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Preliminary studies on some physico-chemical parameters and fish species composition of Doma Dam, Nasarawa State, Nigeria

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Abstract

Study of some Physico-chemical parameters and fish species composition of Doma Dam was carried out between the month of August - October 2012. Fishing communities along the dam were selected at sampling stations and collection of fish species. The values of Physico-chemical parameters obtained for stations were in the range of 28.10-92m for depth, 27.70-28.48o for temperature, 7.03-7.64 for pH, 7.23-7.64mg/l for dissolved oxygen (DO), 30.08-31.75ntu for turbidity, 94.64-105.17mg/l for alkalinity and 79.17-80.58mg/l for total hardness. The result indicated that there was significant difference ($p < 0.5$) for depth, temperature turbidity and alkalinity, while there was no significant difference ($p < 0.05$) for DO, pH and water hardness among the stations. The result of these parameters among the durations shows that there was significant different ($p < 0.05$) in all the parameters except pH. The study revealed that there were twenty five (25) fish species belonging to 12 families in the dam. The family Cichlidae and Mochokidae and Bagridae which has three species each. While the family's Polypteridae, Channidae, Centropomidae, Hepsetidae and Protopteridae has the lowest number of one (1) each. The overall result revealed that the Physico-chemical parameters were mostly influenced by duration and not much by stations and the parameters measured were within the recommended water quality requirement for growth and survival of aquatic organisms.

Keywords: Doma dam, fishing community, physico-chemical parameter, fish species.

Introduction

The rapid urbanization of many towns and cities across the world necessitate the construction of small dams across small rivers and stream to supply these towns with portable pipe borne water. Doma dam, is one of such water body in Nasarawa state that supplies water to Doma L.G.C. These dams apart from their primary functions also have secondary uses of fisheries and irrigation of farmlands. Knowledge of the physico-chemical regime of a water body is of great value in the determination of its productivity, usefulness and other characteristic (Adebisi, 1981, Boyd and Frobish, 1990).

Dependence on these water bodies as a valuable resource demands for adequate understanding of their dynamics since water is the only medium in which members of the aquatic community live and reproduce, this implies that the aquatic organisms must be able to find shelter and food, make use of dissolved gases in it and reproduce without compromising need for a change environment. The diversity of fishes mainly depends upon the abiotic factors and types of ecosystem (Nanda and Tiwari, 2001). Environmental degradation, through pollution of the aquatic environment, flooding and aquatic weed infestation has all tended to reduce the capacities of these natural bodies of water (Nanda and Tiwari, 2004). To support optimum fish population for preservation of natural stocks capacity exist in the man-made reservoir and dams for fish production through stocking and expansion of aquaculture through utilization of vast wetland for pond construction in order to boost fish production, multidisciplinary approach should be adopted for future water resource development project where dams for domestic water supply and irrigation should also incorporates fisheries (NMANR, 1998). The objectives of this study is to determines some physico- chemical parameters of the dam, identify the available fish species with view of assessing its fisheries potentials.

Material and methods

Study site: Doma Dam is located south of Doma L.G.A of Nasarawa state of Nigeria, and lies on latitude 9°3N of the equator and longitude 9°32E. The Dam was constructed in 1985 by Lower Basin Development Authority (LBRBDA) with the aim of providing water for dry season farming (irrigation) and to supply Doma town and its environment with portable drinking water. The Dam has its source behind Kwarafin (Agatu) community where the stream was dammed downstream. The Dam is surrounded by few hills and riparian vegetation. Three (3) fishing community settled along the Dam, namely: Agatu, Juku and

Alago whose primary occupation is fishing. These fishing villages were chosen for study, and designate as station I, station II and station III.

Analysis of physico-chemical parameters: The study was done during the peak of rainy season between the month of August to October 2011. Physico-chemical parameters analysis were done weekly at the respective site using Lamotte fresh water aquaculture testing kit (model Aq-2/aq-3), code 363303/3634-04. Surface water temperatures were measured on the field using the digital mercury thermometer (suntex Ts-2 model). The thermometer was lowered into the water body at the designated site. Colorimetric procedure was used for pH and turbidity while Titrimetric method was used for dissolved oxygen (DO), total hardness and alkalinity as stated in the kit manual. Collection of fish species for identification was done with the help of fishermen living along the dam. Fish caught by fishermen were collected early in the morning and brought to the laboratory for identification using a guide for identification of Nigeria fresh water fishes by Tunde et al. (2006).

