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Length-weight Relationship and Condition Factor of Blackspot Catfish *Auchenoglanis biscutatus* from the Lower River Benue Makurdi, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author EET designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors EVO and OP performed the statistical analysis, managed the analyses and literature searches of the study. All authors read and approved the final manuscript.

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ABSTRACT

This study was carried out to evaluate the length-weight relationship and condition factor of the Blackspot Catfish *Auchenoglanis biscutatus* from the Lower River Benue Makurdi, Nigeria. A total of 200 freshly caught specimens of *A. biscutatus* were collected from the catches of the artisanal fisheries from landing points at Wadata Market in Makurdi, between July and September 2013. The result obtained showed that the "b" value for the males was 1.6698, females (1.6201) and combined sexes (1.7318) indicating a negative allometric growth. Correlation coefficient (r) for males was 0.9524, females (0.9290) and combine sexes (0.9085). Monthly mean condition factor (K), indicated that both sexes of *A. biscutatus* were in good health condition. It is therefore concluded that findings of this study will be useful in the sustainable management of this species in the lower River Benue.

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Keywords: Auchenoglanis biscutatus; length-weight relationship; condition factor and lower river Benue.

1. INTRODUCTION

In Nigeria, fish is an essential source of animal protein for fish consumers and livestock [1] and [2]. According to Raufu et al. [3], fish contain high quality proteins, fats, vitamins, calcium, iron and essential amino acids. Capture fisheries and its products provides valuable source of protein to fish consumers in developing countries especially in rural areas with inland waters [4,5]. Due to pressure on capture fisheries attributed to over-exploitation, many fish species in inland water bodies are threatened while others are endangered. Fisheries management is very important in national food security in countries with inland coastal water ways [6].

Auchenoglanis biscutatus is freshwater species across Western and North-East Africa. It is a bottom feeder which feeds mainly on insects, fishes, crustaceans, molluscs, worms, nematodes and plant materials [7].

Fig. 1. The Blackspot Catfish *Auchenoglanis biscutatus*

According to Abu and Agarin [8], length -weight relationship and condition factor are important tool in fish biology studies. Length-weight relationship allows the conversion of growth-in-length equations to growth-in-weight in which a biometric model is used in the estimation of biomass from length and weight [8] and [9]. Condition factor is useful in assessing the general well-being and health of fish [10,8] and [11]. In fisheries science, condition factor is also used in assessing the life cycle of fish species [12] and relationship between the biotic and abiotic factors in aquatic ecosystem [13]. In the lower River Benue, there is limited information on some aspects of the biology of the Blackspot catfish *Auchenoglanis biscutatus*. Therefore, the objective of this study is to determine the length-weight relationship and condition factor of the Blackspot Catfish *Auchenoglanis biscutatus* from the lower River Benue which will useful in the sustainable management of this species in the River.

2. MATERIALS AND METHODS

2.1 Study Area

This study was carried out in Makurdi, the capital of Benue State, Nigeria. Benue State is bounded by Taraba State to the East, Nassarawa State to the North, Kogi State to the West, Enugu State to the Southeast and Cross River State to the South. This area lies between latitude and longitude 7.7322°N and 8.5391°E. River Benue which is second largest river in Nigeria has great influence on the commercial activities of the inhabitants of the river area. Inhabitants of the river area depend on fishing, farming, trading as a means of livelihood.

2.2 Collection and Identification of the Blackspot Catfish (*A. biscutatus*) from the Lower River Benue

A total of 200 freshly caught *A. biscutatus* were collected from fish landings of artisanal fisheries at Wadata market in Makurdi, Benue state between July and September, 2013. Fish samples were transported in ice-packed containers to Fisheries and Aquaculture Laboratory, University of Agriculture, Makurdi, for identification and biometric measurement. Identification of *A. biscutatus* was done using identification key given by Fischer et al. [14] and Schneider [15].

