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INLAND FISH MARKETING EFFICIENCY IN NORTH BIHAR, INDIA

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ABSTRACT

This study examines on the fish marketing structure in the North Bihar region, particularly in the Madhubani and Darbhanga districts. Data were collected through interviews with 244 inland fishing farmers from 12 village of selected blocks, the intermediaries under five wholesalers, 20 of each vendors/ commission agent and retailers along with the 60 consumers according to annual income basis. The analysis revealed four primary marketing channels, with Channel I (Producer → Retailer → Consumer) being the most commonly used, accounting for 62.30% of sales. The marketable surplus per farm was found to vary with farm size, with larger farms having a higher surplus. The price spread analysis indicated that the shortest marketing channel (Channel IV: Producer → Consumer) was the most efficient, with the highest producer's share in the consumer rupee at 91.27%. In contrast, Channel II, which involves the most intermediaries, had the lowest producer's share at 62.28% due large intermediaries found as vendor, wholesalers and retailers and retained the fish marketing but prevalent practices after II channel. The Conventional, Shepherd and Acharya approaches of analysing marketing efficiency is the larger the ratio the more is efficiency and vice-versa. The Conventional method identified Channel IV as the most efficient, while the Shepherd and Acharya approaches highlighted in order to decreasing rate of ratio viz on Channel IV was most efficient followed by I, III, and II channel. In IV channel was as the most efficient due to direct sales from producers to consumers. These findings underscore the need for reforms in the fish marketing system in Bihar to reduce intermediaries and improve the efficiency of fish distribution, thereby increasing the income of fish producers and reducing consumer prices.

Key words: Marketing costs, Marketing efficiency, Marketing margins, Price spread.

Introduction

India is the 2nd major producer of fish in the world and roughly 68 per cent of India's fish is from the aquaculture sector. Fish production was predicted to be around 14.4 million tons in 2021. The expected output of capture fisheries in that year was about 5 million tonnes (3.2 million tonnes from the oceans and 1.8 million tonnes from inland waters). Estimated number of fishing boats in 2020 was 193 587 (F.A.O., 2022). According to Jayasankar (2018), freshwater aquaculture accounts for more than 95% of the yearly aquaculture production of 5.77 million inland fisheries in India, where the fishing industry is expanding at a rate of more than 7%. Since fish is a very perishable item, the expansion of fish output

really depends heavily on an effective fish marketing strategy. In a paper on post-harvest loss in the fishing industry, (Devadasan, 2005) focused on effective fish marketing channels to reduce post-harvest losses. The marketing efficiency has been found more in the case of marine species than freshwater species, since the latter travel longer distances from the point of production to consumption centre, passing many intermediaries as compared to the former. The fisherman's share in consumer's rupee has shown variations across species, marketing channels and markets. The infrastructure facilities at most of the surveyed landing centres, fishing harbours and wholesale and retail markets have been found grossly inadequate and poorly maintained (Prasad

S., 2023). Marketing fish products is one of the largest challenges in fish farming, according to producers. Farmers must be able to identify workable solutions since they can notice issues like low pricing, inadequate transportation, a lack of rapid markets, and large post-harvest losses. Successful marketing requires learning new skills, strategies, and techniques for obtaining and using information (Ramaraao & Sarada, 2015).

Bihar, one of the country's states with the lowest GDP (Kumari B., 2016), boasts fertile land and abundant water resources from the Ganges (Kumar *et al.*, 2012). Approximately 88 per cent of Bihar's population depends on agricultural and allied production systems, including crops, fisheries, and livestock (Aryal *et al.*, 2018). Bihar ranks 12th in fisheries resources, 4th in inland fish production, and 6th in freshwater fish seed production (Kumar *et al.*, 2018). About 80 per cent of fish production in Bihar comes from capture fisheries, with the remainder from culture fisheries (Jha, 2009). In the fiscal year 2020-21, the fisheries and aquaculture sector contributed 8.1 per cent to the gross state domestic product (GSDP). In 2021, the state produced 7.62 lakh MT of fish primarily from inland resources, falling short of the 8.02 lakh MT demand. Madhubani district contributed the highest (0.81 lakh tonnes), while Jehanabad contributed the lowest (0.14 lakh tonnes) to inland fish farming in Bihar. The eastern Indian state of Bihar is not a significant contributor to India's fish production. Bihar's annual aquaculture production was around 762,000 tons in 2021-22, whereas the state's estimated demand for fish was 850,000 tons (GoB 2012). This fish supply-demand gap has attracted fish producers and traders from other states like Andhra Pradesh, West Bengal, and Nepal fulfills Bihar's demand for fish. Cutting C.L., (1996) and Shepherd Geoffrey S. (1972) has been shown the ratio of cost to margin is directly influenced by the involvement of the fishermen and the efficiency of marketing. The higher the ratio has the more efficient the marketing and vice-versa. This has been demonstrated by researchers. With this background, this study has analyzed the existing marketing structure, marketing channels, market intermediaries, producer share, marketing margins, price spread and marketing efficiency in fish marketing in selected districts of north Bihar.

