Availability of puerulus from natural catch for lobster Panulirus spp. nursery culture

Analisis ketersediaan benih bening lobster puerulus hasil tangkapan alam untuk kegiatan budidaya pendederan lobster Panulirus spp.

Iis Diatin1*, Irzal Effendi1, Yani Hadiroseyani1, Tatag Budiardi1, Virta Rizki Hernanda2, Nidwidyanthi2, Apriana Vinasyiam1

1Department of Aquaculture, Faculty of Fisheries and Marine Science, IPB University, Bogor, West Java 16680, Indonesia
2Undergraduate student of Aquaculture Science, IPB University, Bogor, West Java 16680, Indonesia
*E-mail: iisd@apps.ipb.ac.id

ABSTRACT

Indonesia is one of the lobster (Panulirus spp.) exporters countries to Hong Kong, Vietnam, China, and Singapore, with average export growth of 3.54% per year. The lobster export still relies on the natural catch, as the lobster culture has not been widely practiced in Indonesia. Pesisir Barat District Lampung Province is known as a lobster catch area, used by the local fishermen as the main income source. To determine the economic potential of lobster culture, a study was conducted to analyze the availability of lobster seeds (puerulus) and the lobster distribution channel for lobster culture. This study was conducted by survey method in Krui Selatan Sub-district, Pesisir Barat District, Lampung. Respondents in the study were fishermen who puerulus catch and collectors. The respondents were determined by the snowball sampling method. The results showed that the main types of lobster caught were sand lobster and pearl lobster. The catch of lobster fishermen on the new moon is an average of 121–340 puerulus/month, while on the full moon is an average of 4–680 puerulus/month, so the seed production can gradually reach more than 1,500,000 puerulus. The puerulus caught by fishermen will be sold to small collectors, then to big collectors, distributors, and exporters. The puerulus is distributed to various regions including Lampung, Bengkulu, Jambi, Palembang, and Jakarta. The marketing margin obtained by small and big collectors reaches 15%. The abundant production of lobster seeds in the Pesisir Barat, Lampung has the potential to develop lobster nursery aquaculture.

Keywords: distribution channel, lobster, nursery culture, puerulus

ABSTRAK


Kata kunci: benih bening lobster, budidaya pendederan, puerulus, saluran distribusi
INTRODUCTION

The fishery and marine resources have an important role in the national economic growth. In contrast, the Indonesian fishery production value is increasing by 14.61%, with the quarter months’ fishery export value in 2022 growing by 21.63% compared to the previous year (Asianto et al., 2022). One of the excellent fishery commodities with high export value is lobster. Lobster has become one of the global marine commodities (Penn et al., 2015), with high economic value and price at US$ 100 per kg for 1 kg size and US$ 50 – 80 per kg for 300 g – 1 kg size. Indonesia’s export destinations for lobsters are Hongkong, Vietnam, China, and Singapore (Nursan et al., 2021). The Indonesian lobster export value in 2014-2019 was occupied with growing an average of 3.54% per year (BPS, 2021).

Lobsters have become a commodity that is partly available from the natural catch product, while lobster culture has not yet been performed well in Indonesia, even in other countries (Prompatanapaka dan Lopetcharat, 2020; Goodman et al., 2021). The regulation of lobster culture business needs more attention to produce sustainable lobster, following the market demand (Nursan et al., 2021) and social aspects (Turner et al., 2014; Caputi et al., 2015). Lampung Province, specifically in the Pesisir Barat area, has abundant lobster seeds (puerulus), known as the lobster catching area, which the fishermen utilize as the main income source. The Indonesian Ministry of Marine and Fisheries Affairs’ regulation No. 56 of 2016 About the lobster (Panulirus spp.), mud crab (Scylla spp.), and swimming-crab (Portunus spp.) catching and/or release ban from The Republic of Indonesia obligates that each person is prohibited from selling the lobster seeds for culture and export (KKP, 2016). This regulation causes the fishermen to be unable to catch, and the abundant potential of puerulus is hard to be maximized.

The Indonesian Ministry of Marine and Fisheries Affairs Regulation No. 12 of 2020 About the lobster (Panulirus spp.), mud crab (Scylla spp.), and swimming crab (Portunus spp.) management in the Republic of Indonesia obligates that each person is prohibited from selling the lobster seeds for culture and export (KKP, 2016). This regulation causes the fishermen to be unable to catch, and the abundant potential of puerulus is hard to be maximized.

