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Research Paper

Studies on Planktonic Desmids in Shadawanka River, Bauchi, Nigeria

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Abstract: Planktonic desmids were studied from Shadawanka for eight months (February – September, 2007). Investigation on the physicochemical characteristics were also undertaken to determine quality of the water. Temperature, pH and Transparency were determined in situ, Electrical Conductivity using conductivity meter, Dissolved Oxygen (DO) was determined by the Wrinkler's titrimetric method, Nitrate-Nitrogen and Phosphate-Phosphorus were determined spectrophotometrically, Biochemical oxygen demand (BOD) by evaporation method. Green algae were sampled by towing plankton net for 10minutes. A total of 74 species of green algae were observed belonging to three orders namely, Chlorococcaales, Volvoccales and Zegnematales. The Chlorococcaales formed the bulk of the green algae while the Volvoccales were relatively few. The most abundant species were mainly typical inhabitants of freshwater, these includes; Ankistrodesmus sp, Botryoccocus proturberans, Characium sp, Kirchneriella sp, Oocystis solitaria, Scenedesmus sp, and Spirogyra sp. The water was well oxygenated (>9.8mg/L), was slightly acidic in the wet season (<7.6mg/L), low BOD (2.1-6.4mg/L), high Conductivity (>204µScm-1) and moderate nutrient levels. The study reveals that, the river had low input of nutrients, this suggest that, it is not polluted and could enhance aquatic life performances. Variation in both the physicochemical parameters and desmids composition was attributed to the changes in season with respect to rainfall and solar radiation. This present study was undertaken to ascertain the effects of the differences in seasons and change in the physicochemical attributes on the green algae in the river.

Keywords: Green-algae, Physicochemical, Season, Shadawanka River

Introduction

Algal species present in riverine ecosystems reflect both the present and past history of the water quality in the river, allowing detection of the disturbances that might otherwise be missed (Eekhout *et al.,* (1996). Aquatic communities of both plants and animals integrate and reflect the effects of chemical and physical disturbances that occur over an extended period of time. These communities can provide a holistic and an integrated measure of the integrity or the health of the river as a whole (Chutter, 1998). Desmids high percentage occurrence is an attestation of low nutrients status of the river, desmids are a characteristics of freshwater environment with poor ionic composition (Nwankwo, 1996 and Kadiri, 1999) Stressed that they usually inhibit waters of differing alkalinity levels.

Natural and anthropogenic impact can change the chemical characteristics of the rivers. (Sanet *et al.,* 2007) There are very few rivers that are yet unaffected by people (Mamqvist and Rundle, 2002.). However, information on anthropogenic impact on streams and rivers in Africa are still patchy. Kadiri (1996) acknowledged that the studies of freshwater ecosystems are relatively few. There is therefore, the need for such study as a reference index a well as to contribute to the knowledge and checklist of freshwater desmids.

Materials and Method

Study Area

Shadawanka river is situated in the Shadawanka Military Barracks, off Jos road in Bauchi Metropolis. It is a result of two confluence rivers namely: Lafiyari and Zamfara rivers. The river provides water to the populace for domestic, livestock and irrigation purposes Common aquatic macrophytes are species of *Andropogon, Heropogon, Pistia, Pennesitum* and *Nymphia lotus.* L. Constructed across the river are three culverts to provide access to Schools and Shadawanka Village. Irrigation activities are common during the dry season. The dry season usually last from November to march while the wet season covers from April to October.

Collection of Water Samples

Water samples for both biological and physicochemical analysis was collected in 1litre acid cleaned polyethene bottles between 7 and 8hours on monthly bases from February to September, 2007 and transported to the laboratory in a cooler with ice and stored in the dark prior to analysis.

Analysis of Samples

Temperature, pH, and transparency were determined in situ. Temperature was estimated with an ordinary bulb thermometer, pH using a portable Cyber Scan pH meter, Model pH^{20}

Transparency with a 20cm Secchi disc painted black and white, Electrical conductivity using a portable combo conductivity meter model, Hanna H1-98129. Total dissolved solids by evaporation method, Phosphate- phosphorus and nitrate- nitrogen spectrophotometrically using an atomic absorption spectrophotometer model VGP 210, Biochemical oxygen demand by Hunts method and Dissolved oxygen titrimetrically using Wrinkler's method. Algae were sampled using plankton net of 55µ mesh size.

