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# SUPPLY CHAIN ANALYSIS OF SKIPJACK TUNA (*Katsuwonus pelamis*): A CASE STUDY OF POLE AND LINE FISHERIES IN SOUTHEAST MINAHASA

Analisis Rantai Pasok Ikan Cakalang (*Katsuwonus pelamis)*: Studi Kasus Perikanan *Pole and Line* di Minahasa Tenggara

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**ABSTRACT**

This study aims to determine the supply chain of skipjack tuna (*Katsuwonus pelamis*) caught by pole and line vessels at Belang Port, Southeast Minahasa Regency, using a descriptive survey approach. Involving fishermen, collectors, and retailers as respondents, data was collected through interviews, observation, documentation, and supporting literature review. The results revealed three main marketing channels: (1) directly from fishermen to consumers, (2) fishermen to retailers, and (3) fishermen to collectors and then to retailers. The largest marketing margins are obtained by retailers, while fishermen receive the lowest margins, indicating an imbalance in profit distribution. Marketing efficiency is hampered by limited capital, inadequate infrastructure, limited access to market information, and fishermen's dependence on collectors. To improve fishermen's welfare, this study recommends strengthening fishermen's institutions, improving market access, and training and empowering fishermen in more effective marketing strategies.

**Keywords**: Belang Port, Pole and Line, Skipjack Tuna, Supply Chain

**ABSTRAK**

Penelitian ini bertujuan untuk mengetahui rantai pasok ikan cakalang (*Katsuwonus pelamis)* hasil tangkapan kapal *pole and line* di Pelabuhan Belang, Kabupaten Minahasa Tenggara, dengan pendekatan survei deskriptif. Melibatkan nelayan, pengepul, dan pengecer sebagai responden, data dikumpulkan melalui wawancara, observasi, dan dokumentasi, serta studi literatur pendukung. Hasil penelitian mengungkapkan tiga saluran pemasaran utama: (1) langsung dari nelayan ke konsumen, (2) nelayan ke pengecer, dan (3) nelayan ke pengepul kemudian ke pengecer. Margin pemasaran terbesar diperoleh oleh pengecer, sementara nelayan menerima margin terendah, menandakan ketidakseimbangan distribusi keuntungan. Efisiensi pemasaran terhambat oleh keterbatasan modal, infrastruktur yang kurang memadai, akses informasi pasar terbatas, dan ketergantungan nelayan pada pengepul. Untuk meningkatkan

kesejahteraan nelayan, penelitian ini merekomendasikan penguatan kelembagaan nelayan, perbaikan akses pasar, serta pelatihan dan pemberdayaan nelayan dalam strategi pemasaran yang lebih efektif.

**Kata Kunci**: Rantai Pasok, Cakalang, *Pole and Line*, Pelabuhan Belang

## INTRODUCTION

Fisheries are a vital sector in the food industry, playing a significant role in meeting the protein and nutritional needs of the global population. As the population grows, the demand for high-quality fishery products increases. The quality of fishery products is determined not only by taste and texture, but also by health, food safety, and sustainability. Optimizing quality fishery production emphasizes improving product quality throughout the production chain, from resource management to the end consumer. In this context, "quality" refers to fishery products that meet high standards of food safety, nutritional value, and taste, while preserving the aquatic environment and marine ecosystems. The importance of the fisheries industry is also reflected in its contribution to the national economy (Dwinafiah & Hasan, 2023).

The Belang waters and surrounding areas are the center of skipjack and tuna fishing activity in North Sulawesi waters. The production of skipjack and tuna fisheries in North Sulawesi, including the Belang waters, reached 60,190.3 tons (North Sulawesi Provincial Marine and Fisheries Department, 2011, cited in Kekenusa & Marline, 2016). Belang Fisheries Port is one of the bases for pole-and-line fishing vessels operating in the waters of North Sulawesi and the surrounding areas. Pole-and-line is a type of fishing gear composed of a line (fishing rod). This fishing gear is equipped with live bait to adapt to the habits of skipjack tuna when they strike their prey (Idris et al., 2024).

