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Important Aspects in Mangrove Crabs, Scylla Spp Seed Production in Hatchery

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Abstract

The high economic value of mud crab *Scylla* spp in Indonesia and overseas has impacted the high mud crab exploitation throughout Indonesian coastal waters. In another case, mud crab growing out in brackish water ponds also depends on the wild seed supporting. Nevertheless, it could still improve mud crab seed production in the hatchery to gain higher seed production. Some aspects to enhance hatchery seed production could consider including broodstock quality, which can see from the amount of omega-3 fatty acids, Eicosa Pentanoic Acid (EPA), and Docosa Hexaenoic Acid (DHA) in the eggs. Larvae production is necessary to proceed with a stress test. Furthermore, hatchery could provide environmental factors (temperature, salinity, and lighting) suitable for larvae rearing. The larvae should be free of disease (protozoa, fungi, and bacteria) and fulfill the quality and quantity of feed suitable for larvae also an application of probiotics in larvae rearing.

Keywords: *Scylla* Spp; Production; Larvae; Broodstock; Environmental; Feed

Introduction

Mangrove crab, *Scylla* spp cultured in brackishwater ponds has been carried out in several mangrove crabs producing Indonesia areas. Wild crab seeds (50-100 g/ind.) were catches from the mangrove area then stocked in a brackishwater pond without fencing and crab unfed. After two-three months, they began to harvest, selected fatten male and mature gonadal female. This crab culture model has conducted in Pallima village, Bone regency, South Sulawesi Province, Segara Anakan, Cilacap regency, Central Java Province, and Kuala Lupak Barito Kuala Regency, South Kalimantan Province [1-8].

Research on mangrove crab grow-out have been conducted and showing that male of mangrove crabs, *Scylla* spp grow faster than female mangrove crabs [9-16]. Mangrove crab, *Scylla* spp was stocked in brackishwater ponds at the density of one ind. m^{-2} with an initial size at 50g/ind. reach an average of 200g/ind. with a survival rate of 70-80% for three months of cultured [5]. Crabs grow-out in the pond with different pond conditions mostly based on the distances from the riverbank to irrigate ponds, namely. A). Pond location is around 3-5 m from the riverbank, B). Pond location is approximately 300m away from the riverbank, C). The pond location is about 500 m from the riverbank. The study results showed that during three months, grow-out showed that at treatment A obtained the fastest growth crab, the crab from initial weight 0.03g, which grew to an average of 190 g/ind. after three months of culture, while the other treatments only reach 150 g/ind. [17-25]. On the other hand, the technology for mangrove crab seed production already exists in Indonesia [9], but the output is still fluctuating. Thus, it could improve the development of mass seed production.

Some aspects that need to consider in mangrove crabs seed production are as follows:

Mangrove Crab, *Scylla* Spp Broodstock Quality

In Indonesia, mangrove crab spawning occurs throughout the year, with spawning peaks occurring during the dry season's transition to the rainy season in October-November. Mangrove crab broodstock able spawned in the controlled tank. The captive broodstock is fed trash fish, mollusks, and squid meat to accelerate the spawning activity. The size of eggs did not influence the quality of mangrove crab eggs. The amount of omega-3 fatty acids, Eicosa Pentanoic Acid (EPA), and Docosa Hexaenoic Acid (DHA) affect the quality of eggs [3]. If the quantity of EPA and DHA is increasing, then the quality of eggs will be better. The feed supply provided to the broodstock otherwise affects the crab eggs' nutritional content.

Fish widely contain Omega-3 fatty acids, EPA, and DHA, including mollusks and crustaceans. 20: 5 n-3, EPA content in squid was 12.4% of the total fatty acids in squid, while 22: 6 n-3, DHA content as much as 42.3%, Omega-3 and Omega-6 fatty acids as much as 56.3% and 1.9%. Mangrove crab contains EPA at 5.3% and DHA at 3.4%, while Omega-3 and Omega-6 fatty acids at 10.5 and 29%, respectively [3]. It is better to get a suitable type of feed for mangrove crab egg production, so it sees the quality of the resulting crab eggs and should also see the larvae production quality [22]. Thus, it is necessary to proceed with a stress test to the new hatch larvae, for example, examining the larva's resistance by stressing with formalin, temperature, salinity, or a refraction test without aeration.

Environmental Factors (Temperature, Salinity and Lighting) are Suitable for Larvae Rearing

Temperature plays a significant role in accelerating the metabolisms of an organism. Water temperature affects the incubation period of eggs, survival rate, and the time required to develop larvae [12]. The best temperature for the S. serrata larvae rearing is at 29°C. In China, Chen HC, et al. [2] reported that the optimum temperature for the development of *S.* serrata larvae is 26-30°C. At the higher temperatures (30-31.5°C), the development of mangrove crab larvae *S.* olivacea is faster than in larvae kept at lower temperatures (28-29.5°C). However, the larvae have a lower survival rate at high temperatures than at low temperatures [10]. In another research Gunarto G, et al. [6] reported zoea-5 obtained on day 14 of the rearing period of S. paramamosain. On day 16th of the rearing period, the larvae survival rate was 20 ± 7.21% in water temperature 30 – 33°C and 59 ± 22.31% in water temperature of 28.7 – 30.5°C. Statistically showed a significant difference ($p < 0.05$) between these two treatments. Salinity is substantial to support larvae survival rate Nurdiani, et al. [19] reported that at salinity 20-35 ppt no considerable effect on S. serrata zoea larvae's survival rate. However, from the experiencing, the salinity level at 30-32 ppt is most suitable for larvae rearing [8].

