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### ASSESSMENT OF PHYSICO-CHEMICAL PARAMETERS OF SOME FISH PONDS IN BAUCHI METROPOLITAN

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**Abstract:** Three fish ponds namely; Balera, Baba and Raji in Bauchi were investigated for the purpose of determination of physico chemical parameters of the water, Samples of water were collected monthly for a period of six months (August, 2016 – January, 2017) covering both wet and dry seasons. The physico chemical parameters namely temperature, transparency, conductivity, total dissolve solids, pH, dissolve oxygen, nitrate, potassium and sodium showed significant variation ( $P < 0.05$ ) for both seasons with dry season being higher than wet season except for temperature. Conservation and management of the ponds should be encouraged.

**Keywords:** Bauchi; Fish Ponds; Influence; Physico-Chemicals parameters; Nigeria.

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#### INTRODUCTION

Environmental factors support a great variety of organisms and algae in their habitats to attain a great productivity and succession when they make the environment conducive through the provision of the basic necessities for growth and development for the organisms. These factors serve as essential resources for the survival of these organisms. These are either physical or chemical, and include; pH, temperature, nutrients, and ionic concentrations, which are characteristics of an aquatic system. Any slight fluctuation in each of these factors can adversely affect the biota and the water quality of a pond (Lange-Bertalot and Metzeltin, 1996). It has been found that, an increase in any of these factors above the carrying capacity of the aquatic systems could increase the population of some species, but also limiting to other species. Darley (1982) also reported that, nutrients or physico-chemical resources that are limiting to a species

might be sufficient for another. In flowing aquatic freshwater systems, epilithic algae occur abundantly. Their communities in the running water have been more thoroughly studied as compared to those of the benthic water of stagnant types. In general, epilithic algae are not so affected by slow water movement which does not allow the accumulation of sediments on rock surface. In freshwater, epilithic algal communities commonly found are mainly the representatives of Chlorophyceae, Baccillariophyceae and Rhodophyceae. Their distributions are extremely uncertain due to variability in nature of substrates. Statement of the problem: Anthropogenic activities including logging; sand mining, agricultural activities and waste disposal have a major influence on the physico chemical parameters as well as algal diversity in water bodies (Heywood and Watson, 1995). Hence, the work is designed to contribute to knowledge in this regard. The aim of this study is to assess the influence of physico-chemical parameters of

some fish ponds in Bauchi metropolis. The objectives of the study are to determine the level of physico-chemicals parameters of some ponds in Bauchi metropolis.

## EXPERIMENTAL

### Description of Study Area

Three man-made fish ponds in Bauchi (9°3'N and 1°3'E) Nigeria were investigated. One of the fish pond is located at Piro village near Gubi reservoir which is about 12km north-east of Bauchi metropolis with a depth of about 1.8m and an area of 12m by 12m. The other one is located at Dumi village along railway road with a depth of about 2.1m and area of 30m by 30m. The village is about 5km south east of Bauchi metropolis. And the last pond which is located at Doka village Gwallameji has a depth of 1.5m and area of 12m by 12m. It is 10km West South of Bauchi metropolis. All the three fish ponds provides the bulk of fish consumed in the town as well as providing suitable sites for Fadama farming resulting in the production of some highly favoured selected crops.

### Collections of Water Samples for Physico-Chemical Characteristics

Samples for both physico-chemical parameters were collected on monthly bases for the period of 6 months (August- January 2017) at 7 am to cover both rainy and dry season.

### Determination of Physico-Chemical Characteristics

**Water Temperature:** Surface water temperature was measured *in situ* in the field with mercury bulb thermometer and values were recorded in (°C).

**Water pH:** The pH of the water was determined in the laboratory using a cyber-scan pH meter model pH 20. A standard pH buffer solution (pH 7) solution was first used to standardize the electrode, after which the pH of distilled water was determined to verify accuracy of the electrode. Then, pH of water samples was thereafter determined and, the electrode was washed in distilled water after each determination and recorded.

**Conductivity:** The electrical conductivity of the water was determined in the laboratory using a Combo conductivity meter Model; Hanna H1-98129. Freshwater samples were collected carefully from the river in clean plastic containers of 250mL. The conductivity of the water was first determined as control to gauge the meter at 20°C. The conductivity of each sample was determined and the electrode rinsed with distilled water after each determination.

