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ZOOPLANKTON ASSEMBLAGE, DISTRIBUTION AND DIVERSITY IN LAKE ONA, SOUTHERN NIGERIA

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ABSTRACT
The three main channels of Lake Ona (Obabala, Ogbu and Ona-Ododo), were sampled fortnightly from February to July, 2009 for zooplankton. Sampling was conducted between 07.30 – 10.30 hrs on sampling days using a silk sampling net. Samples collected were viewed using an Olympus dissecting microscope at a magnification of x100 and identified to species level in the laboratory. Data collected were analysed using percentage occurrence, frequency distribution and tested for biodiversity using Mergerlef's index. The lake has a rich assemblage of zooplankton. The presence of zooplankton is not subject to seasonality as species found in the dry season also occurred in the wet season. Two hundred and thirty-nine (239) individuals made up of sixty (60) species of zooplankton were sampled in the lake. Out of this, one hundred and thirty-four(134) individuals or thirty-eight (38) species were sampled in the dry season. In the wet season, one hundred and five (105) individuals or thirty-six (36) species were sampled in the wet season. *Diaphanosomama sarsi* which had twenty-five (25) individuals or 10.46 % of all individuals sampled, was the dominant zooplankton species in the lake. Result of the biodiversity study show the lake to have a high taxa richness (*d*), diversity index (*H*) and evenness index (*E*). This is shown by the high values recorded in the dry and wet seasons, which were $d = 7.554$, $H = 1.502$ and $E = 0.951$ in the dry season while the wet season values were $d = 7.521$, $H = 1.475$ and $E = 0.948$. The abundance of zooplankton in the lake is indicative of its productivity which if well harnessed and managed can boost fish production.

KEY WORDS: Zooplankton, Species, Ona lake, Community, Taxa, Diversity, Eveness.

INTRODUCTION

Plankton are a group of living organisms in the aquatic environment, incapable of swimming against the water current, but are carried passively by the water current. The plankton are classified into phytoplankton and zooplankton. The phytoplanktons generally is autotrophic (primary producers of food through photosynthetic activities) and are composed mainly of the floating algae. Phytoplankton occurring in tropical waters include the following taxanomic groups; Green algae (*Chlorophyceae*), Blue-green algae (*Cyanophyaceae*), yellow and golden brown algae (*Chrysophyceae*), Desmids (*Desmidaceae*), Diatoms and Dinoflagellates. On the other hand, the zooplankton are composed mainly the protozoans, rotifers and crustceans.Based on size, the plankton can be classified into - Picoplankton (< 2mm), Nanoplankton (2-20 mm), Microplankton (20 – 40mm), Macroplankton (200 – 2000mm) and Megaplankton (> 2000mm), (Willoughby, 1976). In the aquatic habitat, phytoplankton are the primary producers. Shortage of one or a combination of the essential nutrients (Nitrogen-N, Phosphorus-P and Silicon-Si), may limit their growth in natural waters hence the need to increase their concentration by fertilization (Ekelemu *et al*, 2006). Water of good quality is necessary for the survival, growth and well being of aquatic organisms, fish and fish food organisms (plankton). This is because part of or the entire life processes of these organisms depend on the environment. Thus water quality variables demand attention and management. For ease of reference, the water quality variables can be grouped into – physical, chemical and biological water quality variables. The most important physical water quality variables are temperature, light and turbidity (transparency). In general, water is turbidity, when it does not permit the passage of light through it. It is therefore a measure of transparency and is affected by the presence of suspended materials that interfere with the penetration of light. Turbidity can be caused by plankton or clay. The extent of plankton abundance in a water body, can render it turbid or otherwise. Turbidity caused by plankton is desirable, as it is an index of the amount of natural food present in the water (Boyd and Lichtkoppler, 1979). The relative abundance of the different groups of phytoplankton in natural waters usually fluctuate with season. Ekelemu, *et al* (2006), stated that as a general rule, phytoplankton communities made up of green algae, contain a greater number of genera than communities composed of blue green algae. Most species of plankton are readily dispersed because the atmosphere contains spores and vegetative parts of many of them. It is however noted that species of plankton which actually colonize a habitat, depend upon chance and the suitability of the habitat for growth. This survey of the plankton community of Lake Ona is necessary,

because most fishes in their early or post embryonic stage, feed on plankton. Consequently, an understanding of plankton composition and abundance is a critical aspect of water quality management especially in ponds (Boyd, 1979).

