MORPHOMETRIC CHARACTERS OF THE SESARMID CRAB, *Neoepisesarma brockii* (DE HAAN, 1887) FROM A TROPICAL ESTUARY, SOUTH WEST COAST OF INDIA

A.R. NIKHILA KHANNA[a], ANEYKUTTY JOSEPH[b1] AND ALPHI KORATH[c]

[ab]School of Marine Sciences, Cochin University of Science and Technology, Fine Arts Avenue, Cochin, Kerala, India
[c]Kerala University of Fisheries and Ocean Studies, Panangad, Cochin, Kerala, India

ABSTRACT

The interrelationship between morphometric characteristics and relative growth of the sesarmid crab *Neoepisesarma brockii* collected from the Cochin estuary from June 2016 to May 2017 was studied. A total of 896 individuals of *N. brockii* were analysed, being 446 males and 450 females. Morphometric characters *viz.,* carapace width, carapace length, sternum width, abdomen width, propodus length and body weight of male and female were taken. The data were plotted and regression equations were calculated by the equation Y= a + b X, where X= carapace width or carapace length as the case may be and Y the other morphometric characters such as sternum width, abdomen width and propodus length. In male, carapace width (r^2 = 0.728) and carapace length (r^2 = 0.6848) had the highest r^2 value with sternum width. In female, carapace width (r^2 = 0.8048) and carapace length (r^2 = 0.7708) had the highest r^2 value with sternum width. The interrelation between the set of characters suggested that, the relationship was positive and highly significant in both the sexes. Analysis of Covariance was done to check whether there exists any significant difference between male and female with respect to growth. Relationship between abdominal width and body weight was significantly different between the sexes. No difference was observed between the sexes in the case of carapace width, carapace length, sternum width with body weight. In all the cases growth was found to be allometric.

KEYWORDS: *Neoepisesarma brockii;* morphometric measurements; length/width – weight relationships; linear regression analysis; allometric growth; Cochin estuary

Neoepisesarma brockii is a major species of sesarmid crab in mangrove ecosystem of Cochin estuary, located at the south west coast of India. The objective of the present study was to determine the interrelation between the various morphometric characters and length/width - weight relationship in males and females.

MATERIALS AND METHODS

Crabs for the present study were collected from the southern region of Cochin estuary, for a period of one year from June 2016 to April 2017. The crabs were captured using knots made of rachis of coconut leaflet and simply by hand picking. A total of 896 individuals (males and females) was analysed. The measurements were made for carapace width, carapace length, sternum width, abdomen width, propodus length and body weight, separately for each sex. Vernier caliper with an accuracy of 0.1mm were used for length measurements, and total weight of the crab was determined to nearest gram using a digital balance. Monthly samples were segregated based on their carapace width and recorded with an interval of 2 mm (Keenan *et.al.;*1998).

Morphometric analysis was done by linear regression equation Y= a + b X, where X= carapace width or carapace length as the case may be and Y the other morphometric characters such as sternum width, abdomen width and propodus length (Zar; 2003). The length/width – weight relationship is represented by: $W = a\ L^b$ (Ricker; 1973), where W is total body weight of crab (g) and L is carapace length (mm) and 'a' and 'b' are constants. In this case, the exponential form was changed to linear form by considering the logarithm and plotted the graph (linear regression) for male and female. The significant difference between the regression coefficients (b) in male and female *N. brockii* was studied using Analysis of Covariance. Student's t-test was applied to study the growth pattern (Zar; 2003).

RESULTS AND DISCUSSION

A total of 896 individuals were analysed in this study. The number of small crabs (carapace width < 10 mm) obtained during sampling was comparatively less and this is mainly due to the difficulty in trapping them due to their small size and their active movement. Thus, the sample collected mainly include crabs belonging to the size group 6-32 mm among males and females. The morphometric characters *viz.,* carapace width, carapace length, sternum width, abdomen width, propodus length and body weight of male and female, respectively were measured during the study period from June 2016 - May 2017. The observation of monthly variation in carapace width in male and female ranged between 8 – 32 mm.

