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LIMNOLOGICAL STUDIES OF BOSSO DAM AND IT'S TRIBUTARIES IN MINNA, NIGER STATE NIGERIA

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ABSTRACT

The physico-chemical parameters of Bosso Dam were analyzed weekly for a period of six (6) weeks from 29th October, 2009. In all, six (6) stations were identified within the dam. The physico-chemical parameters assessed were: temperature, dissolved oxygen, pH, alkalinity, hardness, conductivity and transparency. The results obtained from the analysis revealed slight variations in most parameters. There was no significant difference p>0.05 in pH regardless of stations and weeks. But significant difference p>0.05 were observed in dissolved oxygen, nitrate, temperature, conductivity, hardness, alkalinity, biological oxygen demand, transparency, in respect regard to stations. These variations could be due to influx of organic waste from surface run offs and inorganic waste deposited by man. The physico-chemical parameters observed, indicated that most of them fall with the recommended range or standard by the Federal Ministry of Environment (FMENV, 2000).

Keywords: Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Transparency,and Total Alkalinity.

INTRODUCTION

Water is the most valuable resource to man and other living organisms. About 70% of the human body weight is water and many body functions depend on it (FMENV, 2000). It also serves as a shelter for organisms living in it. Ofojekwu (1990) stated that human activities and a lot of natural process many directly or indirectly alter the composition and condition of natural water. The importance of water as a resource is not only in its availability and quantity, but also its quality. Studies have shown that the conversion of lotic ecosystems to lacustrine one causes changes in water quality (Adebisi, 1981; Kariman, 1982; Khan and Ejike, 1984; Elewa 1985; Akhurst and Breen, 1988). Variations in water quality have been explained in terms of dominance of precipitation chemistry, bedrock chemistry or evaporation, the crystallization process within the dam and its entire basin i.e. the hydrological regime of the water body which affects water depth and nutrient tributary in streams. (Welcome, 1985; Stirling, 1985; Sidinei *et al* 1992; Kolo and Oladimeji, 2004 and, Kolo and Tukura 2007). Surface and ground water have been associated with toxic synthetic chemicals such as a heavy metals and pesticides, nutrient enrichment and recently, acidification (FEPA, 1991).Water contamination is caused by chemical physical and biological processes, which also serve as factors controlling the composition of natural water (Boyd and Froshbish, 1990). Olusegun (1989) viewed that apart from assessing the water sources, that is, stream, rivers, lakes, manmade lakes and ground water such as wells and springs, quality of water should also be assessed. Agricultural activities have been known to contribute to surface water quality deterioration. Evaporation has also been known to consume much of the water applied during irrigation, thus concentrating the salts into the water and soil. The remaining may either infiltrate where it becomes more highly mineralized or flow across the surface into streams, lakes and rivers. Sediments from agricultural lands and construction sites could add their load to surfaces waters, smother benthic organisms and impair water quality for fish spawning and breeding (FMENV, 2000).

MATERIAL AND METHODS

Bosso Dam is located at latitude 9° 39N and longitude 6° 33E in Minna, Niger state. It is a small water body with a mean depth of 6.1M (20.2FT). The dam is shaded by shrubs, trees and bushes especially in the rainy season. The main use of the dam is for water supply (i.e. portable water) supply for domestic use and irrigation. The resources in the dam are conserved and protected from poachers by making it a restricted area. Most changes in the dam were brought about by flooding of terrestrial organic and inorganic materials, defecation of animals and siltation.

The dominant fish species in the dam is *Tilapia zilli.* Crocodiles also inhabit the dam.

The plan of the research work involved weekly sampling of the water for the physico-chemical parameters for six (6) weeks (i.e. from 29th, October to 3rd, December 2009), at six (6) different stations within the Bosso Dam.

Temperature readings were taken in the morning hours (9-11am) at a depth of about 5cm, using a thermometer (D-100°C), by allowing it to remain in the water for at least 2 minutes. Readings were taken at the six stations differently one at a time, where water samples were collected. The temperature of both water and air were taken and the mean values recorded.

A seechi disc was used to determine the transparency of the water. The average of the two readings were taken and recorded as the transparency of the water measured in cm.

Water samples were collected from the different stations and taken to the laboratory where the pH was measured. pH was measured using a digital pH meter model, Kent EIL 7045/46 at room temperature.

The electrical conductivity of water samples was determined in the laboratory using a digital conductivity meter model WPA CMD 400, and values expressed as μs/cm.

Alkalinity of the water samples were determined by taken 50mls of water in a conical flask, and then 3 drops of methyl orange indicator was added. The solution was titrated using 0.02N sulphuric acid until the colour of the solution changed from yellow to orange or pink which marks the end point. The total alkalinity was calculated using the equation below:

Total alkalinity mg/L=

$$\frac{\text{Vol } (H_2SO_4) \times \text{molarity } (H_2SO_4) \times 100{,}000}{\text{Volume of sample}}$$

Total hardness was determined by adding 1ml of Ammonium chloride buffer solution to 50mls of water and followed by adding a pinch of Eriochrome Black-T indicator. The resultant wine colour was titrated using 0.01N Etheyline- Diamine-ethanoic Acid (EDTA) until a blue end point was observed. Hardness in milligram per liter was calculated using the formula below:

Total hardness in mg/l as $CaCO_3$ =

$$\frac{\text{Vol.of EDTA} \times N \times 1000}{\text{Vol. of sample}}$$

Dissolved oxygen content of the dam water was measured using the Azide modified Winkler's method as recommended by (APHA, 1985; Stirling and Phillips, 1990). Water samples were collected in BOD stopper bottle and fixed on the field with reagent 1 (Manganous sulphate) and reagent 2 (alkaline iodide solution). Concentrated sulphuric acid was then added to each sample in the laboratory and mixed gently. 10mls of the sample was collected into a conical flask and a drop of starch indicator was added to the sample. The sample was then titrated using 0.025N sodium thiosulphate until the dark blue or purple colour turned colourless.

Dissolved oxygen was calculated as given below:

DO (mg/L) =

Titer value x 0.025 x 8 x1000/Water sample

Biochemical Oxygen Demand BOD was determined principally by incubating water sample. The samples were incubated using the BOD stopper bottles, stored in a dark place at room temperature for five (5 days). The oxygen content of the incubated sample was determined after 5 days using the Azide modified Winkler's method.

Kjeldahl distillation apparatus was used in the determination of ammonia. 10ml of water sample was discharged into the reaction chamber using a pipette. 5mls of 40% Na0H was then added into the chamber, and the reaction between the two solvents librated ammonia. The flask which contained water from an external source was subjected to heat from an electric burner for the water to boil. The flask was then connected to the condenser and cooling water from a tap. 10mls of 4% boric acid solution and 3 drops of mixed indicator (Bromo cresol green and methyl red) was discharged into a 250ml receiving flask ensuring that the tip of the condenser was immersed into the receiving solution. Distillation continued slowly until 50ml of the distillate was collected in the receiving flask. The resultant solution was then titrated with 0.0545mls of standard HCl acid (hydrochloric acid) until the colour at the end point changed from blue to pink. The calculation was done using the following formula.

$$MgNH3 = \frac{TVxMx17x100}{Vol.\ of\ sample}$$

Phosphate calibration standards were prepared .The solution was thoroughly mixed to a standard. The amount of phosphorus in the sample was read and concentration was calculated thus; $mgL\rho^{-1} = \mu g\ \rho/v$

Nitrate was measured by preparing standard solutions and the concentration of NO_3^- was expressed as mg/L in the samples.

Statistical analysis of the samples was carried out using the one way Analysis Of Variance (ANOVA) to determine the variation of parameters within the weeks and from station to station. Duncans multiple range test for the separation of mean was used to compare parameters between weeks and also between stations.

