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SIZE-AT-MATURITY STAGES OF LOBSTER, *PANULIRUS ORNATUS* FABRICUS

ABSTRACT

Study on the maturity stages of spiny lobster, *Panulirus ornatus* had been made using gonadosomatic index, (GSI) and the gonad structures. A total of 93 female *Panulirus ornatus* of the size range from 27.6 mm to 139.7 mm CL and 103 males of 45.2 - 139.0 mm CL had been used in the study. The samples for the study were collected from Lahad Datu, Sabah, Malaysia from April to November, 1998. Their characteristics for sexual dimorphism were also discussed. The results show that there were no significant difference between carapace length and body weight for male and female specimens but regression between the total length and body weight showed a significant difference between male and female specimens. It was found that the female *Panulirus ornatus* matures at size 107.2 mm CL while the male at 98.1 mm CL.

NINETEEN species of *Panulirus* have been identified and most of them are distributed in the tropical waters (Lipicus and Cobb, 1994). *Panulirus ornatus* is normally found distributed from west of Indo Pacific from Red Sea to east of Africa and South east Asian Island to north of Australia, Papua New Guinea, Fiji Island. The species also inhabit south of Japan (Munro, 1994; Shokita *et al.*, 1991). Holthuis(1991) also reported that this species is also found in Israel and north east of Mediterranean.

P. ornatus normally inhabits shallow tropical waters and is considered a hardy species (Booth and Kittaka, 1994). The landings of this spiny lobster were recorded from Sabah. A total of 423 metric tonnes have been landed during 1991-1995. However, the total spiny lobster landed in 1996 had decreased to 30

metric tonnes worth RM 1.8 millions. The landing statistics does not separate the species compositions of the spiny lobster. There were at least 6 species of spiny lobsters landed in Sabah waters, where *P. ornatus* and *P. versicolor* were the dominant species. Though there were no proper and standard record of the catch, these species were considered as overexploited. Conservation programmes have been conducted on this species especially by the introduction of artificial reef made up of ceramic pipe.

Some studies had been made on the species on the maturity stages such as in captivity (Junio and Estrella, 1994) and general maturation stages in spiny lobster (Nakamura, 1994). However, the aims of this paper is to determine the mature size of *P. ornatus* based on the morphology of their reproductive organ and the secondary characteristics of the wild resources.

MATERIAL AND METHODS

The study was conducted at Lahat Datu and the specimens of *P. ornatus* were obtained from the fishermen near Pulau Tambisan (Fig. 1). The specimens were caught within the

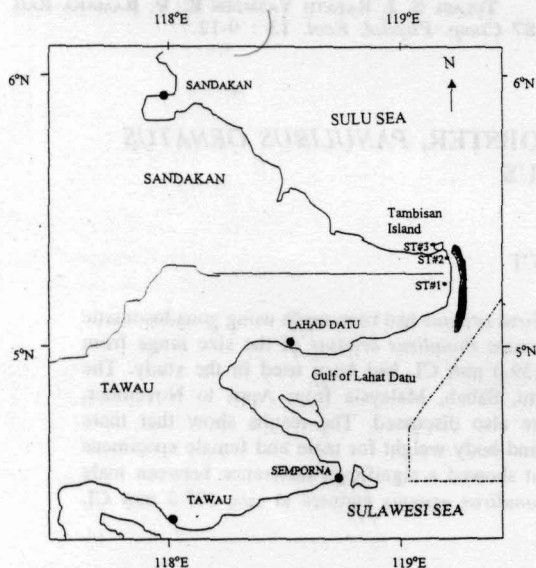


FIG. 1. The map shows the position of the sampling stations (ST#1, ST#2, ST#3) while the shaded area shows the areas of exploitation of *Panulirus ornatus*

119°14'E and 05°08'N and 119°07'E and 05°28'N. ST#1, ST#2 and ST#3 show the location where the species were landed. The shaded area in the figure indicates areas of exploitation.

The morphometric characteristics of *P. ornatus* were recorded which include their total length (TL), carapace length (CL), and weight to the nearest 0.1 g for specimens weight less than 1 kg. The TL was measured to the nearest 1 mm, the CL to the nearest 0.1mm. The TL was measured from the anterior tip of the carapace to the exterior of the telson, CL from anterior carapace to the posterior of the carapace. The aliothorax of *P. ornatus* were dissected and the ovary and the testis including

their vas deferens were removed for measurement and recording. The weight of the gonads were measured to the nearest 0.1 g and the colour of the gonad were recorded for each species. The relationship between the weight of the ovary and testis against their length were calculated and plotted.

