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Distribution and Occurrence of Microcrustaceans in Uwanse Stream, Calabar, Cross River State

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Abstract:

Studies were conducted on the distribution and occurrence of microcrustaceans in Uwanse Stream Calabar, Nigeria between October 2009 and February, 2010. The objectives of this study was to determine the abundance and diversity of microcrustaceans in the Stream. A total of 523 individuals of microcrustaceans belonging to three (3) taxonomic groups (copepoda, cladocera and decapoda) were recorded during the three months sampling period as follows: October 2009, 214 individuals (40.91 %), December 2009, 188 (35.95%) and February 2010, 121 individuals (23.14%). Ecological indices of Microcrustaceans from Uwanse stream showed species were more diverse and richer in a rainy monty (October) than dry season months (December and February). Margalef index (D) was 0.932 (October 2009), 0.955 (December, 2009) and 1.043 (February, 2010). Shanon Wiener (H) was 1.703 (October 2009), 1.688 (December, 2009) and

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1.677 (February, 2010). Evenness (E) was 0.915 (October 2009), 0.884 (December, 2009) and 0.891 (February, 2010). Simpson index was 0.805 (October 2009), 0.801 (December, 2009) and 0.789 (J February, 2010). In conclusion, human activities around the stream such as cultivation of vegetables like water leaf, fluted pumpkin, red pepper, tomatoes and scent leaves negatively affected microcrustaceans abundance in the stream during the dry season months as farmers rely solely on water in the stream to grow their vegetables.

Key words: Microcrustaceans, Distribution, Occurrence, Species Diversity, Uwanse Stream.

Introduction

In Nigeria, small streams such as Uwanse stream support many invertebrate taxa including crustaceans, insects and mollusks although they have not been studied extensively. Uwanse stream geographically located at Latitute 4.936° N and Longitute 8.343° E is a freshwater stream found between the University of Calabar Staff Quarters and the University of Calabar Staff Fish Farm. This stream is a major source of water supply for more than twenty petty farmers who cultivate vegetables and sell it directly to consumers or petty traders around the University of Calabar community. According to Castro and Huber (2005), microcrustaceans are crustaceans which can only be seen under a microscope. Microcrustaceans are known to be among a broad group of primary consumers known as zooplanktons in aquatic ecosystem. They play a significant role in the food web by linking the primary producers (phytoplankton, mainly various bacterio-plankton) and higher trophic levels (Ferdous and Muktadir, 2009). The heterotrophic activity of zooplankton is important in the cycling of organic materials in aquatic ecosystems, hence, its use as bio-indicators (Eyo et al., 2013). Hildrew et al., (1985); Lancaster and Roberston (1995) observed microcrustaceans as prey for

macroinvertebrates in streams. In stream ecosystems, meiofauna is defined by size ranges (Schmid-Araya and Schmid, 1995) and Meyer (1994), defined it as taxa ranging between 50 µm-500 µm in running waters. Macroinvertebrate colonization of streams is influenced by both abiotic and biotic factors (Williams and Smith 1996). Microcrustaceans such as cladocerans, ostracods, and copepods occur in streams where they can reach very high densities greater than 10,000 m^{-2} (Galassi et al., 2002). Studies on microcrustaceans for larger water bodies have been reported, but there is still a wide gap in relation to information on microcrustaceans in smaller water bodies such as streams which also contributes to the diverse water resources in Nigeria.

Therefore, the objective of this paper is to determine the abundance and diversity of microcrustaceans of Uwanse Stream, Calabar, with the aim of contributing to the knowledge of microcrustaceans diversity in the stream.

Materials and Methods

Study Area

The study was carried out at Uwanse stream which is a freshwater stream located between the University of Calabar Staff Quarters and the University of Calabar Staff Fish Farm. Geographically, the stream is located at Latitute 4.936° N and Longitute 8.343° E.

