



ORIGINAL RESEARCH ARTICLE

Length-Weight Relationship and Condition Factor of *Clarias gariepinus* and *Clarias anguillaris* from Yobe Komadougou River

*Peter, M. B.¹; Paulina I. ¹; Valdon, S. B.¹, Peter, K. J.¹ and Tukura, E. E.²

¹Department of Fisheries and Aquaculture, Adamawa State University, Mubi.

²Department of Fisheries and Aquaculture, Federal University Wukari.

DOI: <https://doi.org/10.64290/gjges.v6i2.55>

ARTICLE INFO

Article History:

Received 16th June 2026

Revised 19th June 2026

Accepted August 2026

Keywords:

- Length-weight;
- Condition factor;
- *Clarias gariepinus*;
- *Clarias anguillaris*;
- Yobe River.

*Corresponding Author:

E-Mail: peter1188@adsu.edu.ng

Phone: +2347067766867.

ABSTRACT

A comparative study on the length-weight relationship and condition factor of *Clarias gariepinus* and *Clarias anguillaris* from the Yobe River was conducted. Sixty fish samples were randomly collected from landing sites along Yobe Komadougou River using stratified random sampling over three months (July–September 2019). Morphometric measurements were taken in triplicates and analyzed using regression analysis with weight ranging from 65.92g – 2700.69g and length ranging from 21.1cm – 55.2cm for *Clarias gariepinus* and weight of 56.41g – 2300.2g and length ranging from 19.5cm – 52.2cm for *Clarias anguillaris*. Morphometric measurements were done on site and in triplicates on total length, standard length and weight of each fish sample and the average taken. The results obtained showed that the growth of *Clarias gariepinus* and *Clarias anguillaris* is positively allometric with b-values of 5.9056 and 4.907 respectively which is not statistically different ($p > 0.05$). The positive allometric growth could be due to spawning since the data was collected during the peak spawning season (rainy season). The mean condition factor of *C. gariepinus* is 0.9864 while that of *C. anguillaris* is 1.8109 and were significantly different ($p < 0.05$) indicating that *C. gariepinus* was not in good condition while *C. anguillaris* was thriving and living in good condition during the study period. There was a strong positive correlation between the length and weight of these fish species which shows that this water body had abundant food supply that supported the growth of *C. gariepinus* and *C. anguillaris* making this important commercial freshwater fish species to be exploited. However, the low condition factor for *Clarias gariepinus* is as a result of competition for feed with *Clarias anguillaris*. For sustainability in the Yobe River, proper fisheries management principles should be employed in order to safeguard against the destruction of its flora, fauna and the aquatic habitat and also mitigate over-exploitation of *C. gariepinus* especially.

Introduction

The widespread occurrence of *Clarias spp* in inland waters has been ascribed to their abilities to utilize several varieties of items as food, can withstand different degrees of environmental conditions, fast growth rate,

high fecundity rate, ease of artificial spawning and good marketable value are among the characteristics that made them desirable (Afolabi *et al.*, 2020). Various authors have published on the identification problems between *Clarias gariepinus* and the closely

