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Biodiversity of species of genus: *Macrobrachium* (Decapoda, Palaemonidae) in Lokoundje, Kienke and Lobe Rivers of South Region, Cameroon

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Key words: *Macrobrachium*; Cameroon; Species-rich; Morphology; Diversity.

Abstract
The diversity of freshwater prawns of the Genus: *Macrobrachium* was studied monthly from October 2010 to September 2011 in three rivers of Cameroon: Lokoundje, Kienke and Lobe Rivers, which are three of the most important shrimping areas for artisanal fishermen in the coastal communities of Cameroon. 1337 specimens were examined and their morphometric and meristic characters recorded, alongside the physico-chemical characteristics of the river water. Six species of *Macrobrachium* were identified based on morphology: *M. vollenhovenii* (Herklots, 1857); *M. macrobrachion* (Herklots, 1851); *M. sollaudii* (De Man, 1912); *M. dux* (Lenz, 1910); *M. chevalieri* (Roux, 1935) and *M. felicinum* (Holthuis, 1949). *M. vollenhovenii* was the most dominant species (52%) and *M. felicinum*, the least (1%). Except in *M. sollaudii*, females were dominant. Based on morphological similarity, two main species groups were identified using Hierarchical Ascending Classification. They were Group 1: *M. vollenhovenii* and *M. macrobrachion*; Group 2: the other four species. Group 2 formed 2 sub-groups*: M. sollaudii* and *M. dux* formed sub-group 1 while *M. chevalieri* and *M. felicinum* formed sub-group 2. It is significant to note that this is the first time *M. felicinum* and *M. dux* are described in Cameroon. The study shows that Cameroon may be more species-rich than previously recorded. It is therefore recommended that the species richness of *Macrobrachium* be investigated in other rivers and that the aquaculture of the most promising commercial species is initiated. This will reduce continuous harvesting of the wild species, thus ensuring the conservation of the species and resource sustainability.

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Introduction

Freshwater prawns of the genus *Macrobrachium* are decapod crustaceans belonging to the family Palaemonidae. They are distributed throughout the tropics and subtropics on all continents except Europe (Holthuis, 1980). They are a remarkably successful group both in number of living species and in the colonization of varied habitats.

Although members of this genus are commonly referred to as 'freshwater' prawns, some are entirely restricted to estuaries and many require marine influence during development (New, 2000). A highly bio-diverse group of approximately 240 species (Chen *et al.*, 2009; Wowor *et al.*, 2009; New *et al.*, 2010; De Grave and Fransen, 2011) of *Macrobrachium* is presently recognised in the world and many of the species grow to a sufficient size to be used for human consumption. Freshwater prawns of the genus *Macrobrachium* are ecologically and economically important and as a result, support artisanal fisheries in many developing countries, especially in Africa (Nwosu and Wolfi, 2006). Species of the genus *Macrobrachium* are found in almost all types of freshwater habitats and estuarine environments including lakes, rivers, swamps, irrigation ditches, canals and ponds (New, 2002; Valencia and Campos, 2007) and along the Atlantic Coast.

The genus is one of the most challenging decapod crustacean groups to describe (Chace and Bruce, 1993) due to the great similarities possessed by these freshwater prawns. *Macrobrac-hium vollenhovenii*, widely known as the African giant prawn is the most abundant and is a viable fishery in most countries in the African region (Gabche and Hockey, 1995). *Macrobrachium vollen-hovenii* species occurs from Senegal to Angola.

Although freshwater prawns of this genus have been studied widely around the world, the biology of many species with large distribution areas still needs to be examined at the regional scale (Luis *et al.*, 2001). In Africa, 10 species of freshwater prawns have been identified (Holthius, 1950 and Monod, 1980) and the name 'Cameroon' was derived from the Portuguese slogan "Rio dos Cameroes" meaning "river of prawns". Notwithstanding, very little work has been done on these prawns particularly in terms of their identification and biology, despite their great economic importance and high income-generating potential. One of the prominent works in this area is that of Gabche and Hockey (1995) on the growth and mortality of *Macrobrachium vollenhovenii* from the Lobé River, Cameroon. With the current pressure to expand food production in the face of escalating population, it has become necessary for countries, especially in the Third World to carry out more detailed studies on the potentials in their indigenous natural resources to ascertain which could serve as food for the future. This study was therefore carried out to assess the biodiversity and to properly identify the prawn species present in the rivers of the South region of Cameroon.

