LENGTH-WEIGHT RELATIONSHIPS AND CONDITION FACTOR OF *CLARIAS GARIEPINUS* AND *OREOCHROMIS NILOTICUS IN* GUBI DAM, BAUCHI STATE

[1]Ishaku, S., [1]Abdulkarim, M., [1]Mancha, Y.P., [1]Buba, S.A, [2]Yusuf, Z.A. & [1]Mahmood, S.1

[1]Department of Animal Production, Abubakar Tafawa Balewa University, Bauchi, Nigeria

[2]Department of Biological Sciences, Abubakar Tafawa Balewa University, Bauchi, Nigeria

Corresponding Author: email:Sylveku@gmail.com

ABSTRACT

Studies were conducted to determine the length-weight relationships and condition factor (k) of *Oreochromis niloticus* and *Clarias gariepinus* from Gubi Dam, Ganjuwa Local Government Area, Bauchi State Nigeria were evaluated for a period of four months, (September, October, November, and December, 2019). The following fish species where encountered and identified: *Oreochromis niliticus, Clarias gariepinus, Alestes nurse, Labeo senegalensis, Barillu senegalensis, Distinchodus engycephalus, Heminchromis faciatus* and *Schilbe mystus.* Atotal of three hundred and twenty two (322) *O. niloticus* and one hundred and twenty seven (127) *C. gariepinus* were collected in the dam by artisanal fishermen using drag net and traps. The length and weight of *Oreochromis niloticus* and *Clarias gariepinus* were measured using meter rule and electronic weighing scale (T500Y) respectively. Model equations of *O. niloticus* and *C.* gariepinus were $W = 0.0692 \times L^{2.3857}$ and $W = 0.0342 \times L^{2.5559}$. The fish species had negative allometric growth pattern (b<-3). The length-weight relationships of the fish species (*Oreochromis nilotiuss* and *Clarias gariepinus*) showed no significant difference $P > 0.05$. *Oreochromis niloticus* had a good condition factor with (k) value of 1.7525 while *Clarias gariepinus* had poor condition factor (K) with value of 0.7510. The condition factor (K) for dry season ranges from 1.7705 (*O. niloticus*) to 1.8474 (*C. gariepinus*) indicating that the fish species were in good nutrition condition. The condition factor (k) values for both species were (K >1) indicating the fishes in dam were in good condition except *C. gariepinus* obtained in wet season. Fishing regulations should be introduced in Gubi Dam.

Key Words: length-weight relationship, condition factor, *Oreochromis niloticus, Clarias gariepinus,* Gubi Dam.

INTRODUCTION

Length– weigh relationship studies of fishes are considered as an important tool for understanding the growth pattern of fish species. Length is a linear measure (in centimeter) and weight of a fish (in gram) is approximately equal to its volume (cubic centimeter). Hence weight of a fish is a function of length. The relationships can be expressed by the hypothetical law $W= aL^3$. The value of exponent may considerably deviate from the value 3, as most fishes change their form or shape when they grow (Martin, 1949). This variation form expected weights to the actual weight of individual fish is assessed by analyzing the length – weight relationships. Le Cren (1981) proposed the relative condition factor in preference to condition factors as the letter is influenced by many environmental and biological factors. Condition factor measures the deviation from a hypothetical ideal fish whereas relative condition factor measures the deviation from the average weight or length of fish. There is paucity of information on the length weight relationships and condition factor of fish species in Gubi Dam. This may not be unconnected with insufficient literature and research of all fish species in the dam.

MATERIAL AND METHODS

STUDY AREA

The study was carried out in Gubi dam Bauchi State. Bauchi State is located at longitude 10- 10°N arid altitude 9°40E, it is 69020cm above sea level. It cover an estimated area of about 3,354 kilometers with a population about 344750 people. The state experience two seasons in a year that is, rainy season and dry season. The annual rainfall is 905.3mm with temperature range of 11°c-4°c mean. Monthly hour of sunshine is 300.5 hour and decrease to 150 one hour in August experience minimum relative humidity of about 66.5% and February record lowest of 16.4%. The vegetation is open Savannah and with species of tin or more but the vegetation have been reduced to shrubs due to cultivation and burning effects. There are brown grasses of low nutritive value.

