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THE ZOOPLANKTON AND ENVIRONMENTAL CHARACTERISTICS OF OLOGE LAGOON, SOUTH WEST, NIGERIA

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Abstract

The physiochemical variables and zooplankton of Ologe Lagoon were studied from the dry through the wet season of the year 2000. The zooplankton were sampled by vertical haul. The measured ions, conductivity and TDS were higher during the dry season than in the wet season and at Stations 2 and 3 than at Station 1 probably due to rainfall and anthropogenic activities at each of the stations. Five genera of protozoan, twelve species of rotifer, three species of cladoceran and one *Thermocyclop* species were identified during the study. The rotifers, *Branchionus falcatus* and *B. patulus* were seen in all the stations in both seasons. The crustaceans were only seen at Stations 2 and 3 during the wet season. The protozoan, *Prorodon* sp was absent in all the Stations in the dry season but appeared in Station 2 in the wet season. The highest value of Shannon-Weaver diversity (1.16) was recorded in station 3 during the wet season. Diversity values and total zooplankton abundance were generally higher during the wet season than in the dry season probably due to the ability of rains to bring in allochthonous materials and the mixing of autochthonous materials.

Key words: Ologe Lagoon, Zooplankton, Water quality

Introduction

Among the several studies on the zooplankton of many Nigerian inland waters are those of Green (1960), Bidwell and Clarke (1977), Donner and Adeniji (1977), Khan and Ejike (1984), Jeje and Fernando (1986), Segers (1993), Segers *et al* (1993), Ovie and Sarma (1993), Onwudinjo (1994), Ovie and Adeniji (1994) and Ovie (1997). The available information is insufficient in view of the large number of inland waters in Nigeria. Moreover it is biased in favour of lakes and rivers as opposed to brackish waters like lagoon. The available records on brackish waters in the country include those of Chigbu (1987), Egborge and Tawari (1987), and Egborge (1994).

A major interest in zooplankton research is to understand environmental factors that influence zooplankton diversity. Dissolved oxygen, pH, conductivity, salinity and basin morphometry have great effect on zooplankton community structure (Aoyagui and Bonecker, 2004). Other important factors include food quality and quantity, predation and competition (Junk, 1997). Egborge (1994) suggested that since most of these factors are influenced by rainfall, rainfall regime is considered a dominant factor that affects zooplankton dynamics in tropical waters. To fully understand the factors that regulate the dynamics of zooplankton there is need for continual research especially in the tropics. Since brackish water ecosystems present clear seasonal variation in water quality, they present ample opportunities to understanding zooplankton dynamics (Kozlowsky-Suzuki and Bozelli, 2004). Studies on zooplankton are particularly important as these organisms play the important role of transferring energy from primary producers to organisms higher in the food chain (Aoyagui and Bonecker, 2004). This paper is aimed at studying the zooplankton and the environmental characteristics of Ologe Lagoon, southwest Nigeria in the wet and dry season. This lagoon is dominated by cyanobacteria (Okogwu and Ugwumba, 2005).

Materials and methods

Ologe lagoon is located between longitudes 03°03' and 03°07'N and latitudes

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006°26' and 006°30'S (Fig. 1). The lagoon is situated in the east of Badagry Creek and receives effluents from Agbara Industrial Estate via River Owo.

