ASSESSMENT OF WATER QUALITY PARAMETERS OF BOREHOLE FOR SUITABLE AQUACULTURE IN SELECTED AREAS IN KAURA NAMODA, ZAMFARA STATE NIGERIA

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Abstract: Assessment of water quality parameters of borehole for suitable aquaculture in selected areas in KauraNamoda, Zamfara State Nigeria was conducted. A total of nine boreholes were sampled from the study area. Data collected were subjected to descriptive statistics using SPSS 20. The results revealed that mean temperature (27.10 – 29.50^{o}C), pH (6.79 – 7.22), DO (4.50 – 5.80 mg/l), EC (191 – 454 µms^{-1}), Hardness and Alkalinity (120 – 240 ppm), fluoride (0.32 – 0.74 mg/l), and nitrates (0.28 mg/l). Therefore, water quality parameters of boreholes in the study area were all within the acceptable limits requirements for aquaculture in the all the surveyed locations in KauraNamoda, Zamfara State Nigeria. Therefore, the study area is recommended for aquaculture using the borehole water.

Keywords: Aquaculture, boreholes, water quality parameters

Introduction

Water is one of the most important sources for life and the good quality water is essential for improving the quality of life (Kurnaz *et al.*, 2016). Water quality is one of the most critical factors besides good feed/feeding in fish production (Davies and Ansa, 2010). It is not constant; varies with the time of the day, season, weather conditions, water source, soil type, temperature, stocking density, and feeding rate and culture systems (Khan *et al.*, 2013). For a successful aquaculture venture, the dynamics and management of water quality in culture media must be taken into consideration (Davies and Ansa, 2010).

However, the rapid changes in physical and chemical parameters of the surface waters lead to deterioration of the environment's balance in aquatic environments (Khan *et al.*, 2013). These changes cause the declines of the water quality and pollution of the water. For these reasons, it is very important to analyze the physicochemical properties and heavy metal contents of the fresh water resources regularly for the monitoring the changes (Kurnaz *et al.*, 2016). The rapid increase in population and increasing industrial, agricultural and forestry activities lead to significant affect in terms of amount, quality and usage of water (Davies and Ansa, 2010).

These principles compose the subject of water chemistry and its net result i.e. the water quality. Poor water chemistry leads to deteriorate water quality, which causes stress to the organisms being raised. Efficient feed conversion, growth and marketability of the final product cannot occur unless the pond system is balanced or in harmony with nature is determined by the specific organisms to be cultured and has many components that are interwoven. Sometimes a component can be dealt with separately, but because of the complex interaction between components, the composition of the total array must be addressed. Therefore the overriding concern of the fish culturist is to maintain, 'balance' or 'equilibrium conditions' with respect to water chemistry and its natural consequence, good water quality (Davies and Ansa, 2010). Water quality for aquaculturists refers to the quality of water that enables successful propagation of the desired organisms. The required water quality is growth and survival, which together determine the ultimate yield, are influenced by a number of ecological parameters and managerial practices. Hence, the aim of the study is to assess the water quality parameters of borehole for suitable aquaculture in selected areas in KauraNamoda, Zamfara State Nigeria.

Materials and Methods

The study area is located at KauraNamoda, Zamfara State Nigeria where samples were collected from various nine (9) boreholes to determine total alkalinity, total hardness, ammonium nitrogen, nitrate, nitrite, phosphate, sulfite, sulfate, potassium, chloride, sodium, suspended solid matter (SSM), chemical oxygen demand (COD), biological oxygen demand (BOD), calcium, magnesium, copper, zinc, ferrous, lead, nickel, mercury, and cadmium; and water samples were analyzedat Multi-User Laboratory, Department of Chemistry, Faculty of Physical Sciences, A. B. U. Zaria . Titration with sulfuric acid (for total alkalinity) and titration with EDTA (for total hardness) were performed. The results are presented in mg/L CaCO3 unit. Chemical oxygen level was calculated through titration with ferrous ammonium sulfate based on determining the amount of oxygen being used while lysing the natural and organic pollutant load by using powerful chemical oxidants. The determination of nitrite, nitrate, ammoniac, ammonium nitrogen (NH4+), chloride, phosphate, sulfate, sulfite, potassium, calcium, sodium and magnesium were conducted using the methods described by Khan *et al.* (2013).

Results and Discussion

The results in Table 1 showed that the water quality parameters were all within the acceptable range for aquaculture practice (Boyd, 1998). This could be that the ground water of the study area is suitable for aquaculture and other domestic use. The mean temperature (27.10 - 29.50^{o}C) this was in line with FAO (1993) who suggested that mean water temperature between 20 and 30^{o}C is suitable for aquatic organisms. Similarly, Michael *et al.* (1999) also recommended the mean water temperature range of 21 and 31.9^{o}C for tropical aquatic organisms and also added that temperature beyond 32^{o}C respiration would lead or result to physiological stress, poor feed conversion, and poor growth rate and same effects would be noticed when temperature was below 21^{o}C. According to FAO (1993) noted that the reproductive and immune system of the majority of aquatic organisms has an optimum performance at mean water temperatures above 20°C.

