Fishery Biology of Spiny Rock Crab (*Thalamita crenata* Latreille, 1829) in Sikao Bay, Trang Province, Thailand

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Abstract

The fishery biology of spiny rock crab, *Thalamita crenata* (Latreille, 1829) was, studied in Sikao Bay, Trang Province, Southern of Thailand. Crabs were randomly sampled on monthly basis during October 2008 to September 2009 at Sikao canal. A total of 3,443 crabs was obtained, of which males and females were 1,674 (48.62%) crabs and 1,769 (51.38%) crabs, respectively. The size frequency distributions of female crabs were bigger than male crabs. The overall sex ratio (M:F) was 1:1.06 and significantly different from the ratio of 1:1. Results showed that the asymptotic carapace width (CW_α) of male and female were 83.00 and 84.20 mm and the curvature parameter (K) was 1.7 $year^{-1}$ in both sexes. The total mortality coefficient (Z) of male was 7.54 $year^{-1}$ and female was 7.98 $year^{-1}$. The natural mortality coefficient (M) was 2.70 $year^{-1}$. The fishing mortality coefficient (F) of male was 4.84 $year^{-1}$ and female was 5.28 $year^{-1}$. The exploitation rate (E) was 0.65. For this reason, a 10-20% reduction in the level of fishing effort is recommended to ensure sustainability for the spiny rock crab stock.

Keywords : Fishery Biology, Spiny Rock Crab, Sikao Bay, Trang Province, Thailand

INTRODUCTION

The spiny rock crab (*Thalamita crenata* Latreille, 1829) or crenate swimming crab is a common swimming crab that inhabits the shallow waters of the entire tropical Indo-Pacific Region, western Pacific, Indian Ocean and Red Sea to the coast of Africa (Cannicci *et al*., 1996; Chande and Mgaya, 2003). In Thailand, spiny rock crab found was that in mangrove forest and commonly be non target species (or by catch) for crab fisheries (Poomikong *et al*., 2005; Wisesepongpand *et al*., 2008). Preliminary observations of fisher's catches indicated that in spiny rock crab and menippid crab or hermit crab were typically discarded in mud crab fisheries (Chande and Mgaya, 2003; Sigana, 2002). Spiny rock crab appears to occupy a similar ecological niche as the mud crab and living in the same mangrove habitat (Bellchambers and Lestang, 2005).

Presently, the fishers in some area, such as Sikao Bay, Trang Province of Thailand collect spiny rock crab for local consumption and sold in local markets (Moser *et al*., 2005; Songrak and Choopunth, 2006). The assessment of stock is important for controlling the spiny rock crab fishery in future. However, the study or published literature on the fishery biology of spiny rock crab in Thailand are very limited. The objective of this study were to obtain updated data on growth, length-weight relationship, condition factor and mortality of spiny rock crab collected from the Sikao canal part of Sikao Bay, coast of Trang Province, southern of Thailand.

MATERIALS AND METHODS

1. Study area and sampling sites

A total of 3,443 specimens were monthly collected by collapsible baited traps on monthly during October 2008 to September 2009. Sampling location was in Sikao canal part of Sikao Bay (Figure 1). This canal occupies shore line of 5.0 km and covers the mangrove area around 25 km^2. The 180 collapsible baited traps per time were used in three sampling sites by local fishers. The carapace width (CW) of spiny rock crab was measured to the nearest 0.1 mm, body weight was weighed to the nearest 0.01 g and sex of individual were recorded.

