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Impact of Anthropogenic Activities on Length-Weight Relationship and Condition Factor of Oreochromis Niloticusand Synodontis Clariasof Kiri Reservoir, Adamawa State, Nigeria

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ABSTRACT

A study on the impact of anthropogenic activities on length-weight relationship and condition factor of Oreochromisniloticusand Synodontisclarias of Kiri reservoir was conducted over a period of eighteen months (March, 2017- August, 2018) using standard methods The 'b' value of Oreochromisniloticus for site I (0.7701), site II (1.6393) and site III (1.6144), all shown negative allometric growth. The 'b' of Synodontisclarias value for site I (2.9397), site II (3.5672) and site III (3.2545), site I and site III shown negative allometric growth, while site II showed positive allometric growth. This shows that increase in length was not equal to increase in weight of the two species of fish. This might be as a result of agricultural activities, open defecation, waste disposal into the water and domestic abuse of the water. The results of the condition factor which recorded 1.85 - 6.81 and 1.81 -9.47 for the Oreochromisniloticus and Synodontisclariasis an indication that the fishes were in stable condition throughout the period of this study.

Keywords: *Amino acid, correlation, genotype, phenotype, protein, varieties*

INTRODUCTION

Length-weight relationship is very important for proper exploitation and management of the population of fish species. To obtain the relationship between total length and other body, weight is also very much essential for stabilizing the taxonomic characters of the species (Pervin and Mortuza, 2008). Torres *et al.* (2012), reported that length-weight relationship indicates the average weight of the fish with respect to its length by making a mathematical equation to show relationship between parameters. It is important in assessing the relative condition and well-being of a fish. Length and weight data are a useful and standard result of fish sampling programs. These data are needed to estimate growth rates, length and age structures, and other components of fish population dynamics. Length–Weight Relationship (LWR) is useful tool in fish growth pattern or age determination and fishery assessment (Pepple and Ofor, 2011). Length–Weight Relationship of fishes are important in fisheries biology because they allow the estimation of the average weight of fish of a given length group by establishing a mathematical relation between the two. (Pepple and Ofor, 2011), stated that when the b-value is less than 3, the fish has a negative allometric growth but when it is greater than 3, it has a positive allometric growth and when it is equal to 3, the fish has isometric growth. Length-weight relationships give information on the condition and growth pattern of fish.In fisheries science, condition factor is used in order to compare the "condition", "fitness" or "wellbeing" of fish. It is an estimation of the general well-being of a fish (Oribhabor*et al.*, 2011), and is based on this hypothesis or assumption that heavier fish are in better condition than the lighter ones (Ogamba*et al.*, 2014). Anyanwu *et al.*, (2007), reported that the value of K is influenced by age of fish, sex, season, stage of maturation, fullness of gut, type of food consumed, amount of fat reserve and degree of muscular development. In some fish species, the gonads may weigh up to 15% or more of total body weight. With females, the K value will decrease rapidly when the eggs are shed. The K value can be used to assist in determining the stocking rate of trout in particular water. If the K value reaches an unacceptably low level in water which is totally or partly dependent on stocking, the stocking rate can be reduced accordingly until the K value improves and reaches an acceptable level (Anyanwu *et al.,* 2007). Condition factor is a useful index for the monitoring of feeding intensity, age, and growth rates in fish. The role of the condition indices is to quantify the health of individuals in a population or to tell whether a population is healthy relative to other populations. When fish of a given length exhibits higher weight it means they are in better condition (Anwa-Udondiah and Pepple, 2011). These temporal and seasonal fluctuations of the condition factor are influenced by endogenous parameters (e.g., nutritional aspects, sex, and the state of gonadal maturation) or exogenous parameters (environmental factors) affecting a population (Rodrigues *et al.,* 2010). Ayandiran and Fawole (2014), observed that condition factor (k) values were high in the small sized fishes and it decreased in the larger fishes. When fish of a given length exhibits higher weight it means they are in better condition (Anwa-Udondiah and Pepple, 2011). One of the problems with the condition factor *K'* is that it is very difficult to obtain a reliable value for *b*, particularly if the data set used to estimate *b* is small or does not span a wide enough range of body lengths. Furthermore, as pointed out above, the value of *b* is not constant for any species, but varies between stanzas, so that the results gained from a particular data set cannot be transferred to or compared with another data set, even if it is on the same species.

Materials and Methods

The length-weight relationship was determined using conventional formula adopted by Kefas and Abubakar (2010).

$W = {}_{a}L^{b}$

The equation and the data were transformed to logarithm before determination was made. The equation was therefore transformed into;

$\log W = \text{Log} a + b\text{Log} L$

Where, W = Weight of the fish in grams

L = Standard length of the fish in cm

a = constant

b = an exponent

The graphs log of weight of the fish versus log of standard length of the fish species was plotted.