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According to Selan & Nubatonis (2016), fishermen often sell their catch without considering efficient marketing channels. This is due to the urgent need for cash for household expenses and fishing equipment. Furthermore, the perishable nature of fish forces fishermen to sell their catch quickly, often without considering the optimal market price. To maintain fish freshness, fishermen often use ice as a temporary preservation method. Efficient distribution channels are crucial in fish marketing. The length of the marketing channel can affect the price difference between what fishermen receive and what consumers pay. A large price difference indicates costs and profits taken by marketing institutions.

Efficient marketing not only increases fishermen's income but also ensures consumers receive fish at a fair price and of good quality. Therefore, it is important for fishermen to understand and prioritize effective marketing channels, considering factors such as product quality, fair pricing, and appropriate distribution methods, including when marketing skipjack tuna (Triyastuti et al., 2021). Therefore, this study aims to determine the marketing channels for skipjack tuna caught by pole-end line vessels at Belang Port, Southeast Minahasa Regency.

## RESEARCH METHODS

### Research Time and Location

This research was conducted in Borgo I Village, Belang District, Southeast Minahasa Regency, North Sulawesi Province. This area was selected purposively because it is the primary landing location for skipjack tuna catches using pole and line fishing gear at Belang Port. The research was conducted over four months, from January to April 2024, aligning with the pelagic fishing season in the region. Belang Port plays a crucial role as a hub for landing, distribution, and trade of fish catches. This location was selected based on data availability,

production potential, and the active involvement of key supply chain actors, such as fishermen, collectors, and retailers.

**Research Method**

This research employed a descriptive survey approach. Data collection techniques were conducted through participant observation and direct interviews. Observations aimed to understand the physical flow and marketing process, from fishing to the end consumer. Interviews were conducted to obtain detailed information regarding distribution patterns, marketing margins, and obstacles faced by supply chain actors. The data used in this study consisted of primary and secondary data. Primary data was obtained through direct field observation, in-depth interviews, and documentation of skipjack tuna marketing activities. Interviews were conducted using structured and semi-structured questionnaires with selected respondents: 30 fishermen, 13 collectors, and 17 retailers involved in the marketing of skipjack tuna catches. Secondary data was collected through literature reviews, government agency reports (such as the Maritime Affairs and Fisheries Office of North Sulawesi Province and Southeast Minahasa Regency), and scientific publications relevant to the research topic. The literature used included fisheries production statistics reports, scientific journals, and previous studies on the fisheries supply chain, specifically skipjack tuna.

**Data Analysis**

The analysis used in this study is marketing margin analysis, which aims to evaluate the difference between the price paid by the end consumer (Pr) and the price received by the producer or fisherman (Pf). This price difference is known as the marketing margin (MP) and is calculated using the formula:

$$MP = Pr - Pf$$

Furthermore, the marketing margin can also be broken down into marketing costs (B) and marketing profits (K), so the formula becomes:

$$MP = B + K$$

Where:
MP : Marketing Margin
Pr : Price at the end consumer level
Pf : Price at the producer or fisherman level
B : Marketing costs
K : Marketing profits

## RESULT

Belang Port is located in Belang District, Southeast Minahasa Regency, North Sulawesi Province. Southeast Minahasa Regency is one of the areas on the north coast of Sulawesi with significant fisheries potential, particularly capture fisheries. Belang District is geographically located in a strategic coastal area with direct access to the Sulawesi Sea, making it one of the centers of fishing activity in the area. Belang Port serves as a berthing point for fishing vessels, including those using pole and line fishing gear, the primary means of catching skipjack tuna (*Katsuwonus pelamis*). This port also serves as a center for fishing activities and the distribution of catches to various regions. Infrastructure at Belang Port includes fish laying facilities, fueling facilities, and the provision of clean water and water to support fishing activities (Sri, 2013).

The fisheries potential at Belang Port is strongly influenced by the region's oceanographic conditions. The waters around Belang are known to be rich in pelagic fish such as skipjack tuna and tuna due to ecological factors such as ideal sea surface temperatures,

plankton availability, and ocean currents that support pelagic fish habitats (Rochman et al., 2015). Furthermore, these waters frequently serve as migration routes for high-value fish species (Zainuddin et al., 2013).

Fishing activities in Belang Port generally involve small to medium-sized business groups. Most of the larger fishermen in this area are traditional fishermen with relatively low levels of education, so their business management skills still need to be improved (Indasari, 2017). Fish marketing activities at this port involve several distribution channels that connect fishermen with local, regional, and national markets.