Material and methods

Prawn collection

Between October 2010 and September 2011, *Macrobrachium* samples were collected monthly from fishermen of the Lokoundje, Kienke and Lobe Rivers, Kribi, Cameroon (Fig. 1). Coordinates of each collection point were taken using a GPS and the points are shown in Table 1. The collecting fishing gears were basket traps made of bamboo with length of 40-65 cm and diameter of 14-20 cm. The traps are designed so that when a prawn enters, it is trapped. In the evening (around 6:30 - 8:00 pm), fishermen set baited traps among aquatic vegetation, against the water current and leave it overnight. The bait was rotten meat or fish; fresh ripe palm nuts; chopped coconut; boiled cassava or a mixture of both. In the following morning, after about twelve hours, the traps were retrieved and the prawns were collected and transported to the laboratory of the Institute of Agricultural Research for Development Department (IRAD) Kribi for identification, measurements and taxonomic examinations.

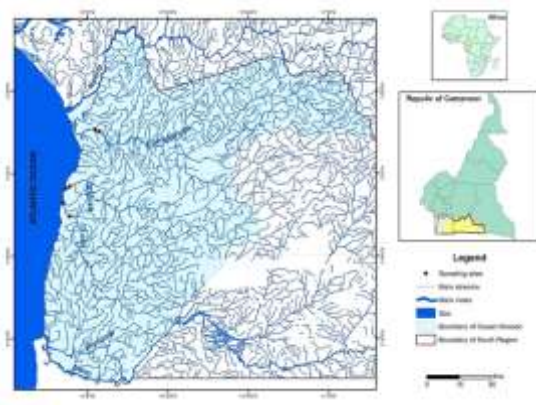


Fig. 1. Map of the Ocean division of Cameroon showing the study areas.

Table 1. GPS points showing the collection sites of *Macrobrachium spp.* in different rivers.

Rivers	Sites	
	1	2
Lobe	N 02°49.567' E 009° 55.512'	N 02°52.865' E 009°53.938'
Kienke	N 02°56.858' E 009°55.514'	N 02°56.319' E 009°54.520'
Lokoundje	N 03°10.217' E 010°02.928'	N 03°10.703' E 010°01.793'

Physicochemical parameters

Measurements of physicochemical parameters of water in the three rivers were done according to standards outlined by APHA (1998) and Rodier *et al.* (2009). Water temperature and dissolved oxygen were monitored daily using an oxymeter (HI 9147, Hanna, Italy) while pH was measured using a pH meter (HI 98130, Hanna, USA).

Laboratory proceedures

In the laboratory, specimens were weighed individually (to the nearest 0.1g) using an electronic balance (Model CS 200, capacity 200g) and coded. During the identification phase, morphometric variables were taken according to the measurement technique described by Kuris *et al.* (1987) for the separation of morphotypes of *M. rosenbergii*. Measurements of all characters were made to the nearest 0.01mm using a digital caliper (range 0-200 mm) for the measurement of large specimens and magnifying binocular glasses for viewing and measurement of small specimens. The dimensions of the two legs of the second pair of the pereiopods and their joints were taken along the external lateral line. For each specimen collected, a total of 33 morphometric (listed under Fig. 2) and six meristic characters (Dorsal teeth, ventral teeth, postorbital teeth, spines of telson, spines of palm, dactylus teeth) were recorded. Ratios for each specimen were calculated according to Konan (2009). After measurement, specimens were identified to species level following the keys described by Konan (2009) and Monod (1980). Sexes were determined by visual examination of the abdomen for the presence of eggs in the females. Also, the ventral side of the first abdominal segment was examined for the presence of a lump in the males as described by Anetekhai (1990). Sex confirmation for the males was by the presence of the *appendix masculina* in the second pleopod (Anetekhai, 1990). The berried females were also separated and counted. To confirm species identification, representative specimens of each of the different species identified were preserved in 95% ethanol and sent to the Museum of Natural History in France for further identification.