Materials and Methods

Since long the northern part of Bihar, which lies north of Ganga River flowing west to east across the state, has been a distinguishing characteristic of the area known as North Bihar (Sinha, C.P., 2011). North Bihar was purposively selected for the research since it has different hydrological, agricultural, socio-economic and

environmental aspects than South Bihar.

The present investigation was conducted during the year (2023-24) by personal interview method with the help of pre-tested and specially designed schedule and during the study two blocks namely (Bennipatti and Pandaul) from Madhubani districts and two blocks (Darbhanga Sadar and Viraul) from Darbhanga districts of the North Bihar were selected purposively. In order to choose inland fish producers, twelve localities were considered. The study on marketing of inland fish production was conducted using stratified random sampling and proportionate probability sampling technique to select 244 inland fishing farmers from 12 village of selected blocks, five wholesalers out of 20 at distinguish fish markets under Madhubani, Bennipatti, Darbhanga, Laheriyasarai, Viraul, 20 of each vendors (paikars) and retailers from selected block market intermediaries and 60 consumers according to annual income basis scale. The price paid by consumers was allocated to the producers by collecting data on fish marketing from farmers and retailers. The price spread was studied for the major marketing channels of inland fish. The efficacy of several marketing channels for fish was assessed in the marketplaces and computed using the following methodology:

Marketable Surplus

It refers to the quantity of crops that farmers are required to provide to the market after satisfying their own agricultural and familial requirements, among other factors. The calculable excess has been assessed using the methodology provided below:

$$MS = P - (C + W) \quad \dots 1$$

Where,

MS = Marketable Surplus

P = Total Production (quintal)

C = Total Consumption (quintal)

W = Quantity paid as Wage (quintal)

Producer's Price

This is the net amount received by the farmer at the time of sale. The producer price was calculated as follows:

$$PF = PA - CF \quad \dots 2$$

Where,

PF= Producer's price

PA = Wholesale price in primary assembling market

CF = Marketing cost incurred by farmer

Producer's Share in the Consumer's Rupee (Ps)

It represents the proportion of the price obtained by the producer to the price spent by the consumer. This may be determined by the formula provided below.

$$PS = \frac{PC}{PF} \times 100 \quad \dots 3$$

Where,

PS=Producer's Share (per cent)

PC = Price paid by the consumer

PF = Producer's Price.

Marketing Margin of Middle Man

(a) Absolute Margin of i^{th} Middle Man (A_{mi})

$$A_{mi} = P_{ri} - (P_{pi} + C_{mi}) \quad \dots 4$$

Where,

P_{ri} = Sale price of i^{th} intermediaries

P_{pi} = Purchase price of i^{th} intermediaries

C_{mi} = Cost incurred on marketing per unit

(b) Percentage Margin of i^{th} Middle Man (P_{mi})

$$P_{mi} = \left[P_{ri} - \frac{(P_{pi} + C_{mi})}{P_{ri}} \right] \times 100 \quad \dots 5$$

(c) Percentage Mark-up of i^{th} Middle Man (M_i)

$$M_i = \left[P_{ri} - \frac{(P_{pi} + C_{mi})}{P_{ri}} \right] \times 100 \quad \dots 6$$