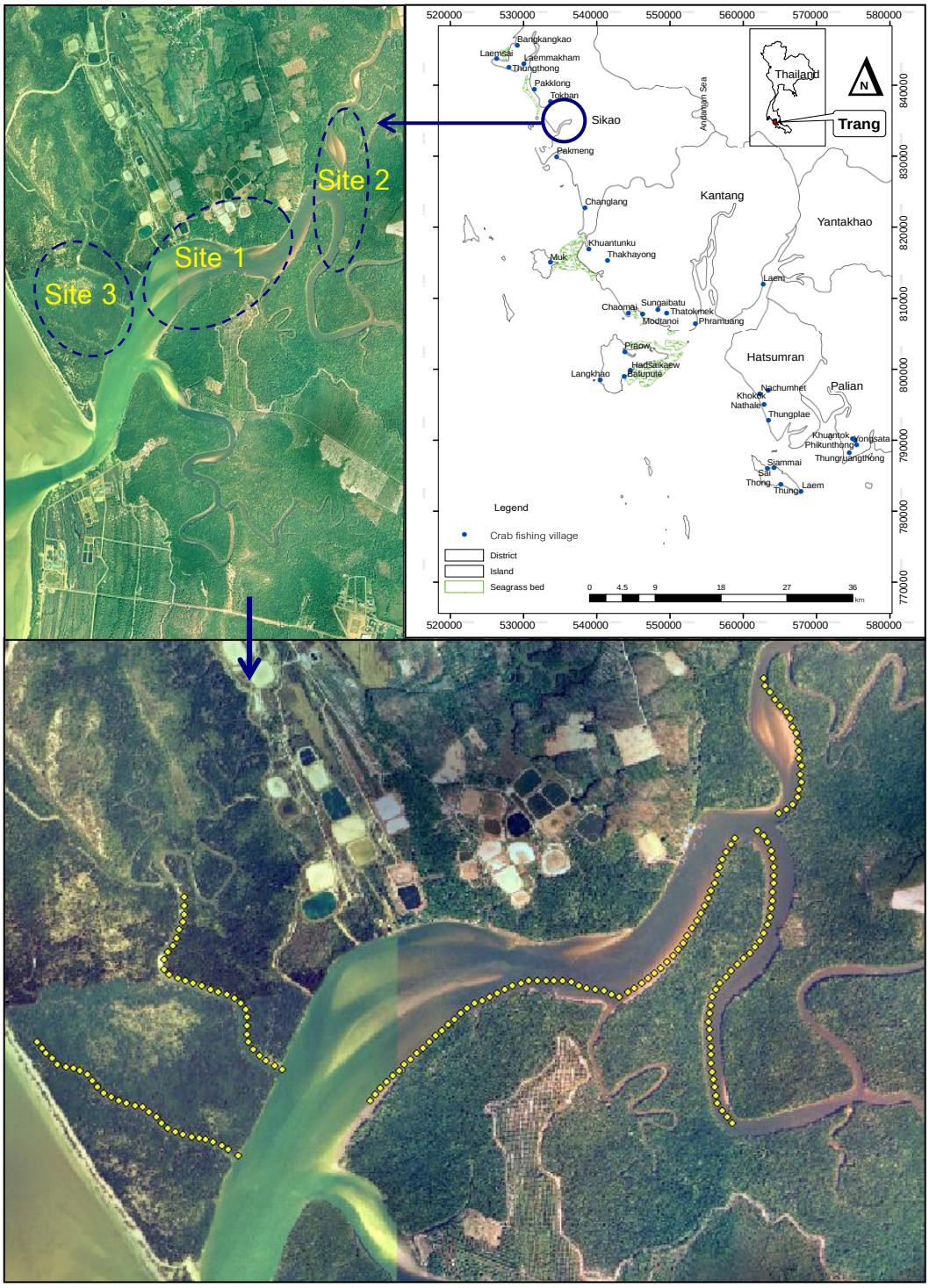

Figure 1. Map of the sites of spiny rock crab fisheries: (1) Sikao canal; (2) Maifad canal; (3) Hot spring canal, on coast of Trang Province, Thailand.

2. Data analyses

The length-weight relationship was described by the equation: $W=aCW^b$, which W is the weight in grams, CW is the carapace width in mm, a is a constant (y-intercept) and b is the growth exponent or length-weight factor (Ricker, 1975; Beverton and Holt, 1957). The parameter a and b were estimated using power regression and the coefficient of determination (r) showed level of length-weight relationship (Ricker, 1975). The hypothesis of isometric growth was tested using t-test (Ricker, 1975). The sex ratio of spiny rock crab between males to females were determined on monthly basis. The overall sex ratio was calculated and tested using Snedecor and Cochran method (Snedecor and Cochran, 1989).

