The Ecological Habitat of Spiny Lobster (*Panulirus* spp.): Case Study on Lobster Fishing Ground in Trenggalek, East Java, Indonesia

Muhamad Amin¹, Anis Fitria², Nur Aini Muslichah², Laila Musdalifah³

¹Department of Aquaculture, Universitas Airlangga, Surabaya, East Java 60115, Indonesia
²Aquaculture Study Program, Department of Aquaculture, Universitas Airlangga, Surabaya, East Java 60115, Indonesia
³Marine Aquaculture Development Centre, The Ministry of Marine Affairs and Fisheries Republic of Indonesia, West-Nusa Tenggara, Indonesia

*E-mail: muhamad.amin@fpk.unair.ac.id*

Abstract. The high market demand for baby lobster (*Panulirus* spp.) so far has been only met by natural catches. On the other hand, the recruitment rate for the lobster seeds in nature is very small (<0.1%). To prevent this from happening, a breakthrough in lobster hatchery technology must be developed immediately. A starting point to develop a lobster hatchery is to know the natural habitat of lobster peurulii and imitate it to provide a suitable environment for their indoor culture. Therefore, this research aimed at investigating the natural habitat of spiny lobster at one of the most common fishing grounds for spiny lobster in East Java, which is Kili-Kili Bay, Karang Gongso, Trenggalek Regency. The measured parameters were mostly focused on physical characteristics including the substrate, DO, transparency, dissolved oxygen salinity, temperature and depth in the waters. The results showed Kili-Lili Bay had in general 18-25 m depth, the salinity of 30-35 ppt, temperature 27-29°C, dissolved oxygen of 5-6.7 and transparency of 5-6.5 m, and sandy substrate. These results can be used as preliminary knowledge to build an artificial environment for lobster hatchery indoors.

Keywords: spiny lobster, ecology, puerulus, natural habitat

1. Introduction

Indonesia is well known for its biological diversity including spiny lobsters. As previously reported by Wijaya and Nurfiarini [1] there are at least seven commercial spiny lobster species which have been identified from the Palinuridae family including *Panulirus homarus, Panulirus ornatus, Panulirus longipes, Panulirus versicolor, Panulirus Penculatus*, and *Puerulus mesodontus*. Thus, Lobster has been determined as one of the main marine commodities to be developed by the Indonesian government to increase the country’s foreign exchange. However, lobster supply has been so far only provided from the wild catch. As consequence, few studies reported about overexploitation of lobster in several Indonesian’s fishing grounds. In addition, such condition has been worsening because the recruitment rate for the lobster seeds in nature is very small (<0.1%). Therefore, lobster hatchery technology is needed for its cultivation by imitating the natural habitat of lobster seed breeding.
One of the most important factors in developing artificial lobster hatchery is providing suitable rearing environmental conditions such as substrate types, temperature, dissolved oxygen, transparency etc. thus inquisitiveness of natural environmental conditions of several fishing grounds of Indonesian waters are important sources for favourable environmental conditions for lobsters. By knowing the lobster's natural habitat in the waters, the density and distribution pattern will be known [2]. Lobsters will grow and breed well if the availability of food is nutritious. Furthermore, the abundance of phytoplankton and zooplankton as natural food for lobsters is influenced by the physical and chemical parameters of the waters. Substrate conditions, biotic and abiotic factors also affect the density and distribution of lobsters.

The most well-known fishing ground of lobster larvae in Indonesia is located in Kili-Kili Bay, Karang Gongso, Trenggalek Regency East Java. Where in this region are the fishermen often catch when the lobster seed season and areas south of Java that are still connected to the Indian Ocean [3]. In addition, there becomes interesting to see the physical and chemical characteristics of the natural habitat in which lobsters are mostly wildly caught. Thus the current study aimed to investigate the natural habitats of lobsters, from larval stages such as puerulus to adult stages. It is expected that the study result can be used as basic knowledge for developing lobster hatchery for better lobster resources management in Indonesia.

2. Material and methods

Study site
This research activity has been carried out in April 2021. While the sampling location for Panulirus spp. (puerulus and adult stage) was Kili Kili Bay Karang Gongso, Trenggalek Regency, East Java Indonesia. The specific geographic site was located at 8° 14 '56S and 111° 2524°E. The sampling was carried out at two stations where the distance between the first and second stations was 500m.