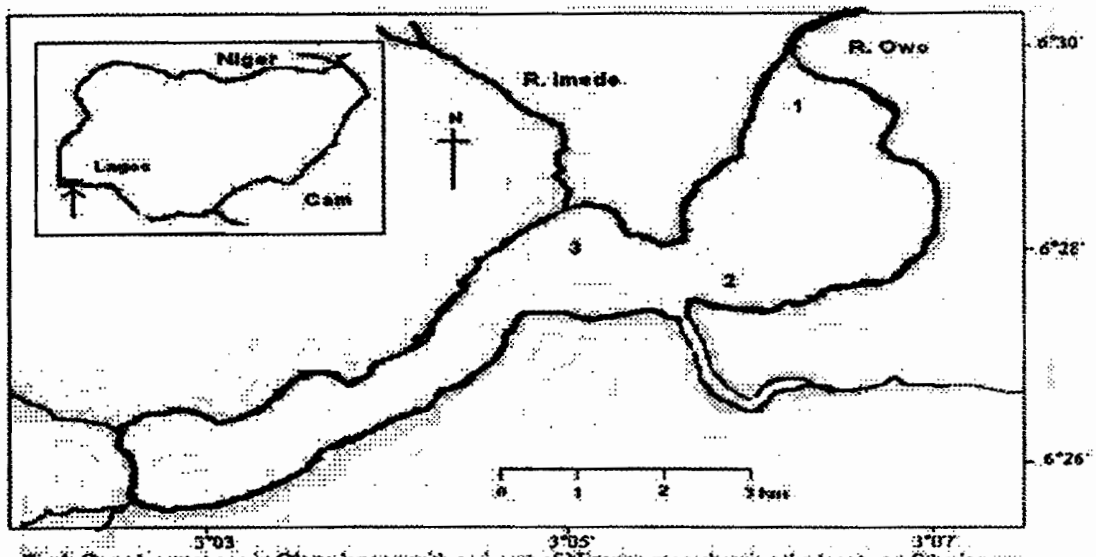

Fig. 1. Sampling stations in Ologe lagoon with an insert of Nigerian map showing the location of the lagoon

The topsoil of the lagoon catchment's area is sandy with a low humus content and low pH level. The mean annual rainfall is 1620.59 mm and the average daily temperature is 27.06 °C (AEIB, 1996).

The lagoon was sampled at three stations (1,2 and 3) for the purpose of this study. Station 1 is the point at which wastewater from Agbara Industrial Estate enters the lagoon via River Owo. Dredging also takes place here. Station 2 is the landing point for fishermen, where fish spoils are discarded and domestic activities such as washing take place due to its proximity to residential areas. Station 3 is located close to the middle of the lagoon. No notable human activity with the exemption of fishing takes place here. Residents drink from here. Fishing takes place in all the stations.

The physicochemical parameters of the lagoon and rainfall were monitored biweekly from February to August 2000. Sampling was done between 1100 and 1500 hours. Water samples for physicochemical analysis were collected in 1.5 litre plastic containers just below the water surface after water temperature was taken. Water temperature was measured at each station with a mercury in glass thermometer to the nearest 0.1 °C. Transparency was measured using a calibrated white 15 cm radius Secchi disc to the nearest 0.01m. Dissolved oxygen was determined using Winkler's method as modified by Kumar (1992). Conductivity as μScm^{-1}, total dissolved solid (TDS) as mg/l and pH were measured with an electronic TDS/Conductivity meter and pH meter respectively in the laboratory. Total alkalinity ($mgCaCO_3^{-1}$) was measured according to APHA (1992). Nitrate (NO_3) and phosphate (PO_4) were analysed using colorimetric method while magnesium, sodium, calcium and potassium were analysed using Atomic Absorption Spectrophotometer method according to APHA (1992). All analysis was done at International Institute of Tropical Agriculture, Ibadan. Hardness was calculated from the values of magnesium and calcium. Records of monthly rainfall for the study area during the study period were collected from the Department of Meteorological Services, Ministry of Aviation, Oshodi, Lagos.

Vertical zooplankton hauls were taken at each station using a 150μm mesh size net and preserved immediately in 4% formalin. In the laboratory, zooplankters were identified using the criteria of Jeje and

Fernando (1986), APHA (1992), and Egborge (1994). Shannon-Weaver (Shannon and Weaver, 1949) biotic index was used to estimate diversity.

Results

Most of the measured variables were higher during the dry season in all the stations than in the wet season save for pH (Table 1). The measured ions as well as conductivity and TDS were higher at Stations 2 and 3 than at Station 1, which is closer to the inflow Owo River. Five genera of protozoan, twelve species of rotifer, three species of cladoceran and one *Thermocyclop* species were identified during the study. The rotifers, *Branchionus falcatus*, *B. patulus* and an unidentified *Branchionus* were seen in all the stations in both seasons. The crustaceans were only seen at Stations 2 and 3 during the wet season (Table 2). The protozoan, *Prorodon* sp was absent in all the Stations in the dry season but appeared in Station 2 in the wet season. The highest value of Shannon-Weaver diversity (1.16) was recorded in station 3 during the wet season (Table 3). Diversity values and total zooplankton abundance were generally higher during the wet season than in the dry season.

