SENRA Academic Publishers, British Columbia
Vol. 7, No. 2, pp. 2381-2386, June 2013
Online ISSN: 1920-3853; Print ISSN: 1715-9997

Canadian Journal of pure&applied sciences

CARAPACE WIDTH WEIGHT RELATIONSHIPS OF MUD CRAB *SCYLLA SERRATA* (FORSKAL, 1775) FROM KARACHI COAST

*Muhammed Atiqullah Khan[1] and Javed Mustaqeem[2]
[1]Department of Zoology, University of Karachi, Karachi
[2]Lasbella University of Agriculture, Water and Marine Sciences Uthal, Balochistan

ABSTRACT

The length-weight and width-weight relationship study assumes an important prerequisite in fishery biological investigations. In this study, Carapace width weight relationship of both sexes of Mud Crab (*Scylla serrata*) were estimated. A total of 938 samples ranging from 40 to 200mm in width and weighing between 22g and 450g were collected during January 2009 to December 2010, and analyzed. The value of the regression coefficient for male (2.481), female (2.632) and combined sexes (2.571) in the present analysis are very much close to 3 and therefore *Scylla serrata* does follow the cube law.

Keywords: Karachi coast, carapace width, body weight, *Scylla serrata.*

INTRODUCTION

Crabs are widely distributed on mud, estuaries and mangrove areas. . The importance of crab is increases due to their consumption, therefore, the biological studies of crabs are become significant (Levent *et al*., 2009). The width/weight: relationship is regarded as more suitable for assessing not only fish, but also Crustacean (Sukumaran and Neelakantan, 1997; Tabash, 2001; Mohapatra *et al.,* 2010). The relationships between carapace length and weight of the crabs have many uses. They are often used to calculate the standing stock biomass, condition indices, analysis of ontogenetic changes and several other aspects of crustacean population dynamics (Atar and Seçer, 2003; Hortnoll, 1978, 1982; Olusoji *et al.,* 2009; Stickeny, 1972; Romaire *et al.*, 1997; Phinney, 1977). In addition they are used for the management of crab population. According to Lagler (1968) the relationship can be used to estimate the recovery of edible meat from crabs of various sizes.

The carapace width weight relation provides a means of converting measurements of width and weight. It can be an indication of some important events in the life history of fishes such as maturity and growth. The width weight relation, which is important information for fish and shellfisheries management has not been reported for *Scylla serrata* in Pakistan. As wild-harvested stock and a commercial aquaculture product *Scylla serrata* have an economic significance (Samonte and Agbayani, 1992; Perry, 2006).

MATERIALS AND METHODS

The sampling of Mud Crabs (Fig. 1) was done twice in a month for a period of two years from January 2009 to December 2010 from the commercial landings in Korangi fish Harbour (24°48′50″N; 67°13′45″E) Karachi Pakistan (Fig. 2). A total of 938 crabs (488 male and 450 female) was collected during the present study. Measuring all the crabs by width, length and weight to the nearest millimeter for the first two categories and to the nearest gram for the last. The Width weight relationships of all samples collected were determined by the expression $W = a L^b$, where W is the derived weight (g), L is the carapace length (mm) or width (mm), a, is the intercept of the regression curve and b the regression coefficient. The parameters a (intercept) and b (slope) are most easily estimated by linear regression based on logarithms; log (W) = log (a)+b log (L) (Lagler, 1968). The significance of regression was assessed by analysis of variance (ANOVA).

Equations expressing the width/length-weight relationships of mud crabs were calculated in relation to sex. For testing possible significant ($P < 0.01$) differences between the sexes Student's t-test was used for comparison of the two slopes.

RESULTS

The minimum, maximum and mean carapace widths (mm), carapace lengths (mm), and weights (g) (± SE) used in the analysis of width/length weight relationships are given in table 1. The parameters of width-weight relationship, length-weight relationship and width-length relationship estimated from the weight, length and width data are presented in tables 2 and 3 for male, female and overall mud crabs. The linear regressions between width

*Corresponding author email: atiqullah002@yahoo.com

Fig. 1. Mud Crab *Scylla serrata* (Source: Williams, 2002).

