



Assessment of Seasonal Variations In The Physico-Chemical Parameters Of Bakolori Dam, Zamfara State, Nigeria

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ABSTRACT

The study investigates seasonal variations in the Physico-Chemical Parameters of Bakolori Dam, Zamfara State, Nigeria. Data for period from July 2015 to February 2016 for selected physico-chemical parameters were collected. Four sampling stations were selected, and standard procedures were adopted for determination of physico-chemical parameters. The parameters analyzed were, atmospheric temperature values which ranged from 26.36 to 28.81°C, water temperature 24.26 to 24.91°C, total dissolved solids 34.63 to 41.38ppm, electrical conductivity 67.63 to 82.60µs/cm, water transparency 2.05 to 2.81cm, dissolved oxygen was between 4.45 to 4.91mg/l, pH varied from 8.29 to 8.56, total alkalinity 0.63 to 0.70mg/l, chloride ranged from 0.81 to 0.98mg/l, nitrogen 0.66 to 0.68mg/l, ammonium 0.45 to 0.48mg/l, nitrate 0.66 to 0.76mg/l and phosphorus was between 0.14 to 0.21mg/l, and there was no significant difference ($p>0.05$) between the means of these parameters with respect to stations. Apart from the water transparency, seasonal variations observed between the parameters studied in Bakolori Dam in wet and dry seasons were found to be within the optimum ranges required for fish culture and domestic use hence the Dam was mildly polluted.

Keywords: physico-chemical parameters, seasonal variation, Bakolori dam

1.0 INTRODUCTION

1.1 Background of the Study

Lakes are socio-economically an important aquatic systems. According to Olanrewaju, *et al.* (2017) lakes are reservoirs of water and comprises of many different fish foods that are very much essential resources for the development and overall sustenance of any nation. Nigeria is one of the tropical countries that are blessed with abundance of renewable natural resources that includes freshwaters. One of these resources is the Bakolori Dam in Northwestern Nigeria. The quality of water in any ecosystem provides significant information about the available resources for supporting life in that ecosystem. Effluent discharges from industries contribute a serious environmental threat to water quality and aquatic resources, including biodiversity. However, declining water quality due to environmental perturbations threatens the stability of the biotic integrity and therefore hinders the ecosystem services and

functions of aquatic ecosystems. Fish growth is directly related to the quality of the water; hence, water quality monitoring can be used as an index to assess the status of aquatic ecosystem in which the fish lives.

According to Ojekunle, *et al.* (2014), water quality assessment generally involves analysis of physico-chemical, biological, and microbiological parameters and addresses abiotic and biotic status of the ecosystem. Several documented reports exist on the physico-chemical dynamics in Nigeria. These include the works of Ibrahim *et al.* (2019) on Bosso Reservoir; Ibrahim *et al.* (2015) on Zaria reservoir; Nwabeze and Erie (2013) on Jebba lake.

This work was therefore carried out to investigate some selected physical and chemical parameters of Bakolori Dam and to make deductions on the temporal and spatial variations

in water quality in terms of pollution and productivity.

2.0 MATERIALS AND METHODS

2.1 Description of the Study Area

Bakolori Dam is located in Maradun Local Government Area of Zamfara State, North-

western Nigeria, within a geographical location of 12° 30' 43" N, 6° 11' 0" E East (SRRBDA, 1992; Mohammed *et al* 2002). The dam covers an area and length of 8000ha and 19km and is a 5.5 km earth fill embankment, the Dam had a current water storage capacity of 51,010,927m³

