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SOME ASPECT OF THE PHYSICO-CHEMICAL PARAMETRES OF DIGIL RESERVOIR NORTHEAST, NIGERIA.

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Abstract

The physico-chemical parameters of the surface water of Digil reservoir at their entry points to the reservoir were assessed over a period of twelve months. Samples were carried to Adamawa State University laboratory. As in other Nigerian inland water, there were seasonal variations in the parameters measured (Table 1). There is a strong correlation at 0.05 levels of significance between Temperature and pH and Transparency, but pH differ significantly with Dissolved Oxygen at 0.05 levels.

Keywords: *physico-chemical parameters, hydrology, Digil reservoir.*

INTRODUCTION

Water and its quality are vital resources for fish. Fish lives in the medium. Their growth, feeding and genetic potentials is directly related to the water quality (Ajana *et al*., 2006).The water resources which support aquatic system constantly come under pressure of usage which often conflict with fishing interests by incusing change in the aquatic environment, the water of such result are no longer able to support fish community. The reason for the prevalence of these negative effects is the management of the resources of such reservoir to the community (Ugwu and Mgbenka, 2006).The increasing level of using pesticides, improper domestic and sewage disposal and global warming in Nigeria has created a growing awareness of rational management of aquatic resources and control of waste discharge from the environment (Egborge, 1981). Global warming and environment contamination

with herbicides and pesticides, more commonly result in exposing aquatic organisms, (Lamai *et al*., 1991).

Limnology or water quality assessment provides data that are useful in the development of fishery resources and control of vectors of water borne diseases (Haruna, 1992). Studying water quality of a lake is helping to protect and maintain the aquatic eco-system and other resources the lake provide to the society.

The productivity of a given body of water is determined by its physical, chemical and biological properties. The environmental properties of water need to be conducive for fish to grow well, therefore an ideal water condition is necessary for the survival of fish, since the entire processes of the fish is wholly dependent on the quality of its environments (Melack, 1976; Ogblesby, 1977).
The physical properties of water that are of paramount importance in out-door productivity studies include, temperature, total dissolve solids (T.D.S). This is because the out-door fishponds and dams are directly exposed to sunlight. Therefore, wide temperature value may occur while total dissolved solid affects turbidity or water transparency. The chemical properties of water include pH, dissolved oxygen (DO) and electrical conductivity. A drastic change, that is, either a rise or fall from the optimum will affect the productivity and existence of fish and therefore requires proper monitoring.

The quality of water plays a vital role in the productivity of aquatic habitats and understanding of the water chemistry serves as basis for considering whether the water is rich or poor in biological production. The physical and chemical properties of water greatly influence the uses, distribution and richness of biota (Courtney and Clement 1998).

Fish requires certain elements to grow and reproduce. The essential elements are carbon, hydrogen, oxygen, nitrogen, phosphorous, potassium, sulphur, calcium, iron and magnesium. Fish obtains these elements from the pond soil, pond water and the food they consume. The environmental factors could be considered as the most important factor affecting the development and practice of aquaculture because included in this are water quality like temperature, dissolved oxygen, turbidity and pH. Temperature affects many vital activities of fish such as growth rate, survival, reproduction as well as susceptibility to disease (Balarin, 1979). In the presence of environmental stress such as low dissolved oxygen, high temperature and high ammonia (Boyd, 1981) the ability of organism to maintain its internal environment (I e metabolism, catabolism and reproduction) is reduced (Ezra and Nwankwo, 2001) in view of this, monitoring of water quality, which centres on determination of optimal, sub-lethal and lethal values of physicochemical parameters standardized for fish culture should be embraced (Boyd and Lichtkoppler, 1985). Such physicochemical parameters include dissolved oxygen (DO), temperature, dissolved carbon dioxide (DCO), pH, and conductivity, chemical oxygen demand (COD) and biological oxygen demand (BOD).

