Journal of Agriculture, Environmental Resources and Management
ISSN2245-1800(paper) ISSN 2245-2943(online)
6(7)1-800: **December.**.2024: pp81-89

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Comparative Study of the Length-Weight Relationship and Condition Factor of *Clarias Gariepinus* and *Clarias Anguillaris* from Upper River Benue

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Abstract

A comparative study of the length-weight relationship and condition factor of *Clarias gariepinus* and *Clarias anguillaris* from Upper River Benue was conducted within a period of three (3) months from July to September 2019. Sixty (60) *C. gariepinus* samples with weight ranging from41.02g – 1100.25g and length ranging19.9cm – 49.3cm and *C. anguillaris* weight of 56.41g – 2100.28g and length ranging from 19.5cm – 52.2cm were randomly collected from landing sites along Upper River Benue. The samples were transported to the Department of Fisheries Laboratory, Modibbo Adama University of Technology, Yola for measurement. Morphometric measurements were done in triplicates on total length, standard length and weight of each fish sample and the average taken. Data collected were analysed statistically using regression analysis with Microsoft Excel 2016. The results obtained showed that the growth of *C. gariepinus* and *C. anguillaris* were positively allometric with b-values of 5.0176and 5.3854respectively. The mean condition factor of *C. gariepinus* was 0.9201 while that of *C. anguillaris* was 4.9919 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 lengths and weights of these fish species. 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. For sustainability in the Upper River Benue, proper fisheries management principles should be employed in order to safeguard against the destruction of its flora, fauna and the aquatic habitat.

Keywords: Length-weight, Condition factor, *Clarias gariepinus*, *Clarias anguillaris*, Upper River Benue.

Introduction: Fish is often recommended for cardio-vascular disease patients and the aged because of its unique fat, which is composed mainly of Omega-3 polyunsaturated fatty acid. In addition to its nutritious flesh, vitamins A and D that are present in fish oil are important especially in infants and children (Fasakin, 2006). It also supplies the body, a range of inorganic minerals such as phosphorus, fluorine, potassium, iron, zinc, magnesium, and copper in marine species,iodine as well as vitamins A and B complex (Adeniyi *et al.*, 2010). The proximate composition, nutritive values and mineral composition of fishes in Nigeria have been documented (Abdullahi and Abolude, 2006).*Clarias* is a genus of catfishes (order:Siluriformes) of the family Clariidae, the air-breathing catfishes. The catfish genus *Clarias*(Scopoli, 1777) has a widespread distribution and it is found commonly in Africa and south-east Asia (Teugels, 1997). The diversity of these catfishes is highest in Africa, however, some (notably the walking catfish) have become pest species where they have been accidentally introduced.They are known for their commercial value to people of Adamawa State because of its high fecundity and its resistance to disease as well as fast growth rate in captivity. Some species particularly the African catfish (*Clarias gariepinus*) is of great economic

importance both in fisheries and aquaculture. *Clarias* species are recognized by their long-based dorsal and anal fins, which give them a rather eel-like appearance. These fish have slender bodies, a flat, bony head, and a broad, terminal mouth with four pairs of barbels (Teugels, 1997). They also have a large, accessory breathing organ composed of modified gill arches. Also, only the pectoral fins have spines. There are currently 61 species recognized in this genus with about 36 recognized in Africa (Wikipedia, 2019).

Various authors have published on the identification problems between *C. gariepinus* and the closely related and partially sympatric *C. anguillaris*(Debouche *et al.*, 1979; Teugels, 1982a). However, the only reliable way of differentiating these species is the number of gills 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 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.

The vision for sustainability in the exploitation of the fishery resource has culminated into the need for researchers to investigate water bodies in terms of fish production potential (Abdul and Omoniyi, 2007).Management measures can be proffered, if the status of the fishery is known. Many tools have been developed to determine the state of fish stocks in order to proffer management measures that can either hinder the collapse of the fishery or aid the development of a recovery plan. Understanding the biology, environmental parameters and population structure of *C. anguillaris* and *C. gariepinus* is essential to optimize production of these fish species from the wild and also through aquaculture. Length-weight relationship and condition factor of *C. angularis* and *C. gariepinus* species from the Upper River Benue will provide information for management decision and culture of the species in the surrounding areas in Adamawa state.

