# Length-weight Relationship, Condition Factor and Feeding Habits of *Synodontis clarias* (Linnaeus, 1758) in the Lower River Benue at Makurdi, Nigeria

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## Abstract
The Length-Weight Relationship (LWR), Condition factor (**K**) and feeding habits of *Synodontis clarias* (Linnaeus, 1758) were investigated over a 24 month period from January, 2009 - December, 2010. A total number of 163 specimens comprising of 74 females and 89 males with the size range of 7.60 – 20.00cm and the mean of 12.72± 0.258cm were investigated. The weight ranged from 13.12 – 607.30g with the mean of 65.83± 0.897g. The LWRs for the females, males and combined sexes had the **r** values of 0. 8415, 0.9463 and 0.8703 respectively. The mean condition factor **K** was 3.3667, 2.6868 and 2.9954 for the females, males and combined sexes respectively. The regression coefficient **b** was 1.9408, 1.8799 and 2.1359 for the females, males and combined sexes respectively indicating negative allometric growth pattern for the species. Out of the 163 stomachs examined for food items, 88 (53.99%) were empty while 75 (46.01%) contained a wide range and varying quantities of food items indicating that *S.clarias* in River Benue is omnivorous.
**Key words:** *Synodontis clarias*, length–weight relationship, condition factor, feeding habits.

## Introduction
The red-tailed catfish *Synodontis clarias* is a fish with good aquaculture attributes and well priced ornamental qualities (Offem *et al*., 2013). Paugy and Roberts (1992) reported that the native range of the species covered Chad, Niger (including the Benue River), Senegal, Gambia, the Volta basins and the Nile. Reide (2004) reported that the fish was a bentho-pelagic and potamodromous freshwater fish with a pH range of 6.5 - 9.5. Willoughby (1974) classified it as an omnivore feeding mainly on insect larvae, molluscs and detritus. Olaosebikan and Raji (1998) recorded the maximum size of 36.0cm standard length.

*Synodontis clarias* is one of the species of *Synodontis* that are found in river Benue though at the period of this study, they were not very common. Agbozu *et al*., (2007) described it as an important fish with bio-economic value to the inhabitants of the Taylor Creek in the Niger Delta area of Nigeria while Odo *et al*., (2009) reported that *Tilapia niloticus* and *Synodontis clarias* were the most preponderant species of fish found in the Anambra River, and constitute the main diet for over one million rural dwellers living

along the river banks.

There are few works on the biology of *S.clarias,* particularly in this area. Most of the works done on this species are in other places in Nigeria. They include those of Akinsanya *et al*., (2008) from Lekki Lagoon, Lagos, Nigeria; Odo *et al*., (2009) on *Tilapia nilotica* and *Synodontis clarias* in Anambra River; Agbozu *et al*., (2007) in the Taylor Creek of the Niger Delta area of Nigeria, Hassan *et al*., (2007, 2010) from Lekki Lagoon Lagos, Nigeria; Offem *et al*., (2013) in Cross river, Nigeria and Wangboje and Omonsaye (2013) from Ikpoba Reservoir Benin city, Nigeria. The only works on this species in river Benue are those of Akombo *et al*., (2010, 2011) who worked on the Intestine to Standard length and food habits of *Synodontis* species from the Lower Benue River, Makurdi, Nigeria and Morphometric measurements and growth patterns of four species of the genus *Synodontis* from Lower Benue River, Makurdi, Nigeria respectively in which *S.clarias* was included and Omeji (2012) who studied the gastrointestinal helminth parasites of *Auchenoglanis occidentalis* and *Synodontis clarias* from lower River Benue, Makurdi, Nigeria. This work is therefore, aimed at providing information on the length-weight relationship, feeding habits and condition factor of *Synodontis clarias* in River Benue at Makurdi.

## Materials and Methods

### Study Area

The study was carried out in the Lower Benue River at Makurdi. The Lower Benue as described by Reid and Sydenham (1979) is the portion of the Benue River contained within the Benue State of Nigeria. It is located between latitude $7^0$30' and $7^0$45'N and longitudes $8^0$30' and $8^0$35E (Denga, 1995). River Benue originates mainly in the Adamawa mountains of Cameroun, some 500km beyond the Nigerian frontier and flows West across East-central Nigeria (Nedeco, 1959). The Lower Benue has the features of a mature River with the extensive alluvial plain being flooded during the rainy season and forms breeding grounds for many fish species (Banks *et al*., 1985). When its banks are full, the area of the Lower Benue is 129,000 ha, but when flooded, it rises to about 310,000 ha (Welcomme, 1971).

