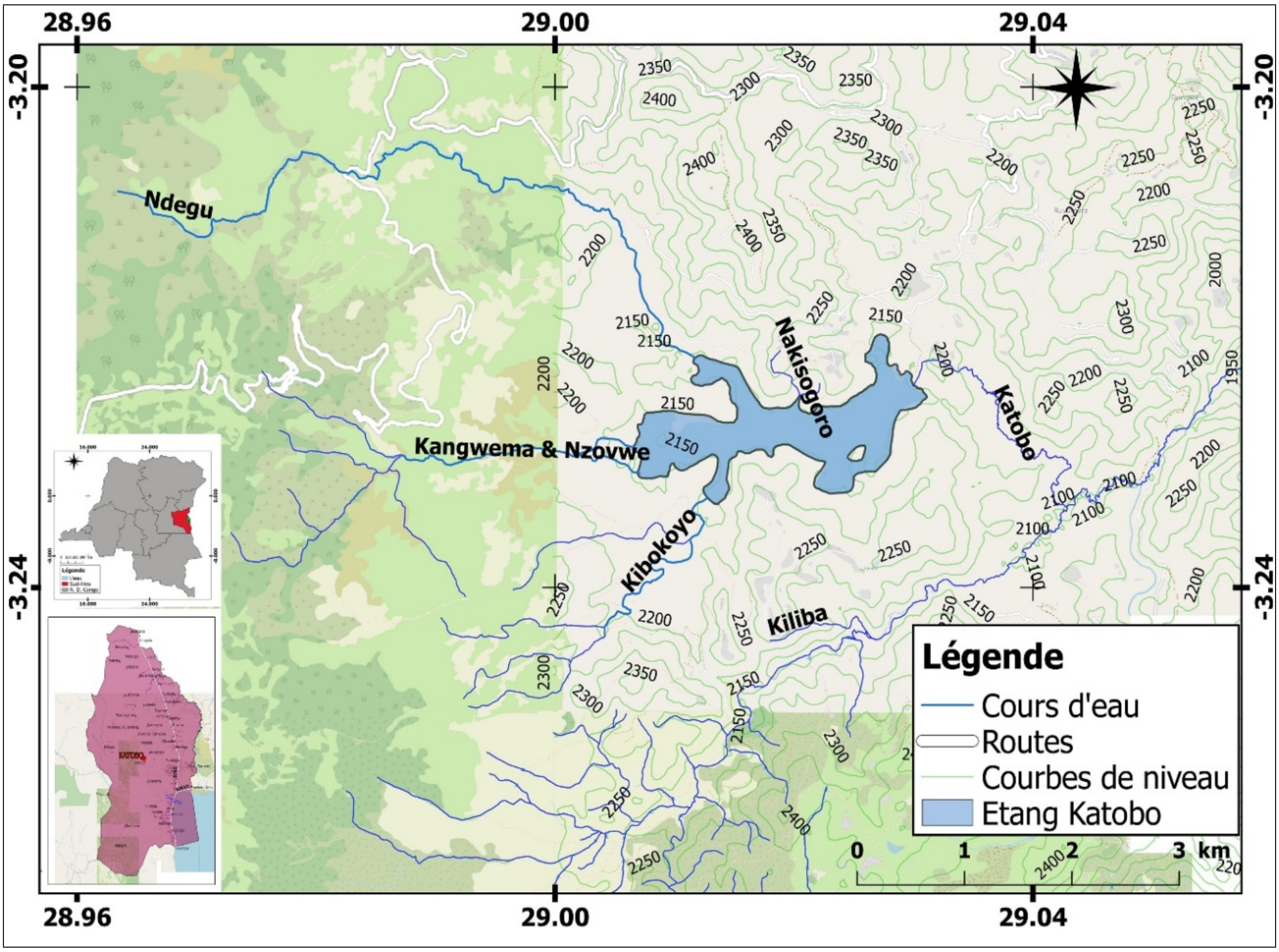
Introduction
A biological study was conducted from 15 to 19 September 2021 on the Katobo Dam pond to inventory the fauna of plankton, benthic macro invertebrate and that of fishes. Located in the Mitumba Mountains between latitudes of 3°13.253'- 3°13.610'S and longitudes of 29°1.009'- 29°1.852'E, Katobo dam pond is part of the Kiliba River basin, tributary of the Ruzizi River on the right bank. The Katobo Dam pond water level was 2150 m and its' main tributaries are Nakisogoro and Ndegu to the north, Kangwemwa and Nzovwe to the west, and Kobokoyo to the southwest. It flows through Katobo to the east (Figure 1).
The Katobo Dam pond was built in 1954 to irrigate the sugar cane fields of Sucraf (Sucrerie d'Afrique today Sucrerie du Kivu Sucki), a sugar company based in the Ruzizi plain near the Burundian border. Also in aim of promoting fish farming in this densely populated area, Cichlid fishes were introduced to Katobo Dam pond during colonial times (before 1960). However, nothing is known about the physicochemical waters conditions nor the planktonic, benthic macroinvertebrates and fish fauna diversity. This work clears the way to inform about the diversity of the listed above taxa and waters physico-chemical quality. More the lack of fisheries regulation is progressively becoming a serious menace for the Katobo pond diversity.

Materials and Methods
Geographical coordinates were taken using the Garmin ETREX 10 GPS along the pond coastal line on a non-motorized boat. QGIS and Google Maps software were used to generate the map of the pond and its watershed. Fishes were collected using monofilament gillnets of 8mm, 10 mm, 15 mm and 25 mm mesh sizes set in the evening around 5 p.m. along the coastal line between 0.5 and 5 m depth and lift between 6:30 a.m. and 7:00 a.m. To complete the specific sample size and composition, other specimens were purchased from fishermen. Specimens were photographed, labelled and fixed with 10% formalin after removing parts of fins for subsequent genetic studies.

Determination was done in the laboratory on the basis of six meristic, 18 measurements, colour patterns and checking original descriptions of close species type specimens of genera *Oreochromis* and *Coptodon*. Principal Component Analyses using Statistica 8 software for Windows and the Man Whitney U-test highlighted morphological differences between species. Benthic macro invertebrates were sampled using 1mm mesh size hand net on 4 stations chosen according to the nature of substrate and vegetation. Fifteen minutes were spent on each of the four chosen stations whose coordinates are : (i) 13°732'S; 29°1.104'E, (ii) 13°710'S; 29°1.164'E, (iii) 13°873'S; 29°1.305'E and (iv) 13°924'S; 29°449'E. Samples were labeled and fixed with 4% formalin, before manual sorting in the laboratory. Determination was done if possible down to the genus or species level on the basis of keys and field guides of Brown, 1980; Van Damme, 1984; Gerber and Gabriel, 2002; De Moor *et al*., 2003; Day *et al*., 2003; Tachet *et al*., 2007; Stals & De Moor, 2007; Forcellini *et al*., 2011; Yapo *et al*., 2012 [3, 33, 6, 26, 27, 11, 36]. The Past 2 software through the analysis of variances, as well as the calculation of Shannon Weaver's H' diversity index allowed comparison of abundances by station; type of substrate and vegetation.

