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Length-Weight and Some Morphometric Relationships of *Valamugil seheli* from Sudanese Red Sea Coast

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Abstract

Length-weight relationship is an essential biological parameter needed to appreciate the suitability of the environment for any fish species. That is why many fishery biological studies give an importance to it. The relationships between total length and body depth and girth are very important in estimating the allowable catch and appropriate mesh size to be used in a fishery. Length-weight and some morphometric relationships (depth-total length, girth-total length and dorsal fin length and anal fin length-total length) of *Valamugil seheli* (local name Arabi) (*Mugilidae*) were calculated from the commercial catches landed at Port Sudan Fish Market from February 2010 to January 2011. The length-weight relationship was found to be stronger in females ($W = 0.0073L^{3.1047}$, $R^2 = 0.966$) than in males ($W = 0.0074L^{3.0954}$, $R^2 = 0.926$). But for sexes combined it was $y = 0.007x^{3.114}$, $R^2 = 0.961$. Values of R^2 were high in all cases. The length-weight relationship indicated the cube law ($W = aL^3$) for males, females and the sexes combined relationships. The power equations for the relationship between total length and body depth, and total length and girth, for the two sexes have higher R^2 than the strait line equations and hence better describe the two relationships. The two relations were stronger in females than in males. The relationships between total length and the first dorsal fin length and anal fin length of sexes combined of *V. seheli* were not as strong as the total length-total weight relationship.

Keywords

Body Depth, Body Girth, Length-Weight Relationship, *Valamugil seheli*

Subject Areas: **Animal Behavior, Aquaculture, Fisheries & Fish Science**

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1. Introduction

The relationship between the length and weight of a fish is used by fisheries researchers and managers for two main purposes (Le Cren, 1951) [1]. First, the relationship is used to predict the weight from the length of a fish. This is particularly useful for computing the biomass of a sample of fish from the length-frequency of that sample. Second, the parameter estimates of the relationship for a population of fish can be compared to average parameters for the region, parameter estimates from previous years, or parameter estimates among groups of fish to identify the relative condition or robustness of the population. By convention, this second purpose is usually generically referred to as describing the condition of the species.

According to the Marine Fisheries Administration records in Sudan, *Valamugil seheli* constitutes high percent of the total fish landings and is available all the year round. It is the best local marine fish for preparing "Fas-seikh" (wet-salted fishes) because of its good taste and texture (Faragalla, 2009) [2].

In practice, the use of morphometric measurements (body length, body girth, head length, fins length, eye diameter and jaw length) and meristics (fin ray, scale, teeth, gill raker and lateral line pore counts) to identify and classify fish is common. Morphometric measurements are generally presented as a proportion of total, standard and fork length, body weight and condition factor (Naeem *et al*., 2010 [3], and 2011a [4], b [5]). The aims of this study were to determine:

1) length-weight relationship of *Valamugil seheli*;
2) body depth-total length relationship of *Valamugil seheli*;
3) body girth-total length relationship of *Valamugil seheli*;
4) dorsal and anal fins-total length relationship of *Valamugil seheli*.

2. Materials and Methods

Random samples of about 30 fish of *Valamugil seheli* were collected monthly from the commercial catches landed at Port Sudan Fish Market from February 2010 to January 2011. Total length was measured to the nearest mm and total weight to the nearest 0.1 gm, then the data was entered to Excel package and the curve of the relationship between them was plotted. Values of the constants (a) and (b) were obtained from the relationship according to Abd El Razik (1987) [6] and Gulland (1985) [7] using the equation:

$W = aLb$

where:

W = total weight in grams;
L = total length in cm;
b = a constant of the relationship represents the slope of the equation;
a = a constant of the relationship represents the intersect part of the "y" axis.

Total length, body depth, body girth, dorsal fin length and anal fin length of *Valamugil seheli* were measured to the nearest mm then the data was entered to Excel package and the curve of the relationships between each one the four later parameters and total length were plotted. Values of the constants (a) and (b) for each relationship separately were obtained using power and linear equations as follow:

$B = aL^b$ (power equation)

$B = aL + b$ (linear equation)

where:

B = one of these parameters body depth, body girth, dorsal fin length or anal fin length in cm;
L = total length in cm.

3. Results

3.1. Length-Weight Relationship

The length-weight relationship was very strong, but there was a little difference between males and females (for males $R^2 = 0.926$ and for females $R^2 = 0.966$) (**Figure 1**). The sexes combined relationship is also very strong ($R^2 = 0.958$**)**.

