

## LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF *SAROTHERODON MELANOTHERON* (RUPPELL, 1852) IN THE AMADI CREEK, RIVERS STATE, NIGERIA.

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### ABSTRACT

The length-weight relationship and condition factor of *Sarotherodon melanotheron* from the Amadi Creek, Rivers State, Nigeria was studied. The sampled population size consisted of 1,499 individuals collected between June and August, 2017; their standard length (SL), total length (TL) and wet weight (gram) were recorded. Monthly analysis of collected data showed that; standard and total lengths from June to August respectively, ranged from 6.0-16.8cm, 7.4-15.5cm and 7.0-17.5cm; and from 8.0-20.5cm, 10-21cm and 9.3-21.5cm while wet weight ranged from 8-133g, 15-131g and 13-143g. The values from the linear regression of length and weight data for the months of June, July and August were "a" = 1.26, 1.19, 1.20; "b" = 2.9, 3.18, 3.01 and "r<sup>2</sup>" = 0.95, 0.88, 0.91 respectively. The condition factor of the species were; 1.67, 1.53 and 1.5 respectively for each month. The result revealed that, the species exhibited isometric growth across the months of study since the "b" can be approximated to 3, while the condition factor for each month revealed that the species could be described to be in a poor condition compared to results obtained elsewhere.

### INTRODUCTION

Fish, apart from being a source of desired quality protein, is also rich in vitamins, and contains variable amounts of fat and minerals needed for human health (Bard *et al.*, 1976). Fishes are also important in the development of a countries, as they are sources of revenue from export trade of the fish and fish products (Abowei *et al.*, 2009); source of livelihood and employment generation.

Length-weight relationship is a vital index for assessing population parameters that are necessary for decision making in the efficient exploitation and management of fish populations in the aquatic ecosystems. It provides information on fish population growth information (Krause *et al.*, 1998; Ecoutin *et al.*, 2005, climatic and environmental changes, change in human subsistence practices (Pauly, 1984; Luff and Bailey, 2000), and an essential fishery management tool (Seiyaboh *et al.*, 2016; Abowei, 2010; Lalrinsanga *et al.*, 2012; Mahmood *et al.*, 2012; Ndiaye *et al.*, 2015). It is an important tool for modelling of aquatic ecosystem (Kulbicki *et al.*, 2005). Length-weight relationship is important for estimation of fish (Kumary and Smrithy, 2016).

The condition factor 'K' is important in understanding the life cycle of fish species and their proper management in preserving the ecosystem balance (Imam *et al.*, 2010), it is used in assessing the status of the aquatic ecosystem as it strongly affected by biotic and abiotic environmental conditions (Anene, 2015). Ajani *et al.* (2013) reported condition factor to be the degree of wellbeing or relative robustness of fishes.