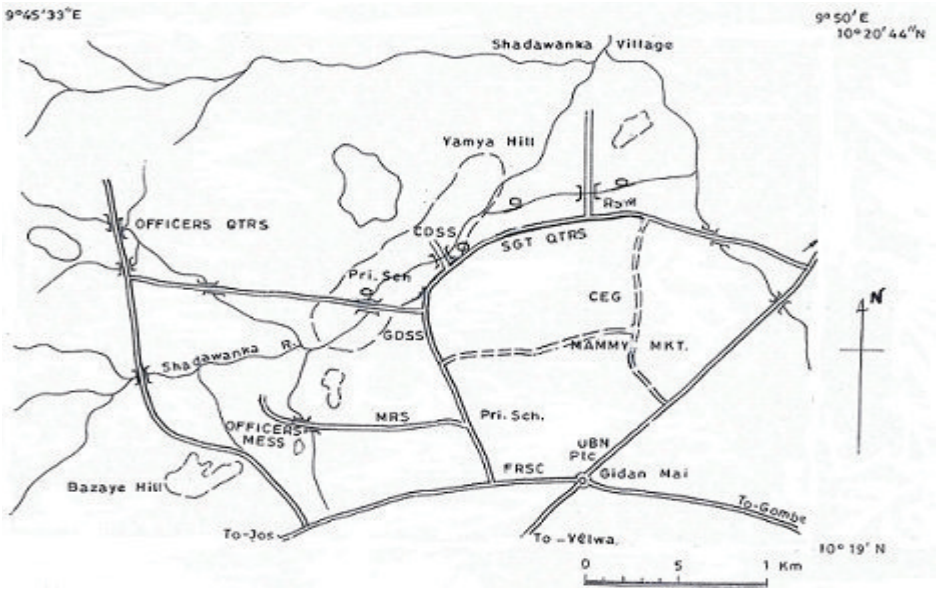


Figure: 1. Map of Shadawanka Military Barracks Showing Shadawanka River

Results

The results of the water quality analysis are given in **Figures 2-10**. The dissolved oxygen ranged between (9.83-15.9mg/L). Electrical conductivity was high (>210µScm^{-1}) moderate Nitrate-Nitrogen content (6.0-7.92mg/L) which was higher during the dry season. However, Phosphate-Phosphorus increases 0.1-44mg/L as the wet season progresses. Temperature was higher during the dry season month with a maximum of 28.6ºC in February and a minimum of 20ºC in July during the wet season. Transparency varied between 0.2m in the dry season to 0.65m in May during the wet season. Transparency was generally higher during the dry season. pH was circum-neutral and had three regimes (Neutral-acidic- Neutral). Total Dissolved solids do not seem to have a definite trend through both seasons but appreciably increased between February to May. Biochemical Oxygen Demand decreased lower in the wet season with season which was higher during the dry season.

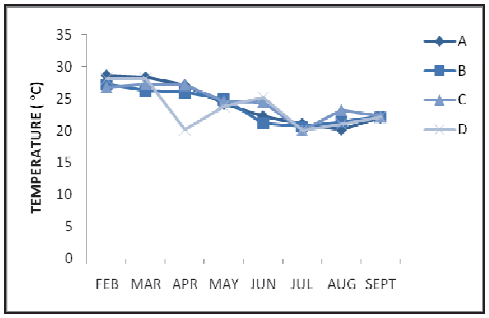
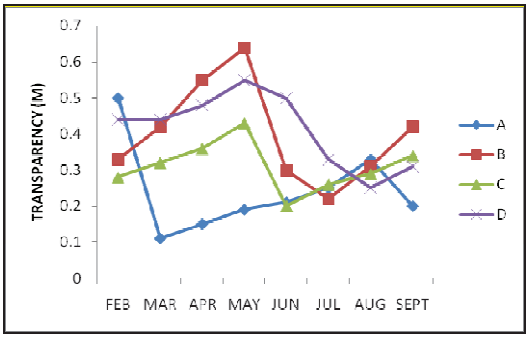
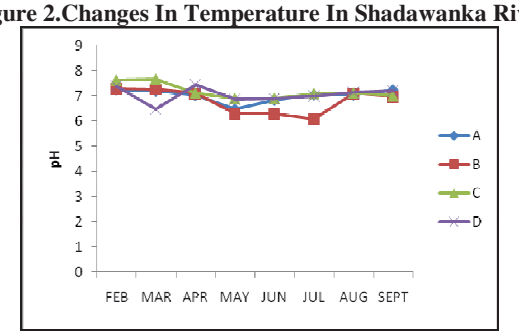