Administratively, Belang District borders the Sulawesi Sea to the north, making it a strategic location for fisheries development. Based on regional fisheries statistics, Belang Port contributes significantly to skipjack tuna production in North Sulawesi, with catches distributed to various domestic markets and for export (North Sulawesi Provincial Fisheries Department, 2011, cited in Kekenusa & Marline, 2016). Given its geographical location and potential resources, Belang Port plays a crucial role in supporting the fishing sector in North Sulawesi.

**Respondent Characteristics**

Respondent characteristics are described based on several aspects, namely education level, age, work experience, and involvement in marketing activities. Most of the fisher respondents at Belang Port, as shown in Table 2, have a low level of education. Based on the survey, 43.33% of fishermen are junior high school (SMP) graduates, while 28.33% are elementary school (SD) graduates, and only 1.67% have a higher education (S1). This low level of education affects fishermen's ability to manage their fishing businesses, including understanding markets, managing finances, and implementing new technologies that can improve fishing efficiency (Indasari, 2017).

Participating fishermen were in the productive age group (26–45 years), which comprised 53.33% of the total respondents. This age group is considered to have good physical capacity for fishing activities. Meanwhile, 33.33% were in the 46–65 age group, with the remainder being teenagers and elderly. Fishermen's work experience at Belang Port ranged from 5 to more than 20 years. This extensive experience gives them in-depth knowledge of potential fishing locations, fish migration patterns, and fishing seasons. However, limited access to market information and technology often becomes a barrier that reduces the efficiency of their operations (Sri, 2013). Regarding involvement in marketing activities, fishermen respondents at Belang Port were mostly only involved in the initial stage of the marketing chain, namely selling their catch to collectors. This is due to limited capital, storage infrastructure, and the ability to access wider markets. Most large-scale fishermen rely on collectors to distribute their catch, which reduces their bargaining position in the marketing chain (Nuriati, 2018).

**Skipjack Tuna Volume at Belang Port**

The volume of skipjack tuna (*Katsuwonus pelamis*) at Belang Port is influenced by the fishing season, the fishing gear used, and the fishermen's operational conditions. Fishermen at Belang Port generally use pole-and-line vessels, known as an environmentally friendly and effective fishing method for catching large numbers of skipjack tuna. The catch volume depends on the fishermen's skills, the weather, and the availability of live bait, a crucial component of this method. Research shows that the potential for skipjack tuna catches at Belang Port remains high, but fishermen often face challenges such as a decline in the supply of live anchovy bait, forcing them to seek bait in other areas, such as Flores.

Furthermore, the volume of fish landed also varies depending on the fishing season. During the peak season (calm seas), catch volume tends to be higher compared to the lean season, when rough seas cause fishing activity to decrease (Sri, 2013). This aligns with the

opinion of Nurdin & Panggabean (2017), who stated that fishermen need to pay attention to the fishing season to maximize catch volume. Oceanographic conditions such as sea temperature, salinity, and currents influence the presence of skipjack tuna around Belang Port (Talib, 2017).

Marketing patterns also impact the distribution of skipjack tuna volume. Some of the catch is sold directly to local consumers on a small scale through the primary channel, while the remainder is sold to wholesalers and retailers through multi-level channels. The volume of fish marketed through multi-level channels is more significant, as wholesalers have the capacity to purchase larger quantities and distribute them to a wider market. This suggests that a marketing chain involving more marketing institutions can accommodate larger fish volumes despite increasing marketing margins at each level. Indirectly, the volume of skipjack tuna in Belang Port has good potential, but challenges such as limited bait, weather, and distribution efficiency still affect fishermen's catches. Optimizing fishing methods and strengthening market access can help increase catch volume and fishermen's income.

**Structure and Flow of the Skipjack Tuna Supply Chain**

Research results indicate that the structure of the skipjack tuna supply chain in Belang Port consists of three main channels, reflecting the complexity and patterns of relationships between actors. This supply chain encompasses the product flow from fishermen as primary producers to the end consumer. The three identified distribution channels are:

- Channel I (Direct): Fishermen → Consumers. This is the shortest and most efficient channel, but its number is very limited because consumers generally come from the port area and make small-scale purchases.
- Channel II (Short): Fishermen → Retailers → Consumers. This channel is common in local and regional markets. Retailers act as the primary intermediaries, purchasing from fishermen or collectors in small to medium quantities and then selling to consumers at higher margins.
- Channel III (Long): Fishermen → Collectors → Retailers → Consumers. This is the dominant channel in the distribution system at Belang Port. Most of the fishermen's catch is distributed through collectors, who then sell to retailers in large quantities before reaching consumers.