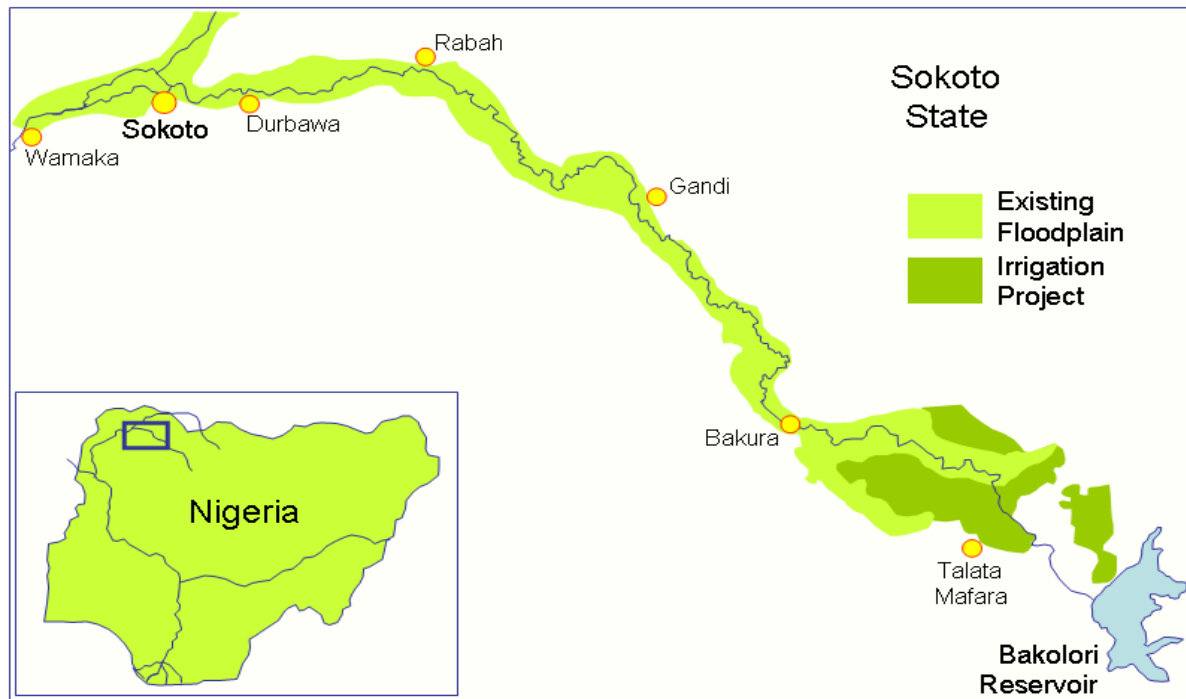


Figure 1: Map of Bakolori Dam Showing the Location of the Study Area.
Coordinate: 12° 30' 43" N, 6° 11' 0" E

2.2 Sampling Techniques

2.2.1 Sampling Stations

Sampling stations were selected based on preliminary surveys of the Bakolori Dam. And factors such as average depth, volume of water, accessibility, security and various activities taking place in and around the Dam.

2.3 Laboratory Analysis

2.3.1 Determination of Water Quality parameters

Four (4) water quality parameters (atmospheric/water temperature, pH, electrical conductivity, total dissolved solids) were measured using a Hanna digital multi parameter water proof tester model (98129) in situ. Secchi

disc was used in determining the transparency of all the water samples in the field.

2.3.2 Water Samples Collection

Water samples were collected between 06.00 to 08.00hours twice monthly from the four selected sampling stations namely 1, 2, 3 and 4 as indicated in (figure 1). The water samples were collected using water sampling bottles and were taken to the Central Laboratory, Usmanu Danfodiyo University Sokoto for analysis of physicochemical parameters.

2.3.3 Water/Atmospheric Temperature (0°)

Atmospheric temperature and surface water temperature of each station was determined using portable Hanna multi- parameter water

proof tester model (HI 98129). For each station, Atmospheric temperature was initially taken before immersing the probes in water. And this was then followed by water temperature with the probes in water. Atmospheric temperature and water temperature reading on the LCD dial were recorded for each station.

2.3.4 Hydrogen Ion Concentration (pH)

A portable HANNA multi-parameter water probe tester model (HI 98129) was used to take pH value of each station. At each station, the probe was inserted in water and reading displayed on the LCD dial was recorded, subsequent readings for the remaining stations was recorded after rinsing the probe in distilled water on the spot.

2.3.5 Total Dissolved Solid (TDS, mg/l)

The TDS was measured and recorded on the spot by inserting the HANNA Multi-parameter water probes tester into the water. And then, left to stabilize for about 5 minutes and readings was taken directly from the LCD dial screen.