Figure 2.Changes In Temperature In Shadawanka River



Figure; 3Changes In Transparency In Shadawanka River



Figure; 4Changes In pH In Shadawanka River

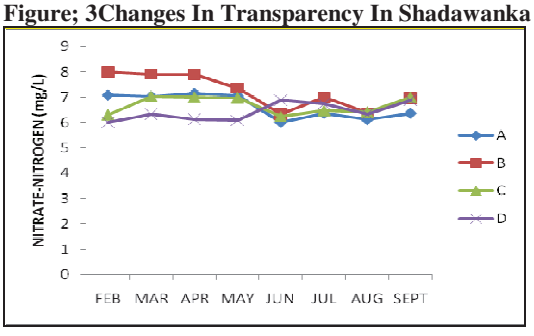


Figure: 5.Changes In Nitrate-Nitrogen In Shadawanka River

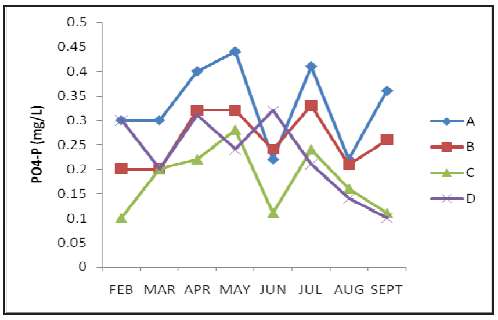


Figure:6.Changes In Phosphate- Phosphorus In Shadawanka River. February-September,2007

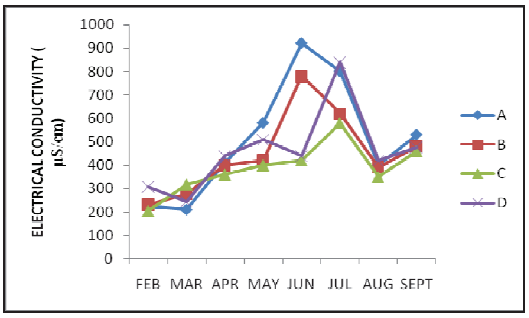


Figure: 7.Changes In Electrical Conductivity In Shadawanka River

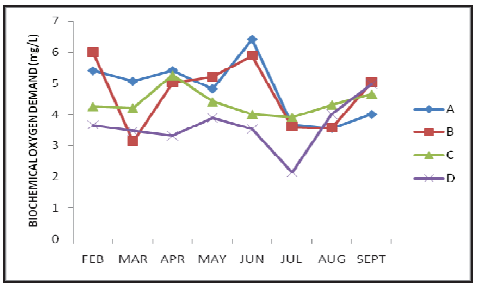


Figure: 8.Changes In Biochemical Oxygen Demand In Shadawanka River. February-September,2007

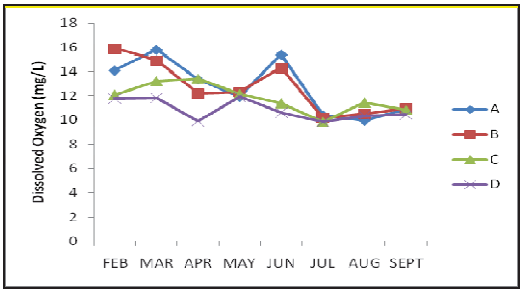


Figure:10.Changes In Dissolved Oxygen In Shadawanka River February-September,2007

