Grouper: Jurnal Ilmiah Perikanan
Vol. 17 No. 2 (2026) pp. 296 - 304
pISSN: 2086-8480 | eISSN: 2716-2702
Journal Homepage: https://grouper.unisla.ac.id/index.php/grouper

Management, Capture Techniques, and Distribution Chain of Lobster Fisheries (*panulirus spp.*) In bawean Island, East Java, Indonesia

Bagus Antan Setiajid[1]

[1] Department of Fisheries, Faculty of Fisheries and Marine Sciences, Airlangga University, Surabaya, Indonesia

*Corresponding Author: bagus.antan.setiajid-2025@fpk.unair.ac.id

Submitted: 20 May 2026 Revised: 07 September 2026 Accepted: 15 September 2026

Keywords:
Capture;
Distribution;
Lobster;
Management;

ABSTRACT

Bawean Island is one of the water areas in Indonesia that has significant potential lobster resources as a high-value fishery commodity. This research was conducted through field surveys and quantitative data collection to comprehensively examine the management aspects, capture techniques, identification of lobster species, collection systems, and the lobster distribution chain on Bawean Island. The research was carried out over four months involving direct observation, interviews with fishermen and collectors, and quantitative data collection from four main collector locations. The results show that lobster fishing on Bawean Island is small-scale and open access, with three species found, namely bamboo lobster (*Panulirus versicolor*), pearl lobster (*Panulirus ornatus*), and Pakistan lobster (*Panulirus polyphagus*). The main capture technique uses the diving method (masker) with the assistance of compressor boats operating at night at depths of 7–30 meters. The distribution system involves local collectors who then distribute to larger markets in Surabaya via sea transportation. Bamboo lobster shows dominance in catch composition (69% of total stock), while pearl lobster has the highest economic value reaching Rp 500,000/kg. The lack of structured production data is one of the main challenges in the sustainable management of lobster resources in this area.

INTRODUCTION

Lobster (*Panulirus spp*.) is one of the fishery commodities with high economic value in both national and international markets, with demand that continues to increase in line with global economic growth. The presence of lobster is closely related to the condition of aquatic ecosystems, particularly coral reefs and rocky environments rich in crevices and caves as their natural habitat (Setyanto and Halimah, 2019). Indonesia as an archipelagic country has enormous lobster potential in various coastal areas, with production reaching more than 100 thousand tons per year (Marine and Fisheries Statistics, 2023), including Bawean Island, which is geographically dominated by coral reefs and coral rock formations that are ideal for lobster habitation.

Lobster fishing on Bawean Island is categorized as small-scale fisheries, where most of the actors are part-time fishermen who combine lobster fishing with other fishing activities. This small-scale fishery system has special characteristics that distinguish it from large-scale commercial fisheries, including simple capture technology, limited capital, and rich local ecological knowledge (Wahyudin *et al*., 2017). Although it has significant economic value for the local community, lobster fisheries management at the local level still faces various challenges, including limited accurate production data, lack of coordinated utilization regulations, and the risk of overexploitation threatening stock sustainability (Ministry of Marine Affairs and Fisheries, 2019).

This research aims to provide a comprehensive and in-depth description of lobster fishing conditions on Bawean Island, starting from aspects of resource management, capture techniques used, identification of existing lobster species, collection and maintenance systems, to the distribution chain and price dynamics. This research is expected to contribute to a better understanding of small-scale lobster fisheries in Indonesia and serve as an information base for developing more sustainable and scientifically evidence-based resource management policies.

METHOD

This research used qualitative descriptive methods with a mixed-methods approach that combined qualitative and quantitative data. This approach was chosen for its ability to capture the complexity of small-scale fishery systems involving various social actors, ecological dynamics, and economic considerations (Ariani *et al*., 2018). The research was conducted over four months on Bawean Island, with observation focused on lobster fishing activities, collection systems, and catch distribution.

Data collection techniques included: (1) Field observation of lobster fishing activities conducted at night, covering observation of equipment, methods, fishing locations, and catches; (2) In-depth interviews with capture fishermen, lobster collectors, and local traders to understand the economic, technical, and social aspects of lobster fisheries; (3) Quantitative data collection from four main collector locations during the study period, including recording of lobster species, number of individuals, weight, and health condition of lobsters being held; (4) Photographic documentation of field conditions, fishing equipment, and catches; (5) Price data analysis from various sources to understand market dynamics (Ani *et al*., 2017).