2.3.6 Electrical Conductivity (EC, $\mu\text{s}/\text{cm}$)

Conductivity value of each station was determined with HANNA multi-parameter water tester model (HI 98129). For each station, the probe was inserted in water and the reading displayed on the LCD dials was taken and recorded on the spot.

2.3.7 Transparency (cm)

The secchidisc with graduated rope was used on site to determine transparency at each sampling stations. The disc was lowered in water, until it just disappears, and the depth was recorded, the disc then raised in water until it just reappears, the depth at which it just reappears was recorded. The average of the two measurements was considered as secchi disc visibility for each station.

2.3.8 Dissolved Oxygen (mg/l)

200ml of water sample was pipette in to bottle and 1ml of manganese sulphate MnSO_4 solution to the bottom and also in the same way 1ml of alkali-iodide azide solution was added and

shakes and waited for about 1 hour and it was become a clear solution. The precipitations were settled and decant most of the clear liquid and 2ml of concentrated auto phosphoric acid (H_3PO_4) was added. And it was titrated against 0.025m of sodium thiosulphate $\text{Na}_2\text{S}_2\text{O}_4$ to the normal color of the water.

2.3.9 Ammonium (mg/l)

Fifty (50) ml of water samples was measured using measuring cylinder, which was then transferred into distillation flask, then 0.2g of Magnesium Oxide (MgO) was also added into the flask. And the flask was mounted on a distillation apparatus. 10ml of boric acid indicator was placed into the conical flask under the condenser, the solution was placed into the condenser and the distillation was commenced. Twenty (20) ml of the distillate was collected and titrated the distillate against 0.01m H_2SO_4 from green to pink colour end point. Ammonium was calculated using the formula:

$$\text{NH}_4^+ (\text{mg/l}) = \frac{TV \times 0.01M \times 1000}{MI \text{ of sample}} \quad (1)$$

2.3.10 Nitrate (mg/l)

Fifty (50) ml of water sample was measured using measuring cylinder, which was then transferred into the distillation flask, 0.2g of Magnesium Oxide (MgO), and 0.4g devada alloy was also added into the flask. The flask was mounted on a distillation apparatus. 10ml of boric acid indicator was placed into the conical flask under the condenser, the solutions were then placed into the condenser and the distillation was commenced, 20 ml of the distillate was collected and titrated the distillate against 0.01m H_2SO_4 from green to pink colour end point. And nitrate was calculated using the formula: NO_3 (mg/l)

2.3.11 Nitrogen (mg/l)

Fifty (50) ml of water sample was measured into distillation flask and 20ml of 40% sodium hydroxide attached to distillation apparatus, and 10ml of boric acid indicator was into conical flask placed under the condenser and the distillation was commenced, then 20ml of distillate was titrated against 0.01m H_2SO_4 . The

color was changed from green to pink at the end point. The nitrogen was calculated using the following formula below.

$$NH(mg/l) = \frac{TV \times 100}{MI \text{ of sample}} \quad (2)$$

2.3.12 Total Alkalinity (mg/l)

To measure total alkalinity, fifty (50)ml of water sample was measured into conical flask and few drops of phenolphthalein indicator solution was added and was turn to pink color, and then it was titrated against 0.05m of H₂SO₄ to the colorless at the end. The pink colour was not produce after adding phenolphthalein indicator the carbonate was not present in the samples.

Then proceed for HCO₃, now a few methyl orange solutions were added and turned to yellow color and then was titrated against 0.05m H₂SO₄ was change from yellow to pink color at the end point and calculated using the formula below.

$$CO_3 HCO_3(mg/l) = \frac{1000 \times 0.05 \times tv}{MI \text{ of sample}} \quad (3)$$

2.3.13 Phosphorus (mg/l)

Phosphorus concentration was analyzed using Model 721A spectrophotometer. 2ml of water sample was pipette in to a 50ml volumetric flask, and 2ml of phosphorus extraction solution was added and another 2ml of ammonium molybdate and water was added to half to the flask and 1ml of dilute stannous chloride and make volume mark with distill water to 50ml. The solution was filled into the cubic and inserted into the spectrophotometer and the absorptions reading was taken at 660 wavelengths.

