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Preliminary survey on freshwater invertebrates of Mambasa, Democratic Republic of the Congo

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1 ABSTRACT

This preliminary investigation deals with freshwater invertebrate populations in Mambasa from six selected sampling sites. The objective of this study was to sample, identify and determine the abundance of invertebrates which are collected in freshwater bodies of Mambasa area. Freshwater invertebrates were collected using a hand scoop net of 0.5 mm of mesh, sieve or plastic container. A total of 1270 invertebrates were collected belonging to 22 species, these including *Lymnaea natalensis* (32.00%), *Biomphalaria pfeifferi* (17.32%), *Gerris spp* (10.78%), *Chironomus plumosus* (10.15%), *Nepa rubra* (8.81%), *Pila ovata* (5.90%), *Micrommata spp* (4.22%), *Tubifex spp* (3.30%), *Sympetrum spp* (1.96%), *Dysticus dimidiatus* (1.02%), *Lestes spp* (0.94%), *Anax spp* (0.71%), *Ephemera mucronata* (0.47%), *Bulinus forskalii* (0.39%), *Ephemera spp* (0.39%), *Hydrometra stagnorum* (0.39%), *Libellula spp* (0.24%), *Chaoborus spp* (0.16%), *Gyrinus spp* (0.16%), *Simulium spp* (0.16%), *Ranatra spp* (0.08%) and *Nepa spp* (0.08%). Invertebrate population was higher in the sites (I, II and IV) dominated by aquatic plants such as *Phragmites spp*, *Panicum spp*, *Typha spp* and *Hyparrhenia spp*.

2 INTRODUCTION

Freshwater invertebrates are separated in two main groups: microinvertebrates and macroinvertebrates (Tachet *et al.*, 1980; Lind, 1985). Invertebrates form an integral part of the aquatic ecosystem and are widely used as indicators of pollution when testing for stream health (Kankonda, 2001; Moore and Palmer, 2005). They are widely used as biological indicators of stream health, with their abundance and diversity being used to indicate the presence of pollution (Curtis, 1991; Grant *et al.*, 1993; Kankonda, 2001; Moisan, 2006; Kankonda, 2008; Heudre *et al.*, 2011). Aquatic invertebrates form also an important part of the aquatic food chain, which provide a food source for numerous vertebrates, notably fish and birds (Curtis, 1991; Kankonda, 2001). Sunlight is converted to energy by aquatic plants (macrophytes) and algae. These plants are then eaten by primary consumers such as freshwater snails, insect larvae, and other invertebrates. Currently, many inventories focus on vertebrates and plants. But inventories of freshwater invertebrates and conservation of

wetland areas are still insufficient (Lhonoré, 1992; Dudgeon *et al*., 2006). Aquatic areas and mainly the streams of Mambasa are unknown, because there is no any study which has been carried out on freshwater invertebrates in this area. Furthermore, the conservation status of many freshwater invertebrates cannot be assessed adequately in the DRC due to lack of data. In order to reach to rational and sustainable management of aquatic ecosystems of Mambasa, it is very crucial to implement a follow-up program of study, control and classification of freshwater invertebrates. This survey intends to sample, identify and determine the abundance of invertebrates which are collected in freshwaters of Mambasa area.

3 MATERIALS AND METHODS

3.1 Area of investigation: Mambasa is located in the province of Ituri in the north-eastern part of Democratic Republic of Congo. It is adjacent to the RFO (Réserve de Faune à Okapi) and covers around 36,783 km^2 and extends between 1°21'31.8" and 1°22'1" N latitude and between 29°1'33.7" and 29°2'33" E longitude.

3.2 Collection and identification of freshwater invertebrates: Six sampling sites were selected based on prospected aquatic ecosystems (ponds, rivers and streams) and accessibility. Freshwater invertebrate samples were collected using a hand scoop net of 0.5 mm of mesh, sieve or plastic container from August to September 2014. The collected specimens were grouped according to the sites and dates of sampling and placed in labelled plastic containers filled with 70% ethanol. Samples were then transported to laboratory of Hydrobiology and Aquaculture, Faculty of Sciences, University of Kisangani for further processing. The sampled invertebrates were washed with running water, counted and the taxonomic identification was initially determined based on individual morphology using the identification keys of WHO (1968); Brown (1980); Tachet *et al.* (1980); Levêque (1981); OMS (1982); Brown (1994); Day & De Moor (2002); De Moor & Day (2002); Gerber & Gabriel (2002); De Moor *et al.* (2003); Day *et al.* (2003); Stals & De Moor (2007).