Each actor earns a marketing margin according to their role and function in this distribution chain. Based on the data analysis, the marketing margin for skipjack tuna at Belang Port can be seen in the following table.

Table 1. Marketing Margin for Skipjack Tuna at Belang Port

| Marketing Channels | Fisherman (IDR) | Collector (IDR) | Retailer (IDR) |
|---|---|---|---|
| Selling Price | 18,400 | 20,308 | 21,647 |
| Marketing Margin | 1,908 | 1,339 | 2,453 |

Fishermen sell fish for IDR 18,400 per kilogram, the price received at the production level. Collectors then purchase fish from fishermen for IDR 20,308 per kilogram and sell them to retailers for IDR 21,647 per kilogram. This indicates that fish prices increase at each stage of distribution, reflecting the additional costs, risks, and profit margins earned by each actor in this marketing channel.

The marketing margin is the difference between the selling price and the purchase price at each level of the marketing channel. According to the table, fishermen earn a margin of IDR 1,908, collectors earn a margin of IDR 1,339, and retailers earn the largest margin of IDR 2,453. These margins indicate a differential distribution of profits at each marketing level.

Fishermen, as the primary producers, earn a relatively small margin compared to collectors and retailers. This is due to fishermen's limited access to wider markets and their dependence on collectors as a link to larger markets (Sutrisno, 2020). In this case, collectors act as intermediaries connecting fishermen with retailers, while retailers provide products in smaller quantities to end consumers at higher prices.

Previous research by Wibowo et al. (2016) showed that long marketing channels with many intermediaries tend to reduce the profits received by producers, in this case fishermen. Higher margins at the collector and retailer levels reflect the costs of distribution, storage, and product value enhancement incurred during the marketing process. This also reflects the distribution of profits along the marketing chain. The longer the marketing channel, the greater the likelihood that costs and margins received by intermediaries will increase, while the margins received by producers (fishermen) remain small (Riyadi et al., 2018).

One solution to improve the welfare of fishermen is to shorten the marketing channel, for example by creating a direct market network connecting fishermen with retailers or end consumers. This approach can reduce the number of intermediaries and increase the share of margins received by fishermen, thereby increasing their income (Sutrisno, 2020). Research conducted by Riyadi et al. (2018) also suggests that strengthening institutions such as fishermen's cooperatives can be a solution to increase fishermen's bargaining power when dealing with collectors and retailers. Furthermore, empowering fishermen through training and capacity building in marketing and distribution of fishery products can also increase the catch they sell and increase their margins.

This high marketing margin indicates that the more intermediaries involved, the greater the price difference between fishermen and end consumers. According to Nuriati (2018), the longer the marketing channel, the higher the marketing costs borne by consumers, while the prices received by fishermen tend to be lower. This situation often places fishermen in a weak bargaining position, making them dependent on wholesalers to market their catch. In the context of marketing efficiency, research by Sudana (2019) states that a marketing chain is considered efficient if marketing costs are low and profits are shared fairly among business actors. However, at Belang Port, marketing efficiency still needs to be improved, as the majority of profits tend to be enjoyed by wholesalers and retailers. Other factors affecting the performance of the marketing chain are price fluctuations due to the fishing season and limited fish storage facilities at Belang Port, which causes fishermen to have to immediately sell their catch even though the price is low (Dewi & Wulansari, 2021).

The main challenges in the skipjack tuna marketing chain at Belang Port are limited direct market access for fishermen, minimal institutional support, and dependence on intermediary traders. According to Triyanti et al. (2014), strengthening fishermen's institutions through cooperatives and joint ventures can improve their bargaining power and shorten the distribution chain. Furthermore, providing supporting infrastructure, such as cold storage, is crucial for reducing marketing operational costs and mitigating losses for fishermen due to declining fish quality. Overall, despite the significant potential of skipjack tuna at Belang Port, the marketing chain remains suboptimal. Strategic measures are needed to shorten the marketing chain, strengthen direct market access, and improve distribution efficiency to ensure fairer profits for fishermen and maintain price stability for consumers.