Phytoplankton was sampled with 10 µm mesh plankton nets and zooplankton with 100 µm mesh nets. About 100 m were swept horizontally on the coastline in parallel to the coastal line, before recovering 50 ml of filtered water into a jar to which 2 drops of Lugol were added to the phytoplankton sample to immobilize specimens, before fixing it with 75% formalin. Fifteen samples numbered from 1 to 15 were taken all around the pond. Identification and enumeration of specimens were done under an Olympus CH30 microscope, on basis of the determination keys of Toshihiko, 1983 [30] for phytoplankton and Fernando, 2002 [10] for crustaceans.

Physico-chemical characteristics of water (pH, OD, t° and conductivity) were collected using the Hanna HI 98194 multi-parameter probe.



3333 n=.

Fig 1: Map of Katobo dam pond in Ndegu in middle flats of the Mitumba mountains chain, Uvira Territory, eastern DRC.

Results

Plankton

Phytoplankton

Twenty genera of phytoplankton grouped into 10 families, 5 orders, 2 classes and 2 phyla were identified in the Katobo dam pond (Table 1) of these genera, *Scenedesmus* predominates with 55.88% (Figure 2).

Table 1: Phytoplankton composition in the Katobo dam pond

Phylum	Class	Order	Family	Genus
Cyanophyta	Cyanophyceae	Oscillatoriales	Oscillatoriaceae	*Lyngbya*
				Phormidium
			Nostocaceae	*Anabaena*
				Nostoc
		Chroococales	Chroococcaceae	*Microcystis*
				Chroococcus
				Aphanocapsa
				Dactylococcopsis
				Closteriopsis
Chlorophyta	Chlorophyceae	Chlorococcales	Micractiniaceae	*Micractinium*
			Oocystaceae	*Tetraedron*
				Ankistrodesmus
			Coelastraceae	*Coelastrum*
			Scenedesmaceae	*Scenedesmus*
				Tetrastrum
				Crucigenia
			Chaetophoraceae	*Stigeoclonium*
				Characium
		Tetrasporales	Tetrasporaceae	*Tetraspora*
		Zygnematales	Desmidiaceae	*Euastrum*
2	2	5	10	20

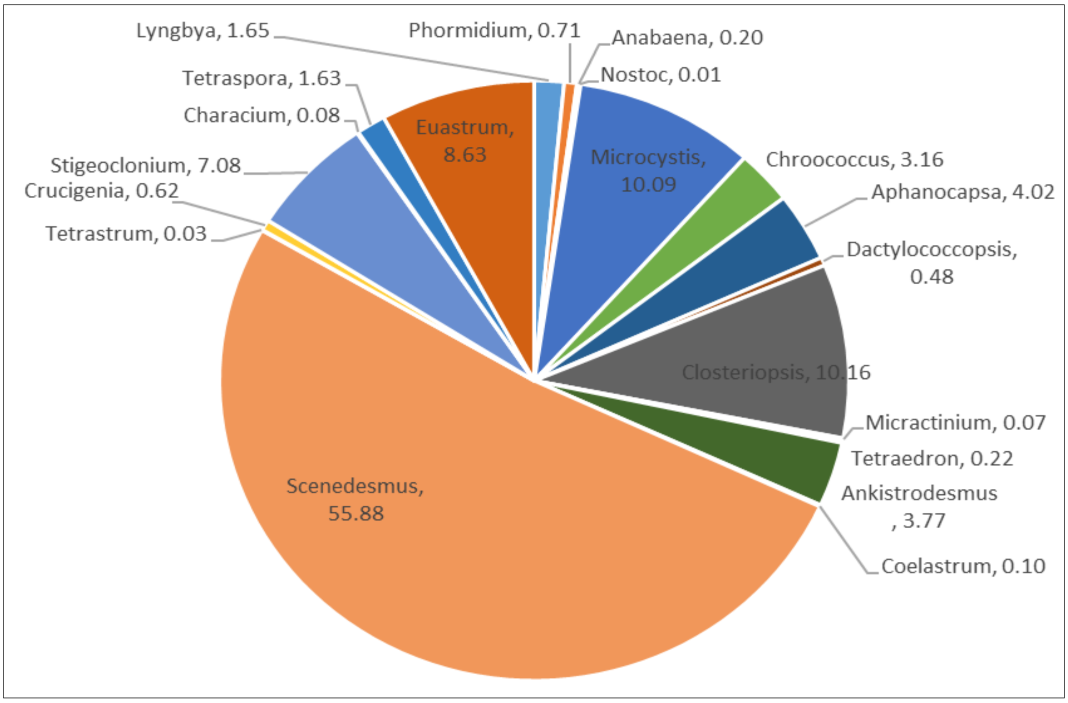


Fig 2: Relative abundance in % of phytoplankton from Katobo Dam pond.

Distribution of phytoplankton

The diversity of collected phytoplankton seems different in the fifteen swept areas (Table 3) because the Shannon H' index of diversity fluctuated from 0.48 to 0.84 (Figure 3). However, no significant differences were observed (P = 09998 >.05).

Table 3: Distribution of phytoplankton by site '+' presence, '-' absence

Families Sites	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Oscillatoriaceae	+	+	-	+	-	+	+	-	-	+	+	+	+	-	+
Nostocaceae	-	-	-	-	+	+	-	+	+	-	-	+	-	-	-
Chroococcaceae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Micractiniaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Oocystaceae	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Coelastraceae	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Scenedesmaceae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Chaetophoraceae	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+
Tetrasporaceae	+	+	+	+	+	-	+	-	-	-	-	-	-	-	-
Desmidiaceae	-	+	-	-	+	-	-	+	-	-	-	-	-	-	-

