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Local Wisdom-Based Marketing of Mahakam River Fish Commodities in West Kutai Regency, Indonesia

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ABSTRACT

Mahakam river fisheries in West Kutai Regency play an important role in supporting food security and the local economy. However, fish marketing continues to face challenges, including long marketing chains, weak bargaining power among fishers, and increasing pressure on fisheries resource sustainability. This study analyzes the marketing structure of Mahakam River fish commodities and examines the role of local wisdom in supporting fisheries sustainability. The stakeholders interviewed included producers, such as fishers and fish farmers, and traders, including village collectors and market traders. A descriptive approach was used to analyze marketing channels, marketing margins, Fisher's share, and marketing efficiency. The study involved 45 informants, and data were anayzed using quantitative and qualitative methods. Fieldwork was conducted in Muara Pahu, Penyinggahan, and Jempang districts, which were selected because they serve as hubs for capture fisheries and aquaculture activities and are designated fishery cluster zones in West Kutai Regency, East Kalimantan Province. These areas are also located near the Mahakam River and Lake Jempang. Four main marketing channels were identified, involving fishers, village collectors, market collectors, retailers, and consumers. Fisher's share ranged from 62.41% to 67.23%, with the highest share recorded in Channel II, involving fishers, collectors, retailers, and consumers. Marketing margins ranged from USD 0.50 to USD 0.61 per kilogram, with Channel I record the largest margin. Channel length alone did not determine marketing performance, as costs, services, risks, and price-setting arrangements varied among channels. Local wisdom, including village rules, seasonal knowledge, restrictions on destructive fishing gear, and community-based monitoring, contributes to fish-stock sustainability and community-based fisheries governance. Integrating local wisdom into fisheries marketing may enhance efficiency, fisher welfare, and fisheries sustainability in West Kutai.

Keywords: *Fisherman's share, fisheries marketing, local wisdom, Mahakam River, sustainability*

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INTRODUCTION

The inland fisheries sector plays a strategic role in supporting food security, creating employment, and improving community welfare, particularly among communities living along rivers and in inland areas. The Mahakam River in West Kutai Regency, East Kalimantan Province, is an important inland-water area with substantial fisheries-resource potential. Capture fisheries and freshwater aquaculture constitute major sources of livelihood for parts of the local population and contribute to the local economy (Nugroho et al., 2025). In 2023, capture fisheries produced about 2,435 tons, while aquaculture produced about 1,311 tons. The dominant species from capture fisheries were striped snakehead (*Channa striata*), kendia fish (*Thynnichthys thynnoides*), and Asian redtail catfish (*Hemibagrus nemurus*). Meanwhile, cultivated species included giant snakehead (*Channa micropeltes*), striped snakehead, Asian redtail catfish, common carp (*Cyprinus carpio*), pangas catfish (*Pangasius* sp.), hoven's carp (*Leptobarbus hoevenii*), Nile tilapia (Oreochromis niloticus), and silver barb (*Barbonymus gonionotus*).

Despite this considerable potential, fisheries-resource management in the Mahakam River faces multiple challenges. Environmental pressures arising from coal-mining activities, the expansion of oil-palm plantations, and changes in aquatic habitat quality may reduce fish-resource productivity. A recent socio-economic study by Nugroho et al. (2025) shows that small-scale, community-based operations dominate fisheries activities in West Kutai. The fisheries marketing system is still characterized by long marketing chains and fishers' heavy dependence on collectors. The longest marketing chain—spanning from upstream to downstream for both wild-caught and farmed fish of inland fisheries—consists of 11 nodes. These conditions weaken fishers' bargaining position, so fishers often receive a relatively small share of the final consumer price. Nevertheless, strong social

capital persists through cooperation, traditional benefit-sharing arrangements, and local practices oriented toward resource sustainability.

From technical and ecological perspectives, Solihin et al. (2025) emphasize that capture fisheries in West Kutai remain dominated by traditional methods and relatively small-scale fishing operations. These traditional methods primarily include hook-and-line fishing, longline, bamboo traps, gillnets, and lift nets. A key characteristic of fishery activities at the research location is that they are small-scale, using non-motorised or small-motorised boats operated by individual or family-based fishers with limited catch capacity. The same applies to cultivation activities using floating cages made from local timber—which can last over five years—and using natural feed in the form of Kendia fish (a type of low-value fish) obtained from wild catch. Local communities in West Kutai continue to maintain various forms of local wisdom in fisheries-resource management. Pressure on fish resources has increased alongside land-use change, mining activities, and declining aquatic habitat quality. Fisheries-management strategies must therefore address not only production but also local socio-cultural values and ecological sustainability.

Previous studies have highlighted the importance of traditional ecological knowledge (TEK) and community-based fisheries management in supporting sustainable fisheries. However, most research still focuses on ecological and socio-cultural aspects, while the linkages between local wisdom and fishery trade systems have not yet been extensively examined. Epistemologically, wisdom is the ability to connect knowledge, practices, beliefs, values, ethics, intuition, and actions (Berkes, 1999).

This study defines local wisdom broadly as a relational and reflective capacity to interpret experiences and knowledge, weigh values and consequences, and determine appropriate timing, boundaries, and actions to sustain relationships among humans, other living beings, and the environment. In practical terms, local wisdom is the broader system of locally embedded knowledge, values, customary norms, institutions, ethical principles, and practices that guide relationships with fisheries resources. Traditional or local ecological knowledge constitutes its ecological-knowledge component, while customary regulations, sanctions, cultural values, collective monitoring, and social obligations constitute its normative and institutional components. This aligns with Karhab (2021), who characterizes local wisdom as wise ideas, values, and local perspectives embedded in and upheld by community members.

Thus, local wisdom encompasses more than traditional knowledge. It is understood as a capacity for action grounded in the values, ethics, experiences, and traditional knowledge of local communities as they interact with their surrounding natural environment. In West Kutai Regency, local wisdom refers to locally developed systems of knowledge, values, customary norms, institutions, and practices that guide the community's relationship with fishery resources. Components of local ecological knowledge include insights into fish behaviour, hydrological seasons, habitats, fishing grounds, spawning periods, and appropriate harvesting practices, alongside the customary rules, prohibitions, sanctions, collective monitoring, cultural values, and social obligations that govern resource use.