**Factors Influencing Supply Chain Inefficiencies**

The inefficiencies in the skipjack tuna supply chain at Belang Port are caused by several key factors, both structural and non-structural, namely:

a. Infrastructure Limitations: The lack of storage facilities such as cold storage and adequate fish auction facilities (TPI) forces fishermen to sell their catch immediately, even when market prices are unfavorable. This results in a decrease in the selling price of the fish and

the margins received by fishermen.

b. Dependence on Collectors: Fishermen tend to depend on collectors due to long-term patron-client relationships. Collectors often serve as sources of capital loans for fishermen, which bind them to sell their catch only to these collectors, at unilaterally determined prices.
c. Limited Access to Market Information: The lack of information regarding market prices, demand, and distribution opportunities leaves fishermen with insufficient bargaining power. Limited communication technology exacerbates this situation.
d. Seasonal and Production Fluctuations: Skipjack tuna production is highly dependent on the season. During the lean season, fishermen experience a significant decline in catches, disrupting the stability of supply and distribution chains.
e. Weak Fishermen's Institutions: The absence of cooperatives or strong joint ventures forces fishermen to operate individually. This makes it difficult for collective efforts to market the catch at better prices or reduce shared logistics costs.

## DISCUSSION

This study reveals that the skipjack tuna distribution chain in Belang Port involves several key actors with diverse distribution channels, ranging from direct channels (fishermen to consumers) to indirect channels involving collectors and retailers before reaching the end consumer. A similar pattern was found in many previous studies examining skipjack tuna marketing in various regions in Indonesia. The identified supply chain structure consists of three main distribution channels: direct, short, and long channels. This finding aligns with Porter (1985) "value chain" concept, which emphasizes the importance of each link in adding value to the product to the end consumer. The direct channel, although efficient because it reduces transaction costs, is unable to reach a wider market due to limited transaction scale and minimal fish storage facilities from fishermen (Setyawan et al., 2019). At Belang Port, there are five pole and line vessels operating: Km. Nelayan 21, Km. Arvina Majo, Km. Belvania 01, Km. Belvania 02, and Km. Aldira 36. These vessels range in size from 20 to 30 GT and are constructed of wood covered with fiberglass. These vessels have several differences compared to typical pole and line vessels (Munirah et al., 2024).

For example, Ekayani et al. (2019) found four distribution channels for skipjack tuna, starting from fishermen to collectors, market traders, motorcycle traders, and finally consumers in Badung Regency, Bali. This long distribution channel indicates the presence of numerous intermediaries, resulting in low marketing margins at the fisherman level, while traders receive higher margins. This is consistent with our research, which shows the highest marketing margins at the retailer level, while fishermen receive the lowest margins. This indicates an unequal distribution of profits in the marketing chain (Ekayani et al., 2019).

Conversely, a long channel involving collectors and retailers dominates the distribution system at Belang Port. This finding is consistent with the research of Wibowo et al. (2020) stated that the longer the distribution channel, the greater the potential for marketing margin inequality between producers and downstream players. Furthermore, the longer the distribution channel, the more actors involved, and the greater the potential for logistics cost inefficiencies.

### Inequality of Roles and Profits in Distribution

Fishermen, as the primary producers in this system, only earn a margin of around IDR 1,908 per kilogram, significantly lower than retailers, who receive margins of up to IDR 2,453 per kilogram. This marketing margin inequality has also been demonstrated in a study by Oktaviani & Syahreza (2021) on tuna commodities in Maluku, where retailers earn higher margins due to their control over prices in the consumer market. Collectors play a crucial role in bridging the catch from fishermen to retailers. However, their dominant bargaining position makes fishermen economically and socially dependent. This patron-client relationship model

was also found in research by Rumengan et al. (2020), which showed that fishermen are often trapped in informal contracts with collectors who act as lenders. Retailers, as the final actors in the distribution chain, operate directly with consumers and set retail prices. This puts them in a strategic position to optimize profit margins. This phenomenon was discussed in a study by Aswandi et al. (2018), which stated that downstream actors with local market control find it easier to accumulate margins.