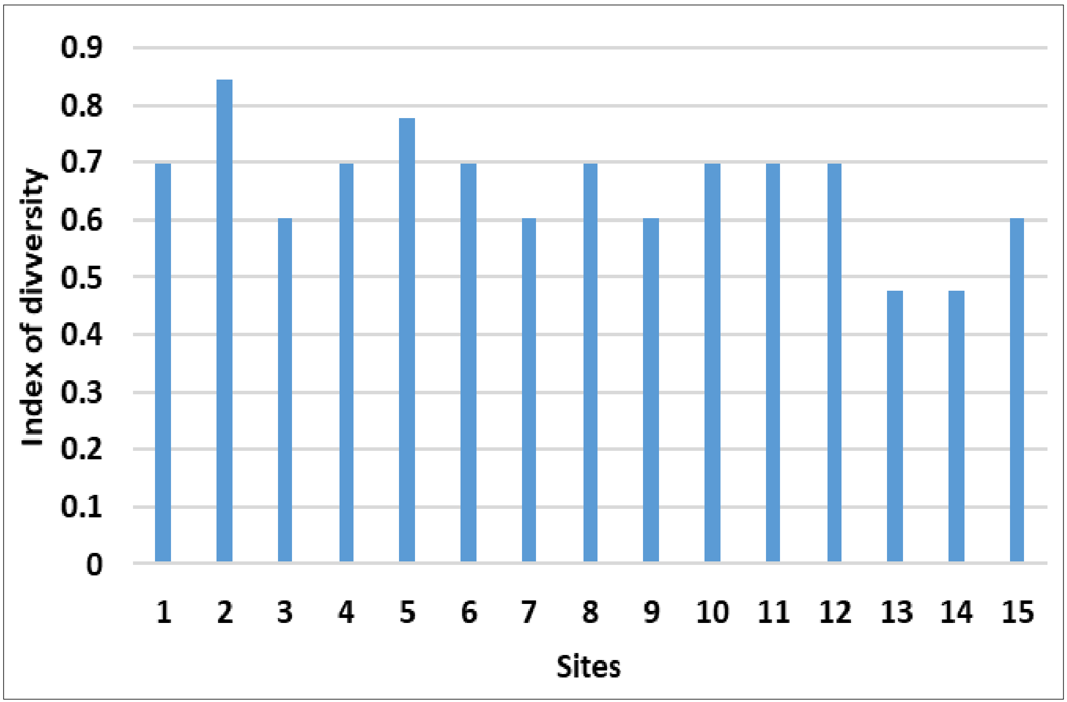


Fig 3: Variation of the H' index of phytoplankton diversity by site at the coast of the Katobo dam pond. Sites are arranged in order: northeast, north, west, south and east.

Zooplankton

Five genera, 3 families, 2 orders, 1 class and 1 phylum were identified for Katobo Dam pond zooplankton (Table 4) with *Mesocyclops* dominance at 73% (Figure 4). The distribution of zooplankton seems variable in the 15 collection sites (Table 5), with the H' diversity index varying between 0.18 and 0.56 (Figure 5). However, no significant difference was observed (P = 0.4688, (= 0.5)).

Table 4: Zooplankton composition in Katobo dam pond

Phylum	Class	Order	Family	Genus
Arthropoda	Crustaceae	Cyclopoida	Cyclopoidae	*Mesocyclops*
				Nauplius mesocyclops
				Cyclops tenellus
		Harpacticoida	Miraciidae	*Schizopera*
			Nannopodidae	*Ilyophilus*
1	1	2	3	5

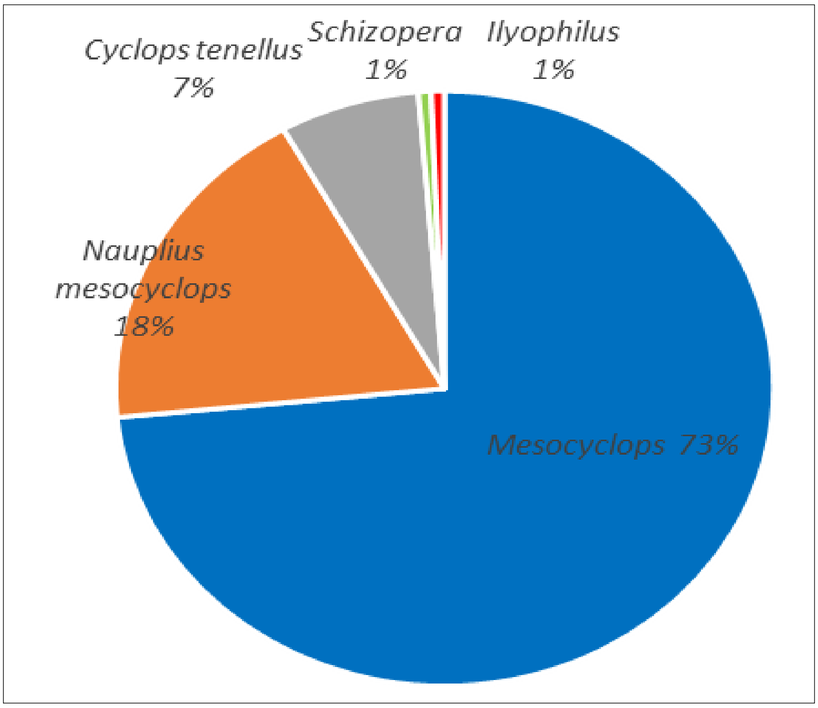


Fig 4: Relative abundance of zooplankton genera in Katobo Dam pond.

Table 5: Zooplankton composition by site in Katobo Dam pond

Genus **Sites**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mesocyclops	215	871	116	1694	106	38	475	1249	145	23	649	45	432	87	734
Nauplius mesocyclops	138	470	208	180	143	9	131	90	30	35	52	22	97	13	106
Cyclops tenellus	7	4	12	96	28	15	110	47	10	8	62	19	99	7	120
Schizopera	0	0	58	0	0	0	0	0	0	0	0	0	0	0	0
Ilyophilus	0	0	37	14	0	0	0	8	2	0	0	0	0	0	0
	360	1345	431	1984	277	62	716	1394	187	66	763	86	628	107	960

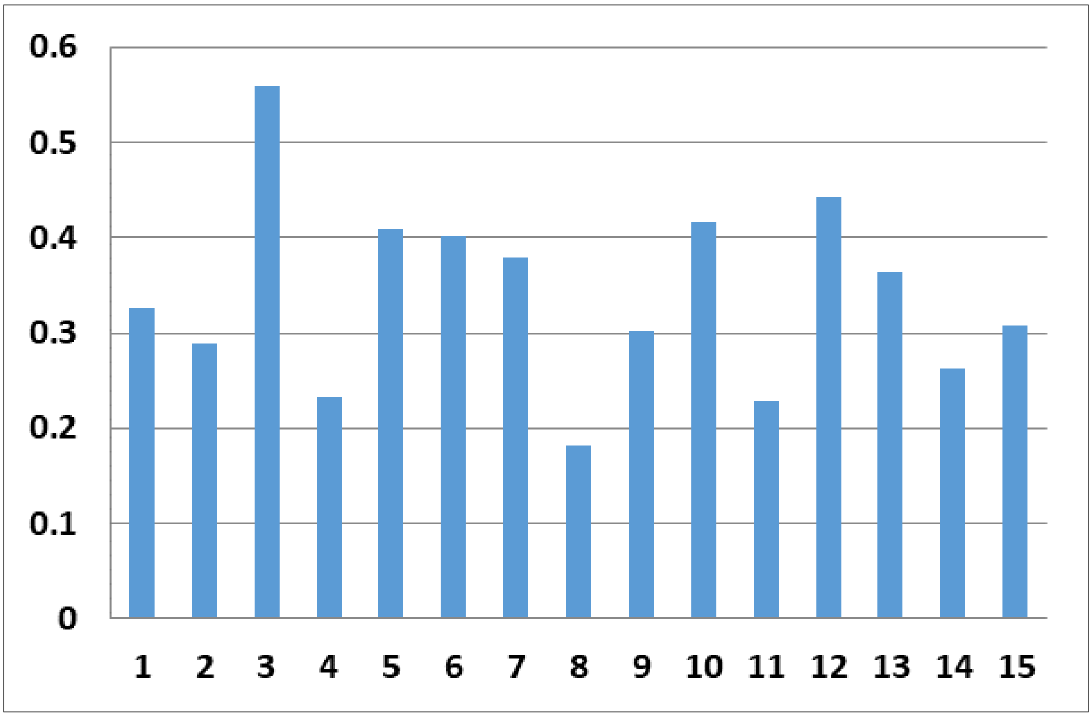


Fig 5: The H' index of zooplankton diversity variation by site, in Katobo dam pond.