The collected data were then analyzed descriptively by creating narratives that combined qualitative information from interviews and observations with quantitative data from field records. Lobster species identification was carried out based on body morphology with reference to validated *Panulirus spp*. taxonomic literature. Price data was collected through recording at collector locations and triangulation of information from various sources to ensure the accuracy and representativeness of the research results.

RESULT AND DISCUSSION

Lobster Management on Bawean Island

Lobster fisheries management on Bawean Island faces significant challenges rooted in the characteristics of an open access and informal fishery system. Open access systems are conditions where there are no restrictions on access to resources, resulting in intense competition and the potential for overexploitation (Alemu *et al*., 2020). One of the main challenges is the limited availability of accurate and systematic production data. Lobster fishing activities scattered along the island's coast and catches that are often unloaded at the nearest locations make centralized and structured production data collection difficult to carry out.

Most fishermen do not report their catches to formal fisheries institutions because they already have direct distribution channels through lobster collectors scattered at various locations on Bawean Island. These collectors are key actors in the local fishery system who have networks and market knowledge to distribute lobsters to their final destination, but this system is not integrated with the official monitoring system. As a result of this informal distribution pattern, lobster production data is often not officially recorded by local fisheries authorities, making it difficult to monitor and manage lobster resources comprehensively, both at the regional and national levels.

Lobster catches are generally sold directly to known collectors or to local morning markets, with some consumed by fishermen themselves together with their families. This pattern reflects a highly local marketing system that differs from what occurs in large-scale commercial fisheries in other regions. Although this informal distribution system is efficient for fishermen and collectors in the short term, the lack of accurate production data can hinder

efforts to manage and conserve lobster populations in the long term, especially given the continuously increasing trend in lobster demand (Central Bureau of Statistics, 2020).

Lobster Capture Techniques
Capture Methods and Fleet



Figure 1. Capture Fleet
Source: Personal Documentation

Lobster fishing on Bawean Island is open access, where anyone who has equipment can catch lobsters in their own way. The commonly used capture method is the diving method, known locally as "masker," where divers use snorkeling equipment or simple SCUBA to manually search for and catch lobsters. This method is chosen for its effectiveness in catching live lobsters, which is the international market standard (Wahyudin *et al*., 2017). Fishermen use compressor boats as the main fleet and fishing aid, equipped with air compressors, long hoses, battery-powered head lamps, and various other supporting tools.

Fishing operations are conducted at night, generally departing around 7:00 PM WIB and returning around 2:00 AM WIB, with a total at-sea operation time of approximately 7 hours. The choice of nighttime is based on the behavior of lobsters that are more active coming out of their hiding places in dark conditions, making the chances of capture higher. Fishing areas are located approximately 7 miles from the coastline, particularly in areas with coral reefs and rock formations that serve as the main habitat for lobsters. The aim of using the diving method is to ensure that captured lobsters remain alive, so that their selling price is higher compared to lobsters that have died or been damaged during the capture process.

Capture Operation System



Figure 2. Compressor
Source: Personal Documentation

In each fishing operation, there are typically 4 crew members with very specific and important task divisions for the success of the operation. Two crew members are tasked with diving and catching lobsters directly, equipped with compressor hoses for air supply, head lamps for illumination of the dark seabed, and masks or diving equipment to see clearly. The other two crew members are tasked with remaining on the boat, keeping the boat in the right

location, ensuring the compressor runs well and consistently provides the appropriate air pressure, and lifting lobsters from the seabed to the surface through slow hoisting. This coordinated work system represents best practice in small-scale lobster fisheries.

In the same fishing area, exploration is conducted for approximately 1 hour with high search intensity. In one trip or night operation, fishermen can move to as many as 4 different fishing areas, so that the total time at sea can reach 7 hours including rest time and travel between locations. This movement pattern allows fishermen to maximize the search area and increase the chance of finding high concentrations of lobsters.

Obstacles to Capture

One of the challenges faced by lobster fishermen is the phenomenon of "bright moon" or during a full moon. In one month, there are approximately 12 days when the moonlight is very bright, making artificial light from head lamps less effective in attracting lobsters out of their hiding places in rock crevices and holes. The negative phototactic behavior of lobsters (avoiding bright light) causes their activity to decrease significantly during the full moon period. As a result, fishermen often choose not to go out to sea during this period to avoid financial losses from fuel costs and time that are disproportionate to the minimal catch.

The use of alternative fishing gear in the form of traps, krendet nets, and pocong nets is considered ineffective by lobster fishermen based on their empirical experience. The main complaint is that these traps can move, break, and be lost when operated on the seabed, either because they are taken by other fishermen or swept away by boats with trawl gear passing through the area. The low effectiveness of these passive fishing gears causes fishermen to continue relying on the active and manual diving method as their main fishing strategy.