**Dissolved Oxygen:** Dissolved oxygen in the water was determined using the Wrinkler's method (Holderness and Lambert, 1982). In this method, freshly collected water samples in 300mL BOD bottles were carefully transported to the laboratory. One gram of magnesium sulphate powder pillow and alkaline iodine-azide reagent powder pillow were added to the sample in a conical flask. The stopper was replaced and inverted several times to mix. When an orange brown flocculent precipitate was formed the stopper was again removed and 1g sulphuric acid powder pillow was added. The stopper was then replaced and inverted again severally to mix the flocculent precipitate dissolved and a yellow colour was observed. The sample was then transferred into 250mL Erlenmeyer flask and titrated against sodium thiosulphate until it turned pale yellow; then a starch indicator was added and mixed. A dark blue colour appeared; titration was continued with sodium thiosulphate until the solution was colourless. The amount of the sodium thiosulphate used is equivalent to the DO content.

**Total Dissolved Solid (TDS):** The Total Dissolved Solids (TDS) was determined in the laboratory by evaporating 100mL of the filtrate in a pre-weighed evaporating dish at 100°C. It was calculated as thus:

$$\text{TDS} = \text{Weight of petric dish after evaporation} - \text{Weight of the petric disc}$$

**Nitrate, Potassium and Sodium:** Nitrate was determined using portable UV spectrophotometer while potassium and sodium was determined using atomic absorption spectrophotometer. Five mL of Conc. HNO<sub>3</sub> were carefully added to 100mL

of the water sample. This was then followed with the addition of 5mL of 50% HCl. The solution was heated until the volume was reduced to 75mL. This was allowed to cool. The solution was then transferred in to 100mL volumetric flask. This was then filtered and the filtrate was analyzed using atomic absorption spectrophotometer (Model 210 VGP).

## RESULT AND DISCUSSION

### Temperature

The monthly variations in the surface water temperature of the three ponds are shown in Figure 1. Temperature reached a maximum of 26°C in November at Raji fish pond minimum of 20.0°C in January at Baba fish pond. Higher temperature was generally recorded in the dry season than in the wet season in all the ponds.

### Transparency

Figure 2 shows the monthly variations of transparency in the various ponds. The highest value (3.0m) recorded was in January at Baba fish pond and the lowest transparency (1.4m) in August at Raji fish pond. The transparency values were significantly higher in the dry season than in wet season.

### Hydrogen Ion concentration (pH)

The pH of the three ponds varied from 6.5 to 7.7 (figure 3). The pH was relatively higher between November to January. It became acidic (August – October) followed by an appreciable increase to neutrality between October and November.

### Nitrate-Nitrogen

Nitrate- nitrogen values recorded was observed highest (7.3 mg/L) in August at Raji fish pond and lowest (1.3mg/L) in January at Raji and Baba fish ponds respectively. Generally, higher nitrate values were recorded during the wet season than in the dry season all the ponds (figure 4).

### Dissolved Oxygen

Figure 5 shows the Dissolved Oxygen (DO) content for the period of the study. The maximum value obtained was (9.0 mg/L) in November at Raji pond and lowest (5.0 mg/L) in August at Baba fish pond. DO levels were generally higher in the dry season in all ponds with a slight increase at Baba and Balera fish ponds.

### Total Dissolved Solid

The monthly variation in total Dissolved solids is shown in figure 6 below. Total dissolved solids value obtained was higher in the dry season that in wet season. The highest value obtained was (175 mg/L) in January at Baba fish pond while the lowest value obtained was (40mg/L) at Raji and Balera fish ponds respectively.

### Electrical Conductivity

Figure 7 shows the monthly variation in the electrical conductivity. It ranged between  $38.1\mu\text{Scm}^{-1}$  in August at Raji and  $1651\mu\text{Scm}^{-1}$  in January at Baba fish pond. Higher values were recorded in the dry season than in wet season.

### Potassium

The monthly variations in potassium are shown in figure 8. The highest (36mg/L) value was recorded in August at Baba fish pond while the lowest (4.0 mg/L) was recorded in January at Balera fish pond. Generally, there was an appreciable higher potassium concentration in wet season than dry season.