**Factors Contributing to Supply Chain System Inefficiencies**

The various factors contributing to distribution system inefficiencies identified in this study reinforce previous findings in the capture fisheries sector.

a. Limited Infrastructure: The lack of cold storage facilities and fish auction facilities leaves fishermen with few options other than selling their catch immediately after landing. This situation leads to a decline in the market value of fish and weak competitiveness. This finding is reinforced by a study by Mahyuddin & Bachtiar (2017), which states that logistics infrastructure significantly influences the efficiency of the fishery product supply chain.
b. Capital Dependence on Collectors: Fishermen's limited access to formal financial institutions makes collectors their primary source of loans. Consequently, there is a high dependence on collectors for marketing their catch. A study by Zakaria et al. (2020) in coastal areas of Sulawesi also concluded that a lack of financial literacy makes it difficult for fishermen to break out of this pattern of subordinate economic relations.
c. Weak Access to Market Information: Fishermen in the research location lack adequate access to market price information outside the region. This information gap severely weakens their bargaining position. A study by Pranadji et al. (2016) stated that accessible information technology plays a crucial role in improving efficiency and price fairness for fishermen.
d. Seasonal Production Instability: Skipjack tuna production is heavily influenced by the seasons. During the lean season, catches decline drastically, leading to supply and price instability. A similar phenomenon was found by Lestari et al. (2018), who studied fluctuations in skipjack tuna catches in North Maluku.
e. Weak Economic Institutions for Fishermen: The limited role of institutions such as cooperatives prevents fishermen from uniting to collectively market their catch. A study by Tania et al. (2022) confirmed that the existence of active fishermen's cooperatives contributes to improving bargaining power and reducing logistics costs.

Research at the Dufa-dufa Fish Farming Center (PPI) in Ternate City also corroborates these findings by identifying five skipjack tuna distribution channels with relatively low marketing efficiency levels, below 5%. Marketing margins for key distribution actors, such as brokers, collectors, and small traders, vary, but low efficiency indicates persistently high costs and inefficiencies in the marketing chain (Ginting et al., 2022). Our research noted similar constraints, including limited capital for fishermen, minimal access to market information, and dependence on middlemen, which impact fishermen's margins. At the Cilacap Ocean Fishing Port, Pardede (2023) stated that skipjack tuna distribution patterns involve fishermen, large, medium, and small traders, across four main marketing channels. The study also showed that fishermen account for 75-95% of the consumer selling price, indicating efficiency, but the highest margins are still achieved by large and medium traders. The use of refrigeration and ice by wholesalers is a crucial factor in maintaining quality in the distribution chain, thus affecting selling prices (Pardede, 2023). This is relevant to the conditions at Belang Port, where fish storage infrastructure is also limited, contributing to low fisherman margins.

Another similarity can be found in a study in Kendari that assessed the population dynamics and distribution patterns of skipjack tuna at the Samudera Fishing Port. There, distribution also involved several levels of actors, from fishermen, collectors, retailers, to

export processing companies, forming a market chain with varying profit margins between actors (Santoso et al., 2023). This study emphasized the importance of marketing chain efficiency and the need to strengthen fishermen's institutions to increase their independence in accessing markets.

The imbalance in margins experienced by fishermen in all these studies was largely due to their low bargaining power due to limited capital, limited market price information, and dependence on middlemen. This aligns with the findings of Safitri et al. (2019), who stated that the efficiency of the skipjack tuna marketing chain can be improved by shortening marketing channels through fishermen's cooperatives or direct-to-consumer marketing mechanisms. Therefore, integrating these results with previous findings demonstrates the urgent need for strengthening fishermen's institutions, improving access to capital, and providing adequate marketing training. This approach can not only improve fishermen's margins but also increase the competitiveness of skipjack tuna in local and export markets, as recommended by various studies (Ronaldi & Putra, 2023; Ekayani et al., 2019; Pardede, 2023).

## CONCLUSION

Based on the results of this study, it is concluded that the skipjack tuna marketing chain in Belang Port consists of three main channels, with the highest margins being in the hands of retailers. The inefficiency of the distribution chain is caused by fishermen's dependence on intermediaries, limited facilities, and low market access. Therefore, to improve marketing efficiency and fishermen's welfare, institutional strengthening, improved market access, and community-based management are necessary.

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