related and partially sympatric *Clarias anguillaris* (Debouche *et al.*, 1979; Teugels, 1982). However, the only reliable way of differentiating these species is the number of gill rakers on the first branchial arch which displays a positive allometry and was not significantly different for con-specific populations but highly significant between the two species. A clearer and more accurate method of differentiating the species is in the pre-maxillary band which is continuous and broad in *C. anguillaris* and is shallow, discontinuous at the middle in *C. gariepinus*. The inland fisheries in tropical Africa face threats both by stress from climate change and by overexploitation (Hughes *et al.*, 1997). Species are becoming extinct and populations decline at an alarming rate. This presents a problem for conservation planning and prioritization, because those species that have not been identified obviously cannot be protected effectively (Swartz *et al.*, 2008). Francis and Elewuo (2012) reported that the world is witnessing a decrease in fish production due to the unsustainable exploitation of the fisheries resource and the human population posing much demand on fish as food and raw materials. Therefore, for fishery resources to effectively manage, fish species among other inhabitants, needs significant awareness of length-weight relationship (Dan-kishiya, 2013). This relationship is very vital as it allows assessment of average fish weight in the given length group; estimate the well-being of individuals and determine the variation between separate unit of fish stocks that are of the same species (Getso *et al.*, 2017). Also, this relationship is useful in fisheries management for comparative growth studies (Dan-kishiya, 2013). Length-weight relationship provides valuable data on the aquatic medium and also aquatic ecosystems modelling. Furthermore, the importance of condition factor in determination and comparison of living condition, fatness or wellbeing of fish species has been reported (Ahmed *et al.*, 2011). Condition factor is a useful index for monitoring of feeding intensity, age and growth rates in fish (Sadauki *et al.*, 2023). It is strongly influenced by both biotic and abiotic environmental factors and can be used to assess the status of an aquatic ecosystem

(Anene, 2005; Sadauki *et al.*, 2023). Despite the economic importance of *Clarias* species in Nigeria, limited comparative data exist on their growth patterns and condition factors in Yobe River. Previous studies have focused on other inland waters (Abowei & Hart, 2009; Kalu *et al.*, 2007; Ude *et al.*, 2011), but Yobe River remains underexplored. This study addresses this gap by comparing *C. gariepinus* and *C. anguillaris*, providing baseline data for fisheries management and aquaculture development in Yobe State. This study aimed at comparing the length-weight relationship and condition factor of *Clarias gariepinus* and *Clarias anguillaris* from Yobe Komadougou River, in Yobe State, Nigeria.

Materials and Methods

The Yobe River, also known as the Komadougou Yobe, is located approximately at 12.6517° N latitude and 10.6472° E longitude. The region experiences a semi-arid climate. The average annual temperature is around 27-29°C (80.6-84.2°F). The hottest months are typically March and April, with temperatures often exceeding 40°C (104°F), while the coolest months are December and January, with temperatures dropping to around 15-18°C (59-64.4°F) at night (Sidi, 2022). The Yobe River in Yobe State is a crucial water resource with significant seasonal variations in temperature, rainfall, and river discharge. These factors influence the local ecosystem, agricultural practices, and water management strategies. Understanding these patterns is essential for effective resource management and planning in the region (Sidi, 2022).

Sample Collection and Identification

Fish samples for this study were purchased from artisanal fishers at landing sites along the Yobe Komadougou River, Yobe State. Morphometric and Meristic measurements were done immediately at the landing site following standard methods. 30 fish samples each per species (*Clarias gariepinus* and *Clarias anguillaris*) were collected from fishermen at designated landing sites along Yobe River. Sampling was stratified across three months and each fish sample was measured for total length, standard length, and weight. Sampling was done between 8am and 12 noon or

between 3pm and 5pm as the case may be once a month for a period of 3 months (September – December 2019). The following clariid species were identified based on the identification guide with the shape of the tooth as the major feature used for identification.

Length – weight relationship

The analysis of length-weight data was done using the conventional formula described by Le-Cren (1951) as follows:

$$W = aL^b \quad (1)$$

The above equation and data were transformed into logarithms before the calculations were made.

Where W = weight of fish in grams; L = Total length of fish in centimeter; a = constant; b = an exponent.

Condition factor (K)



Plate 1: Dorsal view *Clarias anguillaris*



Plate 2: Dorsal view *Clarias gariepinus*



Plate 3: Vomerine tooth *Clarias anguillaris*



Plate 4: Vomerine Tooth *Clarias gariepinus*

Length weight relationship of *Clarias gariepinus* and *Clarias anguillaris*

The length-weight relationship of the fish species from the study area (Yobe Komadougou River) was computed and a scatter diagram plotted with a line of best fit for each of the species in the study area. Table

The condition factors (K) were also calculated using the conventional formulae described by Worthington and Richardo (1930) as:

$$K = W \times 100 / L^3 \quad (2)$$

Where K = the condition factor; W = weight of fish in grams; L = Total length of fish in cm.

