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Full Length Research

Assessment of some physicochemical parameters of Moussa stream, Bida, Niger State Nigeria

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The physicochemical characteristics of Moussa stream were studied monthly from January to August 2017 using standard methods and procedure. The results from the stream showed that water Temperature (24.9-27.5°C), Depth (14.7-45.8cm), Flow velocity (0.14-0.23 m/s), pH (6.33-8.6), Dissolved oxygen (3.10-10.00 mg/L), Biochemical oxygen demand (2.0-7.0 mg/L), Turbidity (61-285NTU), Conductivity (20-63 µ/cm), Alkalinity (8-30 mg/L), Nitrate (0.87-3.85 mg/L), Phosphate (0.31-1.01mg/L) and Sodium (0.9-13.5mg/L). All the physicochemical parameters were within the maximum permissible limit except Dissolved Oxygen (3.1-10 mg/L). All the parameters showed no significant difference ($p>0.05$) among all the sampling stations except depth and flow velocity which differed significantly ($p<0.05$) among all the sampling stations. Similarly temperature, depth and flow velocity showed no significant difference among sampling season. pH, DO, BOD, turbidity conductivity alkalinity, Nitrate Phosphate and Sodium differed significantly among sampling seasons. The deteriorating water quality were implications of pollution stress caused by different anthropogenic activities.

Key words: Physicochemical parameter, Moussa stream, Bida.

INTRODUCTION

Water is an essential component of the environment and it sustains life on the earth. Both plants and animals depend on water for their survival (Smitha et al., 2007; Raji et al., 2015). Water is one of the most precious resources, but as the human population increases globally, the demands for water supply increase. In addition to the increasing demand for water, anthropogenic impact ecosystems directly through land use change and indirectly by generating non-point source pollution that is introduced into streams and rivers via urban runoff. The need for clean water environment has aroused great interest and concern by many nations of the world (Dadi-Mamud et al., 2014). The quality of a given water body is influenced by its physical, chemical and biological factors, all of which interact with one another to control its productivity (Akponine and Ugwumba, 2014). Good water availability is an indispensable factor in preventing disease outbreak and improving the quality of life (Smitha et al., 2007). In most urban-rural communities in the developing countries especially the Sub-Saharan Africa, surface waters (rivers, streams, and lakes among others) have been the most available sources of water used for domestic purposes (Dimowo, 2013). Freshwater ecosystems are increasingly being studied worldwide because of their role in conserving and sustaining several species, which are of global importance (Arimoro et al., 2015; Edegbene et al., 2015). Freshwater pollution by human activities is becoming a matter of urgent concern threatening environmental productivity, sustainability and further social economic development in Africa (Nyenje et al., 2010; Arimoro and Keke, 2016). Several uses of aquatic ecosystems include water source for drinking, laundry, irrigation, hydropower generation as well as riparian activities on rivers catchments such as unregulated land use and landscape alteration, have led to both biotic and physical deterioration of aquatic environment (Nyenje et al., 2010; Kun Li et al., 2015). The deterioration on surface water quality globally has become a growing threat to

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human society and natural ecosystems (Adeogun et al., 2011; Dadi-Mamud et al., 2014). This study is therefore aimed to assessed the physicochemical parameters of Moussa stream so as to ascertain its health status and implication.

MATERIALS AND METHODS

Description of the Study area and Sampling station

The study was carried out on Moussa stream in Bida Niger state. Bida is located in North Central Nigeria (Figure 1). The town lies within the latitude of 09^0 03' 8N and $09^006'40"$N and longitude of $06^001'0"$E and $06^002'42"$E. The study sites lies in savannah region of North Central Nigeria. Bida is characterized by two distinct seasons (wet and dry season) the wet season is from April to October while the dry season is from November to March which is completely devoid of rain.