Benthic macro invertebrates
Composition

Fifteen species of benthic macroinvertebrates divided into 15 genera, 13 families, 7 orders, 3 classes and 3 phyla were identified in the Katobo dam pond (Table 6) of which the genus *Chironomus* predominates 59.8% (Figure 6). Benthic macroinvertebrates seem distributed differently at 4 stations (Table 7), with the H' diversity index varying between 0.45 and 0.82. However, no significant difference exists neither according to the substrate nature, (P = 0.5029, > 0.05) or to the nature of the vegetation (P = 0.8419, > 0.05) (Table 8 & 9; Figure 7).

Table 6: Composition of benthic macro invertebrates collected from the Katobo dam pond (total number of taxa by category at the bottom of the column)

Phylum	Class	Order	Family	Genus	Species
A. Arthropoda	Insects	Odonates	Aeshnidae	*Aeshna*	*Aeshna sp*
				Anax	*Anax sp*
			Gomphidae	*Gomphus*	*Gomphus sp*
			Coenagrionidae	*Coenagrion*	*Coenagrion sp*
		Himenoptera	Corixidae	*Corixa*	*Corixa sp*
		Coleoptera	Dytiscidae	*Dysticus*	*Dysticus sp*
				Cybister	*Cybister sp*
			Belostomatidae	*Appasus*	*Appasus sp*
			Gyrinidae	*Gyrinus*	*Gyrinus sp*
			Hydrphilidae	*Enochrus*	*Enochrus sp*
		Trichoptera	Philopotamidae	*Philopotamus*	*Philopotamus sp*
		Diptera	Chironomidae	*Chironomus*	*Chironomus sp*
			Culicidae	*Culex*	*Culex sp*
B. Annelida	Clitellates	Rhynchobdellida	Glossiphonidae	*Glossiphonia*	*Glossiphonia sp*
C. Mollusks	Gasteropoda	Hygrophila	Planorbidae	*Biomphalaria*	*Biomphalaria pfeifferi*
3	3	7	13	15	15

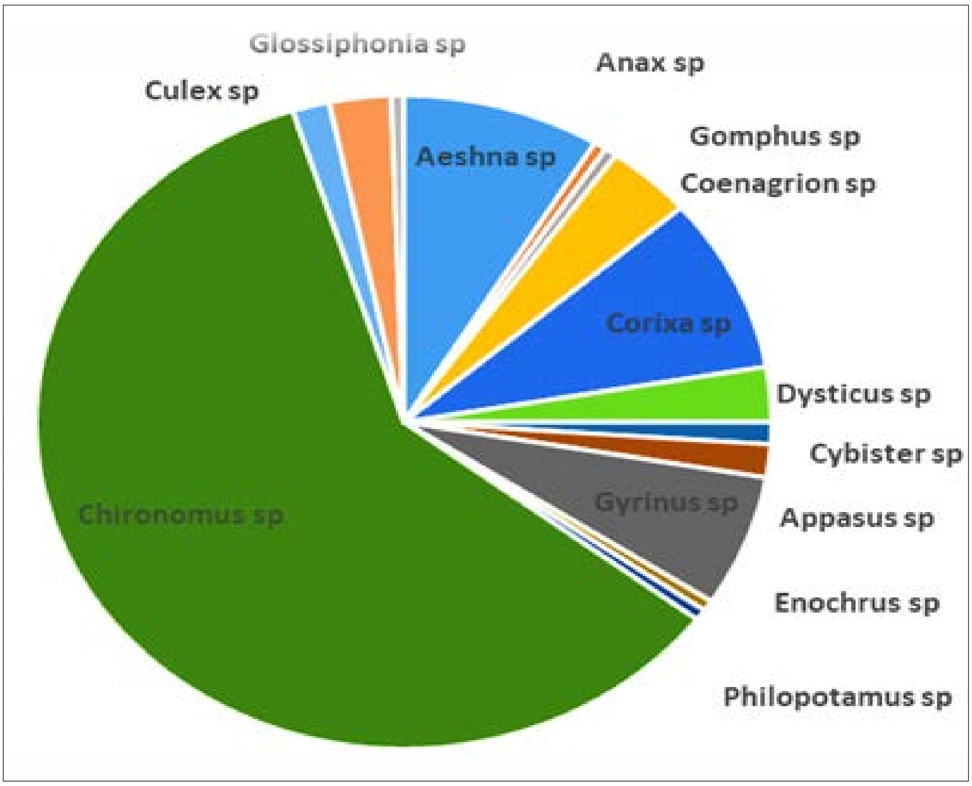


Fig 6: Relative abundance of benthic macroinvertebrate species in Katobo Dam pond.

Table 7: Distribution of benthic macroinvertebrates by station.

Species	Station 001	Station 002	Station 003	Station 004
Aeshna sp	7	1	7	1
Anax sp	0	0	1	0
Gomphus sp	1	0	0	0
Coenagrion sp	1	6	0	0
Corixa sp	0	13	0	3
Dysticus sp	0	5	0	0
Cybister sp	0	1	1	0
Appasus sp	0	1	0	2
Gyrinus sp	0	4	4	4
Enochrus sp	0	0	1	0
Philopotamus sp	0	0	1	0
Chironomus sp	19	19	31	41
Culex sp	1	2	0	0
Glossiphonia sp	0	5	0	0
Biomphalaria pfeifferi	1	0	0	0

Table 8: Diversity of benthic macro invertebrates by substrate type.