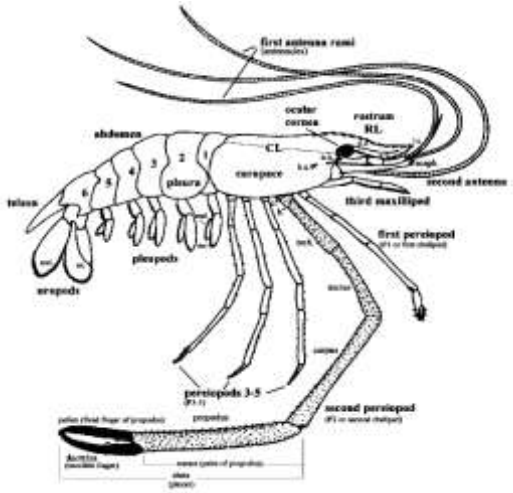


Fig. 2. Schematic drawing of a generalised *Macrobrachium* in lateral view (source Short, 2004) showing morphometric measurements done on specimens of *Macrobrachium* spp. Studied.

LEGEND: 1:Total length; 2: Carapace length; 3: Rostrum length; 4: Head length; 5: Telson length; 6: Telson width; 7: Carapace width; 8: Carapace height; 9 & 10: pereiopod length; 11 & 12: Ischium length; 13

& 14:Merus length; 15 & 16: Carpus length; 17 & 18: Palm length; 19 & 20:Dactylus length; 21 & 22: Distal tooth-fixed digit tip; 23 & 24: Distal tooth-dactylus tip; 25 & 26: Ischium width; 27 & 28:Merus width; 29 & 30: Carpus width; 31 & 32: Palm width; 33: Eye diameter.

Statistical analyses of data

For the analysis of the data collected, the Statistical Package for the Social Sciences (SPSS) Version 17 was used. The data on morphometric measurements and meristic counts were programmed into and analysed using the Microsoft Excel 2007 software. Mean values, ranges and standard deviation (±SE) of each feature were computed for each species.

The differences in sex ratio were analysed with the same statistical package and tested for significant divergence from the expected 1:1 ratio by using the Chi-square ($\chi 2$) goodness of fit statistical test (Zar, 1999).

For the quantitative analysis of species identified, the numerical proportion given as: ratio of the number of individual (n) of a species on the total number of individuals (NT) was applied. The formula is as follows:

$N = n / NT*100$

The Hierarchical Ascending Classification (AHC) based on Euclidean distance and Ward's algorithm was also carried out on the average values of the characters used for identification (Sokal and Rohlf, 1995). The distance from Mahalanobis determined by the discriminating analysis was used as bases as recommended by Dryden and Mardia (1998) and Ferrito *et al.* (2007).

Results

A total of 1337 specimens were examined among which 402 (30.07%) were recorded in Kienke River, 462 (34.38%) in Lobe River and 473 (35.38%) in Lokoundje River. According to the keys described by Konan (2009) and Monod (1980), six prawn species were identified from the specimens collected. These were *M. vollenhovenii* (Fig. 3A), *M. macrobrachion* (3B), *M. sollaudii* (3C), *M. dux* (3D), *M. chevalieri* (3E) and *M. felicum* (3F). All the species were represented in the three rivers sampled (Table 2).

Table 2. Species and numbers of *Macrobranchium* identified from the rivers during study period.

Species	Kienke			Lobe			Lokoundje			Kienke + Lobe + Lokoundje		
	No.	M	F	No.	M	F	No.	M	F	No.	M	F
M. chevalieri	28	20	8	39	17	22	27	12	15	94	49	45
M. dux	55	21	34	45	15	30	60	17	43	160	53	107
M. felicinum	5	3	2	4	2	2	3	2	1	12	7	5
M. macrobrachion	95	29	66	105	31	74	95	35	60	295	95	200
M. sollaudii	31	28	3	28	25	3	19	16	3	78	69	9
M. vollenhovenii	188	56	132	241	75	166	269	114	155	698	245	453
Total	**402**	**157**	**245**	**462**	**165**	**297**	**473**	**196**	**277**	**1337**	**518**	**819**

Fig. 3A. *Macrobrachium vollenhovenii*.

Fig. 3B. *Macrobrachium macrobrachion*.

Fig. 3C. *Macrobrachium sollaudii.*

Fig. 3D. *Macrobrachium dux.*

Fig. 3E. *Macrobrachium chevalieri.*

Fig. 3F. *Macrobrachium felicilum.*

Fig. 3A-3F. *Macrobrachium* species identified from the three sampled rivers in South Cameroon.

Physico-chemical parameters

The physico-chemical parameters of the three rivers sampled are shown in Table 3. Temperature varied between 24.1-29°C, 23.8-29°C and 25.1-30.2°C respectively in Kienke, Lobe and Lokoundje Rivers. The trends in Dissolved oxygen and pH in the three rivers is also shown on the table.

