

Length-weight and width-weight relationship of spiny rock crab *Thalamita crenata* (Crustacea, Decapoda, Portunidae) in Panjang Island Banten Indonesia

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Abstract. This research performed to determine length-weight and width-weight relationship of spiny rock crab (*Thalamita crenata*) caught at Panjang Island. The total number (1,368 crabs) used as sample consists of 838 males and 530 females. Carapace length has significant correlation with weight, where r^2 for males and females are 82.36% and 71.50% respectively. The correlation of length-weight and width-weight relationship at males is higher than females because many crabs still at maturity stage. The ovarian stage will affect to total mass tremendously. T-student analysis that shows growth pattern for males is isometric and negative allometric for females, with b value of males 3.0278 and females 2.729. It also means the male crabs are heavier than the females.

Key Words: carapace, correlation, growth pattern, isometric, negative allometric.

Introduction. *Thalamita crenata* (Latreille, 1829) or spiny rock crab is the common crab that inhabits the mangrove and shallow water of the Indo-Pacific to coastal of Africa (Chande & Mgaya 2003). It is often caught as by-catch at trap and gillnet of mangrove crabs (*Scylla* sp.) and swimming crab (*Portunus pelagicus*) in Panjang Island. It is smaller than mud crab and has lower economic value. Nevertheless, this crab is one of the main commodities in traditional market in Thailand and Africa (Songrak et al 2010).

Length-weight and width-weight relationships are an important aspect in fisheries biological investigation, ecology, and suitability of its environment (Mohapatra et al 2010; Thirunavukkarasu & Shanmugam 2011). In addition, morphometric and weight relationship can also be used for investigating growth model. Food and feeding habits can also be identified from length and weight cluster differences (Thirunavukkarasu & Shanmugam 2011). There have been many investigations in length-weight and width-weight of mangrove crabs or swimming crabs (Thirunavukkarasu & Shanmugam 2011; Pinheiro & Hattori 2006; Josileen 2011; Ribeiro et al 2013). Regarding to other research, natural diet and feeding habit of *T. crenata* was conducted by Cannicci et al (1996) and biochemical changes in larval stage of *T. crenata* by Kannupandi et al (2000). This study aims to analyze relationship of length-weight and width-weight of *T. crenata* from Panjang Island Banten Indonesia.

Material and Method. The experimental fishing was conducted from January to February 2014 in mangrove water of Panjang Island. The collapsible trap was used to collect samples of spiny rock crabs. The 15 days fishing trials got 838 males and 530 females whose carapace length/CL (mm), carapace width/CW (mm), and weight/W (g) were measured.

Length-weight and width-weight relationship were separately for males and females by the least square method using natural logarithmic transformation (ln). The exponential equation for length-weight relationship is $W = a CL^b$; width-weight relationship $W = a CW^b$; "a" is constant (intercept) and "b" is coefficient of length/width

(slope). The value of b is used to determine a growth pattern of *T. crenata*. Length-weight and width-weight relationship were analyzed by coefficient determination (R^2) and correlation (r) to find out association of two variables involved.

T-student analysis is used to define growth pattern related to value of coefficient (b). The isometric growth has $b = 3$, negative allometric has $b < 3$, and positive allometric has $b > 3$ (Araujo & Lira 2012).

That-student equation $t - \text{hit} = \frac{|b - 3|}{SE}$, where "SE" is standard error of coefficient (b) that was calculated using ANOVA (Analysis of covariance) at p (0.05) level of significance.

Results and Discussion. The total individuals (1,368) of *T. crenata* were captured during the study. Males were more abundant (61%) than females (39%) considering the overall samples. In males, the carapace length varied from 30-57 mm, while their carapace width was from 42-70 mm and the weight was from 15 to 78 g. In females, the carapace length ranged from 21-55 mm, the carapace width was from 40-78 mm and the weight was from 10 to 108 g (Table 1). The overall sex ratio between males and females is 1:0.63; there was lower ratio from Sikao Bay Thailand (Songrak et al 2010) and Maftaha Bay Kenya (Sigana 2002).