TABLE 1: MEAN WEEKLY VALUES OF PHYSICO-CHEMICAL PARAMETERS OF BOSSO DAM WATER

Week	1	2	3	4	5	6
Temperature (°C)	29.72±0669^{d}	28.94±0.873^{c}	28.00±0.767^{a}	28.39±0.989^{ab}	29.92±0.752^{d}	28.78±0.878^{bc}
Transparency (cm)	101.83±1.724^{ab}	102.56±0.984^{bc}	102.17±0.985^{ab}	103.08±1.259^{c}	102.61±1.577^{bc}	101.61±2.118^{a}
P^{H}	7.94±0.166^{b}	7.57±0.036^{a}	7.56±0.070^{a}	7.52±0.091^{a}	7.54±0.077^{a}	7.39±0.735^{a}
Conductivity (µs/cm)	55.00±4.446^{c}	53.94±4.439^{a}	54.00±4.159^{a}	53.83±4.396^{a}	54.22±4.440^{ab}	54.78±4.305^{bc}
Alkalinity (mg/L)	40.78±5.275^{ab}	41.00±3.378	41.00±4.130^{abc}	42.00±2.473^{c}	41.22±6.179^{bc}	40.00±4.229^{a}
Hardness (mg/L)	17.82±6.504^{a}	19.89±4.314^{bc}	20.63±5.038^{c}	19.93±6.101^{bc}	18.76±8.462^{ab}	19.19±6.175^{abc}
DO (mg/L)	5.89±0.669^{b}	5.60±0.445^{a}	5.88±0.717^{b}	6.23±0.885^{c}	6.69±0.879^{e}	6.46±0.811^{d}
BOD (mg/L)	2.65±0.458^{a}	2.51±0.514^{a}	2.86±0.925^{b}	2.82±1.235^{b}	3.42±0.565^{c}	3.30±1.045^{c}
Ammonia (mg/L)	1.06±389^{c}	0.84±0.120^{b}	0.84±0.130^{b}	0.79±0.103^{a}	0.76±0.125^{a}	0.88±0.143^{b}
Nitrate (mg/L)	0.2±0.024^{d}	0.22±0.020^{c}	0.22±0.013^{c}	0.20±0.020^{abc}	0.20±0.017^{a}	0.21±0.017^{b}
Phosphate (mg/L)	0.42±0.023^{c}	0.42±0.017^{c}	0.40±0.012^{bc}	0.04±0.070^{b}	0.37±0.027^{a}	0.38±0.037^{a}

TABLE 2: MEAN STATION VALUES OF PHYSICO-CHEMICAL PARAMETERS OF BOSSO DAM WATER

Cc	1	2	3	4	5	6
Temperature (°C)	29.72±0669^{d}	28.94±0.873^{c}	28.00±0.767^{a}	28.39±0.989^{ab}	29.92±0.752^{d}	28.78±0.878^{bc}
Transparency (cm)	101.83±1.724^{ab}	102.56±0.984^{bc}	102.17±0.985^{ab}	103.08±1.259^{c}	102.61±1.577^{bc}	101.61±2.118^{a}
P^{H}	7.94±0.166^{b}	7.57±0.036^{a}	7.56±0.070^{a}	7.52±0.091^{a}	7.54±0.077^{a}	7.39±0.735^{a}
Conductivity (µs/cm)	55.00±4.446^{c}	53.94±4.439^{a}	54.00±4.159^{a}	53.83±4.396^{a}	54.22±4.440^{ab}	54.78±4.305^{bc}
Alkalinity (mg/L)	40.78±5.275^{ab}	41.00±3.378	41.00±4.130^{abc}	42.00±2.473^{c}	41.22±6.179^{bc}	40.00±4.229^{a}
Hardness (mg/L)	17.82±6.504^{a}	19.89±4.314^{bc}	20.63±5.038^{c}	19.93±6.101^{bc}	18.76±8.462^{ab}	19.19±6.175^{abc}
DO (mg/L)	5.89±0.669^{b}	5.60±0.445^{a}	5.88±0.717^{b}	6.23±0.885^{c}	6.69±0.879^{e}	6.46±0.811^{d}
BOD (mg/L)	2.65±0.458^{a}	2.51±0.514^{a}	2.86±0.925^{b}	2.82±1.235^{b}	3.42±0.565^{c}	3.30±1.045^{c}
Ammonia (mg/L)	1.06±389^{c}	0.84±0.120^{b}	0.84±0.130^{b}	0.79±0.103^{a}	0.76±0.125^{a}	0.88±0.143^{b}
Nitrate (mg/L)	0.2±0.024^{d}	0.22±0.020^{c}	0.22±0.013^{c}	0.20±0.020^{abc}	0.20±0.017^{a}	0.21±0.017^{b}
Phosphate (mg/L)	0.42±0.023^{c}	0.42±0.017^{c}	0.40±0.012^{bc}	0.04±0.070^{b}	0.37±0.027^{a}	0.38±0.037^{a}

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ndings revealed that temperature hest week 5 (29.56°C) and lowest k 1 (28.50° C). Duncans multiple est for separation of mean showed nperature at weeks 1,3,4 and 6 were gnificantly different ($p>0.05$) but cantly different in weeks 2 and 5 5),and were also not significantly nt from each other.

ns multiple test also showed that rature at stations 1 and 5 were icantly higher (29.72 ± 0.669) and 2 ± 0.725) and significantly lower at n 3 (28.00 ± 0.767). There was much ficant difference in temperature at all stations except stations 1 and 5 which were significantly indifferent ($p>0.05$).

Duncans multiple range test for separation of mean revealed that transparency in weeks 3 was the highest (103.39 cm) and the lowest in week 6. Transparency in weeks 1, 2 and 3 were not significantly different from those in weeks 4, 5 and 6($p<0.05$).In terms of stations, the highest transparency value was at station 4 (103.08cm) and the lowest was at station 6 (101.61cm). There were significant differences($p<0.05$) between stations 1, 2, 4, and 6 and no significant difference($p>0.05$) between stations 1 and 3 and also between stations 2 and 5.