Where,

P_{ri} = Sale price of i^{th} intermediaries

P_{pi} = Purchase price of i^{th} intermediaries

C_{mi} =Cost incurred on marketing per unit

Total Cost of Marketing (C)

$$C = CF + CM_1 + CM_2 + CM_3 + \dots + CM_n \quad \dots 7$$

Where,

C_f = cost incurred by farmer

C_{mi} = cost incurred by i^{th} middle man

Acharya's Method (MME)

$$MME = \frac{FP}{(MC + MM)} \quad \dots 8$$

Where,

FP = Net price received by farmer

MC = Total marketing costs

MM= Total net margins of intermediaries

Conventional Method

$$\text{Marketing efficiency} = \frac{\text{Consumer purchase price } P_c - \text{Producers selling price } (P_f)}{\text{Marketing Cost } (MC)} \quad \dots 9$$

Shepherd Approach (Shepherd, 1965)

Table 1: Marketable Surplus of Fish Markets (kg).

Sl. No	Particulars	CFF			Overall (n=244)
		S	M	L	
A	Fish Production by the producers	2118	2261	2429	2164.08
B	Consumption by the producers				
i	Home Consumption	5.00	9.13	9.33	6.04
ii	Friends and Relative	6.04	7.02	7.52	6.32
	Total B	11.04	16.15	16.85	12
C	Marketable Surplus (A-B)	2107	2245	2412	2152

CFF: Category of fish farmers
S: Small($n_1=183$); M: Medium($n_2=46$); L: Large($n_3=15$)

A ratio of the total value of goods marketed to the marketing cost is used by Shepherd to analyse the marketing efficiency. Marketing efficiency is determined using the formula provided below;

$$\text{Marketing efficiency} = \frac{\text{Consumer purchase price } P_c}{\text{Total Marketing Cost (TMC)}} \quad \dots 10$$

Results and Discussion

The discussion includes subjective cause-and-effect relationships that were intended to be clarified in light of the economics of onion production in North Bihar, India, and the numerical results of the dissertation have been objectively noted to reveal the analytical importance of using that maintenance condition.

Marketable Surplus of Fish (Fresh Water)

Table 1 highlights fish production across small, medium, and large fishing producers, revealing that most fish is marketed rather than preserved for home use, with average production increasing with farm size: large farmers produced 2,429 kg, medium 2,261 kg, and small 2,118 kg, averaging 2,164 kg overall. Home consumption was low, at 6.04 kg total, making up less than one percent of production. Small, medium, and large farmers retained 5.00 kg, 9.13 kg, and 9.33 kg for personal use, respectively. Social distribution of fish among friends and family added a negligible amount, emphasizing that fish farming is mainly market-oriented. The marketable surplus was

Table 2: Strengthen of the Fish Markets Channels (Number).

Particulars	Category of fish farmers			Overall (n=244)
	S	M	L	
Channel I	115(62.84)	28(60.87)	9(60.00)	152(62.30)
Channel II	23(12.57)	8(17.39)	3(20.00)	34(13.93)
Channel III	37(20.22)	7(15.22)	2(13.33)	46(18.85)
Channel IV	8(4.37)	3(6.52)	1(6.67)	12(4.92)
Total	183(100.00)	46(100.00)	15(100.00)	244(100.00)

S: Small($n_1=183$); M: Medium($n_2=46$); L: Large($n_3=15$)
Note: Figures in parentheses indicate percentage to the total

Table 3: Disposable Patterns of Fish Markets under Distinguish Channel (kg).

Particulars	Category of fish farmers			Overall (n=244)
	S	M	L	
Channel 1	1235(58.60)	1339(59.63)	1381(57.25)	1263(58.71)
Channel 2	316(15.02)	304(13.55)	448(18.56)	322(14.96)
Channel 3	417(19.80)	481(21.43)	388(16.07)	428(19.88)
Channel 4	139(6.58)	121(5.39)	196(8.11)	139(6.45)
Total	2107 (100.00)	2245 (100.00)	2412 (100.00)	2152 (100.00)
S: Small($n_1=183$); M: Medium($n_2=46$); L: Large($n_3=15$) Note: Figures in parentheses indicate percentage to the total				

substantial, with small farmers marketing 2,107 kg, medium 2,245 kg, and large 2,412 kg. Overall, nearly 99% of production was available for sale, indicating strong market integration and revenue generation, while advocating for improvements in marketing infrastructure and access to enhance farmers' income.

