LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF BLACKCHIN TILAPIA (*SAROTHERODON MELANOTHERON*) CULTURED IN SHELTERED OUTDOOR TANKS

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ABSTRACT

Length-weight relationship (LWR) and condition factor (k) of ninety specimens of Blackchin tilapia, Sarotherodon melanotheron cultured for six months in sheltered outdoor tanks were conducted. Initial measurements averaged 0.04 g for weight, while the total length averaged 1.17 cm. Fortnightly, measurements of length and weight gain were recorded over a period of six months. At the end of the experiment, the total length averaged 12.58 cm while the average body weight was 28.55 g. The growth equation for the population studied is Log W = 2.808Log L - Log 1.6117 where the growth factor b estimated showed a negative allometric growth. The average condition factor k was found to be 1.754±0.329 and there was a very strong positive correlation (r = 0.99) between the length and weight of individuals examined. The correlation coefficient (R²) was estimated to be 0.9974. The implication of the LWR parameters to rearing this species in a confined enclosure was highlighted.

Key words: Sarotherodon melanotheron, length-weight relationship, condition factor

INTRODUCTION

Length-weight relationship (LWR) of fishes are important in fisheries biology because they allow the estimation of the average weight of fish of a given length group by establishing a mathematical relation between the two (Beyer, 1987). They are also useful for assessing the relative well being of a fish population as compared to others of the same species exposed to the same or different conditions of food, density, climate or environment.

According to Nash *et al.* (2006), this widely used tool was developed by early fishery scientists to study natural populations and therefore provide methods for management. Schneider *et al.* (2000) stated that the relationship between total length (L) and total weight (W) for nearly all species of fish is expressed by the equation: $W = aL^b$. In addition, they also stated that the exact relationship between length and weight differs among species of fish according to their inherited body shape, and within a species according to the condition (robustness) of individual fish. The role of condition indices as stated by Stevenson and Woods (2006) is to quantify the health of individuals in a population or to tell whether a population is healthy relative to other populations. Condition sometimes reflects food availability and growth within the weeks prior to sampling. According to Anyanwu *et al.* (2007), the condition factor provides information on well being of a fish and is usually influenced by age of fish, sex, season, maturity stages, amongst others. It was also stated that fish specimens of a given length exhibiting higher weight are said to be in better condition.

This study was aimed at using the length-weight relationship in estimating the growth and condition factor of *Sarotherodon melanotheron* reared in fibre-glass tanks. This will provide baseline information on future

research studies on the species.

MATERIALS AND METHODS
The study was based on data collected from ninety (90) Blackchin tilapia fry released from their parent in a moment of fright after it was caught from an artificial water body (burrow pit). They were reared for six months in sheltered 3 m^3 circular fibre-glass tanks at the Nigerian Institute for Oceanography and Marine Research's experimental fish farm at Badore, Lagos State.

The young tilapias were raised on a feed with crude protein level of 56% for the first six weeks and thereafter on 42% till the end of the experiment. Initial fish measurement (total length and weight) was done at the beginning of the experiment and thereafter bi-weekly till the end of the study. The weight of fish was taken using a digital weighing scale (model DT-302) while the length measurements were carried out using a measuring board. Total length of the specimens was used to evaluate the length-weight relationship which was calculated by log transformed data.

The length-weight relationship was estimated by using the equation:

$$W = aL^b \qquad (1)$$

Where: W   = Weight (g)
      L   = Total length (cm)
      a   = Regression constant or intercept
      b   = Regression coefficient or slope

The equation was linearised by a logarithmic transformation into:

$$\log W = \log a + b \log L \qquad (2)$$

With equation (2), linear regression analysis was computed using Microsoft Excel to estimate **a** and **b** values.

The condition factor was calculated using the means of total length and weight of the Blackchin tilapia:

$$K = 100W/L^3 \qquad (3)$$

Where K = Condition factor
      W = Mean body weight (g)
      L = Mean total length (cm)

The linear relationship between the length and weight was also estimated by calculating the correlation coefficient (R^2).

RESULTS
A total of twelve samplings were conducted from August 2009 to February 2010 for 90 specimens of *S. melanotheron*. Over a period of six months, the mean total length increased from 1.17 cm to 12.58 cm while the mean body weight increased from 0.04 g to 28.55 g. This increment in length and weight is depicted in Table 1.

