

## Length–Weight Relationship and Relative Condition Factor of Mullet *Liza macrolepis* (Smith) from Mangalore Waters

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### Abstract

The length weight relationship of *Liza macrolepis* was estimated and given by the equations, male  $W = 0.03272 L^{2.5641}$  and female  $W = 0.0413 L^{2.4909}$ . The  $b$  value did not show significant difference between male and female. Hence the pooled equation for both sexes was obtained at  $W = 0.0376 L^{2.5342}$ . The fluctuations in the relative condition factor ( $K_n$ ) values with respect to size indicated that condition of fish showed that an increase trend in size of the fish. The  $K_n$  value steadily increased up to about 200–220 mm and thereafter showed fluctuations. The seasonal fluctuation in the relative condition factor of both the sexes was attributed to the sexual cycle and food intake.

**Key words :** Length-weight relationship, Relative condition factor, *Liza macrolepis*.

The length-weight relationship (LWR) of fishes are important in fishery 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 (1). They are also useful for assessing the relative well being of the fish population (2). Like any other morphometric characters, the length-weight relationship can be used as a character for the differentiation of taxonomic units and this relationship is seen to change with various developmental events in life such as metamorphosis, growth and onset of maturity. Besides, the length-weight relationship can also be used in setting yield equations for estimating the number of fish landed and comparing the population in space and time (3). The empirical relationship between the length and weight of the fish thus enhances the knowledge of the natural history of the fish about which studies are scant from Mangalore region. However, similar studies were conducted in the *Liza tade* (4), *Liza carinatus* (5), *Liza parsia* (6), *Liza ramada* and *Liza salliens* (7).

### Methods

The present study on *Liza macrolepis* from Mangalore is based on a random sample of 1,100 specimens, in the size range of 95 to 300 mm (TL), consisting of 594 males and 506 females, collected

fortnightly during the period between April 2003 and March 2004 from the fish landing center (Bunder Jetty). The length (L) of specimens was measured to nearest 0.5 mm and the weight (W) was recorded in grams. The length-weight relationship was estimated separately for male and female using non-linear equation of the form  $W = a L^b$  (8), where  $a$  and  $b$  were the constants to be estimated as the least square method after logarithmic transformation of the non-linear equation into a linear form. Analysis of co-variance technique (9) was used to test the equality of condition factor in length-weight relationship of both sexes. Seasonal and size variations in condition of fish were calculated separately for each fish in the sample were added up and the mean for each month obtained using the relative condition factor  $K_n = W_o / W_c$  where  $W_o$  = observed weight and  $W_c$  = calculated weight.

### Results and Discussion

Using the statistical analysis of monthly length-weight data, the following relationship was obtained for the male  $W = 0.03272 L^{2.5641}$  and female  $W = 0.0413 L^{2.4909}$ .

The results of analysis of covariance (Table 1) showed that there is no significant difference in the length-weight relationship between the two sexes.

**Table 1.** Analysis of co-variance for comparison of length-weight relationship of male and female *Liza macrolepis*. \*Not significant at 5% level.

Source of variation	Degree of freedom (df) (n-1)	$\Sigma X^2$	$\Sigma XY$	$\Sigma Y^2$	b	df	Deviation from regression		
							Sum of squares	Mean sum of squares	F ratio
Within males	593	8.4548	21.6788	58.7689	2.5641	592	3.1827	0.005376	
Within females	505	5.8307	14.5237	37.8801	2.4909	504	1.7129	0.003986	*1.9016
Deviation from the individual regression within sex						1096	4.8956	0.004467	
Pooled data	1098	14.2855	36.2025	96.649	2.5342	1097	4.9041	0.004470	
Difference between slopes						1	0.0085	0.0085	

Hence a common regression of log W on log L is calculated. The resultant regression equation is  $\log W = -1.3844 + 2.4909 \log L$ . The corresponding non-linear equation is represented by  $W = 0.0413 L^{2.4909}$ . Wijeyaratne and Costa (10), while studying the biology of grey mullets in Negombo lagoon, Sri Lanka have stated that the regression coefficient was higher (2.8716) in male than in female (2.6952) of *V. cunnesius*. Kurup and Samuel (6) reported the length-weight relationship in *Liza parsia* at Kochi estuary showed higher regression coefficient in male (2.5019) than in female (2.4465). Moorthy (11) while reporting on the length-weight relationship of *V. seheli* of Mangalore coast observed a higher regression coefficient in male (2.6294) than in female (2.5283).