Market Efficiency Performance on Distinguish Channels

It was found that there were three main marketing channels in study area through which inland fish moved from producer to the ultimate consumer. The identified channels were as follows:

- **Channel-I:** Producer → Retailer → Consumer or Channel-I: (P-R-C)
- **Channel-II:** Producer → Vendor/Commission Agent → Wholesaler → Retailer → Consumer;
- Or Channel-II: (P-V/CA-W-R-C)
- **Channel-III:** Producer → Wholesaler →

Retailer → Consumer or Channel-III: (P-W-R-C)

- **Channel-IV:** Producer → Consumer or Channel-IV: (P-C)

Table 2 illustrates the marketing channel preferences among fish farmers in the study area. Channel I was the most favoured, used by 62.84% of small farmers, 60.87% of medium farmers, and 60.00% of large farmers, indicating a clear preference across all categories. Overall, 62.30% of the 244 sampled farmers utilized Channel I, while Channel III, Channel II, and Channel IV were less popular at 18.85%, 13.93%, and 4.92% respectively. The predominance of Channel I suggests that farmers prefer fewer intermediaries for quicker sales, lower costs, and better price retention. The lower utilization of the other channels can be attributed to higher expenses and delays. The results highlight a market-oriented fish marketing system, with recommendations for enhancing direct marketing facilities and infrastructure to boost efficiency and farmer incomes.

Disposable Patterns of Fish Markets

Table 3 the disposal quantities of fish through various marketing channels by fish farmers of different sizes. Channel I emerged as the most significant channel, favoured by small (58.60%), medium (59.63%), and large farmers (57.25%). Small farmers sold an average of 1,235 kg, medium farmers 1,339 kg, and large farmers 1,381 kg through Channel I. Other channels showed lesser quantities: Channel III came second for all categories, while Channel IV was the least utilized. The preference for Channel I is attributed to its efficiency, reduced

Table 4: Marketing Costs Incurred by Fish Marketing Intermediaries.

Sl. No	Particulars	Producer ($n_1=244$)	Vendor/Commission Agent($n_2=20$)	Wholesaler ($n_3=5$)	Retailer ($n_4=20$)
i.	Transportation	4.48(31.41)	1.43(26.68)	1.52(18.40)	2.06(18.33)
ii.	Loading and Unloading	4.71(33.02)	0.63(11.75)	0.41(4.96)	0.65(5.78)
iii.	Weighing charges	1.15(8.06)	0.26(4.85)	20(2.42)	0.44(3.91)
iv.	Packing	3.92(27.48)	0.76(14.18)	0.52(6.30)	0.85(7.56)
v.	Cleaning	-	-	0.34(4.12)	0.52(4.63)
vi.	Electricity	-	-	0.62(7.51)	0.76(6.76)
vii.	Market fee	-	-	1.13(13.68)	1.32(11.74)
viii.	Commission charge	-	1.16(21.64)	-	-
ix.	Storage	-	-	0.90(10.90)	1.01(8.99)
x.	Ice + feeding	-	-	0.68(8.23)	1.42(12.63)
xi.	Container	-	-	0.87(10.53)	0.99(8.81)
xii.	Miscellaneous costs	-	1.12(20.90)	1.08(13.08)	1.22(10.85)
xiii.	Total Costs	14.26(100.00)	5.36(100.00)	8.26(100.00)	11.24(100.00)
xiv.	Market Margin	0	71.25	14.23	18.34
xv.	Total Costs + Margin	14.26	76.61	22.49	29.58
Note: Figures in parentheses indicate percentage to the total.					

Table 5: Price Spread of Fish Markets Allocates the Distinguish Channel (Rs kg⁻¹).