Station 1: This is the reference point of the stream with a latitude of 9°7.328'N, and longitude 6°0.709'E. The station is located along Bida-Zungeru road very close to Federal Government Girls College Bida. The vegetation cover is thick with emergent macrophytes and palm trees making a canopy cover. This station is relatively free from human activities except farming due to its location in the outskirt of the town.

Station 2: This is located along Bida-Minna road very close to Talba Housing estate Bida, close to a motorable bridge with a latitude of 9° 6.388'N, and longitude 6° 2.117'E. It is open vegetation with a large space, thereby receiving thermal radiation directly from sunlight and is surrounded by farms. Human activities in this station predominantly is bathing, washing and farming.

Station 3: This is located in outskirt of Bida with a latitude of 9° 6.342'N and longitude, 6° 2.264'E. It is open vegetation surrounded by farms. Human activities in this station predominantly are farming throughout the seasons.

Sampling techniques

Water sampling

Water samples for physicochemical parameters were collected monthly for a period of Eight (8) month (January to August, 2017) from three selected sampling station in Moussa stream. Sampling period covers both the dry and wet season.

Determination of physical and chemical parameters of the water

Water quality analysis was carried out Monthly between August, 2013 and January, 2014. At each sampling site, the following physical and chemical parameters were measured. Depth was measured in the sample area using a calibrated stick. Flow velocity was measured in mid channel by timing a float as it moved over a distance of 10 m (Gordon et al., 1994). Temperature, pH, Conductivity and Turbidity were determined on the field using multipurpose machine (model JPB-607, HANNA H19813). Dissolved oxygen (DO) Biochemical oxygen demand (BOD_5), and Alkalinity were determined using titrimetric methods (APHA, 2012). Nitrate-nitrogen (NO_3-N) and Phosphate-Phosphorus (PO_4-P) were measured spectrophotometrically after reduction with appropriate solutions and Sodium was determined using flame photometer (APHA, 2012).

Data analysis

The physicochemical parameters data were analyzed by descriptive statistical test, using Microsoft Excel 2010. The mean, range and standard deviation of each physicochemical characteristic were calculated per station. Analysis of Variance (ANOVA) was used to compare the means of the physico-chemical parameters obtained from each sampling stations and months.

RESULTS

Physicochemical parameters.

In Moussa stream, temperature, dissolved oxygen, biochemical oxygen demand, pH, turbidity, conductivity Alkalinity, Nitrate and Phosphate showed no significance difference ($p>0.05$) among the sampling stations of the stream. However, the depth and flow velocity differed significantly ($p<0.05$) among the sampling stations of the stream as indicated by ANOVA. Furthermore, temperature, depth and flow velocity showed no significant difference among sampling season, while pH, DO, BOD, conductivity, alkalinity, turbidity, nitrate and phosphate differed significantly among sampling season (Table 1).

DISCUSSION

Physicochemical parameters of Moussa stream

In most parts of Africa and other developing countries, people live in the riparian zones of streams and rivers for supply of water for their daily needs, resulting in the pollution of these water bodies (Arimoro et al., 2015). The physical, chemical and biotic characteristic of most aquatic ecosystems in Nigeria have been compromised because of discharges of organic and inorganic waste from activities on the catchments of most freshwater bodies (Arimoro and Ikomi, 2008; Andem et al., 2014). The