Data Analysis

The data was analyzed with the analysis toolpak of Microsoft Excel using regression analysis to obtain the length weight relationship of these fish species.

Results and Discussion

The following clariid species (Plate 1-2) were identified based on the identification guide with the shape of the tooth (Plate 3-4) as the major feature used for identification.

1 summarizes the prediction equation between the length and weight of the fish samples which was used to predict the type of growth exhibited by *Clarias anguillaris* and *Clarias gariepinus*.

Table 1: Summary of Prediction Equation between Weight and Total Length of *Clarias gariepinus* and *Clarias anguillaris* from Yobe River

Species	Prediction equation	A	B	R ²
<i>Clarias gariepinus</i>	$W(g) = 0.0527 + 5.9056 \ln TL$	0.0527	5.9056	0.999
<i>Clarias anguillaris</i>	$W(g) = 0.6863 + 4.907 \ln TL$	0.6863	4.907	0.9989

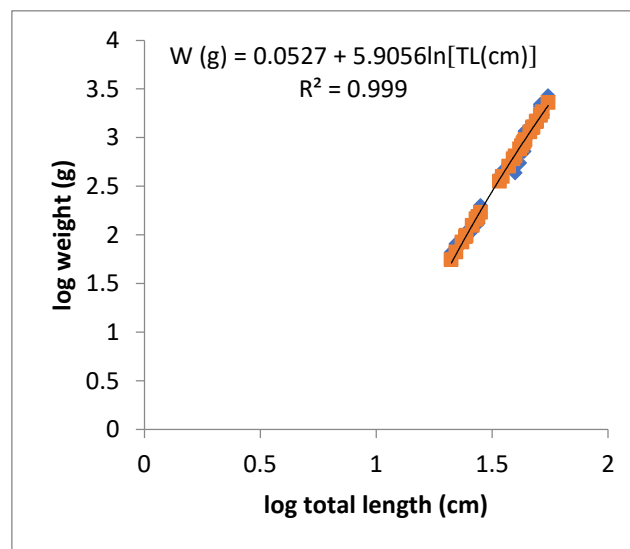


Figure 1: Relationship Between Total Length (cm) and Weight (g) of *Clarias gariepinus* from Yobe River

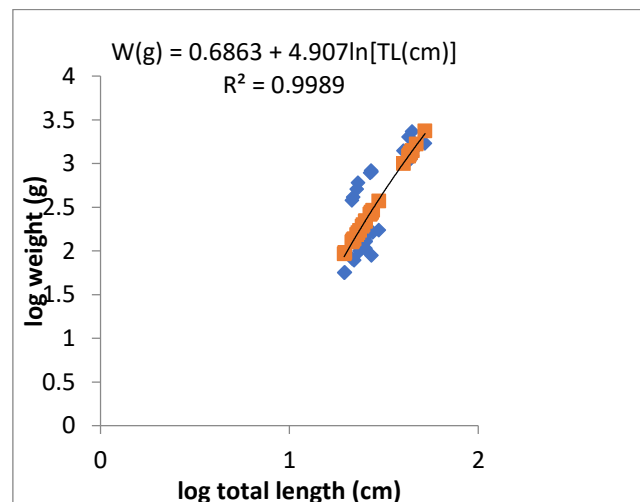


Figure 2: Relationship Between Total Length (cm) and Weight (g) of *Clarias anguillaris* from Yobe River

Condition factor The condition factor (k) of the fish species from Yobe River were computed and summarized in the table below.

Table 2: Summary of Condition Factor of *Clarias gariepinus* and *Clarias anguillaris* from Yobe River.