Table 1: Mean values of Physicochemical variables

Seasons	Dry Season			Wet Season		
Av. monthly Rainfall (mm)	55.3± 3.04			155.07± 56.69		
Stations	1	2	3	1	2	3
Transparency (m)	0.8± 0.21	0.90± 0.14	1.06±0.34	0.54±0.20	0.37±0.20	0.51±0.10
Alkalinity ($mgCaCO_3l^{-1}$)	34.00±5.7	24.00±1.4	34.00±2.8	31.50±19	30.50±9	30.00±7
TDS (mgl^{-1})	35.00±1.4	153.00±44	189.00±9.8	49.17±11	162.00±67	105.00±15
Conductivity (μScm^{-1})	54.00±4.2	250.00±61	302.00±16	78.30±17	257.0±107	170.83±26
PO_4 (mgl^{-1})	0.02± 0.01	0.04±0.01	0.01±0	0.01±0.07	0.01±0.01	0.01±0.01
NO_3 (mgl^{-1})	0.05±0.04	0.05±0.01	0.06±0.01	0.04±0.01	0.02±0.02	0.06±0.01
Pot. (mgl^{-1})	2.61±0.05	5.67±0.28	5.20±0.27	2.91±0.53	5.57±0.89	4.53±0.59
PH	6.70±0.07	6.85±0.07	6.75±0.07	6.30±0.42	6.42±0.3	6.45±0.24
Dissolved Oxygen (mgl^{-1})	1.30±0.1	8.55±0.6	6.80±0.3	1.00±0.2	4.68±2.2	5.23±2.7
Magnesium (mgl^{-1})	1.16±0.12	8.86±0.02	0.96±0.3	0.70±0.32	4.20±1.9	3.74±2.5
Hardness ($mgCaCO_3l^{-1}$)	6.90±0.57	44.15±1.1	46.45±2.2	7.10±1.4	24.04±8.4	20.96±11
Water Temperature (°C)	32.2±0.9	32.2±0.2	30.0±0.2	27.9±1.2	30.0±2.0	29.5±1.1
Calcium (mgl^{-1})	0.86±0.06	3.00±0.28	2.70±0.27	1.70±0.53	2.64±0.9	2.17±0.6
Sodium (mgl^{-1})	26.73±4.1	98.13±25	98.30±26	26.56±6.1	81.70±15	74.60±21

Table 2: Checklist of the lagoon's Zooplankton

	Dry Season			Wet Season		
Stations	1	2	3	1	2	3
Protozoan						
Zoothamium spp	x	x	x	x	x	x
Lionotus sp		x		x	x	x
Prorodon spp					x	
Frontania spp	x			x		
Dileptus spp		x			x	
Rotifera						
BRANCHIONIDAE						
***Branchionus. calyciflorus* (Pallus), 1838**		x	x		x	x
***B. falcatus* (Zacharias), 1898**	x	x	x	x	x	x
***B. patulus* (O F Muller), 1786**	x	x	x	x	x	x
B. sp	x	x	x	x	x	x
***B. caudatus* (Barrois & Daday), 1894**		x	x		x	x
***Keratella tropica* (Apstein), 1907**		x	x			x

Table 2 contd						
K. americana (Carlin), 1943	x	x	x	x	x	
K. sp	x	x	x		x	x
TRICHOCERCIDAE						
Trichocerca similes (Wierzejski), 1893	x		x	x		x
T. cylindrica (Imhof), 1891	x		x	x		x
T. rattus (O F Muller), 1776			x	x		x
T. sp	x	x	x	x		
Crustacean						
Cladocera						
DAPHNIIDAE						
Ceriodaphnia cornuta (Sars), 1885		x			x	x
MOINIDAE						
Moina micrura, (Kurz), ***1874***					x	x
BOSMINIDAE						
Bosmina longirostris (O F Muller), 1785					x	x
Copepoda- Cyclopoida						
Thermocyclops sp					x	x

