

Length-weight relationship and condition factor of *Mugil cephalus* (Linnaeus, 1758) in Elechi Creek, Rivers State, Nigeria

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ABSTRACT

This study examined the length-weight relationship and condition factor of striped mullet *Mugil cephalus* in Elechi creek complex in the Niger Delta of Nigeria. Fish samples were collected from the local fishers along the creeks for six months. Fish lengths ranged from 8.30 to 14.7cm, while fish weight ranged from 10.0 to 86.0 g. *M. cephalus* exhibited negative allometric growth. There was a strong association between length and weight of *M. cephalus*. Regression equation derived from the log transformed data of total length and weight was $\text{Log}W = \text{Log}1.093 + 1.901 \text{ Log TL}$, $r = 0.959$, $P < 0.001$ and $\text{Log}W = \text{Log}1.093 + 1.950 \text{ Log TL}$, $r = 0.920$, $P < 0.001$ for male and female *M. cephalus* respectively. The condition factor (K) obtained for both sexes was 0.950. Length and weight are two indices that can be used in determining the growth rate of fish and hence in estimating the age.

Key words: *Mugil cephalus*, Elechi creek, Length-Weight, Condition factor.

INTRODUCTION

Length-weight data are useful standard results of fish sampling programmes (Morato, *et al.*, 2001). These data are needed to estimate growth rates, length and age structures and other components of fish population dynamics (Kolher, *et al.*, 1995). The relationship is very important for proper exploitation and management of the population of fish species (Anene, 2005). Length-weight relationships allow fisheries scientists to convert growth-in-length equations to growth-in-weight in stock assessment models (Morato, *et al.*, 2001; Stergiou and Moutopoulos, 2001). The condition factor and the relative condition

factor are the quantitative parameters of the well-being state of the fish and reflect recent feeding condition of the fish (Le Cren, 1951). It is based on the hypothesis that heavier fish of a given length are in better condition (Bagenal and Tesch, 1978). This factor varies according to influences of physiological factors.

The striped mullet *Mugil cephalus* belongs to the family Mugilidae. They constitute a large proportion of the catches by artisanal and subsistence fishermen in brackish water estuary and coastal lagoons (Akpan and Ubak, 2004). The family consists of 17 genera and 80 species. The species is widely

accepted and form a large proportion of the diets of rural communities in the coastal areas of Nigeria.

In spite of the great economic importance of *Mugil cephalus* viz its rich nutritional content and potential for aquaculture, information on its growth is lacking. There are however, reports on the trophic biology of other Mugilids such as *Liza falcipinnis* (Fagade and Olaniyan 1972; King, 1988) and *Liza grandisquamis* (King, 1986; Akpan and Ubak, 2004). The length-weight relationship of a fish is basically a measure of its growth pattern or age. These data are useful standard results of fish sampling programmes (Morato, *et al.*, 2001). These data are needed to estimate growth rates, length, age structures and other components of fish population dynamics (Kolher, *et al.*; 1995). This study examined the length-weight relationship and condition factor of *M. cephalus* in the Elechi Creek, Niger Delta, Nigeria. Data from this study will enhance proper exploitation and management of the species which will be

useful for stock assessment models for fisheries biology and population dynamics.

MATERIALS AND METHODS

Description of the study area

The Elechi creek which is called Elechi Omo Ema Creek is located in Rivers State, Niger Delta, Nigeria. The Creek is situated between latitudes 4°45' and 5°50' North and longitude 6°05' and 7°15' East (Fig.1). The Creek is dominated by tide embayment with little fresh water input where salinity fluctuates with season and tidal regime. The Creek has a sub-tropical climate with relative humidity of 80-100%, heavy rainfall as high as 900mm and high temperatures of 28-32°C. The vegetation has a mangrove forest consisting of white mangrove *Avicennia africana* and red mangrove *Rhizophora racemosa*; of these, red mangrove, *Rhizophora racemosa* is the predominant (Nedeco, 1961). The terrestrial environment is affected by some activities of humans including dredging, little or no boat traffic, firewood cutting, refuse dump and fishing.