Species	Min. K	Max. K	Mean K
<i>Clarias gariepinus</i>	0.667	1.639	0.9864

<i>Clarias anguillaris</i>	0.441	4.871	1.8109
----------------------------	-------	-------	--------

Identification of the Species

From the study, it was observed that these two fish species cannot be identified by mere looking at the phenotypic characters except of course using the shape of the vomerine tooth as described by (Idodo-Umeh 2003) and molecular markers. The findings from this research is in agreement with what Reed *et al.* (1967) documented; that the character of the arrangement of the teeth bands in *Clarias* species is the most reliable means for determining the species and it is also in agreement with the results of Onyia (2012), thus validating their reports. However, this contradicts the results of Diop *et al.* (2024) who opined that *Clarias anguillaris* has a convex, continuous and small vomerine plate while *Clarias gariepinus* has a continuous and thicker vomerine plate. Generally, these differences in the vomerine plate could be due to food selection or genetics (Diop *et al.*, 2024) or environmental differences in temperature, turbidity and water depth (Hamad, 2014).

Length-weight relationship

The knowledge of population parameters such as length-weight relationship for the effective management of any fishery cannot be overemphasised. It is also very important in fisheries biology because it allows for the estimation of average weight of a fish of a given length group (Beyer, 1987 as cited in Dan-Kishiya, 2013), assess the well-being of individuals and to determine differences between separate unit stocks of a species population (Dan-Kishiya, 2013). The relationship is also important in fisheries management for comparative growth studies (Moutopoulos and Stergiou, 2002). Kulbicki *et al.* (2005) stressed the importance of LWR in modelling aquatic ecosystems. The b values in length- weight relationships determine the growth pattern of the fish species. When b is equal to 3 or close to 3, growth in the fish is said to be isometric i.e. fish becomes more robust with increasing length (Bagenal and Tesch, 1978). Similarly, when b is far less or greater than 3, growth in the fish is allometric i.e. the fish becomes thinner with increase in length (King, 1996). The result of this study showed that the growth of the species (*Clarias*

gariepinus and *Clarias anguillaris*) in the study area exhibited positive allometry. This means that the fishes do not grow symmetrically. This was similar with documented works from Inland water bodies in Nigeria. Notable among them includes the findings of Abowei and Hart (2009) in an investigation of some morphometric parameters of 10 fin fish species of Lower Nun River in Niger Delta; Kalu *et al.* (2007) on an investigation of the length-weight relationship and condition factor of *Clarias gariepinus* and *Tilapia zilli* in Lake Alau and Munguno Hatchery in Borno State and Peter *et al.* (2024) on the Comparative Study of the Length-Weight Relationship and Condition Factor of *Clarias gariepinus* and *Clarias anguillaris* from Upper River Benue. Also, Ibrahim *et al.* (2009) observed allometric growth pattern in Kontagora Reservoir while Ude *et al.* (2011) made similar findings in an evaluation of length- weight relationship of fish species of Ebonyi River. The b-values recorded for the fish species in Yobe River is 5.9056 for *Clarias gariepinus* and 4.907 for *Clarias anguillaris* which is well above the documented values of 2.5 to 3.5 for tropical fish species (Gayannilo and Pauly, 1997). This could be due to the rate at which the climate is changing in recent years bringing about lifestyle changes in these fishes.

Condition factor (K)

The condition factor of a fish species is used in order to ascertain the wellbeing of fish (Ahmed *et al.*, 2011). Condition factor is also useful in monitoring feeding intensity, age and growth rates in fish (Ndimele *et al.*, 2010). It is strongly influenced by both biotic and abiotic environmental conditions and can be used to assess the status of the aquatic ecosystem in which the fish live (Anene, 2005). Barnham and Baxter (1998) proposed that if the K value is 1.00, the condition of the fish is poor, long and thin. A 1.20 value of K indicated that the fish is of moderate condition and acceptable to many anglers. A good and well-proportioned fish would have a K value that is approximately 1.40. Based on this criterion, *C.gariepinus* from Yobe River are not in good condition while *C. anguillaris* from the same water body is in good condition with mean K

value greater than 1.4. The results obtained is similar to the findings of Peter *et al.* (2024), who obtained a mean K value of 0.6052 for *Clarias gariepinus* and 1.9352 for *Clarias anguillaris* from Upper River Benue. The results from the present study also agrees with that of Ibrahim *et al.* (2012), who recorded a mean K-value of 1.98 ± 0.35 in Kontagora Reservoir in Niger State.