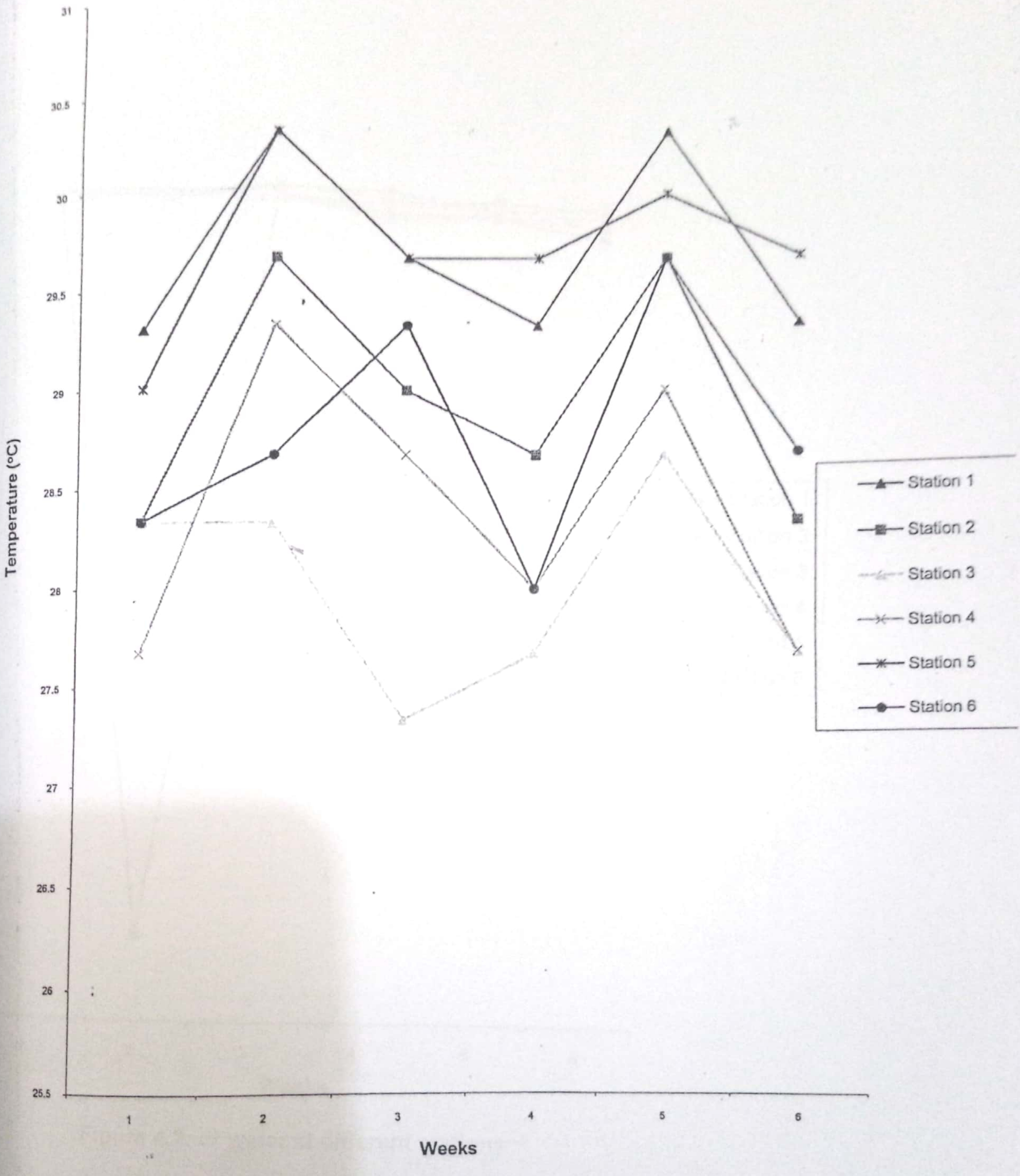

Figure 4.1: Temperature of water at different stations

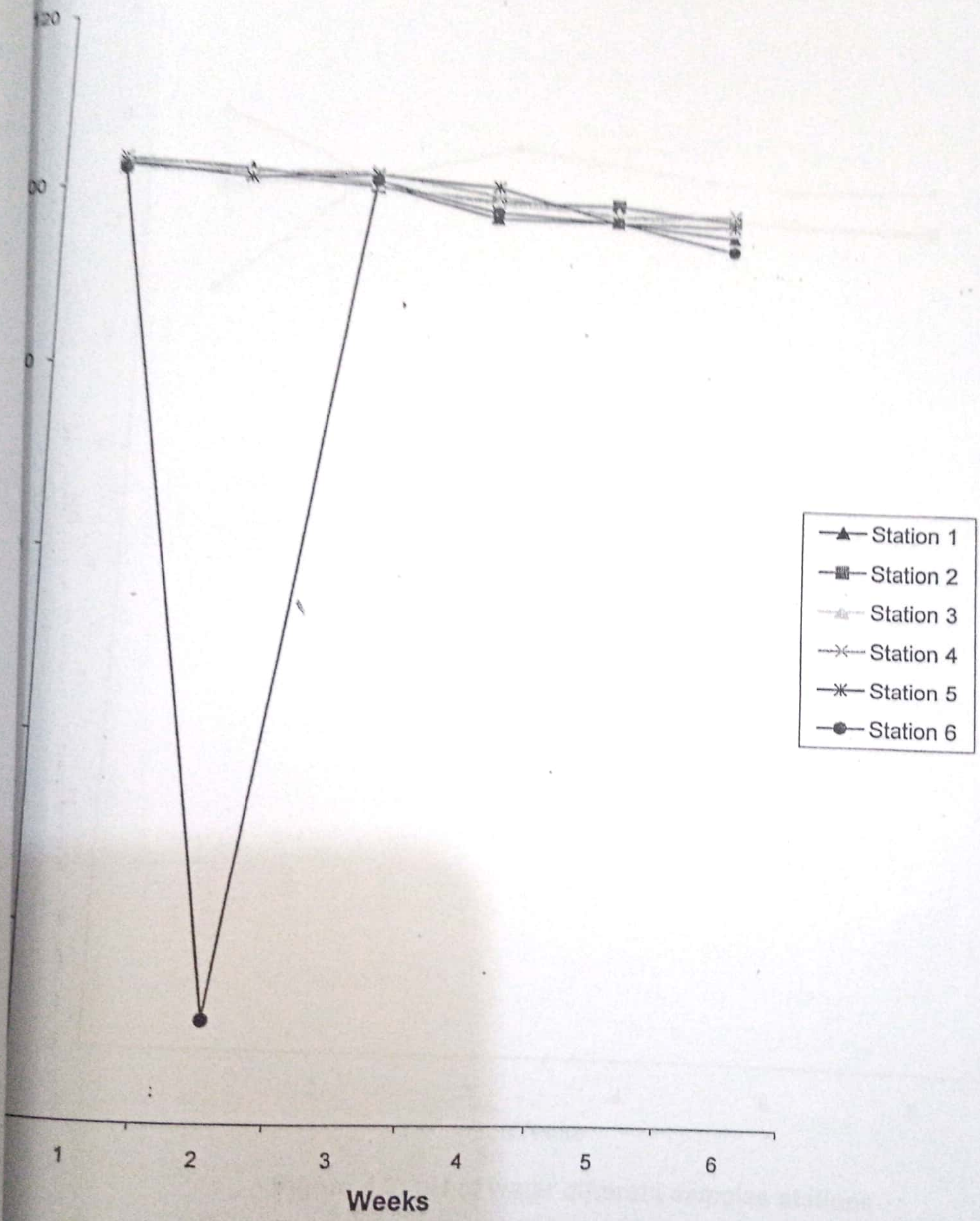

Figure 4.2: of water at different stations

ultiple test of transparency at there were no significant between weeks 1, 3 and 2, 5 respectively. However, there were significant differences between weeks 4 and 6.