2.3 Measurements of Biometric Indices

Biometric parameters measured for each specimen were Total length (TL-cm) and Total weight (TW-g). Total length (TL-cm) was measured using from the tip of the mouth to the end of the caudal fin to nearest 0.1 cm using measuring board. Total weight (TW-g) was measured to the nearest 0.1 g using Metlar-2000D electronic weighing balance. The sex of each specimen was also determined to separate males from females.

2.4 Condition Factor (K)

Fulton's condition factor (K) of *A. biscutatus* was calculated using Pauly [16] equation,

$K = W/L^3 \times 100$, where W is the total weight (TW-g), L is the Total length (TL-cm) and 3 is a constant.

2.5 Length-weight Relationship

Length weight relationship of *A. biscutatus* was estimated using Pauly [16] equation as follows:

$$W = aL^b$$

Where W = Weight (g), L = Length of specimen 'a' the intercept and 'b' the growth exponent. A logarithm transformation as follows was used to obtain a linear relationship.

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

2.6 Statistical Analysis

Values of regression coefficient 'b' intercept 'a' and coefficient of correlation 'r' in Length-Weight relationship (LWR) of *A. biscutatus* from the Lower River Benue were determined by linear and power regressions.

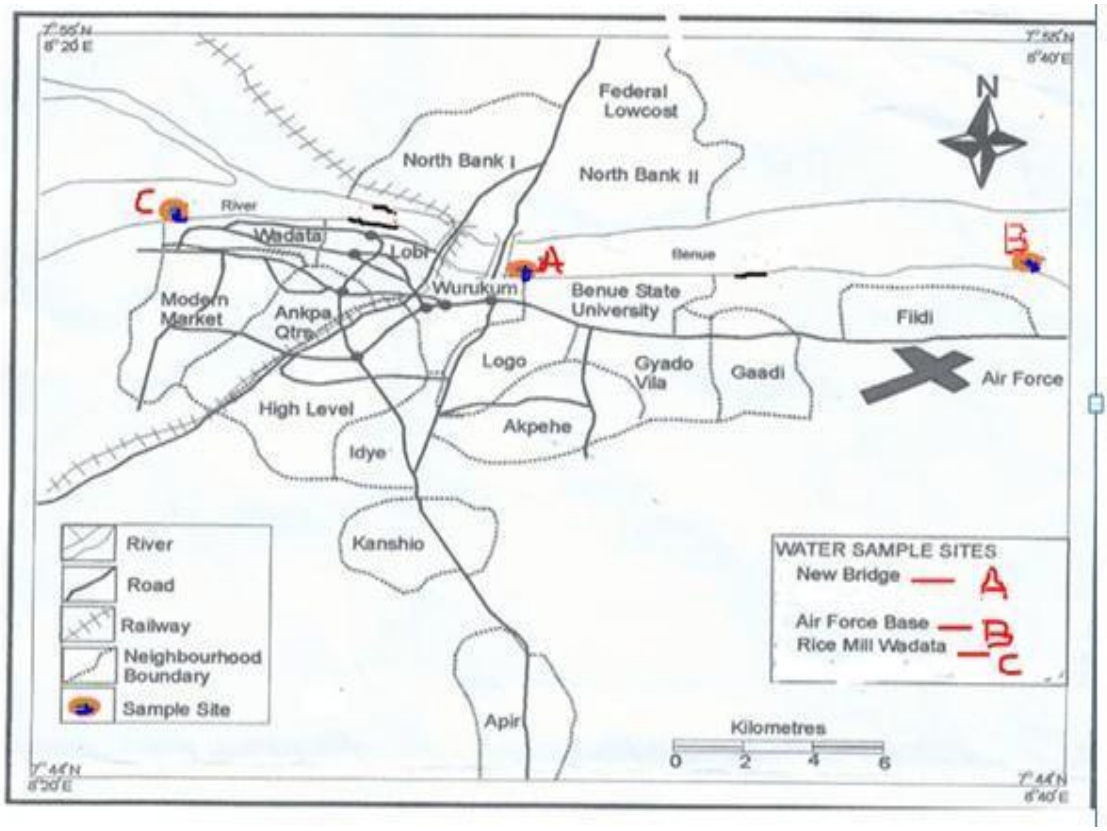

Fig. 2. Map showing the study area (River Benue) where samples were collected

Table 1. The monthly mean condition factor of the Blackspot Catfish (*A. biscutatus*) from the Lower River Benue