Table 1. Range and mean values of carapace length, width and body weight of Mud Crab.

Sex	N	Carapace	Width	Carapace	Length	Body	Weight
		Range	Mean S.D	Range	Mean S.D	Range	Mean SD
Female	450	40-200	101.32 +19.346	23-109	67.90 + 12.515	22-450	167.06+74.684
Male	488	50-170	103.55+18.012	38-149	68.26+11.507	39-500	197.32+89.752
Combine	938	40-200	102.48+18.687	23-149	68.09+11.996	22-500	182.80+84.192

and crab weight were highly significant ($P<0.01$). The carapace width-weight relationships were allometric for both sexes. There were no significant differences in slopes between males and females. Table 1 provides data on carapace length and width and on body weight. Statistical analysis showed that male and female do differ in their carapace width and individual weights ($P<0.001$) The mud crabs of male showed significantly wider carapace (103.55+18.012mm) range (50-170) mm and mean individual weight (197.32+89.752mm) range (39-500g) than female mean carapace width of (101.32+ 19.346mm) range; (40-200)mm and mean individual weight 167.06+74.684) range : (22-450g).

The parameter of Carapace width-weight relationship was allometric for both sexes.

The relationships described in relation to female and male mud crab population. In general males had steeper slopes (i.e larger b value) than female in a population which was attributed to the allometric enlargement of male chelae with sexual maturation. The difference in b between male and female were not remarkable when the data for the two species.

Plots of the male female and combine fit well with the regression line obtained for all individuals regardless of species, sex and population (see Figs. 1A, B, C). Notice that there were some plots that deviated below the regression line. These points correspond to post molt individuals with a soft body.

The width-weight relationships were calculated as:

Log W= -2.779 ± 2.481 log L, r = 0.974 (female)
Log W= -3.035 ± 2.632 log L, r = 0.986 (male)
Log W= -2.935 ± 2.571 log L, r = 0.967 (combined)

The values of regression coefficient for male (2.481), female (2.632) and combined sexes (2.571) in the present analysis are very much closed to 3.0 and therefore, *Scylla serrata* does follow the cube law (LeCren, 1951; Martin, 1949).

DISCUSSION

In various studies the width-weight regression equations and the exponent b often lies between 2.5 and 3.5, and is usually close to 3 (Petrakis and Stergiou, 1995; Stickney, 1972; Dulcic and Kraljavic, 1996; Jones *et al.*, 1999).