Table 3. Seasonal values of Total Zooplankton and Shannon-Weaver Diversity

	Dry Season			Wet Season		
Stations	**1**	**2**	**3**	**1**	**2**	**3**
Total Zooplankton (x $10^3 l^{-1}$)	5.5	6.5	9.5	6.1	12.1	14.6
SD	±3.53	±2.83	±6.36	±6.36	±4.27	±3.66
Shannon-Weaver Diversity	0.92	0.77	0.96	0.92	1.11	1.16
SD	±0.18	±0.19	±0.31	±0.15	±0.15	±0.01

Discussion

Most of the monitored physicochemical variables of the lagoon were influenced by rainfall, which is characteristic of many Nigerian, and tropical waters (Adebisi, 1981; Egborge, 1988; Egborge,

The pH of the water, which was acidic in all the stations and in both seasons, could be attributed to the acidic soil pH within the catchment area of the lagoon (AEIB, 1996). The level of PO_4 in the lagoon (0.008- 0.013) mgl^{-1} are within the range of many Nigerian inland waters such as Oshun River (0.007- 0.12 mgl^{-1}, Egborge, 1974), Oguta lake, (0- 0.01mgl^{-1}, Ovie, 1997, Shiroro (0.006- 0.038mgl^{-1}, Ovie and Adeniji, 1994). NO_3 of the lagoon (0.015-0.061mgl^{-1}) was lower than major Nigerian inland water) Sokoto River (0.1- 0.44 mgl^{-1}, Green, I960), Oshun River (0.02- 0.373 mgl^{-1} 1994; Dejen *et al.*, 2004). Many of the nutrients were diluted during the rainy season. Decreased sodium ion, TDS and conductivity from station 3 to 1 and from dry to wet season may be due to decrease in salinity consequent upon the influence of Owo River as well as due to dilution by rainwater respectively.

, Egborge, 1974) but was within the range of the Cross River (0.01-0.08 mgl^{-1}) (Akpan and Offem, 1993).

Crustaceans were absent in station 1, a combination of factors could be responsible for their absence. These may include high water flow and hydrological disturbance created by the dredging that take place in this station. Dejen *et al.*, (2004) reported that silt held in suspension in turbid water interferes with filter feeding mechanisms of crustaceans and this affect their reproduction success. Moreover, Okogwu and Ugwumba (2005) reported the dominance of

cynobacteria and low abundance of green algae in this Station. Cyanophyceae are also known to interfere with the filter feeding méchanism of crustaceans due to their filamentous cells (Infante and Abella, 1985; Culver and Geddes, 1993 and Matsumura-Tundisi *et al.*, 2002).

The absence of *Prorodon sp, Bosmina longirostrus, Moina micrura* and *Thermocyclops* in the dry season may be due to seasonalility which some authors (Onwudinjo, 1994; Ovie and Adeniji, 1994 and Egborge, 1994) have attributed to water quality, predator, quality and quantity of edible algae and competition. These factors may act in concomitant to favour or exclude a particular group of organisms at a particular time. A successional pattern where by rotifers replace crustaceans during periods of clear water (dry season) is typical of many Nigerian inland waters (Ovie, 1997). This is because crustaceans are selectively preyed on by fish during period of clear water in preference to rotifers which are smaller in size. Although other successional patterns have been recorded by Egborge (1994). In this study, the rotifers dominated the three stations during the dry season (period of clear water) as well as Stations 1 and 3 during wet season. This is in line with Ovie (1997) believe that plankton maxima may occur at anytime of the year in the tropics, depending on prevailing set of physical, chemical and biological conditions of the ecosystem. Interstational variation in Shannon-Weaver diversity and total zooplankton abundance may be due to the quality of food available. These values were higher in station 3 in both seasons. Okogwu and Ugwumba (2005) reported higher values of green algae in this station than in the other two stations. The total zooplankton abundance and Shannon-Weaver diversity of the lagoon was higher during the wet season than in the dry season. This may be due to the ability of rains to bring in allochthonous nutrients from the drainage basin as well as the mixing of autochthonous material that will accelerate primary production and as a consequence, zooplankton production/ abundance (Petersen and Cummins 1974; Evans *et al.*, 1993).

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