Type of substrate	H’	P	Decision
Mixed: Sand-mud	0.470054431	0.5029	No significative diffrence
Mixed: Rock-sand	0.818217145		
mud	0.451831802		

Table 9: Diversity of benthic macroinvertebrates by vegetation type

Station and vegetation type	H’	P	Decision
Station1/*Cyperus papyrus*	0.470054431	0.8419	No significative diffrence
Station2/*Phragmites mauritianus*	0.818217145		
Station/3 *Nymphea lotis*	0.262364614		
Station4/ *Typha lotifolia*	0.532112097		

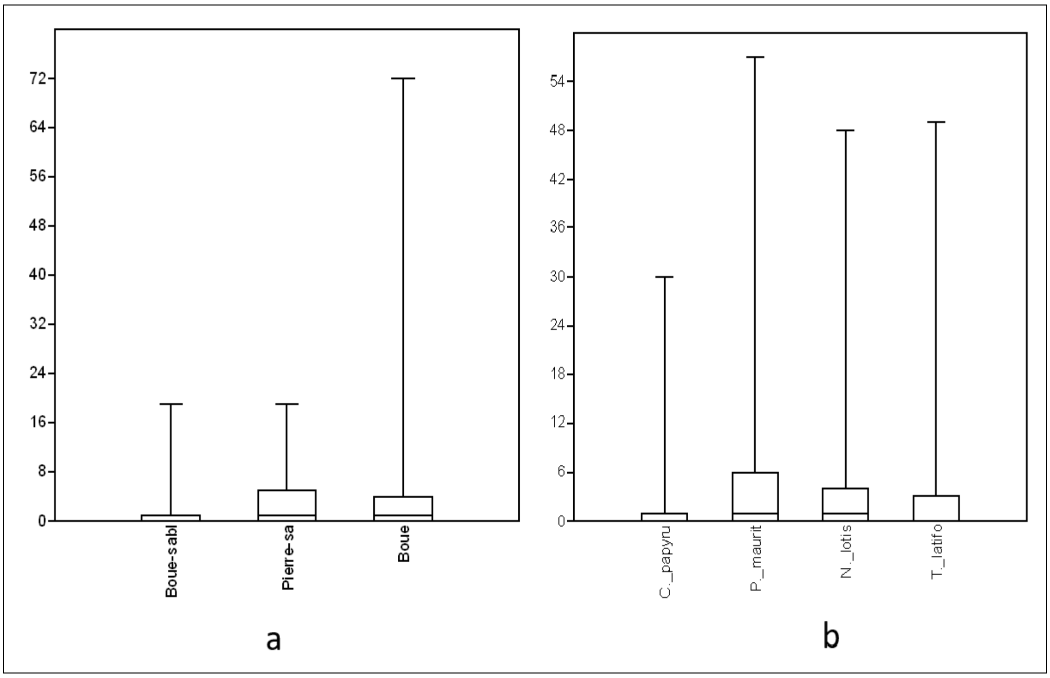


Fig 7: Benthic macroinvertebrate diagram of H' diversity index (a) by substrate type and (b) by vegetation type

Fish fauna

Three morphological types of fish are recognized in Katobo dam pond by the riparian population. The morphological type called '*Ngogota*' has olive dorsal flank with large cycloid scales stained with black at their base in rostral and distal thirds of the flank. The median flank is silvery with longitudinal series of scales black at their base. The ventral flank is silvery and weakly tinged with red, and the pelvic and anal fins are red. The anal fin posteriorly exceeds the origin of the caudal. The caudal fin is truncated and has grey upper half and red-orange lower half. Throughout its height, the caudal fin bears dark and orange stripes of different widths with same direction as caudal fin rays, bearing dark or orange spots. The black dorsal fin posteriorly exceeds the origin of the caudal. Pectoral fins are transparent. The dorsal head part is regularly convex, eyes broad and rounded, the head is olive on the dorsal part and the ventral surface grey tinged with red (Figure 8a). The second morph type locally called '*Rukara*', is considered by the local population as the male of the 3rd morph type locally called '*Mano*'. This 2nd morphological type has a uniformly black dorsal flank and a grey ventral flank. On the dorsal and median flanks a series of three darker bands not clearly perceptible. Cycloid scales are small. The dorsal fin is entirely black at the distal half, and grey at the anterior half with a red upper margin, pectoral fins are pointed and black at the base of the rays, while pelvic fins are black on the basal half and grey on the terminal part. The truncated caudal fin is black on 2/3 towards the origin and grey on the distal third with a red distal margin. Sometimes small irregular vertical bands are observed on the caudal. The dorsal part of the head is almost straight with a short convexity just before the origin of the dorsal fin. The head is entirely black as are the rounded eyes (Figure 8b).

A B C

Fig 8: Three morphological types identified in the ichthyofauna of the Katobo dam pond: a) *Coptodon rendalli* (Ngogota), b) male and c) female *Oreochromis upembae* (Rukara and Mano)

Measurements

On the first axis, the most important values refer to the head length, the snout and the upper jaw lengths. On the second axis, the most important values refer to the length of the lower jaw, caudal peduncle and the inner pelvic length. The most important values on the third axis concern the length of the longest dorsal ray, the longest anal spine and ray. Three highly significant differences ($p<0.01$) concern the head, the snout and the lower jaw lengths. Two significant differences ($p<0.05$) concern the interorbital distance and the longest dorsal spine (Table 10). From the three morphological types identified within the ichthyological fauna of Katobo dam pond emerge two species including *Coptodon rendalli* and *Oreochromis upembae* male and female (Figure 9).

Table 10: Measurements factors correlation coefficients score.

	Factor 1	Factor 2	Factor 3	P
Body depth	0.119421	-0.152099	-0.109003	0.028169
Head length	0.195639	0.077230	0.052210	0.000017***
Snout length	-0.154976	-0.001220	0.028197	0.000031***
Eye length	-0.140356	-0.073018	0.187311	0.003912
Eye diameter	-0.140254	-0.142841	0.136242	0.002387
Interorbital distance	0.073786	-0.208039	0.067681	0.000173*
Upper jaw length	-0.147657	-0.125567	0.097080	0.000055***
Lower jaw length	-0.053249	-0.405074	-0.022443	0.004459
Caudal peduncle length	0.042259	0.180932	-0.017854	0.072732
Caudal peduncle depth	0.134949	-0.213635	-0.230079	0.045322
Dorsal fin base Length	0.043997	-0.191190	0.042830	0.782468
Predorsal distance	0.139716	-0.095287	-0.037122	0.072732
Pelvic length (in)	-0.037473	-0.208719	0.036206	0.320280
Pelvic length (out)	-0.012551	0.054215	0.260716	0.219220
Longest dorsal spin length	0.116485	-0.091865	0.261788	0.000836*
Longest dorsal ray length	0.063558	0.160434	0.313887	0.109304
Longest anal spin length	0.111976	-0.132936	0.294492	0.001988
Longest anal ray length	0.057409	-0.017764	0.296657	0.159131