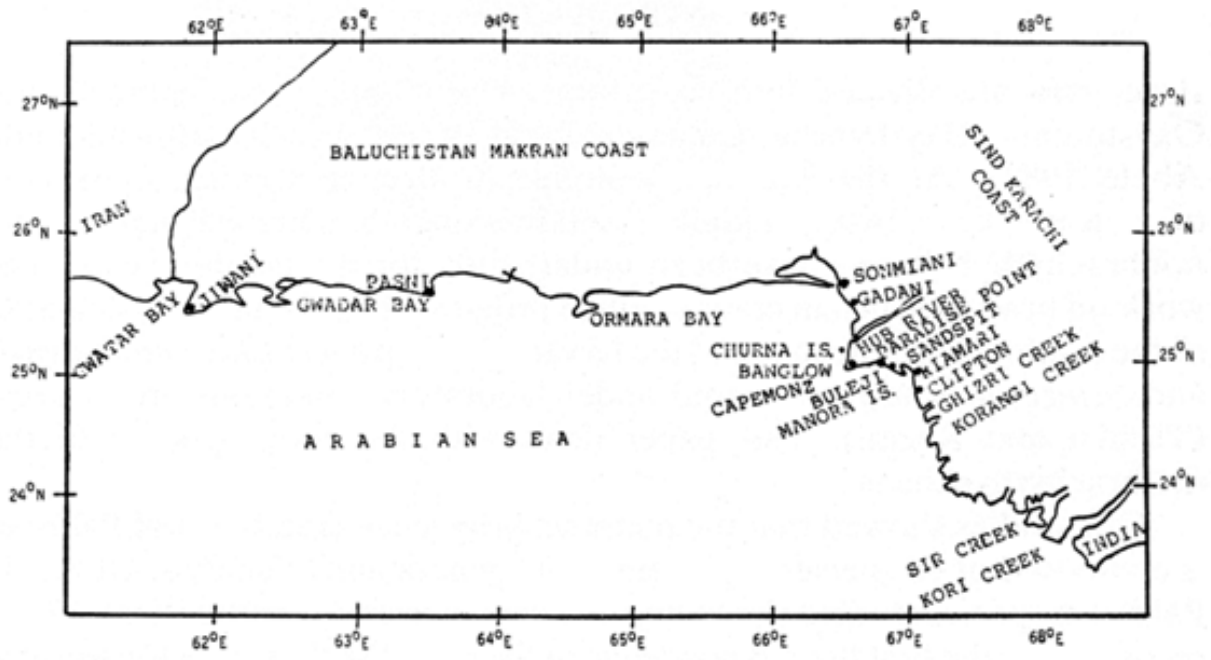

Fig. 2. Coastal region of Pakistan, showing study area Koangi Creek.

According to Pauly (1984), Miyasaka *et al.* (2007) and Mohapatra *et al.* (2010) from an extraordinarily large number of length-weight data taken from a wide variety of Crustacean, values of $b < 2.5$ or $b > 3.5$ are generally based on a very small range of sizes and/or such values of b are more likely to be an error. An exponent (b) value of 3 indicates symmetrical or isometric growth; values other than 3 indicate allometric growth. In the present study, the values for the exponent (b) remained below 3 and the calculated width/ -weight equation was allometric. The values of b ranged from 2.04 to 3.24 for *Callinectes sapidus* from Georgia, and this shows similarities with the b values of the present study (Stickney, 1972). In contrast, the values of b for two other marine portunid crabs (*Portunus sanguinolentus* and *P. pelagicus*) are larger in some cases. Even though the change of b values depends primarily on the shape and fatness of the species, various factors may be responsible for the differences in parameters of the width weight relationships among seasons and years, such as temperature, salinity, food (quantity, quality and size), sex, and time of year and stage of maturity (Pauly, 1984; Sparre, 1992). When the value b is different to 3 or weight growth.

The relationships between carapace width and weight and carapace length and weight have many applications. They are, for example, indicators of environmental condition, and are used to calculate biomass and to estimate the recovery of edible meat from crabs of various sizes (Lagler, 1968). They also have a practical value since they make it possible to convert length into weight and vice versa. On the other hand, body weight and carapace width are the most frequently used dimensions in the study of crustaceans (Sukumaran and Neelakantan, 1997).

The linear regressions between Crab width and weight were highly significant ($P<0.01$). The carapace width/length-weight relationships were allometric for both sexes. There were no significant differences in slopes between males and females.

CONCLUSION

The marketing of fishery products is an essential part of the success of all commercial fishing enterprises. The growing demand for the crab fishery product in the international market offers greater export opportunities for Pakistan Fishery products. Prudent resource exploitation and the production of the quality product according to European Union standards are demand vital to take advantage of the opportunities in fisheries.

The Carapace width weight relationship is important for biological study such as stock assessment and assessment of population parameters. *Scylla serrata* considering the total potential of fish stock in Sindh province waters, the rate of increase in the Crab production and the present catch these appear to be very good potential and scope for

Table 2. Carpace width and body weight of male, female and combine relationship in *Scylla serrata*.

			Regression Equation					t-value	
Realtionship Examined	Sex	N	A	b	R-sq	S.E "a"	S.E "b"	a	b
X:Carp.Wid	Female	450	-2.779	2.481	0.974	0.038	0.019	-73.265	130.771
	Male	488	-3.035	2.632	0.986	0.028	0.014	-107.049	186.596
Y:B.Wt	Combine	938	-2.935	2.571	0.967	0.031	0.015	-94.766	166.436

Table 3. Analysis of covariance (ANOVA) for comparison of regression line of Carp. Width weight relationship of male and female Mud Crab *Scylla serrata.*