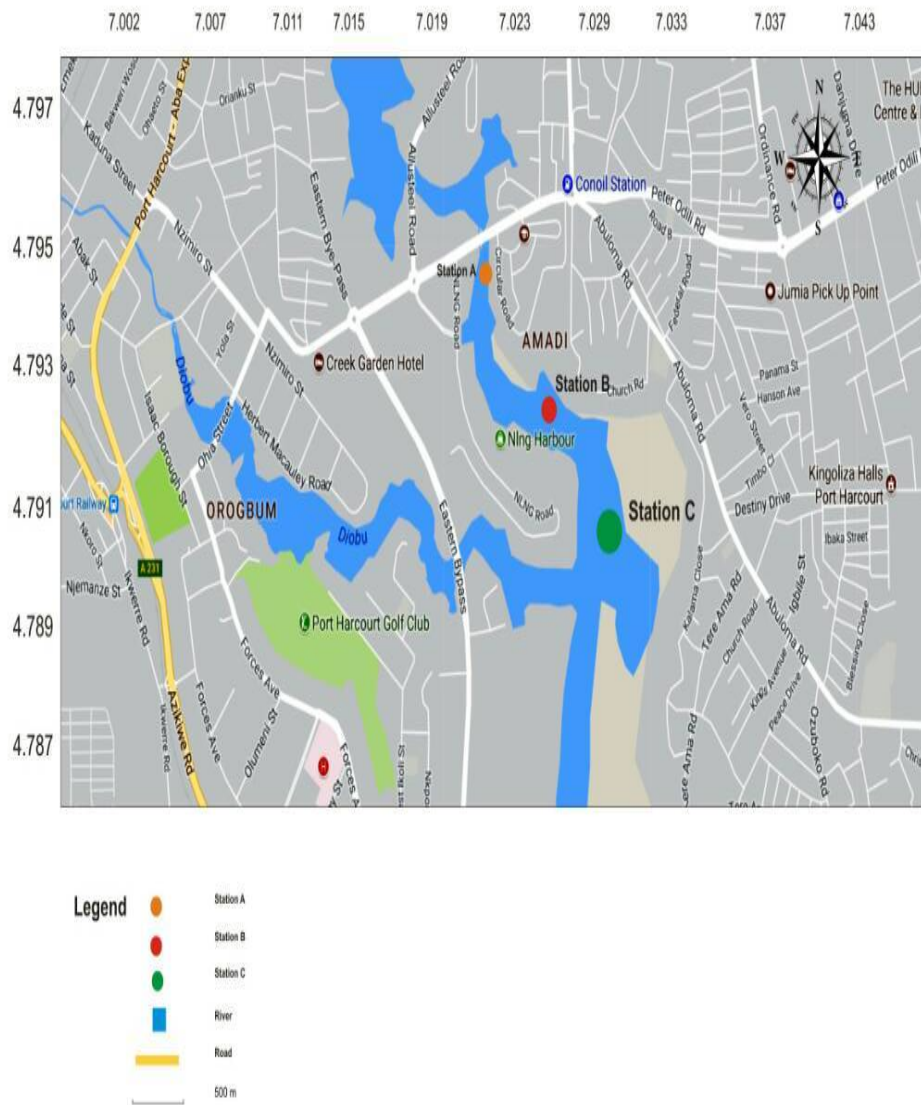
The *Sarotherodon galilaeus* (Black-chin tilapia) has a salinity ranges of 0 – 45 ppt, tolerates as low as 0.1 ppm dissolved oxygen levels and high carbon dioxide levels up to 70 ppm (Pullin and Lowe-McConnell, 1982; Trewavas, 1983; White field and Elliot, 2002). Beras (2005) reported the *Sarotherodon melanotheron* to be confined to brackish water lagoons and estuaries, or water bodies where freshwaters meet oceanic marine waters and the salinity fluctuates, as flooded waters move freshwater zone towards the sea during the rains. Several studies are known to have been carried out on length-weight relationship and condition factor of various fish species, such as that of Niyonkuru and Laleye (2012) for *Sarotherodon melanotheron* and *Tilapia guineensis* in Lake Nakoué and Ahémé (Benin, West Africa), Mahmood *et al.* (2012) for *Ilisha melastoma* from Karachi fish Harbor of Pakistan, Marx *et al.* (2013) for *Oreochromis niloticus*, Kamelan *et al.* (2014) on twenty-four fish species from Tai National Park Basins, Cote d'Ivoire, Onimisi and Ogbe (2015) for fish species of River Okura, Kogi State in Central Nigeria, Uneke (2015) for *Tilapia* species in Ebonyi River of Southeastern Nigeria, Keyombe *et al.* (2015) for *Clarias gariepinus*, Kumary; and the work of Kareem *et al.* (2016) for *Hepsetus odoe* captured in Eleyele Lake, South west Nigeria. However, there is paucity of information on the length-weight relationship for *Sarotherodon melanotheron* in the Amadi Creek. The Amadi Creek, situated along Amadi-Ama community by Port Harcourt City in Rivers State, is a unique creek that is of great economic value to the residents of around it and in Port-Harcourt city in

general. It hosts companies around Trans-Amadi industrial area of Port Harcourt, and also provides water for fishers and water transportation (Fabian and Kingdom, 2012). This work is therefore pertinent as it will go a long way to determine the well being of fish species in this creek. This work is therefore providing preliminary information on the population of *S. melanotheron* that could be useful to form a basis for the development of management strategies by relevant stakeholders.