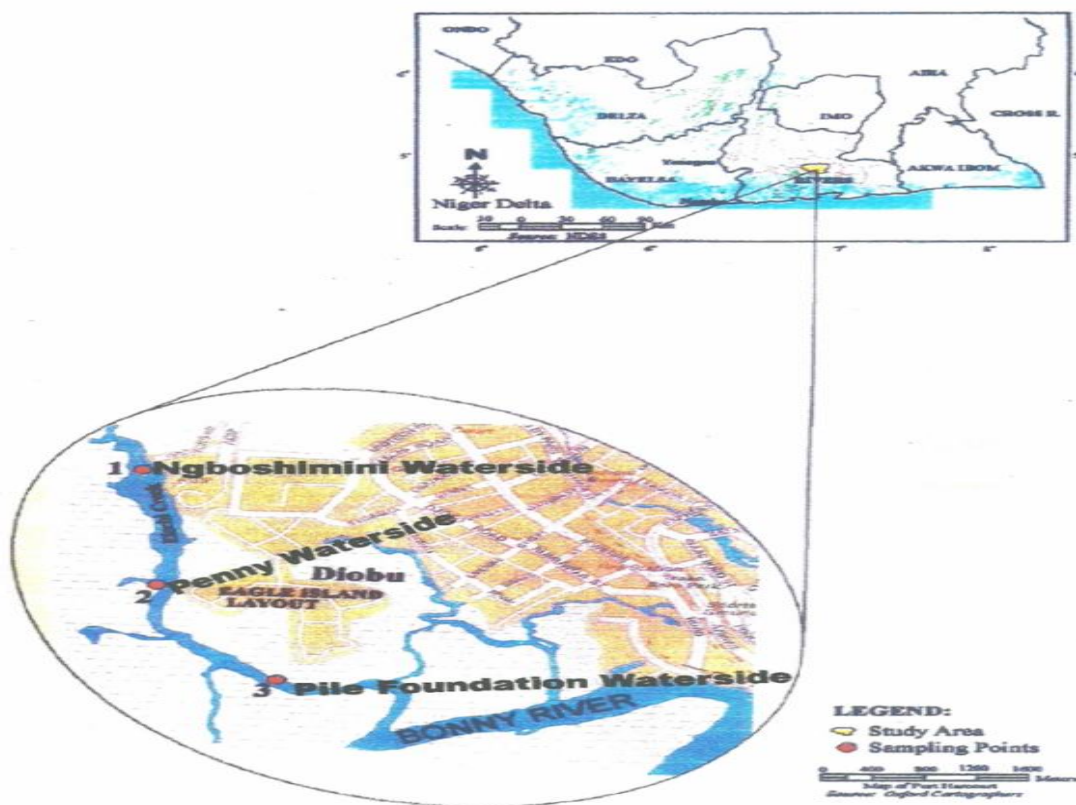


Fig. 1: Map of Niger Delta showing Rivers State and Elechi Creek

Sample collection

The fish samples were collected twice in a month for a period of six months. Fish samples were procured from artisanal fishers and middlemen at their landing sites and were conveyed in an ice chest to the Department of Fisheries laboratory, University of Port Harcourt. Three different stations (landing sites) which include Agip (Mgbuoshiniini water front), Eagle Island layout (Penny water front) and Elechi Beach (pile foundation water front) were chosen for the study (Fig. 1). The fishers used a wide range of fishing gears such as hook and

lines, long line, cast nets, gill nets and traps. The fish specimens from the catches were identified using keys and descriptions by Holden and Reed (1972), FAO, (1981a) and Schneider (1990). Specimens were stored in ice chests containing ice and transported to the laboratory for further analysis.

The total lengths (TL) of the fish samples were measured on measuring board. Fish weight was taken with weighing balance Scout Pro SPU402 (400x 0.01g) to nearest 0.1g. The length-weight relationship was determined by the exponential equation.

$$W = aL^b \text{ (Pauly, 1984) -----(1)}$$

Where W = weight

a = Regression constant (intercept)

L = Total length of fish in (cm)

b = Regression coefficient (slope)

The Fulton's condition factor ((K)) was calculated from the formula

$$k = \frac{w \times 100}{L^3} \text{ -----(2)}$$

Where:

K = Fulton's condition factor

w = weight of fish in grammes (weight difference)

L = Total length of fish in centimeter

Data obtained were subjected to analysis using statistical analysis system (SAS, 2004). These packages analyzed regression, Pearson correlation and descriptive statistics.

The “a” and “b” values were obtained from a linear regression of the length and weight of fish. The correlation (r²) that is the degree of association between the length and weight was computed from the linear regression analysis:

$$R = r^2 \text{ ----- (3)}$$

A log scale regression of dry weight on length was then computed.

$$\text{Log } W = \text{Log } a + b \text{ Log } L \text{ ----- (4)}$$

The linear regression routine option 3 in FiSAT (FAO-ICLARM stock assessment tool) software was used for the analysis.