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The Indonesian Ministry of Marine and Fisheries Affairs Regulation No. 17 of 2021, which re-prohibits strictly the puerulus export, as the puerulus can only be caught in the same province for research and culture purposes. This regulation causes a negative impact on the puerulus smuggling case increase conducts illegally. The puerulus abundance in Pesisir Barat Lampung, has been utilized by fishermen as their main catch commodity since 2015, which secures the standard of living around Pesisir Barat. High puerulus abundance potential is good momentum to develop the lobster culture activity by utilizing the natural catch product in Lampung Province.

Recently, the total puerulus catch is still far lower than the total puerulus abundance around Pesisir Barat, Lampung area. The puerulus abundance in Pesisir Barat Lampung, can be maximized by its absorption level through the cooperation of lobster culture companies in Lampung Province. The puerulus supply provision at the right time, quantity, and the price is extremely important in supporting profitable and sustainable lobster culture business. A process required in this activity is by the supply chain management as a raw material transformation activity to become a product along with the associated stakeholder roles that can elevate the efficiency value (Miftahul et al., 2019). This study aimed to conduct an availability analysis of the puerulus and lobster distribution channel in Pesisir Barat Lampung, as a seed supply source for lobster nursery culture.

MATERIALS AND METHODS

Location and period

The study was conducted in Krui Selatan Sub-district, Pesisir Barat District, Lampung (Figure 1) as a coastal area with most community work as fishermen. This study was performed in October-November, 2021.

Data types and sources

The data types and sources used were primary and secondary data. Primary data was obtained directly from the field through questionnaires, interviews, and observation. Secondary data were obtained from the local government or associated parties, i.e government, private company, and community.

Experimental methods

This study used a survey method in Krui
RESULTS AND DISCUSSIONS

Results
Puerulus abundance in Pesisir Barat Lampung

The puerulus fishermen in Pesisir Barat Lampung have an individual working pattern. Fishermen start to set to the sea in the afternoon to spread the net as the puerulus trap. The number of nets spread from each fisherman is between 50–200 strands. Besides the net, other fishing gears used are lamps and buoys. The number of fisherman's working days in catching the lobster is 20-30 days of fishing per month (Table 1). The abundance of puerulus catch products in Pesisir Barat Lampung is influenced by the new moon and full moon phases.

The abundance of puerulus value in the fisheries management area (WPP) of 572 reaches 3,336,750,000 seeds (BRSDM, 2021). However, only 5% of the puerulus abundance can be caught by the fishermen in Pesisir Barat, namely at 16,143,162 puerulus/month or about 193,718,944 puerulus/year. These numbers are the calculation results of catching potential from 3,843 fishermen joined in 273 cooperative business groups (KUB) (BPS, 2021).

Based on the field observation results, the puerulus caught in the Pesisir Barat Lampung area has a 1–1.5 cm size. The catch product in

<table>
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<th>Activity</th>
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<tr>
<td>Number of working days (day man/month)</td>
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<td>Number of working days during the new moon</td>
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<td>Number of working days during full moon</td>
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<td>Puerulus abundance season</td>
<td>June-October</td>
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the new moon is on averagely 121.340 puerulus/month, while the catch product in the full moon is on averagely 4.680 puerulus/month (Figure 2), therefore the average catch product per month is 126.020 puerulus/month or around 1.512.240 puerulus/year.

Puerulus distribution channel

The Puerulus distribution channel from Pesisir Barat Lampung comprises three trading channel patterns as presented in Figure 3.

The puerulus as the fishermen’s catch product will be sold to the smaller collectors without a minimum limit of total acceptance. Any puerulus numbers caught will be sold to small collectors. The big collectors only accept puerulus from small collectors, which will then be sold to suppliers until exporters. The puerulus selling price from fishermen to small collectors is IDR 23,000/puerulus, then the small collectors sell puerulus at IDR 25,000/puerulus to the big collectors, who will continuously sell the seeds to suppliers at IDR 27,000/puerulus. The average margin accepted by small or big collectors is IDR 2,000 or 15%.

Puerulus supply for lobster nursery culture

The lobster nursery culture activity contains two steps, namely first nursery (puerulus -5 g) and second nursery (5–30 g), then the lobster from the first nursery culture product will become the input for the first growing-out activity (30–120 g) and second growing-out activity (120–500 g). The lobster rearing tank for nursery culture uses

Figure 2. The total average of puerulus caught in Pesisir Barat District, Lampung.