### Sodium

Figure 9 shows the monthly variation of sodium concentration. The lowest value (30 mg/L) was obtained in August at Raji fish pond while the highest value (85.1mg/L) was recorded in January in Baba Pond.

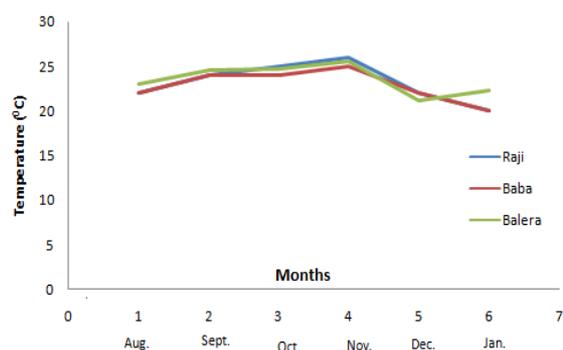


Figure 1. Monthly variations of surface water temperature of the three ponds, in Bauchi, August 2016-Jan 2017

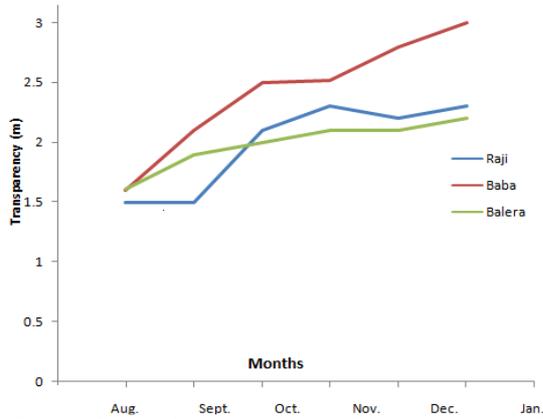


Figure 2. Monthly variations of transparency of the three ponds in Bauchi August 2016-Jan 2017

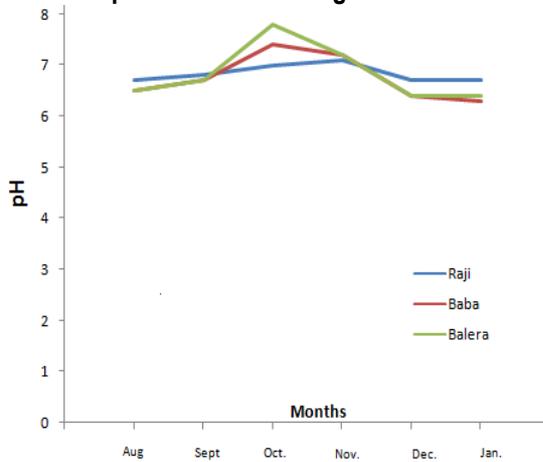


Figure 3. Monthly variations of pH of the three ponds in Bauchi August 2016-Jan 2017

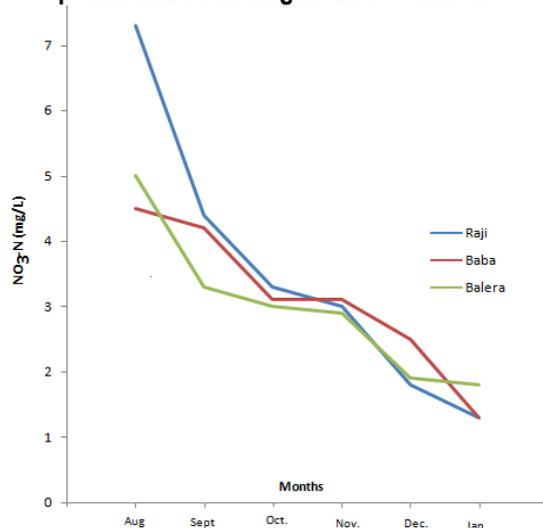


Figure 4. Monthly variations of Nitrate-Nitrogen of the three ponds in Bauchi August 2016-Jan 2017