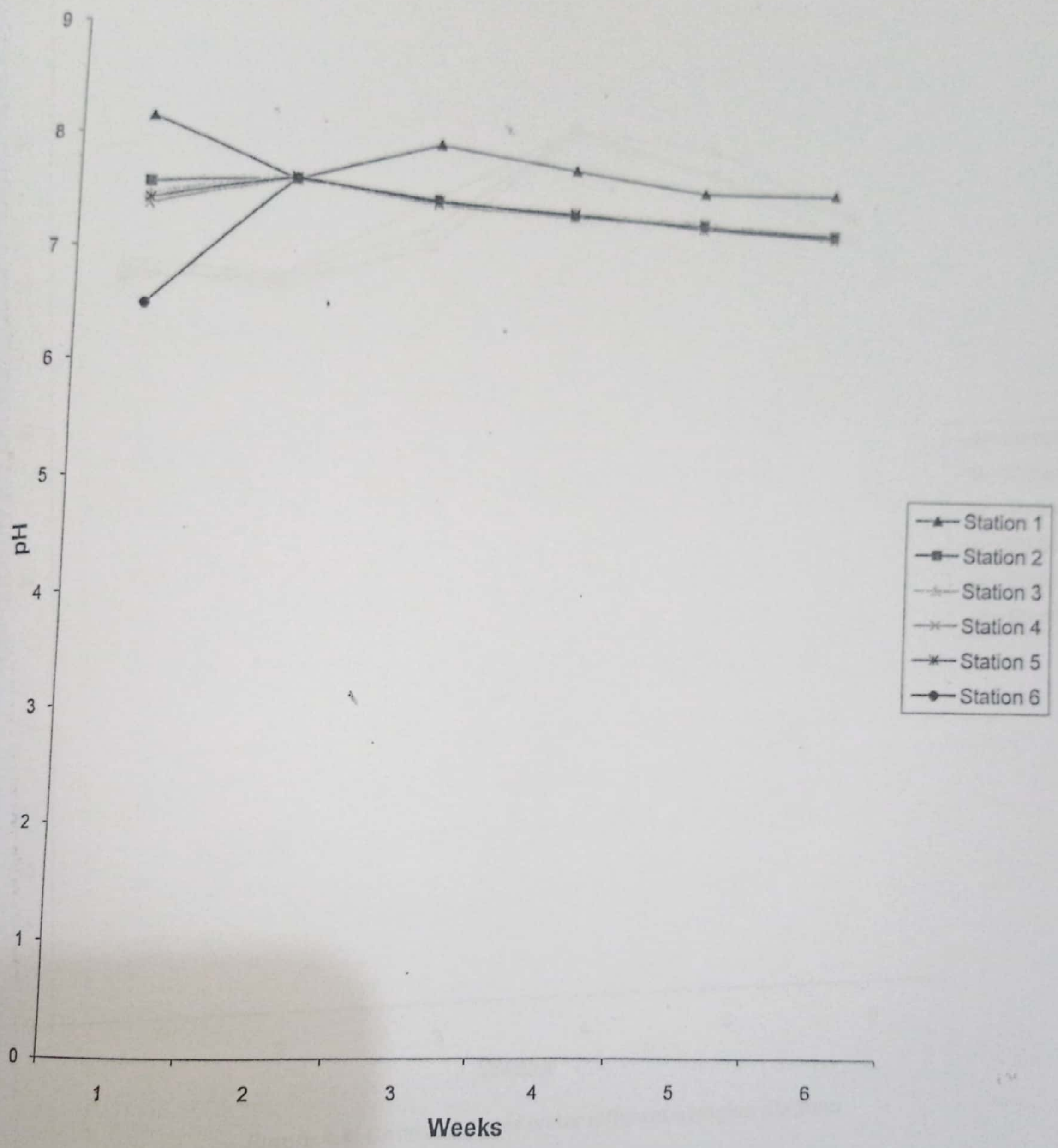

Figure 4.3: pH of water different samples stations

Duncan multiple range test of separation of mean showed that pH in all other weeks was significantly higher than in week one. There was no significant difference ($p > 0.05$) in p^H in weeks 2,3,4,5 and 6 but were significantly difference ($p < 0.05$) from the p^H in week 1.

In terms of stations, station 1 had significantly higher p^H (7.94) than stations 2,3,4,5 and 6. Station 6 had the lowest p^H (7.39). The p^H at stations 2,3,4,5 and 6 showed no significant difference $p > 0.05$ from each other but were significantly different $p < 0.05$ from p^H at station 1

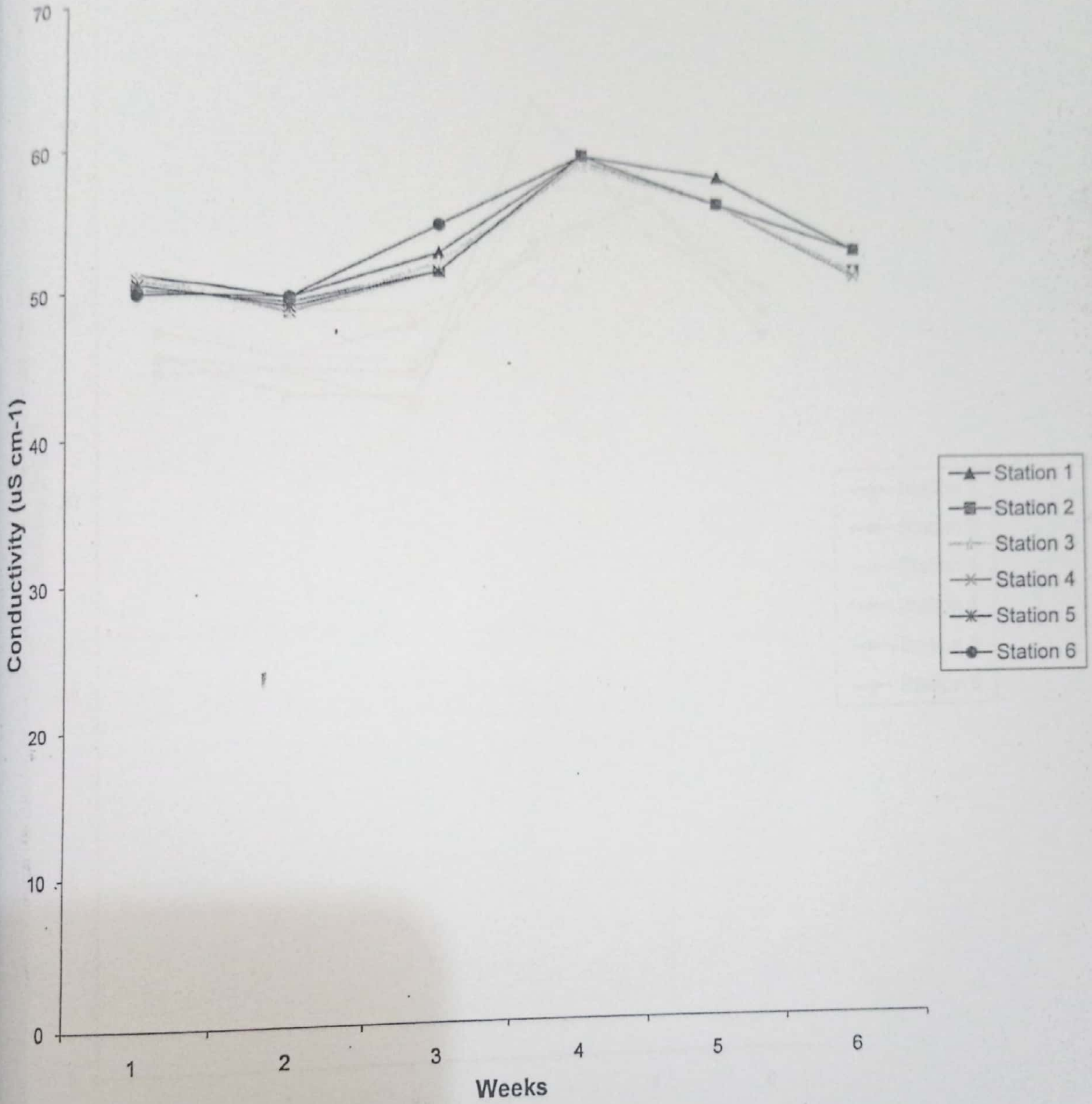

Figure 4.4: Conductivity of water different samples stations

The conductivity of water in Bosso Dam showed a high value (60.83µs\ cm) in week 4 and a low value (49.17µs/cm) in week 2. Duncan multiple range test for separation of mean revealed that there was significant difference $p < 0.05$ in conductivity in all the weeks having slight difference in values.

The Duncan multiple range test for separation of mean showed that at station 1 the highest conductivity value (55.00µs/cm) was recorded and the lowest value (53.83µs/cm) recorded at station 4. There was no significant difference $p > 0.05$ in conductivity at stations 2, 3 and 4 which were significantly different $p < 0.05$ from stations 1, 5 and 6.