[1]Corresponding Author

Interrelationship between different morphometric characters

Statistically well supported relations were found for almost all the measured morphometric characters. In male, carapace width (r^2 =0.728) and carapace length (r^2 = 0.6848) had the highest r^2 value with sternum width (Figure 1 and Figure 2). In female, carapace width (r^2 = 0.8048) and carapace length (r^2 =0.7708) had the highest r^2 value with sternum width (Figure 3 and Figure 4). The morphometric relation between the set of characters studied suggested that in all cases the relationship was positive and highly significant in both male and female (T - 1).

The observations from the present study is in agreement with the findings of Josileen (2011), who reported that the allometric relationships between the characters are positive and highly significant in *Portunus pelagicus*. Kock *et al*. (2011) also pointed out a statistically well supported relation between almost all of the morphometric characters of Mediterranean green crab (*Carcinus aestuarii)*. They reported that the regression analyses between carapace width, carapace length and wet weight for males, females, and both sexes combined which shows a high positive linear relationship between these variables. Ribeiro *et al*. (2013) observed the allometric growth of *Sesarma rectum* and reported that the growth of abdomen width was positively allometric in the beginning of development and, after the puberty molt, it became slightly positive, practically isometric. Males and females showed positive allometry between carapace width and abdomen width and carapace length. Similar trend was also observed in the present study *ie.* the relation between the morphometric characters were found to be positive and significant.

Relationship between length/width and body weight

Analysis of Covariance was performed to study the significant difference between sexes. In this study, it was observed that the relation between abdomen width and body weight were significantly different and hence regression lines were set separately for male and female (Figure 5 and Figure 6). The other parameters such as carapace width and body weight, carapace length and body weight, sternum width and body weight were observed to be insignificant. Therefore, the regression was set for pooled data (Figure 7, Figure 8, and Figure 9).

The scatter diagram for males and females was obtained by plotting body weight against carapace width, carapace length, abdomen width, sternum width. In this case, the exponential form was changed to linear form by considering the logarithm and plotted the graph (linear regression) together for male and female. The length/width – weight relation between the set of characters studied showed that in all cases the relationship was not significant in both male and female except for abdomen width and body weight. The student's- t test for length/width relationship established showed that the samples exhibited an allometric growth pattern (T – 2)

The present findings are in agreement with the observation of Sukumaran and Neelakantan (1997) in *Portunus sanguinolentus* reported that the analysis of variance indicated that there is no significant difference (p < 0.05) between sexes with respect to the carapace width-weight relationship. Contradictory results were observed in the case of Hajjej (2016) in *Portunus segnis* and of Akin Oriole *et al*. (2005) in *Cardiosoma armatum* and *callinectes pallidus*, Carvalho *et al*. (2009) in *Chaceon fenneri*. Positive significant correlations between crab body wet weights and carapace length/carapace width were also observed in case of both different size groups. From the present study, *N. brockii* shows an allometric pattern of growth. Contradictory results were observed in the case of crab species *P. sanguinolentus,* Sukumaran (1997). The exponential values (b) of the width-weight relationship in juveniles, adult males and adult females followed the cube law (b = 3.02612, 3.09969 and 2.96044) in *P. sanguinolentus* indicating there by nearly an isometric pattern of growth.

N. brockii is not an edible crab but it plays an important role in mangrove ecosystem. Morphometric feature of the crab is very much important for determining the general well-being, variation in growth with sex and size of maturity. The knowledge on this aspect will be helpful for adopting specific strategies for the conservation of this species. Protecting mangrove crabs is as important as protecting mangrove ecosystem since all these are interrelated. The result of this study would be very useful for developing their ecological conservation programs in future.