Investigated Parameters
The present study investigated both physical and chemical parameters of the sampling site, at which puerulus or adult lobster were mostly found. The physical and chemical parameters which were measured included transparency, depth, temperature, dissolved oxygen, salinity, pH, nitrate (NO₃), current speed and substrate types. The material used was Refractometer, DO and pH meter, Rope, Sechi Disk, Temperature (HI 98199 digital portable meter) and Nitrate Kit. The parameter measurements are directly carried out at the location in the morning. The sampling station can be seen in (Figure 1).

Data analysis
Data that were obtained during the study such as were transparency, depth, temperature, dissolved oxygen, salinity, pH, nitrate (NO₃), current speed and substrate types were analyzed descriptively and compared with other previous studies.
3. Result and Discussion

Lobster is one of the most economically valuable crustaceans. In Indonesia, lobsters are spread in several areas such as Tawang Bay (Pacitan) and Kili-Kili Bay (Trenggalek) in East Java, Indonesia [4]. Wahle and Steneck [5] previously reported the distribution of this lobster was influenced by geographical conditions and the size (phase) of the lobster. Thus the present study identified one of the most common locations for catching lobster at the larval stage of the adult stage, which was Kili-Kili Bay, Trenggalek Regency, East Java, Indonesia. The results showed that lobster at both puerulus and adult stages were found in the Kili-Kili Bay, which may indicate that the sampling site was very favourable for lobster at both life stages, Figure 2. This result is good proof that the present study has chosen the correct location of profiling the natural habitat for the lobster.

![Sampling location](image)

**Figure 1.** Samling location at Kili Kili Bay, Karang Gongso, Trenggalek Regency, East Java, Indonesia.

![Spiny lobster](image)

**Figure 2.** Spiny lobster at puerulus stage (left) and adult stage (right), caught from Kili-Kili Bay, Trenggalek Regency, Est-Java, Indonesia.

Physical investigation indicated that the fishing ground characters were 19.25m depth, and sandy at the bottom substrate, Table 1. Furthermore, the water appeared to be quite clearly indicated by the transparency which reached ~5.74 m. This present result was quite similar to what has been reported...
previously by Yoshimura, Morinaga [6]. Similarly, The present study result was in accordance with the statement of Radhakrishnan, Phillips [7], which states that both larval phases live in rock areas.

Other water parameters including water temperature, dissolved oxygen and salinity were all in normal condition for aquatic animals [8] which may suggest that the lobster are having some similar preferences for their natural habitats, Table 1. The temperature was ranging from 27.6 to 28°C. The dissolved oxygen was ranging from 5.5 to 6.5 with a salinity of 30 – 35 psu and pH of 7.8 – 8.3 ppm. According to Zurma, Mubarak [9], Lobster also tend to be found in relatively slower current speeds, which is very similar to the result of the present study. It was found that the current speed in the Kili-Kili Bay was about 0.1 m/s.

| Table 1. Physical and chemical characteristics of fishing ground for baby (perurulus) and adult lobster in Kili-Kili Bay, Karang Gongso, Trenggalek, East Java, Indonesia. |
|------------------------------|------------------|
| **Observed Parameters**     | **Values ± Std** |
| Transparancy (m)            | 5.74 ± 1.05      |
| Depth (m)                   | 19.25 ± 1.06     |
| Substrate types             | Sandy            |
| T (°C)                      | 27.8 ± 0.28      |
| DO (mg/l)                   | 6.07 ± 0.88      |
| Salinity (psu)              | 32.5 ± 0.71      |
| pH                          | 8.03 ± 0.66      |
| NO₃                         | <0.01 ± 0.00     |
| Current speed               | 0.1 ± 0.00       |

The other results from chemical parameters such as pH and nitrate are also appeared to be very common values for another marine aquatic organism [10], which may suggest that the lobster are also having similar pH and nitrate tolerance with another marine cultured organism. However, more studies are required in terms of tolerance limits since the measurement values obtained in the present study are very low especially for nitrate (NO₃).

4. Conclusion

Lobster fishing ground characters in Kili-Kili Bay were in general 18-25 m depth, the salinity of 30-35 ppt, temperature 27-29°C, dissolved oxygen of 5-6.7 and transparency of 5-6.5 m, and tend to be the sandy substrate. In addition, nitrate concentration was recorded to be less than 0.01 mg/l and pH at about 8. This study result can be preliminary knowledge to develop the favourable environmental condition for the lobster hatchery in future, though further deeper studies are still required to get a more comprehensive conclusion.

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