Rotifer fauna in Lake Alau, Arid Zone of Nigeria in West African

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Abstract: Rotifer fauna constitute an important source of natural food resources for aquatic organisms especially the young stage of fish and fisheries. Despite their importance in the sustainability of aquatic ecosystem, adequate information about their species composition in most African inland waters is lacking. Meanwhile understanding the species richness of rotifers could provide baseline information for the management of the productivity of water. A study was conducted to determine the species composition and relative abundance of rotifer fauna in lake Alau, Maiduguri, Borno State of Nigeria between 2009 and 2010. Rotifer samples were taken from 4 varied depths of the lake forth nightly for a period of 12 months using standard methods. The result showed that rotifer faunas were represented by 5 families, and 15 species. The faunastic composition and density was found to be higher between the months of July and September and varied in relation to water depth with higher concentration at 2.5 m depth constituting 29.27 % compared to other other depth values.

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Key words: Rotifer fauna, species composition, relative abundance, lake Alau, Nigeria.

1. Introduction

The first report of Rotifers in Nigeria water bodies was given by Holden and Green (1960) in his inventory of River Sokoto invertebrates. Since then, there have been checklists of rotifers of various Nigerian water bodies. These includes Eleiyele Reservoir (Imevbore, 1965), Lake Chad (Pourroot, 1979), River Oshun and Asejire Lake (Egborge, 1970, 1974, 1981), Egborge and Ogbekene(1986), Kainji Lake (Adeniji, 1978), Tiga Lake, Abdullahi, (1982), Shen Reservoir Chidoben (1982), Ona Reservoir Ibadan, Elemi (1992) Lake Alau (Fasesan, 1999; Idowu 2004, Idowu 2004B).

A synthesis of all the investigations shows that there are at least 197 species of rotifers and 20 families in these water bodies. Some of the members of these fauna are excellent live food organisms for the larva stage of fish and prawns (Fasesan, 1992). Ovie (1993) considered them to be better live food than copepods while described their use in fish hatcheries as ubiquitous. Rotifer fauna constitute an important source of natural food resources for aquatic organisms, especially the young stages of fish. These organisms therefore occupy a strategic trophic level in any aquatic ecosystem. Despite the importance of zooplankton organisms in Nigerian water bodies, one finds that most information available on them is concentrated on Southern parts of Nigerian water bodies while the northern parts especially the arid zone of the northern Nigeria has been neglected. Similarly, many man-made Lakes in Nigeria have not received broad attention in the study of their zooplankton community and there is need for more basic limnological information on some of these Lakes. Such information will act as basis for better understanding of the trophic interaction between aquatic organisms and serve as baseline information for assessing their environmental qualities and aquatic biodiversities.

With the exception of Fasesan (2000) there has not been any study of specific Zooplankton populations. More so the relative importances of individual phylum have not been fully evaluated in any

Lake in Borno-State. However, this paper reports on the species composition and abundance of rotifer fauna in Lake Alau in Maiduguri, North East Arid Zone of Nigeria, where such information has not been studied in details. In view of this therefore the objectives of this study is to assess and to compare the seasonal rotifer fauna structure in Lake Alau in relation to its composition and abundance.

2. Materials and methods.

2.1 The study area:

The choice of Lake Alau in Maiduguri, Borno State of Nigeria stems not only from its importance as a source of fish production but also because of its other uses to the people of Maiduguri. Lake Alau is the second largest Lake in Borno-state. It is located between latitude 12 °N and 13°N and longitude 11°E and 13°E with the total surface area of 56 km. The climate is sahelian with two distinct seasons. A rainy season starts from June to September, with a mean annual rainfall of about 600 mm, the dry harmattan season precedes rainy season and starts from October to February. It is a period of very low temperature between 16-19° C and cold dry harmattan wind with temperature value of between 26-29° C. The dry hot season starts from March to May, marking the driest period with intense heat. During this period a temperature value of 46-48 has been recorded. CBDA, 1986, Bankole et al, 1994; Fasesan 2000. Idowu 2004.

2.2 The sampling area.

Sampling stations were chosen after preliminary surveys of the Lake and based on factors as average depth, volume of water, accessibility and the various activities taking place in and around the Lake. Five sampling stations were marked at intervals of 9 km from the main source of the Lake. The description of the Lake has been extensively discussed by Idowu 2004A; Idowu et al.,2004B, and 2008).

2.3 Sampling procedure.

A locally fabricated water sampler constructed at Ramat Polytechnic, Department of Mechanical Engineering was used for Rotifer Collection. At the beginning of every sample collection, the opening of the attached bottles of the sampler was corked using the attached corks. The sampler was lowered to the desired depth by means of the rod attached to the desired bottles. At the desired depths (0 m, 1 m, 1.5 m.2 m and 2.5 m) the corks were pulled off by an upward pull on the strings (sinker) attached to them and later pulled to the surface. Rotifers samples collected were filtered through the plankton net of mesh size 80 um, and transferred into labeled collecting bottles and preserved in 10 % formalin in the department of Biological Sciences, University of Maiduguri. Before enumeration, the supernatant was carefully pipetted off and the rotifer samples were concentrated to 25 ml in each sampling bottles depending on the density observed.