## 2.0 MATERIALS AND METHODS

### 2.1 Description of Study Area

Amadi Creek the study area is located in Port Harcourt metropolis, Rivers State. It receives its water from Okrika River around Okrika town, and flows through Mini-Ewa, in Rumubiakani via Woji, Oginigba and Okujagu communities into the Bonny River and eventually into the Atlantic Ocean. The creek exists within latitude 4°46'00" N and longitude 7°03'00" E Fabian and Kingdom(2012); and surrounded by several commercial and residential



**Fig 1: Map of Port-Harcourt city, Rivers State, Nigeria, showing Amadi Creek.**

settlements on all sides, and a sparse and scattered mangrove forest. Also some portions of the creek are

being mined for sand which is used for the purpose of sand filling. Several other activities within this

creek include human transportation, bridge construction, petroleum product conveyance that leads to incessant spillages, artisanal fishing, boat building, as well as waste disposal from homes and industries.

**2.2 Sample and Data collection:** Sampled population size, of 1,499 individuals of *Sarotherodon melanotheron* were obtained from artisanal fishers and middlemen at the landing site, for this study. Sampling of landed catches was done twice a week for a period of three months (June-August, 2017). The fishers used a variety of fishing gears such as cast nets, long line and traps. The Total length (cm), Standard length (cm) and wet weight(g) were measured using meter rule and digital weighing scale respectively.

**2.3 Statistical analysis:** The mean values for length and weight were obtained from the raw data. Mean length and weight of the different classes were analyzed using SPSS version 16 and Microsoft excel version 10. The Total length (L) and wet Weight (W) of fish relationship is expressed using the equation:

$$W = aL^b \text{ (Pauly, 1983): } \dots\dots\dots(1)$$

Where;

W = Weight of fish in (g)

L = Total length of fish in (cm)

a = Constant (intercept)

To linearise equation (1), log transformation of the measured data was made with a regression equation:

$$\text{Log } W = \text{log } a + b \text{ log } L \dots\dots\dots(2)$$

Where;

a = constant (intercept)

b = The length exponent (slope)

The “a”, “b” and  $r^2$  values were from the linear regression of the weight and length of the fish through equation (2).

The condition factor (K) of the fish was estimated using the relationship:

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

Where;

K = Condition factor

L = Total Length of fish (cm)

W = Wet weight of fish (g)

### 3.0 RESULT

**3.1 Length-weight relationship:** From the three months of sampling, it was observed that standard length of *Sarotherodon melanotheron* ranged from 6.0-16.8cm, 7.4-15.5cm and 7.0-17.5cm with means of  $10.21 \pm 0.72$ ,  $11.21 \pm 0.62$  and  $10.58 \pm 0.70$  respectively; total length ranged from 8.0-20.5cm, 10-21cm and 9.3-21.5cm with means of  $13.58 \pm 0.09$ ,  $15.27 \pm 0.08$  and  $14.35 \pm 0.09$ , weight of the fish ranged from 8.0-133g, 15-131g, 13-143g with means of  $44.27 \pm 0.83$ ,  $55.97 \pm 0.87$ ,  $46.56 \pm 0.84$ . The condition factor with means of  $1.67 \pm 0.01$ ,  $1.53 \pm 0.01$ ,  $1.50 \pm 0.01$  were for June, July and August respectively; as shown in Tables 1, 2 and 4. The “b” values on the other hand were 2.90, 3.18 and 3.01 for June, July and August respectively and can be approximated to 3, see Table 3.

**Table 1: Standard and Total lengths of *Sarotherodon melanotheron*, Amadi Creek (2017).**

a, b, c: means with different alphabets are significantly different (P<0.05).