### Fish Sampling

A total number of 163 specimens were purchased from fish sellers at Wadata and Wurukum markets, Makurdi. The samples purchased fortnightly were transported in an ice-chest with ice cubes (to reduce posthumous digestion of the stomach contents).

The standard length (SL) of each specimen was measured in centimeters (cm) from the tip of the snout to the base of the caudal fin using a measuring board. The body weights were measured in grammes (g) using a digital weighing balance (Adam AFP 4100L). This was read to the nearest 0.1 gramme. These parameters were used to obtain data on the Length-Weight Relationship (LWR) and Condition factor (K) using the equations below:

### Length-Weight Relationship (LWR)

The LWR of the fishes was calculated using the equation

$$W = aL^b$$

Where W = the observed total weights of the fishes, L = the observed standard lengths, a and b are constants, b is the slope usually between 2 and 4 and a is the intercept on the length axis (Bagenal, 1978). The logarithmic transformation of the equation above gives a straight line relationship.

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

When $\text{Log}_{10}W$ is plotted against $\text{Log}_{10}L$, the regression coefficient is b, and Log a is the intercept on the Y axis.

### Condition Factor (K)

The condition factor (K) was computed from the equation:

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

Where K is the condition factor, W is the

total weight of the fish and L, is the standard length of each specimens.

## Sex determination:

The specimens were dissected using a pair of dissecting scissors. This was done from the anal opening to the part of the body below the operculum to expose the gonads for sex identification using a key prepared by Nikolsky (1963). In the young males, testes were thin, thread-like with very small projections, whitish in colour and extend to about 1/3 of the abdominal cavity. In adult males, the testes were creamy in colour with very conspicuous granules. The young females had thin, pink to white tubular structures occupying about 1/5 of the abdominal cavity. In adult females, that were about to spawn eggs were readily discernable in the ovaries which increased in size and filled most of the abdominal cavity (Bagenal, 1978; Halim and Guma'a, 1989).

## Stomach Analysis:

The stomachs of the dissected fishes were removed and immediately preserved in 4% formalin in sterile bottles for subsequent food items examination and analysis. The stomachs were scored 0, ¼, ½, ¾, or full according to their fullness as described by Olatunde (1978). Each stomach sample was then opened and the content emptied in a petri dish. Some food items such as grains and insect parts were identified with the naked eye, while others were identified with the aid of a microscope. Slide preparation were made and examined under the light microscope using the X10 and X40 objectives. The stomach contents were analysed using:

**i.** Frequency of Occurrence method.

$$\% \text{ of Food Sample} = \frac{\text{No. of stomachs with a food sample}}{\text{Total No. of stomachs with food}} \times 100$$

**ii**. Point Method.

$$\% \text{ Points} = \frac{\text{Points allotted to a food sample}}{\text{Total Points allotted}} \times 100$$

**Results**

Table 1 below shows the Morphometric Parameters of *S.clarias* in the Lower River Benue at Makurdi while Figures 1-3 show the log-transformed Length–Weight relationship of *S. clarias* females, males and combined sexes respectively. All the three relationships were positively correlated at 0.05% level ($p<0.05\%$) with the r values of 0.8415, 0.9463 and 0.8703 for the females, males and combined sexes respectively.

**Table 1:** Morphometric Parameters of S.clarias in the Lower River Benue at Makurdi.

| Parameter | Sex | | |
|---|---|---|---|
| | **Female** | **Male** | **Combined Sex** |
| Number | 74 | 89 | 163 |
| Length Range (cm) | 8.20 – 17.50 | 7.60 – 20.00 | 7.60 – 20.00 |
| Mean Length (cm) ±SE | 12.95± 0.344 | 12.53±0. 0.374 | 12.72±0.258 |
| Weight Range (g) | 15.17 – 607.30 | 13.12 – 198.43 | 13.12 – 607.30 |
| Mean Weight (g) ±SE | 77.35±0.458 | 56.26± 0.500 | 65.83± 0.897 |
| **a** | -0.3573 | -0.3505 | -0.6029 |
| **b** | 1.9408 | 1.8799 | 2.1359 |
| **r** | 0.8415 | 0.9463 | 0.8703 |
| **K** | 3.3667 | 2.6868 | 2.9954 |

*a = intercept on x -axis, b = slope, r = Coefficient of Regression, K = Condition Factor.*

The mean condition for the females, males and combined sex were 3.3667, 2.6868 and 2.9954 respectively for the period of study showing that the fishes were in good condition throughout the period (table I). The regression coefficient the **b** values were 1.9408, 1.8799 and 2.1359 for the females, males and combined sexes respectively indicating negative allometric growth pattern.