The Gonadosomatic Index (GSI) was then calculated using;

$$\text{GSI} = \frac{\text{Weight of the gonad}}{\text{Weight of the body}} \times 100\%$$

RESULTS AND DISCUSSIONS

Sexual dimorphism

The males and females of the *P. ornatus* can be distinguished through their external morphology. There were at least 6 external characteristics of the appendages that can be distinguished between the males and females (Table 1). Most of the differences occur at the leg appendages which were adaptable for reproduction success. Ovigerous setae is one of the characteristics that can differentiate the mature female from immature one.

Length weight relationship

The length-weight relationship of the lobsters can be expressed in a linear equation as: $\ln(W) = \ln a + B \ln(L)$, where, W and L is the weight and length of the lobster, respectively, while "a" and "b" are the constants. A total of 103 male lobsters of the size range 45.2—139.0 mm(CL) and 93 females of the size range 27.6 to 139.7 mm (CL) were used in the study for length-weight relationship. The length-weight relationship is shown in Table 2. The one way analysis of variance (ANOVA) between the carapace length and the body weight showed that there were no significant difference for both male and female at $p < 0.05$ although the graph shows that the females are slightly bigger than the males especially

when the carapace length reach more than 50mm (Fig. 2) However, the regression between the total length and the body weight shows that there is a significant difference for both

carry eggs until they reach the size of 107.2 mm. The average value of the GSI for the immature specimens of the size range 62.0 mm to 104.8 mm (CL) were 0.14 ± 0.04 with a

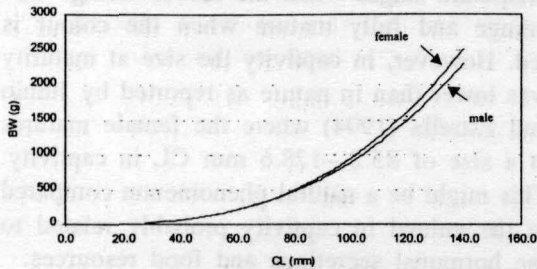


FIG. 2. The result of the regressions between the carapace length and body weight of male and female of *Panulirus ornatus*.

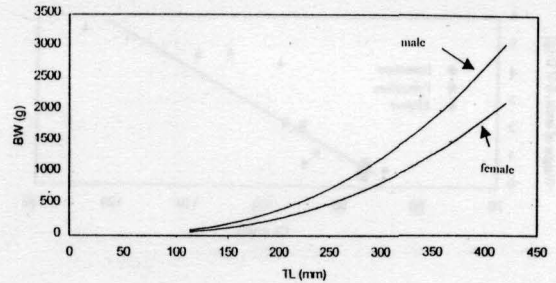


FIG. 3. The result of the regressions between the total length and the body weight of male and female of *Panulirus ornatus*.

the male and female of the *P. ornatus* (Fig. 3).

maximum value of 0.22 and the average wet weight of the ovary 0.83 ± 0.35 g. The shape of the immature ovary follows the letter of "H" and is transparent.

Size-at-maturity

Female

A total of 38 female spiny lobsters *P. ornatus* of the size range 62.0—139.7 mm were dissected to examine the ovary stages and their eggs. It was observed that the species does not

Male

A total number of 14 specimens of male *P. ornatus* 84.2 to 124.0 mm in carapace length were dissected for gonad studies. The maturity stages were determined based on their

TABLE 1. External morphology of the male and female spiny lobster, *Panulirus ornatus*

No.	Structure	Position	Male	Female
1.	Pleopod	Abdomen	Uniramous	Biramous
2.	Endopod	Pleopod	None	Exist
3.	Setae	Endopod	None	Exist
4.	Dactylus	V Pereiopod		Dichotomous
5.	Coxa	V Pereiopod	Cuticle	Smooth
6.	Pereiopod	Sternum	Size longer when mature	No different

TABLE 2. The length-weight relationship of male and female spiny lobster, *Panulirus ornatus*

Sex	Carapace length Vs body weight	Total length Vs body weight
Male	$W = 0.0018 (CL)^{2.8466}$; $r^2 = 0.9854$	$W = 0.0002 (TL)^{2.7388}$; $r^2 = 0.9824$
Female	$W = 0.0013 (CL)^{2.9035}$; $r^2 = 0.9904$	$W = 0.0001 (TL)^{2.7936}$; $r^2 = 0.9810$

composition of the testis and the vas deferens (Fig. 4.) shows that there is a positive correlation between the carapace length and the weight of

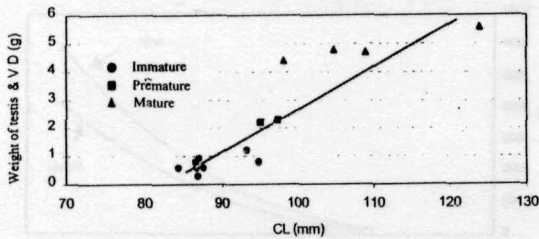


FIG. 4. Linear relationship between the carapace length and gonad (testis and vasa deferentia) of spiny lobster, *Panulirus ornatus*.

the gonad (testis and vas deferens).