Human awareness and concern for preserving the natural state and surrounding environment—shaped over generations by norms, cultural customs, and spiritual values—form the root of traditional ecological knowledge, which underpins local wisdom. However, most research has focused on ecological and socio-cultural dimensions, while the relationship between local wisdom and fisheries marketing systems remains insufficiently examined. The economic shift toward market orientation has commodified river fish resources (Pitcher and Lam, 2015), in which pricing and profit increasingly supplant fish's socio-ecological value. In this context, river fisheries can remain sustainable only if trade systems integrate the local wisdom of indigenous communities—wisdom that has long governed the harmonious relationship between humans and these resources. Research by Reza et al. (2021) in Kutai Kartanegara shows that local knowledge of environmental governance, prohibition systems, and traditional conservation practices constitutes an important source of social learning for developing green-economy awareness.

Damayanti et al. (2025) emphasize that local practices grounded in traditional knowledge can be integrated into conservation strategies and the governance of coastal and inland water resources in Indonesia. TEK not only reflects local communities' ecological understanding of their environment but also functions as a social mechanism for regulating economic behaviour and the distribution of resource benefits. Accordingly, fisheries development based on local wisdom can offer a strategic approach to creating sustainable fisheries systems consistent with the social and cultural context of local communities.

Villages situated near rivers and fish-rich lakes—inhabited by populations that steadfastly uphold the norms, customary values, and spiritual beliefs governing their social relationships with the natural ecosystem, rivers, lakes, and fish—can mitigate market pressures and the commodification of river fish. Fish are viewed not merely as commodities with economic worth, but also as possessing social and ecological value. This dynamic shapes the arena of community interaction, enabling the trade of river fish to persist to this day, even amid ecological pressures from mining and oil palm plantations.

Studies of fisheries marketing generally emphasize marketing-channel analysis, marketing margins, and marketing efficiency without adequately considering the role of local institutions and traditional values embedded in communities. This indicates a research gap concerning how local wisdom can be integrated into fisheries marketing systems to create a more equitable distribution of benefits while maintaining fisheries-resource sustainability. Strengthening local wisdom and empowering fisher and fish-farmer communities are therefore central to promoting productive, adaptive, and sustainable fisheries systems. This study examines more closely how local wisdom can be integrated into fisheries development in West Kutai through local institutional mechanisms, traditional knowledge systems, and community-based economic innovation.

Against this background, this study aims to analyze the marketing structure of Mahakam River fish commodities in West Kutai Regency and to examine the role of local wisdom in supporting economic, social, and ecological sustainability. The study is expected to develop a local-wisdom-based fisheries marketing model that improves marketing efficiency, strengthens fishers' bargaining power, and supports sustainable fisheries-resource management.

MATERIALS AND METHODS

Description of the study area

The study was conducted in three districts—Muara Pahu, Penyinggahan, and Jempang—in West Kutai Regency, East Kalimantan Province, all part of the Mahakam River system. The researchers purposively selected observation sites based on freshwater fisheries potential, fish-marketing activities, and the continued presence of local-wisdom practices within the communities. Field research was conducted from January 4 to 10, 2026.

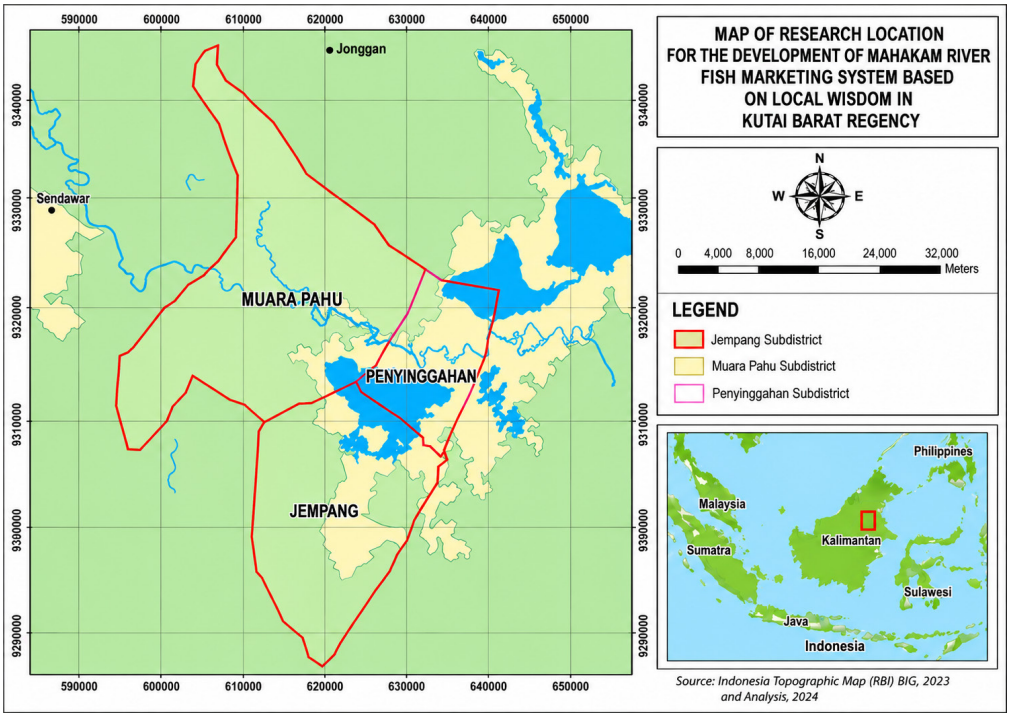

Figure 1. Map of the study area showing the three study districts (Muara Pahu, Penyinggahan, and Jempang) in West Kutai Regency, East Kalimantan Province, along the Mahakam River.

Data collection

This study employed both quantitative and qualitative descriptive approaches. The researchers collected primary data through field observations, interviews, and questionnaires administered to fish-marketing actors, including fishers, collectors, and retailers. The study also conducted in-depth interviews with community leaders and relevant stakeholders to gather information on local-wisdom practices in fisheries-resource management. Secondary data were obtained from government agencies, research reports, scientific publications, and other documents related to fisheries conditions and fish marketing in West Kutai Regency.