Phosphorus,

$$P = \frac{Abs. \times CF \times DF}{atomic \ weight \ of \ phosphorus} \quad (4)$$

Where:

Abs= Absorbance

CF= Conversion factor (0.61),

DF= Dilution factor (25ml) and atomic weight of P. = 30.97mg/l

2.3.14 Chloride (Cl)

Fifty (50)ml of water sample was measured in to the conical flask and 1ml of potassium chromate was titrated against 0.05m of silver nitrate, turbid brown color at the end point and do the

blank at the manner but using distill water. The chloride was calculated using the formula below

$$\frac{CL \quad (mg/l)}{1000 \times 0.05 \times tv \text{ of sample} - TV \text{ of blank}} = \frac{MI \text{ of sample}}{MI \text{ of sample}} \quad (5)$$

2.4 Statistical Analysis

All data on the physicochemical parameters and Heavy Metals for the period of eight months duration were subjected to one way analysis of variance (ANOVA). Mean separations were done using fisher's (LSD) at 95% confidence limit, correlation were also conducted for the physicochemical parameters of the Bakolori Dam and Student T- test were also used for the seasonal variations of the physicochemical parameters and heavy metals concentrations of the water. All analysis were conducted on Minitab 17 edition statistical software

3.0 RESULTS AND DISCUSSION

3.1 Results

Mean seasonal Variations of physicochemical parameters of Bakolori Dam, Zamfara State is presented in table 1. The mean values of the atmospheric temperature were lowest for dry season 25.31°C, but wet season had the highest atmospheric temperature value 29.55°C and the values differed significantly (p<0.01).

The surface water temperature values were lowest for dry season 21.01°C, while wet season had the highest surface water temperature value 28.35°C. However, the values differed significantly (p<0.01).

The total dissolved solids values were lowest for wet season 31.91ppm, while dry season had the highest total suspended solids value of 42.81ppm and the values differed significantly (p<0.01).

The electrical conductivity value was lowest for wet season 64.28µs/cm, with dry season having the highest electrical conductivity value of 84.34 µs/cm and there was significant difference (p<0.01) between the means.

The turbidity value was lowest for dry season with a mean value of 2.14cm, while the wet season had the highest turbidity value of 2.45cm and there was significant difference (p>0.05) between the means.

The dissolved oxygen value was lowest for dry season 4.61mg/l, while wet season recorded the highest dissolved oxygen value 4.84mg/l and there was significant difference ($p>0.05$) between the means.

The hydrogen ion concentration value was lowest for wet season with a value of 8.19, whereas the dry season recorded the highest hydrogen ion concentration with a value of 8.56 and there was strongly significant difference ($p<0.01$).

The carbonate value was below the detectable limit in water sampled of Bakolori Dam. The bicarbonate value was lowest for wet season 0.60mg/l, while the dry season had the highest bicarbonate value 0.76mg/l and there was significant difference ($p>0.05$).

The chloride value obtained was lowest for dry season 0.60mg/l, while the wet season had the highest chloride value of 1.14mg/l. The chloride value differed significantly ($p<0.01$) between the mean values. The nitrogen value was lowest for dry season 0.61mg/l, but the wet season had the highest nitrogen value of 0.73mg/l and there was significant difference ($p<0.01$) between the means.

The ammonium value was lowest for wet season 0.45mg/l, while the wet season had the highest ammonium value of 0.49mg/l and the result showed that there was no significant difference ($p>0.05$) between the means.

The nitrate value was lowest for wet season 0.70mg/l, while the wet season had the highest nitrate value 0.77mg/l with the result showing significantly different mean values ($p<0.05$).

The phosphorus value was lowest for wet season 0.15mg/l, whereas the dry season had the highest phosphorus value 0.16mg/l. The phosphorus value strongly differed significantly ($p<0.01$) between the means.