The condition factor (k) was determined for individual fish using the conventional formula adopted by Ja'afaru and Tashara (2009). The ratio of the length to the weight of the fish was determined as;

$$K = \frac{W \times 100}{L^3}$$

Results and Discussion

Length-weight Relationship of *O. niloticus* and *S. clarias*

The result of length-weight regression analysis of *O. niloticus* is shown on table 1. The 'b' value for site I (0.7701), site II (1.6393) and site III (1.6144), all showed negative allometric growth. The length-weight relationship showed linear relationship with significant correlation coefficient of 0.0376, 0.7615 and 0.794 for site I, II and III respectively. The result of length-weight regression analysis of *S. clarias*is shown on table 1. The 'b' value for site I (2.9397), site II (3.5672) and site III (3.2545), site I and site III shown negative allometric growth, while site II showed positive allometric growth. The length-weight relationship showed linear relationship with significant correlation coefficient of 0.5836, 0.4764 and 0.5464 for site I, II and III respectively.

The result of length-weight regression analysis showed that the "b" values for both Sites I, II, and III of *O. niliticus* and *S. clarias* exhibited allometric growth pattern which ranged between 0.7701 - 1.16393 and 3.2545 - 3.5672, except for *S. clarias* at site I which exhibit isometric (2.9397) growth pattern which indicate that fish increase in length in equal proportions with body weight from constant specific gravity. *O. niloticus* showed negative allometric growth (b<3) at both the three site, while *S. clarias* exhibit positive allometric growth (b>3) at site II and III. The present study is similar to the observation for different species of fish in Lake Tatabu in Niger State and Lake Geriyo in

Adamawa State (Akinwande *et al.*, 2012; Kefas and Abubakar, 2010; Kefas, 2017). The similarities between these results could be related to the types of prospected habitats. Even though the change of b values depends primarily on the shape and fatness of the species, various factors may be responsible for differences in the b value for the length-weight relationships of cichlids (Atama*et al.*, 2013).

These factors may include seasons, water temperature, salinity, food (quantity, quality and size), sex and stage of maturity. The variation experienced in the value of condition factor may be due to human activities such as; used of chemical and treated nets for fishing, activities of Hippopotamus, indiscriminate disposal of waste and open defecation.

From length–weight parameters (a, b), fishes are affected by a series of factors such as season, habitat, gonad maturity, sex, diet, stomach fullness, health, preservation techniques and annual differences in environmental conditions (Onome *et al.*, 2013). Such differences in “b” values can be ascribed to one or a combination of factors including differences in the number of specimens examined, area and season effects and distinctions in the observed length ranges of the specimens caught, to which duration of sample collection can be added as well.

The low alkalinity, free CO_2 and high ammonia during the period of this study in the reservoir might be responsible for allometric growth of the fish.

Table1. *Length-weight Regression Analysis of O. niloticusand S. clarias*

	Site	No. of Fish Examined	LogA	‘b’	Correlation coefficient (r)
O. niloticus					
	I	54	1.1876	0.7701	0.0376
	II	54	0.1301	1.6393	0.7615
	III	54	0.174	1.6144	0.794
S. clarias					
	I	54	-1.3994	2.9397	0.5836
	II	54	-2.1587	3.5672	0.4764
	III	54	-1.7633	3.2545	0.5464

Source: *Experimentation, March, 2017 – August, 2018*

Condition factor of *O. niloticus* and *S. clarias*

The monthly mean condition factor of *O. niloticus* shows on table 2. The highest condition factor of 6.81 was recorded at site II in the month of May, 2018, while the lowest condition factor (1.85) was recorded at site I in the month of February, 2018.

The monthly mean variation of the condition factor ranged from 2.63 in the month of February, 2018 to 5.14 in the month of May, 2018. Showing significant differences in months and seasons ($p<0.05$). The value of mean across site I, II, and III showed no significant differences. The monthly mean condition factor of *S. clarias*shows on table 3. The highest condition factor of 9.47 was recorded at site I in the month of October, 2017, while the lowest condition factor (1.81) was recorded at site I in the month of September, 2017. The monthly mean variation of the condition factor ranged from 2.15 in the month of May, 2017 to 5.57 in the month of December, 2017. Showing significant differences in months and seasons ($p<0.05$). The value of mean across site I, II, and III showed no significant differences.

