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Length-weight Relationship, Condition Factor and Sex Ratio of African Mud Catfish (*Clarias gariepinus*) Reared in Flow-through System Tanks

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ABSTRACT

This study presents the findings of the study on the length-weight relationship, condition factor and sex ratio of African mud catfish (*Clarias gariepinus*) reared in flow-through system tanks. During the study 154 fish samples including 76 females and 78 males ranging from 12.0-35.3 cm total body length and weighing between 12.2-450 g were studied. The parameters "a" and "b" of the length-weight relationship were estimated using the equation $W = aL^b$ while the condition factor was also calculated from the equation, $K = 100\ W/L^b$. The regression coefficient "b" values for the length-weight relationship were 3.358, 3.391 and 3.372 for males, females and combined sexes, respectively. The result showed positive allometric growth exhibited by the species. The mean "K" value for the males was 0.8087±0.23, females 0.7884±0.09 while the combined sex was 0.7987±0.18 and there was no significant difference among the sexes. The sex ratio of males to females was 1: 1.02 and a chi-square test indicated no significant different ($p>0.05$) from 1:1 sex ratio.

Key words: Condition factor, sex ratio, *Clarias gariepinus*

INTRODUCTION

Fish plays a vital role in feeding the world's population and contributing significantly to the dietary protein intake of hundreds of millions of the populace. Length-Weight Relationship (LWR) is of great importance in fishery assessments (Haimovici and Velasco, 2000). Fish length-weight relationships, are useful for converting length observations into weight estimates to provide some measure of biomass (Froese, 1998). Length-weight regressions have been used frequently to estimate weight from length because direct weight measurements can be time-consuming in the field (Sinovcic *et al*., 2004). Knowledge of length-weight relationship and population dynamics of the fish are vital in fishery science (Lizama and Ambrosio, 2001; Ahmed *et al*., 2003).

In fish, condition factor (K) reflects through its variations and provides information on the physiological state of the fish in relation to its welfare and based on the hypothesis that heavier fish of a given length are in better condition (Bagenal and Tesch, 1978). Some condition factors reported for fish species include; *Clarotes lateceps* from the fresh water reaches of the lower Nun river (Abowei and Davies, 2009). *Liza falcipinnis* from Badagry creek (Lawson *et al*., 2010), *Synodontis robbianus* at Idah area of River Niger, Kogi state (Adeyemi, 2011). The condition factor is usually influenced by age of fish, sex, season, maturity stages, etc.

MATERIALS AND METHODS

Fish samples were obtained from a private farm in Lagos state operating a flow-through aquaculture system. They were reared in three months in 3.2 m^3 fiberglass tanks at a stocking

density of 400-fish m^{-3}. Extruded fish feed of 42% crude protein were given to the fish at 5% body weight. The 154 fish specimen were harvested randomly for this study with scoop net. The fish body weights were taken to the nearest 0.01 g using sensitive weighing balance. Total length and standard length were measured with a measuring board taken to the nearest 0.1 cm while fish samples were sexed and recorded. The length-weight relationship was calculated by the least square method for male and female separately and also for combined sexes using the parabolic equation:

$$W = aL^b$$

or its logarithmic form:

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

where, W is weight in grams, L is length of fish in cm, a is intercept and b is slope.

The condition factor was determined by using the expression:

$$K = 100W/L^b$$

where, W is weight in grams, L is in cm and b is exponent of the length-weight relationship.

Chi-squared test was carried out on the observed male and female specimens to show the level or proportion of differentiation from the expected 1:1 ratio.

RESULTS

The length-weight relationship and correlation coefficient (r) for the two sexes separately and combined relationship for both sexes was logarithmic transformation as depicted in Fig. 1-3. The value of 'b' for the female was 3.391 while that of male was 3.358, for combined sexes the value was 3.372. The correlation coefficients (r) were 0.9695, 0.9618 and 0.9649 for the female, male and combined sexes, respectively (Table 1). The equations for the length-weight relationship in this study were as follows:

For females:

$$\text{Log } W = -2.633 + 3.391 \log L \ (r = 0.9695)$$

For males:

$$\text{Log } W = -2.570 + 3.358 \log L \ (r = 0.9618)$$

For combined sexes:

$$\text{Log } W = -2.597 + 3.372 \log L \ (r = 0.9649)$$

The weight of the fish increased more in proportion or less to the cube to its length as indicated by the slope (b). The female grows faster by weight than the male as their exponential value was more (Table 1). The condition factor- length relationship for combined sexes together was

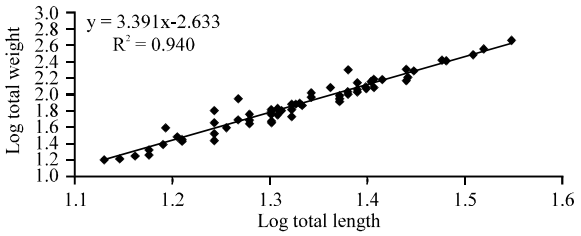

Fig. 1: Length-weight relationship of *Clarias gariepinus* females reared in flow-through system

