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RESEARCH ARTICLE

PHYTOPLANKTON DENSITY IN AWBA DAM AT DIFFERENT STATIONS

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ABSTRACT

Phytoplankton density at three stations along the length of the dam was studied. The drop method was used for the determination of the phytoplankton density. A total of four families made up of 20 genera were identified. No significant difference at 5% level of the ANOVA test on the values of temperature, conductivity, dissolved O_2, alkalinity and dissolved CO_2 at the stations. There is a significant difference of the values of nitrate at the stations. The difference in nitrate content at the station was due to the rate at which particles settled as the water of the dam flowed downstream.

INTRODUCTION

Awba dam in the university of Ibadan campus was constructed as a fish pond in 1962 from a freshwater stream, Awba stream. It is located in the south-western part of the university. It is between latitudes 7^0 26^I N and longitude 3^0 53^I – 3^0 54^I E. It is bounded on the North by Ijoma and Ekwumo roads, on the East by the Department of Zoology and on the West and South by staff Quarters and Faculty of Technology respectively. A lot of anthropogenic activities go around the dam throughout the year, hence, there is need to constantly re-assess the limnological features of the dam.

Phytoplanktons occur as unicellular, colonial or filamentous forms; many carry on photosynthesis and are grazed upon by zooplankton and other aquatic organisms. Phytoplanktons being autotrophic contribute directly to the food available in surface waters by building up their protoplasm and food reserves directly from carbon dioxide and salts in solution (Newell and Newell, 1977). Water from different parts of a lake, fast moving stream, slow running rivers, pools, puddles, ponds into which domestic and industrial waters are discharged can be distinguished through examination of the composition and abundance of the phytoplankton in the water. Phytoplanktons like blue green algae, diatoms and bacteria have been described as indication of water quality (Bonde, 1963; Granberg, 1983). Rao (1953, 1955) reported that Myxophyceae occur profusely in waters with high organic matter, low oxygen content and pH around neutrality.

A comprehensive knowledge of the limnological features of a lake or any environment in which fish live is imperative for the assessing its productivity and suitability for fish rearing (Ayoade *et al*., 2006).

The quality of an aquatic ecosystem is said to be a reflection of all the factors affecting the water (Welch, 1980). This paper is aimed at looking at the phytoplankton density at different stations in the dam, relating it to the factors that affect them.

MATERIALS AND METHODS

Water and plankton samples for the analysis of distribution of phytoplankton at the stations were collected weekly from about 10cm below the surface of the water in June and July. Three stations, henceforth referred to as stations 1, 2, and 3 which are about 200 to 250 metres apart were selected for regular sampling. Station 1 was in front of the monk, station 2 was about the centre of the reservoir and station 3 was 403 metres from the monk.

Surface water temperature at the different stations was measured to the nearest 0.1^o C using mercury in glass thermometer of range 10 – 110^o C. The pH and conductivity of the samples were determined in the laboratory using Beckman electronic pH meter (Model E 512) and an electronic C M 25 conductivity meter Model W.P.A. respectively. The dissolved oxygen concentration (DO_2), dissolved carbon dioxide concentration (DCO_2) and alkalinity were determined by titrimetric methods described by Mackereth (1963). The determination of the nitrate content was according to Boyd (1979).

Phytoplankton samples were obtained by filtering 2 litres of water sample from the stations through plankton net of 60 µm mesh size. The phytoplankton concentrates were immediately preserved in 5% formalin and stored in clean labeled bottles. The drop method used in the phytoplankton analysis gives tolerable accuracy according to Pearsall, *et al.*, 1946).

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Table 1. Values of Temperature, DO_2 and DCO_2 at the stations.

	TEMPERATURE (^{0}C)			DO_2 ($mgO_2\,l^{-1}$)			DCO_2 ($mgCO_2\,l^{-1}$)		
	STATION 1	STATION 2	STATION 3	STATION 1	STATION 2	STATION 3	STATION 1	STATION 2	STATION 3
SAMPLE A	28.0	27.8	28.2	10.5	10.0	9.5	0.88	0.88	1.10
SAMPLE B	26.0	26.0	26.5	9.9	11.2	11.0	0.88	1.10	0.88
SAMPLE C	25.9	25.8	25.9	9.6	9.0	10.5	1.10	0.88	1.10
SAMPLE D	25.9	26.0	26.1	10.5	10.0	10.5	1.10	1.32	1.21
SAMPLE E	25.8	26.0	26.1	10.5	9.5	9.7	1.32	1.10	0.99
SAMPLE F	25.5	25.4	25.3	10.5	10.3	11.0	1.21	1.10	1.10
MEAN	26.2±0.83	26.2±0.76	26.4±0.90	10.3±0.36	10.0±0.68	10.4±0.58	1.08±0.16	1.06±0.15	1.06±0.10

Table 2. Values of conductivity, alkalinity and pH at the stations

	Conductivity (µmhos)			pH			Alkalinity ($mgCaCO_3\,l^{-1}$)		
DATES	STATION 1	STATION 2	STATION 3	STATION 1	STATION 2	STATION 3	STATION 1	STATION 2	STATION 3
SAMPLE A	320	320	400	8.2	8.3	8.2	3.00	2.50	3.00
SAMPLE B	340	330	320	6.4	6.4	6.3	2.50	2.50	2.50
SAMPLE C	320	340	320	6.2	6.3	6.7	2.50	2.50	2.50
SAMPLE D	295	293	290	6.9	7.2	7.3	2.25	2.25	3.00
SAMPLE E	276	283	300	6.7	6.9	7.6	2.25	2.00	2.00
SAMPLE F	296	295	287	8.6	8.6	8.6	2.25	2.00	2.00
MEAN	307±21.0	310±21.0	319±38.3	7.2±0.91	7.3±0.88	7.5±0.80	2.46±0.27	2.29±0.22	2.50±0.41