A total of 45 respondents participated, comprising 15 respondents from each of the three study districts (Muara Pahu, Penyinggahan, and Jempang), drawn from fish-marketing actors (fishers, village and market collectors, and retailers), fish farmers, fish processors, and village officials. The study purposively selected individual respondents based on their direct involvement in fish-marketing activities and their knowledge of local-wisdom practices within each district. Data were collected through in-depth interviews and focus group discussions (FGDs) using a semi-structured interview guide covering four themes: (a) marketing practices and prices, (b) marketing costs, (c) perceptions of the relationship between fishers and collectors, and (d) local-wisdom practices, including customary rules, prohibitions, and community-based monitoring. The focus group discussion participants from Muara Pahu District consisted of one traditional leader, one district official, two community members, two fishers, two individuals who were both fishers and fish farmers, three floating-cage fish farmers, two live-fish traders, and two salted-fish collectors and processors. Participants from Penyinggahan District comprised two village officials, three fishers, four individuals who were both fishers and fish farmers, two individuals who were both fishers and farmers, two fish farmers, and two fish processors. Participants from Jempang District consisted of three village officials; two individuals who were fishers, fish farmers, and fish collectors; four fishers; three fish farmers; and three fish processors.

Data Analysis

Marketing channel analysis

Marketing-channel analysis was conducted to identify the distribution patterns of fish commodities. This analysis does not distinguish between fish commodities from fishers and those from fish farmers, as all the fish farmers are also fishers. A descriptive analytical approach was used to describe the research object based on the data or samples collected in their existing condition (Creswell, 2014).

Marketing margin analysis

Marketing margins are calculated to determine the difference between the price paid by the consumer and the price received by the fisher, using the following formula (Hanafie, 2010; Nugroho et al., 2024):

$$Mp = Pr - Pf$$

Where:

Mp- Marketing margin (USD/kg)
Pr- Consumer-level price (USD/kg)
Pf- Fisher-level price (USD/kg)

The total marketing margin for each channel was calculated as the difference between the final consumer price and the price received by the fisher using the formula: Mp1 + Mp2 + Mp3 + Mp4 + Mp5. The subscripts identify the marketing actors or stages included in the relevant channel: p1 = fishers; p2 = village-level fish collectors; p3 = fish collectors at local markets (Melak/Barong); p4 = salted fish processors; and p5 = village-level fish retailers. The total marketing margin for each channel was calculated as the sum of the margins or marketing costs incurred by the actors participating in that channel. Depending on the

channel structure, these actors included fishers, village-level collectors, market collectors in Melak or Barong, salted-fish processors, and village retailers. Marketing costs included transportation, ice, containers, bags, baskets, packaging, handling, and other distribution expenses. The calculation included only actors participating in a given channel. Because many respondents participate in both capture fisheries and cage aquaculture, we analyzed marketing relationships by channel rather than by respondent occupation. The analysis includes wild-caught fish and fish originating from capture-based aquaculture, in which juveniles or feed inputs are obtained from the river. The study therefore treats capture fisheries and aquaculture as interconnected components of the local fish-marketing system. The reported average prices and margins therefore represent the aggregated capture-fisheries and capture-based aquaculture marketing system. They should not be i nterpreted as separate estimates for wild-caught and farmed commodities.

Fisherman's share analysis

Fisherman's share was used to determine the percentage of the final buyer price received by the fisher as a first seller, using the following formula (Ikhtiagung et al., 2022):

$$Sp = \frac{Pf}{Pr} \times 100\%$$

Where:

Sp- Fisherman's share (%)
Pf- Fisher-level price (USD/kg)
Pr- Consumer-level price (USD/kg)
Currency- The US dollar exchange rate used is based on the Bank Indonesia midpoint rate, namely 1 USD ≈ IDR 17,635.

Marketing efficiency analysis

Marketing efficiency was calculated to determine the efficiency level of each marketing channel using the following formula (Rahim, 2016):

$$EP = \frac{TB}{TNP} \times 100\%$$

Where:

EP- Marketing efficiency (%)
TB- Total marketing costs average (USD/kg)
TNP- Total value of marketed products (USD/kg)

A lower marketing-efficiency value indicates a more efficient marketing channel. The decision criteria are as follows (Janifa et al., 2014; Mahendra et al., 2022):

a. 0–33% = Efficient
b. 34–67% = Less efficient
c. 68–100% = Inefficient

Local wisdom analysis

Local wisdom was analyzed using a qualitative descriptive approach to identify the forms of local wisdom communities apply in fisheries-resource management, including village rules, knowledge of seasonal water dynamics, prohibitions on destructive fishing gear, and community-based monitoring mechanisms. Specifically, local wisdom was assessed using four indicators: (1) the presence and content of village rules governing fishing activity, (2) the existence of a customary seasonal fishing calendar, (3) the types of prohibited fishing gear identified by the community, and (4) the presence of community-based monitoring mechanisms. Qualitative analysis is defined as an approach for identifying and narratively describing events (Creswell, 2014). Focus group discussion transcripts and interview notes were organized according to the four predefined local-wisdom indicators. Responses were compared across participant groups and districts, and recurring practices, agreements, and differences were identified through descriptive thematic coding. Findings were triangulated using interview accounts, FGD discussions, field observations, and available village documents —and all participants were informed about the purpose of the study, the voluntary nature of participation, confidentiality, and their right to withdraw. The researchers obtained verbal or written informed consent before the interviews and focus group discussions. No personally identifiable information is reported.

The results explain the role of local wisdom in supporting the sustainability of Mahakam River fish-commodity marketing. This study relies on descriptive quantitative analysis (marketing margin, fisherman's share, and marketing efficiency) rather than inferential statistics, because its objective is to describe the existing marketing structure and local-wisdom practices rather than to test statistical hypotheses; the qualitative, descriptive-thematic procedure outlined above was used specifically to address the second research objective concerning the role of local wisdom.

RESULTS

Marketing structure of mahakam river fish commodities

The results show that the marketing of Mahakam River fish commodities in West Kutai Regency involves several principal actors: fishers and fish farmers as producers, collectors, retailers, and final consumers. Each actor plays a role in collecting, distributing, and marketing fisheries products. The existing marketing structure remains dominated by a conventional system that relies on local trading networks and social relationships among business actors. Field identification revealed four main marketing channels that differ according to the number of marketing institutions involved, ranging from the longest channel—comprising village collectors, market collectors, and retailers—to the shortest channel, in which fishers sell directly to consumers. Table 1 presents the structure of each marketing channel.

Channel length is defined as the number of marketing-institution nodes between fishers and final consumers, ranging from a single node in the most direct channel (Channel IV) to three nodes in the longest channel (Channel I). All four channels represent downstream (fisher-to-consumer) flows for capture-fisheries products.

Table 1. Marketing channel structure for Mahakam river fish commodities.