IDENTIFICATION OF FISH SPECIES

Fish species caught were identified by their local names. Fish identification key refer to monograph for their scientific names (Reed et al., 1907)

FISH SAMPLING TECHNIQUES

A total of 322 *Oreochromis niloticus* and 127 *Clarias gariepinus* were collected in the dry and wet seasons. Field visited was conducted once in a month in both dry and wet seasons in 2019. The local fishermen operating at the Dam deployed drag net and traps for their catches. The fish sample caught were immediately immersed in 10% formalin and transported to the laboratory for identification using the key provided by fish base (2013).

DATA COLLECTION AND ANALYSIS

The variations in the length weight represented by „b‟ were recorded. The total length (TL) of each fish was measured from the tip of snout (mouth closed) to end of the caudal fin using meter ruleThe relationship between length and weight of the fish was examined by simple linear regression using WINKS software.. Body weight was measured using electronic digital balance (OHAUS). The parameter of length-weigh relationship of sampled fish species were evaluated using the equation.

$W = aL^b$ (Rickter, 1973) ….. equation 1

Where, W is weight of the fish (g), L is length of the fish (cm), a is the intercept

growth coefficient, and b is the slope growth coefficient. The value of constant „a‟ and „b‟ were estimated after logarithmic transformation as described by Zar (1984) to give

$Log_{10}{}^a + b\ Log_{10}L$ …….. equation 2.

The 95% confidence interval (CL) of „b‟ was computed using the equation (Egbal*et al.,* 2011):

$CL = b \pm (1.96 \times SE)$ ….. equation 3

Where SE is the standard error of „b‟. The condition factor was calculated by the formula (Pauly, 1983):

Condition Factor (K) = $100W/L^3$

Where w is weight (g) and L is total length (cm).

RESULTS

Table 1: Length-weight Relationships Parameters of *Oreochromis niloticus*and *Clarias gariepinus* from Gubi Dam, Ganjuwa Local Government Area, Bauchi State (2019)

Species	Regression coefficient a	b	Correlation coefficient (r)	Model ($W=a \times L^b$)	±SE	N	Growth pattern
O. niloticus	0.0692	2.3857	0.7050	$W= 0.0692 \times L^{2.3857}$	0.38	322	NA
C. gariepinus	0.0342	2.5559	0.6618	$W= 0.0342 \times L^{2.5559}$	0.51	127	NA

N=number of Specimen used, **NA=** negative allometry, SE = Standard Error

Table 2: Condition Factor Values (k) of *Oreochromis niloticus*and *Clarias gariepinus* from Gubi Dam, Ganjuwa Local Government Area, Bauchi State for Wet season (2019)**.**

Species	Maximum (k) Value	Minimum (k) Value	Average (k) Value	N	Remark
O. niloticus	2.5451	0.1374	1.7525	161	Good condition
C. gariepinus	2.4303	0.1942	0.7510	74	Not in good condition

Table 3: Condition Factor Values (k) of *Oreochromis niloticus*and *Clarias gariepinus* from Gubi Dam, Ganjuwa Local Government Area, Bauchi State (Dry Season 2019)

Species	Maximum (k) Value	Minimum (k) Value	Average (k) Value	N	Remark
O. niloticus	2.5451	0.1521	1.7706	161	Good condition
C. gariepinus	2.7166	0.7140	1.8474	53	Good condition