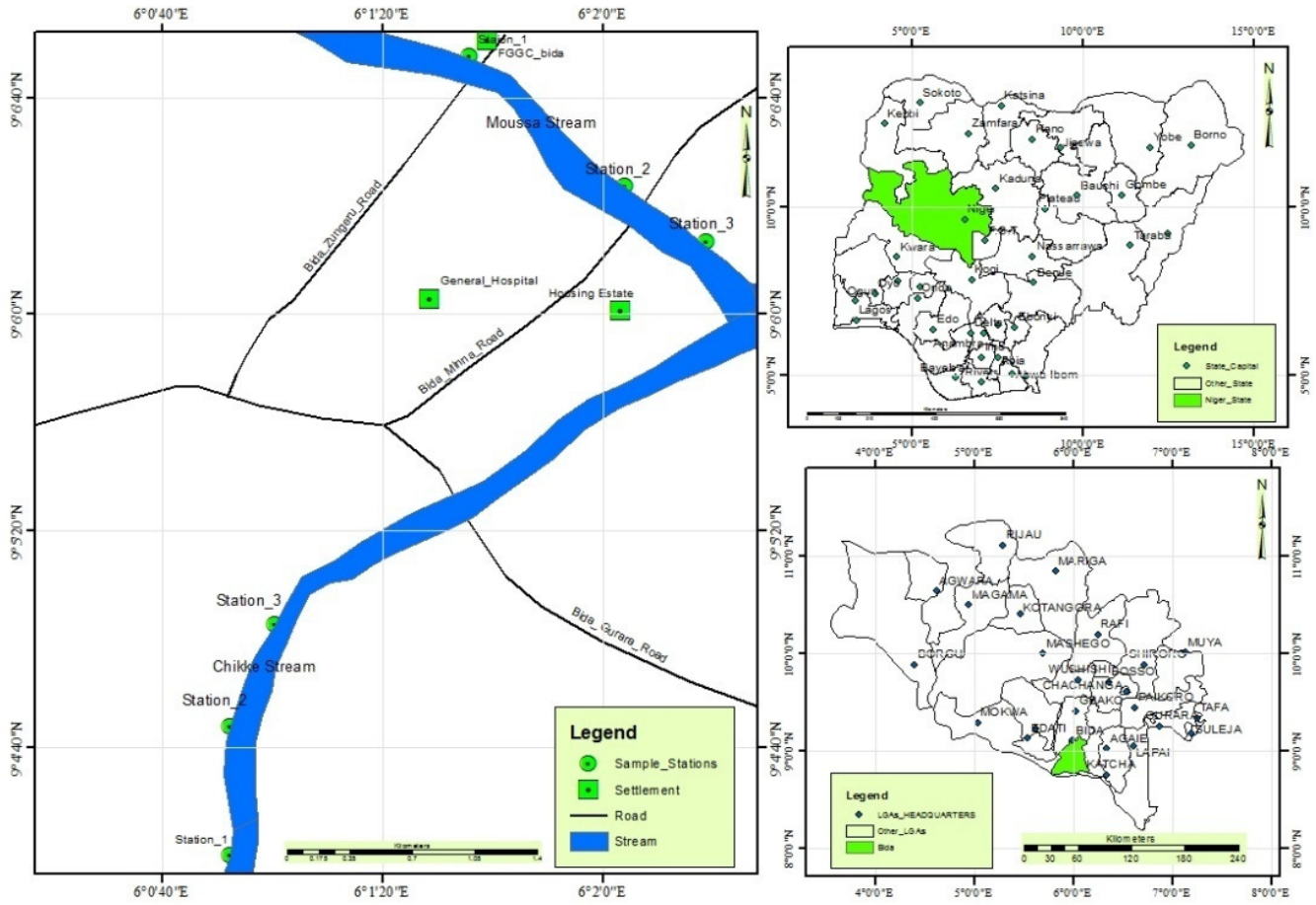

Figure 1: Map showing sampling station of Moussa stream, Bida, Niger state.