Table 1: Linear regression equation showing morphometric relationships in males and females of *N. brockii*

Independent variable (x)	Dependent variable (y)	Male (Y = a + b X)		r^2	Female (Y = a + b X)		r^2
		a	b		a	b	
Carapace width	Abdomen width	2.4641	0.3443*	0.6185	1.105	0.4284*	0.7599
Carapace width	Propodus length	2.2043	0.4942*	0.5891	3.1026	0.4219*	0.6525
Carapace width	Sternum width	2.722	0.5432*	0.728	1.31.3	0.6286*	0.8048
Carapace length	Abdomen width	3.6304	0.349*	0.5663	2.1498	0.4595*	0.7419
Carapace length	Propodus length	3.6252	0.515*	0.5699	4.052	0.4573*	0.6505
Carapace length	Sternum width	4.431	0.5581*	0.6848	2.9516	0.6679*	0.7708

* Significant at P < 0.05

Table 2: Length/width- weight relationship in males and females of *N. brockii*

| Measurements	Y = a + b X (log W = log a + b log L)		r^2	t value	Isomertric / Allometric
	a	b			
Male Abdomen width – Body weight	-1.4793	2.0268*	0.506	-17.47	Allometric
Female Abdomen width – Body weight	-1.8269	1.2869*	0.6238	-10.25	Allometric
Pooled Carapace width - Bodyweight	-1.9927	1.89	0.7211	-27.92	Allometric
Carapace length - Body weight	-1.582	1.7039	0.7407	-38.44	Allometric
Sternum width - Body weight	-1.8263	2.0207	0.6111	-18.16	Allometric

*Significant at P < 0.05
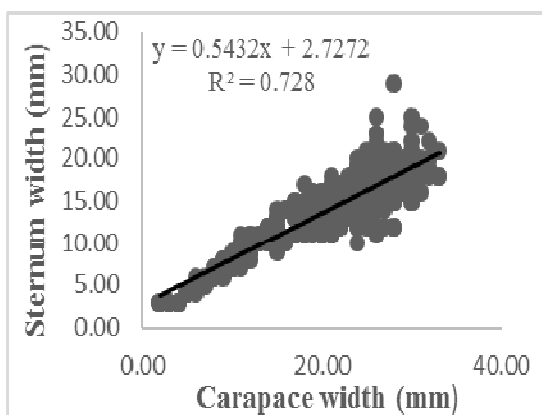
Figure 1: Linear relationship between carapace width and sternum width in male of *N. brockii*
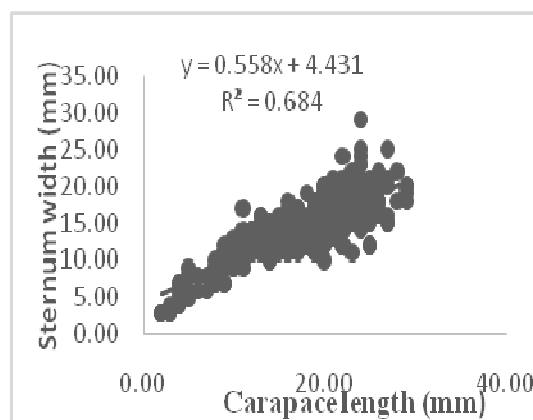