Sampling and Analysis of Microcrustaceans from Uwanse Stream

The stream was sampled twice monthly between October 2009 and February, 2010 for microcruataceans between 0700 and 0900hrs. Quantitative microcruataceans samples were collected by filtering 100 liters of water fetched with a rubber bucket through a standard plankton hydrobios net of 55 µm mesh (Onyeama et al., 2007) microcrustaceans were preserved

in 4% buffered formalin solution before transporting them to Fisheries and Aquaculture Laboratory, University of Calabar for microcrustaceans analysis. In the laboratory, quantitative sample collected from the stream was concentrated to 10 ml. From the 10 ml, 1 ml from each sample was taken and all individual taxa present were counted. Specimens were counted and sorted to their respective taxa using Zeiss binocular microscope at different magnifications (X40, X100 and X400) (Eyo et al., 2013) and identified using relevant literatures (Alfred et al., 1973; Adoni et al., 1985; Newell and Newell, 1966; Korinek, 1999; Smirnov, 1974; and Wiafe and Frid (2001).

Microcrustaceans ecological indices in Uwanse Stream

Microcrustaceans ecological indices in Uwanse Stream was determined using numerical abundance, relative abundance, Margalef's index (D), Shannon-wiener index (H), Evenness (E) and Simpson indices with the aid of Past Software (Paleontological Statistics software package for education and data analysis) version 2.17c and formulas given by Ogbeibu (2005) as follows:

Numerical Abundance

After identification and sorting, the microcrustaceans species were counted individually. The sum of each individual microcrustaceans from the stream was added to give numerical abundance of microcrustaceans from the stream.

Relative abundance (%)

Relative abundance (%) of microcrustaceans species from Uwanse Stream was calculated according to Eyo et al., (2013) as follows:

$$\% RA = n(100)/N,$$

Where;

n = the total number of individuals in each microcrustaceans taxonomic group.

N = the total number of individuals in the entire microcrustaceans taxonomic

Margalef's Index (d)

Margalef's Index (d) is given as: $d = \frac{S-1}{\ln(N)}$

Where;

S is the total number of species
ln is the Natural log
N is the total number of individuals.

Shannon-weiner index (H)

Shannon-weiner index (H) is given as: $H = \frac{N \log N \sum_{i=1}^{s} fi \log fi}{N}$

Where;

N is the total number of individual,
fi is the number of individuals in species and
S is the total number of species.

Evenness (E)

Evenness (E) is given as: $E = \frac{H}{\log S}$

Where;

H is the Shannon-weiner index
S is the total number of species

Simpson index (D)

Simpson index (D) is given as: $D = \sum_{i=1}^{s} \frac{ni(ni-1)}{N(N-1)}$

Where

ni = Number of individuals

N = Total number of all individual microcrustaceans species.

Result

Species Composition

Species composition of the Microcrustaceans identified from Uwanse Stream, Nigeria is shown in Table 1. In October 2009, six microcrustaceans species were identified including *Paralacanus pavus, Microsetella sp, Daphnia pulex, Brachiostoma nigariense, paracatamus sp.* In December 2009, adult stages of *Microsetella sp, Daphnia magna, Oithona sp, Oithona similes* and *Eucrylemora sp* and larval stage of *Typhloscolex sp* were identified. 20% of the Microcrustaceans larvae while 80% were in their adult stages. In February, 2010, adult stages of *Evadne nordmanni, Phllomedes globos, Macrocypridina sp, Calanus finmachicus, Pseudocalanus sp* and *Oithona sp* were identified.

Numerical and Relative Percentage Abundance of the Microcrustaceans Species

A total of 523 individuals of microcrustaceans belonging to three (3) taxonomic groups were recorded during the three months sampling period of the study (Table 1). A monthly breakdown of microcrustaceans from the stream (Table 3) shows that in October 2009, 214 individuals of microcrustaceans (40.91 %), in December 2009, 188 (35.95%) and in February 2010, 121 individuals (23.14%) individuals of microcrustaceans were recorded. The numerical and relative percentage abundance of the individual microcrustaceans (Table 1) showed that in October 2009, 49 *Paracalanus pavus* (22.90 %), 37 larval stages of *Megalopa sp* (17.29%), 58 adult *Microsetella sp* (27.10%), 17 *Daphnia pulex* (7.94%), 34 *Brachiostoma ntgeriense* (15.89%) and 19 *paracalanus sp* larvae (8.88%) were identified. In December 2009, 45 individuals of *Microsetella sp* (23.94 %), 30 *Daphnia magna* (15.96%), 47 *Oithona sp* (25.0%), 31 *Oithona similes* (16.48%), 30 *Typhloscolex sp* (15.96%) and 5 *Eucylemona sp* (2.66%) were

identified. In February 2010, 12 Evadne nordmanni (9.92 %), 19 *Phiiomedes globosa* (15.70 %), 21 *Bosmina longirstris* (17.36%), 16 *Calanus fimachinus* (13.22%), 11 of *Pseudocalnus sp* (9.09%) and 42 *Oithona sp* (34.71%) were identified.

