International Journal of Fisheries and Aquatic Studies 2016; 4(3): 104-108

ISSN: 2347-5129
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.352
IJFAS 2016; 4(3): 104-108
© 2016 IJFAS
www.fisheriesjournal.com
Received: 03-03-2016
Accepted: 04-04-2016

Adeosun FI
Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Nigeria

Adams TF
Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Nigeria

Amrevuawho MO
Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Nigeria

Correspondence
Adeosun FI
Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Nigeria

Effect of anthropogenic activities on the water quality parameters of federal university of agriculture Abeokuta reservoir

Adeosun FI, Adams TF, Amrevuawho MO

Abstract
The study aimed to investigate the impacts of land use types on surface water quality and to determine the various anthropogenic activities of the surface water flowing into the reservoir. Four sampling stations were selected around the study location and water samples collected biweekly from February to June 2013. The result showed that the water quality parameter varied during the study with temperature ranged between 26.88-31.440C, pH (6.82-7.98), alkalinity (6.66-14.5mg/l) and dissolved oxygen (DO) (3.94-6.82mg/l). Highest DO was observed at the reservoir. No significant difference ($p<0.05$) was observed in the values of alkalinity among the water bodies. Temperature was statistically similar ($p>0.05$) at three of the stations but significantly different ($p<0.05$) at the reservoir. The study concluded that water quality of the reservoir was adversely affected by human activities such as domestic runoff, agricultural runoff, and refuse dump as well as seasonality in the streams flowing into the FUNAAB reservoir.

Keywords: Water quality, Anthropogenic activities, Land use and FUNAAB reservoir.

1. Introduction

Water is indispensable natural resources on earth. All life including human beings depends on water. Water is essential for the development and maintenance of the dynamics of every facet of the society [1]. Freshwater is a finite resource, essential for agriculture, industry and even human existence. Without freshwater, fish has no life as it support the different phases of fish life that is, fish lives and carry out activities in water such as breeding, movement, respiration [2]. Physical and chemical parameters of water are very important for fish growth and production. These parameters are vital in that they affect the biotic components of an aquatic environment in various ways [3] and thus boost its production. Assessment of the water conditions will give an insight into the relationships between the organism and their environment and can be used in determining water quality, productivity of the water body, understanding of the structure and function of a particular water body and its relation to its inhabitants. In view of this, importance of monitoring water quality cannot be overemphasized. Anthropogenic influences are known sources of water pollution and include urban, industrial and agricultural activities increasing exploitation of water resources as well as natural processes, such as precipitation inputs, erosion and weathering of crustal materials degrade surface waters and damage their use for drinking water, recreational and other purposes [4]. However, of these, sewage and industrial waste runoff into rivers, have higher probability of heavy water pollution. Industrial influents mostly contain heavy metals, acids, hydrocarbons and atmospheric deposition [5]. Agricultural runoff is another source of water pollution as it contains majorly nitrogen compounds and phosphorus from fertilizers, pesticides, salts and poultry wastes. The study therefore aimed to determine the effects of human activities on the different physical and chemical parameters of the water body and to know if there is a variation in the distribution of physical and chemical parameters in the water body.

2. Material and Methods

2.1 Study area

The study was carried out on Ole Stream in Federal University of Agriculture Abeokuta, Ogun state, south west Nigeria. In order to assess the water quality parameters of the River, four (4) sampling stations were identified and sampling stations were namely site IS (Isolu source point), site HS (Health Centre source point), site GS (GTB source point) and site RS

(Reservoir source point). These sites are noted for different land use which includes Agricultural use, domestic use and fish production.

The Reservoir of the Federal University of Agriculture, Abeokuta (FUNAAB), is located at the fisheries section of the University farm. The 3-heactare reservoir was constructed by damming a stream (Ole stream) in 1997. The reservoir provides water for other earthen ponds downstream, serve as a fishing area, for research and educational purposes.

2.2 Water Analysis

Water samples were collected on bi-weekly basis from the four sampling sites between February and June 2013. Parameters were measured in-situ and ex-situ on samples collected from the stream. Some of the physical and chemical parameters that were measured in-situ were Electrical conductivity, Total dissolve solid, Water temperature and pH using combo meter by Hanna, model HI 98130. The meter was used by submerging the probe into the water and switching it on the values of the Water Temperature, Electrical Conductivity, Total Dissolved Solid and pH were measured while the meter probe was still submerged.