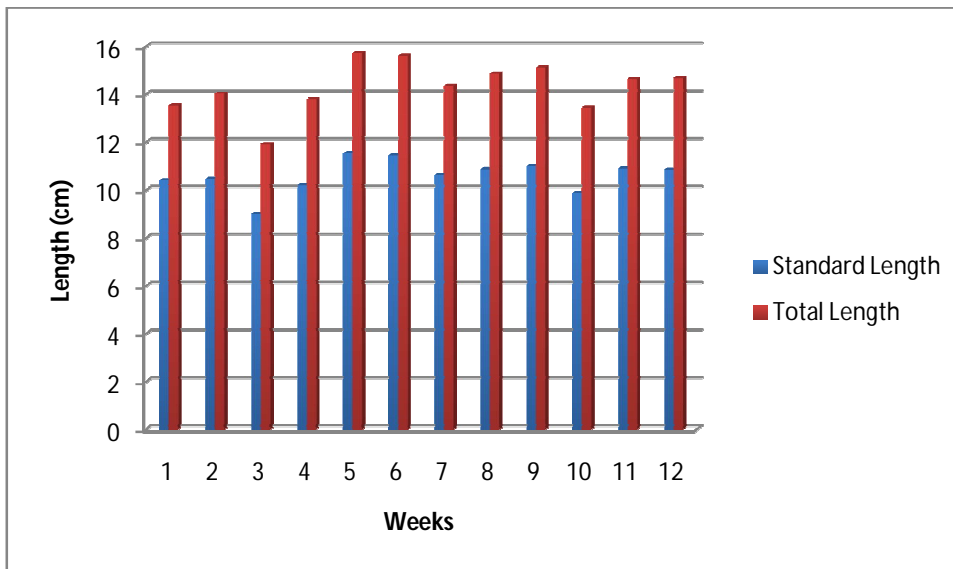
Months	Standard Length (SL)	Total length (TL)
<b>Months</b>	<b>Ranges(cm)</b>	<b>Mean(SE) Ranges(cm)</b>
<b>JUNE</b>	<b>6.0-16.8</b>	<b>10.211 ± 0.072<sup>c</sup></b>
<b>JULY</b>	<b>7.4-15.5</b>	<b>11.216 ± 0.627<sup>a</sup></b>
<b>AUGUST</b>	<b>7.0-17.5</b>	<b>10.583 ± 0.704<sup>b</sup></b>
<b>June</b>		<b>8.0 – 133</b>
<b>July</b>		<b>15 – 131</b>
<b>August</b>		<b>13 – 143</b>
		<b>10 – 21</b>
		<b>9.3-21.5</b>
		<b>44.272 ± 0.837<sup>b</sup></b>
		<b>15.270 ± 0.084<sup>a</sup></b>
		<b>14.359 ± 0.095<sup>b</sup></b>
		<b>55.978 ± 0.876<sup>a</sup></b>
		<b>46.562 ± 0.843<sup>b</sup></b>