3.2. Body Depth and Body Girth

The relationship between total length and body depth, and total length and girth, for the two sexes are shown in

Table 1 and **Table 2** and **Figures 2(a)-(d)**. The two relations were stronger in females than in males. The power equations shown in **Table 1** and **Table 2** have a little bit higher R^2 value than the strait line equations and hence better describe the two relationships.

3.3. Dorsal and Anal Fins

The relationship between total length and the first dorsal fin length and anal fin length, are shown in **Table 3** and **Figures 3(a)-(d)**. These relations were not strong as total length vs. total weight relationship and were done for the sexes combined. For the relationship between total length and the first dorsal fin length the strait line equation have a little bit higher R^2 value (R^2 = 0.6045) than the power equation (R^2 = 0.584) and are therefore more appropriate. The opposite is true for the relationship between total length and anal fin length where the power equation is a little bit stronger (R^2 = 0.653) than the linear equation (R^2 = 0.6382).

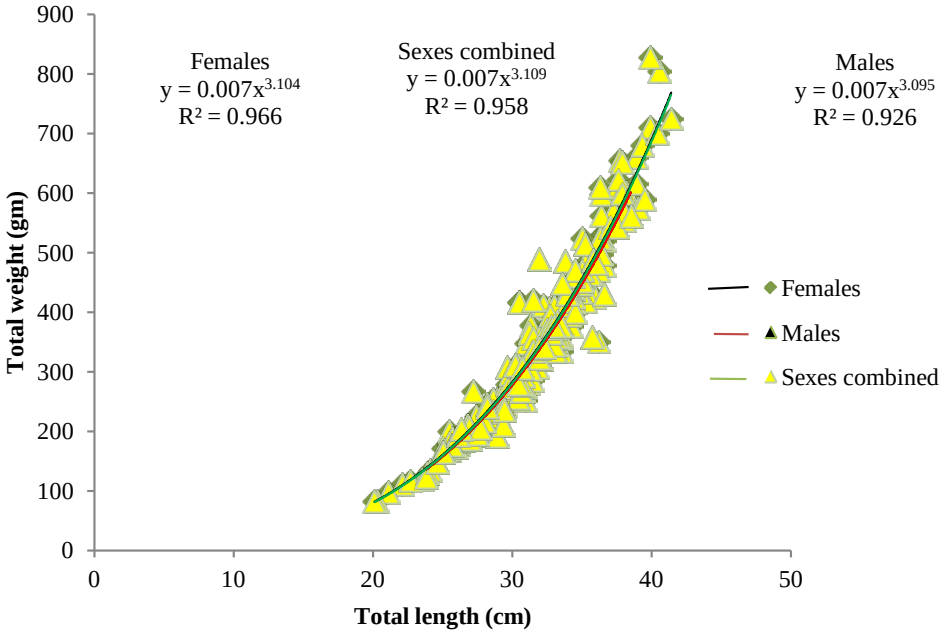


Figure 1. Length-weight relationship for males, females and sexes combined of *Valamugil seheli*.

Table 1. The relationship between total length and body depth of *Valamugil seheli.*

Relationships	Sex	Equation	Equations	R^2
Total length vs. body depth	Male	Power	$y = 0.174x^{1.032}$	0.779
		Straight line	$y = 0.204x - 0.282$	0.764
	Female	Power	$y = 0.204x^{0.997}$	0.837
		Straight line	$y = 0.204x - 0.046$	0.824

Table 2. The relationships between total length and body girth of *Valamugil seheli.*

Relationships	Sex	Equation	Equations	R^2
Total length vs. body girth	Male	Power	$y = 0.642x^{0.933}$	0.811
		Straight line	$y = 0.485x + 0.813$	0.795
	Female	Power	$y = 0.537x^{0.992}$	0.889
		Straight line	$y = 0.522x + 0.044$	0.876