The asymptotic carapace width (CW_α) and curvature parameter (K) of the von Bertalanffy growth equation (VBGE) (Bertalanffy, 1938) were estimated by ELEFAN-1 incorporated with the FiSAT II program (Pauly and David, 1981; Gayanilo *et al*., 1994). The growth curve was used to determine the carapace width of the crab at various ages, under the hypothetical age at which length at first hatching (L_0) was 0.344 mm that calculated from the culture of spiny rock crab (Sigana, 2002). The mortality parameters were estimated as follow: total mortality rate (Z) using the length converted catch curve (Pauly and Munro, 1984); natural mortality rate (M) modified Rikhter and Efanov's formula (Ricker, 1975) where CW_α and K are parameters from the von Bertalanffy equation, and the size at first maturity was 42.5 mm (Sigana, 2002); and fishing mortality rate (F) was estimated by subtractive of Z and M. The exploitation ratio (E) was calculated by the formula $E=F/Z$ (Sparre and Venema, 1992)

RESULTS

1. Sex ratio and fecundity

A total of 3,443 crabs was sampled and divided to 1,674 males and 1,769 females. Overall sex ratio between females and males was 1:1.06. The highest female to male ratio was occurred in June followed by February, April and March. A variance test showed that there was no significant difference in monthly binomial distribution of the sex ratio during the sampling period, (average sex ratio 1:1.06; χ^2=3.84 d.f. =1; P> 0.05). The overall sex ratio was significantly different from 1:1 as shown by the chi-square test in Table 1.

A total of 315 crabs was observed for fecundity studies. The estimated mean number of eggs batches produced by female crabs in different sized after hatching under laboratory conditions. The carapace width ranged from 41.8-68.6 mm. The fecundity ranged from 36,881-164,611 eggs and mean of fecundity was 78,015 eggs.

Table 1. Sex ratio of spiny rock crab during the sampling period.

Month		Males	Females	Total	M:F	χ^2	P
2008	October	130	129	259	1:0.99	0.004	> 0.05
	November	184	146	330	1:0.79	4.376	< 0.05
	December	157	128	285	1:0.82	2.951	> 0.05
2009	January	133	137	270	1:1.03	0.059	> 0.05
	February	121	197	318	1:1.63	18.164	< 0.05
	March	123	171	294	1:1.39	7.837	< 0.05
	April	124	181	305	1:1.46	10.652	< 0.05
	May	108	123	231	1:1.14	0.974	> 0.05
	June	118	196	314	1:1.66	19.376	< 0.05
	July	151	128	279	1:0.85	1.896	> 0.05
	August	258	173	431	1:0.67	16.763	< 0.05
	September	67	60	127	1:0.90	0.386	> 0.05
Total		1,674	1,769	3,443	1:1.06	2.621	> 0.05

2. Carapace width-weight relationship

The carapace width of spiny rock crab ranged from 35.2-81.2 mm (Figure 2) and body weight from 8.63-122.07 g. The data analysis of the carapace width and weigh equations were plotted and shown in Table 2 and Figure 2.

Table 2. Carapace width–weight relationships of spiny rock crab in Sikao Bay.

Spiny rock crabs	Carapace width-weight relationship	
	Equation	(R^2)
Male	$W = 0.0002*CW^{3.014}$	0.832
Female	$W = 0.0008*CW^{2.695}$	0.788
Combined sexes	$W = 0.0004*CW^{2.873}$	0.824

