Indian J. Fish., 35 (3): 211-215, 1988

LENGTH-WEIGHT RELATIONSHIP AND OTHER DIMENSIONAL RELATIONSHIPS OF *METAPENAEUS MONOCEROS* (FABRICIUS) FROM THE KAKINADA COAST

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ABSTRACT

The relationships between total length and total weight, and between total length and tail weight in *Metapenaeus monoceros* are significantly different in both males and females. The equations are:

Males : Log total weight =-5.0895+ 2.9521 log total length
Females : Log total weight = -5.4649 4 3.1509 log total length
Males : Log tail weight = -5.4132 4- 3.0214 log total length
Females : Log tail weight — -5.8117 4- 3.2294 log total length

The relationship between total length and carapace length vary between juveniles and adults in both the sexes. The equations are:

Males (juveniles) : CL = - 0.2157 I 0.2166 TL
Females (juveniles) : CL = - 1.9900 + 0.2407 TL
Males (adults) : CL = -10.1696 4- 0.3109 TL
Females (adults) : CL = -13.4473 4- 0.3411 TL

The relationship between total weight and tail weight is not significantly different in males and females. The common equation for both the sexes is:

Tail weight = 0.3260 + 0.7036 total weight

A conversion table for total weight to tail weight and vice versa is presented.

INTRODUCTION

Information on length-weight relation of prawns is needed in studies on growth and sexual maturity and for obtaining yield estimates by analytical models. Similarly information on carapace length—total length, total length—total weight and total weight—tail relations is needed to compare data from different sources since information on catch statistics is recorded in various units depending on local marketing practices.

The only study on the length—weight relationship of *M. monoceros* is that of George (1959) who studied the relationship in juveniles ranging in total length from 25 to 105 mm from the Cochin backwaters. The present account furnishes for the first time a detailed study of the length—weight relationship covering the entire length range as well as the other dimensional relationships of *M. monoceros*.

MATERIAL AND METHODS

Samples were collected once a month during January, 1974 to December, 1974 from the trawler landings at Kakinada. The data on length and weight were collected from fresh specimens. Weights were taken to the nearest 0.1 gram while lengths were taken to the nearest mm. Total length was measured from tip of rostrum to tip of telson

and carapace length from orbital notch to the posterior margin of the carapace along the mid-dorsal line.

The data of all the 12 months were pooled and the relationships were calculated by the method of least squares 011 the basis of individual measurements. As plotting of the data on graph papsr showed exponential relationship for total length—total weight and total length—tail weight, logarithmic transformation was adopted for determining the relationships of the form:

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

Where 'W is the weight, 'L' is the length and 'a' 'b' are constants representing the intercept and the slope of the regression line. But total length—carapace length and total weight—tail weight relationships were found to be linear. Analysis of covariance (Snedecor and Cochran, 1968) was employed to determine whether the regressions of different paiameters are significantly different between males and females and between juveniles and adults.

RESULTS

Total length—total weight relationship

A total of 220 males ranging from 51 mm to 157 mm and 241 females ranging from 54 mm to 188 mm in length were measured to study the length—weight relationship. A preliminary plot of the total length and total weight showed that a single equation would not fit the data for males and females together, Hence, separate estimates were made for males and females. Similar analysis within the same sex indicated that a single equation would fit the data for the entire length range.

Analysis of covariance, showed that there is significant difference between the regression coefficients in the two sexes. Therefore, separate equations are calculated for each sex. The logarithmic equation for total length (L)—total weight (W) relationship for males and females are as follows:

Males : $\text{Log } W = -5.0895 + 2.9521 \log L$ ($r = 0.995$)

Females : $\text{Log } W = -5.4649 + 3.1509 \log L$ ($r = 0.995$)

The exponential forms of the equations are:

Males : $W = 0.000081376\ L^{2.9521}$

Females : $W = 0.000034278\ L^{3.1509}$

The calculated curves of total length and total weight are presented in Figure 1. It may be seen from the curves that males are heavier than females upto 71 mm and thereafter females are heavier than males for a given length.