Channel	Pattern	Characteristics
I	Fishers → Village collectors → Market collectors → Retailers → Consumers	Longest
II	Fishers → Collectors → Retailers → Consumers	Medium
III	Fishers → Retailers → Consumers	Short
IV	Fishers → Consumers	Direct

Differences in marketing-channel length reflect variation in fishers' market access. Fishers with better access to transportation, price information, and marketing networks tend to sell their catch directly to retailers or consumers. By contrast, most fishers remain dependent on collectors because of limited capital, storage facilities, and access to distribution. Under these conditions, collectors function not only as intermediaries between producers and markets but also as providers of financing and market information. Relationships between fishers and collectors are built not solely on economic transactions but also on long-standing social ties. Capital and operating-cost assistance from collectors encourages fishers to keep selling their catch to the same buyers, weakening fishers' bargaining position in price formation.

From an institutional perspective, the marketing structure is also shaped by the geography of West Kutai, which is dominated by rivers, lakes, and inland areas with limited transportation access. High distribution costs make collectors important actors in maintaining the continuity of fisheries marketing to regional markets. At the same time, the marketing system faces external pressures, including coal-mining activities, oil-palm plantation expansion, and collectors' dominance in price formation. These factors not only affect fish-resource productivity but also raise distribution costs and reduce the share of benefits fishers receive.

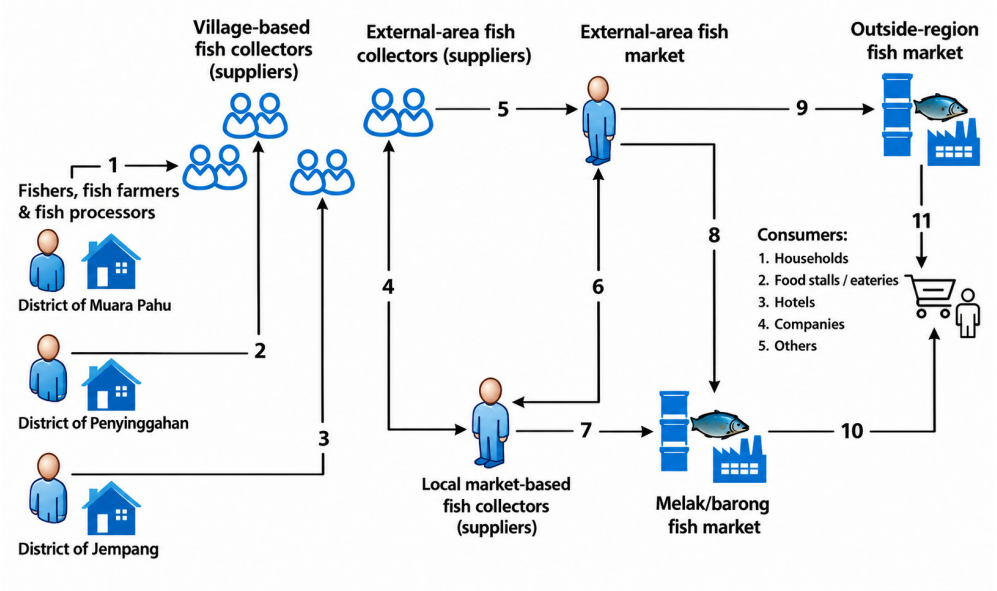

Figure 2. Mahakam river fish marketing channels in West Kutai Regency. Boxes represent marketing actors (fishers, village collectors, market collectors, retailers, and consumers), and arrows indicate the direction of product flow from producer to final consumer for each of the four channels (I–IV).

The results indicate that the marketing structure of Mahakam River fish commodities is shaped by interactions among economic, institutional, social, and environmental factors. Fisheries marketing in this region is therefore better understood as a social-ecological system in which marketing success depends not only on economic efficiency but also on social capital, environmental conditions, and local institutions that support the sustainability of fisheries enterprises.

Fish trade in the Mahakam River area of West Kutai Regency includes fresh or live fish and processed products. Salted fish is the dominant processed commodity. This study focuses exclusively on freshwater river species such as giant snakehead (*Channa micropeltes*), striped snakehead (*Channa striata*), Asian redtail catfish (*Hemibagrus nemurus*), and striped catfish (*Pangasius* sp.), rather than marine species such as tuna, sardines, or milkfish. Marketing channels and the distribution of freshwater fish commodities extend beyond local markets to Kutai Kartanegara Regency, Samarinda City, and Banjarmasin. At the same time, processed salted-fish products are distributed as far as Java.

Fish marketing channels comprise a sequence of activities through which fish commodities move from producers or fishers to final consumers, forming chains or transactional relationships governed by particular strategies that can generate added value and competitive advantage (Nugroho et al., 2024). The channels and distribution of fish commodities are primarily driven and shaped by the interests and cooperation of fisheries-business actors. Fish marketing in West Kutai Regency therefore involves several flows, or marketing networks, among fishers, fish farmers, processors, fish traders, and final consumers.

The analysis shows that marketing margins for Mahakam River fish commodities differ across channels, ranging from USD 0.50–0.61/kg (Table 2). The highest margin occurs in the channel involving village collectors, market collectors, and retailers, whereas the lowest margin occurs in a shorter distribution chain. This finding indicates that more marketing institutions increase the margin generated by accumulating distribution costs and profits at each stage. These margin differences affect fishers' share, which ranges from 62.41% to 67.23%. The highest value occurs in Channel II (fishers, collectors, and retailers to consumers), whereas the lowest occurs in Channel III (fishers, retailers, and consumers). Thus, Channel II enables fishers to receive the largest proportion of the final consumer price, whereas Channel III provides the smallest proportion among the four channels.

A high marketing margin does not necessarily indicate an inefficient marketing system. In the context of Mahakam River fisheries, collectors continue to play important roles in providing access to financing, bearing marketing risks, and connecting fishers with broader markets. Marketing margins therefore also reflect the costs and distribution functions each marketing institution performs. These findings support fisheries-

marketing theory, which holds that channel length affects both marketing margins and the share of the final price producers receive. In West Kutai, however, a river- and inland-dominated geography also shapes this relationship, making collectors essential to maintaining continuity in fisheries-product distribution.

From a sustainability perspective, increasing fishers' share should not rely solely on shortening marketing chains. It also requires stronger fisher institutions, improved access to price information, and the development of cooperatives and marketing technologies. These measures are expected to strengthen fishers' bargaining power without eliminating the strategic functions marketing institutions perform within the fisheries distribution system.

Table 2. Marketing margins and fisherman's share by marketing channel (average values).

