E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2021; 9(3): 98-101

www.fisheriesjournal.com
Received: 08-02-2021
Accepted: 10-04-2021

Abdulazeez Musa
National Institute for Freshwater Fisheries Research (NIFFR), P.M.B. 6006, New Bussa, Niger State, Nigeria

Bitrus Musa Gwari
National Institute for Freshwater Fisheries Research (NIFFR), P.M.B. 6006, New Bussa, Niger State, Nigeria

Mubarak Usman Jikantoro
National Institute for Freshwater Fisheries Research (NIFFR), P.M.B. 6006, New Bussa, Niger State, Nigeria

Godfrey Amedu Aduku
National Institute for Freshwater Fisheries Research (NIFFR), P.M.B. 6006, New Bussa, Niger State, Nigeria

Hamzat Abubakar Woru
National Institute for Freshwater Fisheries Research (NIFFR), P.M.B. 6006, New Bussa, Niger State, Nigeria

Shamsudeen Mohammed
National Institute for Freshwater Fisheries Research (NIFFR), P.M.B. 6006, New Bussa, Niger State, Nigeria

Corresponding Author:
Abdulazeez Musa
National Institute for Freshwater Fisheries Research (NIFFR), P.M.B. 6006, New Bussa, Niger State, Nigeria

Preliminary study of some Physico-chemical parameters of Kitoro reservoir in NIFFR estate, New Bussa, Niger state

Abdulazeez Musa, Bitrus Musa Gwari, Mubarak Usman Jikantoro, Godfrey Amedu Aduku, Hamzat Abubakar Woru and Shamsudeen Mohammed

DOI: https://doi.org/10.22271/fish.2021.v9.i3b.2478

Abstract
The management of water quality is the single most important factor in productive fish farming. Water quality management is an ongoing never-ending challenge, which requires certain diligence from fish farmers. The Physico-chemical parameters (Colour, pH, BOD, Water Temperature, Total Hardness, D.0, Turbidity, Alkalinity, Conductivity, Air Temperature, Depth) of Kitoro reservoir in National Institute for Freshwater Fisheries Research (NIFFR) estate, New–Bussa was studied from October-December 2020. Samples were collected monthly at two (2) different points (Monk and Inlet) on the reservoir and were analyzed using different analytical techniques. The results showed that most of the physicochemical parameters fall within the recommended range value except conductivity (71.08µs/cm) which was below the recommended range value (150-500µs/cm). The potential fish yield of the reservoir (68.7kg/ha) was found to be of high potentials when compared to other studied reservoirs like Dadin kowa (30.2kg/ha), Kiri (42.7kg/ha), Ojirami (49.6kg/ha). Finally, the reservoir was found to be of good quality and is suitable for fisheries and aquaculture.

Keywords: Water quality, Physico-chemical parameters, potential fish yield, reservoir

1. Introduction
The general desire to protect fresh water fisheries as led to an expansion of research into their water quality requirements, in terms of their physicochemical parameters such pH, temperature, dissolve oxygen, transparency, total alkalinity, total hardness, electrical conductivity, total dissolved matter and so on. These factors serve as a basis for the richness or otherwise biological productivity of any aquatic environment (Imevbore, 1970 and Bhatt *et al*, 1999) [6].

Selection of the tested parameters is only depended on the purpose of using that water and what extent we need its quality and purity. According to Patil *et al*, (2012) [22], physicochemical parameter analysis is very important because it helps us have an idea about the quality of water to be used and the obtained results will then be compared with the standard values.

Several of these physicochemical parameters have been studied on large man-made lakes in Northern Nigeria by Adeniji and Ita (1977) and Adeniji (1981) [2]. Other works on physicochemical parameters include that of Balarabe (1989) [5], on Makwaye Lake, Zaria, Oniye *et al*., (2002) [20], on Zaria Dam, Ugumba and Ugwumba (1993) [18], on Awba Lake in Ibadan, Kolo and Oladimeji (2004) [15], studied water quality and some nutrient levels in Shiroro Lake, Niger State. Recent physicochemical parameters studies include olanrewaju *et al*, (2017) [19], on Eleyele Reservoir, Ibadan, Oyo State, Godwin and Abdallah, (2016) [14] on Aleiro Reservoir, Kebbi State, Popoola, (2019) on Erilu reservoir Oyo State and Andong *et al*, (2019) [3] on Oguta, Imo State among many others.