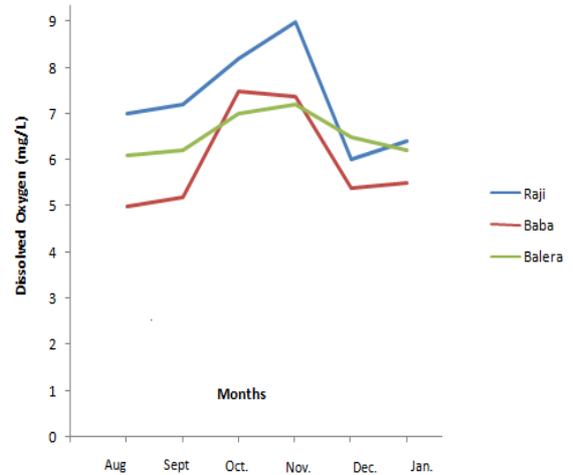


Figure 5. Monthly variations of Dissolved Oxygen of the three ponds in Bauchi

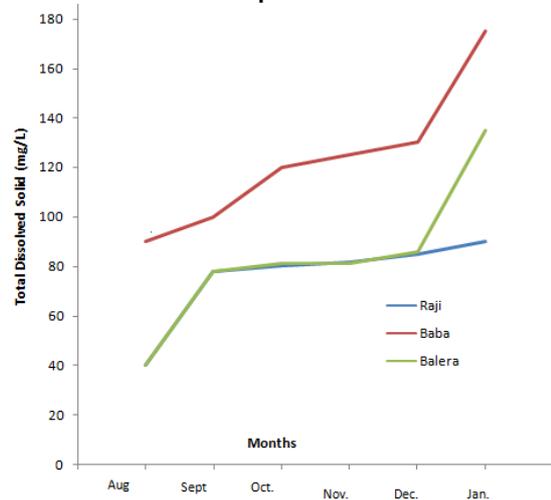


Figure 6. Monthly variations of Total Dissolved Solid of the three ponds

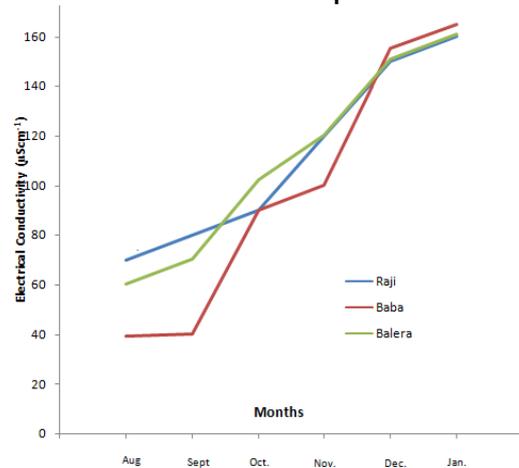


Figure 7. Monthly variations of Electrical Conductivity of the three ponds

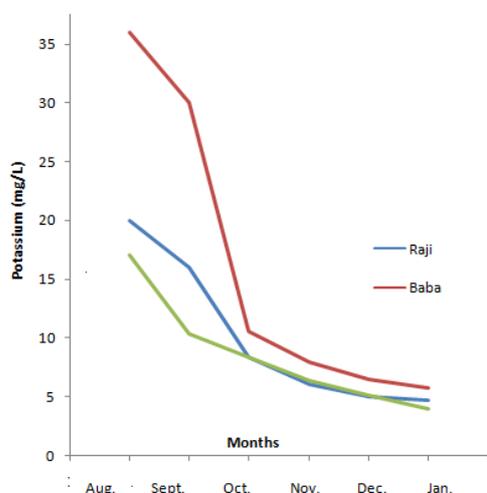


Figure 8. Monthly variations of Potassium of the three ponds, in Bauchi, August 2016-Jan 2017

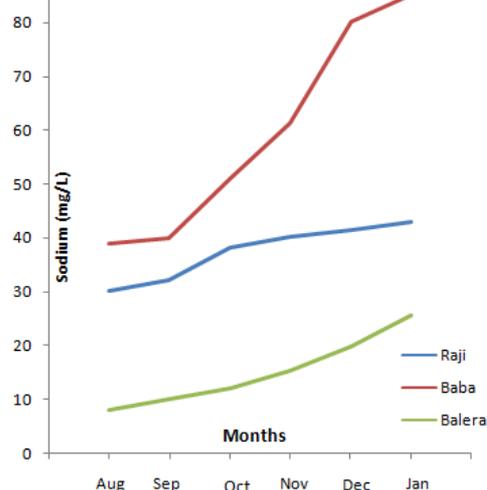


Figure 9. Monthly variations of Sodium of the three ponds, in Bauchi, August 2016-Jan 2017

