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THE LENGTH WEIGHT RELATIONSHIP AND CONDITION FACTOR OF *SCHILBE MYSTUS* AND PHYSICO CHEMISTRY OF WATER IN ZOBE DAM DUTSINMA, KATSINA STATE

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Abstract
Length weight relationship and condition factor of *Schilbe mystus* and physicochemistry of water in Zobe dam in Dutsinma Katsina State was carried out. Twenty (20) *Schilbe mystus* species each were collected with water samples monthly for six (6) months making a total of one hundred and twenty (120) fish and six(6) water samples, morphometric measurement and physicochemical analysis was carried out using a meter rule and weighing balance. The results obtained showed that the growth pattern of the fish were negatively allometric with b values ranging from 2.161 and 2.842 obtained at $p<0.05$. There was strong correlation between the length and weight of the species with condition factor (k) as 0.72, an indication that the fishes were not doing very well in the dam. The physicochemical parameters analysed including temperature, turbidity, pH, conductivity and dissolve oxygen played a negative role in the condition factor of the fish species because it was observed that the water quality of the dam was very poor to aid survival of *Schilbe mystus*. More studies should be carried out on other species of fish found in Zobe dam to enhance proper management of the dam.

Keywords: *Length weight, Relationship, Schilbe mystus, physicochemistry*

Introduction

Fishes are sources of food for human beings and other animals, rich in protein and vitamin A (retinol) thus; they are a source of animal protein (Umaru- Buba *et al*., 2014). Fish is a high quality food apart from its protein contents; it is also rich in vitamins and contains variable quantities of fats and minerals for human health (Bard *et al.,* 1976). Fish oil contains vitamins A, D and K, which have been successfully used in controlling coronary heart disease, arthritis, atherosclerosis, asthma, auto immune deficiency and cancer (Bhuiyan *et al*., 1993). Fishes have been known to feed on a variety of items ranging from sand, leaves, roots, detritus, insects, insect larvae. According to David *et al*. (2010) and Munroe (2001) fishes in temperate climates are seasonal in their feeding which is caused by a combination of factors such as temperature change and distribution of water. The amount of feed required in warm water condition is higher than that in cold water because at lower temperature digestion and metabolism are slowed down. Understanding the food and feeding habit of fish is useful to all scientists who are concerned with any aspect of fisheries (Getabu, 2007). There are four basic eating habits among fishes which are the **carnivorous** which are meat eating fish. Carnivores need 45% of protein in their food without which they become malnourished, they feed on earthworms, redworms, oysters, tubifex worms, shrimps and other fish supplement in form of flakes or granules and pellets for added nutrition. **Herbivorous** fishes are those that will eat only plants, this type of fish need to graze very often, example of feed variety include cucumber, peas, potatoes, vegetable flakes and algal flakes. **Omnivorous** fish are those that eats anything either plant or meat making them dangerous to plant as well as animals, they are voracious eaters and they tend to pile up fat very quickly if overfed. **Limnivorous** are mud eaters which feed mainly on algae and on microorganisms; they are constantly eating (Getabu, 2007).

Physicochemical analysis of fresh water samples is seen as the physical and chemical characteristics of the climatic, geochemical, geomorphological and pollution conditions prevailing in the water body and underlying aquifer. Ground water is generally considered as a safe source of fresh drinking water (Nabanita and Sarma 2011). But the wells are generally considered as the worst type of ground water sources in terms of physio-chemical contamination due to the lack of concrete plinth and surrounding drainage system (UNICEF, 1993).

Parameters such as alkalinity, chloride, hardness and turbidity, conductivity, pH, temperature and trace metal contents are determined from water samples. PH is used universally to express the intensity of the acid or alkaline condition of a solution (Danish, 1996). Electrical conductivity is a measure of water capacity to convey electric current; it signifies the amount of total dissolved salts (Sudhir, 1999). Dissolved oxygen is important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water; it determines the degree of pollution in water bodies (Getabu, 2007). Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compounds of calcium, sodium and potassium. Hardness is the property of water which prevents lather formation with soap and increases the boiling point of water (Trivedy and Goel, 1986). Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. The major source of potassium in natural fresh water is weathering of rocks but the quantities increase in polluted water due to disposal of waste water (Trivedy and Goel, 1986). The chloride concentration serves as an indicator of pollution by sewage. People accustomed to higher chloride in water are subjected to laxative effects (Sudhir and Amarjeet 1999). Groundwater contains nitrate due to leaching of nitrate with the percolating water. Groundwater can also be contaminated by sewage and other wastes rich in nitrates. Sulphates occur naturally in water as a result of leaching from gypsum and other common minerals (Manivaskam, 2005).