Dissolved oxygen decreases with increase in temperature and oxygen depletion will result in asphyxiation. Dissolved oxygen also depends on the quantity of organic matter and submerged

vegetations. Boyd (1979) recommended a pH of 7-8 as being best for fish; however, the maximum acceptable pH level varies with species. Turbidity is also a factor affecting fish. Boyd (1979) reported that high turbidity reduces primary production and oxygen levels ponds and often increases susceptibility of fish to fungal diseases. The objectives of this study were to assess the physico-chemical parameters of Digil reservoir, and compare the water quality parameters with the standard required levels for fish production.

STUDY AREA

Digil reservoir, is located between latitude 10^0 18 North and longitude 13^0 45 East. The reservoir covers about 120,000m^2 and 4m deep. Digil reservoir is located in a village called Digil, inhabited predominantly by the Fulanis. The then Gongola State Ministry of Agriculture and Natural Resources established Digil reservoir in 1970 for the purpose of irrigation, it was then transferred to the Department of Fisheries in the same Ministry, Adamawa State University, Mubi took over from the Ministry after the establishment of the Department of Fisheries and Aquaculture in 2005, Adebayo (2004).

MATERIALS AND METHOD

Five sampling stations were sited within the reservoir. The choice of the sampling stations was based on the entry points of the major tributaries in to the reservoir. At each station, water samples were collected from the surface water every month between January and December 2011**.** Standard method from APHA (1998) was adopted for this study.

Surface water temperatures were measured using an ordinary thermometer, which was held about 5cm above the water surface. The thermometer was allowed to stand for three minutes before the reading were taken. The hydrogen ion concentration was determined in the field using a corning Ps 15 automatic pH probe solution of 0.01m sodium bicarbonate and 0.01m potassium solution. The dissolved oxygen (DO) concentration of the water was determined by Winkler method. Transparency was measured using a secchi disc. Computer programmes were used to analyze the data collected.

RESULTS AND DISCUSSION

This study has been carried out to asses some physico-chemical characteristics of Digil reservoir. Temperature showed the highest mean of 29.59 in March and lowest in December 2011 (Table 1). Dissolved oxygen (DO) was 5.35 in the Month of May and lowest in January2011. pH was normal throughout the year at 6.7mg/l. Water transparency was highest in the month of January at 0.53(m) and lowest in the month of July. Mean water quality per station showed a uniform distribution of temperature with a little variation in dissolved oxygen, pH and transparency. Variations in all stations, is presented in (Fig.1- 6).

Table 1: Mean monthly water quality parameters of Digil reservoir.

Parameters	Temperature	DO	Ph	Secchi disc transparency
January	28.2 ± 0.32^{bc}	4.94 ± 0.28	6.54 ± 0.19	0.53 ± 0.04^{b}
February	28.7 ± 0.3^{bc}	5.01 ± 0.27	6.64 ± 0.122	0.62 ± 0.07^{a}
March	29.59 ± 0.49^{a}	4.94 ± 0.23	6.4 ± 0.15	0.52 ± 0.07^{b}
April	28.8 ± 0.37 ^{b}	5.22 ± 0.15	6.7 ± 0.12	0.50 ± 0.04^{b}
May	28.81 ± 0.52^{b}	5.35 ± 0.167	6.6 ± 0.12	0.31 ± 0.03^{c}
June	26.98 ± 0.42^{c}	5.19 ± 0.15	6.43 ± 0.12	0.25 ± 0.01^{c}
July	28.06 ± 0.59^{bc}	5.15 ± 0.23	6.5 ± 0.13	0.22 ± 0.01^{c}
August	27.01 ± 0.45^{c}	5.07 ± 0.26	6.6 ± 0.27	0.25 ± 0.02^{c}
September	27.18 ± 0.33^{c}	4.94 ± 0.29	6.48 ± 0.16	0.23 ± 0.02^{c}
October	26.9 ± 0.23^{c}	5.31 ± 0.26	6.56 ± 0.13	0.27 ± 0.04^{c}
November	26.98 ± 0.21^{c}	5.23 ± 0.19	6.38 ± 0.16	0.26 ± 0.03^{c}
December	25.06 ± 0.44^{d}	5.24 ± 0.12	6.69 ± 0.08	0.25 ± 0.02^{c}
P.Value	0.001	0.940	0.895	0.001

Mean on the same row with different superscript differ significantly (P<0.05).