The length-weight relationship derived were used to get the mean relative condition factor ( $K_n$ ) for

**Table 2.** Seasonal variation in relative condition factor ( $K_n$ ) of *Liza macrolepis*.

Months	Male		Female	
	No. of fish	$K_n$	No. of fish	$K_n$
Apr 2003	52	1.0901	51	1.0704
May	47	1.1312	45	1.1243
Jun	50	0.9915	49	0.9785
Jul	41	1.0189	52	1.0033
Aug	44	1.0197	51	1.0074
Sep	50	1.0344	41	1.0128
Oct	39	1.0385	26	1.0139
Nov	54	1.0409	34	1.0215
Dec	48	1.0476	36	1.0230
Jan 2004	56	1.0595	38	1.0463
Feb	60	1.0749	42	1.0532
Mar	53	1.0772	41	1.0695
Weighted average		1.0520		1.0353

each month and various size range separately for male and female (Tables 2 and 3) respectively.

In male, the  $K_n$  values were lower than the weighed average (1.0520) during June to December. The lowest  $K_n$  value was found during June (0.9915) and the highest during May (1.1312).

In female, the  $K_n$  values were higher than weighed average (1.0353) during January to May. The highest  $K_n$  value was found during May (1.1243), whereas the lowest during June (0.9785).

The seasonal variation in the relative condition factor of both male and female showed that the  $K_n$  values were more or less similar in both the sexes, thus indicating almost identical metabolic activity in male and female. The high condition exhibited by both sexes during May (1.1312 for male and 1.1243 for female) may be due to gonadal development and active feeding. There was a fall in condition during June but values started increasing from July till May. From

**Table 3.** Mean values of relative condition factor ( $K_n$ ) of different size groups of *Liza macrolepis*.

Size group (mm)	Mid point	Male		Female	
		No. of Fish	$K_n$	No. of Fish	$K_n$
80—100	90	7	0.9853	1	0.9762
100—120	110	45	0.9983	15	1.0043
120—140	130	42	1.0296	30	1.0108
140—160	150	85	1.0342	44	1.0231
160—180	170	79	1.0488	70	1.0264
180—200	190	73	1.0574	56	1.0470
200—220	210	53	1.0824	63	1.0785
220—240	230	72	1.0641	63	1.0793
240—260	250	65	1.0661	69	1.0574
260—280	270	53	1.0769	54	1.0689
280—300	290	20	1.0733	41	1.0632

July onwards, the  $K_n$  values for female increased gradually which may probably be due to the increased feeding activity. El-Maghraby et al. (12) reported that the spawning period affects the weight and consequently the condition factor in *Mugil capita*.

The mean  $K_n$  values of each size group of both males and females are presented in Table 3. The fluctuations in  $K_n$  values with respect to size indicated that condition of fish showed more or less an increasing trend with increase in size of the fish. The highest  $K_n$  value observed in male (200–220 mm) and female (220–240 mm) could be attributed to good feeding. The increase in  $K_n$  value from 120–140 mm size group indicated that the fish started to mature, whereas a sudden decrease at 240–260 mm size groups in female and 220–240 mm size groups in male were probably in the spawning stage. After 240 mm (male) and 260 mm (female), the  $K_n$  values increased gradually. This may be due to the active feeding and recovery after spawning. The study of gonads also indicated the minimum size at maturity in the sexes at 210 mm for male and 230 mm for female. Gowda (13), Reddy (4) and Baburaj (8) opined that point of inflexion on the curve showing a diminution of  $K_n$  with increasing length is a good indication of the length at which sexual maturity starts. Hence, based on the results obtained in the present study, it could be concluded that the variation in the condition of *L. macrolepis* was due to feeding intensity and sexual cycle.

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