Parameters such as Dissolved Oxygen, Alkalinity, Total Hardness, Phosphate and Nitrate were analyzed ex-situ by collecting water samples from the sites in well corked plastic bottles, properly labeled and taken to the laboratory of the Department of Environmental Management and Toxicology, College of Environmental Resource Management, Federal University of Agriculture Abeokuta, for the analysis of dissolved oxygen, nitrates, phosphates and alkalinity.

2.2.1 Temperature, pH, electrical conductivity and total dissolved solids

Temperature, pH, electrical conductivity and total dissolved solids were taken by dipping the Hanna instrument H198129 meter into the river not below 1cm deep. The values for each of the parameters were taken by switching the mode to the requested parameter for five minutes for it to stabilize and then recorded.

2.2.2 Total hardness

EDTA titration method (**ref**) was used in the determination of water hardness. 50ml of each sample were put into the conical flask and 1 ml of ammonium buffer indicator was added. 3-4 drops of Erichrom Black-T was also added and multiplied by 300ml/l (ppm) of $CaCo_3$.

2.2.3 Alkalinity

Acid titration method (ref) was used in the determination of alkalinity; 3drops of methyl orange indicator was added to 100 ml of water sample and mixed thoroughly. Mixture was then titrated against dilute H_2SO_4 and observed for colour change as below; Alkalinity (mg $CaCo_3$/l) = volume N/50 acid (ml) * 10

2.2.4 Nitrate

Using a pipette, 1 ml of water sample from each location was measured into nitrate bottles; 4 ml of distilled water was added. Nitrate bottles of all samples were then placed in a spectrophotometer to determine the level of nitrate.

2.2.5 Phosphate

Water sample was poured into the standard flask to 25 ml mark and 10ml of vanado-molybdate reagent added. 15 ml of distilled water was added to make-up 50 ml mark on the standard flask. Samples were placed in a spectrophotometer for 10minutes at a wavelength of 470 nm to determine the level of phosphate and values calculated using the formula below:

$$\text{Phosphate (mg/}PO_4^{3}\text{-P)} = \frac{\text{Reading from curve*1000*D}}{\text{ml sample}}$$

Where, D = dilution factor

2.2.6 Dissolved oxygen (DO)

DO was determined using wrinkler's method. Water samples were collected using a 125 ml biological oxygen demand bottle (BOD). 0.5 ml manganous sulphate was added by placing the tip of the pipette below the surface of the water. 0.5 ml alkaline iodide in the same manner was added and stopper replaced. The mixture was thoroughly mixed and precipitate allowed settling. 0.5 ml concentrated sulphuric acid was added to the mixture, corked and mixed thoroughly. 100 ml of the sample measured into a flask using a measuring cylinder and titrated with sodium thiosulphate till colour change. 4 drops of starch solution was added and titration continued till colour change. End-point then recorded.

2.3 Statistical Analysis

Data collected were analyzed using the Statistical Package for Social Sciences (SPSS). One-way Analysis of variance (ANOVA) was used to test for significance among the means and standard error. Duncan Multiple Range test was used to differentiate between means.

3 Results and Discussion

The results obtained from the weekly variation in physical and chemical parameters assessed between the months of February and June 2013 is presented in Table 1. DO level showed minimal weekly variation at the four (4) stations. However, higher DO level was observed at the FUNAAB reservoir while lower level was observed at the GTB stream. This could be attributed to its nearness to residential area which means high human activity such as deforestation, bathing, washing, reclamation/farming within the area as compared to that of the other locations. This corroborates the findings of Ayobahan *et al.*, [6] who posit that DO level fluctuates due to the presence of organic pollutants in water majorly through human activities.

Table 1: The Physical and Chemical Parameters of the study locations

Parameters	WHO Std (2007)	Isolu	GTB	Health	Reservoir
Dissolved oxygen (mg/L)	> 4	5.18 ± 0.37^{b}	3.94 ± 0.42^{c}	4.58 ± 0.12^{bc}	6.82 ± 0.38^{a}
Alkalinity(mg/L)	600	6.90±0.26	6.92±0.25	6.66±0.19	7.12±0.33
Nitrate(mg/L)	45	6.40 ± 0.65^{b}	16.32 ± 0.39^{a}	16.19 ± 0.25^{a}	18.02 ± 0.87^{a}
Phosphate(mg/L)	100	0.01±0.00	0.01±0.00	0.01±0.00	0.02±0.00
Total Hardness(mg/L)	500	7.00±3.52	15.20±5.57	43.40±29.23	56.40±7.83
Temperature(^{0}C)	20-30	26.88 ± 0.27^{b}	26.94 ± 0.25^{b}	26.94 ± 0.30^{b}	31.44 ± 0.47^{a}
pH	6.5-8.5	7.73 ± 0.63^{ab}	6.82 ± 0.12^{b}	6.92 ± 0.07^{b}	7.98 ± 0.17^{a}
EC(µs/cm)	1000	285.60 ± 14.74^{ab}	243.40 ± 27.38^{bc}	321.60 ± 22.11^{a}	188.40 ± 2.23^{c}
TDS(ppm)	500	142.80 ± 7.49^{ab}	126.40 ± 14.13^{b}	161.40 ± 11.32^{a}	95.20 ± 1.24^{c}

