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Length-Weight Relationship and Relative Condition Factor of *Parapenaeopsis sculptilis* (Heller, 1862) from the Coastal Waters of Perak, Peninsular Malaysia

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ABSTRACT

Length-weight relationship (LWR) parameters and relative condition factor (K_n) of marine shrimp, *Parapenaeopsis sculptilis* (Heller, 1862) were estimated using length-weight data collected between February 2012 and January 2013 from the coastal waters of Terong, Perak, Peninsular Malaysia. The estimated length-weight relationship of *P. sculptilis* for both sexes was $W = 0.00027TL^{2.80}$. Meanwhile, the estimated relative growth coefficient (b) was 2.80 for both sexes, indicating a negative allometric growth pattern of *P. sculptilis* in the investigated area. Relative condition factor (K_n) values ranged from 0.99 to 1.064 (1.013±0.005, mean ±SD). K_n value changes in various months: the highest peak was in March-April, indicating the spawning period and the trough and small peaks indicating the cycle gonadal development.

Keywords: Parapenaeopsis sculptilis, length-weight relationship, condition factor, coastal waters

INTRODUCTION

The penaeid prawn of the genus *Parapenaeopsis* belongs to family Penaeidae of the decapod groups. *Parapenaeopsis sculptilis*, commonly called 'rainbow prawn', is also known locally as 'udang kulit keras' in Malay (Ong & Weber, 1977). The genus *Parapenaeopsis* is widely distributed from the west and east coasts of India to Hong Kong through Malaysian and Indonesian waters to tropical Australia and New Guinea (Dall, 1957; Lee, 1972). Most of the species are found in the Indo-Pacific

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region, from Persian Gulf Indian region and east coast of Africa to Japan and Australia (Rao, 1969), and inhabit shallow inshore waters where spawning adults are often found and also mostly fished in shallow coastal areas. The juveniles and young prawns live mainly in coastal mud flats or sand flats near to mangroves. The latest information on annual landing of *P. sculptilis* in Malaysia was 3.526 tonnes in 2012 (DOF, 2013). This important commercial fisheries commodity being marketed fresh, frozen, peeled and cooked or canned, and also used as ingredients in the making of shrimp meal or shrimp paste in Malaysia and Singapore (Tham, 1968; Hall, 1962; Kubo, 1949). Studies on the biology of this species are still scarce and the resources continue to be exploited without proper attentive measures. Thus, the objectives of the present study were to estimate the length-weight relationship (LWR) and relative condition factor of *P. sculptilis* collected from the coastal waters of Perak, Peninsular Malaysia. The information gathered would be an added information to the Malaysian penaeid biology database and significant for the management of the resources.

MATERIALS AND METHODS

Study Area and Sampling

The sampling was conducted in the coastal waters of Terong in Perak (N 4°43'0 and E 100°43'60), Peninsular Malaysia, from February 2012 to January 2013 (see Fig.1). The fresh samples were collected from fishermen. The fishermen used special push net (mesh size 0.5 cm) that is fixed in front of the fishing boat. Identification of *P. sculptilis* specimens was carried out based on the works of Dall (1957) and Hall (1962). Total length was measured to the

Fig.1: Geographical location of the study site in Perak, west coast of Peninsular Malaysia (Terong)

nearest 0.1 cm from the tip of the rostrum to the tip of the telson, while body weight was measured to the nearest 0.01 g using an electronic balance.

Data Analysis

For LWR, a total of 660 specimens were analysed. Length-weight relationship was determined by using the relationship of $W = a L^b$ applied by Ricker (1975); where, W is the total weight (g), L is the total length (cm) of the shrimp, 'a' is intercept (condition factor) and 'b' is the slope (growth coefficient). The equation was transformed into logarithmic form as Log W = Log a + b Log L. The estimated b value of *P. sculptilis* was tested by using t-test to verify that it was significantly different from the isometric growth (b = 3) (Froese, 2006). Additionally, 95% of the confidence limits of the parameter b and the statistical significance level of r^2 were estimated (Scherrer, 1984). The monthly relative condition factor (K_n) of *P. sculptilis* was calculated according to $K_n = W/ aL^b$, equation adapted as $K_n = W / w$ (Le Cren, 1951), where, W = observed weight of shrimp (g) and w = calculated weight of shrimp (g). K_n values were estimated for different months and length sizes.

RESULTS

Length-Weight Relationships

Total lengths and total weights of *P. sculptilis* ranged from 7.75-16.65 cm and 2.84-39.89 g for both sexes. The monthly descriptive statistic and estimated parameters of length weight regressions for both sexes of *P. sculptilis* are given in Table 1. The LWR of *P. sculptilis* was found to be $W = 0.00027TL^{2.80}$ or Log W = 2.80 Log TL -4.63 for both sexes. It was found that the estimated b value was significantly lower than the isometric value (3) at 5% level for the population of *P. sculptilis* in the coastal waters of Terong, Perak. Therefore, it could be concluded that the growth pattern of *P. sculptilis* was negative allometric in the study area.