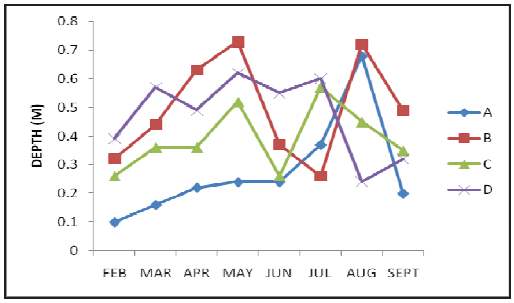


Figure:9.Changes In Depth In Shadawanka River,February-September,2007

The composition of Planktonic desmids presented in **Table: 1**. Species of desmids identified belong to the order Chlorococcales, Volvoccales and Zegnematales. The Chlorococcales were more prevalent in both seasons, and dominated the bulk of the desmids composition throughout the period of study with the highest abundance in March. Abundance of Chlorococcales did not vary in April, May and June and lowest in July. Zegnematales had the same trend as the Chlorococcales but with lower abundance with its lowest in May with two species; however, they did not change in July and August.. Volvocales were sparsely represented with only a species of *Asterococcus superbus* which appeared once in February. *Botryococcus proturbarens, Crucigenia rectangularis, Chlorocytium lumnetica, Pediastrum duplex, Scenedesmus arvensis, Westella botroides, and Westella linearis* were the most abundant species of the Chlorococcales. Species of *Closterium, Spirogyra and Staurastrum* were the most abundant of the Zegnematales. Both orders were more prevalent during the dry than the wet season

Table:1. Species Composition of Planktonic green algae of Shadawanka River, Bauchi. February-September,2007

Class: Chlorophyceae **Order: Chlorococcales**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**
A.fractus. (West and West)Brun.	-	+	-	-	-	-	-	-
A.fusiformis(Corda) Sensukors.	-	+	+	-	+	-	-	-
A.graciles. Korshikov.	-	+	-	-	-	-	-	-
Ankistrodesmus sp.	+	-	+	-	-	-	-	-
Table 1 contd…								
Ankistrodesmus westeii. Grun	+	+	+	-	-	-	-	-
Botryococcus proturberans G.S. West	+	+	+	+	+	-	-	+
Chara sp	+	-	+	-	+	-	-	-
Characium accuminatum. A.Braun	-	-	+	-	+	+	+	-
Characium gracilipes. Lambert.	-	+	-	-	+	-	+	-
Characium sp	+	-	-	-	-	-	-	-

Characium vacualatum. Lee et Bold.	-	+	+	+	+	-	-	-
Chlorella vulgaris. Beig.	-	+	-	+	-	+	+	-
Chroococcus minutes. (Kutz) Naegeli.	+	+	+	+	-	-	-	-
Chlorocytium lemnecum. Williams.	-	+	-	+	+	+	+	-
Crucigenia rectangularis. (Naeg) Kom-legh	+	+	+	+	+	-	-	+
C.tetrapodia (Kirk) West and West.	+	+	-	-	+	-	-	-
Kirchneriella elongata. G. M. Smith.	+	-	+	-	+	-	-	+
K.linearis. G. M. Smith.	+	-	+	-	-	-	-	+
K. obesa. (Bernard) G. M.Smith.	+	+	-	+	+	-	-	-
Kirchenerialla sp	+	+	+	-	-	-	-	-
Oocystis biospora. Kg.	-	-	+	-	+	+	-	-
O. solitaria. Wittrock.	-	+	-	+	-	-	+	+
Pediastrum botroanum. Meneghii	+	+	-	-	-	+	+	-
P. biradinum. Meyen.	+	+	-	-	-	+	-	-
P. duplex. West and West.	+	+	-	-	-	+	+	+
*P. lestyanum.*Meneghii	+	-	-	+	-	-	+	+
Scenedesmus accuminatus (Lagerh) Chod.	+	+	-	-	-	-	-	-
S.arvensis. Chodat.	+	+	-	-	+	-	+	+
S. calyptratus. Comas.	+	+	-	-	-	-	-	+
S. curvicaudal. Brebbisson.	+	-	-	-	+	+	+	-
S. incrassatulus. G.M. Smith.	+	+	-	-	-	-	-	+
S. intermediates. Chod.	+	+	+	-	-	-	+	-
S.opoliensis. P. Richter.	+	+	-	-	-	+	-	-
S. perforatus Lemmermann.	-	+	-	-	+	-	-	+
S. quadracaudal. Grun.	+	+	-	-	+	-	-	+
Scenedesmus sp.	+	-	+	-	-	-	-	+
S. spinosus. Chod.	+	+	-	-	-	-	-	-
S. ventralis. Kom-legh.	+	+	-	-	-	-	-	+
Tetraedron biforcatum (Wolle) Lagerh.	-	-	+	-	+	+	-	-
T. minimum. Hansgirg	-	+	+	-	+	-	+	-
T. regulare. Kutz.	-	+	-	-	-	-	-	-
T.tumidulum. Riemsh.	-	-	+	-	+	+	+	-
T.trigonum. Hansgwg	-	-	-	+	+	-	+	-
Tetrastrum elegans. Playf	+	+	-	-	-	-	-	-
T. heterocanthum. Chod	+	+	-	-	-	-	-	-
T. triangulare. Komareck	+	+	-	-	-	-	-	-
Westella butryoides.(W.West)De Wild.	+	-	+	+	+	-	+	-
W. linearis. G. M. Smith.	-	+	+	+	+	-	+	-
Wolle soccata (Wolle) Bornet Flahault.	-	-	-	-	+	+	-	-
Order: Zegnematales								
Euastrum sp.	+	-	-	-	-	-	-	-
E. sobordinata. Kutzing.	-	-	-	+	-	-	+	-
Closterium biclavatum Scott and Prescott.	+	-	-	+	-	-	-	-

