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Short communication
Length-Weight Relationship of Gold Spot Mullet-*Liza parsia* from Ashtamudi Lake, Kerala

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Abstract

Background and Objective: The determination of the exact nature of relationship that exists between length and weight of fishes has been recognized as an important part of fishery biological studies. The present study was undertaken to elucidate the pattern of growth of male and female *Liza parsia* of Ashtamudi lake. The present study provides baseline information on the length weight relationship of *L. parsia* from Ashtamudi lake, Kollam. The study was undertaken to elucidate the pattern of growth and general well being of *Liza parsia* of Ashtamudi lake. **Materials and Methods:** The study was based on the length and weight data of 417 fishes, of which, 259 females of length range 91 mm to 187 m (20-110 g) and 158 males of length range 92-175 mm (20-90 g). The method suggested by Le Cren was followed to compute the length weight relationship. **Results:** Relationship between total length and weight of female of *L. parsia* obtained by logarithmic regression are female: $\text{Log } Y = -1.406 + 2.7216 \text{ Log } L$, male: $\text{Log } Y = -1.373 + 2.6473 \text{ Log } L$. **Conclusion:** Study indicates that an allometric pattern of growth was shown by the species and it was found to be higher in female.

INTRODUCTION

Growth is the process of progressive development of an organism. Typically growth can be defined as the change in size i.e., length and weight over time. Increase in size is due to the conversion of food matter in to building mass of body through the process of nutrition. The more common determinants which influence the growth of a fish are the quantity and size of available food, the number of fish utilizing same food source, temperature, oxygen and other water quality parameters, the size, age and sexual maturity of fish[1]. The length weight relationship of fish also known as growth index is an important fishery management tool, vital in estimating the average weight at a given length group[2]. Length weight relationships can be used as quality for differentiation of taxonomic units. The length weight relationship can be used in setting up of yield equations, estimate the quantity of fishes landed and for comparing the population over space and time. It also helps in assessing the general health of a population. The morphometric relationship between length and weight can be used to assess the well being of individuals and to determine possible differences between separate unit stocks of same species[3].

Length weight relationships (LWR) have number of important applications in fish stock assessment[4]. In addition, the length weight relationship indicates the degrees of stabilization of taxonomic characters in fish species, is very useful in the management and exploitation of fish populations and also useful for comparing life history and morphological aspects of populations inhabiting different regions[5].

The growth in fish can be evaluated from morphometric parameters relative to total length and length-weight relationship[6]. Length weight is considered as vital in fisheries as it correlates and reveals the mathematical relationship between the variables length and weight of the fishes. It also predicts the growth rate, feeding intensity and general well being of fish population[7].

In fishes, weight is an exponential function of length. Under conditions of isometric growth, the regression follows the cube law but due to the condition of the fish or due to the environmental conditions length and weight may deviate from the cube law[8]. In such cases the value of exponent b in the parabolic equation may be[9] between 2.5 and 4. The degree of well being of a fish is expressed by co-efficient of condition, denoted by K (also known as Fulton's condition factor or length weight factor or ponderal index). The condition factor 'K' is a quantitative parameter of the well being state of the fish and reflects recent feeding conditions as well as reproductive status[8]. The condition of the fish may vary with state of sexual maturity, age, sex, season, etc. If fish does not undergo the cube law, the 'K' value is directly affected by length, age, maturity, feeding intensity and other factors. Thus K factor measures the variation from an ideal fish which holds the cube law, so the study of condition factor (K) is of importance for understanding the life cycle of fish species and contributes to adequate management of these species. Fish with a high value of K are heavy for its length, while fish with a low K value are lighter[10]. The importance of length weight relationship and condition factor of fishes has inspired a large number of workers in different parts of the world to analyze this relationship in fresh water and estuarine fishes. The present study was undertaken to elucidate the pattern of growth and general well being of *Liza parsia* of Ashtamudi lake.

MATERIALS AND METHODS

Study area: Monthly sampling of fishes were done from Ashtamudi lake for one year from December, 2010 to November, 2011. Ashtamudi wetland, situated in the Kollam district, Kerala (Lat 8° 59' N Long 76° 36' E), is the second largest wetland in Kerala with a palm shaped extensive water body and eight prominent arms.