Gender	S.S	df	Mean Square	F	Reg. coeff	Sig.
Female Regression	19.301	1	19.301	17101.00	.987	.000
Residual	.506	448	.001			.000
Total	19.807	449				
Male Regression	18.717	1	18.717	34818.153	.993	.000
Residual	.261	486	.001			.000
Total	18.978	487				
Combine Regress.	38.776	1	38.776	27700.938	.984	.000
Residual	1.310	936	.001			
Total	40.087	937				

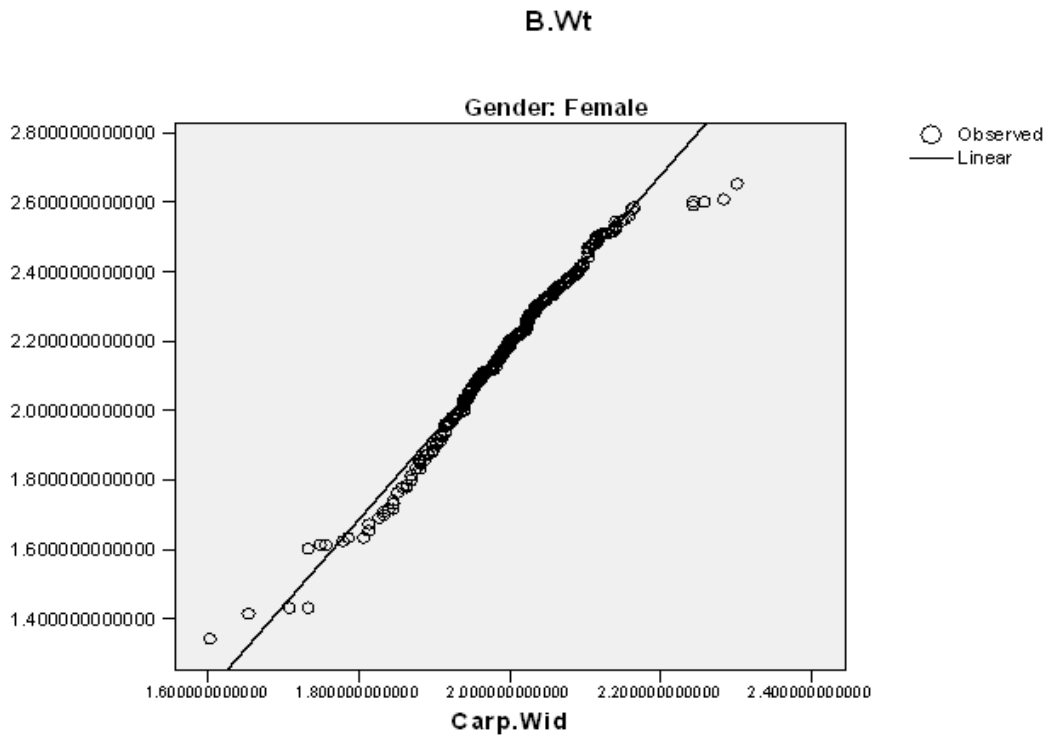

Fig. 1 (A). Carapace width weight relationship of female *Scylla serrata.*

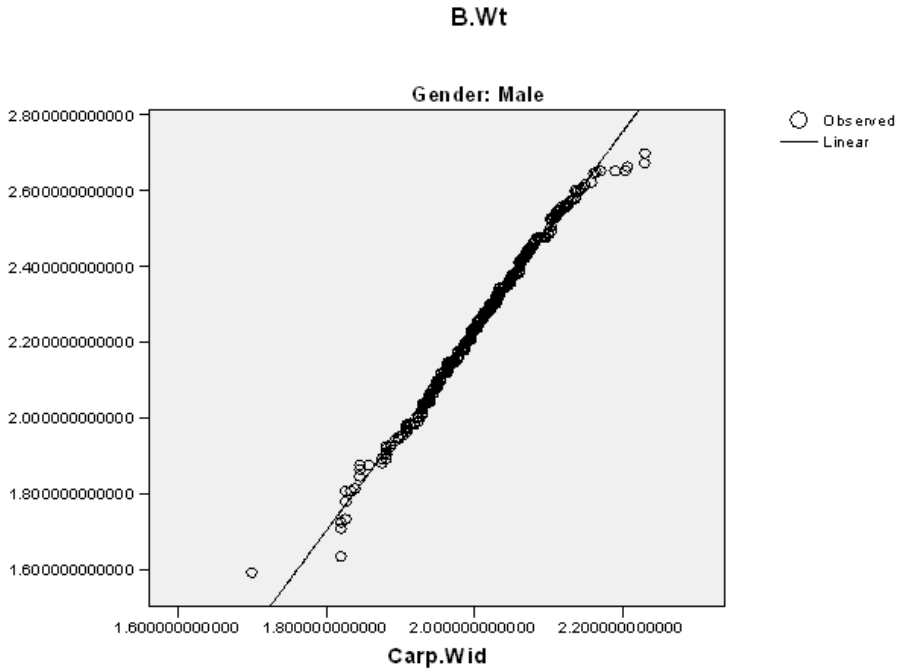

Fig. 1(B). Carapace width weight relation-ship of male *Scylla serrata.*

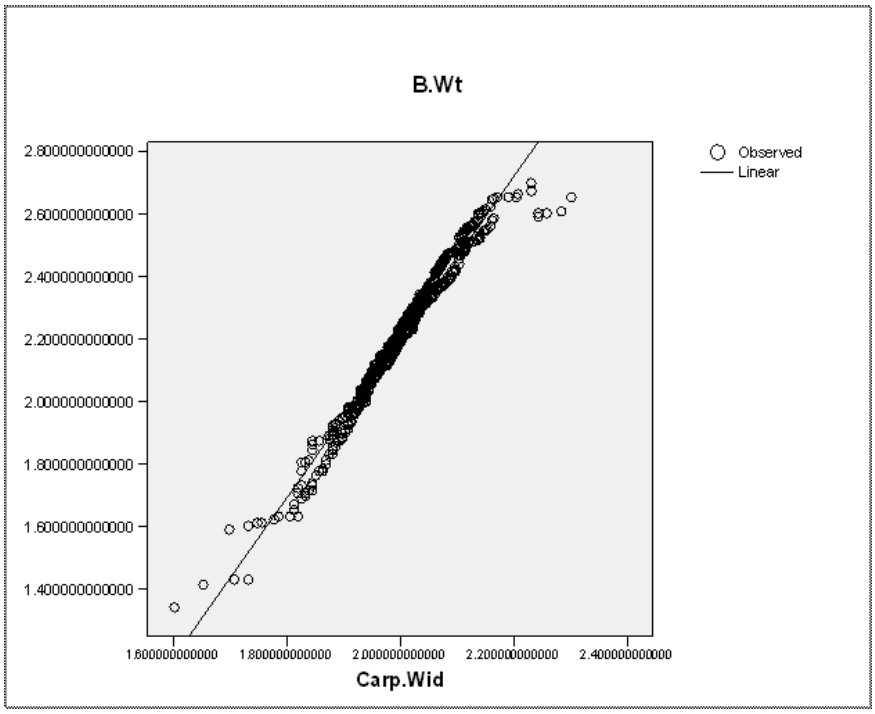

Fig. 1 (C). Carapace width weight relationship of combine (female: male) *Scylla serrata.*
Log W= -2.779 ± 2.481 log L, r = 0.974 (female) Fig 1A
Log W= -3.035 ± 2.632 log L, r = 0.986 (male) Fig.1B
Log W= -2.935 ± 2.571 log L, r = 0.967 (combined) Fig. 1C

further growth to study knowledge of its Carapace width weight relationships is necessary to provide adequate management of its fisheries and aquaculture.

REFERENCES

Atar, HH. and Secer, S. 2003. Width/Length-weight relationship of Blue Crab, *Callinectes sapidus* (Rathburn, 1896). Population living in Beymelek lagoon lake. Turk. J. Vet. Anim. Sci. 443-447.

Dulcic, J. and Kraljevic, M. 1996. Weight-Length Relationship for 40 Fish species in the Eastern Adriatic (Croatian Waters). Fish Res. 28:243-251.

Hartnoll, RG. 1982. Growth. The Biology of Crustacea. Ed. Abele, LG. Academic Press, New York, USA. 111-196.