When the original sample volume exceeded the appropriate concentrated limit, reduction of the excess sample was done by using a siphon pipette fitted with a 156um mesh n et to prevent accidental loss of organisms as suggested by Ovie (1991). Each sample bottle was inverted several times into a standard Sedgwick-Rafter counting chamber using a stamped pipette until the chamber was completely filled without any air bubble. This was carefully placed on the stage and allowed to settle for 10 minutes, to enable the rotifers to settle at the bottom of each square of the chamber.

Proper identification of rotifer fauna was carried out on a wild binocular microscope model BH2 and a wild Olympus microscope model AH2 Vanox 7. The rotifers in each square of the chamber were identified to species level using the taxonomic guide, Peannak, (1979) Jeje and Fernando (1986). For rotifer enumeration and numbers per litre, Numbers of individual per ml was computed. Organism per litre was calculated from the following relationship as described by Ovie, (1993).

Organism per litre

$$= \frac{org\ per\ ml\ of\ concentration}{litres\ of\ filtered\ concentration} \times 1000$$

The mean number of individuals per litre for each group of rotifer at the various depths was calculated. Monthly mean abundance for each station was also calculated, first by integrating the total group abundance in the water column using data from various depths studied, and secondly by dividing the integrated total abundance by the number of depths sampled in the water column. The values obtained from various stations and depths were subjected to a T-test, comparasim were made using one-way ANOVA and T-test on log transformed values at 95 % confidence.

3. Results.

Rotifer species recorded during the present study in relation to stations and depth are listed in Table 1. In total, 15 species belonging to 7 genera and 5 families were identified. The majority of the recorded species were diagononts, from the order monimotricha. The rotifer fauna was dominated by the family Brachionidae, comprising a significant fraction 70 % of the overall species .An analysis of the family wise representation of recorded species depicted the relative qualitative sequence to be. Brachionidae > Synchaetidae > Filinidae > Lechanidae > Asplanchidae.

The seasonal samples from the 4 stations showed relevant difference in number of taxa and relative abundance of rotifers. See Table 1. With respect to rotifer species distribution and depth, the major determinant of the species assemblages (concentration) was depth playing a major role. All the species occurred throughout the depth except *brachionus falcatus* wich was absent in 0 m depth in all the stations studied. The most well represented species in all the depths were *Filinia longiseta, Asplanchna sieboldi, Brachionus bidentatus, Brachionus caudatus Brachionus calyciflorus*, *Brachionus quadridentatus, keratella cochlearis,* and *keratela quadrata., polyarthra vulgaris* (table2). All other species were not present in all the depths.

Table 2 shows the monthly variation of rotifer concentration in Lake Alau in relation to depth. The highest values representing the peak were recorded between July and September in all the stations which varied between80-145organism per litre. There was significant different$P \leq 0.05$between these values and. All other months, there were also a high concentration in October to January in 2m depth and 2.5m depths. The least concentration was observed in the month of April. The percentage concentration of organism per litre recorded for all depths shows a higher value in depth 2.5m 29.27% followed by 28.96% in 2mdepth there were no significant difference$P \leq 0.05$ between these two depths., but they were significantly different t$P \leq 0.05$ from other depths. The least value of organism per litre of 20.38% was recorded from 0m depth. In relation to season, all depths studied were observed to have reduced number of organism between February and May which varied between 18-54organism per litre.

Table 3 shows the species distribution of rotifers in relation to depth studied. All the 15 species from the 5 families of rotifers studied appeared in 2.5m depth. Followed by 14 species in 0m and 13 species in 1m depth. The family Brachionidae has 7 species,.which were fully represented in all the depths.except *Brachionus falcatus* which was absent in 0m depth.

The only specie of Asplanchidae found in this study was *Asplanchna sieboldi* which occurred in all the depths studied.. The family Lechanidae has two species and only *Lechane luna* was not found in 1m and 2m depths.

4. Discussion

The species composition and abundance of Rotifers in Lake Alau as observed may be as a result of local influences such climate change, aridity, physical, chemical and biological factors within each station may also to be associated with trophic state as well as geographical

factorsas observed by Arora and Naresh (2003) in Yamuna River.