**Table 2: Weight of *Sarotherodon melanotheron* from Amadi Creek (2017).**

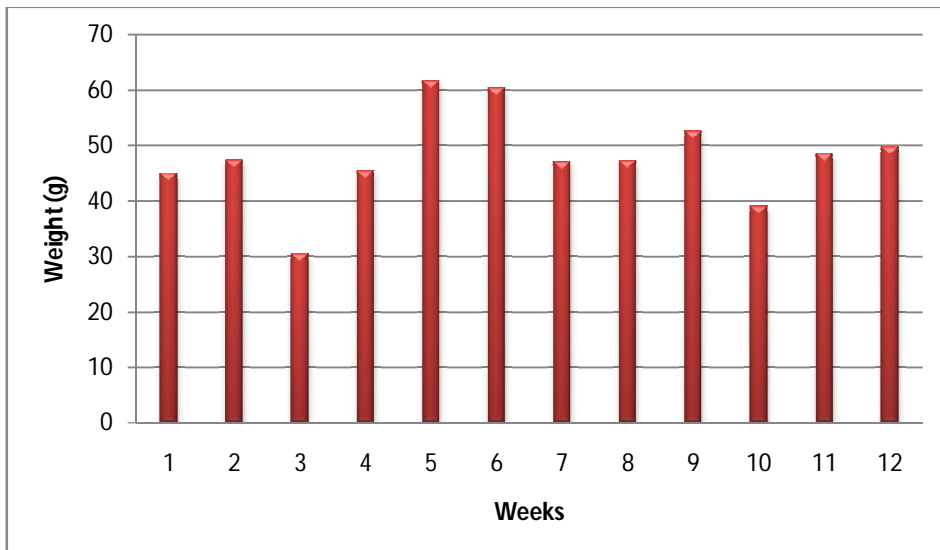
a, b, c: means with different alphabets are significantly different (P<0.05)

**Table 3: Parameters of length-weight relationship and condition factor of *Sarotherodon melanotheron*, Amadi Creek (2017).**

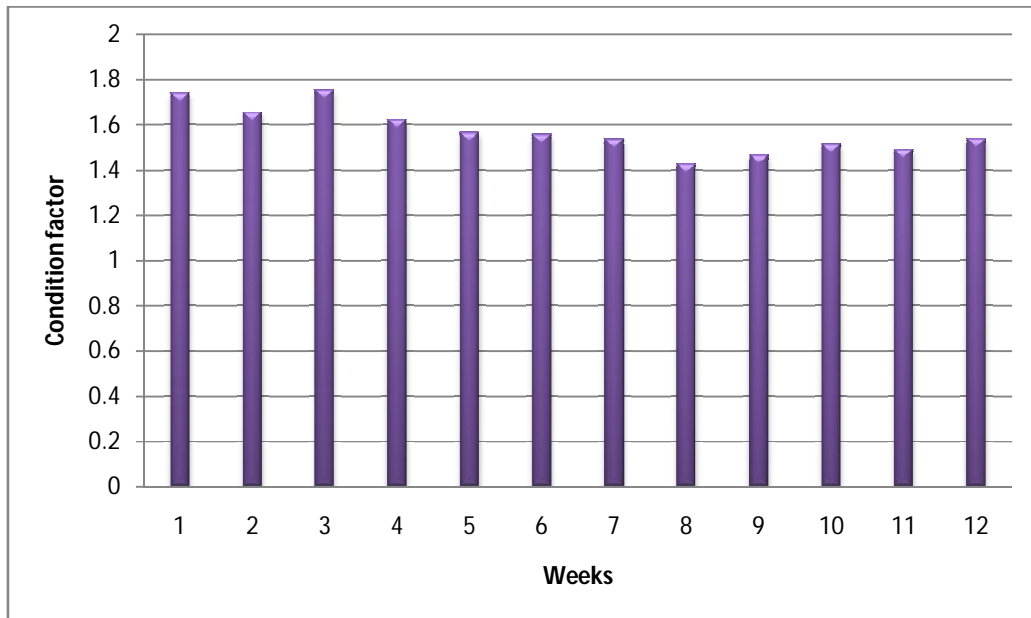
Months	a	b	r <sup>2</sup>	K
June	1.26	2.90	0.95	1.67
July	1.19	3.18	0.88	1.53
August	1.20	3.01	0.91	1.50