The females are heavier than the males because many samples are still mature. The size of first mature *T. crenata* was ranging from 40.5-45.5 mm at carapace width (Sigana 2002). This study analyzes male crabs (0.95%) and females (3.96%) with sizes < 45.5 mm respectively. It means *T. crenata* in Panjang Island were still in breeding stage. These crabs breed throughout the year with two breeding peaks in September and January (Sigana 2002).

Table 1

Carapace length, width, and weight characteristics (mean, minimum and maximum) of *Thalamita crenata* caught in Panjang Island

Sex	Characteristics	Minimum	Mean \pm SD	Maximum
Male	Carapace length/CL (mm)	27	41.62 \pm 4.83	55
	Carapace width/CW (mm)	40	59.53 \pm 7.32	78
	Weight/W (g)	10	48.80 \pm 18.48	108
	Number		838	
Female	Carapace length/CL (mm)	30	38.23 \pm 3.59	57
	Carapace width/CW (mm)	42	53.76 \pm 4.91	70
	Weight/W (g)	15	35.09 \pm 10.65	78
	Number		530	

Length-weight relationship (LWR) analysis showed the exponent 'b' value of males crab is 3.0278 (Figure 1). The regression line revealed high correlation with determination coefficient (r^2) is 82.36%. It means carapace length parameters can be used to estimate weight of *T. crenata* about 82.39%. The t-student value is 0.574; this is not a significant difference at $p < 0.05$. The growth pattern for this case is isometric while length and weight of *T. crenata* have the same growth speed.

LWR analysis for females showed lower coefficient determination than the males. The value r^2 is 0.714; it means carapace length parameters can explain weight of *T. crenata* about 71.40%. The ovarian stage has important factors to total weight. The individuals which have the same carapace length will have different weight if it is in various stages of ovarian. The female crabs have also different growth pattern if it was determined from LWR. The 'b' value is 2.729 (Figure 2) and has significant difference at t-student with $p < 0.05$. It means the female crabs have allometric negative patterns while length growth is more dominant than weight.

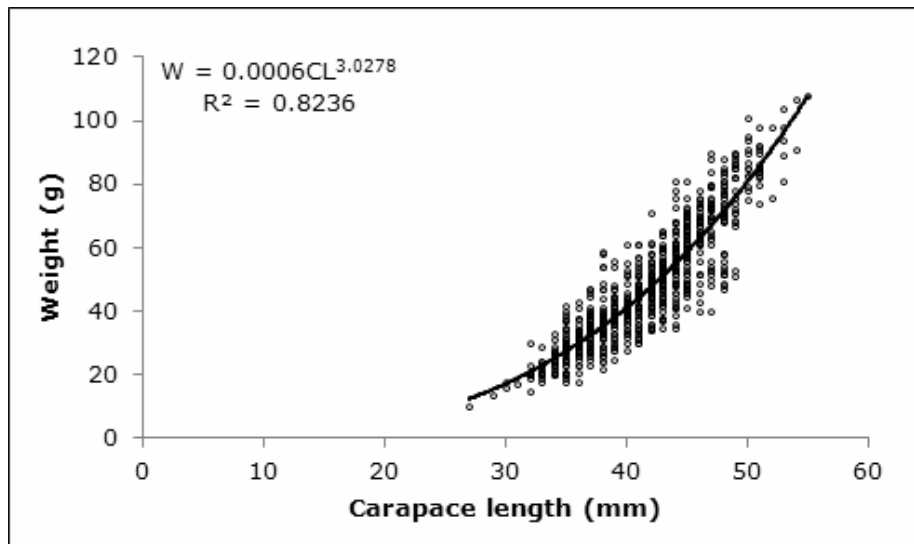


Figure 1. Length-weight relationship of males *Thalamita crenata* (N=838).