In recent years, aquaculture business has increase tremendously in New Bussa and environs. More ponds and reservoirs are constructed to stock fish and study such as this one is important.

The present study therefore aims at assessing water quality of Kitoro Reservoir in NIFFR Estate, New Bussa using physicochemical parameters.
The objectives are:

i. To determine whether the reservoir is good for fisheries and aquaculture
ii. To determine the potential fish of the reservoir using the Morpho Edaphic Index.

2. Materials and Methods

2.1 Description of Study Area

The study area was Kitoro reservoir located at Niffr estate, New Bussa, Niger State. The reservoir was constructed in 2008. It is located at Latitude of N9^{0}52'44" and Longitude of E4^{0}32'20". It has a distinct rainy season from April\May to October and a dry season from November to March.

2.2 Sample Collection

The samples were collected in the morning using water sampling bottle between 09:30am to 10:30am and the samples were all analyzed within 24hrs after collection. The water sample was collected at two (2) different locations on the water body i.e monk and inlet side. This experiment was carried out for three months (October, November and December).

2.3 Methodology

Table 1: Analytical techniques employed for the study

Parameters	Analytical Technique
Colour	Secchi Disc
pH	pH Meter
B.O.D	5 days Tests
Water Temp.	Thermometer
Hardness	Titrimetric
D.O	Azide Modification
Turbidity	Secchi Disc
Alkalinity	Titration
Water Conductivity	Conductivity Meter
Air Temp.	Thermometer
Depth	Secchi Disc

2.4 Potential fish Yield (PFY)

Potential fish yield was estimated using the Morpho Edaphic Index (MEI) method given by the equation:
Log Y = 0.9420 + 0.3813 logX
Where: Y = fish yield in kg/ha
X = MEI = Conductivity in µmhos/cm at 20^{o}c / mean depth in meters.

3. Results

Table 2: Result of Physico-chemical parameters of the reservoir

Parameters	October		November		December		Mean/S.D
	Monk	inlet	Monk	inlet	Monk	inlet	
Colour	B	LB	GY	GY	B	B	
pH	7.0	7.0	7.3	7.2	7.1	7.1	7.11± 0.12
BOD (Mg/l)	2	2	2.4	2.4	6.92	6.91	3.77±2.44
Water Temp (^{O}C)	29.9	30	29	29.7	28.6	29	29.37±0.58
Hardness (Mg/l)	71.58	67.37	99.68	30.79	121.6	1.62	65.41±43.88
D.O (Mg/l)	4	4	6	6	7	7	5.67±1.37
Turbidity (M)	0.22	C.T.B	0.20	0.21	0.03	0.03	0.14± 0.10
Alkalinity (Mg/l)	30	30	10	10	20	18	19.67±8.98
Conductivity (µs/cm)	66	62	99	99.5	20	80	71.08±29.61
Air Temp. (^{O}C)	29.1	28	30	31	30.2	30	29.72±1.04
Depth (M)	0.58	0.22	0.4 3	0.30	0.28	0.19	0.32±0.14

B-Brown LB-light brown GY-greenish yellow BOD- biological oxygen demand Temp.- temperature D.O-dissolve oxygen S.D- standard deviation C.T.B-clear to bottom

