

Length and weight relationship of laboratory reared penaeid prawn *Penaeus monodon* (Fabricius) (Crustacea:Penaeidae)

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A parabolic relationship was obtained while studying the length-weight relationship of the postlarvae of *Penaeus monodo*. The b value (multiplying constant) showed that in the laboratory reared penaeid prawns, length-weight relationship strictly followed the cube law. The weight of the prawn increased at the rate of more or less cube of the length. The relationship was found to be significant ($p < 0.001$). At 95% confidence limit the b values were between 3.0524 and 4.3691. ANOVA showed that there is a significant difference between the length and weight relationship ($p < 0.001$). The two-way analysis of the variance also showed a very high correlation between relative increment in length and weight with temperature ($p < 0.05$). The influence of temperature on weight was more as compared to the length and a decrease in relative weight was observed at low temperature ($p < 0.05$).

The study of length and weight relationship of the penaeid prawns is not only important in understanding the biology of the species and its population dynamics but it is also important for the proper management of their resources. The information helps in selecting suitable species of faster growth rate for culture and assessment of the duration of culture period for the attainment of marketable size of the animal. Number of attempts have been made to study the length and weight of the prawns, collected from the coastal waters¹⁻⁸. It is for the first time an attempt has been made and reported here to show the length-weight relationship of the laboratory reared penaeid prawns.

About 30,000 postlarvae (PL20) were collected from a commercial shrimp hatchery from a single spawn for studying the length and weight relationship of the laboratory reared postlarvae of penaeid prawn *Penaeus monodon* (Fabricius) (Crustacea:Penaeidae). Postlarvae were transported to the laboratory in 100 litre plastic containers with adequate aeration, and kept in nursery tanks (cap 20,000 litre) for further observations. The water of the nursery tank was exchanged twice a day to avoid infection. Salinity of the water was recorded with the help of a refractometer (Atago, S/Mill,

Japan). Minimum and maximum temperatures of the nursery tank were also recorded.

Initially, the larvae were fed four times in a day with artificial feeds (Higashi 3000 Starter B) up to 50 days and then Grower A feed till 120 days at the feeding rate of 10% of the biomass. The diet was also supplemented by phytoplankton (*Chaetoceros* sp. and *Isochrysis* sp.). The length and weight of about 50 postlarvae was recorded weekly for a period of 120 days of the culture cycle. The total length of each of the postlarva was measured from the tip of the rostrum to the tip of telson. Similarly, the weight of each postlarva was recorded on an electronic single pan balance (Essae Digi Model DC 80, Precision 10 mg). The body of each postlarva was blotted carefully, before recording the weight of the animal.

The length and weight data was analysed⁹, the weight of the postlarva at each length interval was calculated and a length-weight curve was plotted. The values of length and weight were computed and plotted and the regression equation was calculated¹⁰. The data was tested statistically by applying two-way ANOVA to know the effect of temperature on the relative increment in length and weight of the postlarvae.

The length-weight relationship of the postlarvae of *P. monodon* is represented in Fig. 1A. The smooth curve represents the calculated weight at each length interval. The parabolic equation calculated for this relationship was; $W = 0.7760 \times 10^{-2} L^{3.8283}$ ($r=0.90$). The straight line in Fig. 1B showed the calculated regression line when the log length data were plotted against log weight ($\log W = -0.4930 + 3.647 \log L$; $r=0.82$).

Regression analysis of the length and weight relationship along with the test of significance is summarised in Table 1. The relationship when tested by applying the Students' t-test (two-tailed), showed that the means of the samples were

significantly different. The relationship was found to be significant ($p < 0.001$) and at 95% confidence limit, the b (multiplying constant) values were between 3.0524 and 4.3691.

A two-way ANOVA showed that there was a significant difference between the length and weight relationship (Table 1). The weekly data of the length and weight showed that there was a significant difference in the weekly increments in the postlarvae ($p < 0.001$).

In the present study b value was 3.8283 which showed that among laboratory reared penaeid prawns, the length-weight relationship strictly followed the cube law. The weight of the prawn increased at the rate more or less cube of the lengths.