Materials and Methods: **Study Area**: The River Benue has its origins from the Adamawa Mountains in Central Cameroon and has total length of about 1400km. it is a major tributary of the River Niger into which it discharges in Nigeria (Van de Knaap, 1994 as cited in Peter and Jauro 2017). The River Benue is located between latitude 09º09'00''N and 09º33'00''N of the equator and between longitudes 12º 21' 00''E and 12º 54' 00''E of the prime (Greenwich) meridian (Federal Surveys, Nigeria 1971)

Sample Collection : Fish samples for this study were purchased from artisanal fishers at landing sites along the Upper River Benue in Yola. The samples collected were then transported in plastic containers to the Department of Fisheries Laboratory Modibbo Adama University of Technology, Yola for further studies. 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 6 months (July – December 2019). **Species Identification:** The following clariid species were identified based on the identification guide with the shape of the tooth as the major feature used for identification.

Determination of Length and Weight: The sampled specimens were examined for total length of the body using a standard meter rule mounted on a dissecting board which was recorded in centimetre, while weight was determined using a sensitive weighing balance. The length-weight relationship was computed using the conventional formula described by LeCren (1951) as follows: $W = aL^b$. The above

equation and data were transformed in to logarithms before the calculations were made. Therefore the equation becomes: Log W = log a + b log L

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

The condition factors (K) were also calculated for individual fish species using the conventional formulae described by Worthington and Richardo (1930) as: K = W×100

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

Data Analysis: The data was analysed in Microsoft Excel 2016 using regression analysis to obtain the length weight relationship of these fish species

