WORLD ENVIRONMENTAL CONSERVATION CONFERENCE

2023

CLIMATE CHANGE PARTNERSHIP ACTIONS FOR SUSTAINABLE FUTURE AND RESTORING LIFE ON EARTH

Proceedings of the 6th edition of World Environmental Conservation Conference

18th – 21st October, 2023

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Production of Proceedings

Netlink Environmental Conservation Organisation

Room 21 Abubakar Adamu Bulding

Federal University of Technology, Akure.

Design amd Printing of Proceedings

Maryj Printing Press

ACAD Fagbote Filling Station Akure-Ilesha Expressway

Phone number: +23407063411658

Copies of Proceedings

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ISSN: 2705-2850

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PREFACE

There is a growing concern on the adverse impacts of climate on biodiversity. This phenomenon is greatly manifested in form of shifting weather patterns threatening global food security, health and species existence. Humanity is at the receiving end of the consequences of climate change hence there is a need to step up actions on all fronts- overtime, everywhere all at once.

This calls for collaboration, partnership and networking to strengthening synergy among relevant stakeholders in a bid to tackling climate change menace. This forms the basis for the theme of this year world Environmental conservation conference: **CLIMATE CHANGE PARTNERSHIP ACTIONS FOR SUSTAINABLE FUTURE AND RESTORING LIFE ON EARTH.** The theme is conceived with a view to create an interface for information sharing and offer opportunities for participants to refine their commitments and pledges in the quest to achieving Sustainability in the face of climate change.

This year World Environmental Conservation Conference is memorable in the sense that it received overwhelming funding from the host - West African Science Service on Climate Change and Adapted Land use). WASCAL is posed to provide information and knowledge at the local, national and regional level to cope with the adverse impacts of climate change. Thus, this conference will offer opportunities for participants to learn from good practices demonstrated and showcase by WASCAL during the course of the conference. It will also strengthen staff-student exchange and provide prospect for Doctorate Research Doctoral Research in West Africa Climate System Programme (DRP WACS) – WASCAL among others.

Special appreciation goes to the management of The Federal University of Technology, Akure the host institution, National Park Service and African Regional Center for Space Science and Technology Education-English (ARCSSTE-E) that co-host this conference. We equally acknowledge other private, individual and corporate organizations that have contributed towards the success recorded in this event.

All the submitted articles were subjected to strict double blind peer-review process by the reviewers that are experts in the area of the particular submitted manuscript. The accepted manuscripts are published in WECC 2023 proceedings and also available for download on the organization website (www.necorng.org).

The accepted manuscripts fall within the underlisted subthemes:

- Climate change adaptation strategies in Agriculture, Forestry and Other Land Use (AFOLU)
- Climate smart city and architectural landscape design
- Retrofitting and decarbonization in tourism and hospitality industry
- Indigenous knowledge and local innovation in climate change adaptation
- Climate risk management, health, safety and hygiene
- Carbon credit-offset marketing/circular economy
- ICT development in environmental conservation (image processing and acquisition, computer vision, graphics, speed, interface technology, HMD devices, GIS: Body Tracking, AI and IOT, VRT, IVE).

We commend our keynote speaker Prof. Douda Kone Director Capacity Building Department, WASCAL Headquarter, Ghana and other guest speakers Prof. Babatunde Rabiu, Director General, Chief Executive Office, African Regional Centre for Space Science and Technology Education-English (ARCSSTE-E) and Dr. Goni I. M., Conservator General National Park Service.

It is hoped that researchers, students and policy makers will find the papers in this book very useful. Even though all the papers were reviewed and edited, the content and option expressed remain essentially that of the authors and not necessarily that of Netlink Environmental Conservation Organization.

Dr. Oladeji S. O.