3.2 Data analysis: Statistical analyses were performed using ANOVA test in R software (version 3.1.2) to compare variables.

4 RESULTS AND DISCUSSION

A total of 1270 invertebrates were collected from the six sampling sites of Mambasa belonging to 22 species, 20 genera, 19 families, 10 orders, and 4 classes. As shown in the Tables (1&2), *Lymnaea natalensis* was abundantly collected (32%) followed by *Biomphalaria pfeifferi* (17.32%). The lowest number with 0.08% belonged to the genera *Nepa* and *Ranatra*. By regarding the Table (2), one can conclude that invertebrate populations were abundantly caught in the sites I, II and IV. It was observed that sites I, II and IV were dominated abundantly by aquatic vegetation namely *Phragmites spp*, *Panicum spp*, *Typha spp* and *Hyparrhenia spp*. This feature could also explain the abundance of *Lymnaea natalensis* and *Biomphalaria pfeifferi*. On the other hand it appears that there's no significant difference in the total abundance of freshwater invertebrates between catchment sites (p= 0.3953). Note that 0.39% of all collected individuals was not identified to genus and species levels due to lack of appropriate key during identification for family of veliidae.

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Table 1. Systematic broad outline and relative abundance of freshwater invertebrates collected in Mambasa

Class	Order	Family	Genus	Species	(%)
Arachnida	Araneae	Sparassidae	*Micrommata*	*Micrommata spp*	4.22
Insecta	Hemiptera	Nepidae	*Nepa*	*Nepa spp*	0.08
				Nepa rubra Linnaeus, 1758	8.81
		Gerridae	*Gerris*	*Gerris spp*	10.78
			Ranatra	*Ranatra spp*	0.08
		Hydrometridae	*Hydrometra*	*Hydrometra stagnorum* Linnaeus, 1758	0.39
	Odonata	Aeshnidae	*Anax*	*Anax spp*	0.71
		Libellulidae	*Sympetrum*	*Sympetrum spp*	1.96
			Libellula	*Libellula spp*	0.24
		Lestidae	*Lestes*	*Lestes spp*	0.94
	Ephemeroptera	Ephemeridae	*Ephemera*	*Ephemera mucronata* Linnaeus, 1758	0.47
				Ephemera spp	0.39
	Coleoptera	Gyrinidae	*Gyrinus*	*Gyrinus spp*	0.16
		Dytiscidae	*Dysticus*	*Dysticus dimidiatus* Linnaeus, 1758	1.02
	Diptera	Chironomidae	*Chironomus*	*Chironomus plumosus* Linnaeus, 1758	10.15
		Simuliidae	*Simulium*	*Simulium spp*	0.16
		Chaoboridae	*Chaoborus*	*Chaoborus spp*	0.16
	Heteroptera	Veliidae	Unknown	Unknown	0.39
Oligochaeta	Tubificida	Tubificidae	*Tubifex*	*Tubifex spp*	3.30
Gastropoda	Architaenioglossa	Pilidae	*Pila*	*Pila ovata* Olivier, 1804	5.90
	Hygrophila	Lymnaeidae	*Lymnaea*	*Lymnaea natalensis* Krauss, 1848	32.00
		Planorbidae	*Biomphalaria*	*Biomphalaria pfeifferi* Krauss, 1848	17.32
			Bulinus	*Bulinus forskalii* Ehrenberg, 1831	0.39

Table 2. List of invertebrate species and their average in six sampling sites (%)