Types of Lobster on Bawean Island
Bamboo Lobster (*Panulirus versicolor*)



Figure 3. *Panulirus versicolor*
Source: Personal Documentation

Panulirus versicolor, known as bamboo lobster, is the species that dominates catches on Bawean Island with the highest percentage in all collector locations. This species has a very distinctive color and pattern on its body parts, making it easily recognizable even by novice fishermen. The carapace (shell) of the bamboo lobster is covered with many spines that function as a body defense system against predators and other threats. These spines are arranged in a regular pattern and give a rough texture to the body surface. These morphological characteristics make this species very easy to identify in the field.

On Bawean Island, bamboo lobsters are generally caught at sizes of 30–40 cm with weights ranging from 0.5–1 kg per individual. This species shows a high level of abundance in the coral reef waters around the island, indicating habitat suitability and adequate food availability. The dominance of bamboo lobsters in catches can be linked to their habitat preference for rocky areas and coral reefs that are abundant around Bawean Island, and also because their population abundance is relatively more stable compared to other species.

Pearl Lobster (*Panulirus ornatus*)



Figure 4. *Panulirus ornatus*
Source: Personal Documentation

Panulirus ornatus, known as pearl lobster, has beautiful and visually attractive colors and patterns. This species displays a combination of colors with a unique motif that distinguishes it from other lobster species and provides added aesthetic value for the premium market. Pearl lobsters are generally found on Bawean Island in large sizes or in adult condition with weights reaching 1–2 kg per individual. The population of pearl lobsters is more limited compared to bamboo lobsters, with a percentage in catches of only 10–15% of the total stock at collectors.

From an economic perspective, pearl lobster is the species with the highest price among the three lobster species found on Bawean Island. At the time of the research, the purchase price from fishermen reached IDR 300.000/kg, while the selling price to the market in Surabaya reached IDR 500.000/kg, indicating a very attractive profit margin for collectors. Its relative scarcity and high price make pearl lobster a highly anticipated capture target by fishermen, although its limited availability indicates the need for protection of this species.

Pakistan Lobster (*Panulirus polyphagus*)



Figure 5. *Panulirus polyphagus*
Source: Personal Documentation

Panulirus polyphagus, known as Pakistan lobster, is characterized by fewer spines compared to other lobster species, with a fairly distinctive grayish-green color. The habitat of Pakistan lobsters is generally in sandy or muddy areas with a different bottom structure from the habitat of other lobster species. This lobster species has the fewest spines among the three observed species, with a smoother and lighter body (Wahyudin *et al*., 2017).

Pakistan lobster comprises 16–20% of catches in various collector locations, with sizes ranging from 25–35 cm. The purchase price of Pakistan lobster is lower than pearl lobster but higher than bamboo lobster, with an average of Rp 200.000/kg. This species shows a stable population in the waters of Bawean Island, with different habitat preferences indicating the availability of different ecological niches, providing opportunities for resource diversification for fishermen.

Table 1. Composition of Lobster Stock at Four Collector Locations on Bawean Island

Collector Location	Bamboo	Pearl	Pakistan	Total
Location 1	46	3	6	55
Location 2	29	9	5	43
Total	75 (69%)	12 (11%)	11 (20%)	98

Stock composition data shows that bamboo lobster dominates in all observed collector locations. This dominance reflects the high catch rate or availability of this species in the waters of Bawean Island. In contrast, pearl lobster is the species with the fewest numbers, with only 12 individuals found out of a total of 98 individuals observed, indicating its relatively high scarcity. Pakistan lobster sits in the middle position in terms of numbers. The dominance of bamboo lobsters can be linked to their habitat preference that suits the water conditions around Bawean Island, which is rich in coral reefs and complex rock formations that serve as shelter and foraging areas.

Lobster Collection System

Lobster Acceptance Criteria

In the lobster fishing industry on Bawean Island, collectors play a critical role as intermediaries between capture fishermen and the wider market, as well as quality regulators. This gatekeeping role is very important in the informal fishery system where there is no official institution conducting quality control. Collectors are very selective in choosing lobsters to purchase from fishermen, with strict criteria to ensure quality. The main criteria that must be met include:

- Minimum lobster weight of 2 ounces (approximately 57 grams), with preference for larger lobsters because they provide higher value and cost efficiency in handling.
- Lobsters in live condition (not accepted in dead or severely damaged condition), because the selling value is significantly higher in line with the preferences of the modern consumer market.

