# MORPHOLOGICAL RELATIONSHIPS AND CONVERSION FACTORS IN SPINY LOBSTER *PANULIRUS POLYPHAGUS* (HERBST) FROM THE NORTHWEST COAST OF INDIA

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ABSTRACT

Conversion factors have been determined for 5 sets of variables, namely carapace length and total length, abdominal weight and total weight, total length and total weight, total length and abdominal weight and carapace length and abdominal weight. The relationship between the first 2. sets of variables was found to be linear and the other 3 sets, exponential. Carapace is longer in male than in female. The female has a shorter carapace and hence a longer as well as heavier abdomen, whereas the total weight is more in male than in female.

The morphological relationships between the variables total length and carapace length and total weight and abdominal weight are largely used for the applied purposes. The measure of carapace length is used by some workers and total length by others in biological studies, making it difficult to compare the results. Hence, an attempt is made in this note to bring out suitable conversion factors for the different morphological relationships of *Panulirus polyphagus.*

Specimens of *P. polyphagus* were obtained from the trawler landings at Sassoon Dock and Kasara Bunder during 1977 and 1978. All the measurements* and weights from fresh specimens were taken separately for males and females. The number of specimens and their size ranges against each of the morphological relationships are given in Table 1.

The scatter diagrams indicated linear relationships between carapace length and total length and between abdominal weigh and total weight, exponential relationship was indicated between total length and total weight, total length and abdominal weight and between carapace length and abdominal weight.

* Measurements were made to the nearest mm and gram and are defined and denoted as: Total length (TL): distance between the transverse ridge in between the supra-orbital horns in front and the tip of telson behind; Carapace length (CL): d'.stance between the transverse ridge in between the supra-orbital horns in front to the posterior extremity of the cephalothorax; Total weight (TW): weight of the whole animal excluding eggs in ovigerous females; and Abdominal weight (AW): weight of the abdomen cut off at the anterior edge of the first abdominal segment.

TABLE 1. *Sex-wise number of specimens^ their size-ranges and the test used for the different morphometric relationships in* P. polyphagus.

| Morphometry relationships | Sex | No. of Specimens | **Size range (mm)** | Test |
|---|---|---|---|---|
| Carapace length and | Male | 490 | **133-343** | Chi-square |
| Total length | Female | 329 | **94-343** | |
| Abdominal weight and | Male | **382** | **135-343** | |
| Total weight | Female | 279 | **127-343** | |
| Total length and | Male | 673 | **83-346** | Correlation coefficient |
| Total weight | Female | 552 | **71-343** | |
| Total length and | Male | 382 | **135-326** | |
| Abdominal weight | Female | **281** | **135-343** | |
| Carapace length and | **Male** | **352** | **59-142** | |
| Abdominal weight | **Female** | 244 | **50-142** | |

By using the linear regression equation Y — a 4- bx, the linear relationship and, by using the exponential equation W - a Lb,the exponential relationship were determined. The exponential relationship was used in the logarithmic form Log W = log a + log L for calculating the weights. In all these 3 cases, the constants a and b were calculated by the method of least squares. Chi-square test for the linear relationships and the correlation coefficient worked for the exponential relationships indicated that the relationships determined in the present study were all significant at 5% level. Lengths and weights calculated with the help of the above formulae were used to prepare graphs (Figs. 1 to 4).

*Carapace and total length:* The linear relationshp between these two lengths is expressed by the formulae:

CL - 6.4550 + 0.4074 TL for males and
CL =• 5.7934 + 0.3946 TL for females.

The carapace length calculated for different lengths at 50 nun and above and presented in Fig. 1 showed that the males have longer carapace length than the females. In other words females have shorter carapace and longer abdomen. The difference in the carapace length in the two sexes ranges from 1.30 mm at the total length of 50 mm to 5.14 mm at 350 mm.

*Abdominal weight and total weight:* The linear relationship between these two weights is expressed by the formulae:

AW - 1.5 = 0.38 TW for males and
AW =— —2.99 + 0.43 TW for females.

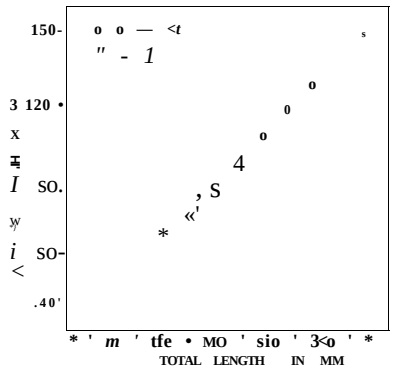


FIG. 1. Relationship between total length and carapace length in *P. polyphagus.*

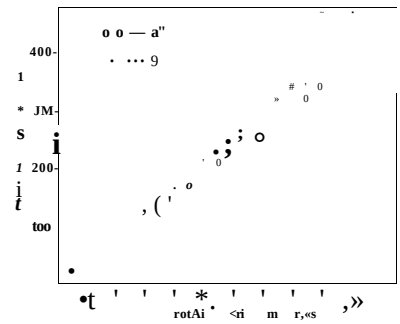


**FIG.** 2. **Relationship between** abdominal weight and total weight in JFM; *polyphagus.*

The calculated weights (Fig. 2) showed that in very small lobsters the abdominal weight was marginally more in males than in females, the difference between them reducing to about 1 g at the increase in total weight of 100 g. After this the abdomen of the female became heavier with increase in total weight, so that, at a total weight of 1050 g, the difference in abdominal weight between the two sexes w.-s around 48 g.