Sex	July	August	September
Male	2.00±0.05[a]	1.89±9.09[a]	1.97±0.05[a]
No. of Samples			
Female	1.98±0.06[a]	2.01±0.13[a]	1.92±0.09[a]
No. of Samples			
Pooled Sex	2.99±0.14[a]	1.95±0.21[a]	1.95±012[a]
No. of Samples	65	70	65

The condition factor was subjected to T-test to determine difference between the sexes for the species studied

3. RESULTS

3.1 Fulton's Conditon Factor (K) of Blackspot Catfish (*A. biscutatus*) from the Lower River Benue

Fulton's condition factor (K) determined for 200 specimens of *A. biscutatus* (Table 1) shows that the condition factor of male, female, and pool sex of *A. biscutatus* in July was 2.00±0.05, 1.98±0.06 and 2.99±0.14; August was 1.89±9.09, 2.01±0.13 and 1.95±0.21 while September was 1.97±0.05, 1.92±0.09 and 1.95±012 respectively.

3.2 Length-weight Relationship of the Blackspot Catfish *(A. biscutatus)* from the Lower River Benue

The length-weight relationship and correlation coefficient (r) for the two sexes separately and combined relationship for both sexes were logarithmic transformation as depicted in Figs. 3-5. The value of 'b' for the male was 1.6698 while that of the female was 1.6201, for combined sexes the value was 1.7318. The correlation coefficient (r) were 0.9524, 0.9290 and 0.9085 for male, female and combined sexes respectively.

4. DISCUSSION

In fisheries management, parameters such as length-weight relationship and condition factor are commonly used to predict the potential yield and determination of size at capture for obtaining optimum yield [17] and [18]. In length-weight studies, the regression coefficient (b-value) shows that the growth pattern in fish which varies between stocks of the same species are either isometric or allometric [19] and [20]. When "b"

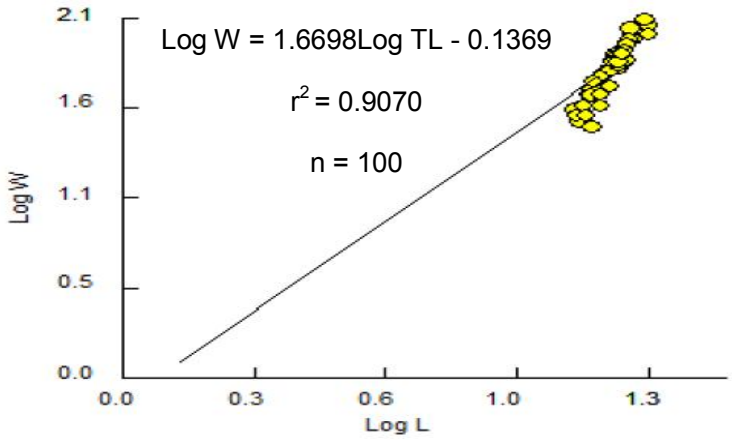

Fig. 3. Length-weight relationship of male *A. biscutatus* from the Lower River Benue, Nigeria

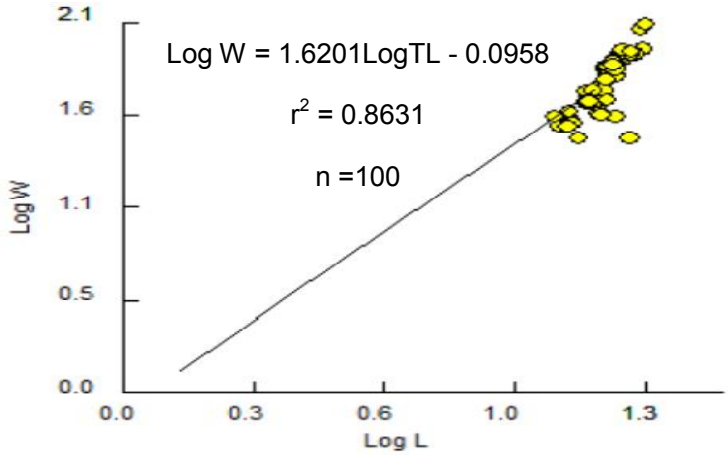

Fig. 4. Length-weight relationship of female *A. biscutatus* from the Lower River Benue, Nigeria