Relative Condition Factor

Relative condition factor (K_n) is a ratio between observed and calculated mean weights. K_n was calculated for different months and for each size class. The K_n values of *P. sculptilis* in the coastal waters of Terong varied from 0.99 to 1.064, while the mean value was 1.013 ±0.005SD. The mean values of K_n for different months and for each size class at 0.5 cm are presented in Fig.2 and Fig.3, respectively. The highest of K_n value was in March-April, indicating reproductive maturity, and the lowest value was in May-June (Fig.2). A marked decline in K_n at 9.30 cm of the total length and a subsequent recovery after 9.30 cm were also observed (Fig.3). Therefore, the first sexual maturity of *P. sculptilis* was attained at 9.30 cm in total length and the peak reproductive maturity was in April.

DISCUSSION

The growth coefficient 'b' of the length-weight relationship generally lies between 2.50 and 3.50 and the relation is said to be

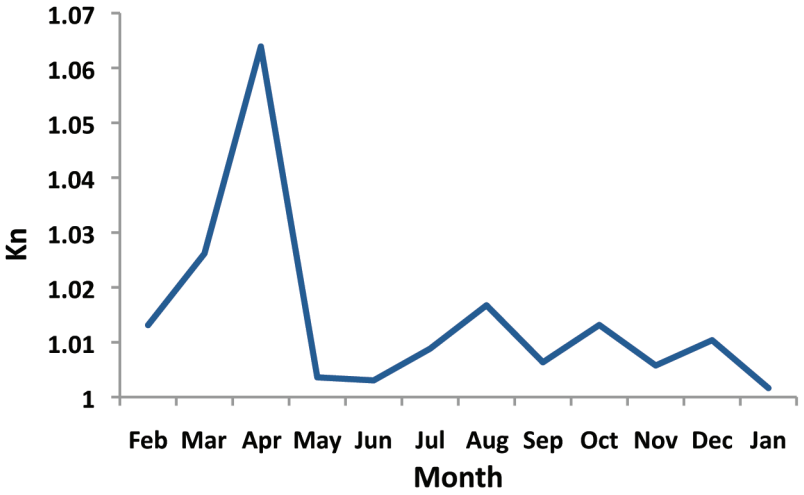

Fig.2: Monthly variation of K_n of females *Parapenaeopsis sculptilis*

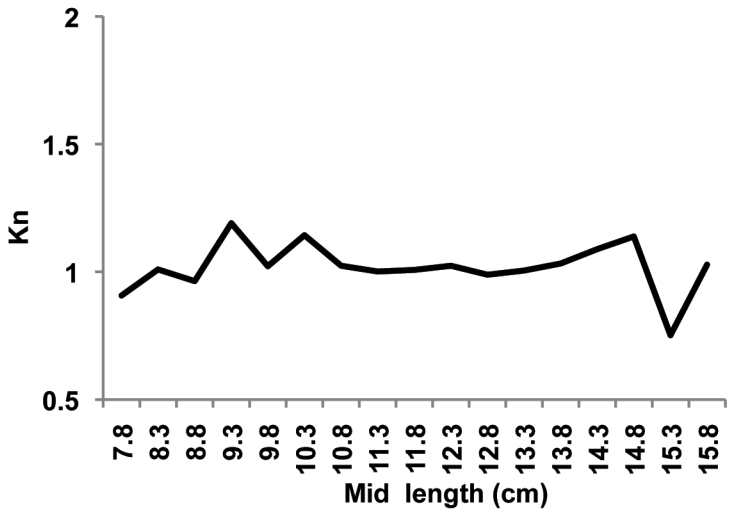

Fig.3: Mean K_n values per each 0.5 cm length for females *Parapenaeopsis sculptilis*

TABLE 1
Monthly descriptive statistic and length-weight relationship parameters for both sexes of *Parapenaeopsis sculptilis* in the coastal waters of Perak, Peninsular Malaysia