Table 1: Summary of growth trend of *Sarotherodon melanotheron* over a six month period

Samplings	Length (cm)			Weight (g)		
	Min	Max	Mean	Min	Max	Mean
1	1.1	1.2	1.17	0.04	0.04	0.04
2	2.1	2.5	2.36	0.18	0.3	0.24
3	3.1	3.9	3.54	0.58	1.08	0.82
4	3.9	4.8	4.42	0.98	2.18	1.59
5	4.8	6.3	5.63	1.86	4.74	3.37
6	6.6	8.1	7.17	5.31	10.11	7.30
7	7.2	10.7	8.89	5.97	18.93	11.57
8	7.6	11.5	9.78	7.22	23.98	15.37
9	9.3	12.3	10.93	12.83	27.48	20.32
10	9.4	12.7	11.24	13.54	30.09	21.43
11	10.2	13.2	11.82	15.44	35.39	24.99
12	10.6	14.3	12.58	18.1	38.88	28.55

The summary of the regression analysis between the length and weight is presented in Table 2. The growth factor estimated was 2.808 which indicates a negative allometric growth while the correlation coefficient estimated was 0.9974 which shows a very strong positive correlation between length and weight. The scatter diagram plot between length and weight is as shown in Figure 1.

Table 2: Parameters of length-weight relationship of *S. melanotheron* reared in fibre-glass tanks.

Tilapia	n	a	b	R^2
Blackchin	90	-1.6117	2.808	0.9974

n = number of specimens, a = regression constant, b = regression coefficient, R^2 = correlation coefficient
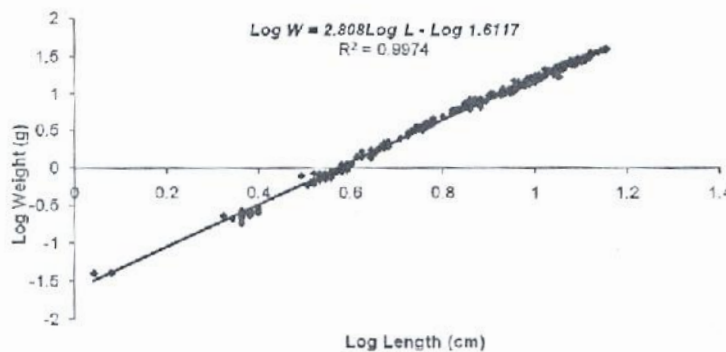

Fig. 1: Scatter diagram plot of log transformed length and weight of *S. melanotheron*.

The condition factor which is an indication of the degree of robustness or the state of well-being of the individuals in the population studied ranged between 1.425 and 3.005 with an average of 1.754±0.329.

DISCUSSION

The assessment of fish stocks or populations using length-weight parameters are important because the values help determine the performance of the fish specimens in the given environment. Also, condition factor is a morphometric index frequently used to evaluate physiological status of fish based on the principle that those individuals of a given length which have a higher mass are in better "condition". Assuming that this relationship holds for wild populations, the experimental population variation of this index was taken as an indicator of the positive or negative physiological impacts of confinement. The condition factor could be influenced by differences in size or age. However, in this study, the experimental fish sampled were the same age being a sib-population and therefore at the same stage of maturity.

The "b" value of 2.808 obtained in this study is supported by studies by Abdallah (2002) who reported a general "b" value of fish to be closer to 3 after examining fishes from different marine water bodies. The author obtained a "b" value between 2.5 and 3.44. Also, Pauly and Gayanilo (1997) reported that "b" value may range from 2.5 to 3.5. *Sarotherodon melanotheron* in this study exhibited negative allometric growth with the regression equation being Log W = 2.808Log L - Log 1.6117 (r = 0.99). In contrast, Ayoade and Ikulala (2007) studied three cichlids in a lake in South-western Nigeria, *Sarotherodon melanotheron* inclusive and found that the growth exponent (b) for *S. melanotheron* had isometric growth. Condition factor values were higher than one in all three species. This k factor value agrees with this study as it was found to be 1.754±0.329.

Kumolu-Johnson and Ndimele (2011) also studied nine fish species from a lagoon in Lagos-Nigeria and found that the "b" values for the nine species ranged from 2.5 to 3.2 and stated that the fish species had allometric growth, while the k factor of these nine ranged between 0.91 and 8.46. Specifically, *S. melanotheron* which was one of the nine fish species studied had a "b" value of 3.094 (positive allometric growth) and 2.38 for the k factor. The implication of this higher value of "k" may be as a result of age differences between this population from the wild against the specimens in this study whose age was known and stated, i.e., fry to six months of age. Otherwise it may be that the lagoon habitat augurs better for this brackish water tilapia than a strictly freshwater confinement as was the case in this study. As reported by Ndimele *et. al.* (2010), the specimens of *Sarotherodon melanotheron* that were obtained from the wild (lagoon) over the course of two years; 2006 and 2007 averaged 14.43±2.14cm and 16.14±2.43cm respectively. Also, the weights averaged 98.26±7.34g and 127.37±9.62g respectively. The correlation coefficients for both years were reported to be similar 0.80 for 2006 and 0.81 for 2007 respectively. The condition factors were 2.39 and 2.38 for 2006 and 2007 respectively.

CONCLUSION
Sarotherodon melanotheron fed a high protein diet and reared in confinement in circular fibre-glass tanks performed within the expected range of $2.5 \leq b \leq 3.5$ in this study within the indicated length range.

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