The requirement for lobsters to be in live condition aims to ensure that quality is maintained until it reaches the hands of the final consumer. After purchasing from fishermen, collectors hold the lobsters in special holding ponds or floating cages, with feeding of shells or small fish every three days to maintain the health and vitality of the lobsters during the holding period. This practice is in line with live lobster management standards adopted in professional lobster-exporting countries (Ahmad *et al.*, 2016).

Holding Ponds



Figure 6. Holding Pond
Source: Personal Documentation

Management of holding ponds requires special attention regarding water quality and environmental conditions within them. Pond water must be changed regularly to avoid the accumulation of waste and organic matter that can reduce water quality and affect lobster

health. The frequency of water changes depends on water conditions, the number of lobsters being held, and the intensity of feeding. Holding ponds are round or rectangular in shape, made of concrete or other materials, with a water depth of approximately 1–1.5 meters. This system allows for better control over environmental conditions but requires a larger initial investment and more intensive management. Some collectors also use aerators to maintain optimal water oxygen levels, following best practices in small-scale aquaculture.

Floating Cages



Figure 7. Floating Cage
Source: Personal Documentation

Floating cages are an alternative lobster holding system that directly utilizes seawater. This system has the advantage of natural and continuous water circulation without the need for intensive manual changes, because seawater continuously flows through the cage. This keeps water quality optimal with sufficient oxygen levels and efficient disposal of organic waste, based on the principles of aquatic ecology.

Floating cages also have their own significant challenges. The cages must continuously move following the changing sea currents to ensure optimal water flow, require intensive and continuous supervision, and have a higher risk of damage during bad weather or unexpected high waves. Operational maintenance costs are also higher compared to fixed holding ponds. Nevertheless, many collectors still choose floating cages because of their efficiency in maintaining lobster quality and cost-effectiveness in the long term.

Lobster Buying and Selling Prices

Lobster buying and selling prices vary depending on the type of lobster, size, body condition, and position in the distribution chain. In recent years, lobster prices have experienced a significant decline, partly due to the government's export restriction policy that requires lobsters to meet certain size criteria (minimum 200 grams for whole lobsters without eggs). This policy is designed to protect lobster stocks from overexploitation and ensure sufficient population reproduction (Ministry of Marine Affairs and Fisheries, 2019).

For lobsters weighing between 2 ounces and 5 ounces, prices are set based on an agreement between fishermen and collectors, due to the rare availability of lobsters at that size and the uniqueness of each individual. For lobsters above 5 ounces (approximately 142 grams), prices follow a per-kilogram unit as presented in the following table:

Table 2. Lobster Buying and Selling Prices on Bawean Island (>5 ounces, per kg)

Lobster Type	Purchase Price (IDR/kg)	Selling Price (IDR/kg)	Margin (IDR/kg)
Bamboo	IDR 150.000	IDR 250.000	IDR 100.000
Pearl	IDR 300.000	IDR 500.000	IDR 200.000
Pakistan	IDR 180.000	IDR 280.000	IDR 100.000

Price data shows that pearl lobster has the highest price, with a significant buying and selling price difference reaching IDR 200.000/kg, reflecting the high market demand and premium economic value of this species. The profit margin for collectors ranges from IDR 50.000–200.000 per kilogram depending on the lobster species, with pearl lobster providing the highest margin. This price variation reflects differences in supply, demand, and consumer preferences at the broader market level, consistent with fishery economic theory that explains the relationship between scarcity and value (Alemu *et al*., 2020).

Distribution Chain

Lobster collectors on Bawean Island distribute their lobsters to buyers with larger distribution networks, such as collectors or wholesalers in the city of Surabaya, which is the most important center of lobster trade and consumption in the East Java region. This network enables products to reach retail markets, high-end restaurants, and export buyers. The structure of this supply chain represents a typical model of small-scale fisheries in Southeast Asia where products move through multiple intermediaries before reaching the final consumer (Artanti *et al*., 2019).

Lobster collection from fishermen is carried out over 7 to 10 days with an accumulated weight of 20–25 kg per shipment, using motorized boats as the main mode of transportation for the journey out of Bawean Island toward Surabaya. Travel time takes approximately 12–24 hours depending on weather and sea conditions. This batch collection system allows transportation efficiency and reduces costs per unit, although it requires adequate storage capacity and good management.

