

Some biological aspects of painted spiny lobster (*Panulirus versicolor*) in Latuhalat waters, Ambon Island, Indonesia

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Abstract. Research to study size distribution, length-weight relationship, condition factor and sex ratio of painted spiny lobster (*Panulirus versicolor*) was carried out in Latuhalat waters, Ambon Island on March to May 2014. Samples of lobster were obtained from the lobster fishers at the village of Latuhalat. Totally, there were 56 individuals of lobsters collected during the study with the carapace length ranging from 6.0 to 14.1 cm, while the weight ranged from 101 to 1130 g. Growth pattern of lobster in the area showed allometric for male and isometric for female. Condition factor showed that females were in better condition than males. The ratio between males and females was equal.

Key Words: lobster, size, growth pattern, condition factor, sex ratio, Ambon Island.

Introduction. Lobsters are important economical species of marine resources in Indonesia (Bakhtiar et al 2013). In the recent years, exploitation of lobsters has increased tremendously because of their high price and as a valued sea food item. Alive lobster in the local market is sold up to USD 30 kg⁻¹, while in the local restaurant it is valued up to USD 50 kg⁻¹ (pers observation).

As many as 149 species of commercially important lobsters are known to occur in the Indian and Pacific Oceans, of which, 47 species belong to the family Palinuridae (Holthuis 1991). Furthermore, Phillips et al (1980) stated that 11 species of family Palinuridae are found in Indian and west Pacific Oceans in which seven species are known to occur in Indonesian territory waters (Junaidi et al 2010). Those species are *Panulirus homarus*, *P. ornatus*, *P. penicillatus*, *P. longiceps*, *P. polyphagus*, *P. versicolor*, and *P. daypus*.

For the adequate management, information on the size composition of individuals harvested, length-weight relationship and condition factor are important tools for any finfish species (King 2007; Ndome et al 2012; Ikhwanuddin et al 2014). According to Montgomery (1995), size distribution data provide knowledge about the impact of harvesting on the population and on the temporal and spatial distributions of individuals of different sizes. Length-weight relationship and condition factor are mainly dealt with to know the variations in expected weight from the known length groups, which are, in turn, the indications of fatness, breeding and feeding state and their suitability to the environment. Furthermore, Bagenal & Tesch (1978) stated that the results of condition factor can be used to compare the wellbeing of a finfish and is based on the theory that heavier finfish of a given length are in better condition. Condition factor decreases with increase in length and also influences the reproductive cycle in finfish (Welcome 1979).

Although exploitation of lobster by traditional fishers has been done for long time in Ambon Island waters, scientific information on this important marine resource is lacking. This research was conducted to provide some biological aspects of painted spiny

lobster (*Panulirus versicolor*) which consists of size distribution, length-weight relationship, condition factor and sex ratio.

Material and Method. This research was carried out from March to May 2014 in Latuhalat waters, Ambon Island (Figure 1). Samples of lobster were obtained from the lobster fishers at Latuhalat village.

Species identification was based on Holthuis (1991). Samples were separated based on their sex and then measured. Carapace length was measured by using vernier caliper from the posterior part of the eye socket to the back of carapace parallel to the medio-dorsal line to the nearest mm, whereas weight was weighted using a 5.0 kg blue LCD backlight portable digital balance to the nearest gram. Data was processed with Microsoft Excel 2010.



Figure 1. Map showing sampling site (red circle).

Length-weight relationship was analyzed using formula proposed by Pauly (1984):

$$W = a L^b$$

where: W - weight (g);
L - carapace length (cm);
a - intercept;
b - slope.

The value of b is then used to determine growth pattern i.e. isometric growth (b = 3) or allometric growth (b ≠ 3) by using t-Student test based on Pauly (1984).

Condition factor was estimated using formula proposed by King (2007):

$$CF = \hat{W}/W$$

where: \hat{W} - observed mean weight;
W - predicted mean weight = $a L^b$.

Sex ratio was analyzed using Chi-square test according to Fowler & Cohen (1990):

$$\chi^2 = \sum (O - E)^2/E$$

where: O - observed frequency;
E - expected frequency.

Results and Discussion

Size distribution of lobster. A total of 56 individual *P. versicolor* which consist of 31 males and 25 females were collected during the study. The carapace length of lobster in the present study ranged from 6.0 to 14.1 cm (mean 9.31 ± 2.15 cm), while the weight ranged between 101 and 1130 g (mean 419.43 ± 239.57 g) (Table 1). In comparison, *P. versicolor* in Latuhalat waters is larger than lobster in Ayah coastal waters (Kadafi et al 2006). The authors found carapace length of *P. versicolor* ranging from 3 to 9 cm. Meanwhile, Vaitheeswaran et al (2012) found the size of *P. versicolor* ranging from 12.9 to 24.1 cm and 105 to 405 g for total length and weight, respectively in Thoothukudi waters, Southeast Coast of India. In general, male lobster in Latuhalat waters is larger and heavier than female one (Table 1).

