WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Mangrove Snail (*Telescopium telescopium*) Meat Enhances Maturation and Berried-Egg Broodstovk of Three Species of Spiny Lobster (*Panulirus*) from Lampung Waters

Bagoes Septananda Putra[1], Munti Sarida[1], Supono[1], Margie Brite[2], Yudha Trinoegraha Adiputra[1]*

[1]Department of Fisheries and Marine Science, Faculty of Agriculture, University of Lampung. No.1 Prof.Sumantri Brodjonegoro St., Gedong Meneng, Bandar Lampung, Indonesia, 35145

[2]Research Center for Marine and Land Bioindustry, National Research and Innovation Agency, Dusun Teluk Kodek, Desa Malaka, Kecamatan Pemenang, Kabupaten Lombok Utara, Nusa Tenggara Barat, Indonesia, 83352

A B S T R A C T

Spiny lobster hatchery (*Panulirus* spp.) is still hampered by technology that has not been mastered and until now still relies on natural catches for puerulus and their prospective brooders. Spiny lobster hatchery can be started by spawning broodstock with sufficient body weight with feeding to increase gonadal maturation. Feed used to enhance gonadal maturation includes the use of mangrove snail meat (*Telescopium telescopium*). The purpose of this study was to study the effectiveness of mangrove snail meat on spawning and berried egg broodstock in scalloped spiny lobster (*P. homarus*), pronghorn spiny lobster (*P. penicillatus*), and longlegged spiny lobster (*P. longipes*). This research was conducted in spiny lobster floating net cages for 60 days of rearing. The experimental design of large scalloped spiny lobster broodstock (>150 g), small scalloped spiny lobster broodstock (<150 g), and pronghorn spiny lobster and longlegged spiny lobster broodstock (>150 g) were fed with mangrove snail meat as much as 20% of the lobster body weight per days to produce spawning and berried egg naturally. The results showed that the feeding of fresh meat of mangrove snails was effective in producing spawning and berried egg broodstock for large scalloped spiny lobster lobster (bodyweight >150 g) compared to small scalloped spiny lobster lobsters (<150 g), pronghorn spiny lobster and longlegged spiny lobster.

Keywords: mangrove conch; maturation; spawning; spiny lobster; reproduction

1. Introduction

The demand for spiny lobster (*Panulirus*) in the world has been increased in last decade. In 2017, demand for live spiny lobster reached 18800 tons with the largest importers from the United States and the People's Democratic Republic of China (FAO, 2017). Indonesia is third rank as a spiny lobster exporting country with a European and Asian market share, in 2016 it was able to export as much as 16482 tonnes (WWF, 2015). Unfortunately, majority supply of spiny lobster in the world origin from fishery in which is currently limited.

Spiny lobster hatchery is main key in comprehensive aquaculture, which is currently still experiencing problems in practice. The maintenance of prospective spiny lobster broodstock is thought and one factor affecting in hatchery quality and quantity (Adiputra *et al*., 2018a). There are at least two things that must be considered in the maintenance of potential broodstock spiny lobsters, in particular determination of productive male-female prospective broodtock and fulfillment of proper nutritional needs (Smith & Ritar, 2007; Aaqillah-Amr *et al*., 2021). Determination of prospective spiny lobster broodstock is based on the first maturation event so size is not a requirement for determining productive broodstock, although minimum body weight restrictions for prospective broodstock must still be implemented in order to control the quality of reproduction produced (Brey & Lawrence, 1992; Adiputra *et al*., 2018b. Meanwhile, fulfilling nutritional needs, especially protein and essential fatty acids, is another factor that also affects maturation in crustaceans (Chimsung, 2014). In short, determination of the type of feed that suits the nutritional needs during the maintenance of prospective spiny lobster broodstock is important.

Shellfish genera is known to be used as feed for crustacean due it contains of protein, fatty acids, and micro-nutrients (Yaghubi *et al*., 2021). On the other hand, spiny lobster showed preferences to feed based shellfish (Sardenne *et al*., 2019). Mangrove snails (*Telescopium telescopium*) are potential to be used as spiny lobster feed. Based on Haikal *et al*. (2017), mangrove snails can used as spiny lobster feed due to supported growth performance. However, studies on the use of mangrove snails as feed that support spiny lobster maturation process are currently unknown. Therefore, this study aimed to evaluate the reproductive performance and maturation of three spiny lobster species fed mangrove snail meat.