Table 1 contd…

C.cynthia. Cynthia	-	-	-	+	-	-	+	-
C. dianae. Kutzing.	+	-	-	+	-	-	-	-
C. giganteum. Breb.	+	-	+	-	-	-	+	-
C. graciles. Grun	+	-	+	-	-	+	+	-
C. incurvum. Breb.	-	-	-	+	-	-	-	-
C. infractum. T. West.	+	+	-	+	-	-	-	+
C. jeneri. Ralfs.	+	+	-	+	+	-	-	-
C. lanula. Stein.	-	+	-	+	-	+	+	-
C. lineatum. Lemmermann.	-	+	-	+	-	-	-	-
C. moniliferum. G. S. West.	+	-	-	+	-	+	-	-
C. pseudolanula. Breb.	+	-	-	-	-	-	-	+
Closterium sp.	+	-	+	-	+	+	+	-
Closterium toxo. Lemmermann	-	+	-	-	-	-	-	-
Cosmarium rodum. Gutw.	-	+	-	-	+	+	-	-
Oedogonium incospicuum. Hirn.	-	-	-	+	+	-	+	-
Spirogyra angulare. Transeau.	-	-	-	-	+	+	+	-
S.porticalis. Cleve.	+	+	-	+	+	-	-	-
Spirogyra sp	+	-	+	-	+	+	-	+
Staurastrum cerates. Krieg.	-	+	-	+	-	+	+	-
Staurastrum sp	+	-	-	-	-	-	+	+
Order: Volvocales								
Asterococcus superbus. Scherffel	-	+	-	-	-	+	-	+

Key: **(+) Present, (-) Absent**

Discussions

Higher temperatures in the dry season could be due to high intensity of solar radiation and depth of the river, the increase due to sunlight intensity was reported by Ezra and Nayaya (1999), Ezra 2000, Ezra and Nwankwo, 2001 and Ezra 2007, in their various studies on freshwater bodies in Bauchi. Low Transparency in the wet season could be attributed to surface run-off of silt particles that eroded in to the river as reported by Ezra *et al.,*(2008) Bagalwa (2006). Higher transparency recorded in the dry season might have resulted due to the absence of disturbances by flood during this period and the sink mechanism of the river. This agrees with the findings of Hallock (2004). The acidic condition of the river during the wet season could be as a result of influx of organic materials and fertilizer deposites from the irrigated farmlands. Similar finding was observed by Ramakhrishman (2003). This could also be attributed to why Phosphate-Phosphorus and Nitrate –Nitrogen high value. Dostine (2002), Ramakrishman (1990) and Kendirim (1990) stressed that the high values within the wet season where farming activities takes place, could be strongly due to fertilizers, domestic and animal wastes deposits could equally be a contributing factor. Low levels of total dissolved solids in the wet season could be due to the diluting effect of rain fall as a result of increase in the volume of the river, as reported by Khan *et al.,* (1983).

The high composition of desmids during the dry season months and early wet season could have been as a result of higher solar radiation at these periods, where they attain maximum photosynthesis. This was also reported by Venkateswarlu (1968), who reported that, their abundance goes almost hand in hand with ionic concentration. Desmids abundance tends to detoriate as the wet season progresses as a result of reduced photosynthetic activities due to lower solar intensity and light penetration. It has been emphasized that, high concentration of dissolved oxygen most have also contributed to the formation of more nitrate which in turn help in the production of larger number of algae..

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