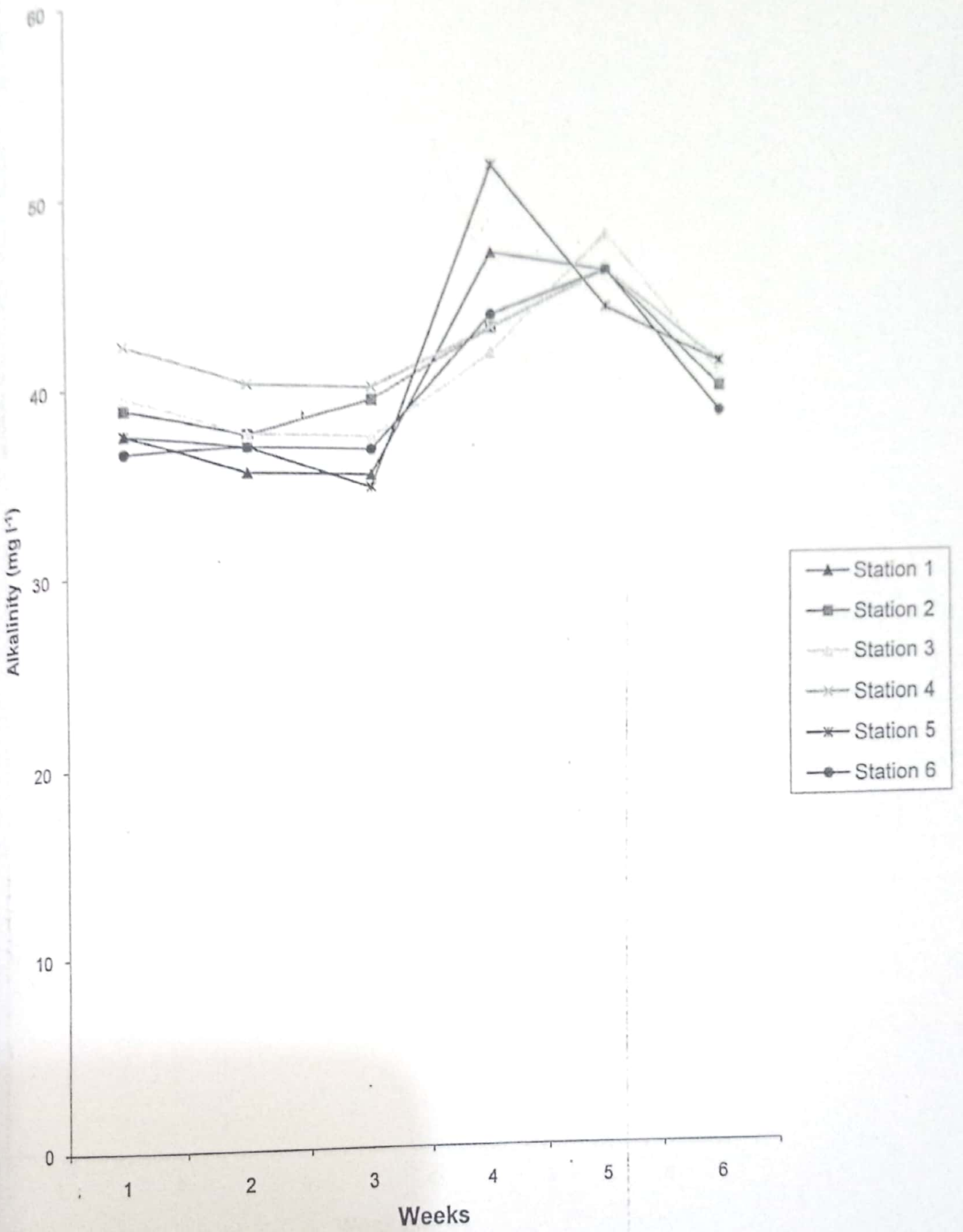

Figure 4.5: Alkalinity of water different samples stations

In week 5, the highest alkalinity value (46.33mg/L) was recorded and the lowest value (37.22mg/L) was recorded in weeks 2 and 3. There was no significant difference p>0.05 between weeks 2 and 3, whereas weeks 1, 4, 5 and 6 were significantly different p< 0.05 from each other. In terms of stations, the highest alkalinity value (42.00mg/L) was recorded at station 4, and the lowest value (41.00mg/L) was recorded at station 6. There was no significant difference p> 0.05 in alkalinity between stations 2 and 3. Stations 1, 4, 5 and 6 were significantly different p< 0.05 from each other.

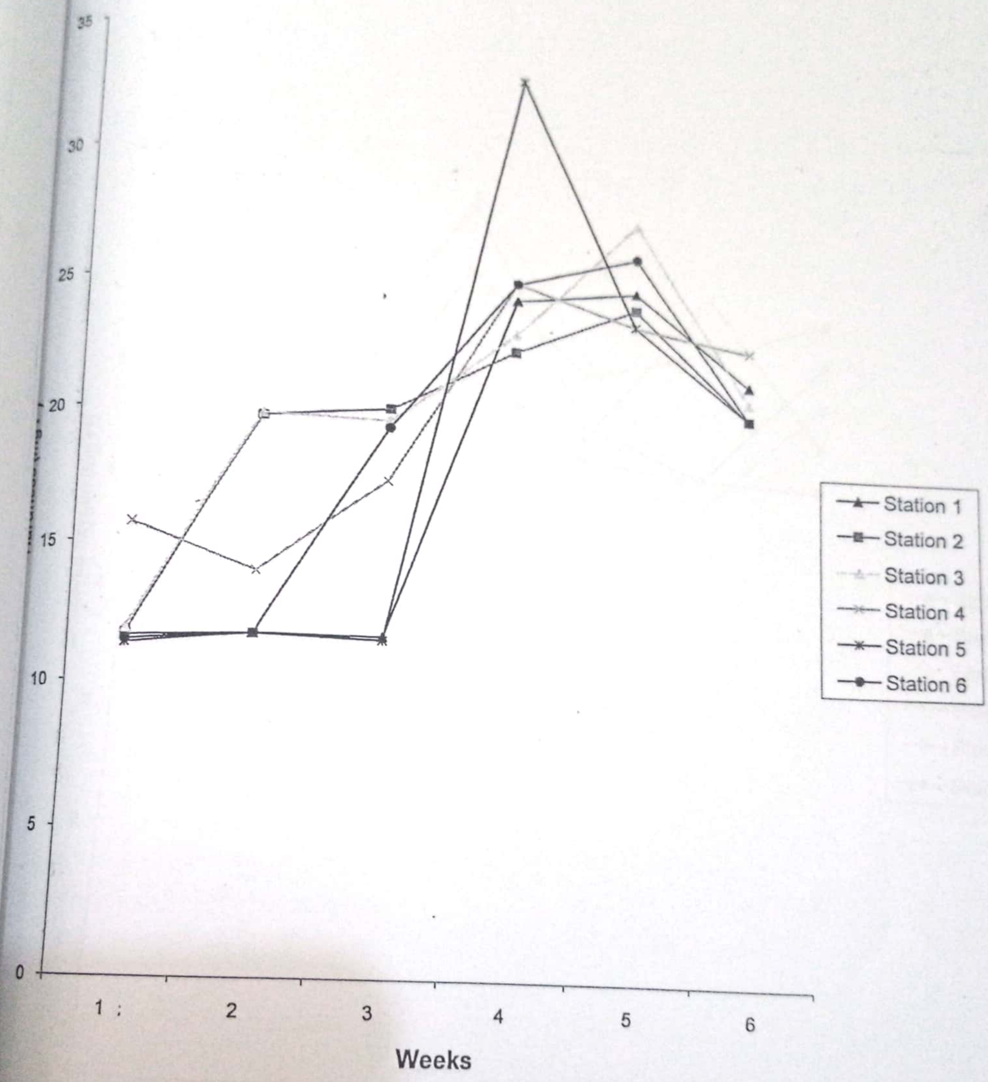

Figure 4.6: Hardness of water of different samples stations

uncan multiple range test for separation f mean showed that in week 4 the highest ardness value (25.78mg/L) was recorded. Veek 1 had the lowest hardness 2.20mg/L) compared to other weeks. he analysis revealed that weeks 4 and 5 ere significantly indifferent p> 0.05 from ach other but significantly different p< 0.05 from weeks 1, 2, 3 and 6 which were also significantly different from each other.

For the stations, the highest hardness value (20.63mg/L) was recorded at stations 3 and the lowest (17.82mg/L) recorded at station 1. Duncan multiple range test for separation of mean revealed that there was no significant difference p> 0.05 between stations 2 and 4 but were significantly different p< 0.05 from stations 1,3,5 and which were also significantly different from each other.