Table 3. Physicochemical parameters in Kienke, Lobe and Lokoundje Rivers.

RIVERS		TEMPERATURE (°C)	DISSOLVED O_2 (mg/l)	pH
Kienke	Mean	25.82	4.68	7.10
	SD	1.52	0.46	0.14
	Range	24.1 – 29	4.2 – 5.5	6.8 – 7.3
Lobe	Mean	25.88	4.46	7.07
	SD	1.47	0.25	0.20
	Range	23.8 – 29	4.1 - 5	6.6 – 7.3
Lokoundje	Mean	27.07	6.79	7.22
	SD	1.61	0.55	0.15
	Range	25.1 – 30.2	6.2 – 7.8	6.9 – 7.5

Sex ratio

With the exception of *M. sollaudii* where the males dominated the females and for *M. chevalieri* in Kienke (Table 4), sex ratio was in favor of the females for all the other species. In *M. vollenhovenii*, the Male: Female ratio was 1: 2.35; 1: 2.21 and 1: 1.36 in

Kienke, Lobe and Lokoundje rivers respectively while for *M. macrobrachion* it was 1: 2.28, 1: 2.39 and 1: 1.71 respectively. The chi-square analysis showed a statistically significant difference between the expected ratio 1:1 and the observed ratios of the two species in the three rivers at 5% level of significance (X^2 1: 3.84) (Table 4).

Table 4. Chi-square values and sex ratios of *Macrobrachium* species sampled in the three rivers.

Species	Kienke		Lobe		Lokoundje	
	X^2	Ratio	X^2	Ratio	X^2	Ratio
M. chevalieri	5.14	2.5:1*	0.64	1:1.29	0.33	1:1.25
M. dux	3.07	1:1.62	5.0	1:2.0*	11.27	1:1.53*
M. felicinum	0.20	1.5:1	0.0	1:1	0.33	2 :1
M. macrobrachion	14.41	1:2.28*	17.61	1:2.39*	6.58	1:1.71*
M. sollaudii	20.16	9.33:1*	17.29	8.33:1*	8.89	5.33:1*
M. vollenhovenii	30.72	1:2.35*	34.36	1:2.21*	6.25	1:1.36*

*Significant at P<0.05.

Morphometric similarities between species identified

A dendrogram of hierarchical cluster analysis showing morphological similarities between the species of the genus *Macrobrachium* identified is shown in Fig. 4. Two main branches are shown, the first one combines *M. vollenhovenii* and *M. macrobrachion*, the second one combines the rest of species. Other species that are grouped with each other are *M. dux* and *M. sollaudii* as well as *M. chevalieri* and *M. felicinum*.

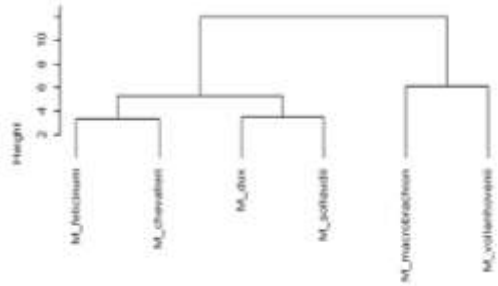
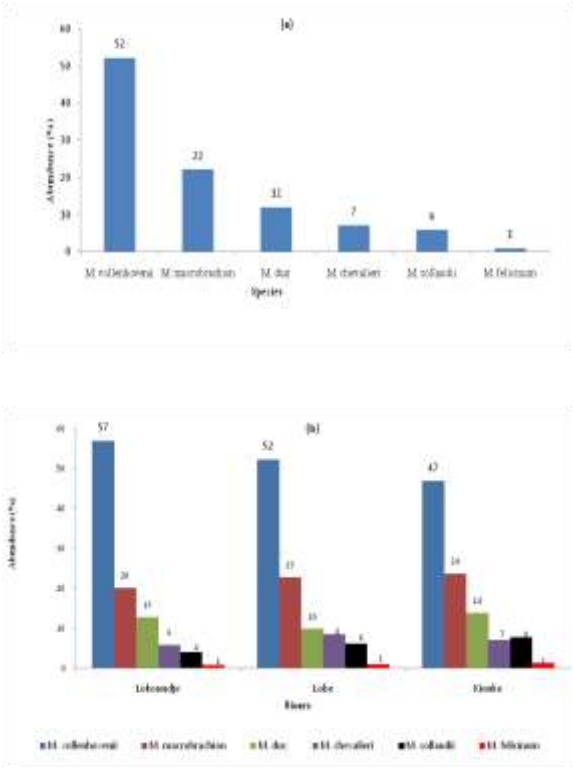


Fig. 4. Dendrogram of hierarchical cluster analysis between species of *Macrobrachium* from Lokoundje, Kienke and Lobe Rivers, Cameroon.