Channel	Fisher price (USD/kg)	Consumer price (USD/kg)	Marketing margin (USD/kg)	Fisherman's share (%)	Marketing efficiency (%)	Classification
I	$1.17	$1.78	$0.61	65.73	22	Efficient
II	$1.19	$1.77	$0.58	67.23	24	Efficient
III	$0.83	$1.33	$0.50	62.41	34	Less Efficient
IV	$1.03	$1.55	$0.52	66.45	20	Efficient

Source: Primary data analysis (2026). Notes: Minor differences between the displayed component sums and total margins are attributable to rounding after conversion from Indonesian rupiah to US dollars. Calculations used the original unrounded IDR values.

The margin values presented in Table 2 above represent the sum of marketing margins across each channel—specifically: Marketing Channel I (0.28 + 0.09 + 0.06 + 0.11 + 0.06 ≈ 0.61), Marketing Channel II (0.31 + 0.07 + 0.05 + 0.11 + 0.05 ≈ 0.58), Marketing Channel III (0.23 + 0.08 + 0.05 + 0.10 + 0.04 ≈ 0.50), and Marketing Channel IV (0.52). As shown in Table 2, Channel I offers fishers a price of USD 1.17/kg and a final price of USD 1.78/kg, resulting in a margin of USD 0.61/kg—the largest among the four channels. The fishermen's share of 65.73% indicates that fishers receive approximately two-thirds of the final price. The efficiency ratio of 22% falls within the 0-33% threshold, classifying it as efficient; this suggests that intermediaries in Channel I provide functions and earn profits greater than those in the other channels.

Meanwhile, Channel II has a margin of USD 0.58/kg and a fisherman's share of 67.23%—the highest among the four channels based on the reported figures. This value indicates relatively good price transmission to the fishers. The efficiency ratio of 24% is still considered efficient, though slightly higher than that of Channels I and IV. Thus, Channel II excels in terms of price distribution to fishers, while its cost efficiency ranks third. These results confirm that fishermen's share and cost efficiency measure different dimensions.

Channel III features the lowest price paid to fishers—USD 0.83/kg—and the lowest fisherman's share at 62.41%. Although the margin of USD 0.50/kg is the smallest, the efficiency ratio of 34% is the highest and slightly exceeds the 0- 33% threshold; consequently, this channel is classified as less efficient. Finally, Channel IV yields a price of USD 1.03/kg for fishers and a consumer price of USD 1.55/kg, resulting in a margin of USD 0.52/kg and a fisherman's share of 66.45%. Its efficiency ratio of 20% is the lowest, making Channel IV the most cost-efficient. The fisherman's share is also relatively high, falling just slightly below that of Channel II. Thus, Channel IV offers the most balanced combination of low marketing costs and favourable price distribution, even though it does not provide the highest fisherman's share.

DISCUSSION

Local wisdom in fisheries marketing

The results show that Mahakam River fish marketing in West Kutai Regency is shaped not only by market mechanisms but also by local wisdom practices that communities continue to maintain. This local wisdom functions as an informal institution that governs the use of fisheries resources and supports the sustainability of fisheries production and distribution. The marketing system in the study area thus operates as a social-ecological system integrating economic, social, and environmental dimensions. Based on observations and interviews, the forms of local wisdom still practiced include village rules governing the use of aquatic resources, traditional knowledge of seasonal water dynamics, prohibitions on destructive fishing gear, and community-based monitoring. These practices help maintain fish-stock sustainability while ensuring a continuous supply of commodities for marketing activities.

However, this study's findings extend beyond prohibitions to the relationships among actors within the village community—for instance, around fishing gear use. The dynamics involve a chain of factors: orientation toward gear like current-aligned fish traps; mesh size determining catch size; seasonal shifts in fishing locations; and fishing methods influencing survival and freshness. Freshness, in turn, affects price; buyers' aggregate volume; market demand drives intensification; and stock depletion triggers calls for conservation measures. This cycle represents a social-ecological feedback loop. Wisdom is manifested in the community's response to such feedback, balancing authority with economic choices.

Village rules function as local mechanisms regulating fishing-gear types, fishing areas and seasons, and sanctions for violations. Communities also use knowledge of seasonal water dynamics to determine fishing times that are compatible with fish life cycles. This knowledge constitutes a form of traditional ecological knowledge developed through community experience in understanding the characteristics of the Mahakam River ecosystem. The variety of gear reflects technical knowledge tailored to specific habitats, target sizes, operational timing, and desired outcomes. Seine nets and gillnets are mentioned across all locations. Longlines, fish traps, and lift nets are prominent in Muara Pahu District; in Penyinggahan District, fishers reported using seine nets and gillnets with mesh sizes of 3.2 and 3.8, lift nets, and cast nets for catching fry or bait; in Jempang District, fishers use seine nets set in the late afternoon and hauled at dawn—ranging from 100 to 200 meters in length—alongside lift nets, longlines, fish traps, trawls, and barrier traps.

Within the framework of local wisdom, fishing gear is evaluated on more than efficiency; considerations include selectivity, soak time, habitat impact, fish size, risks to reproduction, safety, and the community's ability to regulate use. Seine nets

left in the water from late afternoon until dawn may result in dead fish and lower quality, but they are easier to monitor and restrict through mesh-size regulations. Electrofishing yields live or fresh fish and allows for selective harvesting, but it expands the capacity to catch fish in refuge areas and poses a risk of fatal accidents. Fine-mesh nets, trawls, and barrier traps raise concerns about indiscriminate capture of small fish and potential hindrance to fish population regeneration.

Local wisdom is also reflected in the prohibition of destructive fishing gear such as electric shocks, poisons, mosquito nets, moving tools that sweep up small fish, and explosives, as well as in the use of traditional fishing gear that is more selective and environmentally friendly. The community strengthens compliance through joint monitoring mechanisms to reduce the risk of over-exploiting fish resources. The ethical basis is reconstructed from four reasons: damaging regeneration, taking fish without selectivity, entering sanctuaries, and endangering humans. However, the level of institutionalisation is different.

In Muara Pahu District, participants stated that they were unable to prohibit the perpetrators of electrocution directly. Risk knowledge exists, but collective authority is not strong enough. Penginggahan District has village regulations created decades ago that prohibit technologies such as electric shocks or mosquito nets. Implementation relies mainly on socialisation because village officials do not see themselves as having authority like the police. Furthermore, the rules struggle to reach fishers from other villages—such as Jantur, Muara Ohong, or Pulau Lanting—who utilise the same waters, highlighting a mismatch between ecological zones and social jurisdictions.