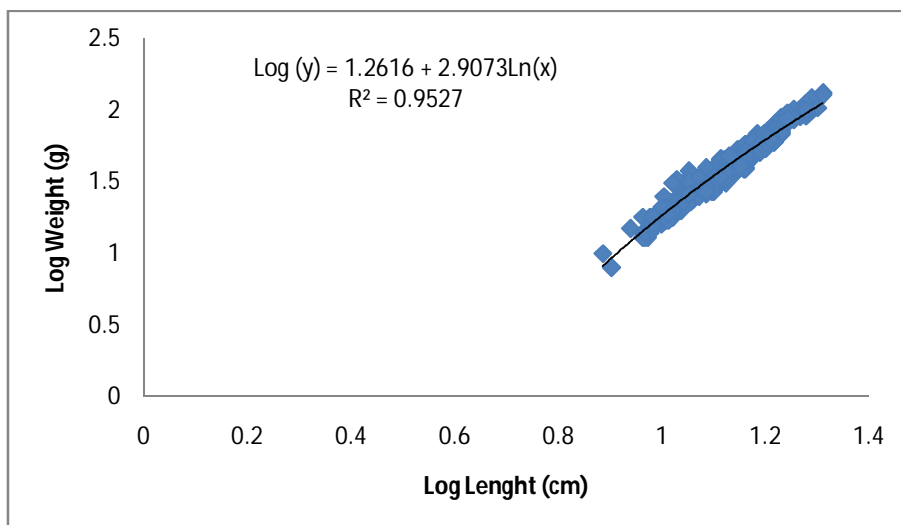
**Fig. 2: Weekly variation in length of *Sarotherodon melanotheron* from Amadi Creek(2017).**



**Fig. 3: Weekly variation in weight of *Sarotherodon melanotheron* from Amadi Creek (2017).**



**Fig. 4: Weekly variation in condition factor of *Sarotherodon melanotheron* from Amadi Creek (2017).**



**Fig.5: Length-weight relationship of *Sarotherodon melanotheron* in (June, 2017).**

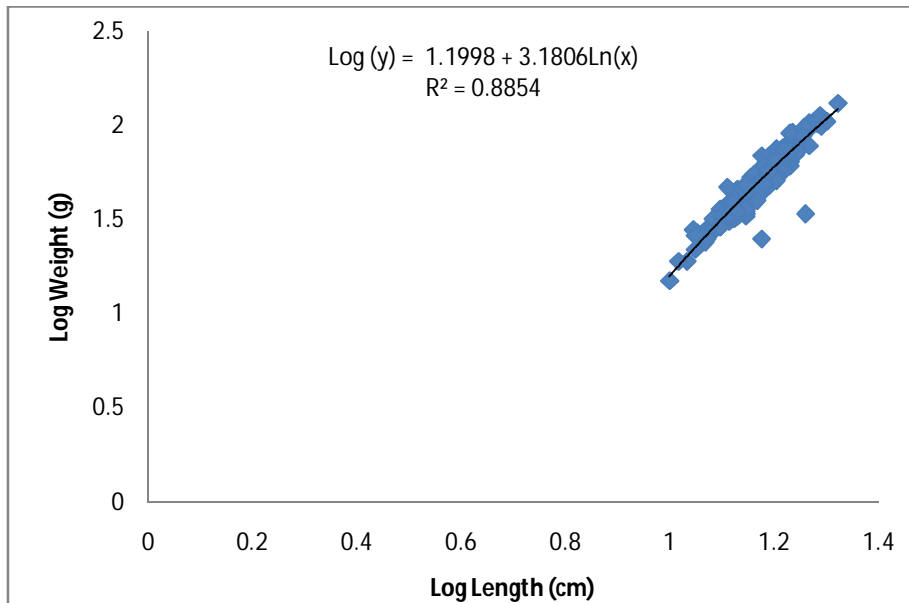


Fig. 6: Length-weight relationship of *Sarotherodon melanotheron* (July, 2017).