DISCUSSION

The (b) value of the fish species from Gubi dam recorded during the period of study, fell within 2.3857 and 2.5559. this result contradicts the reports of Egbal*et al*, (2011) whose study showed that the „b‟ value of the fish species from both Atbara and Khashm el-Girba reservoir in Sudan were within the range of 2.278 and 3.680, and Pauly (1983) who also recorded „b‟ value range of 2.5 to 4.0 for many fish species. It is also reported that when b=3, the fish grows isometrically, resulting in ideal shape of fish (Olurin and Aderibigbe, 2006). When the values of b is less than 3.0 the fish experiences a negative allometric growth (Sudan, 1950). However, when the value of b is more than 3.0 the fish grows following the positive allometric growth pattern. Ibrahim (1984) reported that, the value of b then becomes greater than 3 as the fish is slimmer. Nevertheless, it was observed that the two sampled fish species in the study neither showed isometric nor positive allometric growth pattern but all suffered from negative allometric growth. All value observed for fish collected from the Dam during the study period indicates that, the two sampled fish species experienced this pattern of growth. The coefficient of determination r^2 for the length-weight relationship was high for *O. niloticus* (0.7050) and O.6618 for *C. gariepinus* indicating that the length increased with increased in weight of fish at

Dam. This is an agreement with previous findings (Laleye, 2006). The 95% interval of ranged from 0.0692-2.5451. lazima *et al*, (2007). However, reported a 95% CL of b value range between 2.329 and 3.919 of 12 fresh water fishe species in the Kenian River Basin and Pedu Lake.

The condition Factor (k) gives information on the physiological condition of Fish in relation its welfare, Perry *et al*, (1996) reported that fish with low condition index are presumably believed to have experience adverse physical environmental or insufficient nutrition. According to Maguire and Mace (1993), from a nutritional point of view, increase in k values indicates the accumulation of fat and sometimes general development. Angelscu*et al* (1958) reported that from a reproductive point of view, the highest k value are reached in species if the fish is fully mature and have higher reproductive potentiality. It was observed that the two fish species sampled in the study recorded inconsistent condition factors, with *O. niloticus* in wet season having 1.7252 and *C. gariepinus* having 0.7510. With *O. niloticus* falling within the normal range indicating good condition, while *C. gariepinus* falling below the normal range indicating not good condition. While in dry season all the fish species sampled in the study had condition Factor $\geq$ 1, and were within the normal ranges recommended by Ujjania*et al*, (2012) who stated that condition factor greater than or equal to one is good, indicating a good level of feeding, and proper environmental condition. Benegal and Tech (1978) recommended k value range (2.9-4.8) as suitable for matured fresh water fish. The condition factors of the two fish species sampled in the study revealed that the fish species had their k values outside and within the ranged recommended as suitable for matured fish in fresh water. This could be caused due to environmental factor such as damming the river. Abdullahi and Ahmad (2013) reported the predominance of cyanobacteria and spirogyra, phytoplankton species in Wudil Rivers, which suggest an indication of organic pollution, reflecting human interference to pollute the river. LWR Parameters (a and b) and the k value of the fish has been reported to be affected by factors such as feeding intensity, availability of food, fish size, age, sex, season, stage of maturation, fullness of the gut, degree of muscular development.

CONCLUSION

The following fish species were encountered and identified (*Oreochromisniloticus, Clariasgariepinus, Alestes nurse, Labeo senegalensis, Barillus senegalensis, Distinchodus engycephalus, Hemichromis faciatus, Schilbe mystus*) in the Dam.Length-weight relationships of the fish species indicated negative allometric growth pattern in the fish species. The lengh thas a close relationships with the weight. The fish species in the Dam were in better condition of wellbeing in the dry season.

REFERENCES

Abdullahi J.M. and Ahmad A.M. (2013). Survey of phytoplankton in Wudil River, Kano State Nigeria. *Aquatic Biology Research,* 1 (1), 10-16 DOI: 10.12966.abr.08.02.2013

Angelescu V., Gneri F.S. and Nani A. (1958). Argentine sea hake (biology and taxonomy) Secr. Mar. Serv. Hydrogenation. Nav. Public, H1004: 1-224

Bagenal T.B. and Tesch F.W. (1978). *Methods of Assessment of Fish Production in Fresh Waters.* IBP Handbook No. 3, 3rd ed. Oxford Blackwell Scientific Publication, London. Pp. 101-136