Aim

The study is aimed at determining the length weight relationship and condition factor of *Schilbe mystus* and the Phisio chemistry of the water in Zobe Dam of Dutsinma Local

Government Area of Katsina State with the following objectives

Objectives

1) To determine the length weight relationship of *Schilbe mystus* in Zobe Dam
2) To determine the condition factor of *Schilbe mystus*
3) To determine some physico-chemical parameters of the dam water

Materials and Method

Study area

Zobe Dam is located in Dutsinma Local Government Area of Katsina State. It is an earth-fill structure with a height of 19metres and a total length of 2,750metres. The dam has a storage capacity of 179 million cubic feet and irrigation potential of 8,000 hectares.

Sample Collection

One hundred and twenty (120) species of *S. mystus* (both adults and juveniles) were collected using gillnet, trap and gears over a period of six (6) months and transported in an insulated box containing ice chip and water samples from the Dam to the Biology Laboratory, Federal University Dutsinma for analyses.

Length of Fish

Total length of fish measured in centimeters was done using a fine rope placed from the tip of the snout of the fish to the tip of the caudal fin and length was determined using a calibrated ruler (Le- Cren 1951).

Weight of the Fish

This was done by using a weighing balance to measure the weight of each of the fish samples and recorded appropriately (Le- Cren 1951).

Length and Weight Relationship

The length and weight relationship was done to ascertain the relationship and variation between length and weight of the fish samples. Calculations for male and female fish species was done separately and also combined using the conventional formula described by Le- Cren (1951).

Physico-Chemical Parameters

Water Temperature

Water temperature was measured with the thermometer when the electrode was submerged in the water to be tested for 1-2 minutes. The measurement was taken when the stability symbol O on top of the apparatus disappears (APHA, 1995).

Electrical Conductivity

The electrode conductor meter was inserted into the water and the reading was taken when the stability symbol O on the top left of the apparatus disappears. Plastic beakers were used to minimize any electromagnetic interference (APHA, 1995).

Hardness

Hardness was determined by diluting 25ml water sample with 50ml distilled water. Two milliliter (2mL) of buffered water solution and 0.1g of Erichrome black T-dye was then added followed by EDTA-titrant drop until a blue colour end point was observed (APHA, 1995).

Chloride

One hundred (100) ml of water sample was measured into 250ml conical flask and 1ml of potassium chromate was added and titrated with silver nitrate solution, until the colour changed from yellow to brown (APHA, 1995).

Calcium

Fifty (50) ml of water sample was measured into a conical flask and 2ml of NaOH solution was added and a pinch of meroxide indicator and titrated with 0.1 EDTA solution until the colour changed from purple to violet (APHA, 1995).

Iron

One hundred (100) ml of water sample was mixed with 100ml acid solution (Mixture of 3:1 concentrated HCl and concentrated HNO_3) and immersed in water bathe (90^0C) for 30 minutes followed by analysis with atomic absorption spectrometer (APHA, 1995).

Total Alkalinity

One hundred (100) ml of water sample was measured in 250ml conical flask and 3 drops of methyl red indicator solution was added and titrated with $0.1NH_4Cl$ until colour changed from red to yellow. The amount of acid used was recorded, this was repeated three times and the average volume of acid used was recorded (APHA, 1995).

Statistical Analysis

Length Weight Relationship and condition factor was determined with the use of regression analysis. The statistical relationship between these water parameters was established by using the parabolic equation. Data obtained was subjected to Analysis of Variance (ANOVA) test and the means from the various parameters were compared for significant difference by separating means at ($P<0.05$) (Hadi, 2008).

