

Morphometry and conversion factors in the sand lobster *Thenus orientalis* (Lund) from Bombay waters*

L.M. KABLI¹ AND P.V. KAGWADE²

Bombay Research Centre of Central Marine Fisheries
Research Institute, Mumbai — 400 001, India

ABSTRACT

The Sand lobster *Thenus orientalis* exhibits linear relationship between carapace length and total length and between abdominal weight and total weight. The relationship is exponential in the case of total length with total weight and with abdominal weight, and of carapace length with abdominal weight.

Introduction

Length measurements of crustaceans, especially of prawns and lobsters, taken by various workers are not uniform. Some take total length and others carapace length. The difficulty faced in comparing the results of different workers can be overcome if the morphological relationship between the various characters are known. Conversion factors obtained from such relationship have applied utility. In the case of length and weight, traders and processors can estimate the weight of tail or abdomen that can be realised from the known weight of the prawn or lobster catches.

Templeman (1935) studied the relationship between carapace length and

width of the second abdominal segment in *Homarus americanus* to determine maturity. Later on, morphological relationships have been described in *Jasus lalandii* by Fielder (1964), in *Panulirus homarus* and *J. lalandii* by Heydorn (1969) and in *P. homarus* by Berry (1971). Conversion factors have been worked out for the first time for the various sets of morphological characters in an Indian rock lobster *Panulirus polyphagus* by Kagwade (1987). However, so far no information is available with regard to the morphometric relationships in the case of sand lobster *Thenus orientalis* which has export value. Hence, these relationships have been studied and conversion factors determined for five sets of variables.

* This paper formed part of the thesis for the award of Ph.D. degree to the first author by the University of Bombay.

Present address : 1. Zoology Department Bhavan's H. Somani College of Arts and Science, Mumbai - 400 007. 2. 129, Aakash Darshan, Vakola Masjid, Santa Cruz (E), Mumbai - 400 055.

Materials and methods

Specimens of *T. orientalis* were collected from the trawler landings at New Ferry Wharf in Bombay during January 1985 to December 1986. Total length and carapace length in mm and total weight and abdominal weight in g were noted down separately for males and females. Number of specimens taken and their size ranges against each of the morphological relationships are given in Table 1.

Various body measurements are defined and denoted as follows:

1. **Total length (TL)** : Distance between the notch in the carapace in front and the posterior margin of the telson behind.
2. **Carapace length (CL)** : Distance between the notch in front and the posterior margin of the carapace behind.
3. **Total weight (TW)** : Weight of the entire animal, ovigerous females are excluded.
4. **Abdominal weight (AW)** : Weight of tail region after cutting the abdomen off at the anterior edge of the first abdominal segment; ovigerous females are excluded.

Results and discussion

Scatter diagrams indicate linear relationship between carapace length and total length and between abdominal weight and total weight and exponential relationship between total length and total weight, total length and abdominal weight and carapace length and abdominal weight.

Conversion factors for different relationships are derived by making use of the linear regression equation: $Y = a + b_x$ and the exponential equation: $W = aL^b$ in the logarithmic form \log

TABLE 1. Sex-wise number of specimens and their size ranges for different morphometric relationships in *T. orientalis*

Morphometric relationships	Sex	No. of specimens	Size range (mm)	Weight range (g)
Carapace length and total length	Male	505	52-205	10-355
	Female	394	78-227	30-470
Abdominal weight and total weight	Male	317	60-205	15-355
	Female	275	78-227	30-470
Total length and total weight	Male	444	52-205	10-355
	Female	332	78-227	30-470
Total length and Abdominal weight	Male	398	60-205	15-355
	Female	306	78-227	30-470
Carapace length and Abdominal weight	Male	329	60-205	15-355
	Female	360	78-227	30-470

$W = \log a + b \log L$ wherein the constants a and b have been calculated by the method of least squares. Sex-wise conversion factors and the correlation coefficient (r) for these relationships are given below:

1. Carapace length and total length

$$\begin{aligned} CL &= -0.4047 + 0.4361 TL \\ r &= 0.9626 \end{aligned} \quad \left. \vphantom{\begin{aligned} CL &= -0.4047 + 0.4361 TL \\ r &= 0.9626 \end{aligned}} \right\} \text{males}$$

$$\begin{aligned} CL &= 4.8053 + 0.3832 TL \\ r &= 0.9801 \end{aligned} \quad \left. \vphantom{\begin{aligned} CL &= 4.8053 + 0.3832 TL \\ r &= 0.9801 \end{aligned}} \right\} \text{females}$$

Carapace length calculated using these equations for different total lengths (Fig. 1) shows that males have slightly smaller carapace length than the females before reaching maturity. Difference in the carapace lengths of male and female juveniles is 2.56 mm at the total length of 50 mm. At 100 mm of total length both the sexes have carapace length of almost the same size. In the

higher lengths the differences in them range from 1.4 mm at 125 to 9.33 mm at 275 mm of total length.

2. Abdominal weight and total weight

$$\begin{aligned} AW &= 5.6541 + 0.3732 TW \\ r &= 0.9420 \end{aligned} \quad \left. \vphantom{\begin{aligned} AW &= 5.6541 + 0.3732 TW \\ r &= 0.9420 \end{aligned}} \right\} \text{males}$$

and

$$\begin{aligned} AW &= 0.4100 + 0.4365 TW \\ r &= 0.9744 \end{aligned} \quad \left. \vphantom{\begin{aligned} AW &= 0.4100 + 0.4365 TW \\ r &= 0.9744 \end{aligned}} \right\} \text{females}$$

Fig. 2 shows that in very small lobsters the abdominal weight in males is slightly more than in females. When the total weight is 20g, the difference in the abdominal weights of the two sexes is 3.98 g. The difference reduces to 0.81 g when the total weight is 70 g. As the female grows in size, the abdomen becomes heavier. There is a difference of 30.20 g in the abdominal weights of the two sexes at the total weight of 560 g.

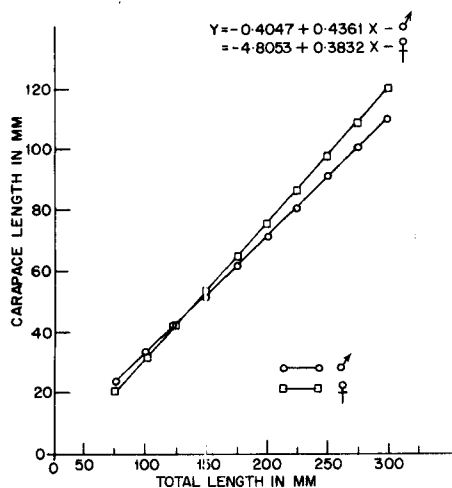


Fig. 1. Relationship between carapace length and total length in *T. orientalis*.

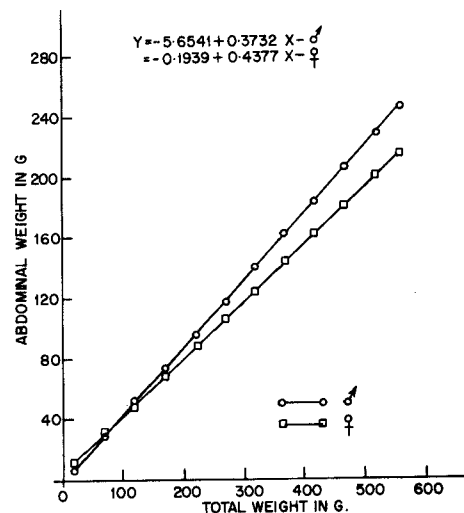


Fig. 2. Relationship between abdominal weight and total weight in *T. orientalis*.

3. Total length and total weight

$$\left. \begin{aligned} \text{TW} &= 0.0001964 \text{ TL}^{2.7013} \\ \text{or } \log \text{ TW} &= -3.7069 + 2.7013 \log \text{ TL} \\ r &= 0.9189 \end{aligned} \right\} \text{ males}$$

and

$$\left. \begin{aligned} \text{TW} &= 0.0001150 \text{ TL}^{2.7938} \\ \text{or } \log \text{ TW} &= -3.9393 + 2.7938 \log \text{ TL} \\ r &= 0.9578 \end{aligned} \right\} \text{ females}$$

In all the sizes males weigh marginally heavier than the females (Fig. 3). The differences in the total weight between the two sexes ranged from 1.21 g at 50 mm and 11.85 g at 275 mm of total length.