Conclusion

This study confirms that both *Clarias gariepinus* and *Clarias anguillaris* in River Taraba exhibit positive allometric growth and high condition factors, suggesting favorable ecological conditions. However, unusually high b-values and low K-values highlight the need for further studies on feeding ecology and gut content analysis. Therefore, it is recommended that seasonal monitoring should be conducted to validate growth trends while also investigating feeding ecology to explain high b-values with low K-values recorded in these fish species.

References

- Abowei, F. N. and Hart, A. I. (2009). Some morphometric parameters of 10 finfish species from the lower Nun River, Niger Delta, Nigeria. *Research Journal of Biological Sciences*. 4(3): 282-288.
- Afolabi, J. O., Oladele, O. O. and Olususi, C. F. (2020). Assessment of bacterial loads of *Clarias gariepinus* (Burchell, 1822) obtained from cultured and natural habitats. *Journal of Basic and Applied Zoology*, 81; 32.
- Ahmed, E. O., Ali, M. E. and Aziz, 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.
- Anene, A. (2005). Condition factors of four cichlid species of a man-made lake in Imo State, Southeast, and Nigeria. *Turkish Journal of Aquatic Science*, 5: 43-47.
- Anigboro, O. F., Ikomi, R. B. and Iloba, K. (2023) Length-weight Relationships and Condition Factor of *Clarias gariepinus* post larvae fed three Diets. *International Journal of Applied Biological Research*, 1 – 24.
- Bagenal, T. B. and Tesch, F. W. (1978). Age and Growth. In: Bagenal, T. Ed., *Methods for Assessment of Fish Production in Fresh waters*, 3rd Edition, IBP Handbook No 3, Blackwell Science Publications, Oxford.
- Barnham, C. and Baxter, A. (1998). Condition Factor, K, for Salmonid Fish. *Fisheries Notes*, 1-3.
- Beyer, J. E. (1987). On length- weight relationships. Part 1: Computing the mean weight of the fish of a given length class. *Fishbyte*. 5(1): 11-13
- Dan-Kishiya, A. S. (2013). Length-weight relationship and condition factor of five fish species from a tropical water supply reservoir IN Abuja, Nigeria. *American Journal of Research Communication*, 1(9): pp 175-187.
- Froese R. (2006). Cube law, condition factor and weight-length relationships: History, metal and recommendations. *Journal of Applied Ichthyology*, 22:241-253.
- Gayannilo, F. C. and Pauly, D. (1997). *FAO ICLARM stock assessment tools (FISAT): References Manual*, FAO Computerized Information Series (Fisheries). 8: 262.
- Getso, B. U., Abdullahi, J. M. and Yola, I. A. (2017). Length-weight relationship and condition factor of *Clarias gariepinus* and *Oreochromis niloticus* of Wudil River, Kano, Nigeria. *Agro-Science*, 16 (1), 1- 4.
- Haymer, D. S. and Khedkar, G. D. (2022). Biology of Selected *Clarias* Catfish Species Used in Aquaculture. *Israeli Journal of Aquaculture*, 74, 1-15.
- Ibrahim, B. U., Auta, J. and Balogun, J. K. (2009). An assessment of the Physiochemical Parameters of Kontagora Reservoir, Niger state, Nigeria. *Bayero Journal of Pure and Applied Sciences*, 2(1): 64 – 69.
- Ibrahim, B.U., Auta, J., Balogun, J.K., Bolorunduro, P.I. and Dan-Kishiya,