Ecological Indices of Microcrustaceans from Uwanse stream

Result obtained for ecological indices of Microcrustaceans from Uwanse stream (Table 2) showed that Margalef index (D) was 0.932 (October 2009), 0.955 (December, 2009) and 1.043 (February, 2010). Shanon Wiener (H) was 1.703 (October 2009), 1.688 (December, 2009) and 1.677 (February, 2010). Evenness (E) was 0.915 (October 2009), 0.884 (December, 2009) and 0.891 (February, 2010). Simpson index was 0.805 (October 2009), 0.801 (December, 2009) and 0.789 (J February, 2010).

Table 1: Microcrustaceaans Identified From Uwanse Stream, Nigeria (December, 2009 – February, 2010)

Taxa	Microcrustaceans Species	October 2009		December 2009		February 2010	
		NA	% Ra	NA	% Ra	NA	% Ra
Copepoda	*Paracalanus pavus*	49	22.00	-		-	-
	Microstella sp (adult)	58	27.10	45	23.94	-	-
	Paracalanus sp (larvae)	19	8.88	-	-	-	-
	Eucylemora sp (adults)	-	-	5	2.66	-	-
	Calanus finmachicus	-	-	-	-	16	13.22
	Pseudocalonus sp	-	-	-	-	11	9.09
	Oithona sp	-	-	47	25.0	42	34.71
	Oithona similis (adults)	-	-	31	16.48	-	-
Cladocera	*Daphnia pulex*	17	7.94	30	15.96	-	-
	Brachiostoma nigeriense	34	15.89	-	-	-	-
	Evadne nordmanni	-	-	-	-	12	9.92
	Philomedes globosa	-	-	-	-	19	15.70
	Bosmina longirostris	-	-	-	-	21	17.36
	Daphnia magna	-	-	30	15.96	-	-
Decapoda	*Megalopa sp (larvae)*	37	17.29	-		-	-
Total		**214**	**100**	**188**	**100**	**121**	**100**

*NA = Numerical abundance, RA = Relative abundance (%)

Table 2: Ecological Indices of Microcrustaceans from Uwanse stream

Ecological Indices	Month of Study		
	October 2009	December 2009	February 2010
Taxa	6	6	6
Individuals	214	188	121
Margalef (D)	0.932	0.955	1.043
Shannon Wiener (H)	1.703	1.668	1.677
Evenness (E)	0.915	0.84	0.891
Simpson	0.805	0.801	0.789

Table 3: Monthly Numerical and Relative Abundance of Mmicrocrustaceans from Uwanse Stream

Month of study	Numerical abundance	Relative percentage abundance (%)
October 2009	214	40.91
December 2009	188	5.95
February 2010	121	23.14
Total	**523**	**100**

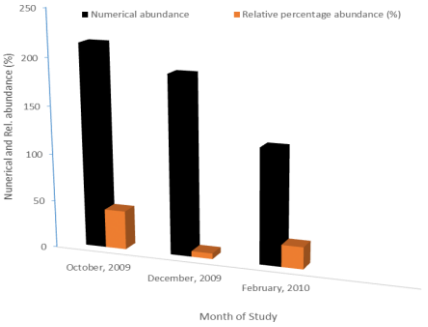

Figure 1: Monthly Numerical and Relative abundance of Mmicrocrustaceans from Uwanse Stream

Discussion

Results obtained from this study showed that a total of fifteen microcrustaceans species were identified from the stream. Numerical and relative percentage abundance of the microcrustaceans was found to vary monthly. Abundance was highest in October 2009, with a total of 214 microcrustaceans (40.91 %), followed by 188 microcrustaceans in December 2009