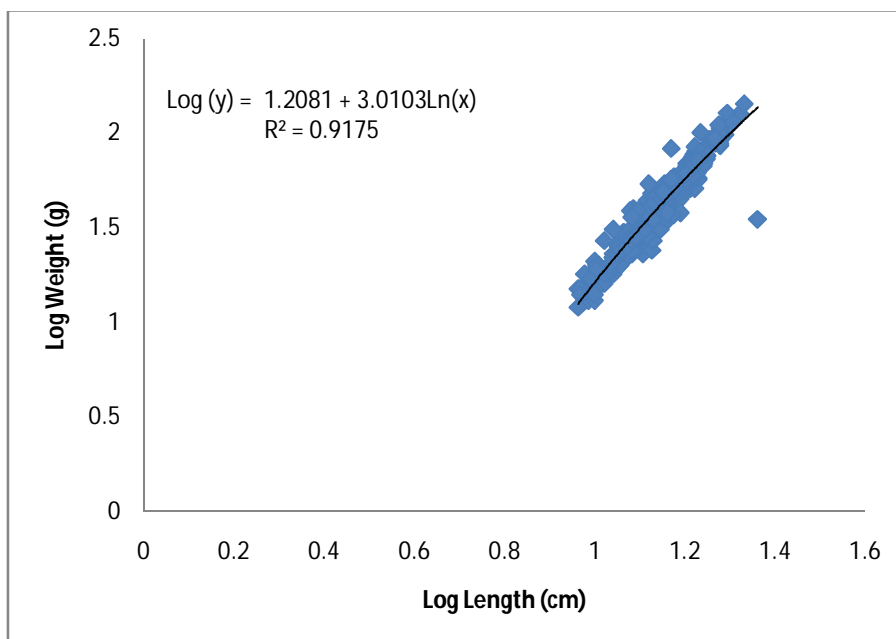


Fig. 7: Length-weight relationship of *Sarotherodon melanotheron* (August, 2017).

Table 4: Mean condition factor for *Sarotherodon melanotheron* from Amadi (Creek, 2017)

Months	Condition factor (K)
	Mean (SE)
June	1.678 ± 0.008 <sup>a</sup>
July	1.533 ± 0.008 <sup>b</sup>

In other words, significant differences were observed in the values of standard length, weight, and total length across the three months of study. The regression coefficient of *Sarotherodon melanotheron* for the three months of study were 0.95 (June), 0.88 (July), and 0.91 (August).

### 3.2 Condition factor (k)

The monthly mean values of condition factor with standard error for *Sarotherodon melanotheron* from Amadi Creek are shown in Table 4. Though there seem not to be significant differences between the monthly means, the highest K value was recorded in June (1.67), while it was 1.53 and 1.50 respectively for July and August.

## 4.0 DISCUSSION

### 4.1 Length and weight parameters

The range of “b” value recorded in this study is similar to the ranges found in other literatures. Gayanilo and Pauly (1997) reported that exponent “b” may range from 2.5 to 3.5, which supports the findings of this study. One of the earliest studies on length-weight relationship in Nigeria by Olatunde (1986) on *Clarias lazera* in Zaria showed that b was = 2.94 (males); b=3.01 (females) and b=3.02 (for both combined), thereby indicating isometric growth since “b” was approximated to 3. Similarly, the result from this study showed that b was = 2.90 (June); b=3.18 (July) and b=3.01 (August), hence insinuating an isometric growth since “b” was approximated to 3.

The “b” values gotten from this study were different from that reported by Niyonkuru and Laleye (2012), who recorded a negative allometric growth for this same species in Lake Nokoué and Ahémé with “b” values less than 3. However, Lagler (1952) observed that “b” values can be affected by certain factors such as increase in weight due to food, water or gonads, season of the year and the time of day when the fish was caught. Factors that can determine the “b” values as suggested by Francis and Sikoki (2007), include stage of maturity of a fish, sexual dimorphism and the natural shape of the fish.

Nwadiaro and Ayodele (1992) reported isometric relationship for *Sarotherodon melanotheron* sampled from the New Calabar River. Isometric growth was recorded in the work of Oribhabor *et al.* (2009) for this same species with “b” value of 3.04 and correlation coefficient (r) of 1.0503 indicating increase in length with increase in weight. This is similar to the reports of Ayoade and Ikulala, (2007) and Laléyé, (2006). Francis and Sikoki (2007), also reported isometric relationship for this same species in Andoni River system. They suggested that isometric relationship recorded for individuals of a species in the Niger Delta basin are likely to be due

to the fish species coming from the same stock, as all the rivers therein are linked to form the Niger Delta. The correlation coefficient ( $R^2$ ) between weight and length of *Sarotherodon melanotheron* for the three months of study were significantly high being and close to 1. This indicates that the data were measured accurately and the results credible.