The condition factor expresses the condition of a fish, such as the degree of well-being, relative robustness, plumpness or fatness in numerical terms. *O. niloticus* and *S. clarias* recorded monthly mean condition factor ranging from 1.85 - 6.81 and 1.81 - 9.47 respectively. The current result is higher than 0.65 - 1.21 reported for *C. gariepinus* from Kiri reservoir (Zira *et al.*, 2015). This also supports the work (Zira *et al.*, 2015), who reported an increase in condition factor during dry season as a result of water clarity during this period and more light penetrates the water and photosynthetic plants flourish.

The condition factor of *O. niloticus* and *S. clarias* studied of the Kiri reservoir were generally in a stable condition throughout the period of research. Ayandiran and Fawole (2014), observed that condition factor (k) values were high in the small sized fishes and it decreased in the larger fishes. But the results of the current study for *S. clarias*, revealed that larger fish has high value of condition factor than smaller sized fish, this agreed with (Anwa-Udondiah and Pepple, 2011), who reported that fish of a given length which exhibits higher weight are in better condition. The value of condition factor for both *O. niloticus* and *S. clarias* Showed significant differences in months and seasons (p<0.05), while the value of mean across site I, II, and III showed no significant differences for the period of the study.

The two species of fish were better condition during the dry season as the higher condition factors were recorded during dry season. Similar results were observed for Lake Geriyo, Anambra River and Upper Benue River respectively (Kefas, 2016; Atama *et al.*, 2013; Edward, 2017).

Therefore, the value obtained across site does not differ significantly throughout the period, but varies across month with reference to season. This could be due to slight variation in the physicochemical parameters resulted from the anthropogenic activities as reported (Zira *et al.*, 2019).

Table2. *Monthly Mean Condition Factor of O. niloticus*

Months	Site I	Site II	Site III	Mean	STD
March, 2017	5.67	3.74	5.86	5.09	1.173
April	2.72	4.01	5.48	4.07	1.381
May	3.25	3.48	2.85	3.19	0.319
June	3.65	3.53	3.81	3.66	0.141
July	4.67	4.66	3.36	4.23	0.754
August	3.65	2.91	3.05	3.20	0.393
September	2.93	4.22	3.73	3.63	0.651
October	4.82	4.67	4.32	4.60	0.257
November	3.26	4.35	4.05	3.89	0.563
December	4.10	2.94	3.71	3.58	0.590
January, 2018	4.25	4.65	4.03	4.31	0.314
February	1.85	2.11	3.92	2.63	1.128
March	5.35	3.56	5.49	4.80	1.076
April	4.25	3.25	3.09	3.53	0.629
May	4.00	6.81	4.60	5.14	1.480
June	3.79	3.39	3.10	3.43	0.347
July	2.57	3.32	2.48	2.79	0.461
August	4.00	4.38	4.49	4.54	0.257
Mean	3.82	3.89	3.97		

Source: *Experimentation, March, 2017 – August, 2018*

Table3. *Monthly Mean Condition Factor of S. clarias*

Months	Site I	Site II	Site III	Mean	STD
March, 2017	2.77	2.78	3.36	2.97	0.338
April	3.56	3.12	2.53	3.07	0.517
May	2.35	1.98	2.13	2.15	0.186
June	2.09	3.05	2.69	2.61	0.485
July	4.94	3.41	7.61	5.32	2.126
August	5.04	1.93	3.21	3.39	1.563
September	1.81	2.92	2.95	2.56	0.650
October	9.47	2.18	2.91	4.85	4.015
November	2.52	2.36	2.07	2.32	0.228
December	3.41	8.23	5.08	5.57	2.448
January, 2018	3.51	3.33	6.95	4.60	2.040
February	2.56	2.47	2.77	2.6	0.154
March	3.01	2.55	2.66	2.74	0.240
April	2.91	3.03	2.99	2.95	0.061
May	3.18	2.50	3.53	3.07	0.524
June	3.08	3.43	4.48	3.66	0.729
July	9.09	3.61	3.00	5.20	3.354
August	3.11	3.57	3.35	3.80	0.230
Mean	3.80	3.14	3.57		

Source: *Experimentation, March, 2017 – August, 2018*

CONCLUSION

In conclusion, both *O. niloticus* and *S. clarias* exhibited negative and positive allometric growth pattern and exhibited stable growth pattern throughout the period of this research.

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REFERENCES

[1] Agboola, J.I. and M.A. Anetekhai, (2008).Length-weight relationships of some fresh and brackish water fishes in Badagry Creek, Nigeria. *Journal of Applied Ichthyological* **24**: 623-625.

[2] Akinwande, A.A., Fagbenro, O.A. and Adebayo, O.T. (2012). Comparative Growth and Survival of Reciprocal Hybrids between *Clariasgariepinus* and *Clariasanguillaris. Journal of Applied Aquaculture*, **24**: 349-355.