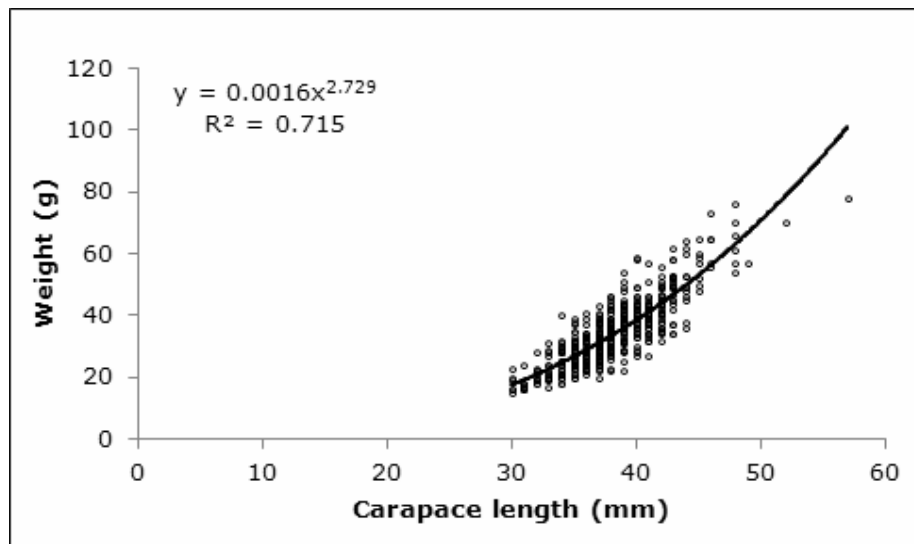


Figure 2. Length-weight relationship of females *Thalamita crenata* (N=530).

The exponential value (b) of carapace-width relationship (CWR) from the males and females are 2.8247 and 2.7433 respectively. The scatter diagram in Figures 3 and 4 show determination coefficient at the females is lower than the males. The carapace width can explain relationship to weight 81.06% for males and 70.26% for females. It indicated positive correlation between width and weight, but the females have lower correlation than the males. The ovaries undergo color changes showed it individual would be mature soon and increase in mass (Sigana 2002). Many females crabs were caught in the ovarian stage especially in stage 2 and 3, so ovarian weight influenced to total weight.

The observed value of b and t-student analysis indicated a negative allometric growth pattern in males and females. It means carapace width growth more dominant than weight. Spiny rock crab as arthropods always undergoes molting to get a bigger size. It process will cause a weight growth delayed. In the other hand, crabs will have a new big carapace after molting and weight will increase after several days of all it process finished.

The growth in arthropods follows a distinct pattern compared to other taxonomic groups. They undergo drastic series transformation from hatching time up to adult stage (Dubey et al 2014). *T. crenata* is a permanent resident in an estuarine habitat and none of the developmental life phase migrates out of its habitat (Sigana 2002). Food and feeding habit will have a significant influence to the growth speed. Moreover, the life

stage of crabs, especially in breeding season, will use majority of food for maturing ovaries. It means increasing of total mass will be lower than growth stage.

