

LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF *Bostrychus africanus* FROM NEW CALABAR RIVER, NIGERIA

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ABSTRACT

The likely variations in the length-weight relationship and condition of *Bostrychus africanus* as it grows in the New Calabar River was studied with samples collected over a period of twenty months ($n = 3103$). The growth pattern determined by the power curve $W = aTL^b$ indicated a mean negatively allometric growth (2.65 ± 0.04), the mean intercept was 1.525 ± 0.038 and a correlation coefficient (r^2) of 0.8892. Analysis of condition by Fulton's factor gave a mean value of 1.353 ± 0.0047 . The condition factor for females was higher than that of males. The fish had its peak condition between December to January and August to September. The condition of the fish in the New Calabar River was good.

Keywords: relationship, condition, *Bostrychus africanus*, growth.

INTRODUCTION

Eleotrids form an important component of the aquatic ecosystem fauna in the regions in which they are found. Adult eleotrids prey on insects, crustaceans and fishes while eleotrid larvae like other marine plankton are food for other marine fish. Eleotrids are opportunistic and can inhabit wide variety habitats, such as freshwater, brackish water ecosystems and zones that are hypoxic or low in oxygen. Eleotrids are a delicacy for humans in many regions. The freshwater species *Dormitator maculatus* (fat sleeper) is prepared as a special dish in Thailand, Borneo, Sumatra and the Malay Peninsula. Although eleotrids are not popular aquaculture candidates, they are hardy and good aquarium objects; besides they are easy to breed in captivity (Wheeler, 1985).

Data gathered in 1994 by the World Conservation Union, indicated that 16 species of the family Eleotridae are near threatened or vulnerable. Many species have small populations that are either small in terms of mature individuals or in terms of total expanse in which they occur, rendering them vulnerable to depletion due to overfishing, pollution, predators, competitors, parasites or disease (The World Conservation Union, 2002). Considering the above therefore, a baseline study on *Bostrychus africanus* as a potential candidate of aquaculture and a fish that could join the ornamental fish industry as a candidate with prospects is not out of place. Length/weight relationship is an invaluable factor not just in growth studies but also for estimation of condition factor which is a key indicator for wellbeing of the fish stock (Okomoda *et al*, 2018). This emphasizes the influence the environment and intrinsic factors such as gonadal development have in determining the growth of

fish stocks which could either be isomeric or allometric (Fafioye and Ayodele, 2018). The relationship between length and weight of any given fish stock becomes more useful with the possibility of conversion, making it possible to obtain length from weight or weight from length when the relationship for a given stock is established (Nazek *et al*, 2018). The objectives of this research therefore were to determine the length-weight relationship and condition factor of male and female *B. africanus* from the New Calabar River, Rivers State, Nigeria.

MATERIALS AND METHODS

Fish specimens of *B. africanus* were collected from the New Calabar River which lies at 4.4167° N, and 7.0333° E (Figure 1). *Bostrychus africanus* specimens (Plate 1) were collected from four stations: Iwofe (Station 1) this station was characterized by fishing activities, trading in petroleum products and transportation. Eagle Cement (Station 2) A cement factory was sited at this station, fishing activities was present, construction of a petroleum tank farm. It also had a sewage dump site nearby. Elechi Creek (Station 3), the creek was surrounded by homes, as such characterized by domestic effluents. Fishing activities was also prominent. Diobu Creek (Station 4) characterized by fishing activities and domestic effluents due to the proximity of homes to it. The water there was also used to transport logs. It is also exposed to other wood processing activities like sawing with the water serving as dump site for the waste from these activities. These stations were about one kilometer apart. Specimens were collected bi-weekly for each month from January 2015 to August 2016. The fish were caught using

locally made non-return valve traps (Plate 2). Samples from the traps for each station were pooled together and preserved in 10% formaldehyde solution. Measurements were carried out for total length using a measuring board to the nearest 0.01cm. Weights of samples were measured by a top loading weighing balance to the nearest 0.01g (Ezenwaji and Offiah 2003).

Length-Weight Relationship

The length-weight relationship (LWR) was determined using the power curve $W = aTL^b$ (Ezenwaji and Offiah, 2003). Where W = Weight of specimen, a = Intercept of the regression, TL = Total length of specimen, b = Slope of the regression. The interaction between the variables length (TL) and weight (W) was tested for significance to give the correlation

coefficient (r) the mean b values was tested for departure from isometry (b = 3) using t- test.