2. Materials and Methods

Early broodstock of spiny lobsters were obtained from lobster collectors in Krui, West Coast District, Lampung Province. The three spiny lobster species used in this study *i.e.* scalloped spiny lobster (*P. homarus*), pronghorn spiny lobster (*P. penicillatus*), and longlegged spiny lobster (*P. longipes*). This study used three reference groups of lobsters which were differentiated based on size, species, and sex. Spiny lobster with same species was reared in one floating net cage for 60 days, where each cage size was 3 x 3 x 3 m. Spiny lobsters mass spawn and produce egg-berried broodstock were focus on study. The details for experimental study of spiny lobsters spawning and berried eggs (Table 1). During the study, spiny lobsters were fed fresh mangrove snail meat, which taken from the mangrove forest around the study site. Feeding is done twice a day (08.00 am and 07.00 pm) with feeding rate of 20%.

During the research, descriptive observations were made of feeding and spawning behavior with underwater camera which directly observes the activities of the spiny lobster. Meanwhile, every 15 days observations and measurements are made of number of spawning broodstock (observation of presence or absence of sperm sacs on female broodstock) and female broodstock carrying eggs, characteristics of female broodstock carrying eggs (egg color change), and absolute weight (final lobster weight – initial lobster weight of study). All data collected was analyzed descriptively by describing, explaining and displaying it in the form of tables and figures, then compared with relevant references to analyze the effectiveness of application of mangrove snail meat as feed in increasing the number of spawning broodstock, the number of broodstock carrying eggs, and the growth of each tested lobster.

Table 1- Experiment design of spiny lobster (*Panulirus*) maturation.

Body weight (g)	Spiny lobster	Sex		Total	Floating cages
		Male	Female		
> 150	Scalloped	30	41	71	A
	Pronghorn	14	21	35	B
	Longlegged	8	2	10	C
< 150	Scalloped	27	41	68	D

3. Results and Discussion

Response of feeding of spiny lobster to mangrove snail meat showed aggressiveness. This indicates that lobsters have a preference for the type of shellfish feed.

During the spawning process (Fig. 1), male spiny lobster lays a spermatophore mass on the sternum of the female lobster. This laying lasts a few moments before the eggs are released. The claws on the legs of the female tear the membrane covering the spermatophore mass while pulling the eggs toward the abdomen (Fig.1). Then, when the egg is pulled towards the abdomen, the sperm comes out of the torn spermatophore mass and fertilization occurs. Meanwhile, the results of observations of spawning behavior for all types of spiny lobsters (Table 2).

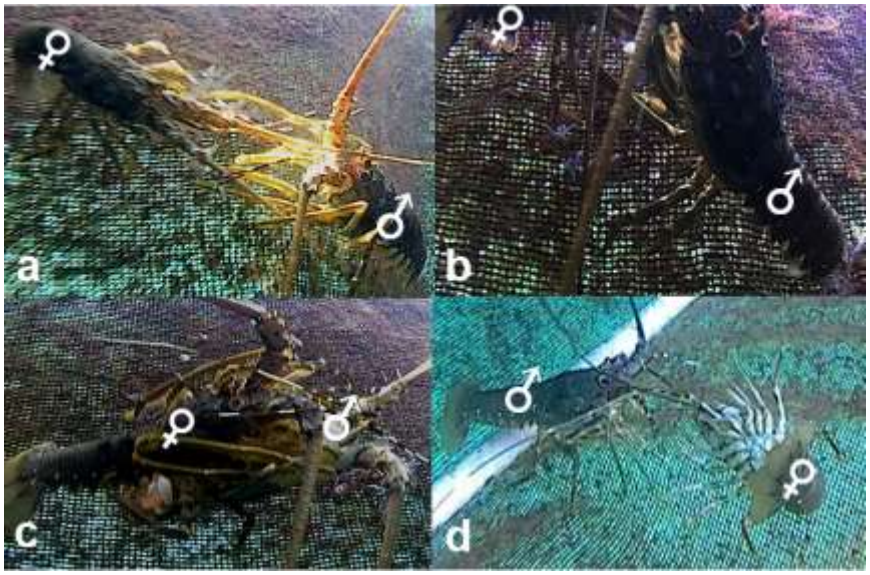

Fig. 1 – Scalloped spiny lobster (*Panulirus homarus*) behaviour related to spawning. (a) Cuortship, (b) Prepared for spawning, (c) Copulation, (d) Separation

Spawning behavior of spiny lobsters was observed in this study. Where through four stages: courtship phase, establishment of spawning positions, copulation, and separation of individuals (Jinbo *et al*., 2017). In the courship phase, two antennae of each individual touch each other, followed by the attachment of the first swimming legs. Followed by facing each other vertically. When the two of them have bonded with each other, the male lobster

will squirt his sperm towards the female's abdomen so that the fertilization process occurs. The last phase is the separation phase where the two individuals are far from each other where the lobster spawning process occurs outside the body.

Table 2- Spiny lobster (*Panulirus*) species spawning phases.