Table 1: Assessment of Water Quality Parameters of Borehole for Suitable Aquaculture in Selected areas in KauraNamoda, Zamfara State Nigeria

Parameters	BLK	BNG	MLN1	MLN2	GBK	HKS1	HKS2	KTR	KGK	FAO (1993)
TºC	29.10	28.20	27.90	27.80	29.10	28.70	28.50	29.50	27.10	Ambient
pH	7.18	7.22	6.80	6.79	7.00	6.78	6.87	7.00	6.95	6.5-85
DO (mg/l)	4.60	4.98	5.01	5.20	4.50	5.02	5.01	4.50	5.80	4.0<
EC	454	447	195	200	251	191	192	211	306	1000
Hardness (mg/l)	120	160	180	180	169	160	200	180	200	150
Alkalinity (mg/l)	220	220	220	220	220	220	240	230	220	-
Chlorides (mg/l)	-	-	-	-	-	-	-	-	-	250
Fluoride (mg/l)	0.74	0.53	-	-	0.32		-	-	0.52	1.5
Nitrites (mg/l)	-	-	-	-	-	-	-	-	-	3
Nitrates (mg/l)	-	-	-	-	0.28	-	-	0.29	1.32	50
Fe^{2+} (mg/l)	-	0.05	0.05	0.05	-	0.05	0.15	-	0.07	0.03
Mn (mg/l)	0.014	0.012	0.02	0.02	0.007	0.003	0.002	0.006	0.08	0.1

BLK = Balanke, BNG = Banga, MLN1 = Mailale 1, MLN2 = Mailale 2, GBK = Gabake, HKS1 = HayinKasa 1, HKS2 = HayinKasa 2, KTR = Katsaura, KGK = Kungurki, FAO = Food and Agricultural Organization, T = Temperature, DO = Dissolved Oxygen, EC = Electrical Conductivity, and - = not detected

The pH (6.79 – 7.22) were within the range suggested by Boyd and Lichtkoppler (1979) that the normal pH value for reproduction, survival and growth performance of aquatic organisms should be between 6.7 and 10. Ovie and Adeniji (1990) also reported that it was necessary to keep the pH range of between 7.6 and 10 to maintain good water fish population in water in the tropics. The higher the pH value the higher the toxicity of ammonium while the lower the pH value the higher the toxicity of sulphates and cyanides (Khan *et al.*, 2013). The result obtained in this study was also within the range reported by FAO (1993) pH range of 6.5 to 10.5, which was also reported to be good for tropical fish production.However, DO (4.50 – 5.80 mg/l) in this study was in line with the findings of Ovie and Adeniji (1990) who reported that it was necessary to keep the DO range of between 4.0 and 10.98 to maintain good water fish population in water in the tropics.According to FAO (1993) suggested that DO should not be below 4.00 mg/l for aquatic organisms has an optimum survival and growth performance. Atay and Pulatsü (2000) also suggested that the dissolved oxygen shall be at least 5 mg/L for the sustainable aquatic life in the freshwaters fishes.

The EC (191 – 454 μms^{-1}), and Hardness and Alkalinity (120 – 240 mg/l) observed during the study could be due to the nature of the study area and was in line with the findings of Sikoki and Veen (2004), and Ogbeide and Victor (1995) who observed the range of 390 to 505 μms^{-1} electrical conductivity and TDS of 150 to 230 ppm. Water must have contained many dissolved substances from organic and inorganic compounds, which are described as 'trace elements'. These elements are important in sustaining life within all ecosystems (Kurnaz *et al.*, 2016). The mean fluoride (0.32 – 0.74 mg/l) and nitrates (0.28 mg/l) was detected in Gabake (GBK) were within the acceptable limits of the reproductive and production of freshwater fishes in Nigeria (Ovie and Adeniji, 1990). There was no significant difference in the values of temperature, pH, EC, DO, Fluorides, and Nitrates in the all the surveyed locations in KauraNamoda, Zamfara State Nigeria.

Conclusion and Recommendation

Water quality parameters of boreholes in the study area were all within the acceptable limits requirements for aquaculture. Therefore, the study area is recommended for aquaculture using the borehole water.

Conflict of Interest

Authors declare there is no conflict of interest related to this study.

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References

Atay D & Pulatsü S 2000. Su KirlenmesiveKontrolu. Faculty of Agriculture, Ankara University, Publication Nr.1513, Ankara.

Davies OA & Ansa E 2010. Comparative assessment of water quality parameters of freshwater tidal earthen ponds and stagnant concrete tanks for fish production in Port Harcourt, Nigeria. *Int. J. Sci. and Nat.*, 1(1): 34-37.

Boyd CE 1998. *Water Quality in Ponds for Aquaculture.* Birmingham Publishing Company. 482p.

FAO (Food & Agricultural Organization) 1993. Water Quality Parameters Fish Health and Aquatic Organisms. *FAO 1993 Rome, EIFAC Technical Paper No. 24: 7-25.*

Khan S, Shahnaz M, Jehan N, Rehman S, Shah MT & Din I. 2013. Drinking water quality and human health risk in Charsadda District, Pakistan. *J. Cleaner Produc.*, 60: 93-101.

Kurnaz A, Mutlu E, Uncumusaoğlu AA 2016. Determination of water quality parameters and heavy metal content in surface water of Çiğdem Pond (Kastamonu/Turkey). *Turk. J. Agric. - Food Sci. and Techn.*, 4(10): 907-913.

Michael P Masser, Don Steinbach & Billy Higginbotham 1999. Catfish Pond for Recreation. In Texas Agricultural Extension Service No B. 1319. The Texas A. and M.University System, pp. 1 – 11.

Ogbeide AE & Victor R 1995. Hydrological studies of water bodies in the Okomu forest reserves (sanctuary) in Southern Nigeria, physico-chemical hydrology. *Tropical Freshwater Biology*, 4: 83-100.

Pearse DE 2001. Turtle mating systems: Behavior, sperm storage, and genetic paternity. *Journal of Heredity*, 92(2): 206–211.

Ovie SI & Adeniji HA 1990. A Simple Guide to Water Quality Management in Fish Ponds. *Technical Report of NIFFR*, No 23.

Sikoki FD & Veen JV 2004. Aspects of Water Quality and the Potential for Fish Production of Shiroro Reservoir Nigeria. *Living Sys. Sustainable Devt.*, 2: 7.