Meanwhile, in Jempang District, prohibitions are linked to plans for village conservation zones and protecting kumpayan—circular structures made of wood or vegetation that serve as fish refuges. The community strives to prevent electrofishing within these areas. Other implicit prohibitions include catching juvenile fish, damaging others' nets, and operating gear without respecting markers; differently coloured flags identify net ownership. Agreements on departure times and gear placement also help reduce conflict among fishers.

Knowledge of the seasons is rooted in water dynamics rather than a fixed calendar. When the Mahakam River rises, water flows into lakes and swamps; when it recedes, fish move back into the river. Fish traps can be oriented in the opposite direction to match the flow. Species such as Kendia and other small fish migrate or become more abundant during specific seasons. At Lake Jempang, the dry season can dry up vast areas, halting floating-cage aquaculture and curtailing net-based fishing.

In contrast, the rainy season—or rising water levels—is associated with fish movement and reproduction. In Muara Pahu, the focus is on changing access to the Mahakam riverbanks; layers of moored barges block sites where fish traps or longlines would be set and extend the time collectors need to travel to Melak from a daily trip to a three- or four-day journey. Oil palm plantations and drainage ditches are also linked to declining fish stocks in inland areas. Local ecological knowledge proves insufficient when infrastructure projects beyond fishers' control alter fishing grounds. The areas of Penyinggahan and Jempang demonstrate that these waters function as an inter-village system; fishers from Jantur, Muara Ohong, Pulau Lanting, Muara Muntai, and other regions all access the same lakes and rivers. Administrative boundaries do not align with fish migration patterns or fishing operations. Consequently, conservation efforts by one village may benefit another. This represents a classic "scale mismatch", local wisdom requires inter-village institutions and support from the regency or provincial government.

From a commercial perspective, local wisdom contributes to production stability, thereby supporting the sustainable distribution of fishery products. In practice, fish prices depend on factors such as size, species, freshness, whether the fish is live or dead, seasonal abundance, sales format, order volume, market location, transportation costs, and the collector's role. In Penyinggahan, fish weighing approximately 300 grams (three ons) or more command higher prices; for instance, larger fish might sell for around USD 1,70, while smaller ones go for USD 1,13 or USD 0,85, and a preference for fish not preserved in ice reflects local quality standards. Farmers sell common carp or tilapia for approximately USD 1,36–1,53 at the source, whereas prices in Melak range from USD 2,83 to 3,12. Market demand—requiring about five different species and a total volume of roughly 2.5 tons per night—makes it difficult for individual producers to access the market directly; collectors gain bargaining power by aggregating volume and variety. In Jempang, units of sale include bundles and packages alongside the standard kilogram. The number of fish per bundle varies by size, ensuring transaction value is maintained by counting individual fish rather than weight alone. Catfish sells for around USD 1,19 when an entire floating net cage is harvested at once but can reach approximately USD 1,42 for smaller orders. Cage-reared snakehead can fetch around USD 4,54 per kilogram. Prices fluctuate based on order specifications, destination, freshness, and the capacity to bear marketing risks.

Maintaining fish stocks enables a more stable supply to collectors, retailers, and consumers, improving marketing-system efficiency and reducing price fluctuations. These findings reinforce traditional ecological knowledge (Khosravi Mashizi and Escobedo, 2025) and community-based fisheries management (FAO, 2006), both of which position communities as key actors in fisheries-resource management. This study, however, demonstrates a broader contribution: local wisdom functions not only in resource conservation but also in sustaining marketing systems by strengthening local institutions, stabilising supply, and increasing trust among business actors. Local-wisdom practices in West Kutai can be understood as a form of counter-politics of value—community efforts to preserve ecological values amid growing pressure from mining activities, oil-palm plantation expansion, and the commercialisation of fisheries resources. Local wisdom therefore functions not merely as cultural heritage but also as social capital that strengthens the resilience of the Mahakam River fish-marketing system.

Biography of the fish commodity

The journey of the Mahakam River fish commodity is a social process that moves from the fish being caught by fishers, being cultivated in cages, the fish in cages being fed with small Kendia (*Thynnichthys thynnoides*) caught in the river, the fish being processed, marketed, to being conveyed to live consumers as a history of fish commodities. The fish commodity's travel process was drawn from field observations and interviews with respondents. This study uses the biography of the fish commodity as an analytical framework, drawing on Appadurai's (1986) concept of the "social life of things," to describe how a fish commodity's economic and social value changes as it moves through the marketing chain, from capture to the final consumer. Based on analyses of the marketing structure, marketing margins, fishermen's share, marketing efficiency, and local-wisdom practices, this study develops a model of Mahakam River fish-commodity marketing based on the social biography of fish and local wisdom. The model integrates economic, institutional, social, and ecological dimensions to support sustainable and equitable fisheries marketing management.

Unlike conventional marketing models focused primarily on distribution efficiency, this model positions local wisdom as central to maintaining resource sustainability while supporting the continuity of the marketing system. As shown in Figure 2, fishers and fish farmers are the principal actors in the production system and are connected to collectors, retailers, and consumers through several marketing channels. Marketing-channel length influences system performance and has implications for marketing margins, fishermen's share, and marketing efficiency.

The marketing system faces external pressures, including coal-mining activities, oil-palm plantation expansion, and collectors' dominance in price formation. These factors may degrade environmental quality, increase distribution costs, and weaken fishers' bargaining position. The findings show that local-wisdom practices provide mechanisms to mitigate these pressures. Village rules, knowledge of seasonal water dynamics, prohibitions on destructive fishing gear, and community-based monitoring help maintain fish-stock sustainability and thereby preserve continuity of supply for marketing activities. Consequently, sustainable marketing depends not only on distribution efficiency but also on communities' ability to maintain local institutions that underpin resource management.

The resulting model demonstrates a mutually reinforcing relationship between fisheries marketing and local wisdom. Local wisdom helps sustain resources so that fish production remains available, while an efficient marketing system generates economic benefits that encourage communities to continue sustainable management practices. This relationship indicates that economic and ecological sustainability are mutually supportive components of the Mahakam River fisheries system. Conceptually, the model extends fisheries-marketing analysis by integrating economic indicators—marketing margins, fishermen's share, and marketing efficiency—with traditional ecological knowledge and community-based fisheries management (Deepananda and Amarasinghe, 2021). The findings show that successful fisheries marketing depends not only on market mechanisms but also on strong local institutions that maintain sustainable production and distribution. The model therefore implies a need to strengthen fisher institutions, improve market access and price information, protect village rules, and provide supporting marketing infrastructure. Integrating government policy with local wisdom is expected to create a more efficient, adaptive, and sustainable fisheries marketing system.