Table 3. Nitrate contents and phytoplankton concentrations at the stations

	NITRATE CONTENT ($mgNO_3\,l^{-1}$)			**PHYTOPLANKTON (Cells per litre)**		
DATES	STATION 1	STATION 2	STATION3	STATION 1	STATION 2	STATION 3
SAMPLE A	6.60	1.90	1.40	31,500	23,500	20,500
SAMPLE B	6.40	1.87	1.36	22,000	11,000	10,500
SAMPLE C	6.29	1.85	1.33	20,500	8,000	7,800
SAMPLE D	6.31	1.85	1.31	17,000	11,500	9,500
SAMPLE E	5.54	1.79	1.28	17,500	16,500	18,000
SAMPLE F	5.46	1.80	1.29	22,000	16,400	16,000
MEAN	**6.10±0.44**	**1.84±0.04**	**1.33±0.04**	**21,750±4785**	**14,483±5035**	**13,717±4703**

Table 4. Families of phytoplankton identified in Awba dam

MYXOPHYCEAE (Blue green algae)	BACCILARIOPHYCEAE (Diatoms)	DESMIDAE (Desmids)	CHLOROPHYCEAE (Green algae)
Polycystis, Aphanocapsa, Coelosphaerium, Microcystis, Aphanothece, Holopedium, Rivularia, Nostoc, Phormidium, Tetrapedia, Anabaena, Lyngbya.	*Synedra, Navicula.*	*Staurastrum.*	*Pediastrum, Coelastrum, Zygnema, Tetraspora, Scenedesmus.*

RESULTS

The values of temperature, DCO_2, DO_2 at the stations are shown in Table 1 while the values of conductivity, alkalinity and pH at the stations are shown in Table 2. There is no significant difference at 5% level of the ANOVA test on the values of temperature (F = 0.2095), conductivity (F = 0.2434), pH (F = 0.2030), DO_2 (F = 0.7660), DCO_2 (F = 0581), alkalinity (F = 0.6325) at the a significant difference at 5% level at the stations during the sampling period (F = 531.0).

A total of four families comprising 20 genera of phytoplankton were identified. The four families are Myxophyceae, Desmidae, Baccilariophyceae and chlorophyceae. The highest phytoplankton density was recorded in Sample A at station 1 and the lowest density at station 3 in Sample C (Table 3). Blue green algae were the

most abundant phytoplankton collected at the stations. Twelve genera of blue green algae were identified. The highest density of blue green algae was recorded in Sample F at station 1 and the lowest density in Sample C at station 2.

Green algae ranked third of the phytoplankton collected at the stations. Five genera of Chlorophyceae were identified. The highest density of green algae was recorded in Sample F at station 1. Diatoms ranked second of the phytoplankton collected at the stations. Only two genera of diatoms were identified. The highest density of diatoms was collected in Sample A at station 1. Desmids were collected only in Sample F at station 1. Only a genus was identified. The diversities of phytoplankton collected during this study are presented in Table 4.

DISCUSSION

The monk of the dam was opened during the period of the study. This caused reduction in the water level of the dam more than 2 metres in depth and caused water with low pH at the bottom to be brought to the surface, hence, the low pH values at the stations when compared with the average value of 8.3±0.9 for surface water before the monk was opened. The high DO_2 values recorded in all the stations despite the bottom water was brought to the surface was due to the effect of water movement and rainfall that enhanced O_2 to dissolve into the water from the atmosphere. The differences in p H values recorded in Sample F at the stations from that of other samples B – F was due to the effect of the closure of the monk during that last sampling day.

Nitrate contents that were distinctly different at the stations were not due to natural distribution of nitrate in the dam but were due to the effect of the opening of the monk of the dam. This is because the highest value of nitrate was recorded at station 1 which is just around the monk where most of the particles (nutrients) carried in the water from the Zoological garden and the staff Quarters were deposited. This was followed by the values recorded for station 2 and lastly by the values recorded for station 3. The large difference between the values of nitrate at station 1 (where the water gathered before being discharged) and stations 2 and 3, and the small difference in values of nitrate between stations 2 and 3 (where the water flowed through before getting to the monk further confirmed this observation. Station 1, where the water gathered before being discharged allowed nitrate containing particles to settle down and increase the nitrate content than stations 2 and 3 where there was no much time for settlement of such particles. The difference between nitrate content of stations 2 and 3 could be due to larger amount of water, hence nitrate containing particles that flowed through station 2 than station 3. Ja"afaru (1991) reported that variation in total suspended solids in Ogunpa River from station to station was due to the rate at which the particles settle as the river flowed downstream.

ANOVA test on nitrate values at the stations showed that there was a significant difference in the nitrate values at 5% level (F = 531.0). But nitrate may have just little effect on phytoplankton distribution as its distribution was not natural as discussed above. There is no significant difference at 5% level of the ANOVA test on the values of temperature, conductivity, pH, DO_2, DCO_2, alkalinity at the stations. Hence, each of these parameters may not be strong enough factor to bring about the difference in phytoplankton distribution at the stations.

The observed difference in the quality and quantity of phytoplankton collected at the stations, though, followed the pattern of distribution of nitrate in the dam, and could not be taken as due to their natural distribution because the distribution of nitrate was swayed by the opening of the monk. However, the quality and the quantity of the phytoplankton indicate that the dam is suitable for rearing of fishes.

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