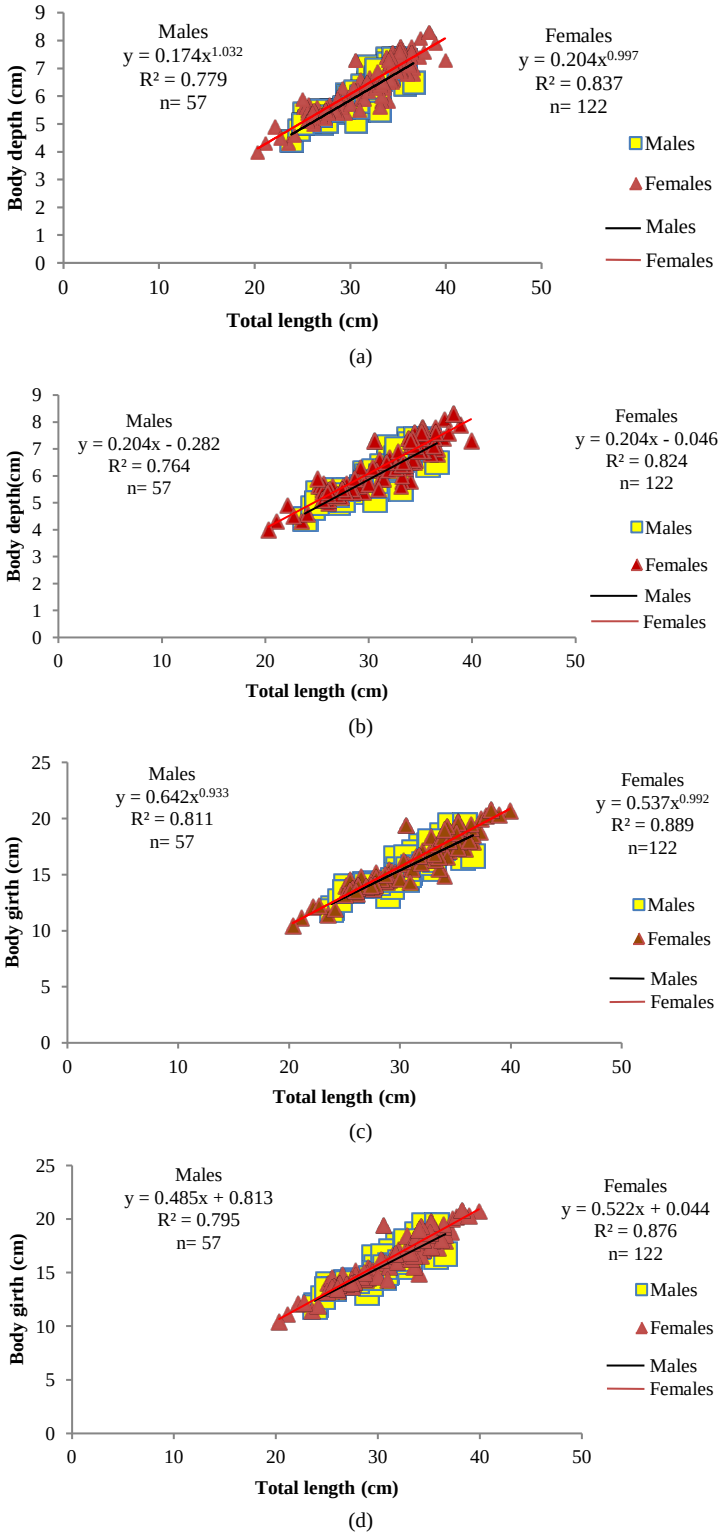
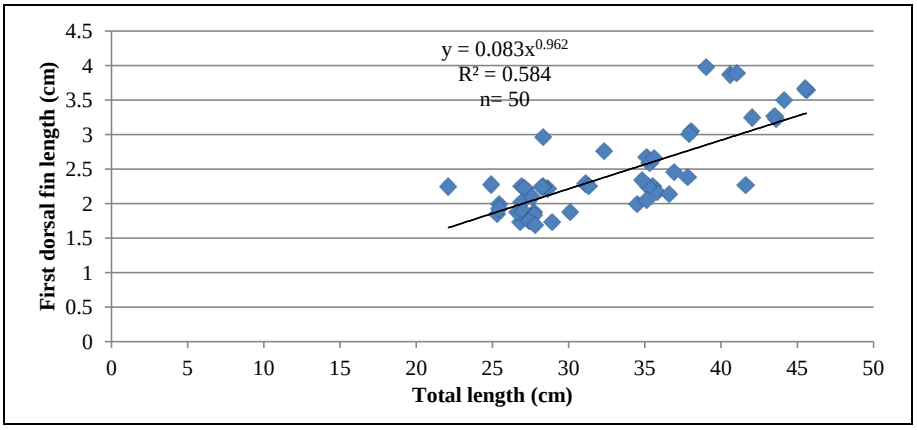