Condition Factor

The condition factor (K) was calculated as $K = W/TL^3 \times 100$

Where W = Weight and TL = Total Length
K was calculated for the months, years, sexes and seasons. K was determined for three length categories (small, medium and big) as well as gravid females (Ezenwaji and Offiah 2003, Inyang and Ezenwaji 2004). Monthly condition factor was tested for variations by one-way ANOVA and where there is significance; Duncan Multiple Range Test (DMRT) was used to separate the means.

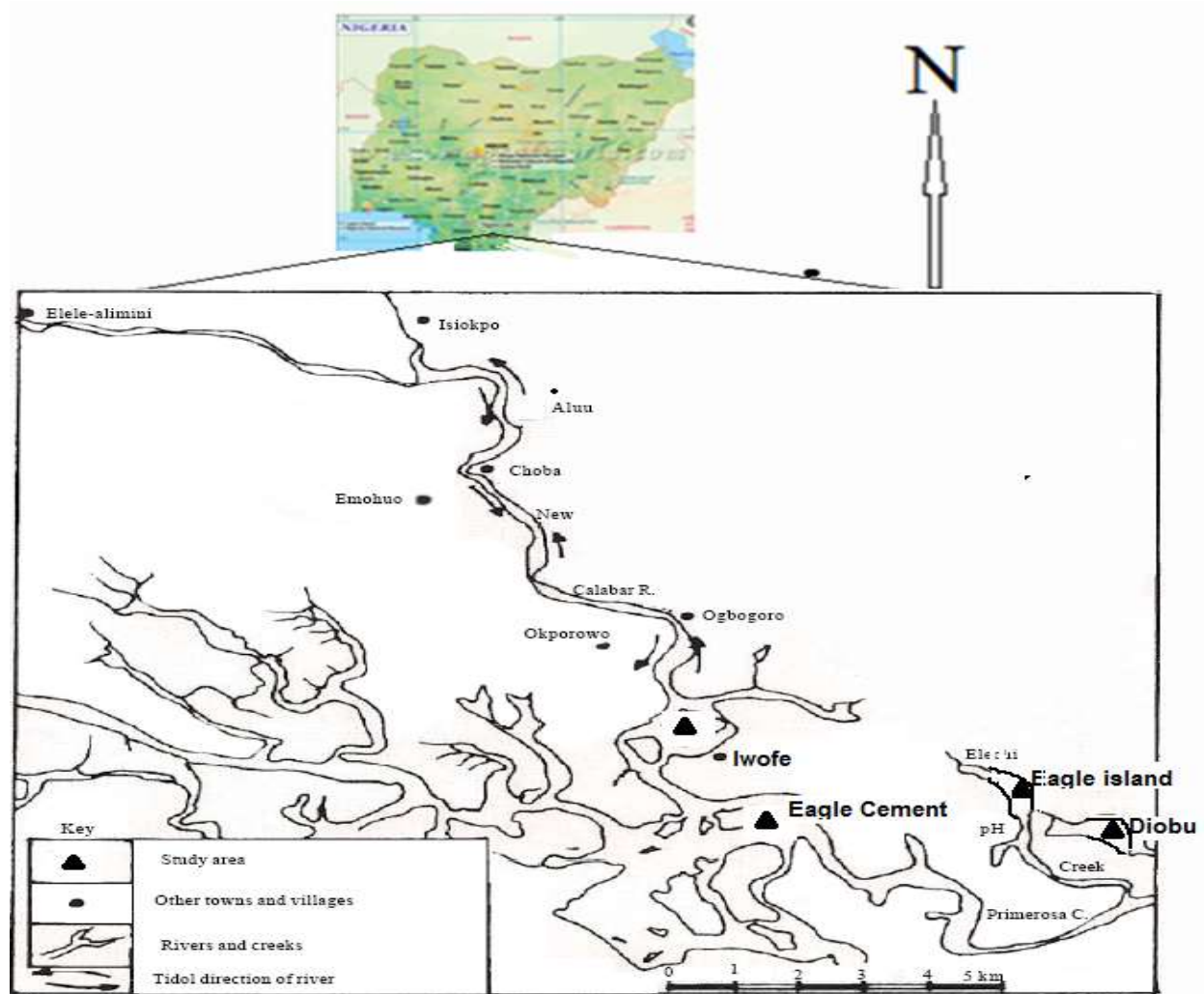


Figure 1: Map of New Calabar River Showing Sampling Stations



Plate 1: *Bostrychus africanus*.



Plate 2: Locally made non-return Valve Trap.