The study was based on the length and weight data of 417 fishes, of which, 259 females of length range 91-187 mm (20-110 g) and 158 males of length range 92-175 mm (20-90 g). The total length and weight were recorded to the nearest 1.0 mm and 1.0 g, respectively. Sex was determined by microscopic examination of the gonads. The method suggested by Le Cren[8] as followed to compute the length weight relationship. Accordingly the length weight relationship can be expressed as $W = aL^b$. Where W and L are weight (g) and Length (m) of the fish respectively, a and b are two constants namely initial growth index and regression constant respectively. When expressed logarithmically the above equation becomes a straight line of the formula:

$$\text{Log } w = \text{Log } a + b \text{ Log } L$$

The constants 'a' represents the point at which the regression line intercepts the Y axis and 'b' the slope of the regression lines which was estimated by the method of least square[11.] The regression of log weight and log length was calculated independently for males and females to estimate the length weight of *L. parsia*. The regression co-efficient of the sexes were compared by the analysis of co variance (ANCOVA) to establish the variation in b value if any between them.

RESULTS

Mathematical relationship between total length and weight of female of *L. parsia* from three sites obtained by logarithmic regression are as follows:

Female : Log Y = -1.406+2.7216 Log L
Male   : Log Y = -1.373+2.6473 Log L

Such relationships are depicted in Fig. 1a, b. Table 1 shows the descriptive statistics and estimated parameters of the length weight relationship of *L. parsia*. The co-efficient of correlation (r) was found to be 0.81 for females and 0.82 for males. In this study the 'b' values of males and females denote that they differ in growth rates from one another, females exhibiting relatively better growth rate than males. The results of ANCOVA on regression of males and females were presented in Table 2. The ANOVA of males and female of
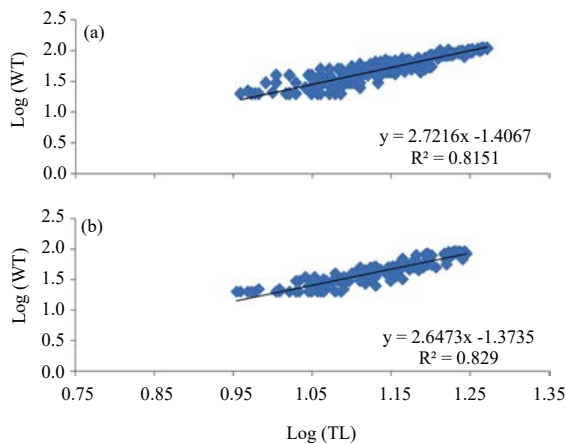

Fig. 1(a-b): Regression equation representation of length weight relationship of (a) Female and (b) Male *L. parsia* of Ashtamudi lake

L. parsia showed significant variation (F = 11.37, p<0.01). The values of the slope ('b') for females and males exhibited significant differences there by indicating the heterogeneity of samples. When the females and males were considered, the females showed higher values for 'b' than the males indicating the growth of female are greater than male.

The graphical representation of the length weight of *L. parsia* indicated straight line relationship in respect of the logarithmic transformation. In addition, the 'b' values of males and females denote that they differ in growth rates from one another, females exhibiting relatively better growth rate than males. In the present study 'r' values showed a fine correlation between length and weight in *L. parsia*.

DISCUSSION

The functional regression 'b' value is directly related to the weight affected by ecological factors such as temperature, food supply, spawning conditions and habit characteristics within a year. Again length weight relation in fishes is affected by a number of factors including stomach fullness, health as well as season and habitat[12]. The regression coefficient 'b' of female (2.72) was found to be higher than males (2.64). From this trend it may be presumed that females gain more weight with the increase in length and age than males. The value of 'b' may differ depending upon feeding, sex and maturity stages[13]. Various factors are responsible for the increase in weight of an individual and these factors could be either intrinsic or extrinsic or both and favoured the changes of the growth parameters like length and weight of fishes[14]. If the fish retains the same shape, its specific gravity remains unchanged during life time, it is growing isometrically and the 'b' exponent would be[15] exactly 3.0. A value greater than 3 shows the fish becomes heavier (positive allometric) where as 'b' value less than 3, the fish becomes thinner (negative allometric).