Table 2: Mean Water Quality parameters per station of Digil Reservoir

Stations	Temp.	DO	pH	SDT
Station A	27.86 ± 0.36	5.05 ± 0.09 ^{b}	6.55 ± 0.08	0.30 ± 0.04
Station B	27.78 ± 0.37	5.14 ± 0.14 ^{b}	6.52 ± 0.133	0.32 ± 0.07
Station C	27.54 ± 0.34	5.55 ± 0.14 ^{a}	6.50 ± 0.09	0.35 ± 0.07
Station D	27.59 ± 0.38	4.93 ± 0.19^{c}	6.56 ± 0.08	0.39 ± 0.04
Station E	27.65 ± 0.29	4.98 ± 0.06^{bc}	6.58 ± 0.08	0.39 ± 0.03
P.Value	**0.965**	**0.016**	**0.980**	**0.301**

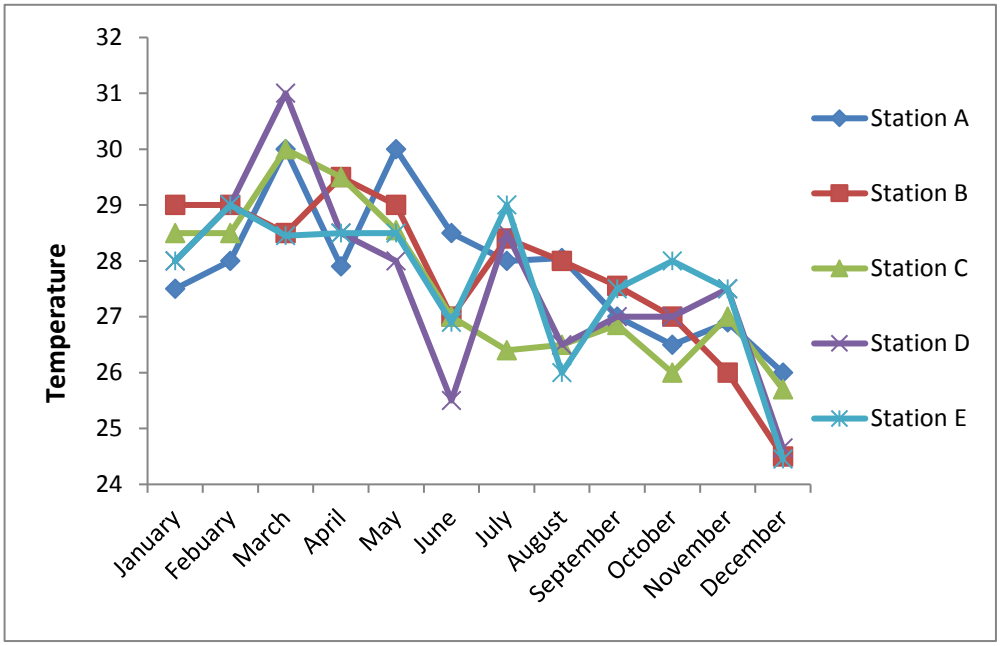

Fig.1: Monthly Variation of Temperature (^{0}C) per station

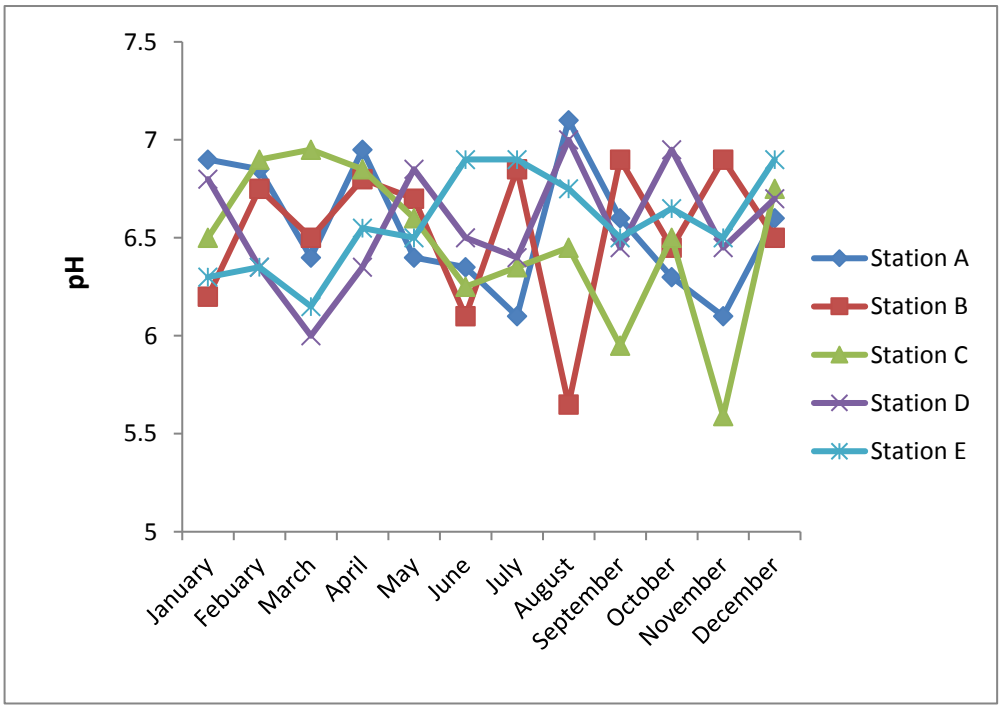

Fig.2: Monthly Variation of Hydrogen Ion Concentration per station

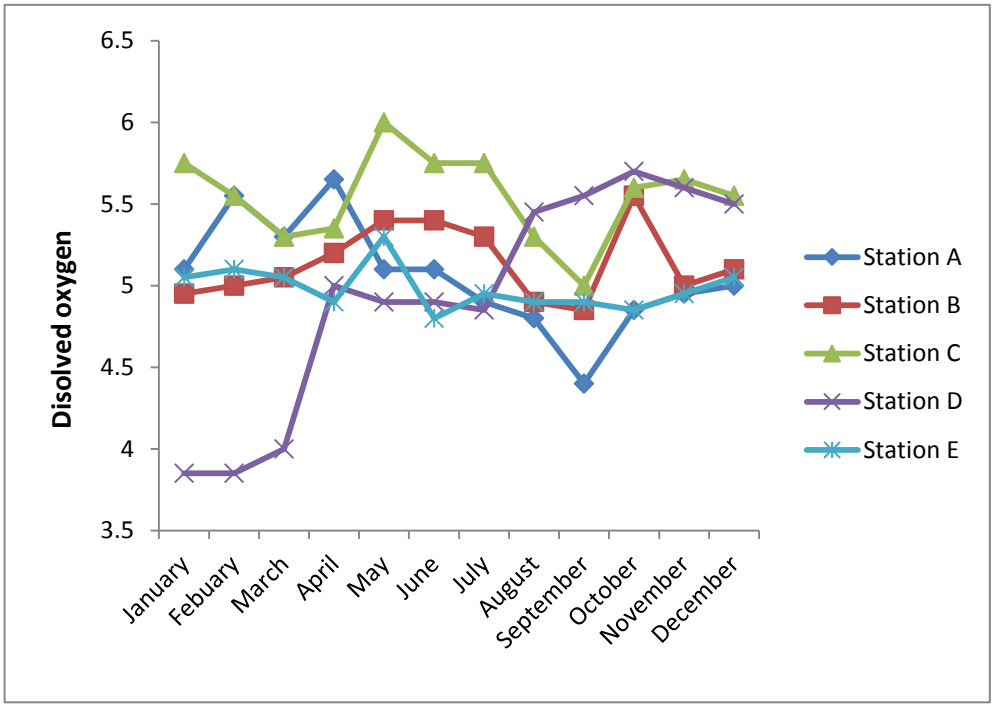