MATERIALS & METHOD

Ona Lake (study area) is a fresh water ecosystem lying west of River Niger. It has it's source from a spring called Utto and is located eight kilometres (8 Km) from Asaba, Nigeria. The lake which lies between latitude 6^0 43^1E and longitude 6^0 15^1N of the equator, is in the Asaba-Ogwashi rock formation. It has a gentle slope from it's banks that allows the inflow of surface run-off and organic matter derived from the surrounding vegetation (Ekelemu and Zelibe, 2006; Ekelemu, 2009). These in turn contribute to the allochthonous input of the lake. The morphometric and Physico-chemical characteristics as well as the ichthyofaunal community of the lake have earlier been described by Ekelemu and Zelibe (2006^a and 2006^b). The Lake in the wet season is compartmentalised into three distinct channels of Ona-ododo, Ogbu and Obabala. These channels for the purpose of this study, were respectively designated Stations I, II and III. The three stations were sampled fortnightly from January to December 2009 for zooplankton, to cover the dry and wet seasons, using a silk plankton net of mesh size number 10. Sampling was done between 07.30 – 10.30 hrs on sampling days. Samples collected were viewed in the laboratory using an Olympus dissecting microscope at a magnification of x100 and identified using a monograph by Jeje (Ogbeibu and Egborge,1995). Zooplankton collected were analysed using percentage occurrence, frequency distribution and tested for biodiversity using Mergerlef's index for species taxa richness (*d*), Shannon-Wiener index (*H*) for general diversity and the evenness index (*E*) of the community (Odum, 1971; Zar, 1984; Ogbeibu, 2005). Species having more than 10 % of the total number individual species sampled were considered dominant (Idodo-Umeh and Victor, 1990)

RESULT

A total of sixty (60) zooplankton species were collected during the sampling period. The organisms sampled / station are presented in the tables 1 and 2 below.

TABLE 1: The relative abundance of organisms collected / station in the dry season

	Number / Station			
Zooplankton	I	II	III	Total
Alona costata	1	1		2
A. davidi	1	2		3
A. excisa	1	3		4
A. eximia	1	1	1	3
A. guttata	1	1	1	3
A. monacantha	1	2		3
A. quadrangularis	1		1	2
A. rectangular	1	1		2
A. verucosa	1	3		4
Bosmina longirostros	6	4	2	12
Bosminopsi deitersi	2	1		3
B. deitersi	1	1	1	3
Camptocerus liljeborji	1	1	2	4
Chydorus parvus		2	1	3
C. parvus		1		1
Cyclopoida spp		1		1
Dadaya macrops		1	1	3
Diaphanosoma bidentata		1	1	3
D. excism		2	1	3
D. sarsi	4	3	4	11
Echinisca capensis	1		1	2
E. rosea	2	1		3
E. triseralis	1		2	3
Euryalona globulosa	3		1	4
Graptoleberis testaudinaria	1		1	2
Guernella raphaelis	2	1	1	4
Harpacticoid spp	1			1
Indialona verucosa	1	2	2	5
Kurzia longirostris	2	1		3
Leydigia leydisi	1	2	3	6
L. ciliata	1		2	3

Macrothriza spinosa		1	1	2
Moina micrura	1	1		2
Oxyurella ciliata	2	3	1	6
O. singalens	1	3	3	7
Peuroxus hamatus	1	2		3
Pseudochydrus globosus	1	1		1
Simocephalus vetulus	1	1	1	1
Total	48	51	35	134