Table 1: Descriptive statistics and estimated parameters of the length weight relationship of *L. parsia* from three sites of Ashtamudi lake

Site	Sex	Length (Mean±SD)	Weight (Mean±SD)	a	b	R^2	Growth type
Pooled	Female	13.86±2.15	54.15±24.30	-1.40	2.72	0.81	-A
	Male	13.45±2.09	44.35±20.96	-1.37	2.64	0.82	-A

Mean±SD: Mean±standard deviation, -A: Allometric growth pattern

Table 2: Results of ANCOVA comparing length weight relation between the females and males *L. parsia*

Sources	Df	SS	MSS	'F' ratio
Differences among slopes B	1	924.54	924.54	11.37**
Sum of group deviation	413	33570.60	81.25	36.20**
Differences among adjusted means	1	3016.16	3016.16	
Error	414	34495.14	83.00	

**p<0.01

It was found that the exponent 'b' usually lies between 2.5 and 4.0 and 3 are the ideal value of 'b' (isometric growth, where the deviation from 3 shows allometric growth). Allen suggested that the value of b remains constant at 3.0 for an ideal fish[16]. Departure from this cubic relation has been recorded by Le Cren[8]. Beverton and Holt[17] recorded that cubic relationship between length and weight existed and suggested that values of b are always near to 3.0. The slope value 'b' indicates the rate of weight gain relative to population of same species or within the same species[18].

In the present investigation the 'b' values were found to be lesser than 3, the fishes were found to show negative allometric growth. From the analysis of Co variance it was clear that the significant differences were shown between males and females and hence it was necessary to have separate regression equations for females and males to express the length weight relationship in *L. parsia* of Ashtamudi lake. A number of factors like sex, season, habitat, gonad maturity, health, locality, etc contribute to the change in the regression equation[19]. The high value of correlation coefficient in both sexes revealed that there is perfect relationship between two variables in this species.

Mortuza and Mokarrama[20] estimated the length weight relationship of *Rhinomugil corsula* and observed that 'b' value for male was 2.94 and that of female was 3.008. Katselis *et al.*[21] estimated the 'b' value of *Liza saliens* as 3.01. Kurup and Samuel[22] calculated the length weight relationship of *Liza parsia* of Cochin estuary and found that the 'b' value of male was 2.5 and that of female was 2.4 where the regression coefficient of female was lower than the male. Babu and Neelakantan[23] reported the 'b' value of male and female as 2.7 and 2.98, respectively. All the earlier reports are in compliance with the present study in which the 'b' value was lower than the value of 3 and this indicated that *L. parsia* in the present study showed allometric growth. The correlation coefficient indicates the degree of association between length and weight of fish. The high values of correlation coefficients in both sexes revealed that there is perfect relationship between the 2 variable of this species in three sites. In the present study both the length and weight are positively correlated.

CONCLUSION

The present study provides baseline information on the length weight relationship of *L. parsia* from Ashtamudi lake. Study indicates that an allometric pattern of growth was shown by the species and it was found to be higher in females. Current study suggested that the females are in better condition than the males. Variation in the values of 'b' and condition factor in three sites clearly showed the influence of environmental conditions for the proper growth of the fish.

SIGNIFICANT STATEMENT

This study discover the length weight relationship of *Liza parsia* from Ashtamudi lake, the Ramsar site. The present study suggested that the females are in better condition than the males. This showed the heterogeneity of samples, with females showing higher values of 'b' than the males, there by inferring the growth of females were greater than males. Every animal during their life span tends to increase in length and weight and the relation between these 2 has both applied and basic importance. Thus this study provides dependable biological information with 2 objectives. Firstly, it establish the mathematical association between the 2 variables, length and weight, so that unknown variable can be easily computed from the known variable, secondly, to know the variations from the predictable weight, for the known length group, thus in turn reflecting its fatness, general well being, gonad development and appropriateness of environment of the fish. This study helps the researcher to uncover the length weight relationship of *Liza parsia*, so that it revealed the length weight relationship of Mullets in other water bodies also. Thus a new theory on Mullets is that the growth of females was greater than males, may be arrived at.

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