Result

A total of 120 fish were collected and the length and weight of the fish ranged from 8.2—26.6cm and 2.9—149.2g respectively. The length weight relationship of *S. Mystus* observed in this study shows a linear regression between (b= 2.842-2.761).. All the length weight regression were significant with the coefficient of determination r^2 ranging from 0.947 and 0.995.The fishes were mostly juveniles making the graphical representation of the coefficient b to have a negative number.

The average condition factor of *S. Mystus* in Zobe dam was found to be 0.72, this figure is far below the standard of 2- 4 for condition factor of fishes.

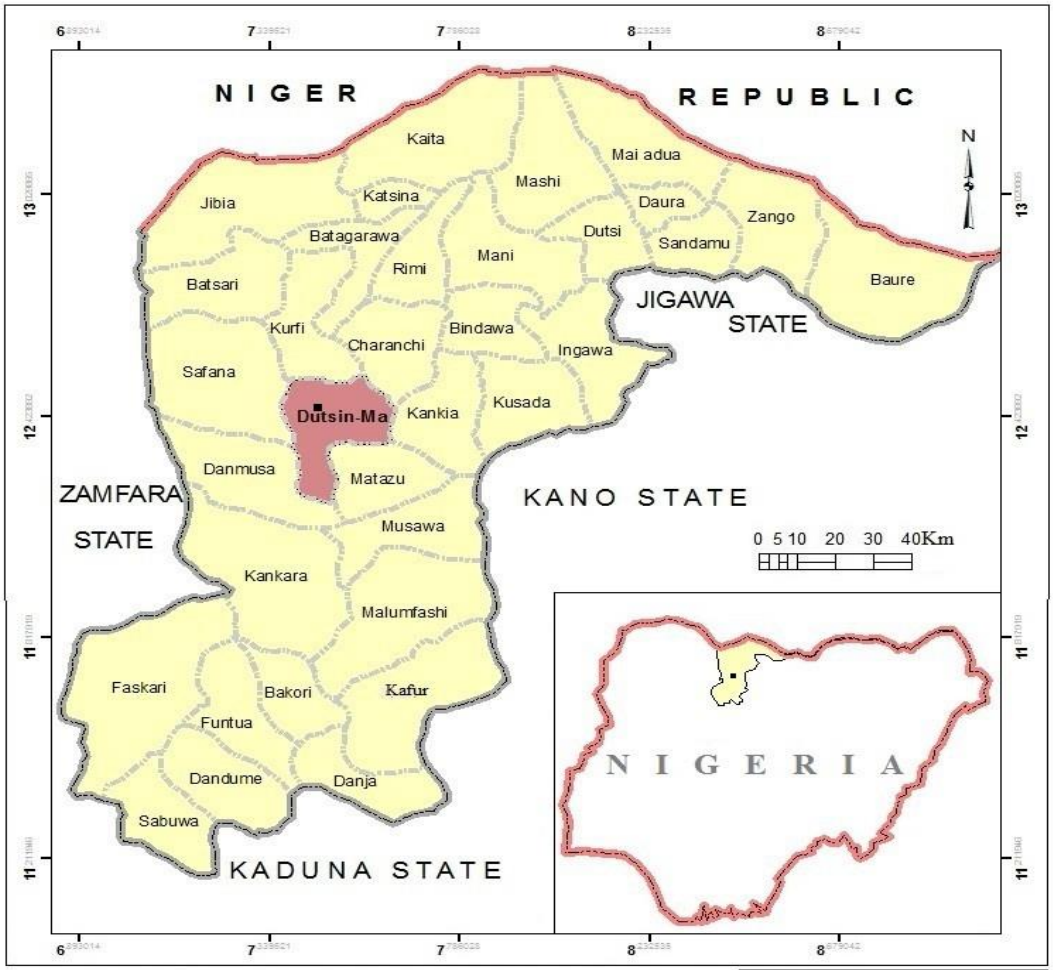

Fig.1:Map of Katsina State Showing Dutsinma L.G.A. and the Study Location.
Source:- Gnes/Spot Image 2014.