In the study of the influence of lighting in larvae rearing Gunartog G, et al. [11] with the treatment of lighting intensity during the day at room conditions without the addition of lights with a light intensity of 44 - 52 lux meters (A) as control treatment; Room condition with added a one piece of the bulb lamp of 5 watts with a light intensity of 66 - 72 lux meters (B). Room condition with the addition of two 5 watt bulb lamps with a light intensity of 82 - 86 lux meters (C). The resulting study showed that the number of megalopae most successfully harvested in the treatment C = 754.5 ± 260.9 ind./250 L /cone fiber tank, then followed treatment A = 725 ±233.3 ind./250 L/ cone fiber tank and the lowest in the treatment B = 471 ± 29.6 ind./250 L/cone fiber tank.

Free of Disease (Protozoa, Fungi, and Bacteria).

Protozoa, fungi, bacteria generally attack mangrove crab larvae [14,17,23,26-29]. Mass of protozoa monitored attack the spawned broodstock. The spawned broodstock could be soaked into formalin solution at 10% for 5 -10 minutes or washed in an antifungal substance (treplan) 10 ppm for 10 minutes—furthermore, the spawned broodstock stocked in a 500 L-1000 L fiber tank volume. Saline sterile water salinity 30 ppt filled to the tank and given aeration. The crabs are kept separately during the incubation process, alone and unfed until the eggs hatch into larvae.

Several disease prevention techniques in crab larvae have used probiotics [15,18,21]. The addition of probiotic bacteria to the larvae rearing can serve as a complement of feed sources. Besides that, it contributes to the digestive system of food and suppresses pathogenic bacteria, because the probiotic bacteria produce anti-bacterial [1,20,27].

The Quality as Well as the Quantity of Feed Suitable for Larvae

Nutritional factors (size, density, and completeness of feed nutrients influence the rearing tank's crab larvae survival rate. Thinning of the larval population is intended to reduce the larvae population kept in the rearing tank. Initially, larvae stocked in the tank for larvae rearing is 100 ind.L^{-1}. On day 5th often found concentrations of ammonia in the larvae rearing tank attained one mg L^{-1}. An accumulation of residual metabolism of dead larvae and rotifers and the degradation of organic matter in the rearing tank affect ammonia's high concentration. To reduce the speed of decreasing water quality, thinning some larvae by transferring them to a new

container is suggested. The high ammonia concentrations (> 0.5 mg L^{-1}), obtained after the larvae reach stadia zoea-3, where this condition often triggers the development of Vibrio spp. Bacteria *V. harveyi, V. alginoliticus, V. parahaemolyticus*, and colonies of green bacteria as pathogens in mud crab larvae and often caused mass mortality at the larval and megalopa stage [26]. The megalopa's mass mortality only appears after the larvae of zoea-5 metamorphose into megalopa. The low survival rate of larvae and megalopa into young crabs due to the low level of feed quality [24]. Encapsulation of rotifer and Artemia using fatty acids HUFA is the way to improve natural feed quality.

Crustacea larvae cannot synthesize fatty acids n-3 family (linolenic), namely EPA, 20:5n-3, and n-6 (linoleic), namely DHA, 22: 6n-3. Both are indispensable for development in crustacean larvae. Therefore, rotifer, Brachionus spp, and Artemia nauplii could support the EPA and DHA needed for the larvae. However, the content of EPA and DHA in Artemia and rotifer, Brachionus spp is relatively low [4], so the nutritional quality is also low. Enrichment of rotifer and *Artemia* nauplii using HUFA and algae such as Nannochloropsis sp before the larvae feed is essential. The high larvae development indices and the high number of crablet production ($p<0.05$) were higher in larvae fed rotifer enrichment with HUFA than controls, without enrichment for the rotifer feed for the larvae. Due to an increase in the quality of rotifers, it is seen from an increase in the DHA/EPA ratio from 0.063 in the unenriched rotifer, increasing to 0.147 in the rotifer enriched using Nannochloropsis sp [5].

Further study on Artemia nauplii enrichment using beta 3 HUFA fatty acids given to mangrove crab larvae, finally improving survival, growth rate, and resistance larvae, then successfully larvae develop to megalopa and young crabs. Enrichment of rotifers with HUFA given as feed for *S. serrata* larvae has resulted in faster development of larvae but often experienced death syndrome molting time [12,24] recommend that to obtain high larvae survival rate, shorter molting periods, and a wider carapace size, the Artemia enriched EPA and DHA should be given to the larvae in the range of concentrations of 0.71-0.87% and 0.49-0.72%.

Conclusion

Hatchery seed production for mud crab with higher production is critical to minimizing wild mud crab overfishing due to overexploitation. Therefore, intensive research on important aspects of seed production in hatcheries includes quality of broodstock, the vitality of larvae, the suitability of environment, quality and quantity of feed also probiotics application to support larvae rearing successfully, is essential.

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