Values are expressed in means. Means having same superscript in the same row are not significantly different at $p>0.05$

Marked variation in dissolved oxygen was observed between February and March in the reservoir, Isolu and GTB, however, no marked difference was observed in the Health location (Fig 1). The low level of DO in February which was the peak of dry season could be due to the temperature effect on solubility of oxygen as high temperature in the dry season could lead to low oxygen solubility. However, the result is not in corroboration with the studies of [7, 8] who reported that DO level was higher in the dry season however no significant difference was reported. However, the finding of this study corroborates the result of the study of Olalekan *et al.,* [9] reported that DO level were lower in the dry season than in the rainy season.

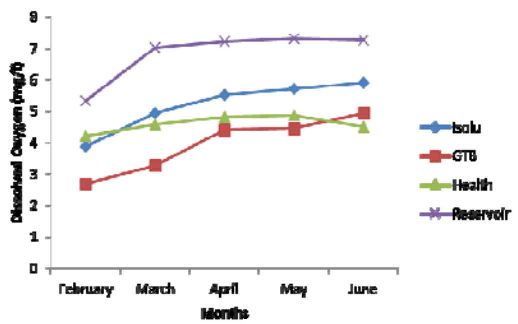

Fig 1: Dissolved Oxygen for four water bodies measured between February and June 201 study.

During the study period, the mean value of alkalinity and hardness was found to range between 6.66 mg/l -7.12 mg/l and 7.00 mg/L - 56.40 mg/L respectively. Although there was no significant difference in alkalinity, however, there was significant difference in the level of total hardness in different locations with highest values observed in the FUNAAB reservoir (56.40±7.83) as compared to other locations (7.00±3.52, 15.20±5.57 and 43.40±29.23 respectively). The observed high levels of total hardness than alkalinity could be attributed to high quantity of calcium and magnesium in the water body than common salt. Umunnakwe *et al.*, [10] posit that water bodies that receive discharge from homes and industries have higher values of total hardness and alkaline. High level of alkalinity in River Asa was attributed to accumulation of alkaline in the effluent being discharged into the water body [11] (Adebayo and Adediran 2005). The low amount of alkaline content during the rainy season as seen in FUNAAB reservoir and Health locations (Fig. 2) could be due to the dilution of the water body by the rains and their distance from residential areas. However, the reverse was observed in the other two locations, reasons could be due to constant discharge of domestic waste into the water body due to proximity to living areas.

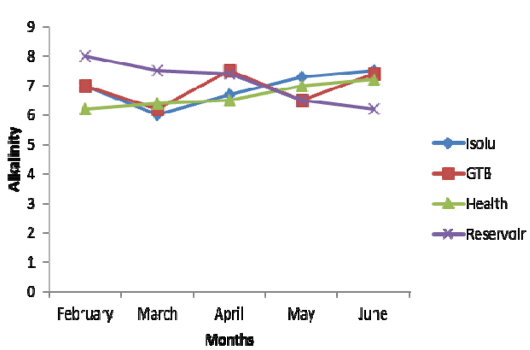

Fig 2: Alkalinity for four water bodies measured between February and June 2013

Table 1 showed no marked variation in temperature across the study locations although; temperature of the FUNAAB reservoir was markedly higher than other locations. The water and air temperature were found to be similar during the study period which corroborates the finding of Singhal *et al.,* [12]. The temperature recorded during the study fell within the WHO range for growth and survival of aquatic organisms. However, high temperature level in the month of February (Fig. 3) could be attributed to the season as studies have shown temperature to be a function of the weather and the extent of shade from direct exposure of sunlight (Ekhaise and Anyasi [13] cited in Akubugwo and Duru [14]. Also, the constant high level of temperature in FUNAAB reservoir compared to other location could be because all other locations excluding FUNAAB reservoir were streams and thus the water was not stagnant.