President Netlink Environmental Conservation Organization

Convener World Environmental Conservation Conference

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INVESTIGATION OF PHYSICO-CHEMICAL WATER QUALITY OF FISH FARM IN FEDERAL UNIVERSITY OF TECHNOLOGY AKURE, NIGERIA

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ABSTRACT

An healthy water is required for supporting life in an aquatic medium, there is therefore need that lead to preliminary investigation of the physico-chemical water quality of the fish farm in the Federal University of Technology Akure which was carried out between July 2015 to April 2016. The physico-chemical water quality parameters considered includes pH, Sodium (Na^+), Potassium (K^+), Calcium (Ca^{2+}), Alkalinity, Conductivity, Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Bicarbonate and Temperature and other parameters. All the physico-chemical water quality parameters were determined using standard methods. Results showed that the fish farm water was fairly clean and unpolluted. It was concluded that the water could be suitable for thriving fishery as well as irrigated agriculture. It is therefore recommended that regular analysis of fish pond water is necessary because is a quality assurance process to ensure that there are no toxic substances in the pond leading to possible bio-accumulation and magnification.Suggestions for further area of research study on the fish farm were also made.

Keywords: *Fish, Investigation, Physico-chemical, Water quality, Farm.*

INTRODUCTION

Water is one of the most abundant compounds on earth approximately covering three-fourth of the earth's surface. Majority of water available on earth is saline in nature; only a small quantity exists as fresh water. Fresh water has become a scarce commodity due to over exploitation and pollution (Gupta and Shukla, 2006). Industrial, sewage and municipal wastes are being continuously added to the water reservoirs affecting the physico-chemical quality of water making it unfit (Dwivedi and Pandey, 2002). Uncontrolled dischargeof domestic waste water into the ponds has resulted in eutrophication of ponds (Pandey and Pandey, 2003). Physico-chemical properties (pH, conductivity, free CO_2, COD, alkalinity, chlorinity-salinity, ions such as Na^+ and K^+) of water in any aquatic system are largely governed by the existing meteorological condition, and are essential for determining the structural and functional status of natural water.

Aquatic ecosystems are of great significance to humans and fulfill many important roles for fish farming, water purification, and hydrological hazard prevention and control (Grizzetti et al., 2016). Fish are the most important part of the aquatic ecosystem, and it can play an important role in material circulation and energy flow (Mansor et al., 2012).

Hydrological condition of water affects the aquaculture activities, fish productivity and species composition of aqua fauna, eutrophication and overall loss of biodiversity that results in degradation of pond ecosystem. The magnitude and dynamics of oxidation-reduction reaction by various elements present in water plays an important role in governing most of the chemical, biochemical and microbial behaviours in the pond water, and also maintaining congenial environmental condition.
The study of different physico-chemical parameters is very important for understanding the metabolic events in aquatic ecosystem. (Shinde *et al*, 2011).

This research tends at determination of the levels and temporal variations of the physico-chemical water quality parameters and investigated build up of toxic substances which could lead to bio-accumulation and magnification leading to health implications and verification of fish pond water to be conducive for profitable fish farming or not.

MATERIALS AND METHODS

Study Area

This study was carried out in the fish farm of Federal University of Technology, Akure, Ondo State, Nigeria on Latitude $7^0 29^1$ 41 North and Longitude 5^0 14^1 58 East within 1200ft elevation above the sea level (Fig.1). It is formerly inhabited by people described as Obanla who used the place for farming before they were been relocated (Field Survey, 2016).

Sampling Program

Routine sampling for the study commenced from 29th July, 2015 to 25th April, 2016, spanning between the rainy and dry seasons. The Sampling was done once in a month throughout the period, and the time of sampling was between 8.30am to 10.30am on each sampling day. The actual samplings were done by dipping each sample bottle at approximately 20-30cm deep into the pond projecting the mouth of the container deep into the water not allowed atmospheric air passage into the sample.

Sampling Station and Collection of Samples

A fixed sampling station (marked X) was established on fish farm as shown in plate 1.

Analyses of Samples

Only the surface water samples were collected using clean uncontaminated plastic containers and taken to the laboratory for analyses.