Relative abundance of species identified

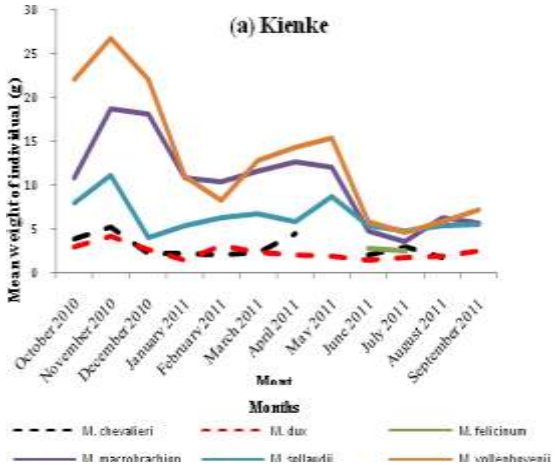
For the six species identified, the most abundant species for all the three sampled rivers combined were as follows (descending order of importance): *M. vollenhovenii* (52%), *M. macrobrachion* (22%) and *M. dux* (12%). *M. felicinum* was the least represented (1%) (Fig. 5A). Taking the rivers individually, the most abundant species were *M. vollenhovenii* with the relative abundance 57%, 52% and 47% respectively in rivers Lokoundjé, Lobé and Kienke; *M. macrobrachion* (Lokoundje : 20%, Lobe : 23%, Kienke : 24%) and *M. dux* (Lokoundje : 13%, Lobe : 10% and Kienke : 14%). *M. felicinum* was rare in the rivers (1%) (Fig. 5B).

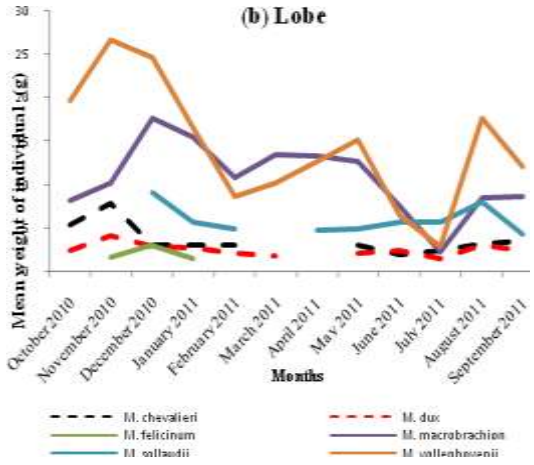


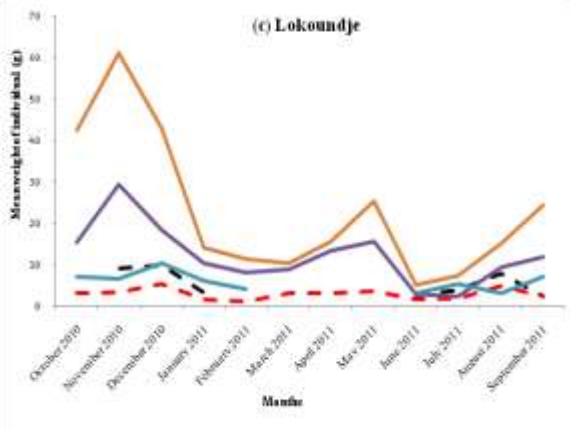
Figs. 5A & 5B. (a)Abundance (%) of *Macrobrachium* in the three rivers combined and (b) Abundance (%) of *Macrobrachium* in Lokoundje, Kienke and Lobe rivers respectively.