Month	Range TL	Range TW	Mean TL ±SD	a	b	95% CI of b	r^2
Feb	10.53 -15.36	8.73 -31.96	12.68±1.08	0.00000339	3.17	2.93-3.41	0.85 ($p < 0.05$)
Mar	9.70 -14.70	8.11-32.57	11.94±1.34	0.00050119	2.13	1.94-2.32	0.81 ($p < 0.05$)
Apr	10.41 -15.60	8.47 -31.59	12.34±1.08	0.00001230	2.90	2.63-3.18	0.79 ($p < 0.05$)
May	9.12 -16.61	8.85 -39.89	12.21±1.16	0.00010000	2.48	2.13-2.83	0.63 ($p < 0.05$)
Jun	8.44 -16.65	8.35 -38.59	12.70±1.41	0.00257040	2.00	1.53-2.12	0.56 ($p < 0.05$)
Jul	9.70 -16.61	8.87 -39.89	12.45±1.08	0.00000912	2.97	2.76-3.18	0.87 ($p < 0.05$)
Aug	10.85 -15.55	9.21 -39.31	12.69±0.88	0.00000045	3.60	3.36-3.83	0.88 ($p < 0.05$)
Sept	7.68 -15.29	2.84 -30.22	11.86±1.71	0.00001549	2.87	2.73-3.01	0.93 ($p < 0.05$)
Oct	9.90 - 14.52	6.45 -26.75	11.83±0.66	0.00000309	3.19	2.90-3.47	0.80 ($p < 0.05$)
Nov	10.27 -15.01	8.72 -26.96	12.01±0.80	0.00001514	2.86	2.58-3.14	0.78 ($p < 0.05$)
Dec	9.85 -14.30	7.02 -27.16	12.06±0.62	0.00000603	3.06	2.75-3.37	0.76 ($p < 0.05$)
Jan	7.75 - 15.00	3.31 - 28.93	11.60±1.27	0.00000331	3.18	3.04-3.32	0.94 ($p < 0.05$)
Overall	7.75- 16.65	2.84-39.89	12.19±1.09	0.000270	2.80	2.70-2.90	0.81 ($p < 0.05$)

Note:
TL= total length (cm); TW= total weight (g); mean ±SD; a and b, parameters of the length-weight relationship; r^2, coefficient of regression

isometric when it is equal to 3, as reported for most aquatic organisms (Ecoutin *et al*., 2005). In the present study, the estimated b value was 2.80 for both sexes. The finding indicated that growth of the *P. sculptilis* is negative allometric because the b value in both sexes is significantly less than the isometric value of 3 at 5% level. Meanwhile, the regression co-efficient (r^2) value for both sexes was 0.81. The present findings seem to be more or less consistent with those of other researchers such as Kirkegaard and Walker (1970) who showed that the exponent 'b' for females was 2.95 and this was 2.94 for males, indicating a negative allometric growth for *P. sculptilis* in Australian waters. Similarly, Thangaraj (2000) also reported negative allometric growth with similar

values for the females and for males of *P. stylifera* from Madras coast, India. Other researchers found higher exponents b of 4.13 and 4.09 for the females and males of *P. stylifera* from Kerala coast (Suseelan & Raj, 1989). Masitah and Chong (2002) reported that the combined sexes of *P. sculptilis* exhibited a negative allometric growth (b = 2.52) from Selangor waters. In addition, Fatima (2001) in *P. sculptilis* from Korangi Fish Harbour, Karachi, showed a negative allometric growth (b = 2.55). In contrast, Hall (1962) reported that this shrimp from Penang waters had isometric growth (b = 2.99). This finding is further supported by researchers from India and Bangladesh, whose results also showed isometric growth (2.98) for *P. sculptilis* (Bhimachar, 1963; Zafar *et al*., 1997; Amin & Zafar, 2003).

There were a fluctuations in the monthly K_n values during the study period. The highest value was obtained in the month of April, while the lowest was in June. The results obtained by Thomas (1975) also showed fluctuations in the monthly K_n values for *Penaeus semisulcatus*. Similar, changes in K_n have been observed for the giant Malaysian freshwater prawn, *Macrobrachium rosenbergii* (Rao, 1969). The K_n value of *Palaemon malcolmsonii* showed the maximum value in September and the minimum value in November, which coincide with the spawning period from September to November (Patel *et al*., 1984). Lack of literature on *P. sculptilis* has prevented comparison of the present study with other works of the same species from Malaysia.

In the present study, the size at sexual maturity of female *P. sculptilis* was 9.30 cm TL (carapace length 2 cm). The highest peak was obtained at 21-22 mm carapace length, which indicated an increase in K_n when the prawn attained maturity, whereas the subsequent peaks represented cyclic gonad development and spawning for *Penaeus semisulcatus* (Thomas, 1975).

CONCLUSION

Parapenaeopsis sculptilis in the coastal waters of Perak showed a negative allometric growth, reaching its first sexual maturity at 9.30 cm of the total length and peak reproductive maturity in March-April. The outcome of the present study has provided basic information on the length–weight relationship and relative condition factors of *P. sculptilis*, which is important for fishery management.

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