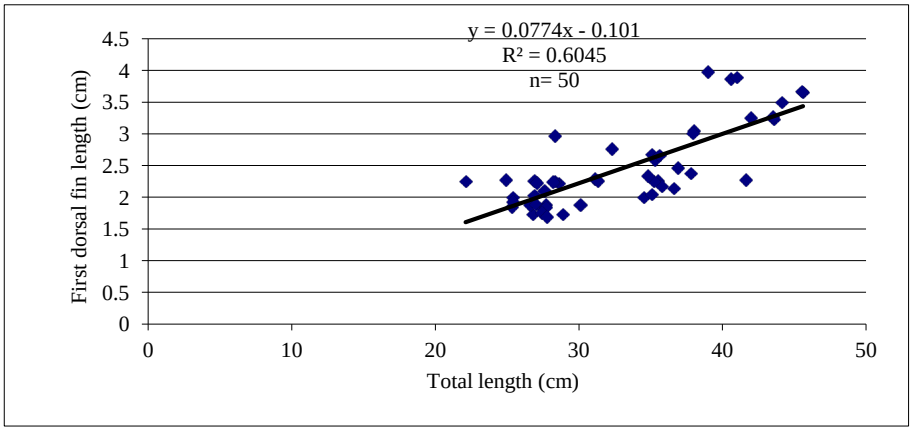
Figure 2. (a) Power relationship between total length and body depth of males and females of *Valamugil seheli*; (b) Straight line relationship between total length and body depth of males and females of *Valamugil seheli*; (c) Power relationship between total length and body girth of males and females of *Valamugil seheli*; (d) Straight line relationship between total length and body girth of males and females of *Valamugil seheli*.

Table 3. Relationships between total length and first dorsal and anal fins of *Valamugil seheli.*

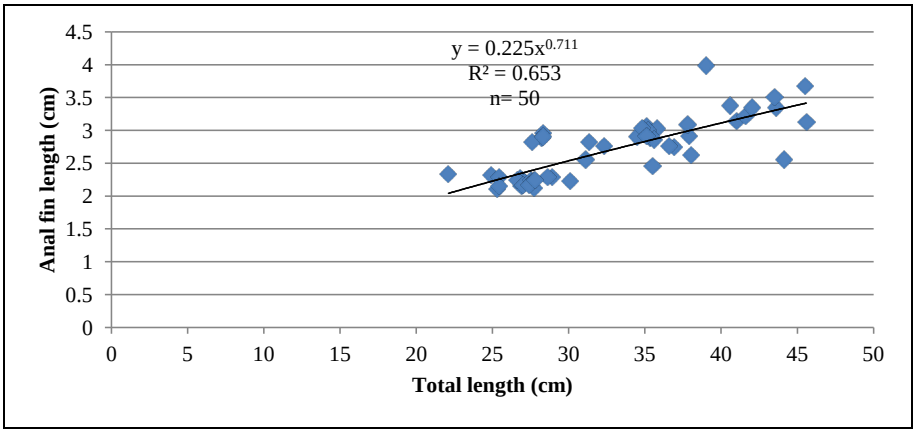
Relationships	Equation	Equations	R^2
Total length vs. first dorsal fin length	Power	$y = 0.083x^{0.962}$	0.584
	Straight line	y = 0.0774x − 0.101	0.6045
Total length vs. anal fin length	Power	$y = 0.225x^{0.711}$	0.653
	Straight line	y = 0.0583x + 0.7946	0.6382



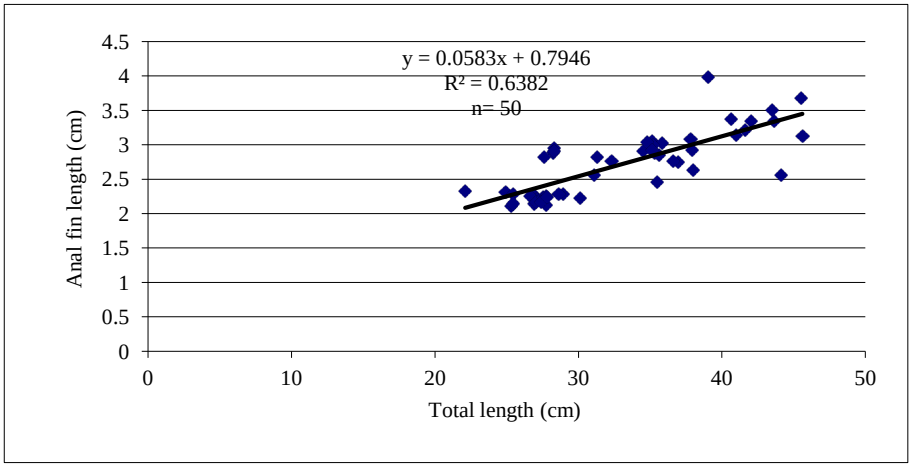
(a)