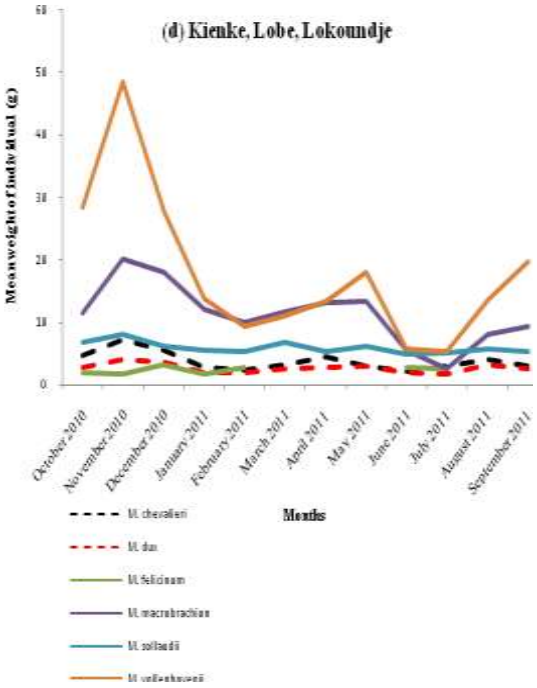
Monthly variation of weight of species identified

Monthly variation of the weight of species of *Macrobrachium* in the different rivers is presented in Fig. 6 (A, B, C and D). As shown in these fig.s, two peaks are present, the first was in the months of November and December and the second peak was in the month of May.









Figs. 6A - 6D. Monthly variations in the weight of species of *Macrobrachium* from (6A)Kienke, (6B)Lobe (6C) Lokoundje (6D) Three rivers combined.

Gravid status of species of aquaculture interest

Two of the species collected in the three rivers are known to be of aquaculture interest. These are *M. vollenhovenii* and *M. macrobrachion*. Their aquaculture potentials are mainly due to their larger attainable size than others (Table 5). For *M. macrobrachion*, 200 females were caught, among which 57 were ovigerous (28.5%). Gravid specimens of this species can be collected practically throughout the year with high frequencies of observation in March (95%) and October (43%). For *M. vollenhovenii*, a total of 453 females was recorded among which 166 (36.64%) carried eggs in their abdomen. Like *M. macrobrachion*, gravid females were abundant in March (81%) and October (68%).

Table 5. Range of sizes (mm) of *Macrobrachium* species identified.

Species	Kienke		Lobe		Lokoundje	
	M	F	M	F	M	F
M. chevalieri	39.76 – 70.53	48.78 – 65.19	45.12 – 77.46	48.97 – 65.85	44.78 – 78.67	42.29 – 62.83
M. dux	38.93 – 72.37	47.75 – 78.78	56.44 – 72.39	48.57 – 86.17	50.46 – 84.09	36.23 – 82.38
M. felicinum	43.74 – 50.31	46.21 – 47.52	45.31 – 50.11	42.59 – 47.31	55.92 – 68.33	48.21
M. macrobrachion	58.45 – 135.24	43.33 -123.18	48.84 – 117.12	47.22 – 127.65	54.42 – 137.83	44.9 – 155.6
M. sollaudii	68.1 – 88.32	61.38 – 67.88	66.17 – 85.98	58.38 – 65.20	57.21 – 91.99	65.28 – 81.37
M. vollenhovenii	49.84 – 137.83	51.23 -146.33	55.75 – 153.16	57 – 145.18	53.12 – 169.86	11.15 – 168.32

Discussion

Freshwater prawns of the genus *Macrobrachium* constitute a group of economically important macroinvertebrate fauna (Abowei *et al.*, 2006; Abohweyere, 2008). In Cameroon they are present in majority of rivers (Foto *et al.*, 2011) This survey achieved for the first time, the morphological identification of species of this group in Lokoundje, Kienke and Lobe rivers which produced an evidence thatsix (6) species of *Macrobrachium*: *M. vollenhovenii* (Herklots, 1857), *M. macrobrachion* (Herklots, 1851), *M. dux* (Lenz, 1910), *M. sollaudii* (De Man, 1912), *M. chevalieri* (Roux, 1935), and *M. felicinum* (Holthuis, 1949) occur in Cameroon rivers.From the general investigation of species of genus *Macrobrachium* in West Africa (Monod 1966, 1980; Powell 1980), 10 species were mentioned to occur throughout the region. These are *M. vollenhovenii*, *M. macrobrachion*, *M. dux*, *M. sollaudii*, *M. chevalieri*, *M. felicinum*, *M. raridens* (Hilgendorf, 1893), *M. thysi* (Powell, 1980), *M. equidens* (Dana, 1852), *M. zariquieyi* (Holthuis, 1949). Based on the distribution given by the same studies throughout the region, *M. vollenhovenii* and *M. macrobrachion* are distributed from Senegal to Angola; *M. dux* is found in Congo, *M. sollaudii* from Cameroon to Congo, *M. chevalieri* in Green Cape, Cameroon, Sao Tomé and Angola while *M. felicinum* is found in Mali, Ghana, Togo and Angola. According to that study, four (4) species are supposed to be found in Cameroon, but the present study has revealed the occurrence of six species. This was data collected from only three rivers, thus indicating that the biodiversity of species of the genus may be yet insufficiently investigated in Cameroon. In the same order, Tchakonté *et al.* (2014) found *M. thysi*, *M. equidens* and *M. scabriculum* in 5 streams in Douala. However, *M. thysi* is known to be an endemic species to Ivory Coast (Powell, 1980, Gooré Bi, 1998). Also, Doume *et al.* (2013) found *M. rosenbergii*, the Indo-West pacific species in Wouri River, Douala. Only a systematic survey in all the Cameroonian rivers can give the actual species richness of Genus: *Macrobrachium* in Cameroon.