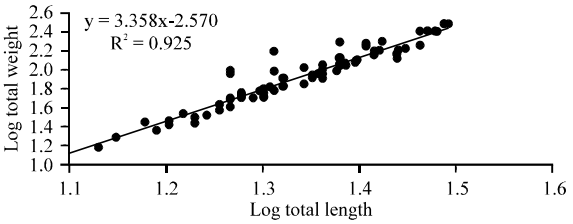

Fig. 2: Length-weight relationship of *Clarias gariepinus* males reared in flow-through system

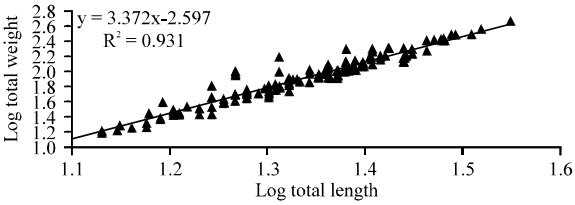

Fig. 3: Length-weight relationship of *Clarias gariepinus* combined sexes reared in flow-through system

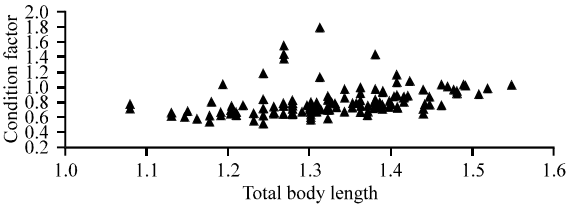

Fig. 4: Condition factor-length relationship of *Clarias gariepinus* combined sexes reared in flow-through system

Table 1: Regression co-efficient of *Clarias gariepinus* reared in flow-through system

Sex	Mean condition factors (K)	Regression constant (a)	Regression co-efficient (b)	Correlation co-efficient (r)
Male	0.8087±0.23	-2.597	3.358	0.9618
Female	0.7884±0.09	-2.663	3.391	0.9695
Combined sexes	0.7989±0.18	-2.597	3.372	0.9649

represented in Fig. 4. The condition factor for combined sexes ranged from 0.5038-1.4214. Average "K" value for the females was 0.7884, males 0.8087, while the combined sex was 0.7989 (Table 1).

Table 2: Chi squared test analysis on sex ratio of *Clarias gariepinus* reared in flow- through system

Sex	Observed (O)	Expected (E)	O-E	$(O-E)^2$	$(O-E)^2/E$
Male	78	77	1	1	0.0130
Female	76	77	-1	1	0.0130
Total					0.0260

The chi-square test was used to determine if a population contains equal proportions of males and females and it is a test of how well a model fits the observed data. Hypothesis: Ho = Male : Female is 1:1, Hi = Male: Female is not 1:1. If n = 2, degree of freedom (df) = 2-1 = 1. From the critical values of the Chi-square distribution table at df = 1, $\chi^2_{0.05,1} = 3.841$. The calculated value 0.0260 is less than critical value, the null hypothesis Ho is accepted meaning not significantly different ($p>0.05$)

The sex ratio of 154 specimens of the fish samples showed a ratio of 1:1.2, female: male ratio. A chi-square test indicated no significant difference ($p>0.05$) from the expected 1:1 ratio. Details of the result are represented in Table 2.

DISCUSSION

The value of "b" closed to 3 indicates that the fish grows isometrically, Values other than 3 indicate allometric growth which occurs when the fishes change slope during growth and the cubic law was no longer obeyed. In this study the "b" value was slightly higher in the females than in the males. This supported studies by Srisuwantach *et al.* (1980) who observed that length-weight relationship and mean condition factor in *C. batrachus* were higher in females than in males. Soni and Kathal (1979) studied the length-weight relationship of *C. mrigala* and *Cyprinus carpio* and found the value of "b" 4.36 and 3.75, respectively. They reported that the "b" value was due to feeding habit of fish. Abdallah (2002) obtained a "b" value between 2.5 and 3.44 for fishes from different marine water bodies. The value of "b" for *C. gariepinus* in this study was calculated as 3.358 for male, 3.391 for female and 3.372 for combines sexes, respectively. They exhibited positive allometric growth with the regression equation for the combined sexes being:

$$\text{Log W} = -2.597+3.372 \text{ Log L } (r = 0.9649)$$

Similar result was shown by Srisuwantach *et al.* (1980) for cultured *C. batrachus* with the regression equation, indicating positive allometric growth:

$$\text{Log W} = -2.1692+3.0857\text{Log L}$$

The condition factors were 0.8087±0.23, 0.7884±0.09 and 0.7987±0.18 for male, females and combined sexes, respectively. Fafioye and Oluajo (2005) reported that the condition factor for *C. gariepinus* in Epe Lagoon was 0.79±0.15 while the b value was 2.790. The difference in the values obtained for male and females could be as a result of egg development in the females and hence increase in body weight. The results were also in agreement with the work of Bagenal and Tesch (1978) documented for mature fresh water fish with "b" values (2.9-4.8) and no significant difference in the mean condition factor of males, females and combined sexes. Generally the K factors obtained in this study were low.

The sex ratio of 1:1.02 (female: male) observed was not significantly different from the expected 1:1 ratio. The sex ratio obtained is highly desirable for broodstock development and hatchery operations for *C. gariepinus*.

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