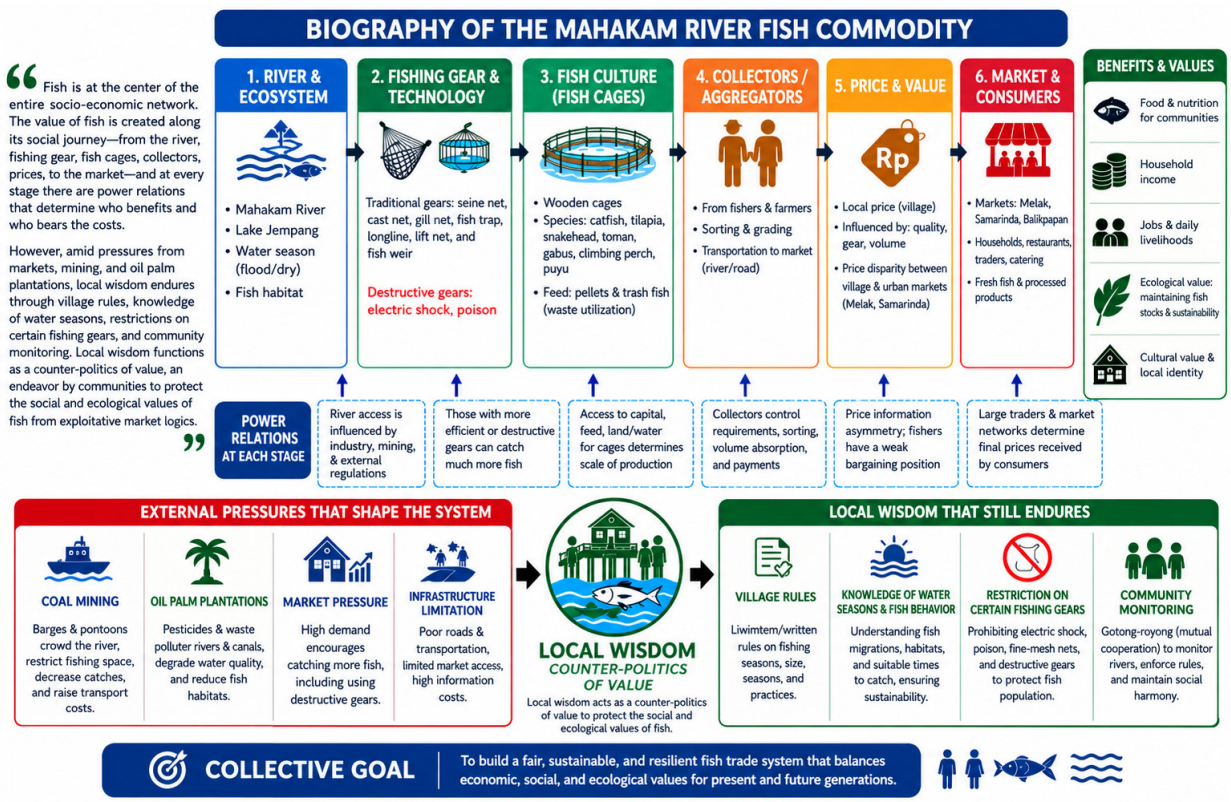

Figure 3. Biography of the Mahakam river fish commodity in West Kutai Regency.

Fishers and fish farmers (top) connect through marketing-channel arrows to collectors, retailers, and consumers; surrounding boxes represent the external pressures (mining, oil-palm expansion, collector dominance) and local-wisdom mechanisms (village rules, seasonal-water knowledge, gear prohibitions, community monitoring) that this study identifies as jointly shaping marketing-channel length, margins, fishermen's share, and marketing efficiency, directly addressing the study's two objectives of analysing marketing structure and the role of local wisdom in supporting fisheries sustainability.

The Mahakam River fish commodity—moving from producers (fishers and fish farmers) to collectors and finally to consumers—carries a social history rooted in the river and its ecosystem. The technologies employed for harvesting, farming, and processing—as well as distribution, packaging, and transport—are inextricably linked to local culture. Similarly, pricing emerges from social interactions among the business actors involved in trade, guided by the local

community's values, norms, and customary agreements. As illustrated in Figure 3, this study highlights that the social journey of this fish commodity—from producer to consumer—is under pressure from mining and oil palm plantation activities, which threaten the sustainability of fish resources. Local wisdom within the West Kutai community helps keep these river fish a viable commodity; they continue to be harvested and farmed in the Mahakam River and Lake Jempang, then processed, traded, and consumed locally. Furthermore, processed products—such as dried giant snakehead, striped snakehead, snakeskin gourami (*Trichopodus pectoralis*), and kissing gourami (*Helostoma temminckii*)—are sold to cities like Samarinda and Banjarmasin, and even as far afield as Java (Jakarta, Surabaya, Bogor, and Cianjur).

Mahakam River fish marketing constitutes a complex arena of the politics of value. Fish as a local commodity lies at the intersection of river ecology, which provides habitat and fish stocks; mining infrastructure, which controls river transport routes; fishing technologies, which determine modes of extraction; intermediaries and collectors, who control market channels; and local wisdom, which maintains the moral and ecological boundaries of fish-resource use.

In Appadurai's (1986) framework, fish have a 'social life.' They move from the river to cages, from fishers to collectors, from villages to Melak, and from local to regional markets. At each point in this movement, fish value changes. Small fish may become feed. Live fish may command higher prices. Fish caught using poison may lose moral value. Farmed fish may function as household savings. Salted fish may enter wider trading networks.

Mahakam River fish marketing is therefore not merely a matter of price; it is also a question of who controls the pathways through which fish acquire and change value. When coal barges dominate river routes, intermediaries control prices, and destructive technologies enter fishing grounds, communities lose their control over the social life of fish as commodities.

The relationship between local wisdom and the Mahakam river fish trade.

The relationship between local wisdom and fish trading systems can be defined as an interplay of ecological knowledge, moral norms, formal and informal rules, technologies, and work practices—all evolved through community experience—that govern interactions among people, fish, aquatic environments, and fellow market participants. Although this study did not directly measure the relationship between local wisdom and the fish trade system, the fishery business operators observed viewed the traditional practices they employed in the Mahakam River fish trade as part of an effort to conserve resources and maintain fish availability. This wisdom extends beyond conservation; it permeates the entire commodity chain, influencing decisions ranging from when and where to fish to whether the catch is accepted, paid for immediately or on credit, salted, kept alive, or rejected.