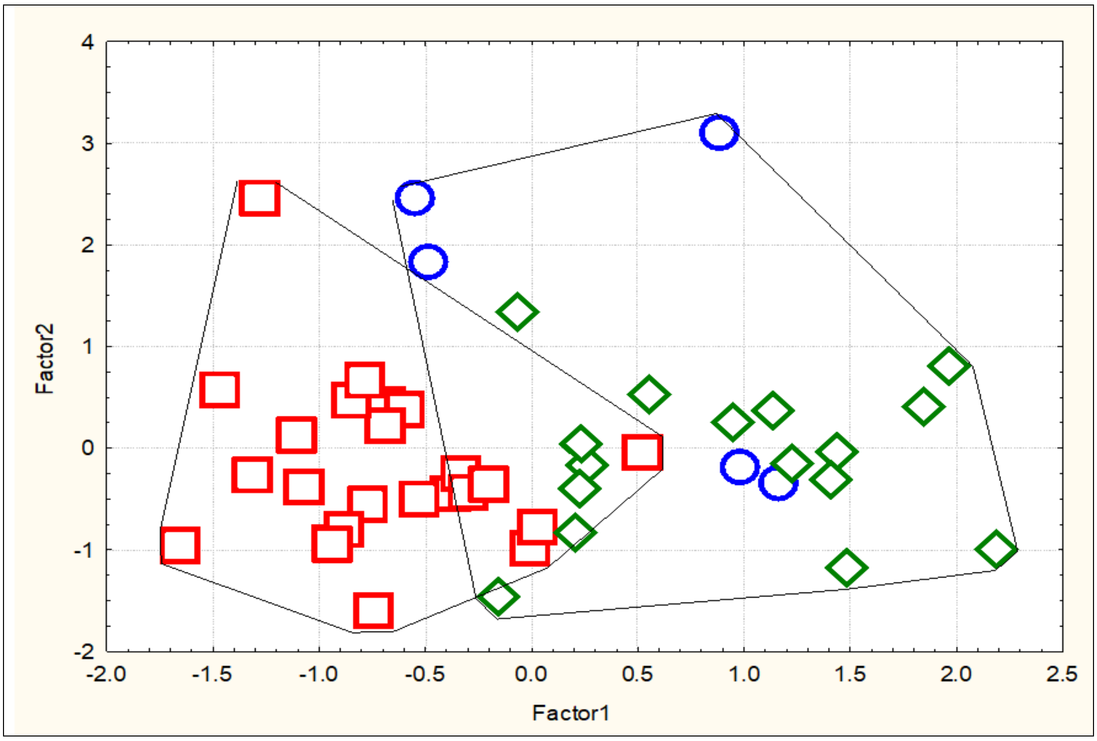


Fig 9: Two species separated based on the basis of metric data. *Oreochromis upembae* located in the positive part of axis 1, with two morphological types, the male ○ and the female ◇ and *Coptodon rendalli* □ located in the negative part of the same axis.

Meristic

The most important values for the first axis correspond to the number of dorsal spines, the number of scales in the longitudinal line and the upper lateral line. For the second axis, they concern the number of rays on the dorsal, anal and pectoral fins. Two highly significant differences ($p<0.01$) concern the number of gills rackers and that of dorsal spines and; a significant difference ($p<0.05$) concerns the number of scales on the longitudinal line (Table 11). Two species are separated on the basis of meristic characters: The first occupies mainly the negative part of the first axis while the second occupies the positive part of the same axis (Figure 10).

Table 11. Meristic factors correlation coefficients score.

	Factor 1	Factor 2	Factor 3	P
Dorsal spines	-0.236252	0.069944	0.504154	0.000081***
Dorsal rays	0.059064	-0.588640	-0.194350	0.580439
Anal rays	-0.111079	-0.390013	0.342643	0.219327
Pectoral rays	0.022409	-0.364589	0.170927	0.164754
Longitudinal line	0.320510	-0.048604	0.274490	0.000332*
Upper lateral line	0.262590	-0.132388	-0.287671	0.032759
Lower lateral line	0.248288	0.029684	0.602410	0.001430
Gills rackers	-0.212844	-0.277720	-0.013192	0.000000***

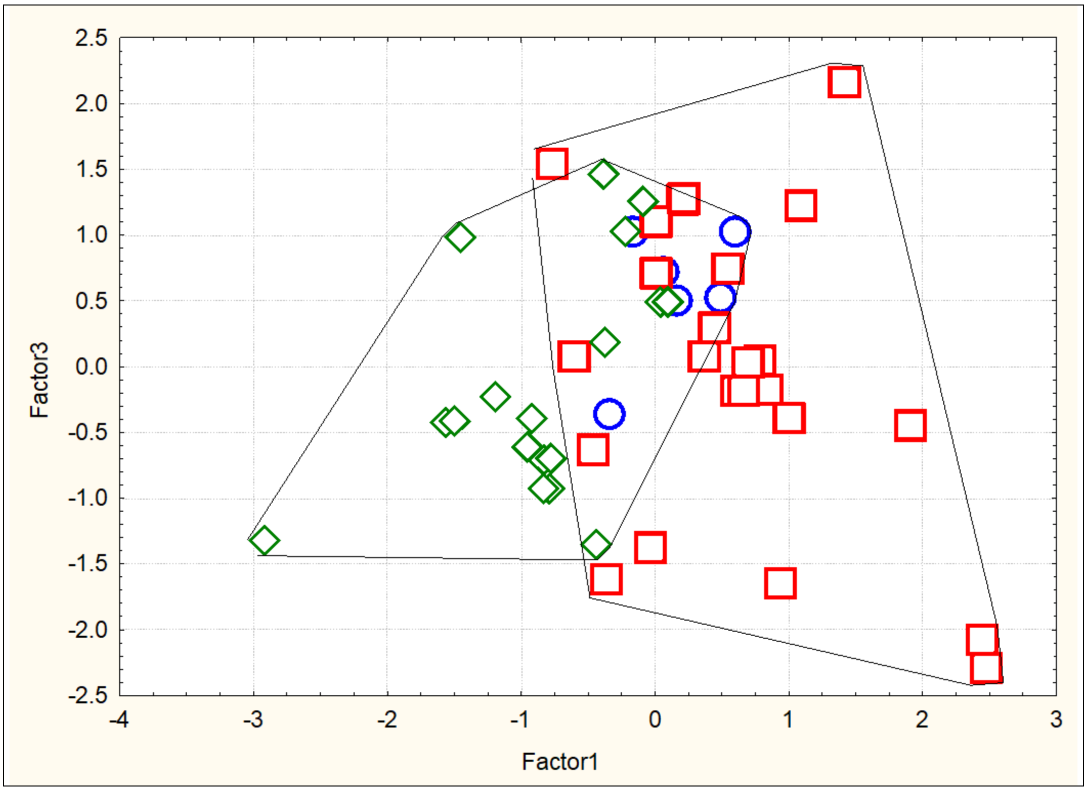


Fig 10: Two species separated on the basis of meristic, *Oreochchromis upembae* mainly on the negative part of the first axis with two morphological types: Males ○and females ◇ and; *Coptodon rendalli* □ almost on the positive part of the first axis

Physicochemical data

Waters of the Katobo Dam pond are very weakly acidic with good dissolved oxygen saturation, low conductivity and low temperature (Table 12).

Table 12: Katobo dam pond waters Physico-chemical data.