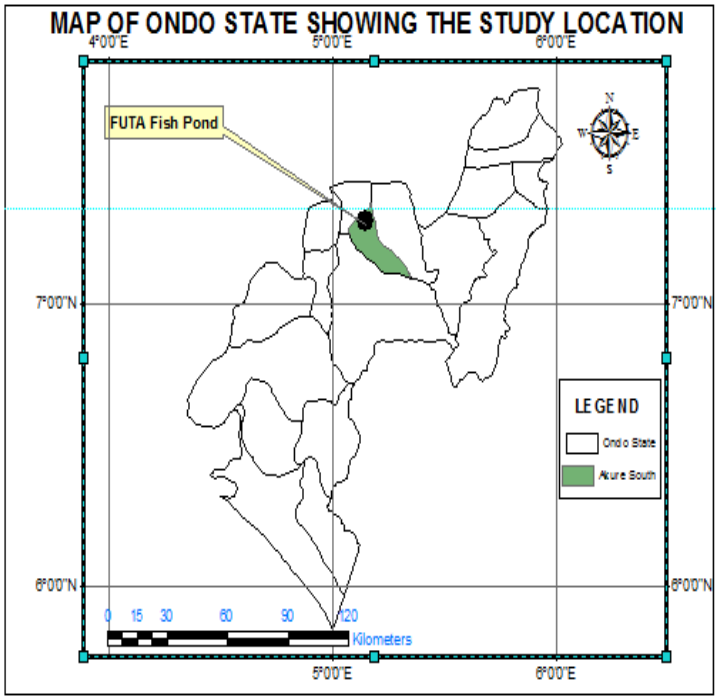

Plate 1: The General Photographic View of the Fish **Farm**

Source: Field Survey, 2016

RESULTS AND DISCUSSION

The results of the analysed Physico-Chemical parameters are shown in tables 1 and 2

The Hydrogen ion concentration (pH)

The pH was generally slightly alkaline throughout the whole period of this research with highest in July 2015 (7.88) and lowest in April 2016 (6.65).

Water Temperature

Water temperature value was between 23^0 C - 32^0C, throughout the period, the highest recorded in April 2016 and the least in January 2016.

Alkalinity

The Alkalinity level ranged between 48mg/l and 280mg/l, the least value was recorded in November 2015, and highest value in July 2015.

Conductivity

The conductivity level of the pond was generally high with the least at 194 µmhos/cm in November 2015 and with a peak at 329µmhos/cm in February 2016.

Dissolved Oxygen

The level of dissolved oxygen ranged between 1.00 to 5.41mg/l, very low value was recorded in September 2015 while the highest in November 2015.

Biochemical Oxygen Demand (BOD)

The BOD level was lowest in September 2015 (0.80mg/l), and peak in April 2016 (3.45)

Chemical Oxygen Demand (COD)

The COD was only recorded in October 2015 with 136.00mg/l

Chloride

The Chloride level of the water did not show a definite variation pattern as it was relatively high in March 2016 (127.55mg/l), with a lower trend in November 2015 and January 2016 (43.73mg/l) respectively.

Nitrate

The nitrate value attained a peak in March 2016 (0.38mg/l), with the least recorded in July and August 2015 (0.03mg/l), there was no definite variation pattern.

Sulphate

The Sulphate value was at the peak in November 2015 (73.31mg/l) and in April 2016 (8.10mg/l) was least recorded.

Phosphate

In July 2015, trace amount of phosphate was recorded, the highest value was recorded in November 2015 (34.19ppm).

Sodium

The Sodium value was recorded highest in January 2016 (52.30ppm) and minimum in April 2016 (20.40).

Calcium

The Calcium value of the water did not show a definite variation pattern as it was relatively high in January 2016 (320ppm), and low in August 2015 (33.60ppm), in some other months; 210ppm in February, 2016, 136ppm in April 2016.

Potassium

The values recorded for Potassium was least in the first month of research with 5.20ppm (July 2015), and got to the peak in March 2016 (66.50ppm).

Magnessium

The Magnessium value for October 2015 (1.71ppm) was recorded lowest but attained its peak value in August 2015 (5.24ppm).

Ionic Hierarchy

The cationic hierarchy was $Ca^{2+}>Mg^{2+}>K^{+}>Na^{+}$while anionic hierarchy was

$HCO3>Cl>SO4^{2-}$

Changing Mg/l to Mequivalent/litre.