In assessing the morphometrics, the *S. melanotheron* reported in Amadi Creek and New Calabar River, also in the Niger Delta, Nigeria may be of different stocks or that those from Amadi Creek are suffering from unfavourable ecological conditions since their morphometrics indicate smaller size. Francis *et al.* (2017) had reported the following for *S. melanotheron* from the New Calabar River:  $Tl = 6.1-32\text{cm}$ ;  $Lm = 20.20\text{cm}$ ;  $L\infty = 34.65\text{cm}$ ;  $Lmax = 33.55\text{cm}$ ;  $Lopt = 21.4$ ;  $Tmax = 2.1\text{yr}^{-1}$ . The greatest length reported in this study as 21.5cm is much below the 32cm recorded for same species from the New Calabar River; and even as the data are all of the same season.

In terms of weight, the fact that there was significant difference in the weights across months is in order since the fishes are in a population should consist of a good number of cohorts. The cohorts definitely will not be of the same sizes.

**4.2 Condition factor (k):** The condition factor (k) values for the three months of study were well above 1 with values of 1.67, 1.53 and 1.50 for June, July and August respectively. This result is clearly different from that reported by Fagade (1979) with K value range of 4.1-5.7 for *Sarotherodon melanotheron* in the Lagos lagoon. However, K values of 1.46-2.27 and 0.64-3.00 were recorded for this same species in the New Calabar River and in the Andoni river respectively (Francis and Sikoki, 2007). Francis and Sikoki (2007b), suggested that the relatively low value of K of *Sarotherodon melanotheron* from Andoni river may be as a result of the high fishing pressure, since it is the main occupation of the Andonis; as well as crude oil related activities that go on in the river system. Same can be said for the species in Amadi creek as its K value is also low compared to that recorded by Fagade (1979), thus highlighting the varied ecological conditions between the Lagos Lagoon and Amadi Creek. During the course of this study, several pollution-related activities were observed in the Amadi creek which seemed to have affected the catch of other species, making *Sarotherodon melanotheron* the major species being caught at that period. The ability of this species to be seen during this period despite the seeming high level of pollution within the creek indicates *Sarotherodon melanotheron* ability to live in an environment with dissolved oxygen levels as low as 0.1ppm and carbon dioxide levels as high as 70 ppm and resulting from

pollution (Whitefield and Elliot, 2002; Trewavas, 1983). This result could be indicative of the ability of the species to tolerate a polluted environment.

## 5.0 CONCLUSION

Results presented in present study is as an important contribution in the provision of information on the length-weight relationship and condition factor of *Sarotherodon melanotheron* from Amadi creek. This species exhibited isometric growth across the months of sampling, that is, they increase in weight as the cube of the length, thus complying with the cube law as opposed to King (1996b) that majority of Nigerian fishes show allometric growth. The condition of the fish was also not that good compared to condition factor calculated for this same species in other parts of the world and even the Niger Delta, thus insinuating an unfavourable ecosystem for its growth. Besides, the high values of the regression coefficient is indicative of high correlation between the length of the individuals, and that the raw data were accurately measured. The constancy with which the standard length varied from the total length as seen graphically highlights the accuracy of measurement and confirming that the total length is always longer than the standard length of a fish.

## 5.1 RECOMMENDATION

The condition of the *Sarotherodon melanotheron* from Amadi Creek is not good, yet further research should be carried out on the adverse effect of pollution on the species over a longer period of time as well as its effect on other fish species. This will help to ascertain the precise condition of all the fish species in Amadi Creek as there exists interaction between different species as well as with the ecosystem in which they live in. Management strategies and policies should be put in place and adhered to strictly, to reduce and monitor the several activities going on in the creek.

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