Name of Species	Site I	Site II	Site III	Site IV	Site V	Site VI	Mean	Stdev
Anax spp	0.71	0.00	0.00	0.00	0.00	0.00	0.12	0.0029
Biomphalaria pfeifferi	11.73	5.51	0.00	0.08	0.00	0.00	2.89	0.0486
Bulinus forskalii	0.00	0.16	0.00	0.24	0.00	0.00	0.07	0.0010
Chaoborus spp	0.00	0.00	0.16	0.00	0.00	0.00	0.03	0.0006
Chironomus plumosus	10.16	0.00	0.00	0.00	0.00	0.00	1.69	0.0415
Dysticus dimidiatus	0.08	0.39	0.31	0.24	0.00	0.00	0.17	0.0017
Ephemera mucronata	0.47	0.00	0.00	0.00	0.00	0.00	0.08	0.0019
Ephemera spp	0.31	0.00	0.00	0.00	0.08	0.00	0.07	0.0013
Gerris spp	1.34	0.39	7.01	0.63	0.00	0.71	1.68	0.0265
Gyrinus spp	0.16	0.00	0.00	0.00	0.00	0.00	0.03	0.0006
Hydrometra stagnorum	0.00	0.00	0.00	0.00	0.16	0.24	0.07	0.0010
Lestes spp	0.08	0.71	0.00	0.16	0.00	0.00	0.16	0.0028
Libellula spp	0.00	0.00	0.00	0.16	0.00	0.08	0.04	0.0007
Lymnaea natalensis	0.39	0.63	0.00	30.55	0.00	0.71	5.38	0.1233
Micrommata spp	2.60	1.10	0.00	0.87	0.00	0.00	0.76	0.0102
Nepa rubra	0.24	7.64	0.47	0.16	0.31	0.00	1.47	0.0303
Nepa spp	0.00	0.08	0.00	0.00	0.00	0.00	0.01	0.0002
Unknown	0.08	0.00	0.00	0.31	0.00	0.00	0.07	0.0013
Pila ovata	1.65	2.05	0.87	0.08	0.39	0.87	0.98	0.0074
Ranatra spp	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.0003
Simulium spp	0.08	0.00	0.00	0.08	0.00	0.00	0.03	0.0004
Sympetrum spp	0.63	1.02	0.00	0.31	0.00	0.00	0.33	0.0042
Tubifex spp	3.31	0.00	0.00	0.00	0.00	0.00	0.55	0.0123
Total	34.09	19.69	8.82	33.86	0.94	2.60	16.67	0.1493

These two snail species *Lymnaea natalensis* and *Biomphalaria pfeifferi* abundantly collected in the freshwater bodies of Mambasa are among freshwater snails that have been known to play significant roles in the public and veterinary health and thus need to be scientifically exploring more extensively (WHO, 1968; Lévêque and Durand, 1980; De Clercq, 1987; Brown, 1994; Campbell *et al.,* 2000; Dillon, 2000; Day and De Moor, 2002; Supian and

Ikhwanuddin, 2002; Ntonifor and Ajayi, 2007; Kane *et al.*, 2008; Joergensen *et al.*, 2010; Nalugwa, *et al.,* 2010b; Darwall *et al.*, 2011; Isabwe *et al.*, 2012; Kotchi *et al.*, 2013; Zaghloul *et al.*, 2013; Standley *et al.,* 2014). Lévêque (1967); Dillon (2000); Thiam and Diallo (2010) suggesting that gastropod abundance may be explained by aquatic vegetation (macrophytes). OMS (1957); Lévêque and Durand (1980); Gryseels (1985); Brown (1994); Sarr *et al.* (2011) noted that in stagnant waters, the pulmonate vectors of schistosomiasis are usually dominant and often very abundant in the aquatic vegetation. This is among the significant aspects influencing the distribution and abundance of gastropods (Dillon, 2000). Fain (1951); De Clercq (1987); Dillon (2000); Day and De Moor (2002); Ndassa and Mimpfoundi (2005); Ntonifor and Ajayi (2007); Sarr *et al.* (2011); Stauffer and Madsen (2012) mentionned that *B. pfeifferi*, is the main intermediate host of *Schistosoma mansoni* in tropical Africa. *B. forskalii*, intermediate host of *S. intercalatum*, *L. natalensis*, intermediate host of *Fasciola gigantica* and *F. hepatica*. *L. natalensis* is common in perennial streams in small dams unpolluted, in impoundments shallow but rarely in temporary pools (Kotchi *et al.*, 2013). Note that the families of Nepidae, Hydrometridae, Aeshnidae, Lestidae, Gyrinidae, Chaoboridae, Tubificidae, Lymnaeidae and Planorbidae have not been found in the 39 families collected in Epulu river by Vandelannoote (1990) and families of Sparassidae, Hydrometridae, Lestidae, Ephemeridae, Chaoboridae and Tubificidae have not been reported in the checklist of 44 families recorded in the Kisangani streams by Kankonda (2001). These results might suggest a need for conservation and management to be targeted at the freshwater ecosystems of Mambasa.

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