Statistical Analysis: Data collection was processed statistically using two way analysis of variance (ANOVA) to verify the differences in physico-chemical parameters. Correlation analysis was used to determine both the direction and the degree of freedom or relationships that exist among the variables.

Results

The result from table 1 revealed that the average water hardness of 80.08mg/l, the highest water hardness of 80.58mg/l was observed in station I followed by 80.50mg/l was obtained from station II while the least water hardness of 79.17mg/l was obtained from station III. There was no significant different ($p < 0.05$) in the hardness of water among the stations. Results in table 2 showed that the highest water depth 29.75m was observed in August followed by 28.60m was obtained from September while the least water depth of 27.83m was obtained from October. The average water temperature as indicated in table 2 was high in August (28.56°C) and the least in October (27.56°C). The total alkalinity was 104.50mg/l, 99.58mg/l and 95.75mg/l for the months of August, September and October respectively. The highest value of water hardness of 82.75mg/l was recorded in August followed by 80.67mg/l in September while the least water hardness of 76.83mg/l was obtained in October.

Table 1: The mean value of the parameters measured at different stations of Doma Dam and their standard deviation and standard errors.

Station/parameters	Depth (m)	T°C	pH	DO mg/l	Turbidity (NTU)	Alkalinity mg/l	Hardness mg/l
Station I	28.17 ^a	27.70 ^a	7.15 ^a	7.64 ^a	31.75 ^b	94.67 ^a	80.58 ^a
Station II	28.10 ^a	28.27 ^{ab}	7.03 ^a	7.23 ^a	30.08 ^a	99.58 ^{ab}	80.50 ^a
Station III	29.92 ^b	28.48 ^b	7.10 ^a	7.47 ^a	29.75 ^a	105.17 ^b	79.17 ^a
Grand mean	28.73	28.15	7.09	7.45	30.53	99.81	80.08
Standard deviation	1.49	0.90	0.58	0.87	1.84	8.80	6.57
Standard error of mean	0.28	0.15	0.10	0.15	0.13	1.47	1.09

Value in the same column followed by different superscripts differ significantly ($p < 0.05$)

Table 2: The mean monthly physico-chemical parameters of the Doma Dam from August–October 2011.

Month/parameters	Depth (m)	T°C	pH	DO mg/l	Turbidity (NTU)	Alkalinity mg/l	Hardness mg/l
August	29.75 ^b	28.56 ^b	7.28 ^a	7.98 ^b	31.50 ^b	104.08 ^b	82.75 ^b
September	28.60 ^a	28.31 ^b	7.12 ^a	7.38 ^{ab}	30.00 ^a	99.58 ^{ab}	80.67 ^{ab}
October	27.83 ^a	27.58 ^a	6.89 ^a	6.98 ^a	30.08 ^a	95.75 ^a	76.83 ^a
Grand mean	28.73	28.15	7.90	7.45	30.53	99.81	80.08
Standard deviation	1.49	0.90	0.58	0.87	1.84	8.80	6.57
Standard error of mean	0.25	0.15	0.97	0.15	0.31	1.47	1.09

Value in the same column followed by different superscripts differ significantly ($p < 0.05$)

The result of fish species caught and their families indicated that twenty five (25) fish species belonging to 12 families were identified during the study period. The families' *Cichlidae* and *Mochokidae* has the highest number of species which is four (4) followed by the families of *Clariidae* and *Bagridae* which has three (3) species each. The family of *Mormiridae*, *Schilbeidae* and *Clupeidae* has two (2) species each, while the family of *Polyteridae*, *Channidae*, *Centropomidae*, *Hepsetidae*, and *Protopteridae* has the lowest number of species of (i) each.

Discussion

The result obtained from the analysis of water quality of Doma Dam shows that most of the measured physical and chemical parameters were within the recommended range for most tropical fish species. This explains why there are high catches by

fishermen throughout the year along the dam especially *Tilapia species*, *Mormyrus sp* and *Clarias species*. The relatively low temperature observed between the three months could be attributed to the effect of rainfall within the month which makes the weather cold and thereby affect the temperature of the water. Boyd and Frobish (1990) observed that in tropical Climate, water temperatures are high all the year round, never the less difference in air temperature between raining and dry season may appreciably affect water temperature. Dupree and Hunner (1984) observed that warm water fish grow best at temperatures of between 25.0°C and 32.0°C.