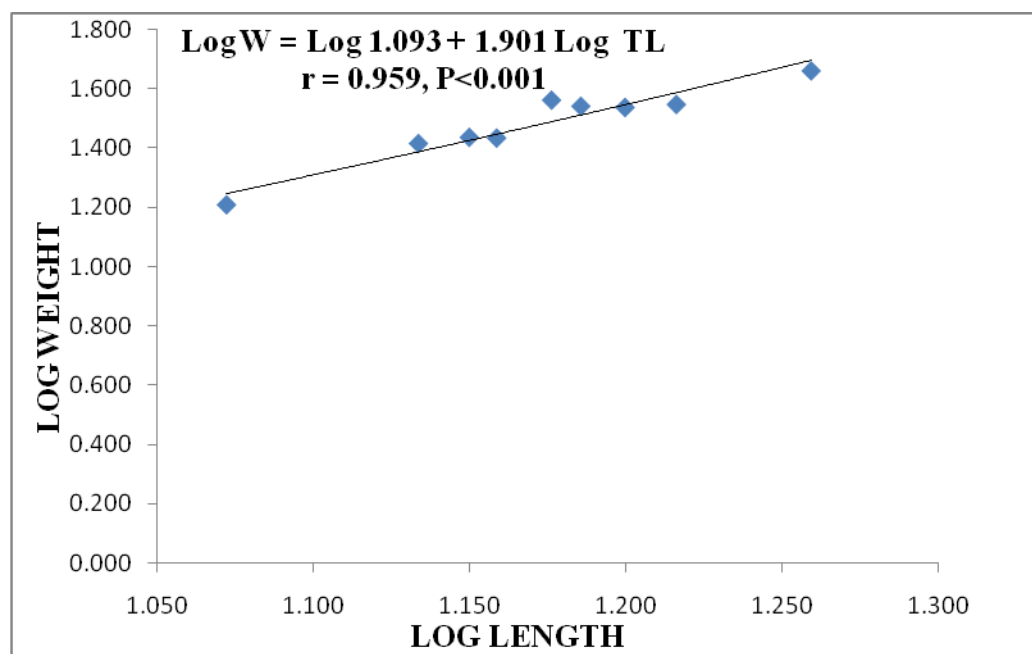
RESULTS

The length-weight relationship was determined following a logarithmic transformation. The statistics of regression are shown in Table 1. The regression trend was the same pattern for both sexes. The linear relationships of the log-weight and log-length are shown in Figs. 2 and 3. The

slope or regression coefficient b ranged from $b_{\min} = 1.901$ to $b_{\max} = 1.950$. The intercept (a) value was 1.093 for the male and 1.093 for the female. The correlation coefficient (r) was highest for the male (0.959) and 0.920 for the female. The condition factor (k) for male and female *M. cephalus* was 0.950. The result showed no significant variation in the values obtained.

Table 1: Exponential equations, correlation coefficient (r), condition factor (k) and Length-weight relationship of male and female *Mugil cephalus* in Elechi creek

Sex	Regression Equation	R	Condition Factor Equation	K
Male	$W = 1.093 L^{1.901}$	0.959	$K = \frac{100W}{L^3}$	0.950
Female	$W = 1.093 L^{1.950}$	0.920	$K = \frac{100W}{L^3}$	0.950