The mean monthly variations in water quality parameters across the stations studied in Bakolori Dam is presented in figures. It showed that the atmospheric temperature values across

the stations had a mean value that ranged between 26.36 to 28.81°C in sampling stations 3 and 4. There was no significant difference ($p>0.05$) between the means. The water temperature values ranged between 24.26 to 24.91°C in stations 1 and 3. There was no significant difference ($p>0.05$). The mean values for Total Dissolved Solids ranged between 34.63 to 41.38ppm in stations 4 and 1. And the mean values showed no significant difference ($p>0.05$). The mean values for electrical conductivity ranged between 67.63 to 82.60 μ s/cm in stations 3 and 1, and there was no significant difference ($p>0.05$) between the mean values. The transparency value across the stations was within the range of 2.05 to 2.81cm in stations 2 and 1. There were no significance differences ($p>0.05$) between the means.

The dissolved oxygen values ranged between 4.45 to 4.91mg/l in stations 2 and 4. And there were no significant differences ($p>0.05$) between the values across the stations. The mean values of hydrogen ion concentration across the stations ranged between 8.29 to 8.56 in stations 4 and 1. And the values showed no significant differences ($p>0.05$). The mean values of bicarbonate ranged between 0.63 to 0.70mg/l in stations 3 and 1. And showed no significant differences ($p>0.05$). The carbonate value was not detected throughout the period of the study in Bakolori Dam. The chloride values ranged between 0.81 to 0.98mg/l in stations 4 and 2. And showed no significant difference across the stations ($p>0.05$). The nitrogen values ranged between 0.66 to 0.68mg/l in stations 3 and 2. And showed no significant differences ($p>0.05$) between the means. The mean values of ammonium ranged between 0.45 to 0.48mg/l in stations 2 and 1. And the values did not differ significantly. The nitrate value across the stations ranged between 0.66 to 0.76mg/l in stations 3 and 2. And showed no significant differences ($p>0.05$) between the mean values. The mean values of phosphorus ranged between 0.15 to 0.15mg/l in the stations 1 to 4. And showed there was no significant differences ($p>0.05$).

Table 1: Mean Seasonal Variations of Physico-chemical Water Parameters of Bakolori Dam in Zamfara State, Nigeria

Variables	Seasons		DF	T-Values	P-Values
	Dry	Wet			
Air Temperature (°C)	25.31±0.81	29.55±0.45	48	-4.56	<0.01**
Water Temperature (°C)	21.01±0.64	28.35±0.38	50	-9.77	<0.01**
Total Dissolved Solids (ppm)	42.81±1.81	31.91±2.68	54	3.38	<0.01**
Electrical Conductivity (µS/cm)	84.34±3.88	64.28±5.43	56	3.01	<0.01**
Turbidity (cm)	2.14±0.19	2.45±0.19	61	-1.12	0.26
Dissolved oxygen (mg/l)	4.61±0.06	4.84±0.17	40	-1.25	0.21
PH	8.56±0.06	8.19±0.09	55	3.31	<0.01**
Carbonate (mg/l)	0.00±0.00	0.00±0.00	-	-	-
Bicarbonate (mg/l)	0.76±0.09	0.60±0.01	32	1.71	0.09
Chlorides (mg/l)	1.14±0.12	0.06±0.01	42	4.03	<0.01**
Nitrogen (mg/l)	0.73±0.03	0.61±0.03	61	2.53	0.01*
Ammonium (mg/l)	0.49±0.02	0.45±0.01	61	1.63	0.10
Nitrate (mg/l)	0.77±0.02	0.70±0.02	61	2.04	0.04*
Phosphorus (mg/l)	0.16±0.00	0.15±0.00	61	4.74	<0.01**

** indicates statistical significance at 0.01%; * indicates statistical significance at 0.05%. 0.00: Not detected

Table 2: Variations in Physico-chemical Parameters of water across the Stations in Bakolori Dam, Zamfara State, Nigeria