Heure Caractéristiques	7h48'	12h00'	13h37'
pH	6,62	6,8	6,69
DO (mg/l)	142,5	100.1	101,1
Conductivité (µS/cm)	193	190	190
Température (°C)	19,75	21,44	21,13

Discussion

There are cold lakes in tropical regions of altitude not similar to lakes of low altitude. The main difference between these lakes is not the temperature but the nutrients they contain. Lake Titicaca in the Alpine Andes contains a high ionic concentration of 1170µs/cm while Lake Mukabaji in the Andes of Venezuela has demineralized water, 12µs/cm (Widmer *et al.*, 1975; Levis & Weibezahn, 1976; Gessner & Hammer, 1967) [35, 16, 13]. The values of the low abiotic parameters (temperature and pH) are not favourable to the development of microalgae of the phyla Cyanoprokaryota and Chlorophyta. These phyla have a high affinity for environments with high pH and temperature (Assougnon *et al.*, 2017) [1]. Cyanoprokaryota have an optimum growth rate between 28°C and 32°C although they are able to tolerate and survive lower temperatures. These taxa can also adapt to extreme environmental conditions to proliferate (Codd, 1998) [7]. Some factors interact to determine the structure of the zooplankton community, including phytoplankton abundance and composition, temperature change, light, mixing, and the effect of predation by higher trophic levels (Sommer, *et al.*, 1986; Valerie *et al.*, 2008) [25, 32]. The specific richness of zooplankton crustacean group decreases in cold waters due to constraints due to the variation in the environmental gradient (Gislason, 2005; Christine & Roy, 2008) [14, 5]. Aquatic macro-invertebrate fauna is an indispensable biological element for determining the biological status of an aquatic ecosystem such as lakes, rivers and transitional waters (Water FD, 2000; Timm & Möls, 2008) [29]. The distribution of benthic macroinvertebrates shows a clear reduction in diversity compared to that earlier observed at low altitudes in the Ruzizi River plain. The specific diversity of Hemiptera (4 vs 1), Diptera (7 vs 2), Beetles (7 vs 5) and Trichoptera (7 vs 2) decrease while that of Odonates (4 vs 3), Annelids (1vs1) and Mollusks (1vs1) increase or remain unchanged (Safari *et al.*, 2018) [22]. This decrease in the number of taxa is explained by the decrease in water temperature and the water demineralization at high altitudes. Benthic biodiversity is distributed according to the prevalence, temperature of water and distribution of habitat types (sandy, muddy, rocky) (James *et al.*, 2013) [15]. The distribution of macrobenthos is related to environmental factors such as temperature, water depth, silicate, dissolved oxygen and inorganic nitrogen (Lu *et al.*, 2013) [17]. It is probably the diversity of nutrition mechanisms and the availability of food sources in these places that have contributed to a wide distribution of benthic macroinvertebrates in the tropics. The marginal vegetation supports a great diversity including molluscs, dragonfly larvae and aquatic beetles more associated with the vegetation itself than with the substrate of the lake. Thus, in large reservoirs, the benthic fauna is not very diverse, the Chironomidae being the most numerous (Payne, 1986) [21]. Four fishes species of the genus *Oreochromis*, including 3 introduced (*O. Leucostictus*, *O. Macrohir*, and *O. Niloticus Nilotisus*) and two native, (*O. Niloticus eudouardinus* and *O. Tanganicae*) are distributed in the Ruzizi Basin (De Vos, 2001; Banyakimbona *et al*., 2012; Muzumani, 2019, Nabintu *et al*., 2021) [8, 2, 18, 19, 20]. *O. niloticus niloticus* was introduced to Rwanda and Burundi, countries including the Ruzizi Basin, from the DRC since 1951 for fish farming and storage dams (FAO, 1988) [9]; *O. macrochir* was introduced to Rwanda and Burundi, regions sharing the Ruzizi Basin, from the DRC in 1950 for aquaculture and; *O. Leucostictus*, native to Lake Albert, was introduced to eastern DRC in 1955, via Uganda for an unknown reason (Moreau 1979). In 1956, after the erection of the Katobo dam pond on 1954, *Coptodon rendalli*, an herbivorous species often used to control the proliferation of aquatic plants in ponds and along rivers (FAO, 1988, Skelton, 1993) [9, 24] was introduced from the DRC to Rwanda and Burundi, countries partially covered by the Ruzizi Basin. Its' natural area of distribution covers the Middle Congo Basin, drainage of the Kasai River and the region between Lomami and Kisangani to the upper Lualaba, the region of Bangeulu, Lake Tanganyika, Malagarasi, Lake Malawi and Cunene, the Zambezi Basin and southern Africa (Skelton, 1993; Froeze and Pauly, 2023) [24, 12]. *O. upembae* (Thys van den Audenaerde, 1964) [28] naturally distributed in the Lake Upemba and Lualaba River region to Yangambi and Isangi in DR Congo (Froeze & Pauly, 2023) [12] was not yet described in 1956, when *C. rendalli* was introduced to the Albertine Rift region, including the Ruzizi Basin. As the natural distribution of both species overlaps in the Lualaba River and Lake Upemba watershed, the presence of *O. Upembae* in Katobo suggests that this species was introduced under the name *C. rendalli*, because no mention of its introduction exists while only that of *C. Rendalli* is confirmed in the region (FAO 1988).

Conclusion

The Katobo Dam pond, an aquatic ecosystem of the Ruzizi River Basin is very different from similar low-altitude aquatic environments. It is interesting for hydro biological and water physico-chemical comparative studies. The present study paves the way for further physico-chemical and ecological studies covering different seasons and the life cycle of identified taxa. The use of monofilament gillnets in fisheries, the lack of fishing regulation as well the missing knowledge of the ecosystem life constitute a serious threat to the low fishes diversity including only the two species introduced as *Coptodon rendalli* in the dam pond.

Acknowledgements

I express my gratitude to Yolande Byanwa my spouse for the solitude she usually felt when remaining alone during my field research times. We acknowledge the Centre de Recherche en Hydrobiology CRH-Uvira, for the given opportunity to conduct this study. We are grateful to the family of Mugozi Rukanyaga for the warm welcome extended to the research team during its stay in Ndegu. We express our gratitude to Kamoni Rukanyaga, the Ndegu locality Chief in Kigoma area, for the security conditions that allowed carrying out of this study. We owe gratitude to Mukirania Simon, Moise Kimanuka and Bahane Byeragi laboratory assistants in the Department of Biology for their participation to the advancement of this study.