Fig. 2: Length-weight relationship of male *Mugil cephalus* in Elechi creek

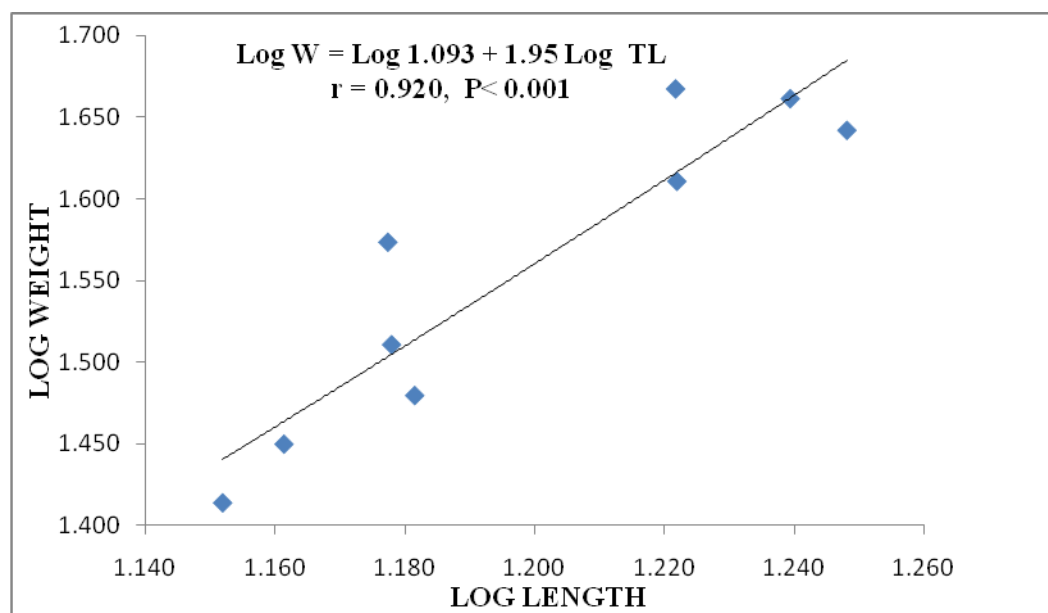


Fig. 3: Length-weight relationship of female *Mugil cephalus* in Elechi creek

DISCUSSION

The regression equation obtained in the present study is worthy of note that the 'b' values for females (1.950) and males (1.901) were less than 3, which shows a negative allometric pattern of growth. The exponent (b) in the length-weight relationship of fishes is usually 3 (King, 1996b). According to (Bagenal and Tesch, 1978), the 'b' value is very close to 3.0 but varies between 2.5 and 3.5. If the 'b' value for fish is 3, the fish grows isometrically; if it is greater than 3, the fish exhibits positive allometry and if it is lower than 3 the fish exhibits negative allometry. The change of b value depends primarily on the shape and fatness of the species, although various factors may be responsible for the differences in parameters of the length-weight relationships among seasons and years, such as temperature, salinity, food (quantity, quality and size), sex and time of the year and stage of maturity (Pauly, 1984). Omogoriola and Solarin (2012) reported allometry coefficient (b) value of 2.29 for *Ilisha africana* of

Lagos coast, in Nigeria. Abhijit (1998) reported negative allometric growth for deep-sea fauna. It has been stated by fishery biologists that 'a' and 'b' values not only differ in different species but differ in the same species depending on sex, stage of maturity and food habits (Qasim, 1973).

Furthermore, from the length-weight relationship of *M. cephalus* in the present study it is clear that the b values of both males and females were less than 3. However, separate regression equations were derived for males and females because differences were found between the regressions. The weight of both sexes of this mullet species increases in proportion 1.950 for females and 1.901 for males. The minor difference in b values of males and females may be as a result of several factors, such as differential metabolic rates and growth rates, status of ovarian maturation, reproductive potential and fullness of stomach or intensity of feeding during analysis, food and feeding habits, biochemical make-up, environmental

conditions and so on (Priyadarshini, *et al.*; 2013).

The correlation coefficient for male and female indicates a positive slope during the period of the research, there was a noticeable difference between the sizes of the individuals. Similarly, most of the fish samples were small in size. This might be as a result of factors such as overfishing by the natives owing to the easy accessibility to the sampling station, hence making it difficult for the species to grow to a sizeable population (Routeillet, 1979). The effluent discharges from industries within the vicinity also impacted increase in the size of the species harvested (Jamabo, 2007). Several authors have reported both isometric and allometric growth for different fish species from various water bodies. Allometric growth patterns for *Tilapia* species from Umuoseriche Lake has been reported (King, 1991). Isometric growth for *P.elongatus* from Qua Iboe estuary was also reported (King, 1996). Isometric growth pattern for *E. fimbriata* from Cross River estuary in Cross River State has also been reported (Ekeng, 1990). Similarly, Isometric growth patterns for *E. fimbriata*, from coastal and brackish water of Akwa Ibom State, was obtained (Marcus, 1984). Isometric growth patterns for *Chrysichthys auratus* from southernmost parts of River Nile and Egypt has also been observed (Shenouda, *et al.*, 1994). Values of length exponent in the length-weight relationship of *Parailia pellucia* being isometric implies that the fish species did not increase in weight faster than the cube of their total lengths (Hart and Abowei, 2007). In general, the values of the relationship between length and weight obtained in the present study are very similar to those found by other investigators who carried out studies in coastal lagoons and marine areas. The results obtained for *M. cephalus* in the present study agree with those of other

scientists (Garcia, *et al.*; 1998) and (Haimovici and Velasco, 2000). Also, the slope value indicates the rate of weight gain relative to growth in length and varies among different populations of the same species or within the same species. Positive allometry ($b = 3.177$) for *Cynoglossus canariensis* (Ajayi, 1982), $b < 3$ indicates that the fish gets plumper as it grows larger.

This paper provides information on length-weight relationship and condition factor of *M. cephalus* in Elechi creek in Rivers State. This information is needed to estimate growth rates, length and age structures in fish population studies.

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