4. Total length and abdominal weight

$$\left. \begin{aligned} \text{AW} &= 0.0001252 \text{ TL}^{2.6105} \\ \text{or } \log \text{ AW} &= -3.9023 + 2.6105 \log \text{ TL} \\ r &= 0.9118 \end{aligned} \right\} \text{ males}$$

and

$$\left. \begin{aligned} \text{AW} &= 0.00004064 \text{ TL}^{2.8234} \\ \text{or } \log \text{ W} &= -4.3910 + 2.8234 \log \text{ TL} \\ r &= 0.9601 \end{aligned} \right\} \text{ females}$$

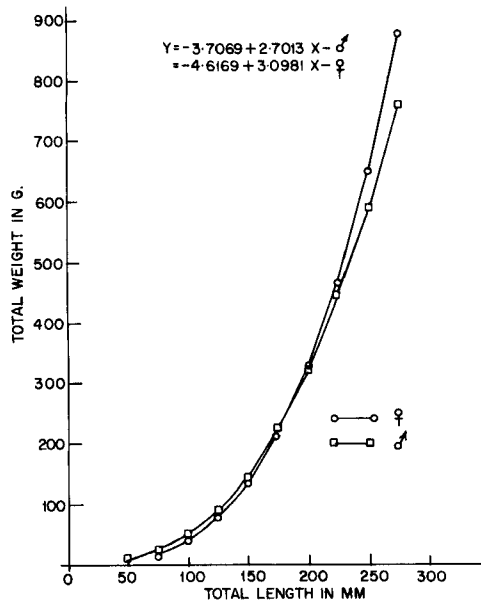


Fig. 3. Relationship between total length and total weight in *T. orientalis*.

Fig. 4 indicates that the abdomen of males is slightly heavier than of females upto about 200 mm total length. The marginal differences between them in smaller sizes ranged from 0.86 g at 50 mm to 3.41 g at 150 mm total length. Thereafter, the differences in the abdominal weight of the two sexes gradually drop till about 200 mm and beyond this length the females have heavier abdomen. At the total length of 275 mm, the difference in the abdominal weights of the two sexes is about 21.31 g.

5. Carapace length and abdominal weight

$$\left. \begin{aligned} \text{AW} &= 0.003051 \text{ CL}^{2.3703} \\ \text{or } \log \text{ AW} &= -2.5155 + 2.3703 \log \text{ CL} \\ r &= 0.9052 \end{aligned} \right\} \text{ males}$$

and

$$\left. \begin{aligned} \text{AW} &= 0.004257 \text{ CL}^{2.3032} \\ \text{or } \log \text{ AW} &= -2.3709 + 2.3032 \log \text{ CL} \\ r &= 0.9317 \end{aligned} \right\} \text{ females}$$

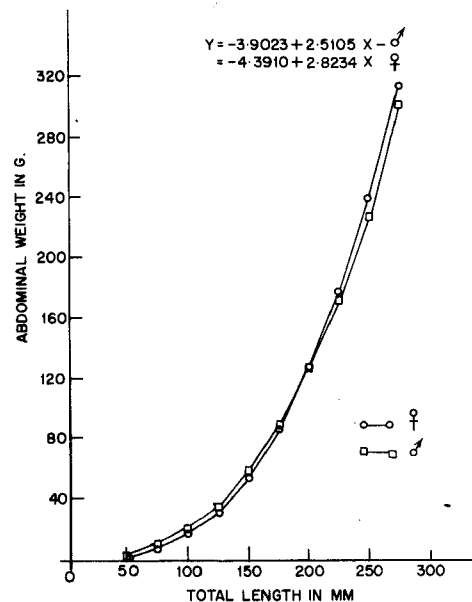


Fig. 4. Relationship between total length and abdominal weight in *T. orientalis*.

It is noticed that the difference in abdominal weight at different carapace lengths is marginal in the two sexes (Fig. 5). However, the weight was always on the higher side with the females.

