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Zira Joshua Dali

Dept. of Fisheries, Adamawa
State Ministry of Environment,
P.M.B 2170, Yola-Nigeria.

Abubakar Kotos Abdulrahman

Dept. of Zoology, Modibbo
Adama University of
Technology, P.M.B 2076,
Yola-Nigeria.

Ja'afaru Ali

Dept. of Zoology, Modibbo
Adama University of
Technology, P.M.B 2076,
Yola-Nigeria.

Elisha Daniel Shingu

Dept. of Bio. Sciences, Adamawa
State College of Education Hong,
P.M.B 2237 Yola, Nigeria.

Length-weight relationship and condition factor of *Clarias gariepinus* (Burchell, 1822) from Kiri reservoir, Adamawa state, Nigeria

**Zira Joshua Dali, Abubakar Kotos Abdulrahman, Ja'afaru Ali, Elisha
Daniel Shingu**

Abstract

The present study describes the length-weight relationship and condition factor of *Clarias gariepinus*, in Kiri reservoir. A total of 90 specimens were caught by local fishermen using fishing gears such as gill net and drag net from July-December, 2014. Mean monthly standard length of 22.63 ± 2.91 cm, 22.20 ± 1.82 cm, 21.57 ± 2.47 , 23.43 ± 2.18 , 21.57 ± 2.25 cm and 22.13 ± 1.44 cm, and Mean monthly weight of 116.68 ± 53.03 g, 105.56 ± 20.76 g, 78.69 ± 19.85 , 124.24 ± 28.25 , 106.64 ± 43.17 and 112.51 ± 16.47 were observed from July-December respectively. The 'b' values obtained for the *C. gariepinus* was 3.80 and differed significantly ($p < 0.05$) from 3, which indicates that fish species has allometric growth. *C. gariepinus* recorded a monthly condition factor range between 0.65 and 1.21 with a mean value of 0.78 ± 0.09 and 1.04 ± 0.12 . Examination of the condition factors revealed that most of the *C. gariepinus* investigated were not in a good condition.

Keywords: Allometric growth, *Clarias gariepinus*, Condition factor, Kiri, Length-weight.

1. Introduction

Fish play an important role in the economy of a nation and is a nutritious aquatic animal. It constitutes reasonable percentage of the dietary requirement of human consumption when processed [1]. The principal nutritional constituents of fish include water, protein, lipid, mineral and vitamin B2. The importance of fish cannot be over emphasized; due to the fact that is a cheap source of animal protein for man, raw materials for our growing factories and job opportunity for the teeming population [2]. Apart from being a cheap source of highly nutritive protein, it also contains other essential nutrients required by the body [3]. The African catfish (*C. gariepinus*) has also gained widespread recognition as a promising species in aquaculture production [4, 5].

The length-weight relationship is very important for proper exploitation and management of the population of fish species [6]. To obtain the relationship between total length and other body weight, it is very much essential for stabilizing the taxonomic characters of the species [7]. 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 [8]. Length-weight relationships allow fisheries scientists to convert growth-in-length equations to growth-in-weight in stock assessment models [9, 10], estimate biomass from length frequency distributions [11, 12], compare life history and morphological aspects of populations inhabiting different regions [10] and calculate fish condition [11]. Many scientists have studied aspects of the biology of *C. gariepinus*, like food and feeding habits. The length-weight relationships and condition factor in different water bodies were investigated and reported by [13-19] and similar studies were also carried out by [20-23].

This research aims at determining the length-weight relationship and condition factor of *C. gariepinus* in Kiri Reservoir. The results will provide base line information for the management of this resource as no work was earlier been documented.

2. Materials and Methods

2.1 Study Area

Kiri Reservoir has a coordinates of $9^{\circ}40'47''N$ $12^{\circ}00'51''E$ on the southern part of Adamawa State, North Eastern part of Nigeria [24]. It is situated within Shelleng Local Government Area

Correspondence

Zira Joshua Dali

Dept. of Fisheries, Adamawa
State Ministry of Environment,
P.M.B 2170, Yola-Nigeria.

and about 20 km from Numan Local Government. The Dam is 1.2 km long, 20 m high zoned embankment with an internal clay blanket. The Reservoir was completed in 1982. It has a capacity of 615 million m³ and it was built to provide irrigation for the Savannah Sugar Company. A large-scale sugar cane plantation and processing company set up as a joint venture between the Nigerian Federal Government and the Commonwealth Development Corporation, London.

2.2 Duration of Sampling

The sample collection lasted for a period of six months (July-December, 2014).