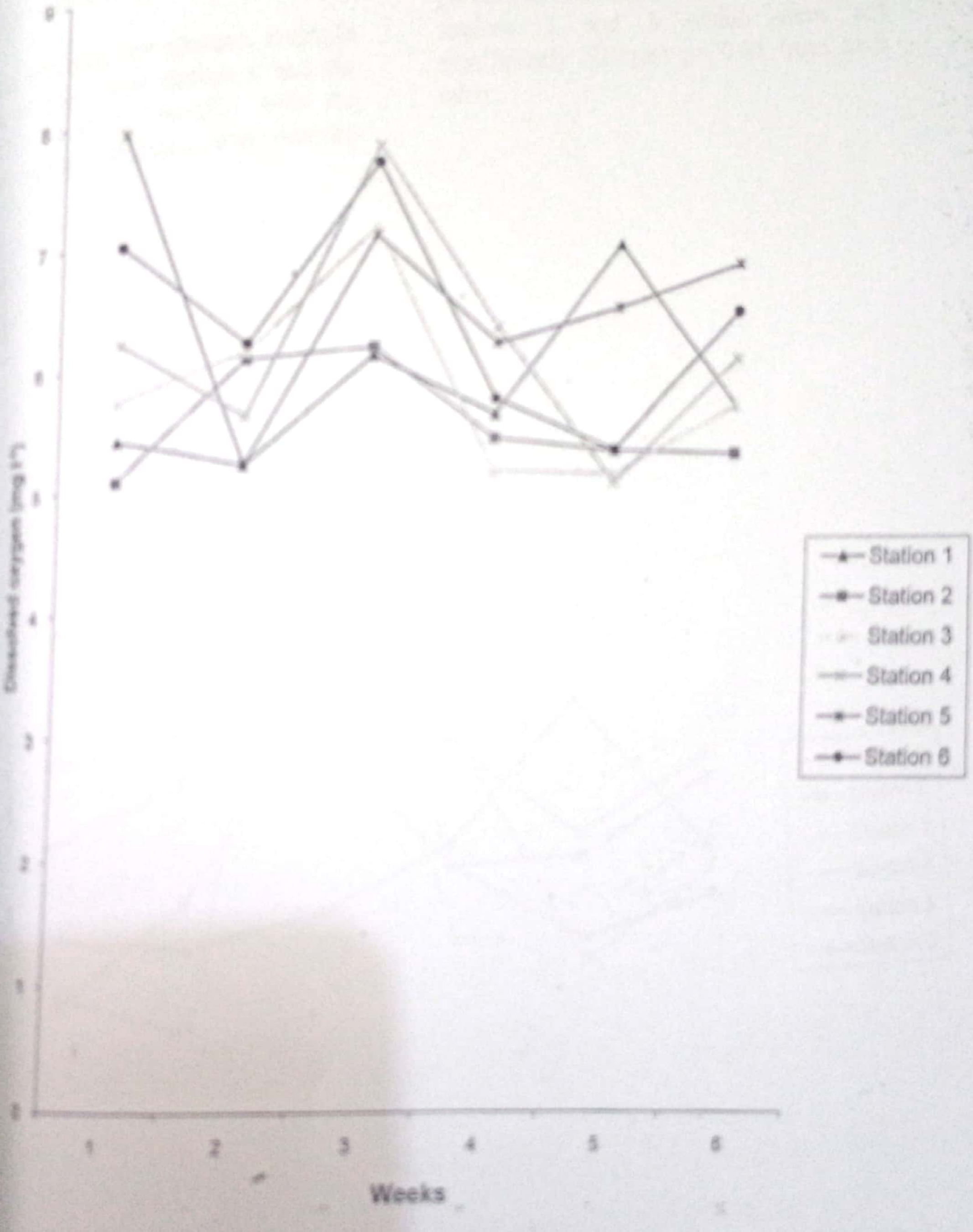

Figure 4.7: Dissolved oxygen of water of different samples stations

The Duncan multiple range test for separation of mean showed that: DO in week 3 was significantly higher (7.04mg/L) than in weeks 1,2,4,5 and 6. The DO values in weeks 1 and 6 were not significantly different p> 0.05 from each other but significantly higher than the DO in weeks 2, 4 and 5 which were also not

...ficantly different p> 0.05 from each ... In terms of stations, the Duncan multiple range test revealed that station 5 had the ...est DO value (6.69mg/L) with the ...est DO value (5.60mg/L) was recorded station 2. There was significant difference p< 0.05 in DO between stations except for stations 1 and 3 which were not significantly different p> 0.05 from each other.

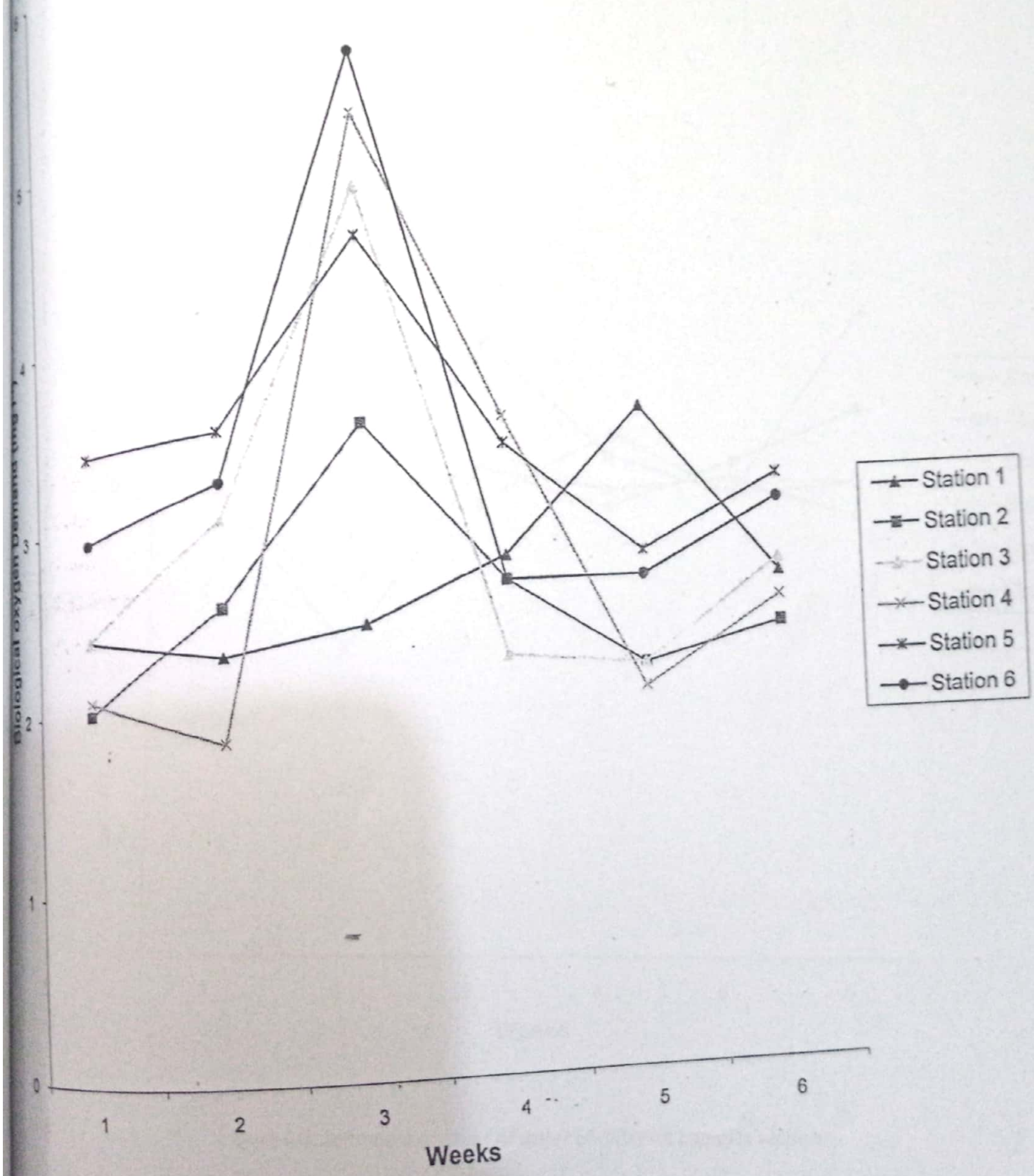

Figure 4.8: Biological oxygen Demand of water of different samples stations

The analytical result of the weekly mean values of Biological Oxygen Demand (BOD) revealed that week 5 had the highest value (4.28mg/L) and that of week

5 was the lowest (2.52mg/L). There was no significant difference p>0.05 in BOD between weeks 1 and 5 and also between weeks 2, 4 and 6.