### Physical and chemical characteristics

#### Temperature

The high surface water temperature values recorded between September, October and November coincided with the period of increased solar radiation and reduced cloud covered. Similar observation was made by Ezra (1997). The low surface water temperature recorded between December and January could be attributed to the harmattan experienced during this period when large amount of dust covers the area, thus tends to reduce the amount of solar radiation and resulted in low water temperature. Similar low temperature values due to the

influence of Harmattan have been reported by Egborge (1971).

#### Transparency

Lower transparency of the three ponds during the wet season was general phenomenon in all the three ponds which might have been as a result of influence of debris, silt or organic matter from surface run-offs by erosion while higher transparency during the dry season could be attributed to less amount of influx of debris and silt in all the ponds. This has been reported by Ezra (2006), and Kendrium (1990).

#### Hydrogen ion concentration (pH)

The pH values recorded in all the three ponds were within the expected range (pH 6.5-7.7) as reported by Sarkeret. al.,(1980) and Antoine (1982).

#### Dissolved oxygen (DO) of the three ponds

Dissolved Oxygen values were lower during the wet season and relatively higher during the dry season in all the three ponds. This could be as a result of low photosynthetic activities of the algae due to reduced solar radiation (Ezra, 1995). The higher levels of dissolved oxygen could be attributed to the high levels of productivity of algae from their photosynthetic activities (Carin and Michael, 2007).

#### Total dissolved solids of (TDS) of the three ponds.

The higher values of TDS recorded in the dry season in all the ponds could be due to concentration of solids as a result of evaporation of water while the lower values recorded in the wet season may be attributed to dilution effect by rainfall and reduced evaporation during this period. This observation agrees with the findings of (Adeniji,1973).

#### Electrical conductivity (EC) of the various ponds

The high conductivity values recorded during the dry season might be attributed to high concentration of dissolved solids as a result it of high evaporation rates of water due to high water temperature and increased level of solar radiation. The lower values in the wet season could be related to dilution effect by rainfall. Khan

and Ejike (1984) also reported high conductivity values during the dry season than wet season.

#### **Nutrients (Nitrate potassium and sodium)**

Variation in nutrients, namely nitrate and potassium contents of the ponds showed closed relationship with the rainfall pattern and since these nutrients levels were high in the wet season than dry season, streams and rivers which flow into the these ponds as well as run-off from agricultural lands, livestock and human wastes could be a major source.

Olaniyan (1989) reported that low Nitrate and Potassium levels during the dry season could be due to the absence of flood waters and possibly due to utilization of the nitrates by Biota. Similar observation was made by (Nwadiaro, 1986). The concentration of Sodium in the various ponds showed different pattern to that of nitrate and potassium. Generally, lower levels of sodium were obtained in the wet season than in the dry season. This could be due to the low concentration of sodium brought from the catchment areas by flood into these ponds as well as the dilution by rainfall. This observation agrees with the findings of Imerbore (1965), who reported that during the wet season the rapid influx of rain water into aquatic system causes dilution of nutrient, but in a situation where run-offs are loaded with nutrients, rather than dilute, they concentrate nutrients in receiving water body. The pH values recorded were within the expected range (pH 6.5-7.7) as reported by (Sarker et. al 1980; Antoine, 1982).

#### **CONCLUSION**

Generally, three phase of temperature was recognized in the three ponds. The first was the high temperature phase in the months of October and November with the range of 24.6°C - 26°C. The period of intermediate temperature phase was between august to September with temperature range between 22°C-24.5°C. Low temperature phase occurred between December to January ranging between 20.1°C-21.2°C. Temperature fluctuations were attributed to changes in solar energy between wet and dry

season as well as harmattan period. Secchi disc transparency value were significantly, higher ( $P < 0.05$ ) in the dry season than wet season in all the three ponds. This could be due to less silt particles brought in to the three ponds and consequently less turbidity. There was an appreciable high conductivity and TDS values during the dry season in the three ponds. This may be due to high concentration of dissolved solids as a result of high evaporation rates of water due to high water temperature and increased in the levels of solar radiation. Surface water pH with BDH Iovibond comparator, dissolved oxygen (DO) with portable Hach digital titrator model No. 169-01, nitrate, potassium and sodium were analyzed using atomic absorption spectrophotometer model 210 VGP.