2.3 Collection of fish samples

Fishing was done during late night with the help of professional local fishermen. 90 fish specimen were collected for the present research using gill and drag nets. Samples were stored in coolers containing ice and transported to the Laboratory, Department of Zoology, Modibbo Adama University of Technology, Yola for further studies.

2.4 Length-Weight Measurement

Length measurements were done with Length Measuring Board (cm), while weight was taken using an Electronic Weighing Balance (g) after removal of excess water from the body surfaces. The total length was measured from the tip of the Snout to the tip of the caudal fin while the standard length was taken from the tip of the snout to the base of the caudal fin [20].

2.5.1 Length – Weight Relationship:

The length – weight relationship was calculated using the formula describe by Le-Cren (1951)

$$W=aL^b$$

Where,

W = Weight of fish (g)

L = Length of fish (cm)

a = y-intercept or the initial growth coefficient

b = Slope or the growth coefficient.

The values of constants a and b was estimated after logarithmic transformation of $W=aL^b$ using least square linear regression to give:

$$\log W = \log a + b \log L \text{ [26]}$$

2.5.2 Determination of Condition Factor

The condition factor K was determined for each fish using the conventional formula as described by Warthington and Richardo (1931). The ratio of the length to the weight of the fish was determined as:

$$\text{Condition Factor: (K)} = \frac{W \times 100}{L^3}$$

Where

K = Condition factor

W = Weight in grams

L = Length in cm

3. Results

3.1 Monthly Mean Length Measurement for *C. gariepinus*

The Monthly mean standard length observed for *C. gariepinus* from Kiri reservoir ranged from 18.11 cm to 26.40 cm (Table 1). Mean monthly length of July varied between 19.3cm and 26.4 cm with a mean value of 22.63 ± 2.91 , in the month of August, the length varied between 19.8cm and 24.2cm with a mean value of 22.2 ± 1.82 , September recorded a length between 18.11 cm and 23.7 cm with a mean value of 21.57 ± 2.47 , during the month of October, the length varied between 20.4 cm and 25.4 cm with a mean value of 23.43 ± 2.18 , in the month of November, the length varied between 18.7cm and 24.2 cm with a mean value of 21.57 ± 2.25 , while December recorded a length between 20.6cm and 24.1 cm with a mean value of 22.13 ± 1.44 .

Table 1: Monthly Mean Length Measurement of *C. gariepinus*

Fish Species	<i>C. gariepinus</i>				
Month of the Year	No. of Fish Examined	Lower Limit	Upper Limit	Mean	S.D
July	15	19.3	26.6	22.63	2.91
August	15	19.8	24.2	22.2	1.82
September	15	18.11	23.7	21.57	2.47
October	15	20.4	25.4	23.43	2.18
November	15	18.7	24.2	21.57	2.25
December	15	20.6	24.1	22.13	1.44
Total	90±15	116.91±19.49	148.2±24.7	133.53±22.26	13.07±2.18

3.2 Monthly Mean Weight Measurement for *C. gariepinus*

The monthly mean weight of *C. gariepinus* recorded from Kiri reservoir ranged between 50.16 g and 187.67 g (Table 2). Mean monthly weight of July varied between 60.25 g and 187.67g with a mean value of 116.68 ± 53.03 , in the month of August, the weight varied between 75.21 g and 123.12 g with a mean value of 105.56 ± 20.76 , September recorded a

weight between 51.53 g and 98.41 g with a mean value of 78.69 ± 19.85 , during the month of October, the weight varied between 86.34 g and 154.14 g with a mean value of 124.24 ± 28.25 , in the month of November, the weight varied between 50.16 g and 154.96 g with a mean value of 106.64 ± 43.17 , while December recorded a weight between 96.66 g and 135.22 g with a mean value of 112.51 ± 16.47 .

Table 2: Monthly Mean Weight Measurement of *C. gariepinus*

Fish Species	<i>C. gariepinus</i>				
Month of the Year	No. of Fish Examined	Lower Limit	Upper Limit	Mean	S.D
July	15	60.25	187.67	116.68	53.03
August	15	75.21	123.12	105.56	20.76
September	15	51.53	98.41	78.69	19.85
October	15	86.34	154.14	124.24	28.25
November	15	50.16	154.96	106.64	43.17
December	15	96.66	135.22	112.51	16.47
Total	90±15	420.15±70.03	853.52±142.25	644.32±107.39	181.53±30.26

3.3 Length-Weight Relationship

The result of length-weight regression analysis of *C. gariepinus* is presented in table 3. The 'b' value for *C. gariepinus* was 3.80, which shows allometric growth. The length-weight relationship of *C. gariepinus* showed linear relationship with significant correlation coefficient of 0.122 ($P < 0.05$).