The results of the study also indicated that the three rivers shared more or less the same proportion of the six species identified. *M. vollenhovenii* was the most dominant species contributing 52%, followed by *M. macrobrachion* with 22%, while *M. felicinum* was the least dominant of the total landings during the study period. This result can be due to the type of gears use. According to Nwosu and Holzlöhner (2006) beach seines and push nets landed more 'juveniles' (shrimps below 40 mm total length) than traps. In the present study, specimens were caught using basket trap and with this small specimens can easily escape. It is possible that many specimens of the small sized species like (*M. felicinum*, *M. sollaudii* and *M. dux*) escaped. For future studies of this nature, gears that could capture all available specimens are recommended. From the results, it can however be assumed that *M. vollenhovenii* is not only the largest size species of *Macrobrachium* but also the most dominant by quantity and the main target species for fisheries in the three rivers. However, to the contrary, in Cross River estuary, Nwosu (2010) and Enin (1998) reported that *M. macrobrachion* was the dominant species. Marioghae (1982) and Powell (1982) also had the same conclusion in Lagos Lagoon and Niger delta respectively.

This study has also shown that metric variables can be satisfactorily applied in the identification of species in the Genus: *Macrobrachium*.

The values of the physicochemical parameters observed in the rivers were generally within the ideal range cited by Sampaio and Valenti (1996) for *M. rosenbergii* cultivated in ponds and Francis and Jacob (2007) for *M. dux* in their natural environment. Oxygen levels were however slightly lower except in Lokoundje. This did not appear to have a significant effect on the population of the species collected but may have an influence on the observation that the largest sizes of males and females in both *M. macrobrachium* and *M. vollenhovenii* were all from River Lokoundje. These are pointers to the environmental suitability for successful culture of the species in the area.

In this study, for almost all the species identified, the proportion of females was higher than the males. It was about 1:2 for *M. vollenhovenii* and *M. macrobrachion*. This was in agreement with the findings of Anetekhai (1990) who reported a sex ratio of 1:3 in favor of the females for *M. vollenhovenii* from Asejire Lake. Similar results were also reported by Jimoh *et al.* (2012) and Meye and Arimoro (2005) for *M. vollenhovenii*, *M. macrobrachion* and *M. dux*.Deviations in the sex ratio could be a consequence of differences in size, mortality and birth rates between males and females or other factors, such as molt rates, dispersal, reproduction and differential migration (Botelho *et al.*, 2001).

The largest female of *M. macrobrachium* collected was 155.6 mm total length, whereas the largest male was 137.42 mm and the two from Lokoundje River. This observed maximum size is higher than the 138 mm known as a maximum size of this species (Marioghae, 1987; New, 2002; New *et al.*, 2010). For *M. vollenhovenii* in the other hand, maximum size for female and male was respectively 168.32 mm and 169.86 mm total length from Lokoundje River. This result is higher than the maximum size (131 mm) and the estimated asymptotic length (164.1 mm) reported by Gabche and Hockey (1995) for the same species in Lobe River. However, this size still lower than the value of 189.63 mm obtained by Konan (2009) and 187 mm reported by Holthius (1980) and Powell (1982). Improvement of the maximum lengths and weights obtained in the wild can be attained by intensive culture which will result in an increase of the growth performance index.