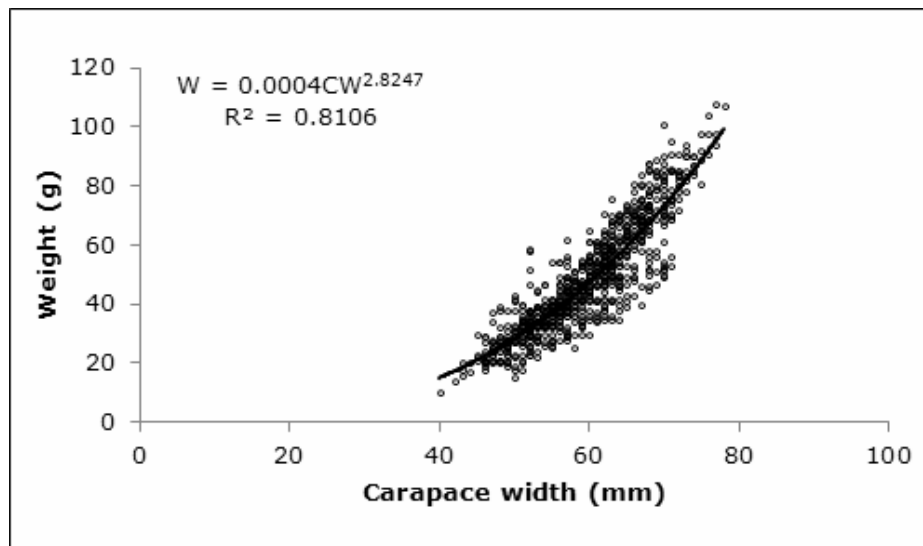


Figure 3. Width-weight relationship of males *Thalamita crenata* (N=838).

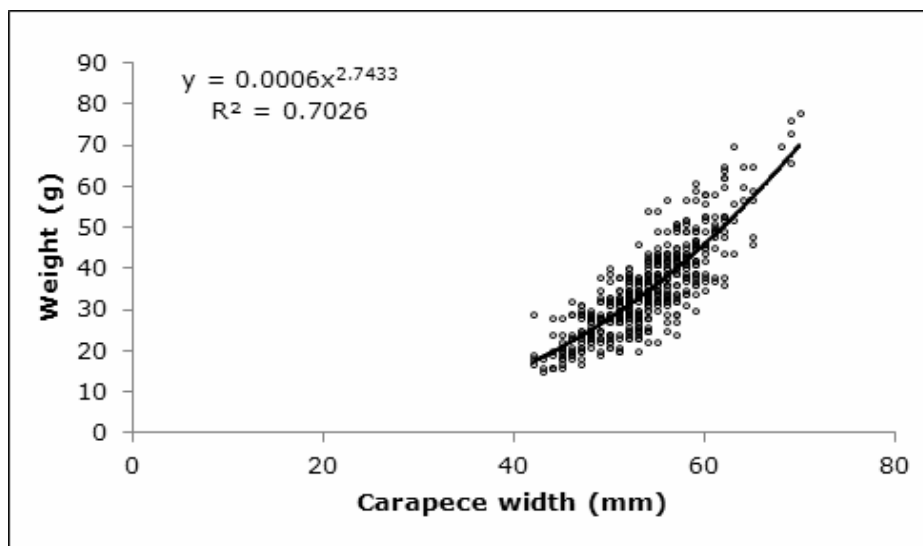


Figure 4. Width-weight relationship of females *Thalamita crenata* (N=530).

The difference of b value at LWR and CWR showed the males and females have various growth pattern. The males have higher b value because they are heavier than females. It is the same trend with the results of Dubey et al (2014) at *Ocypode macrorera*, and *Scylla tranquebarica* in Thailand (Thirunavukkarasu & Shanmugam 2011). The differences of LWR often depend on a various environmental factors such as salinity, temperature, pH, food (quality and quantity), sex and ovarian stage (Olusoji et al 2009).

Conclusions. Males *T. crenata* caught in Panjang Island have various sizes, namely from 27 mm to 55 mm for their carapace length, from 40 mm to 78 mm for their carapace width, and from 10 g to 108 g for their weight. The females are thinner than the males, namely from 30 mm to 57 mm for the carapace length, from 42 mm to 70 mm for the carapace width, and from 15 g to 78 g for the weight. The male's growth pattern base on LWR is isometric with r^2 is 82.36%, but from CWR it is negative allometric with r^2 is 81.06%. The female's growth is negative allometric with r^2 is 71.50% at LWR and 70.26% at CWR. The correlation of LWR and CWR in the males is higher than the females because most of the females were caught in stage 2 and 3 maturity phase. The further

research may be necessary to determine fecundity, food and feeding habit, and breeding season of *T. crenata* for its management.

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