Within this framework, fish protection addresses two interconnected objectives. First, fish are protected as a biological population to ensure they can reproduce and remain available. Second, they are protected as a commodity to maintain quality, safety, value, and market trust. Measures such as bans on catching small fish, prohibitions against the use of poisons and electric shock, the protection of fish aggregation devices (*kumpayan*), and restrictions on fishing grounds primarily target the first objective. Conversely, practices such as handling live fish, using ice, eviscerating fish suspected of toxin exposure, salting unsold stock, and differentiating prices based on size or freshness address the second objective. Both approaches converge on a shared goal: sustaining ecological reproduction and the community's economic reproduction. The table below (Table 4) presents the relationship between local wisdom and fish commodity trading systems.

Table 4. The relationship between the trade of Mahakam River fish commodities and local wisdom in West Kutai Regency.

Trade and distribution process	Local wisdom	
	Forms of local knowledge or rules	**Economic and protective functions**
Ecology and season	Reading water level fluctuations, floods, droughts, currents, aquatic vegetation (kumpayan), and fish spawning grounds and migration patterns.	Determining timing, location, gear, and fish species; mitigating risk and safeguarding fish spawning grounds.
Fishing	Adapting gear—such as seine nets, longlines, fish traps (bubu), and lift nets (sangga)—to the season; while the use of electric shock, poisons, and fine-mesh nets (kelambu) is controversial or prohibited.	Regulating selectivity, product quality, safety, access rights, and fishing pressure on stocks.
On-board handling	Keeping fish alive, sorting the catch, and monitoring submersion times and signs of poisoning.	Preventing quality loss, building the fisher's reputation, and influencing buyer acceptance.
Landing and processing	Transferring fish to floating cages (keramba) or holding pens (kuhung), icing, splitting, and salting them if they do not sell immediately.	Extending shelf life, preserving value, and aligning supply with demand.
Valuation and transactions	Price tiers determined by size, species, freshness, volume, and season; transactions conducted by the kilogram, bundle, container, or specific order.	Translating biological quality into economic value and sharing market risks.
Payment and relationships	Cash, deferred payment, revolving credit, regular clientele, trust, and reputation.	Overcoming capital and distance constraints, though potentially creating dependency and bargaining power imbalances.
Monitoring and recovery	Warnings, village regulations, bans on destructive gear, conservation zone planning, and social controls.	Correcting over-exploitation and maintaining the legitimacy of trade practices.

Source: Compiled from interviews and focus group discussions in three districts: Muara Pahu, Penyinggahan, and Jempang.

CONCLUSIONS

Mahakam River fish marketing in West Kutai Regency is organised through four channels connecting fishers and fish farmers with village collectors, market collectors, retailers, and consumers. Their configuration reflects differences in transport, capital, storage, market information, volume aggregation, and long-standing producer-collector relationships within a riverine geography. The corrected results show marketing margins of USD 0.50-0.61/kg, fishermen's shares of 62.41%-67.23%, and marketing-efficiency ratios of 20.07%-34.07%. Channel II provides the highest fisherman's share (67.23%), whereas Channel IV records the lowest efficiency ratio (20.07%) and offers the best balance between a relatively high producer share (66.45%) and low marketing costs. By contrast, Channel III has the smallest margin (USD 0.50/kg) but the lowest fisherman's share (62.41%) and is classified as less efficient. Thus, shorter channels are not automatically more efficient; performance depends on the costs, risks, services, and bargaining relations embedded in each channel.

Local wisdom connects the ecological reproduction of fish resources with commercial continuity by governing fishing methods, product quality, transactions, and resource protection. Village rules, seasonal-water knowledge, selective gear, prohibitions on destructive methods, community monitoring, post-harvest handling, quality grading, price negotiation, and payment arrangements shape how fish are obtained and retain value. Muara Pahu is shaped by restricted riverbank access and coal-barge activity; Penyinggahan by village regulation, capture-aquaculture linkages, and collector dependence; and Jempang by seasonal lake knowledge, kumpayan protection, and conservation planning. Although constrained by mining, oil-palm expansion, destructive technologies, collector dominance, and jurisdictional mismatches, these institutions demonstrate that Mahakam River fish marketing is a socially embedded social-ecological system and a politics of value rather than a self-contained price mechanism. The resulting model integrates marketing margins, fishermen's share, and cost efficiency with traditional ecological knowledge, trust, quality practices, and collective resource protection. Sustainable improvement therefore requires transparent prices and payments, stronger producer organisations, shared logistics and cold-chain facilities, inter-village governance, and recognition of local conservation rules. This approach can retain the useful functions of intermediaries while strengthening producers' bargaining position and maintaining fish as an ecologically available, commercially valuable, and socially legitimate commodity.

RECOMMENDATIONS

The study recommends strengthening collective marketing institutions, such as fisheries cooperatives and BUMDes, to improve fishers' bargaining power, facilitate collective marketing, provide financing and storage, and reduce fragmented sales. Existing collectors should be retained as important sources of financing, market information, transportation, and market access, but partnerships should be guided by transparent agreements covering prices, quality standards, weighing, payment, risks, and dispute resolution.

Furthermore, the proposed fisheries cluster in Muara Pahu, Penyinggahan, and Jempang should be developed through an integrated master plan covering capture fisheries, aquaculture, processing, marketing, conservation, water management, and transportation. An inter-district and inter-village coordinating body should oversee the cluster to address shared fisheries resources and activities across administrative boundaries. These measures can promote a more coordinated, transparent, and resilient fisheries marketing system while improving fisher welfare and supporting long-term fisheries sustainability.

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AUTHOR CONTRIBUTIONS

T. N: Lead author, drafted and designed the manuscript, processed and analysed the data, and revised it through the final draft. M and S: Collected data in the field and suggested improvements to the draft manuscript. N. A: Assisted with editing the manuscript draft.

DECLARATION

Informed consent statement

This study was conducted in accordance with ethical research standards. We obtained informed consent from all participants, and we strictly maintained data confidentiality.

Conflict of interest

The authors declare no conflict of interest regarding the publication of this research article. This study was conducted independently, free from any commercial, financial, or institutional relationships that could be construed as a potential conflict of interest, and all data collection and manuscript writing were undertaken solely for academic and professional development.

AI Disclosure

The authors explicitly state that artificial intelligence tools were not used in data collection, analysis, or manuscript preparation. The authors conducted this entire study—from conceptualisation to final written output. Generative AI tools were used solely to help check the accuracy of language usage.

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