Figure 2: Linear relationship between carapace length and sternum width in male of *N. brockii*
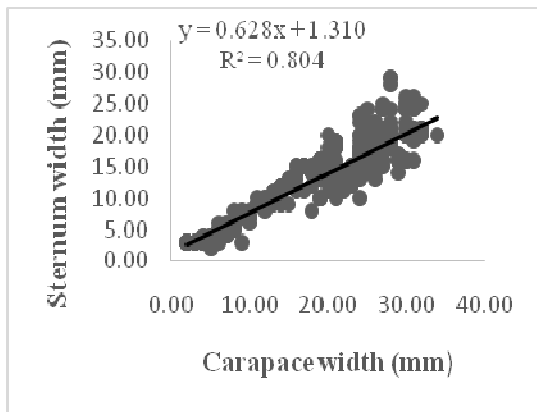
Figure 3: Linear relationship between carapace width and sternum width in female of *N. brockii*
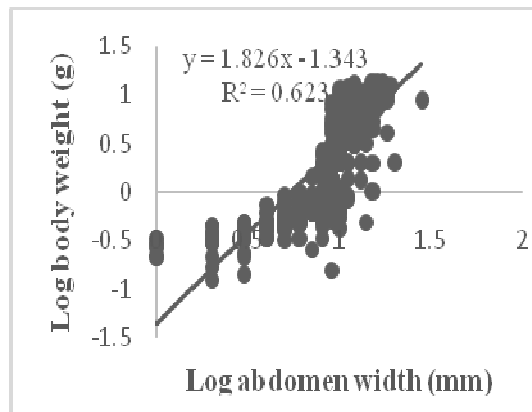

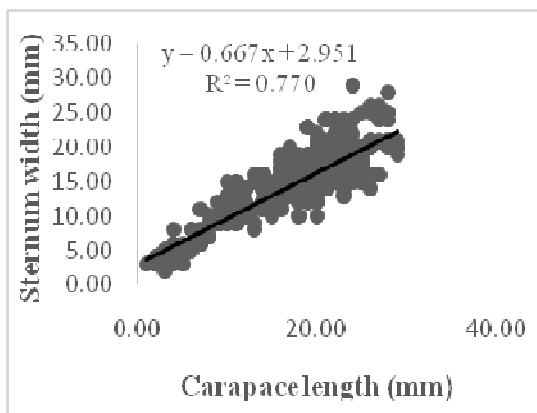**Figure 6: Linear relationship between the abdomen width and body weight in female of *N. brockii***

Figure 4: Linear relationship between carapace length and sternum width in female of *N. brockii*
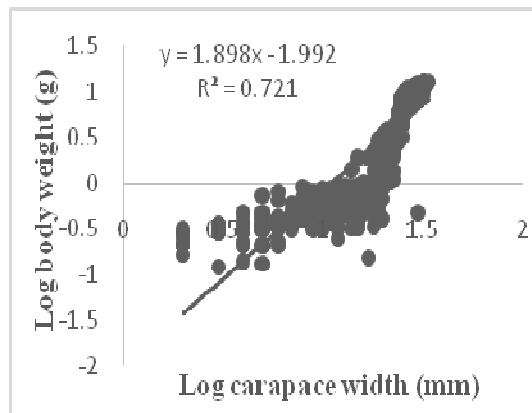

Figure 7: Linear relationship between carapace width and body weight combined in males and females of *N. brockii*
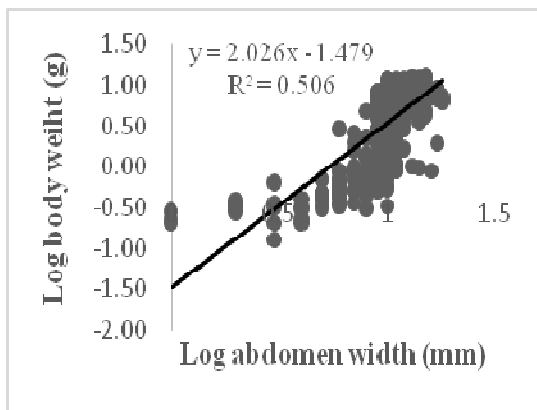

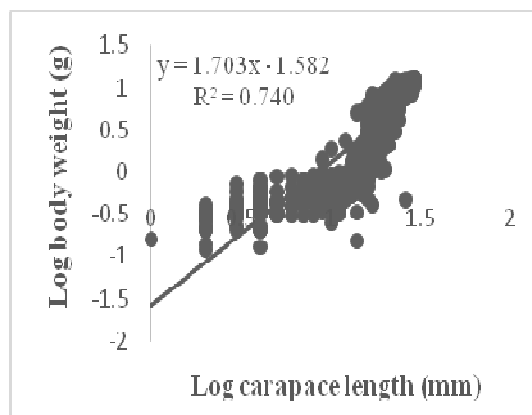**Figure 5: Linear relationship between the abdomen width and body weight in male of *N. brockii***