Na^{+}---------- 29.58 x 0.0432 = 1.28

Ca^{+}---------- 156.3 x 0.0499 = 7.80

Mg^{2+}---------- 3.32 x 0.0822 = 0.27

SAR = $\frac{1.28}{\sqrt{7.80 + 0.27}}$

SAR = $\frac{1.28}{\sqrt{8.07 = 0.45}}$

Anionic order

Cl = All addition of chlorine x 0.0282

73.79 x 0.0282 = 2.08

SO_4^{3}= 34.49 x 0.0208 = 0.72

HCO^{3} = Alkalinity x 1.22

206.7 x 1.22 = 252.17

252.17 x 0.0164 = 4.14

The anionic order is: HCO^{3}> Cl>$SO4^{2-}$

Cationic Order

Na^{+} = 29.58 x 0.0432 = 1.28

K^{+} = 25.84 x 0.02557 = 0.66

Mg^{2+} = 3.32 x 0.0822 = 0.27

Ca^{+} = 156.3 x 0.0499 = 7.80

The order is: Ca>Na>K>Mg

Table 1: Chemical Parameters of Fish Farm Water in FUTA

Parameters	July 2015	August 2015	September 2015	October 2015	November 2015	January 2016	February 2016	March 2016	April 2016	Mean
DO (mg/l)	1.80	1.60	1.00	3.77	5.41	5.40	5.40	5.36	5.29	3.89
BOD (mg/l)	1.40	1.20	0.80	1.61	1.90	1.94	2.05	1.62	3.45	1.77
COD (mg/l)	-	-	-	136.00	-	-	-	-	-	136.00
Chloride (mg/l)	80.17	80.17	65.59	81.00	43.73	43.73	51.02	127.55	91.11	73.79
Nitrate (mg/l)	0.03	0.03	0.11	0.13	0.11	0.10	0.11	0.38	0.13	0.13
Sulphate (mg/l)	11.60	23.20	12.00	34.80	73.31	40.40	50.00	57.00	8.10	34.49
Phoshate (mg/l)	Trace Amount	13.68	20.52	15.04	34.19	13.68	27.36	27.48	17.09	18.78
Sodium(ppm)	22.20	24.70	20.50	45.00	33.00	52.30	22.50	25.60	20.40	29.58
Calcium (ppm)	37.70	33.60	34.60	316.00	167.00	320.00	210.00	152.00	136.00	156.3
Potassium (ppm)	5.20	6.70	5.60	21.30	18.50	35.40	25.40	66.50	48.00	25.84
Magnessium (ppm)	4.93	5.24	2.88	1.71	1.25	2.50	1.92	4.86	4.55	3.32

Table 2: Physical Parameters of Fish Farm Water in FUTA

Parameters	July 2015	August 2015	September 2015	October 2015	November 2015	January 2016	February 2016	March 2016	April 2016	Mean
Temperature ^{0}C	27	27	28	27	30	23	29	30	32	28.1
Conductivity µmhos/cm	287p	274	209	212	194	265	329	252	286	256.4
Alkalinity Mg/l	280.00	232.00	168.00	200.00	48.00	240.00	248.00	256.00	188.00	206.7
pH	7.88	7.15	6.96	7.18	7.24	6.89	7.69	6.71	6.65	7.15

DISCUSSION

General Physico-Chemical Features

In the present investigation, it has been observed that the physico-chemical characteristic of fish farm at the Federal University of Technology Akure generally bear some resemblance with some other Nigerian fresh water bodies already investigated.The water temperatures were observed highest during the dry period with 32^0C than in the rainy period which was 27^0 C in July this corroborate with what was reported by Akinbuwa (1998) that generally temperature were characterized by relatively high water temperature during the dry season, and relatively low during the rainy season which is usually attributed to longer duration of insulation in the dry season.

The desirable range of hydrogen-ion-concentration pH for pond water is 6.5 – 9.5 and acceptable and acceptable range is 5.5 – 10.0 (Stone and Thomforde 2003). The range of the pH obtained from this study was 6.65 – 7.88, this agrees with Stone and Thomforde (2003). Thus, good pond productivity and fish health can be maintained. Furthermore, a similar range was obtained by Kamal *et al*. (2007) who reported a range of 7.3 – 8.3.