(35.95 %) and lowest in February 2010 with 121 microcrustaceans (23.14 %). According to Hart (1999), the monthly variation observed in this study as in any other group of organism in a particular habitat may be attributed to several ecological factors such as reproductive recruitment pattern, predation, and human impact. The high abundance of the microcrustaceans in recorded in October, 2009 may be an indication of suitable ecological factors compared to other months. Findings of Hart (1999) and Kadiri (2001) revealed that there are certain periods of the year in which conditions become optimal for organisms to reproduce and be recruited into the stock leading to increase in their abundance. Ajah (2008) reported a similar observation that favorable ecological conditions usually give rise to high population of zooplankton in aquatic systems. Ajah (2010) observed that predation rate can lead to a reduction of a particular species population. Predation rate of microcrustaceans in this study might have been lowest in October 2009 and highest in February 2010 leading to monthly variations in abundance of microcrustaceans in the stream. Findings of this study showed that abundance of microcrustaceans in Uwanse stream was highest in October which falls in the rainy season compared to December and February which are dry season months. Arimoro and Oganah (2010) attributed increase of zooplankton abundance to increase in the amount of rainfall. According to Okogwu and Ugwumba (2006), this may be due to the ability of rains to bring in allochthonous nutrients from drainage basinand also by the mixing of autochthonous materials that will encourage primary production which will accelerate zooplankton production and abundance. This is also similar to the findings of Onwudinjo and Egborge (1994) in Benin River and Egborge et al., (1994) in coastal western rivers of Nigeria who observed a negative correlation between rainfall and zooplankton abundance. In this study, microcrustacean species recorded differ from species reported for other similar water bodies.

Ohimain *et al.,* (2002) reported *Ectocyelops phalerates, Microcyclops varicaus, Thermodiaptrmus yabensis, Tropodiaptomus laucrentii, Eudiaptomus gracilis, Bryocampus mlnutus* and *Nauplius sp.* for Warri River, Nigeria. None of these species reported by Ohimain *et al.,* (2002) was present in Uwanse stream. This may be attributed to the differences in the aquatic system where the studies was conducted. Hart (1999) further explained that variations in both ecological conditions and species composition are usually encountered in two different ecological settings. The larval stages of microcrustaceans observed in this study is similar to findings of Ohimain *et al.,* (2002) for Warri River. Results of this study is also similar to findings of Wiafe and Frid (2001) who reported microcrustacean species such as *Oithona sp, Paracalanus sp* in freshwater systems, including streams. According to Ali *et al.,* (2003) ecological parameters of a group of species such as species abundance, species dominance, species evenness and Shannon weiner index are indicators of the health status of any habitat. Also, species diversity indices employed in ecological studies considers the total number of species found in the sample, which is expressed as richness, abundance and evenness (Ogbeigbu, 2005). Results obtained for species diversity indices including Margalef index (D), Shannon-Weiner index (H), Evenness (E) and Simpson index in the present study is lower than findings of Eyo et al., (2013) in the Great Kwa river, Ekwu and Sikokki (2005) in the Lower Cross River estuary; Imoobe and Adeyinka (2010) in a tropical forest river in Nigeria. Monthly evaluation of species diversity indices from Uwanse stream shows that species were more abundant and dominant in October 2009. This may also be attributed to rainfall introducing nutrients into the stream through runoff which boosted primary and secondary productivity. Ali *et al.,* (2003) attributed variations in species diversity indices in Indies River, Pakistan to prevailing ecological factors such temperature, food availability and predation. This may imply

that ecological factors in Uwanse stream was more favorable for microcrustaceans in October 2009 than December and February, 2010. Uwanse stream is a major source of water supply for petty-farmers who grow vegetables such as water leaf, fluted pumpkin, red pepper, tomatoes and scent leaves around the stream. Therefore variation in microcrustaceans in the stream may be influenced by the rate of harvesting water by farmers in the stream to cultivate their farms. Comparatively, farmers rely on rainfall during October but in December and February where rainfall is scarce, all the farmers depend solely on the stream for water supply.

Summary and Conclusions

In conclusion, a total of fifteen (15) microcrustaceans species belonging to three (3) taxonomic group was recorded in this in the following order of dominance: Copepods > Cladocerans > Decapods. Abundance was highest a rainy season month (October) than Dry season months (December and February) and this was likned to favorable ecological conditions in the rainy season. Human activities around the stream such as cultivation of vegetables like water leaf, fluted pumpkin, red pepper, tomatoes and scent leaves also affected microcrustaceans abundance negatively in the stream during the dry season months as farmers rely solely on water in the stream to grow their vegetables.

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