Table 1
Descriptive statistics of *Panulirus versicolor* in Latuhalat waters

Lobster	n	Carapace Length (cm)				Weight (g)			
		Min	Max	Mean	SD	Min	Max	Mean	SD
Male	31	6.3	14.1	10.14	2.10	233	1130	506.45	241.95
Female	25	6.0	12.4	8.28	1.74	101	749	311.52	190.89
Total	56	6.0	14.1	9.31	2.15	101	1130	419.43	239.57

The lobster population in Latuhalat waters is composed predominantly of adults > 6.0 cm in carapace length. Junaidi et al (2010) stated that *P. versicolor* in Ekas Bay, Lombok Island Indonesia attained first maturity at 61–71 mm carapace length. Based on that statement, it can be concluded that lobster captured in Latuhalat waters has spawned at least once.

Length-weight relationship. There is a close relationship between carapace length and weight as indicated by high values of coefficient correlation (r) which ranges from 0.957 to 0.964 (Table 2). The b values are lower than 3, ranging from 2.048 to 2.931 (Figures 2, 3, 4). However, the t-student test indicated that b value for female is not significantly different from 3 (Table 2). Subsequent analysis showed that the b value of female at 95% confidence interval ($p = 0.05$) ranged from 2.581 to 3.280 (Table 2). These results indicate that growth pattern of female is isometric i.e. weight increment is equivalent to the cubic system of length (Pauly 1984) whilst male and combined sex of male and female lobster have negative allometric growth i.e. length increment is faster than weight increment.

Table 2
Length-weight equation, range of slope, correlation coefficient and t-student values of *Panulirus versicolor* in Latuhalat waters

Lobster	$W = a L^b$	Range of b at $p = 0.05$	r	t calc.	t ($p = 0.05$; $df = n-2$)
Male	$W = 4.159 L^{2.048}$	1.817 - 2.279	0.959	8.43*	2.05
Female	$W = 0.561 L^{2.931}$	2.581 - 3.280	0.964	0.41	2.07
Total	$W = 0.152 L^{2.054}$	2.291 - 2.711	0.957	4.80*	2.00

Legend: df = degree of freedom; * = significant at $p = 0.05$.

The similar growth pattern had been observed by Kadafi et al (2006) who found isometric growth for female and negative allometric growth for male *P. versicolor* in Ayah coastal waters. In other species *P. gracilis*, Perez-Gonzalez (2011) also found isometric growth for female and negative allometric growth for male. On the other hand, Vaitheeswaran et al (2012) found negative allometric growth for both sexes of *P. versicolor* in Thoothukudi waters, Southeast Coast of India.

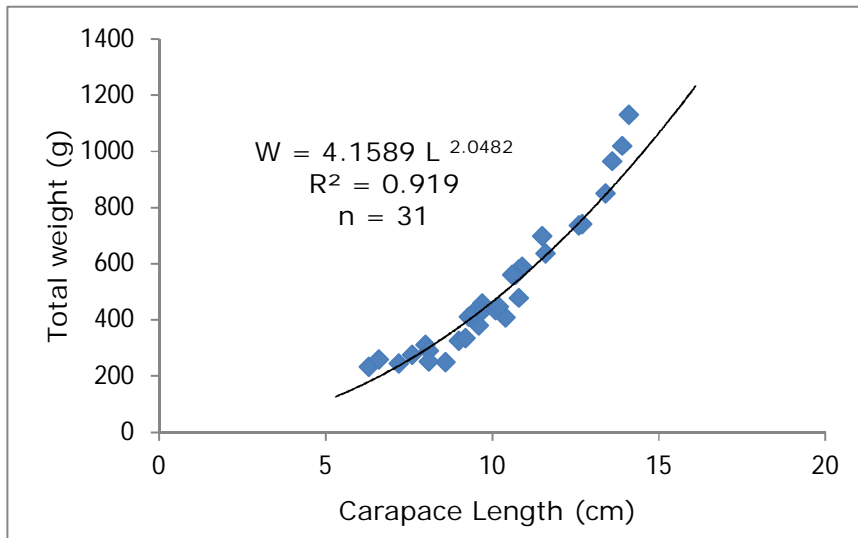


Figure 2. Length-weight relationship of male *P. versicolor*.