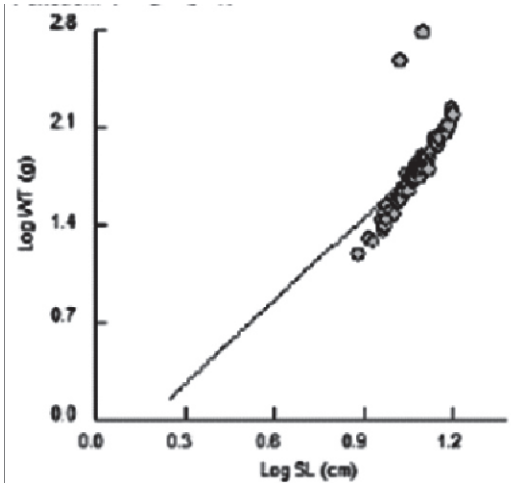


**Fig 1: LWR of *S. clarias*-Female**

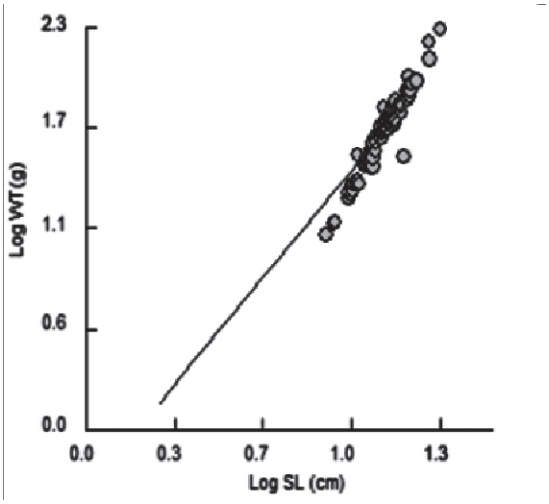


**Fig 1: LWR of *S. clarias*-Male**

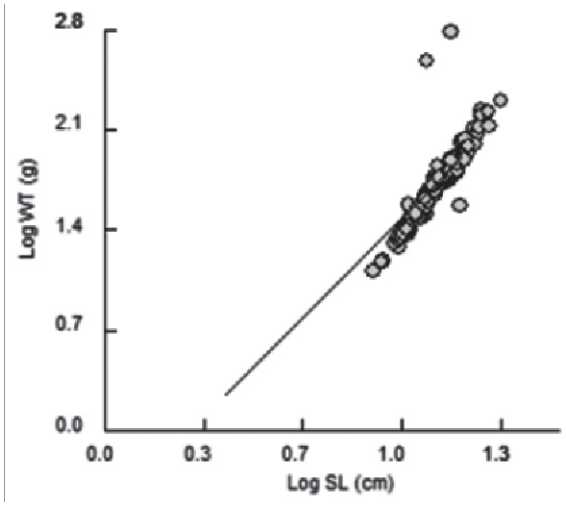


**Figure 3: LWR of *S. clarias*-Combined Sexes**

Table 2 shows the stomach content analyses of *S.clarias* by frequency of occurrence and point methods, while table 3 shows the stomach fullness of the fishes. The analysis of the stomach fullness revealed that 53.99% of the stomachs were empty while 46.01% had varied quantities of food. Stomachs with 50% fullness were 14.72% and much more than those with 100% fullness which were only 3.07%.

The results of the stomach contents of *S.clarias* as shown in Table 2 revealed that it feeds on various food items such as plant materials, artificial corn meals, Algae of various types, insects, molluscs, crustaceans, fish parts, protozoa, worms, detritus, mud and sand.