RESULTS

The details of growth of *B africanus* (n = 3103) are provided in Table 1. A length range of 5.4- 17.1cm and weight range of 2.20-75.50g was recorded. The mean regression coefficient (b) was 2.64 ± 0.046 , for the stations in 2015 and 2.66 ± 0.033 in 2016. The range of the regression coefficient was $2.52 \pm 0.05 - 2.73 \pm 0.04$, showing an all negative allometric growth pattern for the two years the study lasted. The mean intercept for the entire study was 1.525 ± 0.038 , and the mean correlation coefficient (r^2) was 0.8892 indicating a strong correlation between the length and weight variables.

The mean combined condition factor was 1.353 ± 0.0047 , for male was 1.365 ± 0.0053 , and 1.394 ± 0.0097 for female in 2015, and 1.352 ± 0.0040 was the combined value for 2016, while that of male was 1.343 ± 0.0105 and 1.398 ± 0.0096 for female. Details of the condition factor by stations are provided in Table 2. The general trends seen for the condition factor for the species indicates a major high between December to January, and a minor high from August to September. A major low was recorded from May to June and a minor one between October to November (Figs 2 - 5).

Table 1: Parameters of length-weight relationship of *Bostrychus africanus* in the New Calabar River in 2015 and 2016 respectively

2015					
Parameter	Station 1	Station 2	Station 3	Station 4	Mean ± SE
B	2.61 ± 0.049	2.52 ± 0.050	2.69 ± 0.043	2.73 ± 0.040	2.64 ± 0.046
A	-1.49 ± 0.047	-1.40 ± 0.048	-1.57 ± 0.042	-1.60 ± 0.041	-1.52 ± 0.045
r²	0.8619	0.8535	0.8956	0.9016	0.8782
2016					
B	2.69 ± 0.048	2.57 ± 0.043	2.67 ± 0.038	2.72 ± 0.046	2.66 ± 0.033
A	-1.51 ± 0.042	-1.46 ± 0.044	-1.61 ± 0.041	-1.53 ± 0.040	-1.53 ± 0.031
r²	0.8727	0.9318	0.8941	0.9016	0.9001

Where a = regression intercept, b = regression co-efficient, r^2 = correlation co-efficient, SE=standard error of mean

Table 2: Condition factor and standard error of *Bostrychus africanus* for stations in the New Calabar River in 2015 and 2016 respectively (2015)

	Station 1	Station 2	Station 3	Station 4	Mean
Combined	1.346 ± 0.046	1.366 ± 0.014	1.354 ± 0.029	1.346 ± 0.032	1.353 ± 0.0047
Male	1.365 ± 0.038	1.365 ± 0.028	1.378 ± 0.042	1.352 ± 0.040	1.365 ± 0.0053
Female	1.386 ± 0.031	1.370 ± 0.034	1.414 ± 0.036	1.404 ± 0.019	1.394 ± 0.0097
(2016)					
Combined	1.358 ± 0.034	1.359 ± 0.046	1.349 ± 0.037	1.342 ± 0.030	1.352 ± 0.0040
Male	1.358 ± 0.029	1.346 ± 0.031	1.312 ± 0.041	1.354 ± 0.025	1.343 ± 0.0105
Female	1.395 ± 0.044	1.372 ± 0.049	1.414 ± 0.047	1.411 ± 0.046	1.398 ± 0.0096