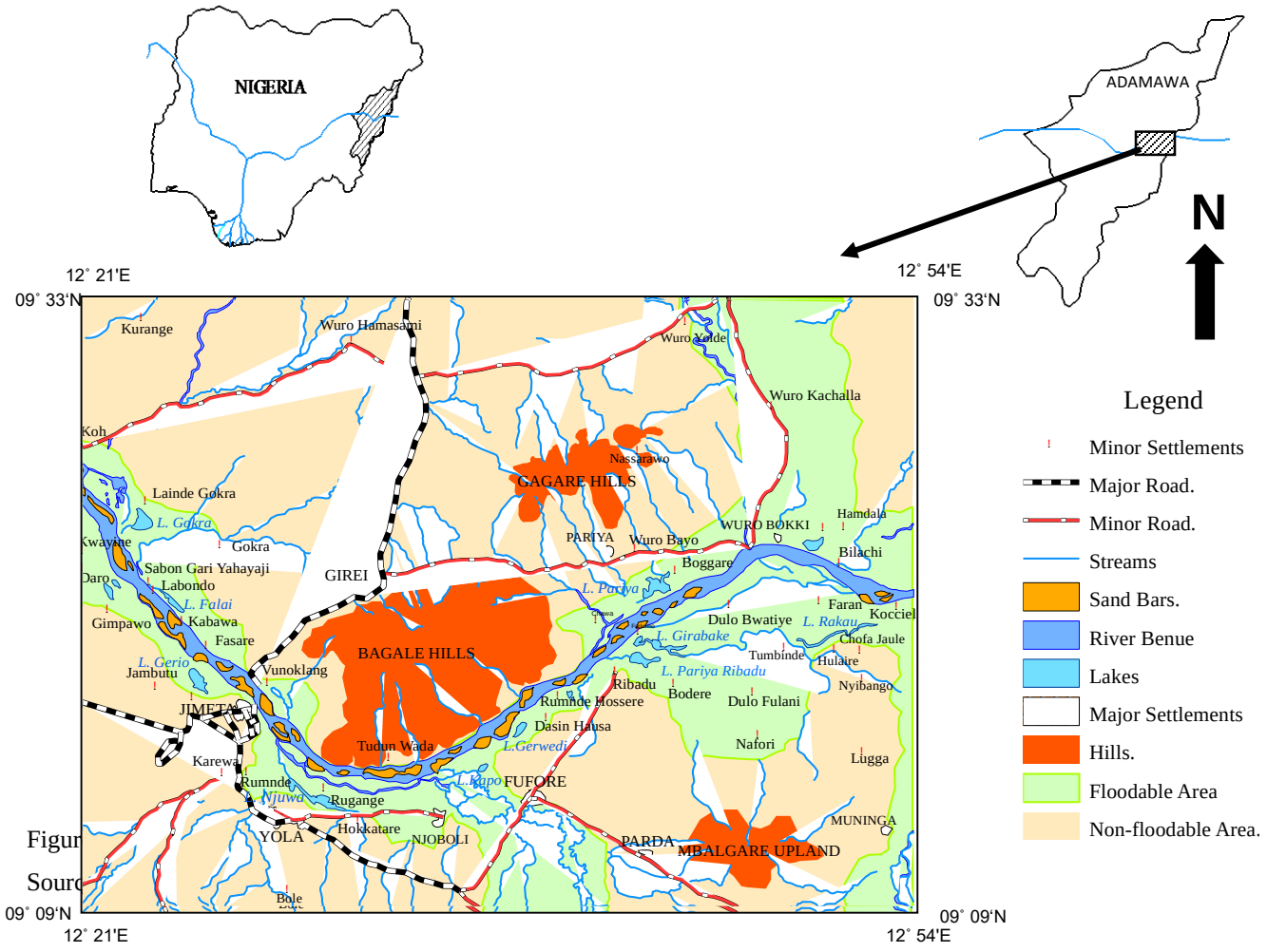

Figure 1: Map of the study area (Upper River Benue)
Source: Peter and Jauro 2017

Results : 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.

Plate 1: Dorsal view *C. anguillaris* Plate 2: Dorsal view *C .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 (Upper River Benue) was computed and a scatter diagram plotted with a line of best fit for each of the species in the study area. Table 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 *C. anguillaris* and *C.gariepinus*.

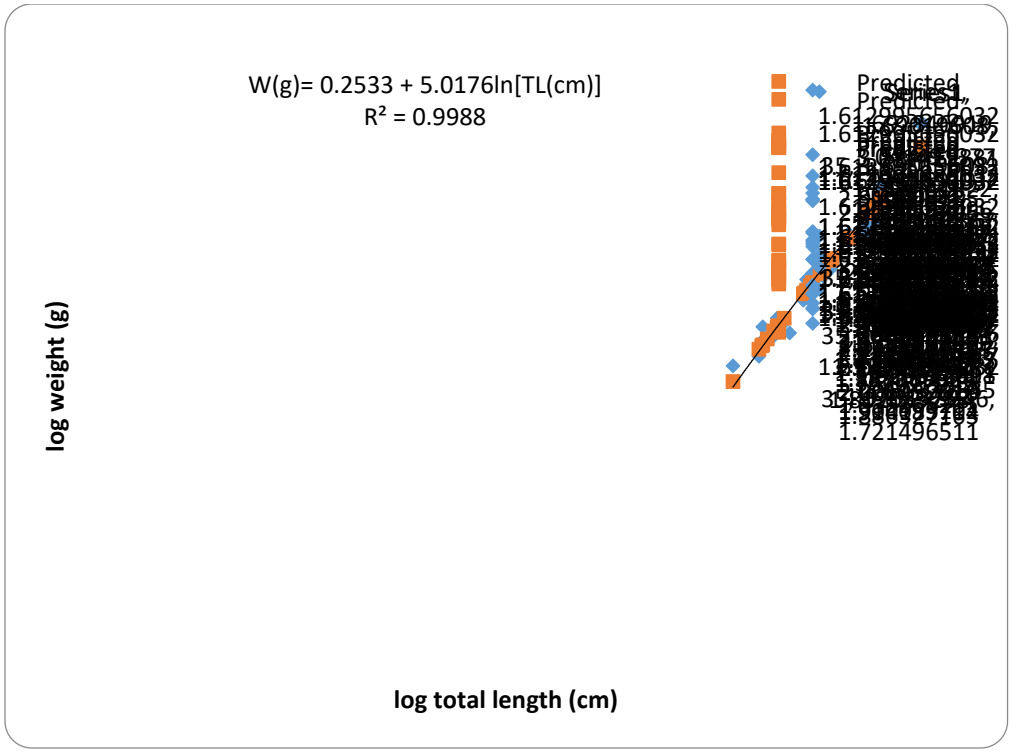

Figure 3: Relationship Between Total Length (cm) and Weight (g) of *C.gariepinus* from Upper River Benue