The GSI values shows that they can be divided into three stages of maturity, that is, immature at carapace length between 84.2—94.7 mm, premature at size between 95.0—97.2 mm and mature at size between 98.1—124.0 mm with GSI values ranging from 0.05—0.17, 0.27—0.29 and 0.39—0.58, respectively (Fig. 5).

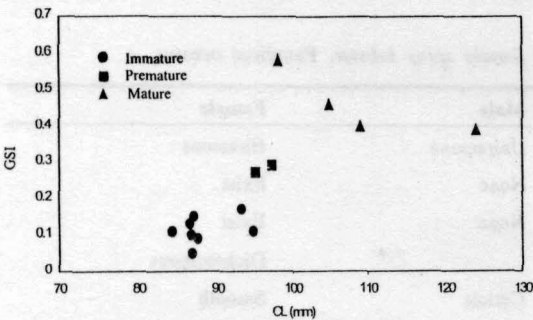


FIG. 5. The Gonadosomatic Index of the male spiny lobster, *Panulirus ornatus*.

Figure 6 shows that the percentage of vas deferens of the male spiny lobster *P. ornatus* increase from the immature stages, that is, from 60.6% to 62.4%.

The creamy colour of the ovary below 10.48 mm CL shows that they are still immature at these sizes. Berry (1971) described that the ovary of the lobsters normally attained their premature stages when the colour change into orange and fully mature when the colour is red. However, in captivity the size at maturity was lower than in nature as reported by Juinio and Estrella (1994) where the female matures at a size of 85.2—128.6 mm CL in captivity. This might be a natural phenomenon compared to the animal in captivity probably related to the hormonal secretions and food resources.

The present findings were similar to the observations of Nakamura (1994) who recognised three maturity stages of testis, and in this study, the wild resources of male *P. ornatus* were immature at CL < 94.7 mm. At this stage the testes were small with no spermatozoa in the gonad (testes and vas deferens). The second stage, premature stages have a size range from 95.0—97.2 mm CL. The size of the testes was found much bigger and there were spermatozoa in the gonad. The concentration of spermatozoa in both the testes and vasa efferentia were almost the same. The third stage is the mature stage with the size range from 98.1—124.0 mm CL. At this stage the testes were slightly yellowish and the vasa efferentia become bigger than the testes and were filled with the spermatozoa.

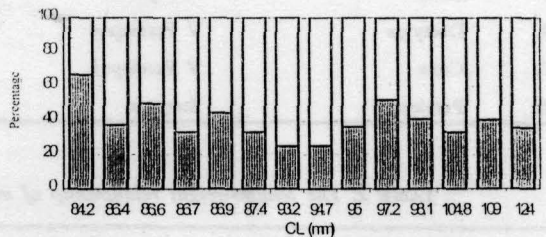


FIG. 6. Percentage of the testis and vasa deferentia of the spiny lobster, *Panulirus ornatus*.

Since the regression between the carapace length and body weight shows no significant difference for male and female it is much better to use the carapace length in the comparative study. We could conclude that the male attained

their maturity stages at CL smaller than the female but this does not mean that male *P. ornatus* attained their age at maturity earlier than the female. Ageing studies should be done to clarify this statement.

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EFFECT OF MALATHION ON RESPIRATION OF MARINE EDIBLE CRAB *UCA MARIONIS* (DES)

ABSTRACT

Respiration rate is an important parameter to find out physiological and metabolic state of the animal in toxic medium. It can help to evaluate the rate of toxicant entering in the body and affecting the availability of molecular oxygen which is essential for the cell development, cellular function and energy metabolism. Oxygen is one of the most important requirements in aerobically respiring aquatic organism. The crab *Uca marionis* (Desmarest) depends on aerobic mechanism for its energy need. In the present study attempts have been made to investigate and to find out the effect of Malathion pesticide on marine crab *U. marionis* (Des) at lethal and sublethal concentration both under acute toxicity exposure and chronic toxicity exposure.