(b)



(c)



(d)

Figure 3. (a) Power relationship between total length and first dorsal fin length of sex combined of *Valamugil seheli*; (b) Strait line relationship between total length and first dorsal fin length of sex combined of *Valamugil seheli*; (c) Power relationship between total length and anal fin length of sex combined of *Valamugil seheli*; (d) Strait line relationship between total length and anal fin length of sex combined of *Valamugil seheli.*

4. Discussion

The length-weight relationship of *Valamugil seheli* was found to be a little bit stronger in females ($W = 0.0073L^{3.1047}$, $R^2 = 0.966$) than in males ($W = 0.0074L^{3.0954}$, $R^2 = 0.926$), but there was no significant difference between sexes. Khalifa (2007) [8] estimated length-weight relationship for this fish from Abu Hashish area, Portsudan. He found that this relationship was significantly high in both sexes and the (b) value for females and males was 2.775 and 2.808 respectively. The variation of the (b) value between the two studies may due to the different times of the two studies. Moorthy *et al*. (2003) [9] estimated this relationship for *V. seheli* from Mangalore region-India to be $W = 0.0373L^{2.6294}$ for males and $W = 0.0502L^{2.5283}$ for females. Comparing with the present study the variations may be due to the different environmental conditions of the two localities. Borafy and Soliman (1988) [10] recorded positive allometric growth for *V. seheli* (b = 3.508 in males and 3.462 in females) from UAE which is similar to results of the present study. This may be due to the similar environmental conditions in the two localities. Generally the present study indicated the cube law, $W = aL^3$ as proper representation of the length-weight relationship for *V. seheli* inhabiting Sudanese Red Sea coast. Renjini and Bijoy (2009) [11] estimated length-weight relationship of *Liza parsia* from Cochin estuary in India. The (b) value was 3.1938 for males and 3.0094 for females. Luther (1968) [12] estimated (b) values in *Mugil cephalus*. In both studies length and weight were positively correlated. This is similar to the case in the present study. A study by Rao *et al*. (2005) [13] regarding the length-weight relationship of *Liza parsia* in relation to industrial pollution gave (b) value of 2.4986 for males and 2.5210 for females. Moorthy *et al*. (2003) [9] reported the (b) value for *V. seheli* (unsexed) as 2.6207 showing a negative allomeric growth pattern.

The relationships of total length-body depth and total length-body girth for *V. seheli* were closely related for the two sexes. However, they were stronger in females ($R^2 = 0.824$ and 0.876 respectively) than in males ($R^2 = 0.764$ and 0.795 respectively). These parameters are very important in estimating the allowable catch and appropriate mesh size to be used. The values of body depth and body girth of this fish increase with increasing in total length. The average values of depth and girth for males and females of *V. seheli* were 5.93 cm, 6.31 cm, 15.55 cm and 16.30 cm respectively. Khalifa (2007) [8] found these parameters for the same species from Abu Hashish area to equal 4.92 cm, 5.73 cm, 14.24 cm and 15.18 cm for males and females respectively. Bilal (2006) [14] found that the average values for males and females of *Siganus revulatus* were 5.83 cm, 6.2 cm, 12.53 cm and 13.27 cm respectively while for *Siganus stellatus* they were 9.19 cm, 9.08 cm, 19.25 cm and 19.2 respectively.

In the present study the relationships between total length and the first dorsal fin length and anal fin length of sexes combined of *V. seheli* ($R^2 = 0.60$ and 0.63 respectively) were not as strong as the total length-total weight

relationship (R^2 = 0.926 for males and 0.966 for females). This may be due to the differences of growth rhythm of the different parameters in each relationship. The relation between total length and anal fin length (R^2 = 0.6382) was stronger than the relation between total length and first dorsal fin length (R^2 = 0.6045). Renjini and Bijoy (2009) [11] calculated R^2 for the relationship between total length and anal fin length of the mullet *Liza parsia* from the Champakkara region of Cochin estuary, India, as 0.452 and for the relationship between total length and first dorsal fin length as 0.476. They reported that these two relationships were positively correlated.

Both power and linear equations used in the present study to describe morphometric relationships of *V. seheli* have equal strength. The power equations however, had slightly higher R^2.

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