Table 3: The Length-Weight Regression Analysis of *C. gariepinus*

No. of fish examined	Log A	'b'	Correlation coefficient (r)
90	-3.12	3.80	0.122

3.4 Condition Factor (K)

The monthly mean condition factor obtained for *C. gariepinus* from Kiri Reservoir varied between 0.65 and 1.21. Table 4 present the monthly mean condition factor for *C. gariepinus*. In July the condition factor varied between 0.84 and 1.02 with mean value of 0.93 ± 0.07 , In August the condition factor varied between 0.85 and 0.97 with a mean value of 0.89 ± 0.05 , in September the condition factor varied between 0.65 and 0.87 with a mean value of 0.78 ± 0.09 , the mean condition factor observed in October varied between 0.81 and 1.02 with a mean value of 0.96 ± 0.11 , in November the condition factor varied between 0.77 and 1.11 with a mean value of 0.99 ± 0.16 , while the value for December varied between 0.95 and 1.21 with a mean value of 1.04 ± 0.12 .

Table 4: Monthly Mean and Mean Condition Factor of *C. gariepinus*

Month of the Year	No. of Fish Examined	Condition Factor range	Mean	S.D
July	15	0.84-1.02	0.93	0.07
August	15	0.85-0.97	0.89	0.05
September	15	0.65-0.87	0.78	0.09
October	15	0.81-1.05	0.96	0.10
November	15	0.77-1.11	0.99	0.16
December	15	0.95-1.21	1.04	0.12

4. Discussion

This study revealed that *C. gariepinus* of various size ranges were found in Kiri Reservoir. The monthly mean standard length of *C. gariepinus* was observed to be ranged from 18.11cm to 26.40 cm with a mean value of 133.53 ± 22.26 cm. The weight of the fish ranged from 50.16 g to 187.67 g with a mean value of 644.32 ± 107.39 g. Similar observations were made by [28] on *C. gariepinus juveniles* reared in concrete tank; they observed a length and weight ranged from 20.2-26.1 and 110.50-240.5 g respectively. This results contradicts with [20] on *C. gariepinus* from polluted river Oluwa, they observed a length ranged from 43.00-45.90 cm, 37.00-39.90 cm and 46.00-48.90 cm, and weight ranged from 342.50-2125.00 g. The result obtained for the length-weight regression analysis was 3.80, this showed that *C. gariepinus* exhibited allometric growth. The "b" values obtained during the period of the study shows that increase in length is not in equal proportion with the weight under constant specific gravity. This is in consonance with the earlier findings [22, 29]. It has been observed that certain factors such as increase in weight due to intake of water or food, season of the year, and the time of the day when the fish was captured, loss of weight due to food regurgitation and spawning can among other things affects "b" values [30]. There was significant correlation ($P < 0.05$) between length and weight which exhibiting linear relationship which is similar to observation made by [22, 23, 31]. Several studies have reported both isometric and allometric growth for different fish

species from various water bodies. Allometric growth pattern in *Oreochromis niloticus* in Lake Geriyo Adamawa State [32], [33] obtained a positive allometric growth with regression equation for the combined sexes as $\text{Log } W = -2.1612 + 3.0445 \text{ Log } L$ ($r = 0.95466$) for *Heterobranchus longifilis* reared in earthen ponds in Lagos State and [34] also reported allometric growth patterns for Tilapia species from Umuoseriche lake. Isometric growths were also reported in different water bodies in Nigeria [35-38].

Monthly mean condition Factor of *C. gariepinus* for the period of the study, July-December, 2014 respectively revealed that, *C. gariepinus* recorded monthly mean condition factor ranging from 0.65 and 1.21. This supports the work of [17] 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. This result also conforms to the value obtained by [39], with a value of 0.946 and monthly condition factor of 0.6-1.00; a value between 0.77-0.81 for *Claroetes filamentosus* in Lake Oguta were reported by [40]. But it is in contrast with [41] who observed that there was fall in condition factor of *C. gariepinus* in Zaria from October to February during the dry season. The examination of the condition factors revealed that 100% of the *C. gariepinus* species had their K values outside the range (2.9-4.8) recommended as suitable for matured fresh water fish by [42]. The factor that may be responsible for the poor physiological condition of the fish might be due to the concentration of heavy metals observed in the Kiri reservoir [43].

5. Conclusion

An important contribution of this study is the provision of base line data on the length-weight relationships and condition factors of *C. gariepinus* species in Kiri Reservoir.

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