S. no.	Particulars	Marketing Channels			
		I	II	III	IV
A.	Cost of production overall fishing farm	55.54	55.54	55.54	55.54
i.	Marketing Cost incurred by producers	7.25(3.26)	15.20(5.40)	20.15(9.87)	14.45(8.73)
ii.	Sub-total of fish growers	62.79(28.20)	70.74(25.13)	75.69(37.08)	69.99(42.29)
B	Realized price value receive by producer's sale price or Vendor/Commission agent of the purchase price	185.62(83.36)	175.34(62.28)	170.45(83.50)	151.05(91.27)
iii.	Marketing cost	-	5.36(1.90)	-	-
iv.	Market Margin	-	71.25(25.31)	-	-
v.	Marketing costs + margin	-	76.61(27.21)	-	-
	Sub-total incurred of vendor/commission agent price	-	251.95	-	-
C	Vendor sale price/wholesalers purchase price	-	251.95(89.49)	-	-
vi.	Marketing cost	-	8.26(2.93)	-	-
vii.	Market margin	-	14.23(5.05)	-	-
viii.	Wholesaler of marketing cost and margin of fish per Kg in Rupees	-	22.49(7.99)	-	-
ix.	Sub-total Wholesalers sale price or Retailer purchase prices of fish per Kg	-	274.44(97.48)	-	-
D.	Retailer purchase prices/wholesaler's sale price	-	273.44(97.13)	170.45(83.50)	-
x	Marketing cost	11.24(5.05)	11.24(3.99)	11.24(5.51)	-
xi.	Market margin	25.82(11.60)	18.34(6.51)	22.45(11.00)	-
	Marketing cost and margin	37.06(16.64)	29.58(10.51)	33.69(16.50)	-
xii.	Retailer sale price / consumer price	222.68(100.00)	281.53(100.00)	204.14(100.00)	165.50(100.00)
	All Marketing cost	18.49	40.06	31.39	14.45
	All Market margin	25.82	103.82	22.45	0
	Total Marketing cost and margin	44.31	143.88	53.84	14.45
Note: Figures in parentheses indicate percentage to the total.					

intermediaries, quicker sales, and lower marketing costs, which are crucial for perishable fish. Overall, 58.71% of the average 2,152 kg marketed per farm was disposed of through Channel I, highlighting its dominance in the study area.

Marketing Cost Incurred by Different Intermediaries on Fish Markets

As fish travels through the marketing channel from the producer to the retailer, Table 4 shows that the overall marketing expense rises. Producers spend Rs 14.26, while vendors, wholesalers, and retailers spend Rs 5.36, Rs 8.26, and Rs 11.24, respectively. Key costs for producers are loading/unloading (Rs 4.71), packaging (Rs 3.92), and transportation (Rs 4.48), totalling over 91% of their costs. Middlemen benefit from marketing margins that significantly boost their profits; vendors have minimal costs but a high margin of Rs 71.25, yielding a total return of Rs 76.61. Wholesalers incur higher overall costs (Rs 8.26), primarily due to transportation and market fees, resulting in a total of Rs 22.49 after accounting for margins. Retailers face the highest costs (Rs 11.24), largely due to transportation and preservation needs, bringing their total to Rs 29.58. The findings suggest that

improving logistics and infrastructure could lower costs and enhance producers' pricing power.

Price Spread, Marketing Cost and Market Margin of the Fish Marketing

Table 5 presents the price spread for fish across four
Table 6: Marketing Efficiency of the Inland Fish Markets (Rs kg⁻¹).

Sl. No.	Particulars	Marketing Channels			
		I	II	III	IV
1.	I. Convectional Method				
2.	Producer Price	152.75	150.25	152.75	151.05
3.	Consumer Price	189.81	256.44	186.44	165.50
4.	Total Marketing cost	44.31	143.88	53.84	14.45
5.	Marketing efficiency	0.84	0.74	0.63	1.00
6.	II. Shepherd Method				
7.	Consumer Price	189.81	256.44	186.44	165.5
8.	Total Marketing cost	44.31	143.88	53.84	14.45
9.	Marketing efficiency	3.28	0.78	2.46	10.45
10.	III. Acharya Approach Method				
11.	Producer Price	152.75	150.25	152.75	151.05
12.	Total Marketing cost	18.49	40.06	31.39	14.45
13.	Total Marketing Margin	25.82	103.82	22.45	0
14.	Marketing efficiency	3.45	1.04	2.84	10.45

marketing channels, detailing marketing expenses, margins, producer shares, and consumer prices. All channels share a manufacturing cost of Rs 55.54/kg, indicating that variations in consumer prices stem from differing marketing costs rather than production costs.

Channel I had the lowest marketing cost for producers at Rs 7.25/kg and the highest price received, Rs 185.62/kg, signalling greater producer benefits from shorter marketing paths. Channel II, the longest route involving multiple intermediaries, incurred higher marketing costs and generated a consumer price of Rs 281.53/kg.

Retailers in Channels I, II, and III shared a marketing cost of Rs 11.24/kg, but margins varied, with Channel I offering the highest at Rs 25.82/kg. Channel IV, which sells directly to consumers, had no retail margin and the lowest consumer price of Rs 165.50/kg.