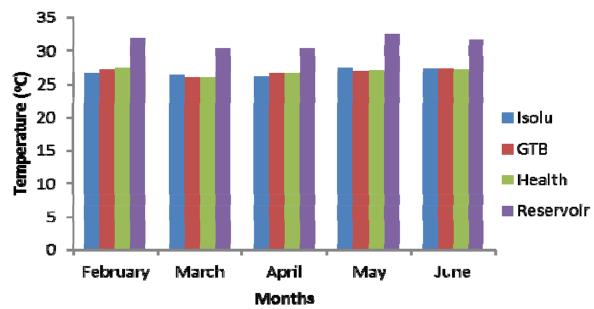

Fig 3: Temperature for four water bodies between February and June 2013 (1971) [13].

Nitrate, a form of nitrogen vital for growth and survival of aquatic organism was observed to range between 6.40 and 18.02 mg/L while the level of phosphate observed in all locations during the study was negligible compared to the required range as specified by WHO. The phosphate and nitrate levels observed in the study, may have entered the river from land surrounding the river, since their levels in water reflects the influence of human activities like farming, washing, bathing on lands surrounding the water body [15]. According to Rast *et al.*, [16], increase in nitrogen or phosphorus or both tends to limit productivity and leads to eutrophication. Throughout the study period, mean nitrate level was relatively low compared to WHO standard while mean phosphorus was negligible. The results are in line with the finding of Akubugwo and Duru [14] who reports low levels of sulphate, phosphate and nitrate in water due to anthropogenic activities. However, the result did not agree with the finding of Umunnakwe *et al.*, [10] who reports increase in both phosphate and nitrate levels due to sewage discharge into water body.

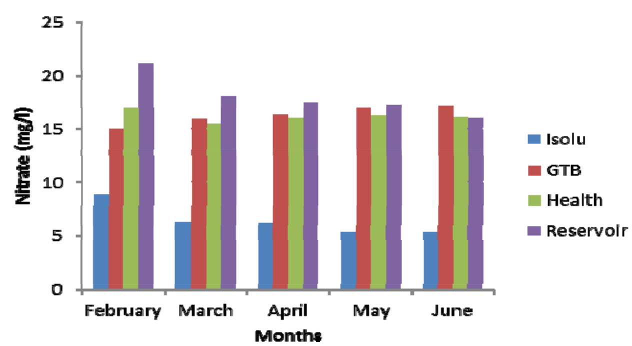

Fig 4: Nitrate for four water bodies between the month of February and June 2013.

There was no marked monthly variation of nitrate in the different study location however marked increase was observed at FUNAAB reservoir in the month of February which could be attributed to the peak of the dry season leading to water evaporation and stagnant water. While negligible level in Isolu could be attributed to the nature of waste entering into the water body.

Hydrogen ion concentration or degree of acidity and alkalinity (pH) at the different locations were observed to range from 6.82-7.98. pH range observed in all locations fell between the optimal range for sustainable aquatic life as posited by Murdoch *et al.,* [17]. Aquatic organisms are affected by pH because most of their metabolic activities are dependent on pH level [18].

Electrical conductivity (EC) was observed to be highest in health source point and lowest at the FUNAAB reservoir source point. However no significant difference was recorded between the Isolu source point and health and also between the GTB source point and Isolu. However, the range observed in all the locations was lower as recommended by the WHO. This low level of EC at the FUNAAB reservoir can be attributed to the low level of total dissolved solid (TDS) in the location and the reverse is the case for the Health center location. This holds true as reported by Ewa *et al*., [19] who recorded high level of EC corresponding to TDS in Omoku Creek. High concentration of conductivity and salinity in water has been reported to cause danger to both aquatic and human lives [20].

TDS in the study was observed to correspond to EC. However, there was no significant difference between the health center source point and the Isolu source point and between the GTB source point and the Isolu location. The observed range though falls below the WHO recommended level for TDS. The high level of TDS at the Health center can be attributed to the type of waste discharged into the water body at this location. Result is similar to that observed by Samuel *et al.*, [21] who reported similar trend in the TDS with the electrical conductivity of River Galma in Zaria, Kaduna State.

4. Conclusion

The monitoring of physical and chemical characteristics of a water body is vital for long term and short term productivity of the water as the importance of these parameters to aquatic life and aftermath effect on human cannot be overemphasized. Although, results from this study indicated that the four locations studied were not to mildly polluted as values obtained were within the WHO standard however, monitoring of the water must be given apt attention as continuous discharge of this waste can lead heavy pollution of the water and thus pose health risk to humans who depends on water.

Competing Interest

The authors declared that they had no competing interest.

Authors' Contribution

FIA and TFA participated in the design of the study. TFA carried out the experiment and performed the statistical analysis. FIA supervised and coordinated the research. FIA and AMO participated in the discussion and corrected the manuscript. All authors read and approved the final manuscript.