[3] Anyanwu, P.E., Okoro, B.C., Anyanwu, A.O., Matanmi,s M.A., Ebonwu, B.I., Ayabu-Cookey, I.K., *et al.* (2007). Length–Weight relationship, condition factor and sex ratio of African mud catfish (*Clariasgariepinus*) reared in indoor water recirculation system tanks. *ResearchJournal of Biological Sciences*, **2**(7): 780-783.

[4] Anwa–Udondiah E.P. and Pepple P.C.G. (2011). Length-Weight relationship and Condition Factor of Black chin Tilapia (Sarotherodon Melanotheron) cultured in sheltered outdoor, anks, In: R.J. Kolo and A.M. Orire (Eds). *Proceedings of the 26th Annual Conference of the Fisheries Society of Nigeria* (FISON), Minna. 98-102.

[5] Atama, C.I., Okeke, O.C., Eken, F.N., Ezenwaji, N.E., Onah, I.E., Ivoke, N. *et al.* (2013) Length-Weight Relationship and Condition Factor of Six Cichlid (Cichilidae: Perciformis) Species of Anambra River, Nigeria. *Journal of Fisheries and Aquaculture*, **4**(2): 82-86.

[6] Ayandiran, T.A. and Fawole, O.O. (2014). Seasonal distribution and condition factor of *Clariasgariepinus* from polluted Oluwa River, Nigeria. *International Journal of Pharmacy and Biological Sciences*, **9**(4): 86-93.

[7] Edward, A. (2017). Assessment of Physicochemical Parameters and Heavy Metal Levels in Water, Sediments and some Fish Species from Upper Benue River, Adamawa State, Nigeria. Doctoral Thesis, Modibbo Adama University of Technology, Yola, Nigeria.

[8] Ja'afaru, A., and Tashara, A.T. (2009). Some Aspect of the Biology of *Auchenoglanis occidentalis* from River Benue at Yola, Adamawa State, Nigeria. *Nigerian Journal of Tropical Agriculture,* 1**1**: 296-304.

[9] Kefas, M. and Abubakar, K.A. (2010).Some aspects of Biological status of *C. garriepinus*in River Ilagil, Ngurore, Yola South Local Government Area, Adamawa State, Nigeria. *International Journal of Biological Science,* **2**(7): 82-86.

[10] Kefas, M. (2016). Incidence of Pollution and its Effects on *Clariasgariepinus* and *Oreochromis niloticus*in Lake Geriyo, Yola, Adamawa State, Nigeria. Doctoral Thesis, Modibbo Adama University of Technology, Yola, Nigeria.

[11] Ogamba, E.N., Abowei, J.F.N. and Onugu, A. (2014). Length-weight relationship and condition factor of selected finfish species from Odi River, Niger Delta, Nigeria. *African Journal of Aquatic Science,* **29**(1A): 1-12.

[12] Onome, A.D., Charles, C.T. and Keme-Iderikumo, K. (2013).Length –Weight Relationship, Condition Factor and Sex Ratio of *Clariasgariepinus* Juveniles Reared in Concrete Tanks. *International Journal of Scientific Research in Environmental Sciences,* **1**(11): 324-329.

[13] Oribhabor, B.J., Ogbeigbu, A.E. and Udo, M.T. (2011). Length-weight relationship of Brackish Water/Marine Fish Species Assemblage in Niger Delta Mangrove Creek, Nigeria.*Current Research Journal of Biological Science,***3**(6): 616-621.

[14] Pepple, P.C.G. and Ofor, C.O. (2011). Length-weight relationship *of Heletero branch uslongifilis* reared in earthen Ponds. *Nigerian Journal of Fisheries*, **8**(2): 315-321.

[15] Pervin, M.R. and Mortuza, M.G. (2008). Notes on length-weight relationship and Condition Factor of Freshwater fish,Labeoboga (Hamilton) (Cpriniformes Cyprinidae). *University Journal of Zoology, Rajshashi University*, **27**: 97-98.

[16] Rodrigues, E.G., Virgi, M.A., McClean, M.D., Weinberg, J., Woskie, S. and Pepper, L.D. (2013). Personal exposure, behavior and work site conditions as determinants of blood lead among bridge painters. *Journal of Occupational Hygiene,* **7**(2): 80-87.

[17] Torres, M.A., Ramos, F. and Sobrino, I. (2012). Length-weight relationships of 76 fish species from the Gulf of Cadiz (SW Spain). Fisheries Research; 171-175.

[18] Zira J.D., Abubakar, K.A., Ja'afaru, A. and Elisha, D.S. (2015). Length-weight Relationship and Condition Factor of *Clariasgariepinus* (Burchell, 1822) from Kiri

reservoir, Adamawa state, Nigeria. *International Journal of Fisheries and Aquatic Studies*,**3**(2): 471-475.

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