The richness of the rotifer fauna within Lake Alau is low compared with what was obtained in some Southern Nigerian Lakes.Egborghe(1981) recorded 78 species in Asejire Lake, Jeje (1982) recorded 65 species in Adada, Bonny and OgutaLakes. The average rotifer species per station per station is high in comparism with previous studies in Nothern Nigerian Lakes in relation to stations is higher. For example, Arora and Naresh (2003) recorded 110 species inYamuna River, India Abdullahi (1989) observe 18 species from Tiga Lake in Kano, Ovie, (1991) recorded 13 species in Kainji Lake. This is especially notable given that the sampling assessed was from the Arid Lake with very low rain, as well as a few depths sampled. A higher number would be expected if greater sampling frequency at a deeper depth was employed. Also, low rain with reduced vegetation had a great effect on the qualitative and quantitative level of rotifer fauna. The highest species recorded by Arora and Naresh (2003), and Egborghe (1981) was associated with high vegetation which provided anchorage to the resting eggs and larva stage of rotifer in those water bodies studied. Species abundance of rotifers does not vary widely between stations in this study. It is difficult to make a definite conclusion on the causes of the species pattern but we can suggest that the flow of water from the source through all other stations as well as homogeneity of the stations may have been one of the factor to be considered. Our results show that the distribution of rotifers varied among depths, most species recorder here are likely to be limited in their distributions by their tolerance to environmental conditions and their preferences for food quality and quantity,

The seasonal variation in the rotifer density and abundance varied significantly as we observed in this study. The lowest density of between 18 and 50 org/ml was recorded between February and April, while the highest densities of between 58-145 org/ml was recorded between the month of June and September. In any water body, for some species, the environment will represent the optimum, for others the condition may mark the extreme of tolerable conditions. Rotifers will therefore occur in their greatest numbers towards the centre of that area where conditions are most suitable .As one moves farther away from the most suitable area, the density of the population gradually becomes less as condition becomes less suitable.The seasonal variations of the rotifer abundance during this study is presumably a direct result of the effects of wash in and wash out of organisms from various sources during the rainy season and low water regimeas well as the Lake hydroperiod Changes in species composition from the rainy season suggest a shift in the community's resource base..Also the dynamics of rotifers population in Lake Alau may be regulated by avariety of factors which may shift in importance from one year to another.

Physical forces such as the disturbance of stratum, climate change can cause significant changes in community structures, which may also cause an enormous reduction in the rotifer density as observer in some water column.

` Majority of the species recorded in this study were also recorded in Kainji Lake, (Adeniji, 1989), Asejire Lake (Egborghe 1987) and ShiroroLake (Ovie, 1991). The lack of significant difference in the population density between 0m depth and 1mdepth suggests that there was virtually uniform population in these columns. And may be their preferences for specific member of rotifer community were found to move up or down to congregate at a definite water column compared to other column studied. The rotifers recorded in this study were not restricted to any particular depth, although they were more concentrated in 2.5m depth than all other subsurface depths sampled. This was observed in the 2.5 m, depth where we recorded the greatest percentage of the rotifer fauna in terms of number as well as in the abundance of species, hence, the rotifers were found not to

be evenly distributed in the column Hence there were significant positive relationship between total rotifers in the water column and at various depths..This may be as a result of their sensitivity to illumination. Idowu, (2004) observed that majority of zooplankton were found to be sensitive to low, medium or high levels of illumination, and as transparency changes, their positions in the water column also changed.

Rotifers species diversity expressed as the number of species or combined abundance and number of species in Shannon- index was very low compared with what was obtained in Oguta Lake. But it was higher in Lake Alau compared with what was obtained in Tiga Lake (Abdullahi, 1989). Ovie (1991) also suggested that flow velocity may be particularly important as a determining factor of composition and diversity of rotifer assemblage.Light intensity can also be considered as a limiting factor for rotifers occurrence in Lake Alau for thevaritions in their distributions in relation to depths and stations. More intensive studyof the pelagic rotifers in Nigerian Lakes will lead to the documentations of other species and wider distribution of many others than those that were recorded in the current study. This will lead to greater understanding of the factors that controls the distribution of these species.

Table 1: Check list of species occurrence of rotifer fauna in relation to water depth in Lake Alau.

Family	**Species**	**Average depth (m)**			
		1.0	1.5	2.0	2.5
Filinidae	*Filinia opolensis*	+	+	-	+
	Filinia longiseta	+	+	+	+
Asplanchidae	*Asplanchna sieboldi*	+	+	+	+
Brachionidae	*Brachionus bidentata*	+	+	+	+
	Brachionus caudatus	+	+	+	+
	Brachionus falcatus	-	+	+	+
	Brachionus calyciflorus	+	+	+	+
	Brachionus quadridentatus	+	+	+	+
	Keratella quadrata	+	+	+	+
Lechanidae	*Lechane luna*	+	-	-	+
	Lechane quadrata	+	-	-	+
Synchaetidae	*Synchaeta longipens*	+	+	-	+
	Voritella sp	+	+	-	+
	Polyarthra vulgaris	+	+	+	+
Frequency of species occurrence		14	13	11	15

Key: + = present - = absent

Table 2. .Monthly records of rotifers concentration in Lake Alau in relation to depth with their percentage.

	Depth (m)			
Months	0	1.5	2	2.5
January	55	38	65	60
February	28	37	54	50
March	25	30	32	40
April	18	22	28	32
May	20	24	26	30
June	58	65	78	85
July	80	92	102	122
August	90	98	122	130
September	92	100	130	145
October	40	35	60	45
November	50	42	55	68
December	52	55	62	66
% Per Depth	20.38	21.39	28.96	29.27

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