- A.S. (2012). Length-weight relationship and condition factor of *Barilius niloticus*(Family: Cyprinidae) in Kontagora Reservoir, Niger State, Nigeria. *Biological and Environmental Sciences Journal for the Tropics*, 9(2): 155-158.
- Joshua, M. M., Oruonye, E. D., Zemba, A. A. and Yusuf, M. B. (2023). Impact of Climate Variability and Land Cover Dynamics on Groundwater Potential of Upper Benue River Basin, Nigeria. *Jalingo Journal of Social and Management Sciences*, 4(3), 337-353.
- Kalu, K. M., Umeham, S. N. and Okereke, F. (2007). Length-weight relationship and condition factor of *Clarias gariepinus* and *Tilapia zilli* in Lake Alau and Munguno Hatchery, Borno State, Nigeria. *Animal Research International*, 4(1); 635-638.
- King, R. P. (1996). Length-Weight Relationships of Nigerian Coastal Water Fishes. *Naga, The ICLARM Quarterly*, 19, 53-58.
- Kulbicki, M., Guillemot, N. and Amand, M. (2005). A general approach to length-weight relationships for New Caledonian Lagoon fishes. *Cybiurn*, 29: 235- 252.
- Le Cren, E. D. (1951). The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). *J. Animal Ecology*. 20: 201-219.
- Moutopoulos, D. K. and Stergiou, K. I. (2002). Length-Weight and Length-Length Relationships of fish species from Aegean Sea (Greece). *Journal of Applied Ichthyology*, 18, 200-203.
- Ndimele, P. E., Kumolu-Johnson, C. A., Aladetohun, N. F. and Ayorinde, O. A. (2010). Length-weight relationship, condition factor and dietary composition of *Sarotherodon melanotheron*, Ruppell, 1852 (Pisces: Cichlidae) in Ologe Lagoon, Lagos, Nigeria. *Agric. Biol. J. North Am.*, 1: 584-590.
- Okwudu, N. E. (2016). Aquaculture for Sustainable Development in Nigeria. *Scholars World-International Refereed Multidisciplinary Journal of Contemporary Research*, IV(II): 76-84.
- Okwudu, N. E., Okorie, P. U. and Nwoke, B. E. B. (2022). Length-Weight Relationship and Condition Factor of African Mud Catfish (*Clarias gariepinus* Burchell, 1822) and *Tilapia* (*Oreochromis nilotica* Linnaeus 1758) in Orashi River of Ogba/Egbema/Ndoni LGA of Rivers State, Nigeria. *Asian Journal of Fisheries and Aquatic Research*, 16(2): 16-31.
- Peter, M. B., Duwal, S. D., Sogbesan, O. A. and Onyia, L. U. (2024). Comparative Study of the Length-Weight Relationship and Condition Factor of *Clarias gariepinus* and *Clarias anguillaris* from Upper River Benue. *Journal of Agriculture, Environmental Resources and Management*, 6(7), pp 81-89.
- Sadauki, M. A., Bichi, A. H. and Geidam, M. B. (2023). Length-Weight Relationship and Condition Factor of *Clarias gariepinus* (Burchell, 1822) in Zobe Reservoir. *Life Sciences: An International Journal (LSIJ)*, 1(1): 1-10.
- Ude, E. F, Ugwu, L. L. C., Mgbenka, B. O. and Nwani, C. D. (2011). Baseline evaluation of length-weight relationship of fish species of Ebonyi River, Nigeria. *Nigerian Journal of Fisheries* 8(1): 136-144.
- Worthington, G. H. and Richardo, C. K. (1930). Scientific Results of the Cambridge Expedition to the East African Lakes No 15: the Fish of Lake Rudolf and Lake Baningo. *Journal of the Proceedings of the Linnean Society, Zoology*, 267, 353-389.