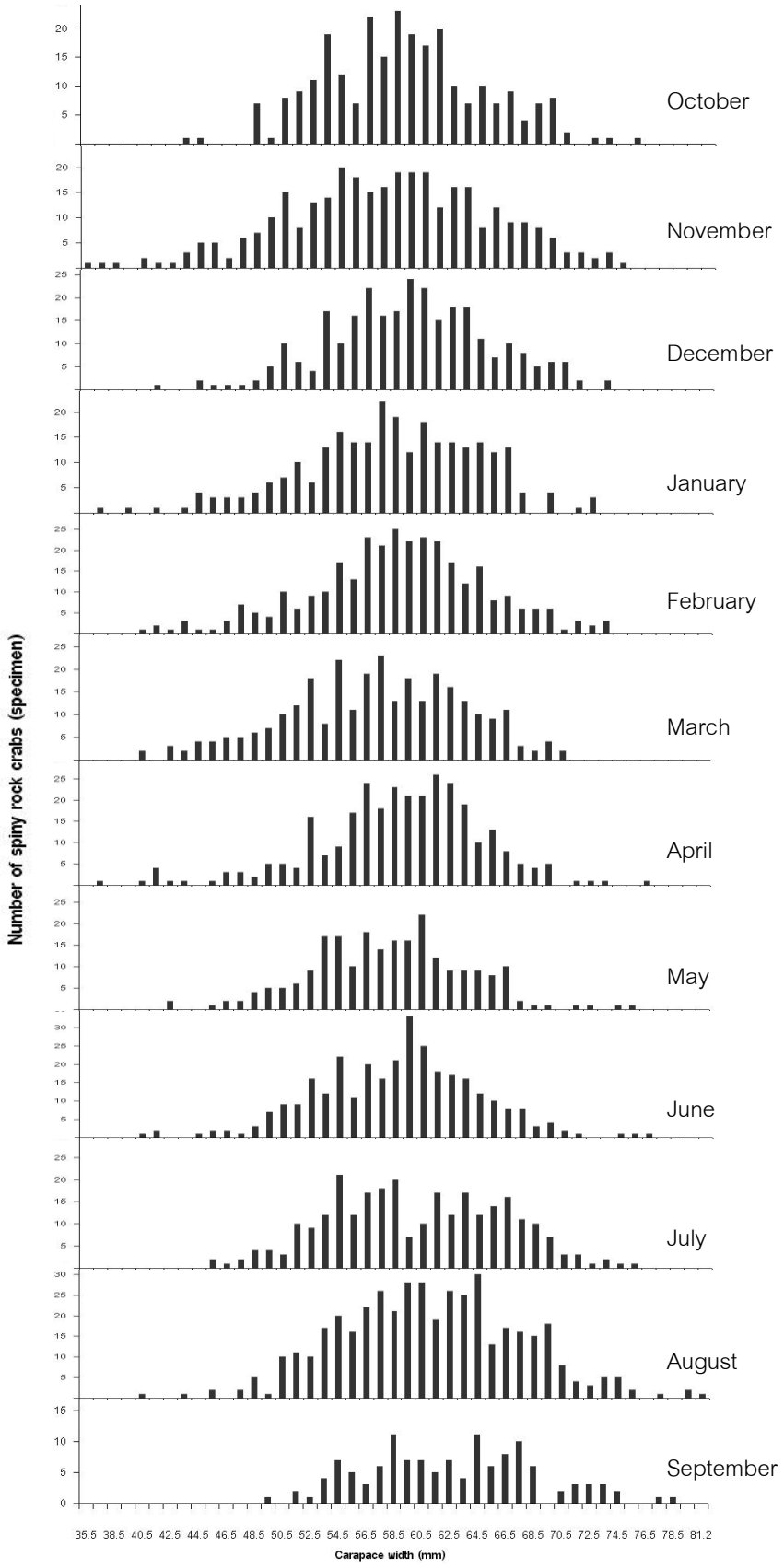

Figure 2. Carapace width frequency distribution of spiny rock crab in Sikao Bay.

3. Growth parameters

The von Bertalanffy growth parameters of spiny rock crab of male, female and combined sexes found that the asymptotic carapace width (CW_∞) were 83.00, 84.20 and 83.70 mm, respectively. The curvature parameter (K) was 1.7 year^{-1} in all sexes. The hypothetical age (t_0) was -0.0024 year. The asymptotic carapace width of spiny rock crab in male and female were higher than maximum observed carapace width. The results of relationship between carapace width-age and weight-age were shown in Table 3 and Figure 3.

Table 3. Growth curves of spiny rock crab in Sikao Bay.

Spiny rock crabs	Relationship between carapace width and age	Relationship between weight and age
Male	$CW_t = 83.00\,(1 - e^{-1.70(t+0.0024)})$	$W_t = 121.87\,(1-e^{-1.70(t+0.0024)})^{3.0144}$
Female	$CW_t = 84.20\,(1 - e^{-1.70(t+0.0024)})$	$W_t = 125.69\,(1-e^{-1.70(t+0.0024)})^{2.6953}$
Combined sexes	$CW_t = 83.70\,(1 - e^{-1.70(t+0.0024)})$	$W_t = 133.37\,(1-e^{-1.70(t+0.0024)})^{2.8725}$