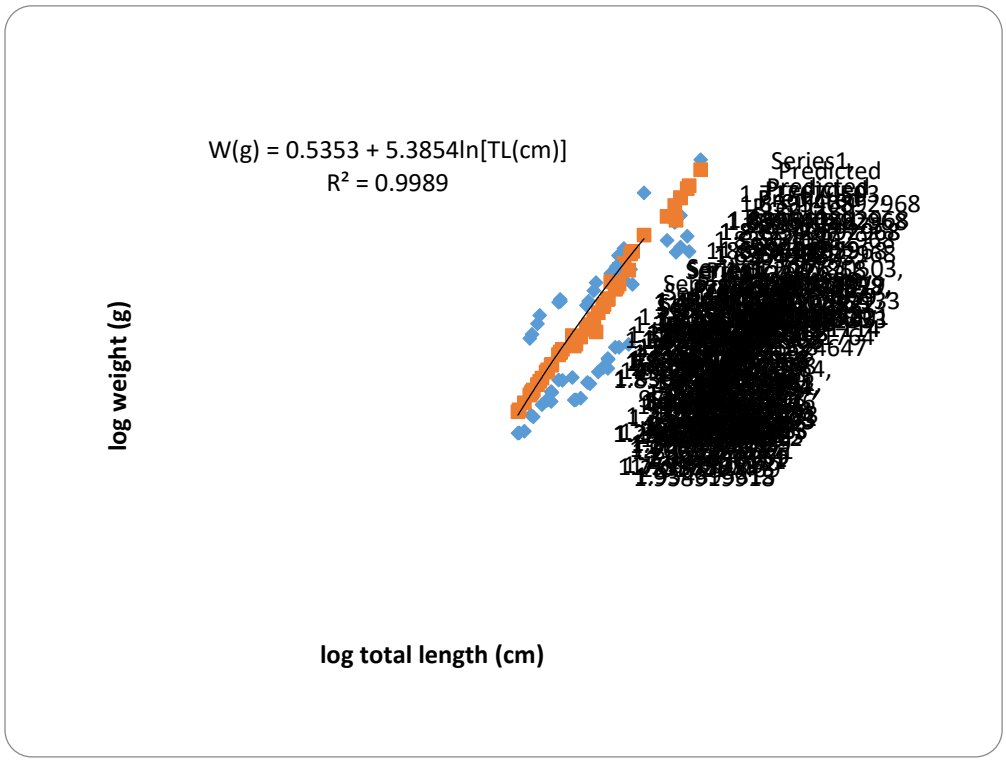

Figure 3: Relationship Between Total Length (cm) and Weight (g) of *C.anguillaris* from Upper River Benue

Table 1: Summary of Prediction Equation between Weight and Total Length of *C.gariepinus* and *C. anguillaris* from the Upper River Benue

Species	Prediction equation	a	b	R^2
Clarias gariepinus	W(g) = 0.2533 + 5.0176ln TL	0.2533	5.0176	0.9988
Clarias anguillaris	W(g) = 0.5353 + 5.3854ln TL	0.5353	5.3854	0.9989

Condition factor

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

Table 2: Summary of Condition Factor of *C.gariepinus* and *C. anguillaris* from Upper River Benue

Species	Min. K	Max. K	Mean K

Clarias gariepinus	0.5443	0.9201	0.6052
Clarias anguillaris	0.6539	4.9919	1.9352

Discussion: The regression analysis of the length and weight of *C.gariepinus* and *C. anguillaris* from Upper River Benueshowed that these species exhibited a positive allometric growth since their b-values (exponent) of the regression equation were all greater than 3 (Table 3). It was also observed that there was a strong relationship between the length and weight of each of the species from the studied locations with coefficient of determination (r^2) values close to 1. This result disagreed with the work of Fagbuaro *et al.* (2015) who reported that *C.gariepinus* exhibited a negative allometric growth. It is also in disagreement with the report of Kalu *et al*. (2007) who reported a negative allometric growth pattern for this species in Alau in Borno State. However, it agreed with the work of Ezenwaji (2004) who reported a positive allometric growth for all species of the genus in Nigerian Freshwater Systems. The present study also was not in agreement with the work of Eke *et al*. (2017) who reported a negative allometric growth pattern for *C. anguillaris* from Oguta lake in Nigeria. 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 Upper River Benue are not in good condition while *C. anguillaris* from the same water body is in good conditionsince wirh K value greater than 1.4.

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