Table 1: Length-Weight regression analysis of *Schilbe ystus* in Zobe Dam

MONTH	NO. EXAMINED	SEX	MTL	MTW	a	b	R	P	PATTERN OF GROWTH
1	20	M+F	15.6	28.07	2.99	2.16	0.98	0.05	Negative allometric
2	20	M+F	13.14	21.16	3.59	2.84	0.99	0.05	Negative allometric
3	20	M+F	14.29	24.59	3.46	2..74	0.99	0.05	Negative allometric
4	20	M+F	16.47	41.39	3.16	2.31	0.98	0.05	Negative allometric
5	20	M+F	17.11	40.14	3.22	2.44	0.95	0.05	Negative allometric
6	20	M+F	18.17	49.72	3.32	2.53	0.99	0.05	Negative allometric

Probability p= <0.05, MTL=mean total length, MTW=mean total weight, P=percentage error, a=scaling constant, b= allometric growth coefficient

The result in table two shows the condition factor across all the months amongst the male and female species with a systematic increase and decrease across the months

Table 2: Condition factor (k) of *Schilbe mystus* monthly in Zobe Dam

MONTH	N	S	MTL	MTW	K
1	20	M+F	15.6	28.07	0.0073
2	20	M+F	13.14	21.16	0.0093
3	20	M+F	14.29	24.59	0.0084
4	20	M+F	16.47	41.39	0.0093
5	20	M+F	17.11	40.14	0.0080
6	20	M+F	18.17	49.72	0.0083

KEY
N = Number of Sample Size
S = Sex
MTL = Mean total Length
MTW = Mean Total weight
K= Condition Factor

Result from table three shows the values recorded considering the various water parameters, the pH values were all acidic in all the months except the second month which was neutral with a value of 7. Conductivity decreased between the second to fourth months and then increased subsequently. Turbidity was very high during months five, three and six respectively and hardness was noted in all the months with high values.

Table 3: Water Parameters from month one to six Measured in Mg/litre

MONTH	PH	ELECTRIC CONDUCTIVITY	TURBIDITY	HARDNESS
1	6.90	0.01	270	8.00
2	7.00	0.01	227	12.60
3	6.80	0.01	1289	13.50
4	6.70	0.01	311	10.20
5	6.80	0.03	1436	16.60
6	6.90	0.04	1267	15.90

Results in table four shows the trace elements and their corresponding amounts recorded accordingly. High chloride was recorded during the first and second months, sulphate was highest in the second month. Phosphorus was high during the sixth month as well as calcium and Iron. Manganese and Zinc were not measured at all in the fourth and sixth months respectively.

Table 4: Trace Elements present in the Water Sample from month one to six measured in Mg/litre

MONTH	CL-	NO_3	SO_4	P	Ca	Mg	Fe	Mn	Zn
1	0.40	0.01	2.84	1.16	2.34	5.03	9.80	0.05	0.31
2	0.40	0.01	12.69	2.29	5.36	4.73	9.80	0.05	0.00
3	0.30	0.01	5.41	1.25	6.73	4.73	9.80	0.00	0.54
4	0.30	0.02	2.59	1.11	4.84	3.97	7.80	0.00	0.00
5	0.20	0.01	2.35	3.33	6.36	5.18	9.80	0.05	0.67
6	0.30	0.02	2.12	3.56	9.47	4.42	13.80	0.00	0.00

KEY: CL- Chloride, NO_3 – Nitrate, SO_4 – Sulphate, P – Phosphorus, Ca – Calcium, Mg – Mangnesium, Fe – Iron, Mn – Manganese, Zn – Zinc

Mean of all Physico chemical Parameters for six months of sampling with the Desirable Range

Parameters	M 1	M 2	M 3	M 4	M 5	M 6	MEAN ± SD	DESIRABLE RANGE
Temperature	25.0	25.0	25.0	25.1	25.0	25.0	25.03±0.26	$20\text{-}30^0$C
ph	6.90	7.00	6.80	6.70	6.80	6.90	6.85 ± 0.50	6.5-9.0
Electric conductivity	0.01	0.01	0.01	0.01	0.04	0.04	0.021±0.068	20-1500mg/l
Turbidity	270	227	1289	311	1436	1267	800 ± 2914	10-1000ppm
Chloride(cl^-)	0.40	0.40	0.30	0.30	0.20	0.30	0.32 ± 3.8	150-1000
Nitrate($n0_3$)	0.01	0.01	0.01	0.02	0.11	0.02	0.029±0.012	<1mg/l
Sulphate (so_4)	2.84	12.69	5.41	2.59	2.35	2.16	4.67± 17.54	1-10 mg/l
Phosphate (p)	1.16	2.29	1.25	1.11	3.33	3.56	2.12 ± 5.66	0.01-0.1mg/l
Hardness	8.00	12.60	13.50	10.20	16.60	15.90	12.8± 15.13	50-400mg/l
Calcium(ca)	2.34	5.36	6.73	4.84	6.36	9.47	5.85 ± 9.96	2mg/l
Magnesium(mg)	5.03	4.73	4.73	3.97	5.18	4.42	4.68 ± 3.94	5-30mg/l