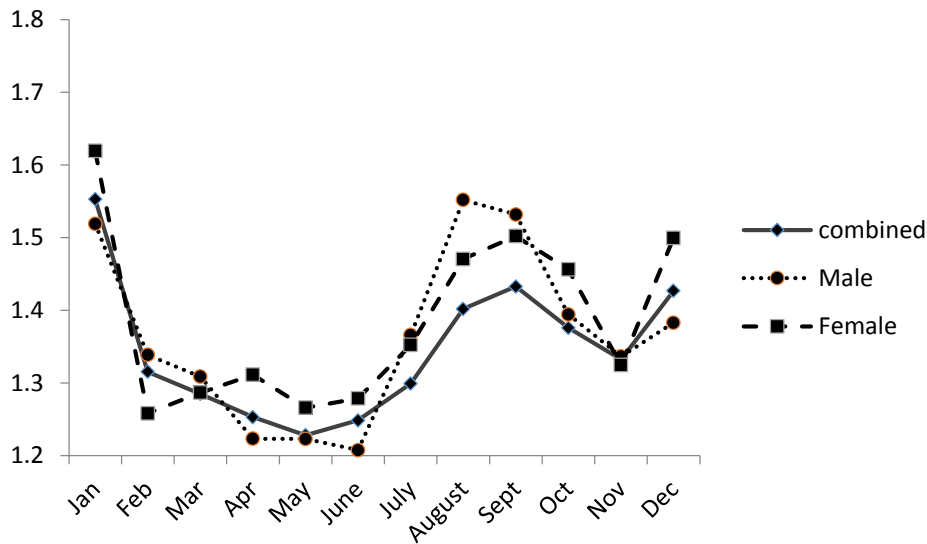


Fig. 2: Condition factor of *B africanus* from New Calabar River (Station 1)

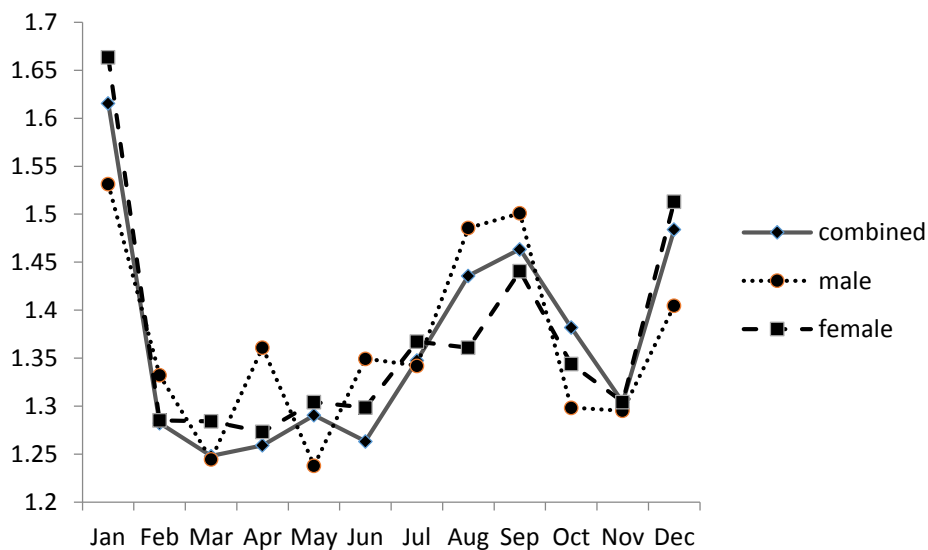


Fig. 3: Condition factor *B africanus* (station 2)

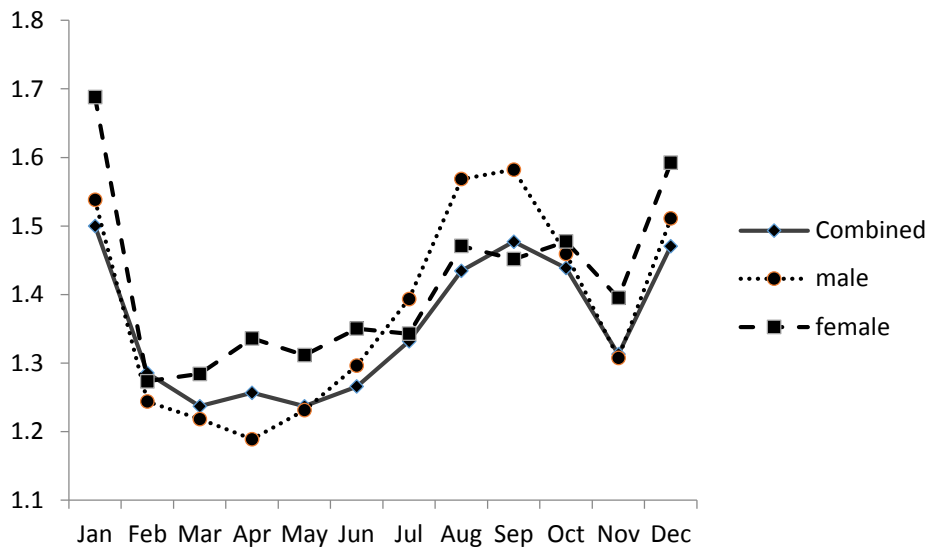


Fig. 4: Condition factor *B. africanus* (station 3)