Fig 1: Kitoro Reservoir in October

Fig 2: Kitoro Reservoir in November

Fig 3: Kitoro Reservoir in December

Table 3: Potential Fish Yield in Kitoro Reservoir

Reservoir	MEI	PFY (Kg/ha)
Kitoro	222.125	68.7

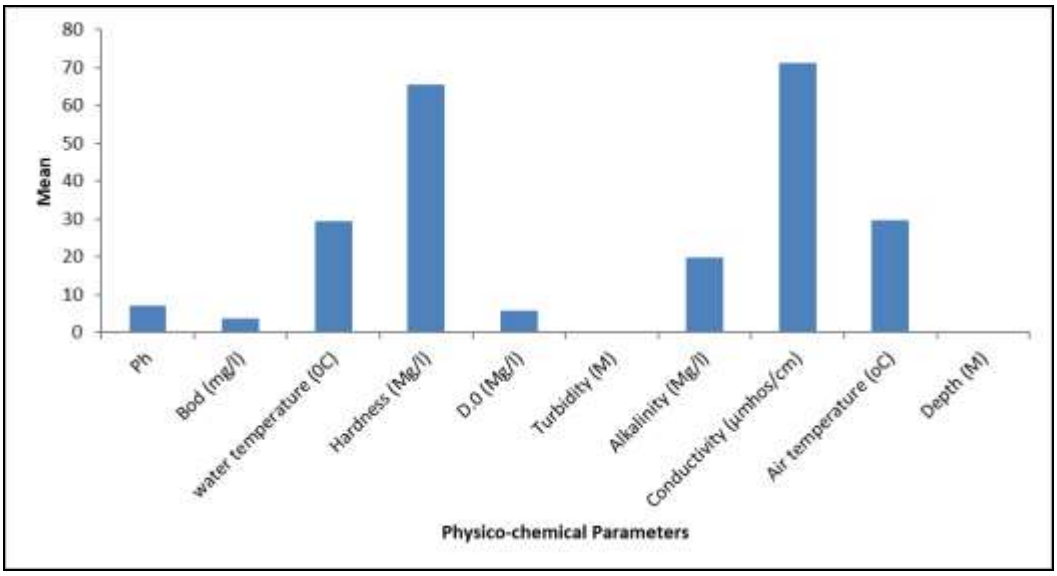

Fig 4: Mean value of Physico-chemical parameters Analyzed in kitoro Reservoir

4. Discussion

4.1 pH: pH is one of the most important parameters commonly measured in natural and waste waters to ascertain their quality status. Generally, pH values measured in the present study (7.11) shows that it falls within the normal range value (6.5-8.5) as prescribed by Boyd (1979) [8]. Many aquaculture research scientists agreed that freshwaters with alkaline pH have potential to be productive and suitable for fish culture (Adeniji, 1986; Boyd, 1979) [1, 8]. Acid waters (pH belong 6.5) will not have good plankton growth and so will not be productive. Generally, freshwater fish cannot survive in waters below pH 4 and above pH 11 for long periods.

4.2 Biological Oxygen Demand (BOD): Biological Oxygen Demand (BOD), which is a measure of the biological activities in a water body, gives an indication of the organic load of water bodies, especially those receiving organic effluent. The BOD of the reservoir (3.77mg/l) falls within the range for optimum fish production 3-20mg/l as recommended by Boyd (2003) [11]. Ephraim and Ajayi (2015) [13] interpreted low BOD values as an indication of limited levels of organic matter decomposition requiring oxygen from the water. High level of BOD value indicates high level of organic matter decomposition requiring oxygen from the water.

4.3 Water Temperature: Temperature is known to affect the behavior, feeding, growth and reproduction of fish. In this study the water temperature (29.37 ^{0}C) and Air temperature (29.72^{0}C) falls within the range of 27.6 ^{0}C to 30 ^{0}C for optimum yield in aquaculture recommend by FAO (2006) [16]. Fish are known to have poor tolerance to sudden changes in temperature (Boyd and Lichtkoppler, 1979) [10]. Therefore, fish farmer should not suddenly thrust them into a water of appreciably higher or lower temperature

4.4 Dissolved Oxygen (D.O): Maintenance of sufficient dissolved oxygen in the fish pond at all times is without doubt, the most essential of water quality management tasks performed by the fish farmer. The mean value of the reservoir was found to be 5.67mg/l which falls within the recommended value 5-8mg/l by Swingle (1969) [24]. Its presence in good quantity in the fishpond will improve the water quality in the fishpond by oxidizing poisonous gases such as, ammonia, carbondioxide etc into their non-poisonous forms.