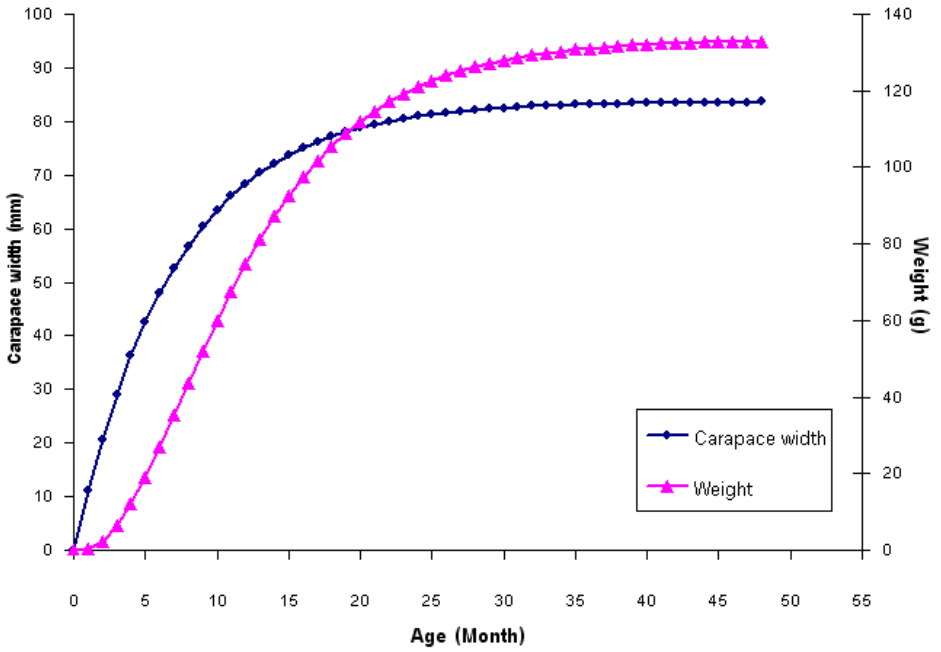

Figure 3. Growth curves of spiny rock crab in Sikao Bay.

4. Mortality parameters

The total mortality rate (*Z*) of males and females were 7.54 and 7.98 year^{-1}, respectively. The natural mortality rate (M) was 2.70 year^{-1}. The fishing mortality rate (*F*) of males and females were 4.84 and 5.28 year^{-1}, respectively. The exploitation ratio (*E*) of males and females were 0.64 and 0.66, respectively. Since the exploitation rate was more than 0.50, indicating that the spiny rock crab was slightly over-fished (Table 4).

Table 4. Mortality and exploitation ratio of spiny rock crab in Sikao Bay.

Spiny rock crabs	Total mortality *Z* (per year)	Natural mortality *M* (per year)	Fishing mortality *F* (per year)	Exploitation rate; *E = F/Z*
Male	7.54	2.70	4.84	0.64
Female	7.98	2.70	5.28	0.66
Combined sexes	7.72	2.70	5.02	0.65

DISCUSSIONS

The spiny rock crab is a permanent resident in an estuarine habitat. All the 10 developmental stages of embryos were observed; therefore, it appears that the population studied does not migrate out of its habitat (Sigana, 2002). Boolootian *et at*. (1959) observed that some lower intertidal crabs re-berry themselves a few days after the escape of the larvae. Fecundity studies are important for estimating the reproductive capacity of a species. Furthermore, the early stages of an organism contribute a major proportion to the annual production. Bagenal and Braum (1978) reported that fecundity studies give data relating to population stability and yearly class fluctuations which may be a major factor determining variations in production from year to year. Hines (1982) observed that female body size in the principal determinant in reproductive output in brachyuran crabs. Sethuramalingam *et al*. (1982) studied the fecundities of *T. chaptali* and reported that fecundities ranged from 16,422 eggs in a specimen of 8 mm carapace length to 22,694 eggs in a specimen of 28 mm carapace length. In *T. crenata* the fecundity ranged from 13,650 eggs in specimen of 28.9 mm carapace width to 207,710 eggs in a specimen of 60.4 mm carapace width. Variation in the total number of eggs produced in crabs of the same carapace width was also observed in *T. crenata*. Thorson (1950) pointed out that crabs have high fecundities because there is a wastage of eggs and larvae during development since the larvae are subjected to planktonic

and non-planktonic mortality sources such as unsuitable salinities, variation in water temperatures and unsuitable habitats.

CONCLUSIONS

The management measures recommended from this study are based on the estimated exploitation rate was 0.65 for spiny rock crab fisheries in Sikao canal, coastal area of Trang Province. For sustainability of spiny rock crab it showed reduce the exploitation rate by 10-20 percent. However, the fishery extension for promoting spiny rock crab as a target species of crab fisheries not use only biological information. In addition, the socio-economic condition of fishermen in area should be considered to achieve sustainable management of spiny rock crab resource and also to ensure the fairness to all stakeholders. So that, the exploitation on spiny rock crab should not go beyond the point unless further investigations have shown that recruitment of stock.

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