Considering the hierarchical clustering between the 6 species identified, the morphological similarities between *M. vollenhovenii* and *M. macrobrachion*; *M. dux* and *M. sollaudii*; *M. chevalieri* and *M. felicinum* were clear. This result is in accordance with the finding of Konan (2009) for the cluster of *M. vollenhovenii* and *M. macrobrachion* as well as *M. chevalieri* and *M. dux*. However, the Euclidean distances which showed the level of proximity between cluster species were not the same. For *M. vollenhovenii* and *M. macrobrachion*, Euclidean distance found by Konan (2009) was 0.35 while in the present study it was 6.09, suggesting that the resemblance between *M. vollenhovenii* and *M. macrobrachion* of Ivory Coast is larger than the Cameroonian one. This can be explained by the variation of the environmental condition of the two countries, specifically of the Rivers where the species were collected. Indeed, Konan's study pointed out the presence of dams in his collection site. It is well known that dams constitute physical barriers, limiting the migration of specimens, therefore subjecting them to the same variation of habitats. Rivers Lokoundje, Kienke and Lobe however, are emptied directly into the Atlantic Ocean. Specimens caught in these rivers can be influenced by variation of marine conditions. Also, the absence of dams in these three rivers can allow the specimens to migrate to a long distance, then crossing many environmental conditions. According to Dimmock *et al.* (2004) environmental factors strongly influence the phenotypic expression of external morphology in

crustaceans and population separated by as little as 1km showed significant morphology differences.

It should be noted that during the course of this study, specimens sharing more or less the diagnoses of *M. vollenhovenii* and *M. macrobrachion* as well as *M. sollaudii* and *M. dux* were found. It may be there is an intermediate population between them which share the characteristics of both species. The intermediate forms would be related to a possible hybridization between couples of these two species. According to Arnold (1997), hybridization is a common phenomenon in birds, fish and other taxonomic groups. In crustaceans, inter-fecundity is well known in the *Macrobrachium* genus.Viable hybrids were obtained from crosses of female *M. nipponense* and male *M. hainanense* and the morphological characteristics of the hybrids resembled a combination of the features of both parents (Fu *et al.,* 2004). Also, Graziani *et al.* (2003) reported hybridization between *M. rosenbergii* and *M. carcinus*.The existence of morphotypes of the populations of the above-mentioned species could also be a possibility. Three distinct male morphotypes and several intermediate forms have been described for *M. rosenbergii* (New and Valenti, 2000; New *et al.,* 2010). Molecular identification can clarify the taxonomy status of species of this group, if carried out.

For *M. vollenhovenii* and *M. macrobrachion*, berried females were obtained almost all the months with reproductive peak period in March and October, coinciding with the rainy season. Year round brooders from the wild are an advantage for aquaculture. However, this result is in contrast with the findings of Marioghae and Ayinla (1995) who reported that the breeding of these species were strictly seasonal. Wild *M. rosenbergii* females from India showed peak reproductive activity during the summer months of August to October (Rao, 1991). Similarly, 90% of *M. rosenbergii* females collected in Israeli ponds during the warmer breeding season were observed to carry eggs (O'Donovan *et al.*, 1984).

Concerning variation of the weights during the sampling period, two peaks of relatively high importance were noted principally for *M. vollenhovenii* and *M. macrobrachion,* coinciding with periods of increased capture and high water. According to the local fishermen, capture of the prawns is abundant during high rainfall. This may suggest that prawns catches are strongly influenced by rainfall. Bentes *et al.* (2011) and Lima *et al.* (2014) had the same conclusion for *M. amazonicum* in Amazon River estuary.

Conclusion

The present study has elucidated the biodiversity of the freshwater prawns in Cameroon and demonstrated that six (6) species of genus *Macrobrachium* exist in Rivers Kienke, Lobe and Lokoundje, with *M. vollenhovenii* being the most abundant. These three major rivers share more or less the same proportion of the identified species. Based on resemblance by morphological similarities, *M. vollenhovenii* and *M. macrobrachium* are close while the 4 others can be grouped together with *M. sollaudii* and are closer to *M dux*. *M. felicinum* is closer to *M. chevalieri*. For the species of high aquaculture potential, females reproduce continuously throughout the year with a peak reproduction period in March and October.

It is recommended that other rivers in the country be investigated to determine the total species richness and biodiversity of *Macrobrachium* genus in Cameroon. It is further recommended that the aquaculture of *M. vollenhovenii* should be embarked upon in Cameroon as a means of boosting the protein component in the local diets of its populace, for income generation and to attract the much needed foreign exchange into the country. This study has also contributed data on the physico-chemical properties of water that can sustain a high diversity of fresh water prawns and these values can be replicated under culture conditions. The technology can then be spread to the rest of Africa and other developing countries.

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