4.5 Total Hardness: The mean value of total hardness of the reservoir is found to be 65.41mg/l. This value is within the standard range of 50 – 100 mg/l as recommended by WHO (2003) [25]. This implies that the water is soft and suitable for fish breeding.

4.6 Turbidity: High turbidity of water can decrease fish productivity, as it will reduce light penetration into the water and thus oxygen production by the water plants. Dissolved suspended solids will also clog filters and injure fish gills (Carballo *et al.*, 2008) [12]. The mean value obtained in this study was found to be 0.14m which indicates th at there is little light penetration into the reservoir and this is because of cow activities taking place into the reservoir.

4.7 Alkalinity: The recommended level of alkalinity for freshwater system is 5-500 mg/l (Lawson, 1995) [17]. In the present study, total alkalinity (19.67mg/l) was generally found to be within the recommended range as indicated above. Boyd (1982) [9] advocated that total alkalinity should be more than 20mg/l in fertilized ponds as fish production increases with increase in total alkalinity. Also Water with a high alkalinity is more strongly buffered than water with a low alkalinity.

4.8 Conductivity: The mean value obtained in this study was found to be 71.08µs/cm and it falls below the recommended range of 150-500µs/cm for ideal fish culture as recommended by Russell *et al.* (2011) [23]. This could be because the reservoir is the accumulation of rain water and at such the conductivity is expected to be low.

4.9 Potential Fish Yield (PFY)

The potential fish yield of kitoro reservoir was found to be 68.7kg/ha. This was calculated on the basis of the Morpho Edaphic Index. The value obtained in kitoro reservoir (68.7) could be said to have high potential for fish production when compared to other reservoirs like Dadin kowa (30.2), Kiri (42.7), Ojirami (49.6) studied by Ovie *et al* (2009) [21].

5. Conclusion and Recommendations

The physiochemical parameters of the reservoir were found to

be of high quality and suitable for fisheries and aquaculture except for conductivity which fall below the recommended standard value. Therefore National Institute for Freshwater Fisheries Research (NIFFR) should stock Kitoro reservoir for fish production as it possesed high quality. There is also the need for a study of one year calendar capturing both the dry wet season in order to assess any significant changes in the physiochemical parameters. The activities of herders in and around the reservoir should be checked by the National Institute for Freshwater Fisheries Research New bussa Authority. This is because their affects some of the physiochemical parameters like turbidity of the reservoir.