In terms of stations, the highest BOD value (3.42mg/L) was recorded at stations 5 and the lowest (2.51mg/L) at stations 2. Duncan multiple range test for separation of mean revealed that there was no significant difference p>0.05 in BOD between stations 1 and 2 and also between stations 3 and 4. Stations 5 and 6 too, showed no significant difference from each other.

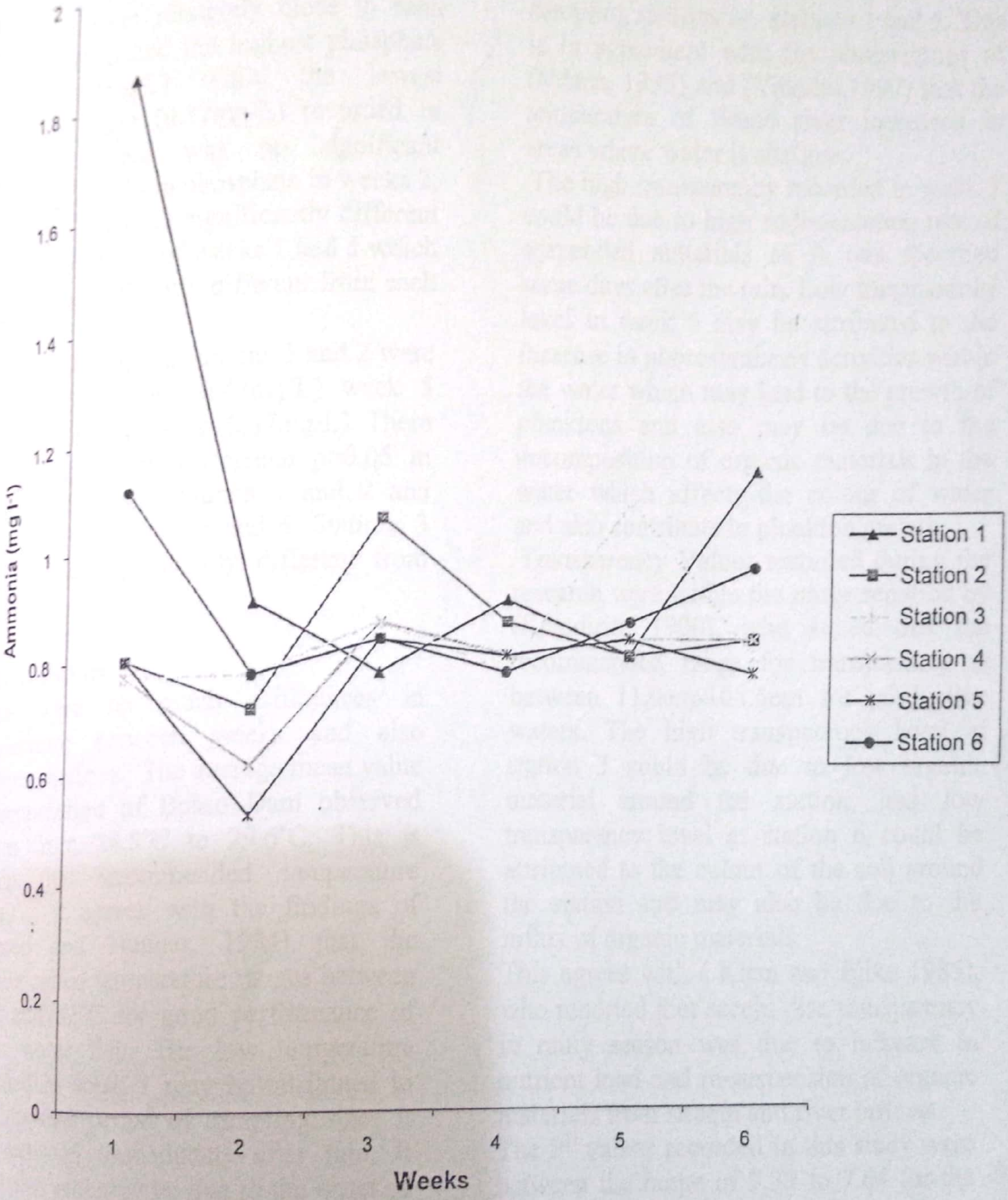

Figure 4.9: Ammonia content of water of different samples stations

In week 1 the highest value of ammonia (1.02mg/L) was recorded and week 2 had the lowest ammonia value (0.071mg/L). Ammonia was significantly higher in weeks 1 and 6 than in weeks 3 and 5. Weeks 1 and 6 were significantly also significantly different from each other.

Duncan multiple range test for separation of mean also revealed that station 1 has the highest nitrate value (0.024mg/l) and stations 4 and 5 had significantly low. Value (0.20mg/l). There was no significant difference $p>0.05$ between stations 2 and 3. Stations 1, 4, 5 and 6 were significantly different $p<0.05$ from each other.

There was no much difference in the values of phosphate within the weeks as the values were relatively close to each other. Week 5 had the highest phosphate value (0.42mg/L) while the lowest phosphate value (0.37mg/L) recorded in week 1. There was no significant difference $p>0.05$ in phosphate in weeks 2, 3, 4 and 6 but were significantly different $p<0.05$ from those of weeks 1 and 5 which were also significantly different from each other.

In terms of stations, stations 1 and 2 were significantly higher (0.42mg/L) week 5 was significantly lower (0.37mg/L). There was no significant difference $p>0.05$ in ammonia between stations 1 and 2 and also between stations 5 and 6. Stations 3 and 4 were significantly different from each other.

DISCUSSION

There were no much differences in temperature between weeks and also between stations. The average mean value of temperature of Bosso Dam observed ranges from 28.5°C to 29.6°C. This is within the recommended temperature range as it agrees with the findings of (Dupree and Hunner, 1984) that the recommended temperature ranges between 25°C and 32°C for good performance of warm water fish. The low temperature recorded in week 1 may be attributed to the time and period of sampling since it was recorded immediately after rain. It could also probably be due to the onset of harmattan. This agrees with the findings of (Brown, 2003) that water temperature varies with season, elevation, geographic location, climatic condition and is influenced by stream flow, stream side vegetation, ground water inputs and water effluents. The slight increase in temperature observed in week 5 could be due to mineralization, which is in agreement with (Boyd and Lichtklopper, 1990). In terms of stations, the low temperature recorded in station 3 could be due to the shade provided by trees and vegetation around the station. High temperature values were recorded at stations 1 and 5 and these may be attributed to the shallowness of the sampling stations i.e. stations 1 and 5. This is in agreement with the observations of (Ndana, 1995) and (Yakubu,1997) that the temperature of Bosso river increased in areas where water is shallow.

The high transparency recorded in week 3 could be due to high sedimentation rate of suspended materials as it was recorded some days after the rain. Low transparency level in week 6 may be attributed to the increase in photosynthesis activities within the water which may lead to the growth of planktons and also may be due to the decomposition of organic materials in the water which affects the colour of water and also contribute to plankton growth.