The weekly relative increment in length, weight, minimum and maximum temperature data are tabulated in Table 2. The two-way ANOVA showed a very high correlation between relative

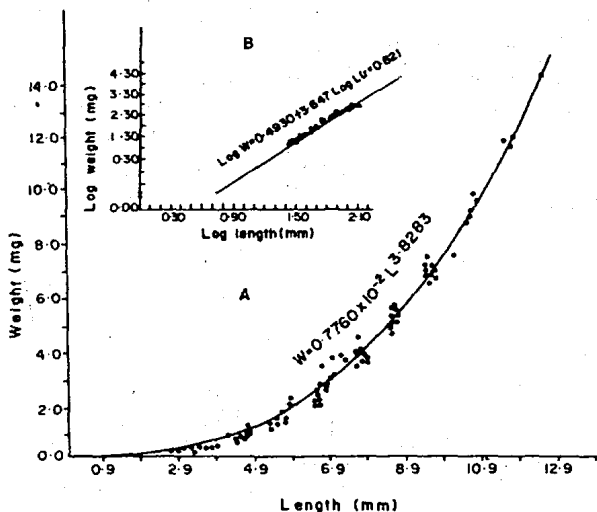


Fig 1—The length and weight relationship of *P. monodon*: (A) Smooth curve presents the calculated weight to show the parabolic relationship, (B) The straight line represents the calculated regression line of log weight or log length.

Parameters		Values
Standard T-test	Normal value	9.4043
	Log value	12.9304
Pearson correlation coefficient	Normal value	0.9067
	Log value	0.8200
Two-way analysis	Normal total SS	1.4439E + 07 S
	Residual	4.314289
	Log total SS	71.2197
	Residual	7.81701 S
Parabolic equation	$W = 0.7760 \times 10^{-2} L^{3.8283}$	
Linear regression	$\log W = -0.4930 + 3.647 \log L$	

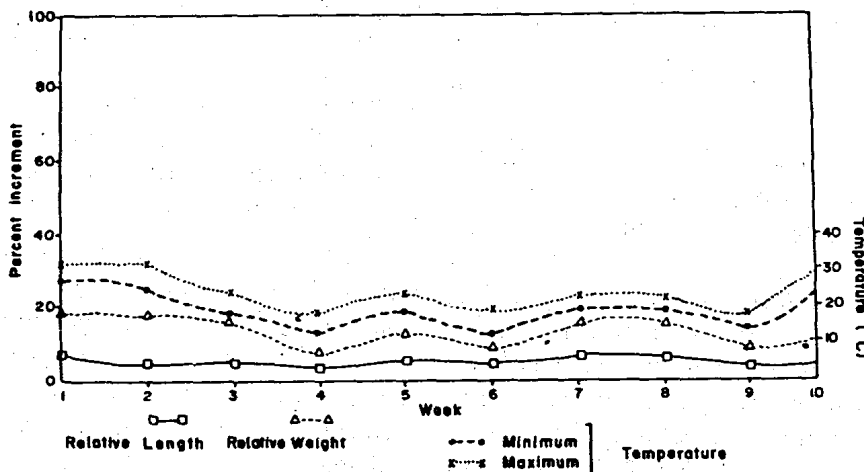


Fig. 2—Relative increments in length and weight with temperature

Table 2—Effect of temperature on the weight of postlarvae of *P. monodon*

Week	Increment in length (%)	Increment in weight (%)	Temperature (°C±SD)	
			Min.	Max.
1	7.243	18.110	27.87 ±0.398	34.25 ±0.341
2	2.840	17.79	24.97 ±1.247	32.44 ±1.978
3	7.192	18.89	24.0 ±0.501	28.04 ±1.381
4	1.766	2.55	25.0 ±1.142	30.42 ±1.047
5	7.550	17.51	26.12 ±1.003	31.95 ±0.255
6	3.403	5.2	24.72 ±0.587	30.37 ±0.419
7	7.361 ±0.439	17.08 ±1.239	23.32	27.7
8	7.687	18.84	24.31 ±0.615	27.68 ±0.970
9	2.545	5.949	24.72 ±0.458	29.2 ±0.529
10	4.054	9.920	24.54 ±0.665	29.11 ±0.496

increment in length and weight with temperature ($p < 0.05$). The change in temperature showed more influence on relative weight as compared to the relative length. The relative weight decreased at low temperature (Fig. 2).

Marine organisms of different stocks, races or population show slight but significant changes in their growth pattern. The differences in length or weight which are considered to be the main parameters for studying the growth of an animal, can not be judged easily and need to be tested statistically to know exactly the variations occurred in the population.

In the present study, it is evident from the results that in the laboratory condition, the weight of the postlarvae of *P. monodon* increased more

than the cube of the length and followed parabolic relationship. This relationship becomes linear after logarithmic transformation of the data. The b value calculated in the present study was 3.8283. However, in *Penaeus penicillatus*¹¹ the b value has been reported to be 2.71 whereas, between 2.5 and 4.0 by Hile^{12,13}. Similar observation has been made in *Metapenaeus kutchensis* where b value was 3.35 as observed for the length and weight relationship by Joseph & Soni¹⁴.

The present investigation shows that the growth in terms of weight in *P. monodon*, is slightly faster under simulated conditions as compared to the other investigations reported earlier. As such the length weight relationship not only provides information on the general well being of the organism, growth pattern, gonadal development but also suitability of the environment.

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