**STD= Standard Deviation*

Table 6: Anova for Physicochemical Parameters

Time	pH	EC	NTU	Cl	NO_3	SO_4
Month 1	6.90 ± 0.47^a	0.014 ± 0.00^b	270.00 ± 10.00^b	0.45 ± 0.08^a	0.007 ± 0.00^c	2.84 ± 0.05^c
Month 2	7.00 ± 0.10^a	0.012 ± 0.00^b	227.00 ± 5.00^b	0.40 ± 0.08^{ab}	0.007 ± 0.00^c	12.69 ± 0.20^a
Month 3	6.80 ± 0.20^a	0.013 ± 0.00^b	1289.00 ± 100.00^a	0.30 ± 0.07^{ab}	0.014 ± 0.00^{bc}	5.26 ± 0.61^b
Month 4	6.70 ± 0.10^a	0.011 ± 0.00^b	311.00 ± 18.00^b	0.30 ± 0.00^{ab}	0.018 ± 0.00^{ab}	2.49 ± 0.14^c
Month 5	6.80 ± 0.05^a	0.036 ± 0.01^a	1436.00 ± 116.00^a	0.20 ± 0.02^b	0.011 ± 0.00^c	2.35 ± 0.10^c
Month 6	6.90 ± 0.10^a	0.040 ± 0.01^a	1267.00 ± 36.00^a	0.30 ± 0.01^{ab}	0.022 ± 0.00^a	2.12 ± 0.00^c
Total	6.85±0.07	0.021±0.00	800.00±162.15	0.33±0.00	0.013±0.00	4.62±1.14
P value	0.939	0.011*	0.000*	0.142	0.008*	0.000*

Anova for physico chemical parameters for six (6) weeks
EC= Electric conductivity, NTU= turbidity, CL=Chloride, NO_3= Nitrate, SO_4=sulphate.

Discussion

It is evident that *Schilbe mystus* in Zobe Dam do not thrive very well due to the water quality of the dam. Another issue might be inadequate availability of phytoplankton and zooplanktons for the fishes to feed on.

The analysis carried out on male and female sexes combined showed that all the samples exhibited a negative allometric growth i.e the longer the fishes grow the thinner they become, since the value of 'b' was less than 3 showing a strong correlation between the length and weight. The result correlate with Barthélemy (2014) in the study of the importance of sustainable management tools for ecosystems, reported that the Length-Weight Relationships of 30 fish species he studied were significant.

Imam *et al.,* (2010) also reported on length-weight relationship and condition factor of four fish species i.e. *Tilapia zilli, O.niloticus, Hemichromis bimaculatus and Clarias gariepinus* from Wasai reservoir in Kano and the result also showed negative pattern of allometric growth, with maximum b values of 2.5 obtained from *T.zilli* in wet season as the highest at P<0.01. The maximum condition factor (K) of 3.4 was recorded during the wet season for *T.zilli*, this report disagrees with that of the present research probably due to the difference in weather condition because this research was conducted during the dry season.

The result of the physico chemical parameters of the water showed fluctuations between the months making the water less conducive for the species to carry out their normal activities relating to the growth for example the normal desirable range for phosphate in a water body is 0.01-0.1 mg/l but in this study it exceeded the limit which could have great impact on the fishes. Calcium also exceeded the desirable range of 2mg/l to 2.34mg/l, sulphate was good but higher in month 2 with a value of 12.69mg/l which can be attributable to effect of corroded metal which flow into the dam as a result of human activities.