Overall marketing costs were highest in Channel II at Rs 40.06/kg, with the accompanying marketing margin at Rs 103.82/kg, demonstrating the inefficiencies of involving more intermediaries. Conversely, Channel IV stood out as the most efficient due to its lower costs and consumer price. The study emphasizes that reducing intermediaries and enhancing direct marketing can improve producer returns and consumer prices while boosting overall fish marketing efficiency.

Marketing Efficiency of Fish (Fresh Water) Markets

The analyses the marketing efficiency of inland fish markets across four marketing channels using three methodologies as the Conventional Method, Shepherd's Method, and the Acharya and Agarwal Method. Each method assesses efficiency in terms of producer pricing, consumer price, marketing expenses, and marketing profits, where a higher efficiency value indicates a more effective marketing system.

1. **Conventional Method:** This method evaluates marketing efficiency by comparing production prices with marketing costs. Key findings include:
 - i. Producer prices: Rs 152.75/kg (Channels I & III), Rs 150.25/kg (Channel II), Rs 151.05/kg (Channel IV).
 - ii. Consumer prices: Highest in Channel II (Rs 256.44/kg), lowest in Channel IV (Rs 165.50/kg).
 - iii. Marketing costs were greatest in Channel II (Rs 143.88/kg), and lowest in Channel IV (Rs 14.45/kg).
 - iv. Marketing efficiency values were 1.00 (Channel IV), 0.84 (Channel I), 0.74 (Channel II), and 0.63

(Channel III), indicating Channel IV as the most efficient.

2. **Shepherd's Method:** This measures efficiency as a ratio of consumer price to marketing cost. Results include:
 - i. Consumer prices: Channel I (Rs 189.81/kg), Channel II (Rs 256.44/kg), Channel III (Rs 186.44/kg), Channel IV (Rs 165.50/kg).
 - ii. Marketing expenses: Ranged from Rs 14.45/kg (Channel IV) to Rs 143.88/kg (Channel II).
 - iii. Efficiency ratios: 10.45 (Channel IV), 3.28 (Channel I), 2.46 (Channel III), and 0.78 (Channel II), with Channel IV being the most efficient.
3. **Acharya and Agarwal Method:** This comprehensive method factors in marketing expenses and margins. Key outcomes include:
 - i. Producer prices: Mirrored the previous findings.
 - ii. Total marketing expenses: Rs 18.49/kg (Channel I), Rs 40.06/kg (Channel II), Rs 31.39/kg (Channel III), Rs 14.45/kg (Channel IV).
 - iii. Marketing margins: Highest in Channel II (Rs 103.82/kg) and zero in Channel IV.
 - iv. Efficiency figures: 10.45 (Channel IV), 3.45 (Channel I), 2.84 (Channel III), 1.04 (Channel II).

Collectively, all three methods indicate that Channel IV (direct producer-to-consumer) is the most efficient route for marketing inland fish, largely due to the absence of intermediaries, which minimizes marketing costs and maximizes producer value. Channel I follow as the second most efficient, while Channel II, burdened with multiple intermediaries, displays the lowest efficiency. The findings advocate for promoting direct sales through methods like farmers' markets and digital platforms to enhance overall marketing competitiveness and efficiency in inland fish markets.

Conclusion

The study analyses the marketable surplus and efficiency of fish farming among small, medium, and large producers. It shows that a majority of fish produced is marketed, with the average production being highest in large farms (2,429 kg) and lowest in small farms (2,118 kg). Home consumption is minimal, indicating a market-oriented approach rather than subsistence farming, and less than 1% of total production was retained for family use. The primary marketing channel preferred by farmers is Channel I (Producer → Retailer → Consumer), used

by 62.30% of the farmers, indicating its efficiency due to fewer intermediaries, lower costs, and quicker sales. The study highlights that while costs increase as fish move through the marketing chain, Channel IV (Producer → Consumer) offers the lowest costs and highest efficiency. Comparative analyses using Conventional, Shepherd's, and Acharya Methods confirm that direct marketing enhances producer returns, minimizes expenses, and reduces consumer prices, advocating for improvements in marketing infrastructure to elevate fish farmers' incomes and market efficiency.

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