TABLE 2: Relative abundance of organisms collected / station in the wet season

	Number / Station			
Zooplankton	I	II	III	Total
Alona affinis	1	2		3
A. cambeoui	1		2	3
A. davidi		2		2
A. gutata	1			2
A. karua	1		1	2
A. monacentha	1			1
A. rectangular	1	1		2
A. verucosa	1	2		3
Bosmina deitersi	1	1		2
Chydorus pubescens	2	1		3
C. reticulates		1	1	2
C. sphaericus	1	1	1	3
Dadaya macrops	1	2		3
Daphnia		2		2
D. longispina	2	1		3
Diaphanosoma barroisi		2	1	3
D. sarsi	3	9	2	14
Dunhevedia crassa	1			1
Echinisca capensis		1		1
E. troeralis		2	1	3
Euryalona orientalis			1	1
Graptocerus testudinria	1	2	1	4
Grimaldina brazzia	1	1		2
Kurzia longirostris	3	2	2	7
Leydigia australis		3		3
L. ciliata	1	1		2
Macrothriza spinosa	2	1	1	4
M. geoldi	2	2	1	5
Moina micrura	2	2	1	5
Moinadaphnia macheayl	1	1		2
Oxyurella singalensis		1		1
Pleuroxcus laevis	1			1
P. similes	1		1	2
Pseudochydrus globosus	2	2		4
Pseudosida bidentata	1	1		2
Sepholeberis kingi	1	1		3
Total	38	50	17	105

The contingency tables showing dry and wet season species diversity / station in the lake are presented in tables 3 and 4 below. In both seasons, highest number of individuals (*N*) sampled, was recorded in station II while the least was in station III. In the dry season, station I had the highest taxa richness (*d*) and diversity index (*H*). The lowest evenness index (*E*) was recorded in station I, while the highest value was in station III.

TABLE 3: Contingency table showing dry season species diversity / stations in Lake Ona

	Station I	Station II	Station III	Whole Lake
Total number of Taxa (*S*)	33	31	23	38
Number of Individuals (*N*)	48	51	35	134
Taxa Richness (*d*)	8.266	7.360	6.188	7.554
Shannon-Weiner diversity index (*H*)	1.441	1.437	1.307	1.502
Evenness index (*E*)	0.949	0.964	0.960	0.951

TABLE 4: Contingency table showing wet season species diversity / station in Lake Ona.

	Station I	Station II	Station III	Whole Lake
Total number of Taxa (*S*)	27	28	14	36
Number of Individuals (*N*)	38	50	17	105
Taxa Richness (*d*)	7.148	7.157	4.588	7.520
Shannon-Weiner diversity index (*H*)	1.394	1.354	1.124	1.475
Evenness index (*E*)	0.974	0.936	0.981	0.948

DISCUSSION

The result shows the lake to have a rich assemblage of zooplankton. Apart from *Diaphanosoma sarsi* which was the dominant species, in having twenty-five (25) individuals or 10.46 % of the total number of individuals sampled. All the other species sampled were sub-dominant in having values less than 10 % of the total population of zooplankton sampled. This is supported by Idodo-Umeh and Victor (1990) who stated in their work in Ase river, that species of an organism making up 10 % of the total number of an ecosystem is dominant. Biodiversity studies of the organisms sampled show the lake to be taxonomically rich, highly diverse, with the organisms collected evenly distributed among the species of zooplankton identified. Species of zooplankton sampled in the lake, both in the wet and dry seasons were similar. This observation suggests that species availability was not subject to seasonality and that the lake is a stable ecosystem. However, in terms of total number of individuals sampled, the higher values of zooplankton recorded in the dry season, could be attributed to the availability of nutrients in the water resulting from mineralisation and decomposition of organic matter washed into the lake from the surrounding catchment area during the flood season. The increase in nutrients in the water results in higher production of phytoplankton which translates to more zooplankton which serve as food for fish, with a concomitant increase in fish production This is supported by Boyd and Lichktoppler (1979), who reported that the abundance of phytoplankton and zooplankton in a water system, is an indicator of the water body being a good fishing ground. Ona Lake is productive and good for fish production, in having a rich assemblage of zooplankton. This view is supported by earlier studies conducted by Ekelemu and Zelibe (2006[a]),on the fish fauna of Ona lake, where they reported the presence of thirty-nine (39) species of fish in the lake. Furthermore the productivity of the lake is supported by the report of the study on the hydrology of the lake, which showed that the water quality was adequate for fish production (Ekelemu and Zelibe, 2006[b]). Thus the potentials of Ona Lake, if well harnessed and managed can help to bridge the supply and demand gap for fish and fish products.

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