Figure 8: Linear relationship between carapace length and body weight combined in males and females of *N. brockii*
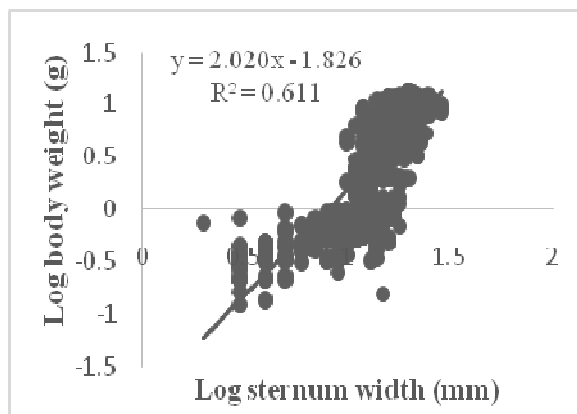
Figure 9: Linear relationship between sternum width and body weight combined in males and females of *N. brockii*

ACKNOWLEDGEMENT

REFERENCES

Akin-Oriola G., Anetekhai M. and Olowonirejuaro K., 2005. Morphometric and meristic studies in two crabs: *Cardiosoma armatum* and *Callinectes pallidus.* Turk J Fish Aquat Sci., **5**(2): 85-89.

Barros Carvalho T., Ruy de Oliveira Filho R. and Monteiro da Cruz Lotufo T., 2009. Note on the fisheries and biology of the golden crab (*Chaceon fenneri*) off the northern coast of Brazil. Lat Am J Aquat Res., **37**(3): 571-576.

Bezerra Ribeiro F., Matthews Cascon H. and Arruda Bezerra L.E., 2013. Morphometric sexual maturity and allometric growth of the crab *Sesarma rectum* Randall, 1840 (Crustacea: Sesarmidae) in an impacted tropical mangrove in northeast Brazil. Lat Am J Aquat Res., **41**(2): 361-368.

Hajjej G., Sley A. and Jarboui O., 2016. Morphometrics and length-weight relationship in the blue swimming crab, *Portunus segnis* (Decapoda, Brachyura) from the gulf of Gabes, Tunisia. Int. J. Eng. Appl. Sci., **3**(12): 10-16.

Josileen J., 2011. Morphometrics and length-weight relationship in the blue swimmer crab, *Portunus pelagicus* (Linnaeus, 1758) (Decapoda, Brachyura) from the Mandapam coast, India. *Crustaceana.,* **84**(14): 1665-1681.

Keenan C.P., Davie P.J.P. and Mann D., 1998. A revision of the genus Scylla (de Haan, 1833) (Crustacea: Decapoda: Brachyura: Portunidae). Raffles Bull of Zool., **46**: 217- 245.

Kocak C., Acarli D., Katağan T. and Özbek M., 2011. Morphometric characters of the Mediterranean green crab (Carcinus aestuarii Nardo, 1847) (Decapoda, Brachyura), in Homa Lagoon, Turkey. Turk J. Zool., **35**(4): 551-557.

Ricker W.E., 1973. Linear regression in fisheries research. J. Fish Res Board of Can., **30**(3): 409-434.

Sukumaran K.K. and Neelakantan B., 1997. Length-weight relationship in two marine portunid crabs, *Portunus (Portunus) sanguinolentus* (Herbst) and *Portunus (Portunus) pelagicus* (Linnaeus) from the Karnataka coast. Indian J. Mar. Sci., **26**(1):39-42.

Zar J.H., 1999. Biostatistical Analysis, 4th ed. Pearson education India.