

Short Communication

Morphometric characteristics in the horseshoe crab *Tachypleus gigas*
(Arthropoda: Merostomata)

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The relationships observed between total carapace length with carapace width, carapace weight, telson length, body weight were found statistically significant ($p < 0.05$) in the male and female horseshoe crab, *Tachypleus gigas* (Muller). In females, increase in weight was found to follow the cube law strictly. The carapace width grew faster at higher carapace length in females whereas, carapace weight in males was more at lower carapace. In general, a proportional increment in morphometry was seen with increase in age.

Allometry is described as the study of relationship between difference in one body parameter to the other. The allometric relationship provides an important information regarding comparative growth of various body parameters. A proper understanding of allometry in shell and soft body parts of horseshoe crab is essential to define the growth of a species. The morphometric characters and their allometric relationship are to a large extent influenced by age, local environmental conditions and population density of the species^{1,2}. In this study we have applied allometric relationship to the horseshoe crab, *T. gigas* to establish the ratios between any two parameters at one time. It is known that animals changing their body proportion may also change their shape. The use of regression analysis to explain such relationship between various morphometric characters are found to be most suitable^{3,4}. The present study was therefore, taken up primarily to examine how best the concept of allometry fits to this species.

The specimens of the horseshoe crab, *Tachypleus gigas* (Muller) (Arthropoda: Merostomata) were collected from Balaramgari, Orissa (lat. 21° 17' N; long. 87° 00' E) from June, 1995 to June, 1996. Fortnightly samples of 12-15 specimens were collected and examined for various morphological characters. A total number of 220 specimens were examined for the study. Specimens were measured with the help of Vernier Caliper to 0.1 mm accuracy, for length of prosoma (a); length of opithosoma (b); length of telson (c); and width of prosoma (d). The allometric and morphometric analysis were followed as described by Chatterji *et al.*⁵.

Carapace length - total length relationship (Fig 1A) was linear, with a high degree of correlation ($r = 0.87$), indicating that the carapace length increases proportionately with the gradual increase of total length. Carapace width - total length relationship is linear showing that the carapace width increase proportionately with advancement of total length (Fig 1B). Telson length-total length relationship highlighted a proportionate increase in telson length to the total length (Fig. 1C). Body weight - total length relationship was observed to be linear (Fig. 1D). The rate of body weight increase was of higher magnitude than that of total length. The body weight increased very sharply in the length range of 300-400 mm. The relationship between carapace width and carapace length was linear with a very high degree of correlation ($r = 0.95$), implying that the increase in carapace width to carapace length was proportionate (Fig. 2A). Body weight - carapace length shows that sharp increase in body weight was observed, the carapace length increased marginally in the specimens in the size range of 100-200 mm and the relationship was linear (Fig. 2B). Body weight - carapace width relationship (Fig. 2C) was found to be of same nature as in the case of body weight and carapace length. The increase in body weight was associated with carapace length and width with equal degree of correlation.

The concept of allometry was first postulated by Huxley & Tessier⁶ and since then it has been extensively applied by many biologists to estimate the population growth characteristics of multitude organisms. Chatterji *et al.*⁵ reported the length and