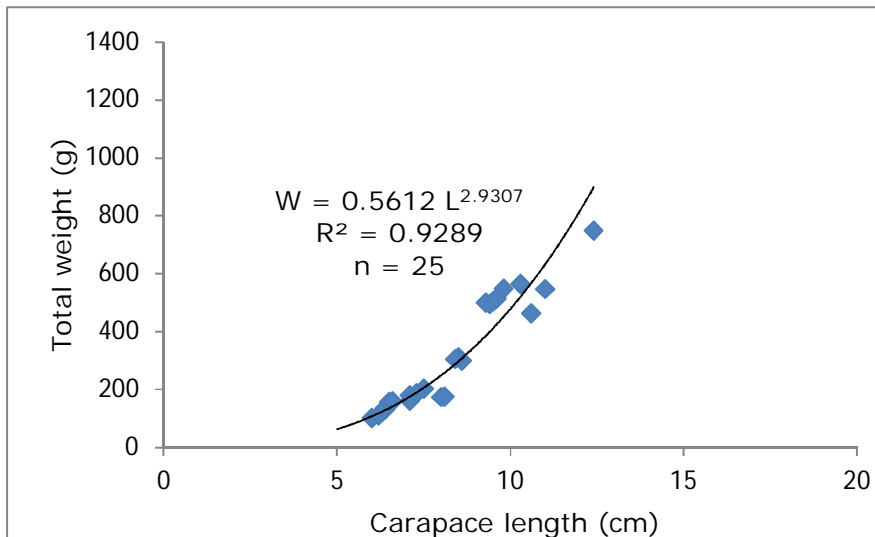


Figure 3. Length weight relationship of female *P. versicolor*.

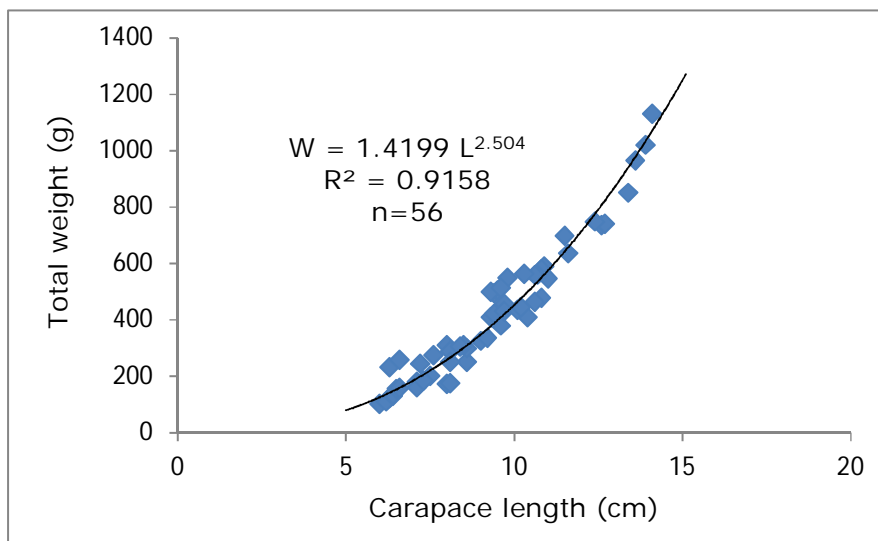


Figure 4. Length-weight relationship of *P. versicolor*

Condition factor. The calculated values of condition factor showed that the value for female (1.13) is higher than male (1.06). According to Bagenal & Tesch (1978), condition factor can be used as an indicator for fatness or well-being. Furthermore, Effendie (1997) stated that ideal condition of an organism is achieved when the length increment is proportional to weight increment or weight increment is equal to the cubic of length (isometric growth). Based on those, this result implies that condition of female is better than male because at the same length female is heavier than male.

Sex ratio. In the present study, sex ratio between male and female is 1:0.81. However, the result of chi-square test showed that there is no significant difference between male and female in which χ^2 calc. = 0.64 < χ^2 table = 3.84 ($p = 0.05$; $df = 1$). This result suggests that proportion of male and female lobsters in the area are equal or both sex have an equal probability to be captured. Deviation of an equal sex ratio of lobster could occur and it has been associated with differential male and female movements during their reproductive activity (Perez-Gonzalez 2011). The author found that female lobster *P. gracilis* tend to migrate to deeper waters or decreased activity during egg development. This pattern of movement of the females toward deeper waters is common in family Paniluridae and has been observed in *P. argus* (Freitas & Castro 2005), *P. ornatus* (Bell et al 1987), *P. guttatus* (Padilla-Ramos & Briones-Fourzán 1997), and in *P. elephas* (Goñi et al 2001).

Conclusions. A total of 56 individual lobsters *P. versicolor* which consist of 31 males and 25 females were collected during the study. The carapace length ranged from 6.0 to 14.1 cm (mean 9.31 ± 2.15 cm), while the weight ranged from 101 to 1130 g (mean 419.43 ± 239.57 g). Male lobsters are larger and heavier than females. Growth pattern of lobsters in the area was negative allometric and isometric for males and females respectively, with the condition factor of females being better than males. Ratio between males and females was equal.

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