#### **REFERENCES**

- Antoine S.E., and Al-Saadi H.A. (1982). Limnological studies on the polluted Ashar canal and Shatt al-Arab River at Basrah (Iraq)*Int. Revue. Ges. Hydrobiol.*, 67:405-418
- Adeniji, H.A (1973). Preliminary Investigation into the Composition and Seasonal Variation of the Plankton in Kaninji Lake, Nigeria. *Geographical monograph series 17 Hydrobiologia* 79:157-165.
- Carin, E. V. and Micheal, J. S. (2007). Temporal Trends in Total phosphate, Temperature, Oxygen Chlorophyll-a and Phytoplankton Populations in Hartbeepoort Dam and Roodeplaat Dam, South Africa between 1980 and 2000. *African Journal of Aquatic Science* 32(1): 63-70.
- Darley, W. M. (1982). *Algal Biology: A Physiological Approach*. Blackwell. Scientific Publication, Oxford. p.350.
- Egborge, ABM. (1971). The chemical hydrology of the River Oshun, Western State, Nigeria. *Fresh water Biology* Volume 1, Issue 3, Pages 257-271
- Ezra. A.G. (1995). The Ecological Studies of Algae in Gubi Dam, Bauchi State. Nigeria. Ph.D. Thesis. Abubakar Tafawa Balewa University Bauchi, Bauchi State, Nigeria. p. 187.
- Ezra, A.G. (2006). Phycoperiphyton of Some Aquatic Algae in a Stream Near Abubakar Tafawa Balewa University, Bauchi State, Nigeria.

- Journal of Experimental Aquatic Biology* 7(2):117-122.
- Ezra. A.G. (1995). The Ecological Studies of Algae in Gubi Dam, Bauchi State. Nigeria. Ph.D. Thesis. AbubakarTafawaBalewa University Bauchi, Bauchi State, Nigeria.p. 187.
- Heywood, V. H. and Watson, R. T. (1995).*Global Biodiversity Assessment*.Cambridge University Press. Cambridge UK. 322pp
- Holdernes, A. and Lambert, E. A. (1982). Ordinary Level Certificate Chemistry, Vol II. 2<sup>nd</sup> Edition.Hienemann Educational Books London. 160pp.
- Imerbore, A.M.A.,and Odu, E. A. (1985).Environmental pollution in the Niger Delta.*The Mangrove Ecosystem of the Niger Delta*.University of Port Harcourt.
- Kendirim, H. E. C. (1990). Periodicity and Succession of Phytoplankton in Upland and Lowland Impoundments in Plateau State (Nigeria): In Relation to Nutrient Levels and Physical Characteristics. *Journal of Aquatic Sciences* 5:43-52.
- Khan, M.A., and Ejike, C. (1984).Limnology and plankton periodicity of Jos Plateau water reservoir, Nigeria, West Africa.*Hydrobiologia*114(3):189–199
- Lange-Bertalot, H. &Metzeltin, D. (1996).Indicators of oligotrophy. 800 taxa representative of three ecologically distinct lake types, carbonate buffered- Oligodystrophic-weakly buffered soft water with 2428 figures on 125 plates. *Iconographia Diatomologica* 2(1):390-125
- Nwadiaro, C. S. (1989). Ichthyofauna of Lake Oguta, a shallow lake of South Eastern Nigeria. Arch. Hydro. Biol. 115 (3) pp.463-47
- Olaniyan, C. I. O. (1969). The seasonal variation in the hydrology and total plankton of the lagoons of South West-Nigeria.*Nigerian Journal of Science*. 3(2):101-119.
- Sarker, A.L., Al Daham, N.K. and Bhatti, M.N. (1980).Food habits of the mudskipper, *Pseudapocryptesdentatus* (Val.) *Journal of Fish Biology* 17(6):635-639

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