*Total length and total weight:* The exponential relationship between the two variables total length and total weight is expressed as:

TW = 0.00001343 TL28022
or Log TW = -4.128 -f 2.8022 log TL for males
and TW =• 0.0005127 TL2.6163
or Log TW = -3.7099 + 2.6163 log TL for females.

The calculated values plotted (Fig. 3) for total weight against total length showed that in lower lengths the females were slightly heavier than the males. The difference in the total weights for the two sexes narrowed down to about 0.39 g with the increase in length at 175 mm, after which the males became heavier. The difference in their weights widened with the increase in length. At 350 mm of total length, the male was heavier than the female by 119.05 g.

*Total length and abdominal weight:* The exponential relationship between total length and abdominal weight is expressed by the formulae:

AW = 0.00001480 TL26390
or Log AW = -4.1704 + 2.6390 log TL for males
and AW = 0.00004009 TU-MIO
or Log W = -4.6031 + 2.8310 log TL for females.

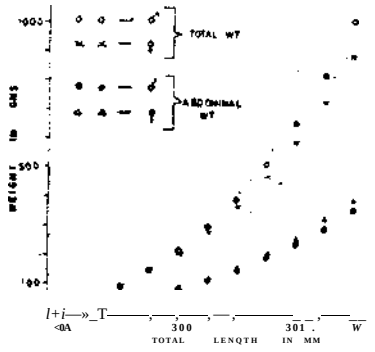
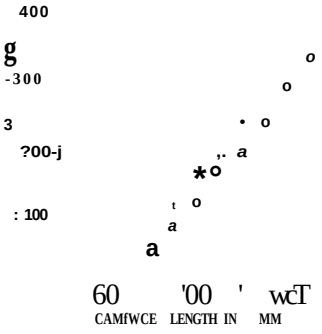



FIG. 3. Relationship between tola] length and total weight and between and abdomina weight in *P. polyphagus*.




Fl.G. 4. Relationship between carapace length and abdominal weight in *P. polyphagia*.

The calculated abdominal weights against the total lengths (Fig. 3) showed the reverse of the findings on relationship between total length and total weight. The abdomen of the male was slightly heavier than of the female in lower lengths. The difference in the weights of male and female reduced with the increase in length. As in the earlier relationship the difference narrowed at 175 mm to 0.27 g. Thereafter, the abdomen of the females become increasingly heavier with increasing length. At the total length of 350 mm, the difference in the abdominal weights of the two sexes was 47.8 g.

*Carapace length and abdominal weight:* The exponential relationship between the carapace length and abdominal weight is expressed by the formulae:

AW = 0.0001468 CL2-6077
or Log AW = -3.1669 + 2.6077 log CL for males
and AW - 0.0005685 CL2-9358
or Log AW - -3.7547 + 2.9358 log CL for females

The calculated abdominal weights against the carapace lengths (Fig. 4) showed that the abdominal weight of male was slightly higher than of female in lower length, the difference between them narrowing with increase in length up till 60 mm of carapace length, when the difference noticed was 0.30 g. Beyond this carapace length, the abdominal weight of the female increased with the increase in length, the maximum difference in the weight between the two sexes being about 108.55 g at the carapace length of 150 mm.

The present investigation has shown that the carapace length is more in males than in females of *P. polyphagias.* Similar observation has been made earlier by Fielder (1964) in /. *lalandii,* Heydorn (1969) in *P. homarus* and /. *lalandii* and Berry (1971) in *P. homarus.* This difference in the size of the cephalothorax and abdomen appears to have a bearing on the distribution pattern of weight in the body of the two sexes.

All the relationships concerning weight have shown that there is an unequal distribution of weight at different parts of the body with respect to sexes. In the juveniles, except for the total length and total weight relationship in which the females are heavier, all the 3 relationships of abdominal weight with total weight, total length and carapace length, have shown that males are marginally heavier than the females till a particular stage. After this, in the adult stage, the males are found to be heavier in the case of total length and total weight relationship and the females to be heavier in the case of abdominal weight relationship with the total weight, total length and carapace length. The minimum difference in the weights of males and females showing a turning point thereafter in the distribution pattern *ot* the weight may be due to the maturity of the animal. The difference in the weights in the various relationships of the two sexes is so small and negligible in the juveniles that it may be considered that both males and females grow at the same rate. Both the sexes recording the same rate of growth in length in *P. polyphagia* is reported by Kagwade (MSS) in the juvenile phase of this lobster. Thus the growth in length and weight appears to be almost identical in the two sexes during the juvenile phase of P. *polyphagus.*

In the adults, abdominal weight of the female is more than that of the male because the carapace length here is shorter and the abdomen longer to carry a large number of eggs. The carapace length of the males is more than that of the female because the reproductive organs of the male require more space. Heydron (1965) mentions that in /. *lalandii* with the onset of maturity the weight of the vasa deferentia progressively increases with the length. According to Berry (1971) the second and third walking legs in P. *homarus* elongate in direct proportion to the increase in length. The reasons attributed to by these two authors may hold good for P. *polyphagus* in exhibiting the sexual dimorphism in the distribution of the weight in the body.

## REFERENCES

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