The values of conductivity in the pond which ranged from 194 - 329µmhos/cm can be said to belong to Talling and Talling (1965) class I of African water as the electrical conductance is less than 600µmhos/cm. This class of water is been regarded as being poor in chemical nutrient. It should be noted there was a marked similarity in the temporal variation of the level of conductivity with pH; oxygen and alkalinity, in that both conductivity and alkalinity were relatively high in the rainy months and low during the dry months. Similar observation had also been made in Lake Asejire, River Oshun (Egboege, 1981) and Opa reservoir (Akinbuwa, 1988). Discharge to the pond would raise the conductivity because of the presence of nitrate, phosphate and chloride. The explanations for this trend is that during rainy season, the rains after soaking the soil, pick up most of the soluble compound from materials such as the ashes of bush fires, animal dung and decomposed organic debris left during the dry season and carries them with their run-off into the ponds, and hence cause an increase in the level of nutrient.

The alkalinity ranged from 48 – 280mg/l. The alkalinity of unpolluted pond was reported by Shastree *et al*. (1991) to be 171.2 – 235.5mg/l, this agree with this result with only exemption in November 2015 when 48mg/l was recorded making the water to be polluted in that month. The maximum oxygen recorded in this research was 5.41mg/l is in consonance with minimum DO required for tropical fish that is 5mg/l and agree with those of Saloom and Duncan, (2005). Biochemical oxygen demand varied significantly among the ponds. The highest value was 3.45mg/l and least was 0.80mg/l. These are all below FEPA standard (Federal Environmental Protection Agency of Nigeria, 1991). The FEPA limit is 30mg/l. this suggestive that the pond water is not polluted and the fishes are not being negatively affected. However, permissive limit as reported by APHA (1992) is 4mg/l. This was not significantly different from the highest of 3.45mg/l obtained from this study. Accumulation of low BOD results in organisms being stressed, suffocated and death (APHA, 1992). This was not observed in the pond under study. The concentration of sulphate in the pond in the present study suggested high values as similar values were reported by Mishra (1991) as 42.46 – 57.36. He suggested that the high values he obtained may have been caused by the used detergent and soaps by neighbours which got into the water body. This was not the case in the present study, hence possibly the low values obtained from this study.

In this study, the phosphate value of 13.68 – 34.19ppm indicate that the pond is not polluted as against the report by Pahawa and Mehrotra (1966) reported 1.00mg/l for a polluted fish pond. The desirable limit for nitrate level is 0 – 2mg/l and acceptable limit less than 4mg/l (DWAMD, 1994), this is consonance with the result of this study with 0.03 – 0.38mg/l. There is no presence of pollutants like bacterial and pesticides. Magnesium concentration was 1.71 - 5.24ppm. Trivery and Khatavker (1986) reported magnesium concentration which ranged from 7.32 to 18mgl, these are higher values than the result of this study. Also Desia (1982) reported higher value of 70 mg/l. The two are not supportive of the result of this study.

The calculated SAR values was less than 1 which means that the water is suitable for irrigation agriculture practices. The cationic hierarchy was $Ca^{2+}>Na^{+}>K^{+}>Mg^{2+}$contrast the standard world's average ($Ca^{2+}>Mg^{2+}>Na^{+}>K^{+}$). While anionic hierarchy was $HCO_3>Cl>SO_4^{2-}$ conform with the world's average ($HCO_3>Cl>SO_4^{2-}$). It therefore reveal that the water is not polluted.

CONCLUSION

The physico-chemical investigation carried out in this research at the Federal University of Technology Akure fish farm water is not polluted, very good for thriving fish farming as well as appropriate for irrigation agriculture, which confirmed previous water quality studies in pond water in other part of the world. Despite the low DO in the first three months, the remaining months revealed that the DO is alright for fish farming, however, the abnormality value of DO in the first three months may be due to analytical, calculation error or equipment fault, thereby, future research can be employed for elaborate result as this is a preliminary work. It is therefore suggest that comprehensive and elaborate research be carried out in the fish farm, regular analysis of fish pond water is necessary because is a quality assurance process to ensure that there are no toxic substances in the pond leading to possible bio-accumulation and magnification. In this way the good health of the aquatic ecosystem, humans and environment can be guaranteed.

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