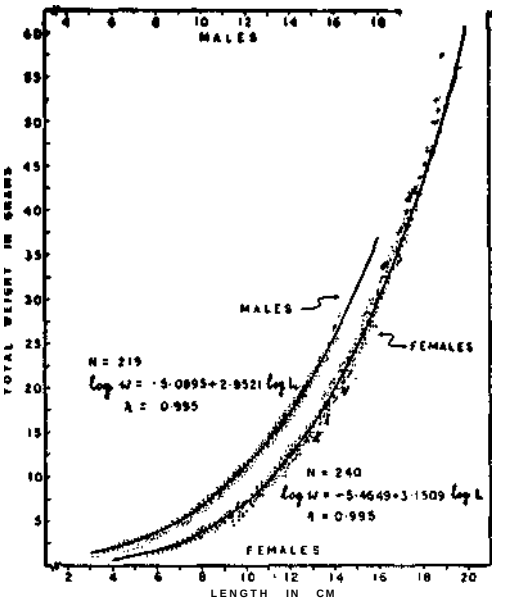

Fig. 1. Total length—total weight relationship of *M. monoceros* from Kakinada coast.

Total length—tail weight relationship

A total of 197 males ranging from 42 mm to 155 mm and 266 females ranging from 40 mm to 194 mm in length were studied for this purpose. As with the total length—total weight relationship, in the case of total length—tail weight relationship also it was found that a single equation would not fit the data for males and females. Hence separate equation were derived for males and females. Similar analysis within the

same sex indicated that a single equation would fit the data for the entire length range.

Analysis of covariance showed that there is significant difference between the regression coefficients of both the sexes. Therefore, two separate equations are calculated for the two sexes. The equations for total length (X)—tail weight (Y) relationship for males and females are as follows:

Males : Log Y = -5.4132 + 3.0214 log X (r » 0.996)

Females : Log Y = -5.8117 + 3.2294 log X (r = 0.992)

The exponential forms of the equations are:

Males : Log Y= 0.000003853 $x^{3.0214}$ * (r = 0.996)

Females : Log Y = 0.000001543 $x^{3.2294}$ (r *m* 0.992)

The calculated curves for total length—tail weight relationship are presented in Figure 2. It is seen from the curves that the tail weight of males is more than females upto 100 mm total length and thereafter the situation reverses.

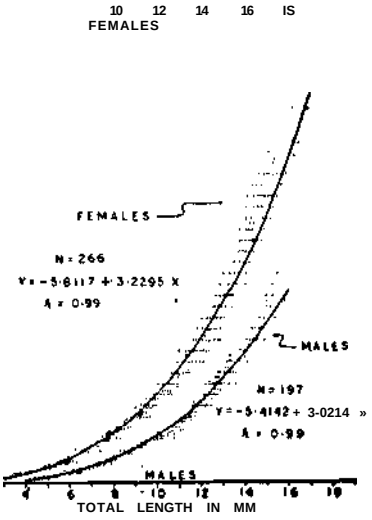

Fig. 2. Total length—tail weight relationship of *M. monoceros* from Kakinada coast.

Total length—carapace length relationship

A total of 210 males ranging in total length from 40 mm to 165 mm and 222 females ranging in total length from 45 mm to 186 mm were analysed to calculate the total length (TL)—carapace length (CL) relationship. A preliminary plot of the observed data sex-wise indicated inflections in the linear relationship at 100 mm in males and 110 mm in females. Hence juveniles and adults sex-wise were treated separately and four separate equations were calculated.

Analysis of covariance for juveniles and adults in both sexes showed that there is significant differences in the regression coefficients. Analysis of covariance for juveniles of males and females and for adults of males and females showed that there is significant difference in the regression coefficients. The regression equations are:

Males (juveniles) : CL = -0.2157 + 0.2166 TL(r=0.984)

Females (juveniles) : CL = -1.9900 + 0.2407 TL(r=0.975)

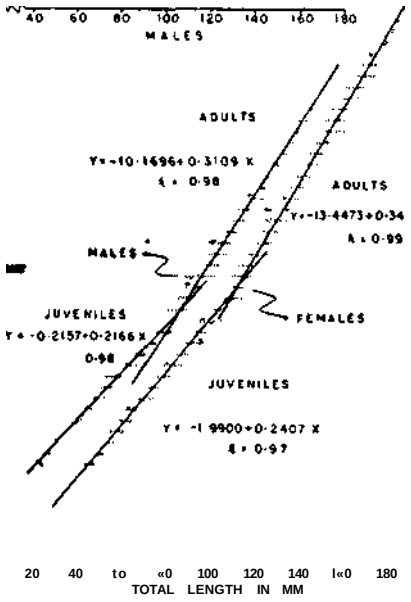

Fig. 3. Total length—carapace length relationship of *M. monoceros* from Kakinada coast.