Parameters	Mean Values for the Sampling Sites				Sig.
	Site 1	Site 2	Site 3	Site 4	
Air Temperature (°C)	26.93±0.86	27.64±1.11	26.36±1.06	28.81±1.20	0.40 ^{ns}
Water Temperature (°C)	24.26±1.74	24.72±1.11	24.91±1.33	24.84±1.23	0.98 ^{ns}
Total Dissolved Solids (ppm)	41.38±5.63	38.50±3.39	34.94±1.62	34.63±1.77	0.47 ^{ns}
Electrical Conductivity (µS/cm)	82.60±11.40	77.31±6.63	67.63±3.68	69.69±3.62	0.42 ^{ns}
Transparency (cm)	2.81±0.45	2.05±0.15	2.22±0.21	2.09±0.10	0.17 ^{ns}
Dissolved oxygen (mg/l)	4.79±0.13	4.45±0.29	4.76±0.13	4.91±0.13	0.37 ^{ns}
PH	8.56±0.11	8.35±0.12	8.31±0.09	8.29±0.13	0.35 ^{ns}
Carbonate (mg/l)	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	-
Bicarbonate (mg/l)	0.70±0.11	0.69±0.11	0.63±0.06	0.69±0.07	0.95 ^{ns}
Chlorides (mg/l)	1.86±0.17	0.98±0.20	0.83±0.69	0.81±0.05	0.86 ^{ns}
Nitrogen (mg/l)	0.68±0.04	0.67±0.05	0.66±0.05	0.67±0.05	0.99 ^{ns}
Ammonium (mg/l)	0.48±0.03	0.45±0.02	0.47±0.03	0.47±0.02	0.80 ^{ns}
Nitrate (mg/l)	0.76±0.04	0.76±0.03	0.66±0.03	0.76±0.03	0.15 ^{ns}
Phosphorus (mg/l)	0.15±0.00	0.15±0.00	0.15±0.00	0.15±0.00	0.92 ^{ns}

Means on the same row are not statistically significant (p>0.05). ns = not significant, 0.00: Not detected, Site.1: (downstream), Site. 2: (midstream), Site. 3 (midstream), Site.4 (upstream).

3.2 Discussion

3.2.1 Mean Seasonal Variation of Some Physico-Chemical Parameters of Bakolori Dam Zamfara State, Nigeria (July 2015 to February 2016)

The findings of this study revealed that, there were some marked variations in the physico-chemical parameters observed for the sampling stations and the seasons of Bakolori Dam. Water temperature values of 21.01°C and 28.35°C for the dry and wet seasons for the entire reservoir,

compares well with the ranges recorded for other tropical lakes. The low water temperature of Bakolori Dam during the dry season obtained in this study could be as a result of seasonal changes in air temperatures associated with the cool dry North- west trade winds (Harmattan). Zubia *et al.*, (2015) recommended temperature range of 26 – 32°C for the productivity and growth of fish. This implies that the temperature range in Bakolori Dam is suitable for fish growth.

The relatively, high total dissolved solids values (42.81ppm) observed during the dry season could be attributed to low level of water and impact of decomposing waste materials deposited during the wet season. The higher total dissolved solids value in the dry season compared with the observations by (Sikoki and Veen, 2004) also acknowledged seasonal and daily changes in the concentration of substances present in a water body. According to WHO (2011) normal values of total dissolved solids of water ranges from 500-1000mg/l.

The high value of electrical conductivity in the dry season (84.43 μ s/cm) may be due to the higher rate of evaporation that reduced the water level and increased concentration of nutrients due to runoff from inorganic fertilizer from irrigation farm lands. Decrease in conductivity values during the wet season might be due to increase in rainwater which caused dilution of the dissolved solids in the Dam.

The water transparency value for the wet season (2.45cm) was the highest compared to that of the dry season and this could be due to floodwater, surface runoffs and settling effect of suspended materials from catchment area that followed the cessation of rainfall. The mean values were low in comparison to the findings by Utang and Akpan (2012) where a range of (126.2 to 130.9NTU) was reported for turbidity. The disparity could be as a result of the differences that existed between the two water bodies. According to Adjarho *et al.* (2013) turbidity range from 35-80 cm is good for fish health, 15-40 cm is good for intensive culture system and < 12 cm causes stress.