Spiny lobster species	Spawning phases			
	Phase I	Phase II	Phase III	Phase IV
Scalloped >150 g	√	√	√	√
Scalloped <150 g	√	√	√	√
Pronghorn >150 g	√	√	√	√
Longlegged >150 g	-	-	-	-

Appendix: Cuortship (phase I), Prepared for spawning (phase II), Copulation (phase III) and Separation (phase IV). Marked (√) for positive results and (-) for negative results.

The number of spawning females broodstock can be observed by the presence of sperm sac marks on the female crayfish which have been inserted into the egg sac until the eggs are ready to be released. It is known that scalloped spiny lobster with body weight > 150 g spawn as many as 36 individuals or 80% of the total lobsters (Table 3). Meanwhile, longlegged spiny lobsters with body weight >150 g not spawn due to environment factors. Characteristics of egg-berried broodstock were observed for scalloped spiny lobster >150 g, scalloped spiny lobster <150 g, and pronghorn spiny lobster >150 g (Table 3). In general, during incubation the body of the lobster is always bent and the telson covers the egg, but when the eggs start to hatch the abdomen begins to straighten (Fig. 2).

Table 3- Spiny lobster (*Panulirus*) species spawning phases.

Body weight (g)	Spiny lobster	Number Female Spawning		Percentage (%)	Absolute growth (g)
		Study	Spawn		
> 150	Scalloped	41	36	80	38.50
	Pronghorn	31	1	3	10.67
	Longlegged	2	0	0	26.50
< 150	Scalloped	41	32	68	50.80

In the first week, the eggs are still yellowish in color, followed in the second week they start to be more orange in color, until fourth week the mature eggs are brownish in color (Fig.2). This condition is in accordance with that reported by Junaidi *et al*. (2011), where the color change in lobster eggs occurs along with the development of the embryo. During the egg incubation process, the female spiny lobsters broodstock is always in a bent position to keep the eggs attached to the abdomen (Fig.2). Eggs incubation time in this study lasted up to four weeks. This is in accordance with that reported by Junaidi *et al*., (2011), where the incubation time for lobster eggs vary between 16 to 22 days. It was further noted that the highest percentage of broodstock carrying eggs was found in scalloped spiny lobster with an initial weight of more than 150 g with a percentage of 68% (Table 3). Meanwhile, for the type of longlegged spiny lobster with body weight >150 g, there are no broodstock who carry any eggs. Feeding mangrove snail meat also affect absolute growth of female lobsters (Table 3). In female spiny lobsters, the highest absolute weight growth was found in scalloped spiny lobster with 50.8 g.

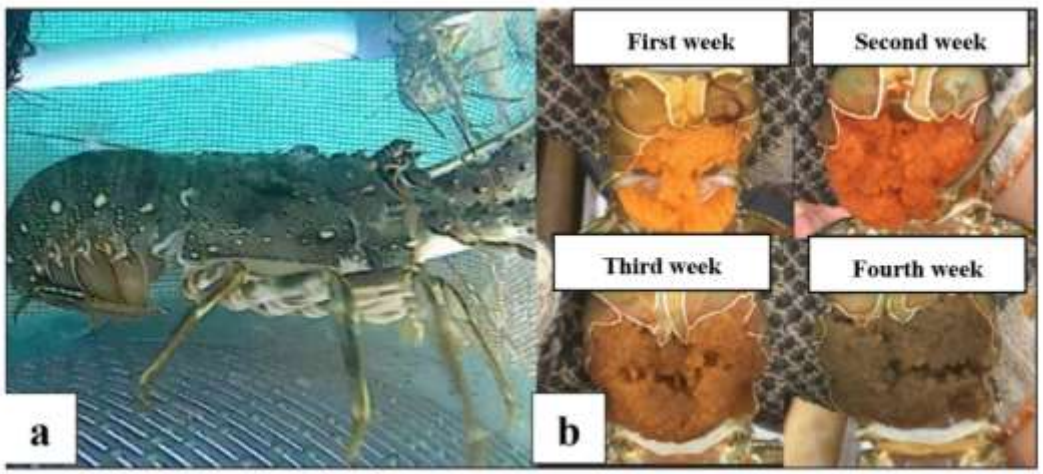

Fig. 2 – Female egg-berried scalloped spiny lobster (*Panulirus homarus*) (a). Egg development progress from first week to fourth week (b).

Reproduction and growth in lobsters are two things that mutually control each other (Lipcius & Herrnkind, 1987). This is comparable to this study where scalloped spiny lobsters weighing more than 150 g had a higher quantity of spawning broodstock. This phenomenon indicates that spiny lobster with

body weight 150 g optimal in terms of spawning. In contrast, to scalloped spiny lobster with body weight < 150 g was highest absolute body weight in females. It is proved that there was mutual control between growth and reproduction spiny lobster.