Hartnoll, RG. 1978. The determination of relative growth in Crustacea. Crustaceana. 34:281-293.

Jones, RE., Petrell, RJ. and Pauly, D. 1999: Using Modified Length-Weight Relationship to Assess the Condition of Fish. Aqua. Eng. 20:261-276.

Le Cren, ED.1951. The length-weight relationship and seasonal cycle in gonadal weight and condition in the perch, *Perca fluviatilus*. J. Anim. Ecol. 20:201-219.

Lagler, KF. 1968. Capture, Sampling and Examination of Fishes. In: Methods for assessment of fish production in freshwaters. Ed. Ricker, WE. IBP Handbook. 3:7-45.

Levent, S., Canan, T., Erhan, A. and Onder, D. 2009. Width/Length-Weight and Width-Length Relationships for 8 Crab species from the North-Eastern Mediterranean Coast of Turkey. Journal of Animal and Veterinary Advances. 8(1):75-79.

Martin, WR. 1949. The mechanics of environmental control of body form in fishes. Univ. Toronto. Stud. Biol. 58:1-91.

Miyasaka, H., Kato, MG., Goda, Y. and Omori, K. 2007. Length–weight relationships of two varunid crab species, Helice tridens and Chasmagnathus convexus, in Japan. Limnology. 8:81-83.

Mhapatra, A., Mohanty, RK., Mohanty, SK. and Dey, SK. 2010. Carapace Width and weight relationshipps, condition factor, relative condition factor and gonado-somatic index (GSI) of Mud Crab (*Scylla* spp.) from Chilka Lagoon, India. Indian Journal of Marine Sciences. 39(1):120-127.

Olusoji, O. AB., Anifowose, OJ. and Sodamola, MY. 2009. Length-Weight Relationships, condition factor and fecundity of the West Africa Freshwater Crab, *Sudanonautes africanus* (Milne-Edwards, 1883), in Western Nigeria. West African Journal of Applied Ecology. 16:65-74.

Pauly, D. 1984. Fish Population Dynamics in Tropical Waters: A Manual for use with programmable calculators. ICLARM. Manila, Philippines. 325.

Petrakis, G. and Stergiou, KI. 1995. Weight-Length Relationship for 33 Fish species in Greek Waters. Fish Res. 21:465-469.

Phinney, DE. 1977. Length-Weight Relationships for the mature male Snow Crab, Chionocoetes bairdi. Fish Bull. NMFS/NOAA. 75:871-970.

Perry, H. 2006. *Scylla serrata*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL, USA.

Romaire, RP., John, SF. and James, WAJ. 1977. Length-Weight Relationships of two commercially important Crayfishes of the Genus Procambarus. Freshwater Crayfish. 3:463-470.

Samonte, GPB. and Agbayani, RF. 1992. Pond culture of Mud Crab (*Scylla serrata*) and economic analysis. SEAFDEC Asian Aquaculture. 14:3-5.

Stickney, RR. 1972. Length-Weight Relationships for several Fishes and Invertebrates in Georgia Coastal Waters with Condition Factors for Fish Species. Skidaway Institute of Oceanography Savannah, Georgia, USA.

Sukumaran, KK. and Neelakantan, B. 1997. Length-Weight Relationship in two Marine Portunid Crabs *Portunus sanguinolentus* (Herbst) and *Portunus pelagicus* (Linnaeus) from the Karnataka Coast. Indian J. Mar. Sci. 26:39-42.

Sparre, P.1992. Introduction to Tropical Fish Stock Assessment. Part IManual. FAO Fisheries Technical Paper 306/1. Rev 1. Rome.

Tabash, FA. 2001. Assessment and Ecological Characterization of the Blue Crab (*Callinectes arcuatus*) in the Gulf of Nicoya, Costa Rica. www.una.ac.cr/ biol/ unalaw/ english /crab.htm

Williams, LE. 2002. Queensland's Fisheries Resources: Current Condition and Recent Trends 1988–2000. QI02012. Department of Primary Industries, Queensland, Brisbane, Australia.

Received: July 10, 2012; Revised: Aug 23, 2012;
Accepted: Jan 23, 2013