Transparency Values recorded during the research were within the range reported by (Kemdirin, 1990), who stated that the recommended range for transparency is between 11.0cm-108.5cm for productive waters. The high transparency level at station 3 could be due to low organic material around the station, and low transparency level at station 6 could be attributed to the colour of the soil around the station and may also be due to the influx of organic materials.

This agrees with (Khan and Ejike 1985), who reported that secchi disc transparency in rainy season was due to increase in nutrient load and re-suspension of organic materials from stream and river inflows.

The P^H values recorded in this study were between the range of 7.39 to 7.64 for the weeks and 7.94 to 7.39 for the stations. This is within the recommended range of 6.5-9.0 for Tilapia culture (Natrividad 1984) and generally suitable for fish production (Ofojekwu, 1990) Kolo and

Tukura (2007), reported that pH of 6.5 has been associated with productive water. The gradual decrease in pH from week 2 to week 6 could be due to the continuous reduction in water volume and the decomposition of organic material. In terms of stations, there was decrease in pH from station 1 to 6 this could be as a result of higher input of allocthonous organic matter and higher temperature which enhances decay process (Kolo *et al.*, 2009). P^H correlated negatively with dissolved oxygen. This disagrees with the findings of (Kolo and Yisa, 2000) that increase in dissolved oxygen increases P^H.

Electrical conductivity usually depends on the presence of inorganic dissolved solids such as chloride, phosphate sodium, magnesium, calcium, nitrate, sulphate e.t.c. (Ojutiku and Kolo, 2008). The highest weekly mean value 'for conductivity recorded was recorded in week 4. This may be due to reduced volume of water in the dam as a result of the on set of harmattan. The warmer the water, the higher the conductivity (Kolo *et al.*, 2009). The value of conductivity recorded in week 2 (49.19µs/cm) and week 1 (50.44µs/cm) could be as a result of the dilution of water from runoffs since the sample were collected few days after the rain. Stations 1 and 6 had higher conductivity values 55, 00µs/cm and 54.78µs/cm respectively. This could be as a result of dissolve solutes from decaying organic material highly deposited at these stations from surface runoffs. The positive correlation which exists between conductivity, hardness, temperature and alkalinity could be attributed to increase in the above water parameters which led to greater solubility of ions (Kolo and Yisa, 2000).

The range of alkalinity recorded during this work within the weeks and stations were 37.22-46.33 mg/l and 40.00mg/l – 42.00 mg/l respectively. This is below the recommended range of 50 mg/l as CaCO3 to 300 mg/l as CaCO3 for fresh water fish culture (Stirling, 1985). This could be as result of little or minute deposits of limestone in and around the Dam to raise the alkalinity level of the dam to the recommended values reported by (Hem, 1970). The high alkalinity observed in week 5 (46.33mg/l) could be attributed to the reduction in water volume, which agrees with the observation of (Ovie and Adeniji 1993) of higher alkalinity during low water level. Alkalinity correlates positively with hardness, pH, conductivity, temperature, nitrate, and phosphate, and negatively with BOD, DO, transparency and ammonia.

The highest value of hardness recorded during this research for both weeks and stations were 25. 74mg/L in week 4 and 20.63mg/L at station 3 respectively. The lowest values were 12.20mg/L in week 1 and 17.82mg/L at station 1. These values falls within the range classified for soft water observed by (Thurston *et al.*, 1979), who classified water as being soft when it falls within the range of 0-75mg/L. The above classification by (Thurston *et al.*, 1979) implies that the water in Bosso Dam is soft water. It was observed that hard waters are more productive biologically than soft water (Hadrian, 1985). High hardness observed in week 4 may be due to low temperature (28.56°C). This agrees with the findings of (Rand and Ptrocelli, 1985) that water hardness could be as a result of mineralization of the parent rock of the water body and lower temperature. This is also known to enhance water hardness. The high hardness observed at station 3 may be due to decay process as a result of less water movement and low temperature (28.00°C). Low water hardness observed in weeks 1,2,and 3 and stations 1 and 5, could be as a result of low concentration calcium and magnesium carbonates, since carbonate mineral have been implicated in influencing the degree of water hardness (Boyd, 1979) . It could also be attributed to higher temperature especially around the stations.

The dissolved oxygen recorded during this research was not stable. The range of DO recorded were 7.04mg/L-5.73mg/L within weeks and 6.69mg/l-5.60mg/l within stations. These values agree with the recommended minimum of 5.0mg/L by

(EIFACT, 1973) for fish culture. The high values of DO obtained in week 1 and 3 may be due to cool weather and cool water, which agrees with (APHA, 1995) that cool water has more DO than warm water. It could also be as a result of the aeration of water by wind which consequently increased the DO content in the water. High DO value obtained at stations 5 and 6 could be due to water movement, human activities such as bathing, fetching of water e.t.c and animal activities which lead to the agitation of water and subsequently increased the DO content in the water. Low DO at station 1 could be due to discharge of organic and inorganic wastes into the water around the station. This agrees with the findings of (Michael, 1986), who reported that water with high organic or inorganic pollution may have very little oxygen in them.

High BOD values were recorded at station 5 (3.42mg/L) and Station 6 (3.30mg/L). This could be attributed presence of decay processes. It could also be as result of the turbulence in the stations; therefore the organic decay process might have used up the DO, thus resulting to lower DO content and higher BOD. The lower values recorded at station 1 and 2 could be due to little organic matter and low decomposition process which subsequently led to decrease in biodegradation of organic matter.

Ammonia value at station 1 was high and low at station 5. The high value at station 1 could be attributed to the decomposition of organic materials and could also be due to abundance of macrophytes in the station which might have released ammonia into the water via the nitrogen cycle. High ammonia at station 1 may also be as a result of human activities. Stirling and Phillips, (1990) observed that ammonia could originate where water is polluted with sewage and silage. The low value recorded at station 5 could be as a result of human activities since it was observed that bathing or washing took place and detergents were released into the water at some points around the stations.

There was no much difference in nitrate between the weeks and stations. The values of nitrate recorded in mg/l during this research were very low indicating that the concentration of nitrate in Bosso Dam was very low and has very low potential for primary productivity. The low nitrate level of Bosso Dam could be attributed to the absence of farming activities round the dam.

The values of phosphate-phosphorus recorded were generally low when compared to the standard recommended by Beadle (1981), 3.2-630 mg/L which could be due to dilution and movement of water which prevented rapid sedimentation and decay of organic matter. The low level of phosphate in Bosso Dam could be attributed to the absence of farming activities upland around the dam. Meanwhile stations 1 and 2 recorded higher values of phosphate; this may be due to the release of phosphate in the water at the station from the decomposition of dead animals or micro organisms. It could also be from droppings of animals defecating in the water.

CONCLUSION

The differences observed between stations and weeks and other variations in the physico – chemical parameters of Bosso Dam could be attributed to the site/location of the Dam, the amount of precipitation obtained annually as well as the anthropogenic activities taking place around the Dam.

The physico – chemical parameters analyzed indicated that most of them fall within limit standard set by the Federal Ministry of Environment (FMENV, 2OOO) for Nigeria. The only exceptions are Alkalinity, Nitrate and Phosphate which were below the recommended standard.

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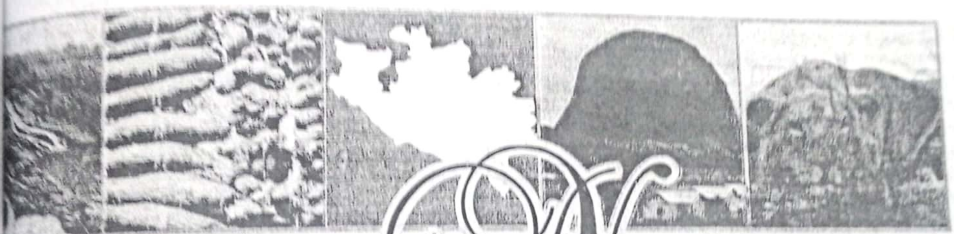

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