Imam *et al.,* (2010) reported on water samples that were collected from two different locations in Maharashtra State, India and checked for various parameters such as pH, Temperature, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Alkalinity, Acidity, Total Hardness (TH), Chloride and Phosphorus and results revealed that the physico-chemical parameters are within the maximum permissible limit of WHO which disagrees with this study.

Conclusion

The length and weight relationship studies of *Schilbe mystus* in Zobe Dam have shown that all the fish species underwent negative allometric growth and are not thriving very well in their habitat due to some deviation of physico chemical parameters of its water from the standard limit to accommodate aquatic lives.

Recommendation

- The need for more studies on the length-weight and the condition factors of other fish species should be encouraged to be able to establish the suitability of water bodies for fish survival.
- The water bodies should be properly checked to ensure it is fit for aquatic lives.
- Effective measures should be taken to ensure proper management of fishermen from poaching the fishes.
- Fishing activities should be regulated in order to allow the fishes to grow properly.
- The physico-chemical parameters of the water should be checked regularly and treated if possible

References

A.P.H.A,(1995) Standard methods for the examinations of water and wastewater, American Public Health Association, *Washington, DC*, 18th Ed**.** 11.

Bard, J., De Kimpe, P. J., Lazard, J., Lemasson, J. and Lessent, P. (1976). Hand Book of Tropical Fish Culture. *Centre Technique Forestier Tropical*, France. p128

Barthélemy Kouakou Koffi (2014) Siaka Berté and Tidiani Koné Laboratoire d'Hydrobiologie, UFR-Biosciences, Université Félix Houphouët-Boigny, 22 BP 582 Abidjan 22, Côte d'Ivoire *Current Research Journal of Biological Sciences* 6(4): 173-178,

Bhuiyan, A.K.M., Ratnayake, W. M. N. and Ackman, R. G. (1993). Nutritional composition of raw and smoke Atlantic mackerel (*Scomber scombrus*): oil-water soluble vitamins. *Journal Food Composition Analysis*. 6:172-184

David and Hamer (2010). New Zealand Freshwater Fish Sampling Protocols. Part one- wideable rivers and stream. EPA Protocol *Journal on Applied. Ichthyology* 8:13-16

Danish, P.S. (1996). University of Montpellier II. Theses and Documents Microfilms, 156. Paris, France: ORSTOM.

Getabu, .A (2007). An Overview of the Diversity and Conservation Status of the Ethiopian Freshwater Fauna. *Journal of Afrotropical Zoology*, Special Issue: 87-96.

Imam, T. S., Bala, .U., Balarabe, M. L. and. Oyeyi T. I (2010). African Studies on Population and Health Printed in Nigeria *Cifa technical* paper, 10:43-103.

Le cren, E.D. (1951). The length-weight relationship and seasonal cycle in gonad weight and condition in the perch Perca fluviatilis. *Journal Animal Ecology***.,** 20(2): *201-219*

Manivaskam (2005). Industrial Water Analysis handbook 456 pp.

Munroe, T.A. (2001). Bony fishes. Animal Ecology 6: 387-388.

Nabanita, H. and Sarma, H.P. (2011). Ground Water Quality Assessment of some parts of Brahmaputra Flood plain in Barpeta district, Assam with special focus on Fluoride, Nitrate, Sulphate and Iron analysis, *International Journal of Chem Tech*, 3:(3)1302- 1308.

Sudhir, D. and Amarjeet K. (1999). Physico Chemical Characteristics of Underground Water in rural areas of Tosham Subdivisions, Bhiwani District, Haryana India, *Journal on Environmental Pollution*. 6 :(4) 281- 282.

Trivedy, R. K. and Goel, P. K., (1986). Chemical and Biological methods for Water Pollution studies. *Environmental Publication, 5th Ed. P38-41*

Umaru, B.W. (2014). Examination of the Stomach Contents of Two Fishes (*Clarias gariepinus* and *Oreochromis niloticus*) in Lake Alau North Eastern Nigeria. *Journal of Food Science* 67:(9) 331-332.

UNESCO (1993). Manuals and Guides: Nutrient analysis in tropical marine waters. Practical guidance and safety notes for the performance of dissolved micronutrient analysis in sea water with particular reference to tropical waters, p24.