Scalloped spiny lobsters with > 150 g body weight had highest number of broodstock carrying eggs compared to the other three types of spiny lobsters. This is comparable to a study by Adiputra *et al*. (2018a) in which broodstock lobsters weighing > 150 g had more egg-berried quantities than broodstock <150 g. This is also suspected due to importance role of mangrove snail meat, where the content of palmitic and linoleic fatty acids was able to improve the reproductive performance of spiny lobsters. This research also proved that mangrove snail meat can support the reproduction of pronghorn spiny lobster broodstock which has never reported.

4. Conclusions

Application of mangrove snail meat is effective to:

1. Increased number of spawning broodstock for all sizes of scalloped spiny lobster, but not effectives for pronghorn spiny lobster and longlegged spiny lobster >150g.
2. Increased percentage of eggs-berried female broodstock for all sizes of scalloped spiny lobster, but not effectives for pronghorn spiny lobster and longlegged spiny lobster >150g.
3. Increased growth of all sizes of scalloped spiny lobster, but not effectives for pronghorn spiny lobster and longlegged spiny lobster >150g.

Acknowledgements

University of Lampung (LPPM) and PT. Kreasi Bahari Mandiri supported this research for MBKM's collaboration.

References

Aaqillah-Amr, M.A., Hidir, A., Azra, M.N., & Noordiyana, M.N. (2021). Interactions between food, feeding and diets in crustaceans: A review. *Animals, 11,* 1761.

Adiputra, Y.T., Zairin, M.Jr., Suprayudi, M.A., Manalu, W., & Widanarni, W.(2018a). Ablasi tangkai mata mempercepat pematangan ovari lobster pasir (*Panulirus homarus*) pada musim pemijahan. *Prosiding Simposium Nasional Kelautan dan Perikanan*, Universitas Hassanudin, Makassar. (In Bahasa Indonesia with English abstract).

Adiputra, Y.T., Zairin, M.Jr., Suprayudi, M.A., Manalu, W. & Widanarni. (2018b). Pemijahan induk, profil kolesterol dan asam lemak telur lobster pasir *Panulirus homarus* hasil budidaya. *Jurnal Riset Akuakultur, 13*, 219 – 227. (In Bahasa Indonesia with English abstract).

Brey, W.A., & Lawrence, A. L. (1992). Reproduction of *Penaeus* species in captivity. *Developments in Aquaculture and Fisheries Science, 23,* 93 – 170.

Chimsung, N. (2014). Maturation diets for black tiger shrimp *Penaeus monodon* broodstock: a review. *Songklanakarin Journal of Science Technology, 36,* 265 – 273.

FAO. (2017). *Total World Lobster Production by Country and Origin*. Fishstat FAO.

Haikal, M., Kurnia, A., & Mustika, W.H. (2017). Pengaruh kombinasi tepung bakau (*Telescopium telescopium*) dan minyak kelapa tradisional dalam pakan buatan terhadap pertumbuhan lobster mutiara (*Panulirus ornatus*). *Jurnal Media Akuatika, 2,* 418 – 425. (In Bahasa Indonesia with English abstract).

Jinbo, T., Akira, S., Keisuke, M., & Katsuyuki, H. (2017). Effects of body size on mating behavior and spawning success of the Japanese spiny lobster *Panulirus japonicus* (Decapoda: Palinuridae): implications for broodstock management techniques. *Journal of Crustacean Biology, 37,* 90-98.

Junaidi, M.J., Cokrowati, N., & Abidin, Z. (2011). Tingkah laku induk betina selama proses pengeraman telur dan perkembangan larva lobster pasir (*Panulirus homarus*, Linneaus, 1785). *Jurnal Akuatika, 2*(1): 1 – 10. (In Bahasa Indonesia with English abstract).

Lipcius, R. N., & Herrnkind, W. F. (1987). Control and coordination of reproduction and molting in the spiny lobster *Panulirus argus*. *Marine Biology, 96,* 207.

Sardenne, F., Forget, N., & McKindsey, C.W. (2019). Contribution of mussel fall off from aquaculture to wild lobster *Homarus americanus* diets. *Marine environmental research, 149,* 126 – 136.

Smith, G.G., & Ritar, A. J. (2007). Sexual maturation in captive spiny lobsters, *Jasus edwardsii*, and the relationship of fecundity and larval quality with maternal size. *Invertebrate Repro-duction & Development, 50,* 47 – 55.

WWF Indonesia. (2015). *Seri Panduan Perikanan Skala Kecil: Perikanan Lobster Laut*. WWF Indonesia. Jakarta. 38 pp. (In Bahasa Indonesia).

Yaghubi, E., Carboni, S., Snipe, R.M., Shaw, C. S., Fyfe, J. J., Smith, C. M., & Hamilton, D. (2021). Farmed mussels: a nutritive protein source, rich in Omega 3 fatty acids, with a low environmental footprint. *Nutrients, 13,* 1124.