References

1. Assougnon DL, Agadjihouèdé H, Kokou K, Lalèyè AP. Caractérisation physico-chimique et diversité du peuplement phytoplanctonique des mares au sud de la réserve de faune de Togodo (sud-Togo). International Journal of Biological and Chemical Sciences. 2017 Dec 19;11(4):1920-36. https://doi. org/10.4314/ijbcs.v11i4.40
2. Banyankimbona G, Emmanuel V, Ntakimazi G, Snoeks J. The riverine fishes of Burundi (East Central Africa): An annotated checklist chthyological Exploration of Fresh Waters. 2012;23(3):273-288.
3. Brown DS. Freshwater Snails of Africa and their Medical Importance. British Museum (Natural History), London: Taylor & Francis Ltd; c1980. p. 450.
4. Buhungu S, Montchowui E, Sibomana C, Barankanira E, Ntakimazi G, Bonou CA. Diversité et abondance zooplanctoniques de la rivière Kinyankonge (*Bujumbura, Burundi*) en relation avec les variables environnementales. Annales des sciences agronomiques. ISSN: 1659-5009. 2019;23(1):1-20.
5. Christine E. Campbell & Roy Knnoechel, Species occurrences of microcrustacean zooplankton in Labrador, Canada. International Society of Limnlogy 2008;30(1): 77-81.
6. De Moor IJ, Day JA, De Moor FC. Guides to the Freshwater Invertebrates of Southern Africa. 2003b Volume 8: Insecta II Hemiptera, Megaloptera, Neuroptera, Trichoptera & Lepidoptera. WRC Report No. TT 214/03. South Africa; c219.
7. Codd GA. Cyanobacterial blooms and toxins in fresh, brackish and marine waters. In Harmful Algal News. 1998;16:13-17.
8. De Vos L, Seegers L, Taverne L, Thys Van Den Audenaerde D. Lichtyofaune du bassin de la Malagarasi (Système du Lac Tanganyika): UNE synthèse de la connaissance actuelle. In Annales Musée Royal de l'Afrique Centrale, Sciences Zoologies. 2001;285:117-135.
9. FAO. FAO Database on Introduction of Aquatic Species (DIAS). FAO, Rome, Fisheries and Aquatic Department; c1988. p. 318.
10. Fernando CH. A guide to tropical freshwater zooplankton, identification. Enology and impact on fâcheries; c2002. p. 291.
11. Forcellini M, Mathieu C. et Merigoux S. Atlas des macros invertébrées des eaux douces de l'île de la Réunion. Convention de la recherche et développement. 2008 ; c2011. p. 137.
12. Froese R, Pauly D. (Eds), Fish Base. World Wide Web electronic publication Available; c2023 Jun. from: www.fishbase.org.
13. Gessner F, Hammer L. Limnologische Untersuchungen An Seen der Venezuelanischen Hochanden. Int. Rev. Ges. Hydrobiol. 1967;52:301-320, in Payne AI. The Ecology of Tropical Lakes and Rivers, John Willey & Sons LTD; c1986. p. 301.
14. Gislason GM. Origin of freshwater fauna of the North-Atlantic Islands: Present distribution in relation to climate and possible migration routes. International Society of Limnology. 2005;29:198-203.
15. James CB, Sam M, Chris W, Andrew RGP. Benthic marine biodiversity pattern across the United Kingdom

and Ireland determined from recreational diver observation: A baseline for possible species range shifts induced by climate change. Aquatic ecosystem Health & Management. 2013;16:20-30.
16. Lewis WM, Weibezahn FH. Chemistry energy flow and community structure in some Venezuelan freshwaters. Arch. Hydrobiol. Suppl. 1976;50:145-207, in Payne AI. The Ecology of Tropical Lakes and Rivers, John Willey & Sons LTD; c1986. p. 301.
17. Lu S, Jiangning Z, Yibo L, Ting X, Aigen G, Ziqiang C, *et al*. Temporal and spatial variability of benthic macrofauna communities in the Yangtzee River estuary. Aquatic Ecosystem Health & Management. 2013;16:31-39.
18. Muzumani RD. Ichtyofaune du Parc National de la Ruzizi (PNR/Burundi) Mémoire présenté pour l'obtention du Diplôme d'Etudes Approfondies (DEA) en Gestion des Ressources Naturelles Renouvelables Université de Lubumbashi; c2019. p. 85.
19. Mpawenayo B. Les eaux de la plaine de la Rusizi (Burundi): Les milieux, la flore et la végétation algales. Académie Royale des Sciences d'outre-mer, Classe des Sciences naturelles et médicales Mémoire in-8°, Nouvelle Série, Tome 23, fasc. 2, Bruxelles 235; c1996.
20. Nabintu BN, Safari Ruffin R, Muzumani RD. Natural hybridization between species of the cichlid genus *Oreochromis* (*Cichlidae*, *Perciformes*) in ponds of the low Ruzizi River (DR Congo) International Journal of Fisheries and Aquatic Studies; 2021;9(4):30-36.
21. Payne AI. The ecology of tropical lakes and Rivers. John Wiley & Sons Ltd; c1986. p. 301.
22. Safari RR, Amundala SC, Nabintu BN, Shabani EI. Benthic invertebrates of natural ponds of Ruzizi plain, Democratic Republic of the Congo. International Journal of Fisheries and Aquatic Studies. 2018;6(2):381-386
23. Sangne YC, Akoua DK, Kobenan PN, Kouassi BK, Yao Sadaiou SB. Evaluation du peuplement du phytoplancton dans les bassins d'une station d'épuration des eaux usées en milieu hospitalier (Centre hospitalier régional de Daloa, Côte d'Ivoire) Déchets Sciences et Techniques. 2019;81:43-53.
24. Skelton P. A complete Guide to the freshwater fishes of Southern Africa. Southern Book Publishers, 1993, 388.
25. Sommer U, Gliwicz Z, Lampert WM, Duncan A. The PEG model of seasonal succession of planktonic events in fresh waters. Arch. Hydrobiol. 1986;106:433-471.
26. Tachet H, Richoux P, Bournaud M. Invertébrés d'eau douce, systématique, biologie, écologie. Usseglio Polatera. CNRS Editions, Paris 587; c2000.
27. Stals R, de Moor IJ. Guides to the Freshwater Invertebrates of Southern Africa. Volume 10: Coleoptera WRC Report No. TT 320/07. South Africa 275; c2007.
28. Thys van den Audenaerde DFE. Revision systematique des speices Congolaises du genre Tilapia (*Pisces*, *Cichlidae*). Annls Mus. R. Afr. Cent. Ser. 8°, Sci. Zool. 1964;124:155.
29. Timm H, Möls T. Do shallow-water macroinvertebrate assemblages correspond to physico-chemical habitat of streams and lakes? International Society of Limnology. 2008;30(1):138-140.
30. Toshihiko M. Illustration of the freshwaters plankton of Japan, 1983, 353.
31. Trewavas E. Tilapiine fishes of the genera Saretherodon, Oreochromis and Danankilia. Trustees of the British Museum (Natural History); c1983. p. 583.
32. Valerie CC, David AC. Trends in the western Lakes Erie zooplankton community: Evidence for top-down control by age-0 percids. International Society of Limnology. 2008;30(1):95-99.
33. Van Damme D. The Freshwater Mollusca of Northern Africa. Distribution, Biogeography and Paleoecology. Developments in Hydrobiology. 1984;25:164.
34. Water Framework Directive the European Parliament and Council of the European Union. Directive 2000/60/EC.
35. Widmer C, Kittle T, Richerson PJ. International Society of Limnology. 1975;19:1504-1510 in Payne AI. The Ecology of Tropical Lakes and rivers, John Willey & sons LTD; c1986. p. 301.
36. Yapo ML, Atse BC, Kouassi P. Inventaire des insectes aquatiques des étangs de piscicoles au sud de la Côte d'Ivoire. Journal of Applied Biosciences. 2012;5(8): 4208-4222.