Males (adults)	CL = -10.1696 + 0.3109 TL (r=0.983)
Females (adults)	CL = 13.4473 + 0.341 lTL (r=0.988)

Calculated straight lines for these relationship are presented in Figure 3. In all the cases a high degree of correlation was observed.

Total weight—tail weight relationship

A total of 146 males ranging in total weight from 4.2 g to 24.4 g and 228 females ranging in total weight from 1.7 g to 47.5 g were analysed for this study. A preliminary plot of the data separately for males and females indicated a linear relationship.

TABLE 1. *Conversion table for commercial counts of* M. monoceros

Total weight in grams	No. per kg	Tail weight in grams	No. per kg
2	500	1.08	926
4	250	2.49	402
6	167	3.90	256
8	125	5.30	189
10	100	6.71	149
12	83	8.12	123
14	71	9.52	105
16	63	10.93	91
18	56	12.34	81
20	50	13.75	73
22	45	15.15	66
24	42	16.56	60
26	38	17.97	56
28	36	19.37	52
30	33	20.78	48
32	31	22.19	45
34	29	23.60	42
36	28	25.00	40
38	26	26.41	48
40	25	27.82	36
42	24	29.23	34
44	23	30.63	33
46	22	32.04	31
48	21	33.45	30
50	20	34.85	29

Analysis of covariance showed that there is no significant difference between the two regression lines of males and females. Thus the single equation representing the total weight—tail weight relationship in both sexes is:

$$Y = -0.3260 + 0.7036\ X \quad (r = 0.996)$$

Coversion tables showing total weight, tail weight and count per kg are given in Table 1.

DISCUSSION

George (1959) derived the relationship between total length and total weight for juveniles ranging from 25 mm to 105 mm in total length as: W = 0.01989 L ^{1}-7«°>. This is quite different from what has been derived in the present study. Rajyalakshmi (1961) calculated two different relationships for *M. brevicornis*, one for O-year group and another for older groups but combined the two sexes in each case. Hall (1962) calculated the carapace length—weight relationship for a number of Indo-Pacific penaeid prawns. He also fitted a combined equation irrespective of sexes. Klima (1969) studying the length—weight relationship of *Hymenopenaeus robustus* from the Gulf of Mexico found that the regression lines for males and females were significantly different. Similar observation was made by Fontaine and Neal (1971) in respect of *Penaeus setiferus, P. aztecus* and *P. duorarum.*

The present study also corroborates that separate equations are necessary to describe the length-weight relationship in M. *monoceros.* It is not possible to compare the present results with the previous works in the Indo-Pacific region as the two sexes were not treated separately. It is noted that the male is heavier than the female upto a total length of 77 mm and thereafter the female is heavier than the male for a given length. At this length (77 mm) juveniles from estuaries move to inshore waters and the maturation process starts. The gonads in females is heavier than those in the males and hence after this stage females become heavier than males.

In the present study total length—carapace length relationship indicated a change in the slopes of the regression line at 100 mm and 110 mm for males and females respectively. It has been recorded that males and females attain sexual maturity at these lengths (Rao, 1985). It would therefore appear that the growth rate of carapace changes at ;the time of maturity. Similar observations jwere made by Anderson and Lindner (1971) iia the case of *H. robustus* from the Gulf of Mexico. However, Ramamurthy and Manick-!raja (1978) studying the total length—carapace length relationship in *M. dobsoni*, *M. qffints* and *P. stylifera* did not find any change in the growth rate of carapace at the time of maturity. The studies of Sukumaran and Rajan (1981) on *Parapenaeopsis hardwickii* again did not indicate any change in the relationship between juveniles and adults.

ACKNOWLEDGEMENTS

I wish to thank Dr. B. Krishnamoorthi, Emeritus Scientist, Central Marine Fisheries Research Institute and Prof. K. Hanumantha Rao, Department of Zoology, Andhra University for guidance and Dr. P.S.B.R. James, Director, Central Marine Fisheries Research Institute for his encouragement

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