Fig.3: Monthly Variation of Dissolved Oxygen (mg/l) per station

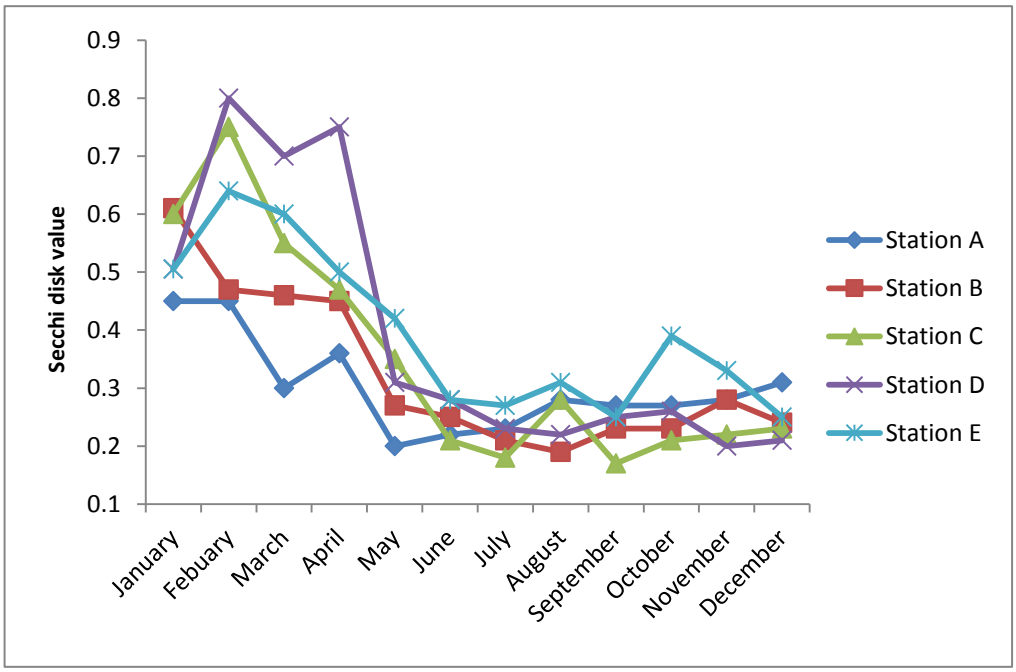

Fig.4: Monthly variation of Secchi Disc Transparency (m) per station

Table 3: Correlation coefficient 'r' between the physic-chemical variables

	Temperature	**pH**	**DO**
Ph	0.007		
	0.943		
DO	-0.020	0.195*	
	0.822	**0.032**	
Secchi disk	0.461**	-0.049	-0.151
	0.000	**0.592**	**0.100**

Cell contents: Pearson correlation
P-value **P<0.01, *P<0.05

Temperature in Digil reservoir ranges between 25^0c and 29^0c higher than the values reported by Apollos *et al* (2011), this was due to decrease in water volume during the study times. Egborge, (1970) singled out that, rainfall as the important climate factor influence the physical hydrology of the River Oshun. Water temperature said to be influenced by a combination of sunshine duration, mean diurnal, air temperature and relative humidity (Egborge, 1970). The mean dissolved oxygen of (6.02 $mg1^{-1}$) obtained fall within the desirable range for fish culture and survival (Boyd 1979). The transparency value obtained is greater than the values obtained by Apollos *et al* (2011). This is due to decayed phytoplankton in suspension. The reservoir had a mean pH of 6.5 still in line with Apollos *et al* (2011). The pH value was quite optimum for fish culture. pH 5.5 to 10 was recommended for tropical fish culture, Bennet (1973).

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