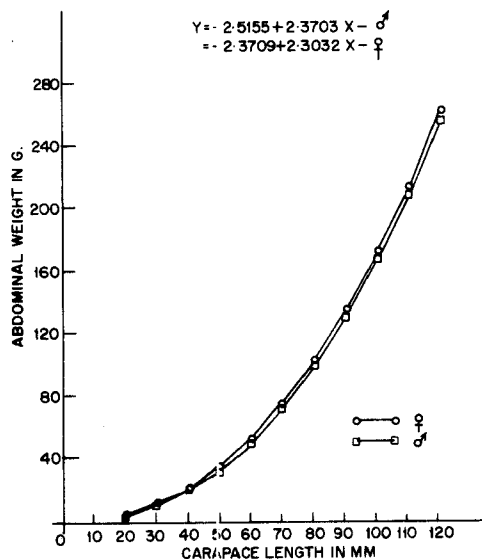


Fig. 5. Relationship between carapace length and abdominal weight in *T. orientalis*.

It is clear from the above that the difference in all the morphological relationships between the two sexes of *T. orientalis* is very narrow. Males have shorter carapace length than the females till the size at maturity and thereafter it elongates. In the total weight and abdominal weight relationship, the abdominal weight of the female which is slightly lower than that of the males in smaller sizes, increases narrowly to higher than of males in longer sizes. Relation of the total length with total weight shows a little lower weight for females than for males while

the relation between carapace length and abdominal weight shows slightly more weight in females than in males. Total length and abdominal weight relationship shows slightly higher weight for females in higher sizes.

It is noted that the differences in the values of all these relationships are so narrow between the two sexes that they may not be of any practical use to consider them separately. Thus, the traders can group them all into one lot. The observations noticed here differ greatly from the findings in spiny lobsters made earlier by Fielder (1964) in *J. lalandii*, Heydorn (1969) in *P. homarus* and Kagwade (1987) in *P. polyphagus*. The spiny lobsters studied above have shorter carapace length in males than in females till the size at maturity and thereafter it elongates. All the weight relationships except that of carapace length and abdominal weight have indicated that males are heavier than females upto a certain length, after which the females become heavier with the increase in length. The carapace length of the males increases with maturity in order to accommodate the highly convoluted vas deferens while the abdominal length in females increases with length in order to carry a large number of eggs on the pleopods. The vas deferens in *T. orientalis* is less convoluted and the number of eggs carried on the pleopods also vary much less than in spiny lobsters. Possibly these are the reasons for not having well pronounced differences in the various morphometric relationships between the two sexes of this species. Moreover, unlike the spiny lobsters wherein males grow to a much larger size than the females, the two sexes in *T. orientalis* grow to almost similar size, the largest

male recorded being 277 mm and female, 275 mm, (Kagwade and Kabli, 1990 MS).

Acknowledgement

The authors are grateful to Dr. P.S.B.R. James, former Director, C.M.F.R. Institute for providing all facilities to carry out this investigation.

References

- Berry, P.F. 1971. The biology of the Spiny lobster *Panulirus homarus* (Linnaeus) off the east coast of southern Africa. *S. Afr. Oceanogr. Res. Inst. Invest. Rep.*, No. 28 : 1-75.
- Fielder, D.R. 1964. The Spiny lobster *Jasus lalandii* (H. Milne-Edwards), in South Australia. II - Reproduction. *Aust. J. Mar. Fresw. Res.*, 15 : 133-144.
- Heydorn, A.E.F. 1969. Notes on the biology of *Panulirus homarus* and on length-weight relationships on *Jasus lalandii*. *S. Afr. Liv. Sea Fish. Invest. Rep.*, No. 69 : 1-22.
- Kagwade, P.V. 1987. Morphological relationships and conversion factors in spiny lobster *Panulirus polyphagus* (Herbst) from the northwest coast of India. *Indian J. Fish.*, 34 (3) : 348-352.
- Kagwade, P.V. and L. M. Kabli. 1990. MS. Age and growth of sand lobster *Thenus orientalis* (Lund) from Bombay waters.
- Templeman, W. 1935. Local differences in the body proportions of the lobster *Homarus americanus*. *J. Biol. Bd. Can.*, 1 : 213-226.