Clay D (1979). Population biology, growth and feeding of the African catfish (*Clarias gariepinus*) with special reference to juveniles and their importance in fish culture. *Arch. Hydrobiologia Supp.* **87**:453-482

Egbal O.A., Mohammed E.A. and Afra A.A. (2011). Length-weight relationships and condition factors of six fish species in Atbara River and Khashm El-Girba Reservoir, Sudan. *International Journal of Agriculture Sciences,* 3 (1), 65-70

Elias D (2000). Reporoductive biology and feeding habit of catfish. *Clarias gariepinus* Burchell (*Pisces: Clariidae*) in Lake Awassa, Ethiopia. SINET: Ethiop. J. *Sci*. **23**: 231-246.

Fishbase (2013). Online fish identification sheet. Available at http://www.fishbase.org/search.php, accessed on 10/06/2013

Ibrahim A.M. (1984). The Nile: Description, hydrology, control and utilization. *Hydrobiologia*, 110, 1-13

Laleye P.A. (2006), Length-weight relationships of fishes from the Oueme River in Benin (West Africa). *J. Appl. Ichtholo,* 22, 330-333

Le Cren, E. D. (1951). The length-weight relationship and seasonal cycle in gonad weight and condition in Parch Perca, Fluvatilis, *J. Anim. Ecol.,* 20:201-219

Lizama M., De Los A.P. and Ambroso A.M. (2002). Condition factor in nine species of fish of the Characidae family in the upper Parama River floodplain, Brazil. *Braz. J. Biol,* 62 (1), 113-124

Maguire J.J. and Mace P.M. (1993). Bilogical reference points for Canadian Atlantic Gadoid stocks. In: Smith S.J., Hunt J.J. and Rivard D. (eds.), *Risk Evaluation and Biological Reference Points for Fisheries Management. Can. Spec. Publ. Fish. Aquat. Sci.,* 120, 67-82

Nyamweya CS, Mlewa CM, Ngugi CC and Kaunda-Arara B (2010), Validation of daily growth of African catfish *Clarias gariepinus* (Burchell 1822) young-of-the-year from Lake Baringo, Kenya. Lakes and Reservoirs: Research and Management **15**: 341-345.

Olurin K.B. and Aderibigbe O.A. (2006). Length-weight relationship and condition factor of pond reared *Oreochromis niloticus. World Journal of Zoology,* 1 (**2**), 82-85

Pauly D. (1983). Some simple methods for the assessment of tropical fish stocks. FAO Fisheries Tech. Pap., FAO Rome, 234, 52

Perry R. I., Hargreaves N.B., Waddell B.J. and Mackas L. (1996). Spatial variations in feeding and condition of juvenile pink and chum salmon off Vancouver Island, British Columbia. *Fish Oceanogr*., 5 (**2**), 73-88

Rickter W.E. (1973). Linear regression in fisheries research. *J. Fish. Res. Board Can.,* 30 (**3**), 409-434

Spataru P, Viveen WJAR and Gophen M (1987). Food composition of *Clarias gariepinus (Cypriniformes, Clariidae)* in Lake Kinneret (Israel). *Hydrobiologia **144**: 77-82.*

Tesfaye W (1998). Biology and Management of fish stocks in Bahir Dar Gulf, Lake Tana, Ethiopia. Ph.D. dissertation. Wageningen Agricultural University, Wageningen. 142 pp.

Ujjania N.C., Kohli M.P.S. and Sharma L.L. (2012). Length-weight relationship and condition factors of Indian major carps (*C. catla, L. rohita and C. mrigala*) in Mahi Bajaj Sagar, India. Research Journal of *Journal of Biology,* 2 (**1**), 30-36

Viveen WJAR, Richter CJJ, Van oordt PGWJ, Jansen JAL and Huisman EA (1986). *Practical Manual for the Culture of the African Catfish (Clarias gariepinus).* Department of Zoology of the University of Utrecht. The Hague. 121 pp.