Authors' Information

FIA is a PhD and a Senior Lecturer of the Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria and a member of the Fisheries Society of Nigeria (FISON).

TFA is a graduate student of the Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.

AMO is a Post graduate student of the Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Ogun State Nigeria.

5 Acknowledgments

The authors are grateful to the technologist in the Department of Environmental Management and Toxicology, College of Environmental Resource Management, Federal University of Agriculture Abeokuta of the biotech center, Federal University of Agriculture, Abeokuta, Nigeria.

6. References

1. United Nations Conference on Sustainable Development (UNCSD) 2000.
2. Edunjobi GO. Preliminary study on physical, chemical and planktonic abundance of the fisheries reservoir University of Agriculture, Abeokuta. 2010; 55.
3. Ugwurnba AO, Ugwurnba AA. A study of the physicochemical hydrology and Plankton of Awba Lake in Ibadan, Nigeria. Fish Acad biz Comm. 1993; 1(1-4): 20-39.
4. Irfan R, Shakil AR. Impact of anthropogenic activities on water Quality of Lidder River in Kashmir Himalayas. Environ Monitoring Assessment 2012; 185(6).
5. Aina EOA, Adedipe NO (Eds). Water Quality Monitoring and Environmental Status in Nigeria. FEPA Monograph 6, FEPA, Abuja, Nigeria. 1996; 239.
6. Ayobahan SU, Ezenwa IM, Orogun EE, Uriri JE, Wemimo IJ. Assesment of Anthropogenic Activities on Water quality of Benin River. J Appl Sci Environ Manager. 2014; 18(4):629-636.
7. Ibrahim BU, Auta J, Balogun JK. An Assessment of the Physico-Chemical Parameters of Kontagora Reservoir, Niger State, Nigeria. Bayero J Pure Appl Sci 2009; 2(1):64-69.
8. Oribhabor BJ, Udoidiong OM, Udoh DF, Akpan BE. Evaluation of the Ecological Impact of Human Settlement on the Water Quality of Lower Cross River, Nigeria. J Ecosystems. 2013; 12.
9. Olalekan OI, Oladipupo SO, Habeeb AQ, Oluwaseun AB. Influence of Human Activities of the Water Quality of Ogun River in Nigeria. Civil Environ Res. 2012; 2(9):36-48.
10. Umunakwe JE, Akagha CI, Aharanwa BC. Influence of Industrial and Abattoir Waste on some Physicochemical and Bacteriological variables of Aba River. Civil Environ Res. 2013; 3(11):83-90.
11. Adebayo SA, Adediran.GO. Effect of Waste Water Discharge on the water quality of Asa River in Ilorin, Nigeria. Sci Focus 2005; 10(2):116-122.
12. Singhal RN, Swarenjeet, Davis RW. The physical chemical Environment and the plankton of managed ponds in Haryana, India- Proc. Indian Acad Sci 1986; 95:253-263.
13. Ekhaise FO, Anyasi C. Influence C of breweries effluent discharge on the microbiological and physicochemical quality of Ikpoba River, Nigeria. African J Biotech 2005; 4(10):1062-1065.
14. Akubugwo EI, Duru MKC. Human Activities and Water

Quality: A case study of Otamiri River, Owerri, Imo. Global Res. J Sci 2011; 1:48-53.
15. APHA. Standard methods for the examination of stwater and wastewater. 21 edition, Amercian public Health Association. Washington DC. 2005.
16. Rast W, Holland M, Rying SO. Eutrophication, Management framework for policy makers. MAB digest I. UNESCO, Paris. 1989; 83.
17. Murdoch T, Cheo M, O'laughlin K. Streamkeeper's Field Guide: Watershed Inventory and Stream Monitoring Method. "Adopt-a-Stream Foundation", Everett. 2001; 297.
18. Wang W, Wang A, Chen L, Liu Y, Sun R. Effect of pH on survival, phosphorus concentration, adenylate energy charge and Na+ - K+ ATPase activity of Penaeus chinensis Osbeck Juveniles. Aquatic Toxicol 2002; 60:75-83.
19. Ewa EE, Iwara AI, Adeyemi JA, Eja EI, Ajake AO, Otu CA. Impact of Industrial Activities on Water Quality of Omoku Creek. Sacha J Environ Studies 2011; 1(2):8-16.
20. Verla Samuel PO, Adakole JA, Suleiman B. Temporal and Spatial Physico-Chemical Parameters of River Galma, Zaria, Kaduna State, Nigeria. Resources Environ 2015; 5(4):110-123.