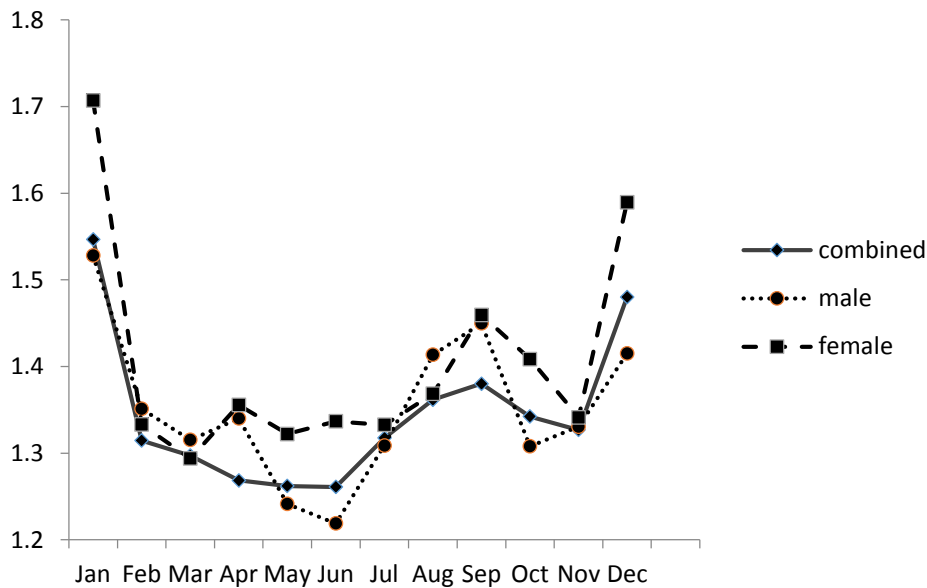


Fig. 5: Condition factor *B. africanus* (station 4)

DISCUSSION

The growth of *B. africanus* was negatively allometric, the implication of this being that this species get slimmer as it grows (Froese and Pauly, 2011). Isomerism and allometric growth in fishes are influenced by both intrinsic and extrinsic factors in fishes, this is evident in the result obtained by Fafioye and Ayodele (2018) in Oyan lake where studies on four fish species showed that *Coptodon zilli* was negative allometric (2.545), *Orochromis niloticus* (2.793) while *Brycinus nurse* (2.908) was

approximately isometric and *Chrisichthys nigrodigitatus* (3.411) was positively allometric. The exact relationship between length and weight varies among species of fish according to their inherited body shape, and within a species according to the condition (fatness) of individual fishes (Pereira and Ferreira, 2013).

Changes in the use of habitat are important some species of fishes and are usually associated with a combination of morphological and behavioral changes including variations in diet, social behavior

and spatial use of the water column (Pereira and Ferreira, 2012). Allometry and changes in body shape usually lead to changes in individual habitat use (Barros *et al.*, 2011). Studies by Loy *et al.*, (2001) showed that morphometric changes in early stages of sea bream (Sparidae) are essential for different species settlement. Furthermore, these habitat changes require some other developments and changes in external morphology of the species such as paired and unpaired fins modifications which contributes to the successful changes in habitat selection (Diana, 1995).

Condition factor which shows the degree of well-being of the fish in their environment is expressed by 'coefficient of condition' which is also known as length – weight factor. This factor is a measure of various ecological and biological indicators such as degree of fitness, gonad development and the suitability of the environment with regards to the feeding condition (Lizama and Ambrosio, 2002, Okomoda *et al.*, 2018). The condition factor for *B africanus* was above 1 which indicated that they were in good state. When condition factor value is higher than 1 it means that the fish has attained a better condition. Condition factor of fish can be affected by many factors including stress, sex, season, availability of feeds, and other water quality parameters (Khallaf *et al.*, 2003). The relative condition factor has an expectation of one and the deviation from one will yield information such as differences in the nutritive level and the effect of physico-chemical factors on the life cycle (Froese, 2006, Nazek *et al.*, 2018). The observed changes on the condition of the fishes at various times of the year were likely associated with the changes in their environment and physiological state as it concerns food availability, and spawning (Lizama and Ambrosio, 2002). The better condition observed at the peaks of dry and wet seasons (December to January and August to September) could be connected to changes in physiology associated with breeding activities and food availability at these periods (Lizama and Ambrosio, 2002). Fafioye and Ayodele (2018) reported a condition factor greater than 1 for *Coptodon zilli*, *Oreochromis niloticus*, and *Brycinus nurse*, but 0.74 was reported for *Chrysichthys nigrodigitatus*.

CONCLUSION

Bostrychus africanus shows resilience in the environment it inhabits and therefore expresses relatively good condition all year round.

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