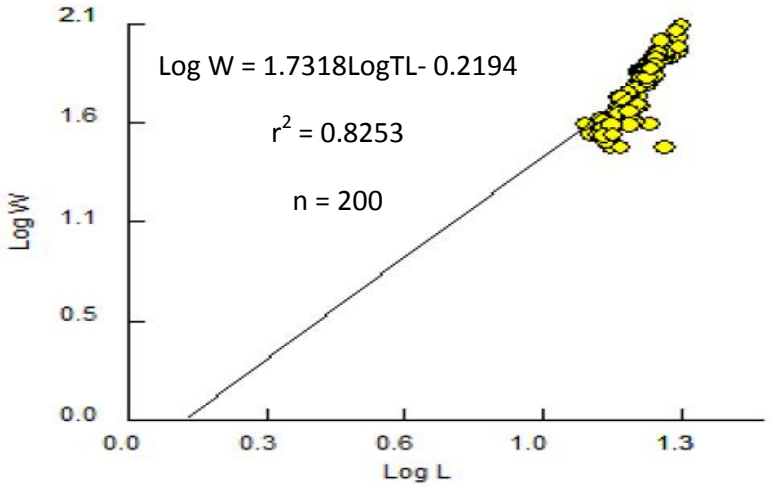

Fig. 5. Length-weight relationship of the pooled sex of *A. biscutatus* from the Lower River Benue, Nigeria

value is less than 3, it indicates a negative allometric growth in fish, when greater than 3, it indicates a positive allometric growth and when "b" value is equal to 3, it indicates an isometric growth pattern in fish [21]. In the present study, b-values obtained indicates that male, female and pooled sex of *A. biscutatus* from the lower River Benue exhibit a negative allometric growth pattern. According to [19], fish exhibiting a negative allometric growth pattern tends to become thinner as they increase in length. Asuquo et al. [19] explained that when fish species exhibit a negative allometric growth pattern, some conventional fish population dynamic models which assumes isometry in fish growth (b = 3) cannot be useful in analyzing the population of such species. This finding is similar to results obtained by Okpasuo et al. [22] who reported a negative allometric growth pattern (b=2.181) for *A. biscutatus* from Anambra River Basin, Nigeria. Also, similar finding was reported by Ogamba et al. [23] for *A. occidentalis* (b = 2.88) from Odi River, Niger Delta, Nigeria. According to Asuquo et al. [19], when fish species exhibit a negative allometric growth pattern, some conventional fish population dynamic models which assumes isometry in fish growth (b = 3) cannot be useful in analyzing the population of such species. Findings of this study disagrees with that of Ibrahim [24] who obtained a positive allometric growth pattern (3.292) for *A. occidentalis* in Kontagora Reservoir, Niger state, Nigeria. Condition factor is an important index used in fisheries science to ascertain the relative well-being and health status of fish species. Condition factor which also indicates the health state of water bodies is influenced by several factors such as sex, age, food availability and environmental conditions. Low condition factor in fish may be attributed to poor environmental conditions and reduced availability of food and prey items [25] and [26]. Results of this study showed that both male and female *A. biscutatus* were in a better condition which could be as a result of better opportunity to availability of food. The mean condition factor of 20.00±0.05 obtained in this study for male in July agrees with the finding of Ezenwa et al. [27] from Badagry Lagoon, Warri River and Imo River populations respectively.

5. CONCLUSION

Findings of this study showed that *A. biscutatus* in the lower Benue River, Makurdi which exhibited a negative allometric growth were in healthy condition. It is therefore concluded that information provided in this study will be useful in the sustainable management of this species in the lower River Benue.

ETHICAL APPROVAL

As per international standard or university standard written ethical permission has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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