Packing Process

The lobster packing process for distribution is carried out carefully and follows well-tested procedures to keep the lobsters in live and fresh condition throughout the long journey. The packing stages involve a well-coordinated series of steps, adopting best practices in handling high-value live commodities:

- Material preparation: selected lobsters, scales, used newspaper or packing paper, fine sand or moisture-absorbing wood dust, sturdy container boxes, and bottles of ice in frozen plastic wrapping.
- Weighing lobsters to ensure weight and type comply with orders from buyers in Surabaya.
- Lobster preparation: the lobster's body is coated with sand or wood dust that absorbs the water content of the lobster's body, causing the lobster to become sedated and enter a dormant state with low metabolism. This process can maintain the lobster's condition for up to one week with minimal mortality.
- Wrapping: each lobster is wrapped one by one using newspaper to protect from mechanical damage and maintain moisture.
- Arrangement in box: lobsters are neatly arranged in boxes with several ice bottles interspersed among them to keep the temperature cool and slow the lobsters' metabolism.

This entire process is systematically designed to minimize damage and maintain the quality of lobsters as high-value commodities during the shipping process to Surabaya or other markets. The success of this packing has a significant influence on the lobster survival rate and buyer satisfaction, which in turn affects the reputation and business continuity of the collector. Good packing practices in small-scale fisheries often become an important differentiating factor in market competition (Asbari *et al*., 2021).

CONCLUSION

This research shows that lobster fishing on Bawean Island is a small-scale open access fishery system with three main lobster species (*Panulirus versicolor*, *P. ornatus*, and *P. polyphagus*), where the dominant capture method is night diving using compressor boats at depths of 7–30 meters, with bamboo lobster dominating 69% of total catches. The informal yet structured collection system plays a crucial role as a quality regulator and link to the wider

distribution market in Surabaya, although the lack of accurate production data is the main challenge in the sustainable management of lobster resources. To ensure long-term sustainability, collaborative efforts are needed among all stakeholders to develop a more structured monitoring system, education on responsible fishing practices, and further research on population dynamics and the carrying capacity of Bawean Island's waters.

REFERENCES

Ahmad, N. I., Wan Mahiyuddin, W. R., Tengku Mohamad, T. R., Ling, C. Y., Daud, S. F., Hussein, N. C., and Sulaiman, L. H. (2016). Fish consumption pattern among adults of different ethnics in Peninsular Malaysia. *Food and Nutrition Research*, 60(1), 30892.

Alemu, M. H., Sigurdsson, V., Fagerstrøm, A., and Foxall, G. R. (2020). Developing the e-commerce sector for the fishery industry: What business are we really in? *Managerial and Decision Economics*, 41(2), 274–290.

Ani, N. R., Kusai, K., and Zulkarnain. (2017). Analysis of sea fish consumer behavior in traditional markets arengka city of Pekanbaru Riau Province. *Jurnal Online Mahasiswa Fakultas Perikanan Dan Ilmu Kelautan Universitas Riau*, 4(2), 1–12.

Ariani, M., Suryana, A., Suhartini, S. H., and Saliem, H. P. (2018). Performance of animal food consumption based on region and income at household level. *Analisis Kebijakan Pertanian,* 16(2), 147–163.

Artanti, Y., Prasetyo, F. H., and Sulistyowati, R. (2019). How social media marketing influences online purchasing decision: Study of the viral marketing and perceived ease of use*. KnE Social Sciences,* 988–1004.

Asbari, M., Hidayat, D. D., and Purwanto, A. (2021). Managing employee performance: From leadership to readiness for change. *International Journal of Social and Management Studies,* 2(1), 74–85.

Badan Pusat Statistik (BPS) Kabupaten Lamongan. (2020). *Kabupaten Lamongan dalam angka 2021.*

Kementerian Kelautan dan Perikanan. (2019). Status *pengelolaan sumber daya lobster air tawar dan lobster laut Indonesia.* Jakarta: KKP.

Setyanto, A., and Halimah. (2019). Identifikasi jenis lobster (*Panulirus spp.*) di perairan Indonesia. *Jurnal Perikanan Indonesia*, 18(3), 215–228.

Statistik Kelautan dan Perikanan. (2023). *Produksi perikanan laut menurut jenis ikan dominan tahun 2022.* Jakarta: Pusat Data Statistik dan Informasi KKP.

Wahyudin, Y., Suhartono, Y., and Fahrudin, A. (2017). Studi biologi lobster Pakistan (*Panulirus polyphagus*) di perairan selatan Jawa. *Jurnal Ilmu Dan Teknologi Kelautan Tropis*, 9(1), 45–62.