**Table 2:** Stomach Contents of S.clarias in the Lower Benue River at Makurdi using Frequency of Occurrence and Point Method

| Food item | Frequency of Occurrence | Point Method |
|---|---|---|
| PLANT | | |
| Plant Remains | 48.72 | 10.25 |
| seed/grains | 46.67 | 6.86 |
| Corn meal (artificial) | 77.44 | 13.58 |
| ALGAE | | |
| Filamentous | 46.15 | 3.36 |
| Colonial | 32.21 | 11.98 |
| Diatoms | 47.65 | 12.34 |
| INSECTS | | |
| Insect parts | 37.34 | 3.76 |
| Chironomid larvae | 28.97 | 1.36 |
| Coleoptera larvae | 26.15 | 1.52 |
| MOLLUSCS | | |
| Bivalves | 31.29 | 1.74 |
| Gastropods | 23.56 | 1.45 |
| CRUSTACEANS | | |
| Crayfish | 27.95 | 1.50 |
| Prawns | 18.46 | 0.98 |
| Copepods | 30.77 | 1.64 |
| Water mites | 27.12 | 1.26 |
| FISH | | |
| Fish parts | 23.15 | 1.87 |
| Scales | 38.72 | 2.23 |
| PROTOZOA | | |
| Paramecia | 18.76 | 2.46 |
| Amoebae | 23.12 | 1.12 |
| WORMS | | |
| Roundworms | 23.08 | 0.83 |
| Detritus/Mud | 67.44 | 5.80 |
| Sand | 44.62 | 3.77 |
| Unidentified food items | 77.44 | 7.97 |

**Table 3:** Stomach Fullness of S.clarias in the Lower Benue River at Makurdi.

| Stomach | Number | % |
|---|---|---|
| 0 (ES) | 88 | 53.99 |
| ¼ | 37 | 22.70 |
| ½ | 24 | 14.72 |
| ¾ | 09 | 5.52 |
| Full | 05 | 3.07 |
| **Total** | **163** | **100** |

## Discussion

The high positive correlation in the length-weight relationship of *S.clarias* in the Lower River Benue at Makurdi agrees with many researchers of length-weight relationships such as Ayuba (1997) on *Synodontis* species in River Benue at Yola; Abubakar and Ishaya (2000) on *O.niloticus* in Geriyo lake, Yola; Abubakar and Edward (2002) on the catfish *Synodontis* in upper Benue River basin Yola; Abowei and Hart (2009) on ten finfish species from the lower Num River, Delta State and Akombo *et al*., (2011) on four species of *Synodontis* from the Lower Benue River at Makurdi in which *S.clarias* was included.

The **b** values observed in this study (Table 1) were significantly below 3 which mean that the *S.clarias* in River Benue at Makurdi exhibited negative allometric growth pattern. In other words, the fishes became thinner as they grew longer. These observations are in agreement with those of Midhat *et al.,* (2012) who observed the **b**

values of 2.2749, 2.2915 and 2.2863 for *S. schall* females, males and combined sexes in River Nile at Gizza. Other observations of negative allometric growth have been made by Lalèyè *et al.,* (2006) for *S. schall* and *S. nigrita* in Ouémé River, Benin; Hassan (2007) for *S. schall* in River Nile at Assiut; Akombo *et al.,* (2011) on four species of *Synodontis* in River Benue at Makurdi. Egbal *et al.,* (2011) reported that most of the fish species (61.1%) investigated in Atbara River and Kashin El-Girba reservoir in Sudan indicated negative allometric growth. Adeyemi (2010) also reported negative allometric growth in *S. robbianus* in River Niger at Idah, Kogi State.

The condition factor reflects the well being of the fish (Abowei, 2010). It gives information when comparing two populations living in certain feeding, density, climate and other conditions when determining the period of gonad maturation, and when following up the degree of feeding activity of species to verify if it is making good use of its source (Ighwela *et al.*, 2011). It is strongly influenced by both biotic and abiotic environmental conditions and can be used as an index to access the status of the aquatic ecosystem. Condition factor can also be affected by factors like sex, season, age and maturity stages of fish (Edah *et al.*, 2010). It usually decreases as the fish increases in size.

The values of the condition factor in this study were 3.3667, 2.6868 and 2.9954 for the females, males and combined sexes respectively. These values were within the range of 2-4 recommended by Bagenal and Tesch (1978) as suitable for fresh water fishes. This means that *S.clarias* in River Benue is in good condition. The females in this case were in a much better condition (3.3667) than the males (2.6868). The mean condition factor obtained in this study varied slightly with the results from other studies. Adeyemi (2010) reported a range of 2.34 – 4.90 for males and 2.56 – 4.03 for females in *S. resupinatus* at Idah area of River Niger. Baijot *et al* (1997) documented 2.65 – 3.32 while Offem *et al.,* (2013) reported the mean range values of 0.32

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