Figure 3. Puerulus distribution channel from Pesisir Barat.

Figure 4. Simulation of lobster nursery culture production pattern.
a floating net cage (KJA), whereas each KJA has nine KJA plots in 3 m x 3 m size and 4–7 m depth. Six cages in cylinder shape were placed in each KJA plot with 100 cm diameter and 60 cm height. The cage was drowned in the water at 3–4 m depth. puerulus stocked at 50 puerulus/m² in the first nursery tank has 0.2–0.3 g weight (Cokrowati et al., 2012), therefore each tank is stocked with 50 puerulus. The first nursery rearing period is 8–10 weeks and produces lobster seeds at 5 g weight. The second nursery culture uses lobster seeds from the first nursery product with 5 g weight and 20 lobster seeds/m² stocking density. The second nursery rearing is performed for 8–10 weeks and produces lobster seeds at 30–50 g with a survival rate of 30–70%.

Based on the production pattern management (Figure 4), the production cycle of lobster nursery culture activities can be performed 48 times per year, which means that the seed stocking can be performed weekly and the harvest can also be performed weekly. The total KJA requirement to support the production pattern well and continuously is eight units. The calculation results of the puerulus requirement for lobster nursery culture obtain 16,200 puerulus/KJA/year, therefore total puerulus requirement in all KJAs is 129,600 puerulus/year. The puerulus produced by fishermen in Pesisir Barat is 1,500,000 puerulus/year.

Discussions
Lobster seed-catching activity has been developing since 2015 on Pesisir Barat Lampung. Krui Selatan is one of the main location for producing puerulus in Pesisir Barat Lampung apart from Bengkunat. The Krui Selatan community mostly works as puerulus fishermen, while fish only becomes the bycatch product. This condition occurs due to quite abundant puerulus availability in Pesisir Barat waters, starting from Labuhan Jukung, Labuhan Agung, Lintik, Siging, Ranggai, Serai, and Bengkunat as the puerulus fishing area.

Lobster types that are commonly found in Pesisir Barat waters are Panulirus homarus (spiny lobster) and Panulirus ornatus (tropical rock lobster). Both lobsters are types that have many been cultured in Vietnam with the broad market approach in China. Pesisir Barat is located in the WPP of 572 (Mous et al., 2020). According to Priyambodo et al. (2020), the abundance of puerulus is also found in water areas around Sumatra Island. The puerulus abundance is affected by the appropriate environmental condition, mainly in the area around the coast with muddy/sandy substrate characters, followed by the existence of a current that brings puerulus in several areas called sink population. Lampung has five big rivers and 25 small rivers, forming eight river banks (DAS). The river has a role in carrying sediments, such as mud and sand, to the sea and regions around the coast. This condition impacts the creation of muddy land and sandy beach (Pariwono, 1999).

The fishing activities conducted by fishermen in Pesisir Barat Lampung use a fishing gear called a net, and most fishermen use two lamps for each net, as mentioned by Musbir et al. (2014) and Witomo and Nurlaili (2015). This condition is performed to produce a wider light appropriate for the fishing location. The moonlight condition affects the puerulus catch product due to phototaxis characteristics (Cohen and Epifanio, 2020; Setyanto et al., 2020). According to Priyambodo et al. (2020), the water condition during the new moon phase without moonlight causes the puerulus to concentrate near the lamp light and be trapped in the net. In contrast, the moonlight during the full moon phase will illuminate the waters, causing the use of lamps to be ineffective in attracting puerulus in the net. This condition causes the puerulus catch product during the full moon to be less than during the new moon (Fachry et al., 2018; Steell et al., 2020). During the new moon, fishermen will perform a fishing activity more similar to Gaol et al. (2019), who stated that the fishing boat distribution in the sea increased by 400% during the new moon phase.