6. References

1. Adeniji HA. Some Limnological precautions for fish farmer; Fisheries enterprises and information Brochure in commemoration of the 5th annual conference of fisheries society of Nigeria 1986.
2. Adeniji HO. The development of Limnology in Nigeria, In: proceedings of the first workshop for the promotion of limnology in developing countries 1981, 15-17.
3. Andong FA, Ezenwaji NE, Melefa TD, Hinmikaiye FF, Nnadi OV, Oluwafemi O. Assessment of the physico-chemical properties of Oguta Lake compared to the established values of the Federal Ministry of Environment, Nigeria: Water quality of Lake Oguta, Nigeria. Advances in Oceanography and Limnology, 2019;10(2)https://doi.org/10.4081/aiol.2019.8522
4. Arain MB, Kazi TG, Jamali MK, Afridi HI, Baig JA, Jalbani N *et al*, Evaluation of Physico-chemical parameters of manchar lake water and their comparison with other global published values. Pak. J. Anal. Environ. Chem 2008;9:101-109.
5. Balarabe ML. Limnology and zooplankton distribution of Makwaye, (Ahmadu Bello University Farm Lake, Samaru, Zaria. Unpublished, MSc. Thesis. Ahmadu Bello University, Zaria 1989, 143.
6. Bhatt LR, Lacoul P, Lekhak HD, Jha PK. Physicochemical characteristics and phytoplankton of Taudaha lake, Kathmandu. Poll. Res 1999;18(4):353-358
7. Boyd CE. Water quality for pond aquaculture. Research and Development Series No.43. International center for Aquaculture and Aquatic Environments, Alabama Agricultural Experiment Station, Auburn University, Alabama 1998.
8. Boyd CE. Water quality in warm water fish ponds, Auburn University Auburn, Alabama Res and Development series 1979, 22.
9. Boyd CE. Water quality management for pond fish culture. Elservier Sci. publ. Co. Amstrdam-Oxford-New York-Tokyo, 1982, 318.
10. Boyd CE, Lichtkoppler F. Water quality management in pond fish culture. International center for aquaculture, Agric Expt. Station Auburn University Alabama 1979.
11. Boyd CE. Guide lines for aquaculture effluent management at farm-level. Aquaculture 2003;226:101-112.
12. Carballo E, Eer AV, Schie TV, Hilbrands A. Small- Scale fresh water fish farming. Agrodok 2008, 15.
13. Ephraim BE, Ajayi IO. Compositional evaluation and quality status of surface waters of Mbat-Abiati and Oberekkai Creeks of the Great Kwa River, Southeastern Nigeria. Advances in Applied Science Research 2015;6(6):36-46.
14. Godwin Abuh, Abdullah Adil Ansari. Assessment of physico-chemical quality of water in Aliero Dam (kebbi state, nigeria) International Journal of Climate Research 2016;1(1):17-21.
15. Kolo RJ, Oladimeji AA. Water quality and some nutrient levels in Shiroro Lake Niger State. Nigeria. Journals of aquatic sciences 2004;19(2):99.
16. FAO (Food and Agriculture Organization of the United Nations). 2006b. State of World Aquaculture. FAO Fisheries Technical paper 500. Rome: FAO Fisheries Department 2006.
17. Lawson TB. Fundamentals of aquaculture engineering. New York, Chapman and Hall 1995.
18. Ugwumba AO, Ugwumba AA. A study of the physico-chemical hydrology and plankton of Awba Lake in Ibadan, Nigeria. Fish Acadbiz, comm 1993;1(144):20-3
19. Olanrewaju AN, Ajani EK, Kareem OK, Orisasona O. Relationship between Physico-Chemical Parameters and Reproductive Indices of Parachanna obscura (Gunther 1861) in Eleyele Reservoir, Ibadan, Nigeria. Eur Exp Biol 2017;7(6):36.
20. Oniye SL, Ega RA, Ajanusi OJ, Agbede RIS. Some aspects of the physicochemical parameters of Zaria Dam, Nigeria. J. Agric and Environ 2002;11(2):367- 379
21. Ovie SI, Adepoju F, Ajayi. Limnological stock assessment, productivity and potential fish yield of Dadin Kowa and Kiri reservoirs. In: Ovie, S.I. and Ajayi, O. Preliminary studies on the limnological stock assessment, productivity and potential fish yield of Ojirami Reservoir, Edo State, Nigeria. Tropical Freshwater Biology 2009;18(1):1-8.
22. Patil PN, Sawant DV, Deshmukh RN. Physico-chemical parameters for testing of water: A review. Int. J. Environ. Sci 2012;3:1194-1207.
23. Russell M, Shuke R, Samantha S. Effects of conductivity on survivorship and weight of Goldfish *(Carassius auratus*). 2011. Available at http://departments.juniata.edu/biology/eco/documents/Russell *et al*. pdf.23 Apr (2017).
24. Swingle HS. Method of analysis for waters, organic matter and pond bottom soils used in fisheries research. Auburn University, Auburn, Alabama. Alabama. Research and development 1969;22(30).
25. WHO (World Health Organization) Global journal of pure and Applied Science 2003;4(2).