The mean concentrations of dissolved oxygen of Bakolori Dam ranged between (4.84 – 4.61mg/l). Wet season showed higher concentrations (4.84mg/l) than the dry season (4.61mg/l). With the peak period during the wet season. Low concentration was observed in the dry season. The higher dissolved oxygen recorded in the wet season in this present study was attributed to increase mixing of water in the Dam. The Bakolori dam exhibit lotic

characteristics during the wet season which create constant movement as well as turbulences and a resultant exposure of the water to atmospheric air with resultant increase in dissolved oxygen content of the dam during wet season. Almost similar results were reported in some reservoirs such as Dirican (2015) in Camligoze dam, Turkey; Mandal *et al.* (2013) in Karola reservoir, India; Anago *et al.* (2013) in Awba reservoir, Nigeria. The low dissolved oxygen in this present study in the dry season could be attributed to the peak time of biochemical oxygen demand due to bacteria and other decomposers uptake. The mean levels in this study supported the requirement for survival of freshwater and aquatic life (Chapman and Kimstach, 2012).

A pH range of (6.0 to 9.0) appears to provide protection for the life of fresh water fish and bottom dwelling invertebrates. pH of Bakolori Dam was within (8.56 to 8.19). The (8.56) of pH during the dry season may be due to decomposition of living organisms in the water coupled with the reduction in the water levels during the dry season. The little decrease in (8.19) pH during the wet season was probably due to the stirring effect of the incoming flood from the rivers that converged towards the dam resulting in the mixing of poorly alkaline bottom water with alkaline surface water to reduce pH in the dam.

The mean total alkalinity values (0.76 – 0.60mg/l) for the dry and wet season. The alkalinity values were higher in the dry season and lower in the wet season, when the dam had higher water level. This could be due to low water levels with its attendant concentration of salts and lower value in the wet season could be due to dilution. Mine Lake. The WHO (2011) report has no stated guideline value for alkalinity because high concentrations of carbonate / bicarbonate. Species in drinking water does not pose any health concern (WHO, 2011).

Nitrate /nitrogen concentrations varied with the seasons. It was below 10mg/l limit at dry and wet seasons. There was significant difference ($p < 0.01$) and (> 0.05) between the seasons. This

agrees with the finding of Ideriah *et al.* (2010), and they attribute it to the reduction of water volume in the dry season, and the dilution effect in the wet season. The implication of dam waters nitrate concentrations is the stimulation of plankton and water weeds that provide for fish. If algae growth too widely, oxygen levels will be reduced, and fish will die. Park (2009) stated that the guideline value for nitrate in drinking water is solely to prevent metamolobinaemia, which depends upon the conversion of nitrate to nitrite.

The mean value (0.16mg/l) obtained for dry season could be due to the concentration effect because of reduced water volume in the reservoir. It also could be due to lower water hardness, thus less co precipitation of phosphorus with calcium carbonate, a phenomenon that has often been reported to occur in many fresh water lakes Heleen *et al.* (1995). Akpan and John (1993), reported similar finding in Cross River State Eastern Nigeria.

The mean chloride concentration of 1.14 – 0.60mg/l was generally below the permissible limit of 250mg/l, for surface water to be used for drinking water E. U. (1989). Although there were inputs of pollutants from municipal wastes in to the Dam, the level was not high enough to significantly increase chloride concentration above the limit.

4.0 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

It can be concluded that the higher dissolved oxygen recorded in the reservoir of the Bakalori dam in the wet season in this present study was attributed to increase mixing of water in the Dam. The Bakalori dam exhibit lotic characteristics during the wet season which create constant movement as well as turbulences and a resultant exposure of the water to atmospheric air with resultant increase in dissolved oxygen content of the dam during wet season. Apart from the transparency, other parameters were found to be within the optimum ranged required for fish culture. Therefore, Bakolori Dam was within tolerant limits required for fish production hence the Dam is mildly polluted.

4.2 Recommendations

The following recommendations are hereby, made:

- i. The water quality of the Dam should be monitored regularly to ensure that good quality water for irrigation and domestic activities are maintained.
- ii. Similar studies should be carried out to assess other physicochemical water parameters such as Heavy metals in water, sediment, and fish species of Dam.
- iii. Regular monitoring should be conducted to ensure the continued safety of the water and fish species from the Dam.

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