The puerulus abundance season in Pesisir Barat Lampung occurs from June-October, 2021, following Priyambodo et al. (2020), who mentioned that the puerulus abundance also occurs in the following period, starting from April to November. The lobster spawning pattern emerges in the spring and egg hatching occurs in the summer (Alborés et al., 2019; Fernández et al., 2021; Yeap et al., 2022). During these periods, lobster spawning is performed in the Northern and Southern water areas, so the Indonesian waters, located on the equator line, have the benefit of gaining puerulus abundance from both regions. The puerulus abundance in the Indonesian waters, mainly in WPP of 572, should be utilized in its potential, specifically for seed catch product-based culture activities as performed in Vietnam, which is called the lobster aquaculture industry country (Jones et al., 2019).
The puerulus trade in Pesisir Barat District, Lampung, has been established as a distribution channel and formed naturally by involving various actors in the activity (Marimin & Maghrirah, 2011). Fishermen who catch puerulus will sell their catch product to small collectors who live in a similar region by considering the highest purchase price. Then, the big collectors will send puerulus to the core warehouse or suppliers located in Lampung. Transporting the product to suppliers in Jambi commonly passes Bengkulu or Palembang area. Suppliers in Jambi will send puerulus to exporters in Singapore, while suppliers in Lampung will send to exporters in Jakarta and Singapore (Figure 3). The puerulus are transported using the land transportation line.

High demand for puerulus causes its exploitation continues to increase with quite high selling price from the fishermen that can reach IDR 23,000/puerulus, similar to Junaidi et al. (2021), who reported that the puerulus price was among IDR 17,000-IDR 20,000/puerulus. The puerulus selling price varies due to market conditions, puerulus supply, total demands by the buyers, and fishing season (Thuy et al., 2009). The margin value in each collector can vary according to the market strategy of each collector. This condition is caused by the competition among collectors to gain puerulus supply from fishermen, which needs a different marketing strategy to improve a business’s success and competitiveness (Rusdi, 2019).

The selling margin of puerulus in the small or big collector range level is approximately IDR 1,000 – IDR 2,000/puerulus, producing the average margin at 15% of the selling price. The 5% of the margin is generally allocated as a cost in a value chain used in the processing, quality control system, and business certification (Promptatanapak & Lopetcharat, 2020; Petersen et al., 2020). A quite low margin added with puerulus mortality risk in the transportation process among stakeholders in the distribution channel causes the available supply chain to be less efficient. The supply chain shrinkage and cost increase become the solutions that can be taken to make the puerulus selling business more profitable and sustainable for each stakeholder.

Using seed catch products in aquaculture activities requires cost calculation for transportation and mortality risk along the way. The 9-hour transportation time is tolerable for puerulus to remain away from much stress and minimize puerulus mortality during the transportation period. The stress caused by the post-transportation effect can also affect the survival rate value during the rearing period (Virgilio, 2019). Mortality risk during transportation can be reduced using a wet packing with oxygen in addition to preserving the physiological and metabolism activities that remain in optimum condition for puerulus (Arumugam et al. 2020). The habitat difference in the rearing tank and transportation box due to shelter absence can trigger puerulus stress (Supriyono et al., 2017; Adiyana et al., 2020; Slamet et al., 2021). Administration of an anesthetic substance can also be used to reduce the stress level in transporting the living lobsters (Pozhoth and Jeffs, 2022).

The Indonesian Ministry of Marine and Fisheries Affairs Regulation No. 17 of 2021 which states that the puerulus aquaculture activity is obliged to perform in the same location as the fishing ground, can provide a chance for developing the lobster culture in Indonesia, specifically in Lampung, the seed commodity potential. The distribution networks of puerulus supply have been organized well from upstream to downstream, simplifying the Lampung region’s lobster supply for aquaculture activity. The lobster culture can utilize this distribution network to gain continuous seed supply for aquaculture activity. Seeds can be bought from collectors who have collected the seeds in a great amount from fishermen. The puerulus supply availability should also be balanced with the preparation of tank and culture location, so the puerulus abundance can be maximized its potential as the nursery culture activity input by organizing the production pattern way (Figure 4). The products obtained through the production pattern will produce continuous and sustainable lobster production. Moreover, water quality management by maintaining the temperature, pH, salinity, alkalinity, and optimal dissolved oxygen in the culture period can maximize lobster growth (Balkhair et al., 2012; Aji et al., 2019).

**CONCLUSION**

The puerulus abundance in Pesisir Barat is dominated by *Panulirus homarus* (spiny lobster) and *Panulirus ornatus* (tropical rock lobster). In a year, lobster fishermen’s catch product reaches more than 1,500,000 puerulus. The puerulus catch product from fishermen will be sold to small collectors, then big collectors, distributors,
and exporters. The marketing margin received by small and big collectors is 15%. The abundant puerulus production in Pesisir Barat Lampung has the potential to develop sustainable lobster nursery culture.

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