medium temperature range (24.6 to 27.8°C) from this study could be as a result of the time of sample collection and the nature of vegetation around the stream. Temperature is one of the important environmental variables because it regulates the physiological behavior and distribution of aquatic organism (Mustapha, 2008). There is a sharp increase in depth and flow rate during the wet seasons, this could be as a result of increase in the water volume as a result of rain and wind blowing across the streams which were absence during dry season. The pH value observed exceed the recommended range of 6.5 to 8.5 (SON, 2007). This could be as a result of surface run off or decay of organic matters in the water (Mustapha, 2008). Higher Dissolved oxygen (DO), Biochemical Oxygen Demand (BOD_5) and Turbidity observed in this study is an indication of well oxygenated water body throughout the study period which involved both dry and wet season. Higher DO, BOD_5 and turbidity were recorded in raining season than in the dry season, this could be as a result of increase in volume of water in raining season, influx of organic matters into the stream though surface run and erosion and high temperature coupled with high sunlight intensity in the dry season (Raji et al., 2015). BOD values recorded in the study is an indication that the river was gross polluted by organic waste (Arimoro *et. al.*, 2015). High value of Conductivity and Alkalinity observed in the dry season than in raining season indicating that the sampling station might contain more amount of suspended and dissolved solid materials, which increases the concentration of cation such as calcium, magnesium and sulphate (Mustapha, 2008). High content of Nutrient such as nitrate and phosphate could be as a result of surface run off from farms, decomposition of organic matters into the water and different anthropogenic activities around the water body (Arimoro *et al.*, 2015).

Conclusion

Moussa stream is an important source of water for Domestic and industrial activities of the riparian users. Poor management of this water bodies has led to the degradation of its uniqueness, thus there is need to provide efficient measures to protect and manage this

Table 1: Physicochemical parameters measured at all the sampling station of Moussa stream in Bida Niger state. Nigeria (January to August 2017).

Parameters	Station 1	Station 2	Station 3	Probability		Maximum permissible limit	
				Months	Stations	FEPA	SON
Temperature (ºC)	26.06±0.28 (25.2-27.1)	26.36±0.21 (25.1-27.2)	25.83±0.33 (24.9-27.5)	0.241	0.435		
Depth (cm)	29.4±2.24 (23.1-38.9)	34.31±3.09 (24.2-45.8)	22.58±2.29* (14.7-31.9)	0.255	0.014		
Flow velocity (m/s)	0.158±0.003 (0.15-0.18)	0.155±0.003 (0.14-0.17)	0.179±0.008* (0.15-0.23)	0.474	0.019		
pH	7.30±0.21 (6.33-8.1)	7.48±0.21 (6.33-8.3)	7.35±0.25 (6.33-8.6)	0.00027	0.837	6.0-9.0	6.5-8.5
DO (mg/l)	6.43±0.68 (3.1-8)	6.45±0.87 (3.1-10)	6.37±0.75 (3.1-10)	2.53E-07	0.997	5	
BOD_5 (mg/l)	4.0±0.45 (2.0-5.8)	4.2±0.57 (2.2-7.0)	3.88±0.42 (2.2-6.0)	0.0014	0.901	10	
Turbidity (NTU)	172±30.88 (61-285)	198±29.09 (71-285)	199±29.79 (70-265)	6.34E-09	0.761		
Conductivity (µS/cm)	42.25±4.39 (20-56)	47.12±4.75 (20-63)	43.75±6.27 (20-63)	4.17E-06	0.796		1000
Alkalinity (mg/l)	20±2.69 (8-30)	20.37±2.52 (10-30)	20.5±2.28 (10-30)	8.87E-09	0.989		
Nitrate (mg/l)	2.40±0.36 (0.87-3.83)	2.58±0.31 (1.31-3.66)	2.41±0.39 (1.01-3.85)	3.49E-06	0.936	20	50
Phosphate (mg/l)	0.63±0.08 (0.33-0.98)	0.67±0.09 (0.31-1.0)	0.68±0.09 (0.33-1.01)	7.90E-10	0.993	5	

NOTE: values are mean±S.E; range in parenthesis; values with asterisk (*) differs significantly Federal Environmental Protection Agency (FEPA 1991). Nigerian Standard for Drinking Water Quality; Standard Organisation of Nigeria (SON, 2007).

freshwater resources, for sustainability and conservation of water quality and aquatic biodiversity. The physicochemical parameters measured during the study period revealed strongly that the surface water was fairly polluted.

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