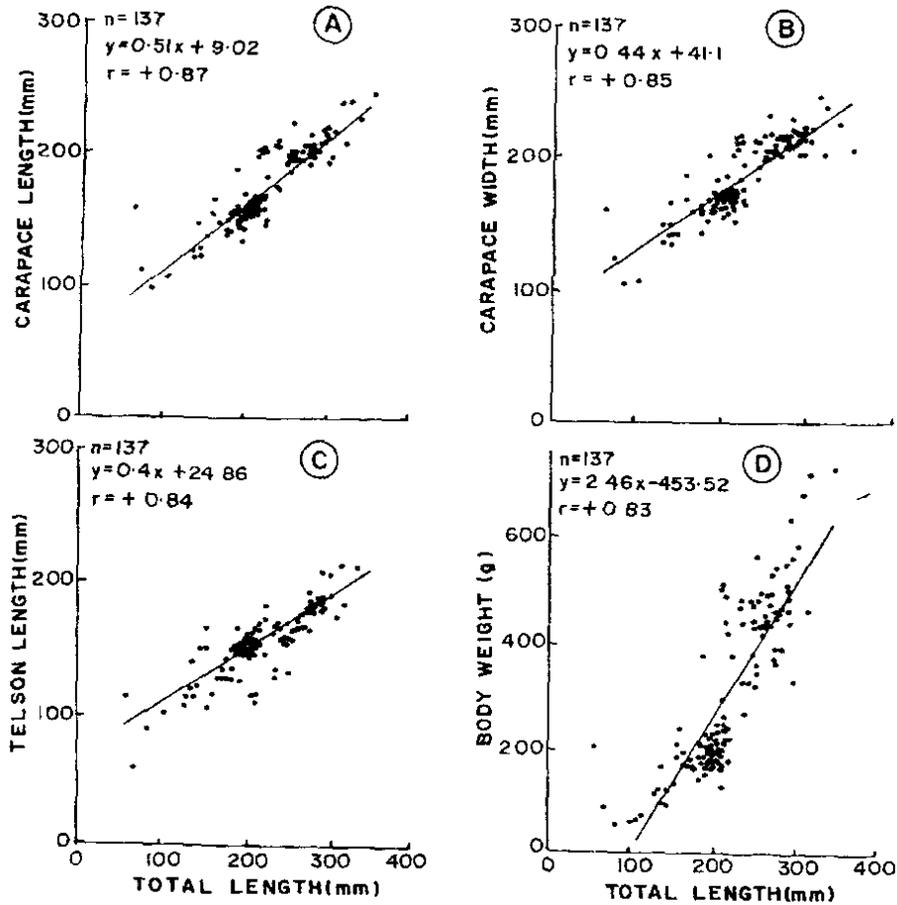


Fig- 1 —Regression relationship between — A: Carapace length and total length, B: Carapace width and total length, C: Telson length and total length, D: Body weight and total length.

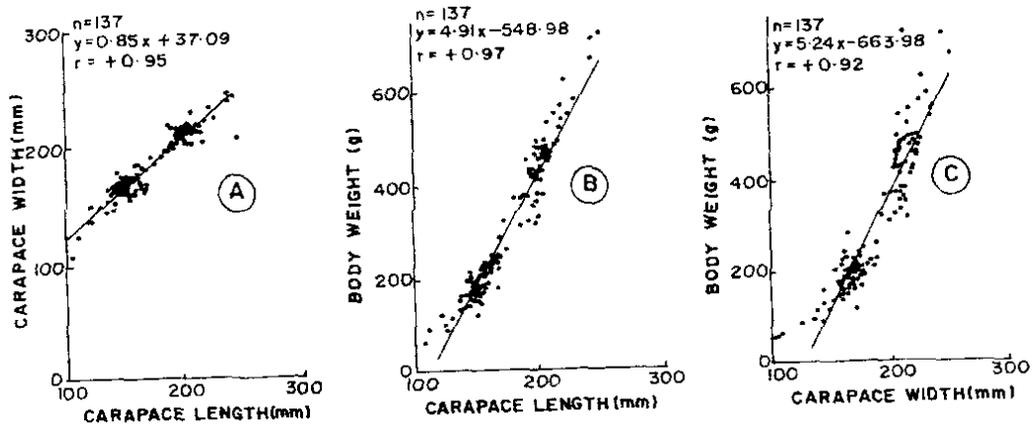


Fig. 2 — Regression relationship between — A: Carapace width and carapace length, B: Body weight and carapace length, C: Body weight and carapace width.

weight relationship of *Carcinoscorpius rotundicauda* (Latreille). This study suggests that allometric relationship in horseshoe crab plays an important role in understanding comparative morphometry. This study also emphasizes that care must be taken to apply morphometric for a uniform size group of

horseshoe crab populations. It is known that the changes in the form of an animal cannot be described satisfactorily by such relationships. They are, however, useful in comparison of carapace/shell dimension of animals of known size within a locality which is a primary concern of such a study. An

understanding of the allometric relationship in shell/carapace and soft body parts is therefore, essential to understand the growth of a species.

The carapace length-total length suggests a linear relationship between these parameters. Carapace width-total length relationship was found to be proportionate and uniform as also indicated by linear relationship. It appears, therefore that the energy gained by these crabs from ingested food gets evenly distributed in the body building processes.

Telson length-total length relationship indicated a linear relationship and found proportionately increasing, thus suggesting uniform growth pattern of body dimensions with the advancement of growth. The relationship between body weight and total length was linear. In general, the rate of increase of body weight was of highest magnitude than that of the total length. In the length range 300-400 mm, the weight increased sharply. The increase in the soft body parts could probably be due to increased feeding efficiency and food availability to horseshoe crabs.

Carapace width and carapace length relationship also showed a proportionate increment in these parameters. The ratio of carapace width length increasing with the increase in the age of horseshoe crab, suggests that as the animals grow older, they become wider and many a times carapace width exceeds carapace length. Higher increase in body weight was associated in the animal's groups with carapace length range of 100-200 mm. This could probably be due to increased soft tissue (e.g. ovary and testes) and also increased availability of food.

Although the data analysed during this study was not of a greater magnitude, it is still possible to infer that the allometric relationship among various parts of the body is functionally important in the biology of the organism and particularly serve as a predictive tool for ecological investigations. The changes in body dimensions of the *T.gigas* population indicate that the relationship could indirectly be influenced by population density, feeding efficiency, food availability and local environmental conditions.

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