The average pH recorded in the months of study in all the Station fall within the recommended range by Boyd and Lichtkoppler (1997). This may be the reason for the richness of the dam of diverse fish species recorded. The highest dissolve oxygen range recorded in all the months and stations was attribute to the greater and frequent agitation rate by wind current in this period, which does not encourage or enhance decay of organic matter, which could have used up much of the dissolved oxygen. Esrey (1992) recorded that water holds higher dissolve oxygen at low temperatures than at higher temperature. High DO in all the stations could be the possible reason for high catches by fishermen along the dam, as high DO favors fish reproduction, survival and growth. The mean value of turbidity recorded in all the stations was high. This could be as a result of suspended material and humid turbidity brought by tributaries of the dam during the rainy season (Esrey, 1992). Stirling (1985) and Hem (1970) gave a range of 75ppm-210ppm as adequate for productive warm water streams. This could be because there is little lime stone (carbonate of Ca Mg) deposit in the surrounding soils and along the course of tributaries that entered the Dam, therefore it may have little buffering capacity and respond little to fertilizer input into the dam. The higher Alkalinity at station III could be attributed to decay process of organic materials that settle at the bottom. The low water hardness values recorded in the peak of the rainy season (August to October) range from 79.1 mg/l to 80.58 mg/l falls within the classification of soft water and this may be attributed to the effect of rain waters which neutralizes the chemical concentration of the water within the dam. The low number of fish diversity in the dam could be attributed to the fact that the dam is man made with only few annual stream at it tributaries. This is in contrast to natural lakes that normally have diverse fish and abundant species due to abundant allochthynous food brought to them from rivers during rainy season. This explains why there are high catches by fishermen throughout the year along the dam especially *Tilapia species*, *mormyrus species* and *Clarias species*.

Conclusion

The result obtained from the three months (August-October) showed that most of the studied physico-chemical parameters of the dam were in conformity with the recommended values for tropical water and the rainy season hardness range of 79.10mg/l to 80.60mg/l that was obtained fell within the classification of moderately hard water. However, it is the hard range of 150mg/l to 300mg/l as CaCO₃ that is said to be more productive. Hence the dam is likely to be highly productive. The result further revealed that the physico-chemical parameters were influenced by duration but not greatly influence by stations.

Recommendations

This study only investigates some of the important physico-chemical parameters of the dam. It is therefore, recommended that further study should be carried out in other physico-chemical, biological, parameters and heavy metal in the dam in order to determined the accurate quality of the water for its suitability for both primary and secondary uses. Further research should also be carried out on fish species composition of the dam in order to determine its potential for fisheries development plan.

REFERENCES

- Adebisi, A. A. (1981). The physico-chemical properties and hydrology of tropical seasonal river, Upper Osun. *Afr. Journ. of Science* 64.
- Boyd, C.E. and F. Lichtkoppler. (1979): Water quality management in pond fish culture. *Auburn University R&D Series* 22: 30-111 (Pro. AID/DSAN. G 0039).
- Boyd, C.E., Frobish, L. T. (1990): *Water Quality in Ponds for Aquaculture*. Alabama: Birmingham Publishing Co., 10-30.
- Dupree, K. H., Hunner, J. V. (1984). *The Status of Warm Water Fish Farming and Progress in Farming Research*. U.S. Fish & Wildlife Service, Washington, DC.
- Esrey, S.A. (1991). Effect of improved water supply and sanitation on ascariasis, diarrhea, dracunculosis, hookworm infection, schistosomiasis and trachoma. *WHO Study Report: Africa, South, Southeast and Central Asia*. Geneva, Switzerland, 200pp.
- Hem, J. D. (1970). Study and interpretation of the chemical characteristics of natural water. *C.S. Geol. Surv. Water Supp.* 147, 23.
- Nanda, S.N and Tiwari, I.N. (2001). A survey of fish fauna in the sambalpur-Hirakund-Burin region, Orissa. *Environment and Pollution*, 8/1: 43-44.
- Nasarawa Ministry of Agriculture & Natural Resources (1998). Report of a fisheries assessment survey conducted in January to February 1998. 46-47 (unpublished).
- Stirling, H. P. and Phillips, M. J. (1990). Lecture note on the water quality management for aquaculture and fisheries resources unit (Overseas Dev. Admin.) Institute of Aquaculture Publications, University of Stirling.
- Thurston, R. V., Russo, R. C., Feteroff, C. M., Edsall, T. A. and Barber, Jr., Y. M. (1979). *A Review of the EPA Redbook: Quality Criteria for Water*. Water Quality Section, American Fisheries Society, Bethesda, Maryland, 313p.