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Socio Economic Profile and Marketing Channel Analysis of Inland Fish Producers in Middle Gujarat, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The study assesses the socio-economic profile and marketing channel efficiency of inland fish producers in middle Gujarat with a particular focus on the Anand and Kheda districts. Primary data were collected from 120 fish producers and 15 market intermediaries across four talukas. The study revealed that on an average inland fish producer household comprised 6 to 7 members with about 1 to 2 members contributing to household income and 1 actively engaged in inland fish farming. A significant number of respondents (77.50%) reported that fisheries as their primary occupation. In terms of education, 39.17 per cent of the producers had attained secondary-level education. The majority were adults aged 36-50 years (45%) suggesting a demographic more open to adopting new techniques and innovations. However, limited fish farming experience (up to 10

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years) was found to influence the adoption of best practices. A strong preference was observed towards Rohu-Catla-Mrigal combination (70.83%). Regarding pond size, 51.67 per cent of the respondents operated on un-irrigated leased ponds, and they primarily stocked 100 gm fingerlings. Feeding practices indicated that 44.16 per cent of producers used the household food waste as feed, following a daily feeding schedule. Among all marketing channels, Channel-I (Producer → Wholesaler → Retailer → Consumer) was the most widely used accounting for 71.67 per cent of the total quantity marketed. However, Channel-IV (Producer → Consumer) despite being used for only 5.83 per cent of the sales, exhibited the highest marketing efficiency (22.99) and the greatest producer's share (95.68%). On the other hand, Channel-I had a price spread of ₹ 33.77 per kg with the producer's share limited to 76.51 per cent. The low adoption of Channel-IV was attributed to limited market access, weak consumer networks, labour intensity and the risk of unsold produce. These findings suggest that reducing the number of intermediaries and promoting direct sales can significantly improve the returns to fish producers. The study emphasizes the critical need to strengthen extension services by providing comprehensive technical, financial and marketing support, alongside targeted training programs focused on effective pond management and market access strategies.

Keywords: Inland fish; food waste; marketing efficiency; fish producers.

1. INTRODUCTION

Agriculture is the main source of livelihood for the majority of India's population, despite the country experiencing extensive industrialization over the past six decades. However, a majority of Indian farmers are still following traditional farming practices, which are not remunerative at all. Consequently, there is a pressing need to diversify agricultural activities, particularly through the promotion of allied sectors like fisheries, especially in rural areas of India (Nath, 2015). The fisheries sector holds a significant position in India's socio-economic development, contributing significantly to food and nutritional security, as well as generating employment and income for more than 28 million people (Nayak *et al.,* 2023).

Fisheries are one of the fastest-growing sectors in India, which contributes approximately 1.09 per cent to the country's Gross Value Added (GVA) and over 6.72 per cent to the agricultural GVA in the Indian economy. India is the second largest inland fish producing country in the world after China and the third largest overall fish producer in the world, contributing 8 per cent to global fish production. Inland fisheries contribute about 70 per cent to India's total fisheries production and the remaining 30 per cent from the marine sector. Since independence, fish production in India has shown a continuous and sustained increase. Recently, there has been growing interest in food, ornamental fish culture and high-value fish cultivation (Kumar, 2020). India's fisheries and aquaculture sector is a major contributor to export revenue and employment, reflecting its growing role in the national economy. In the financial year 2023-24, India exported an all-time high of 17.82 lakh tonnes of seafood, generating revenue of approximately ₹ 60,524 crore (Garg, 2025). Fisheries and aquaculture are an important source of food, nutrition, income and livelihood to millions of people. Fish, being an affordable and rich source of animal protein, plays a vital role in combating hunger and nutrient deficiencies.

Asia is the largest centre for inland fish production, which shares 63 per cent of the global inland fish production. India is the second largest inland fish producing country in the world with 1.80 MMT in the year 2020-21. In India, the annual growth rate of inland fish production has increased from 6.28 per cent in 2011-12 to 8.18 per cent in 2022-23.

Gujarat is mostly known for producing marine fish, as indicated by its 1600 km of coastline. Gujarat ranks 16th with the inland fish production of 1.94 lakh tonnes and also has rich water reservoirs. In Gujarat, the value of inland fish has shown consistent growth which has increased from ₹ 586.85 crore in 2011-12 to ₹ 3,561.76 crore in 2021-22. However, Gujarat's share in national production has fluctuated in terms of volume and value, largely due to declining fish catch and quality issues (Sharma *et al.,* 2017). Anand and Kheda have the highest ponds and tanks fish production in Gujarat. Both Anand and Kheda together contribute 43.72 per cent of ponds and tanks fish production in Gujarat during 2020-21. The industry has the potential to earn foreign exchange and generate employment,

particularly in coastal rural areas. But the long-term sustainability of the industry is at risk, posing potential threats to food security and livelihoods (Chrispin & Kumar, 2024). The main objectives of the study were to assess the socio-economic conditions of inland fish producers and to identify and analyse the marketing channels, marketing costs and margins associated with inland fish marketing in the study area.

2. REVIEW OF LITERATURE

Bhutti *et al.* (2022) observed the socio-economic condition of fish farmer in Sabarkantha district of Gujarat state. The results revealed that the majority of fish farmers were belonging from Hindu religion and their primary occupation was agriculture. Most of the farmers belongs to the age group of 51-60 years. Majority of the respondents had concrete house and rest had semi-concrete. The farmers were educated from primary level to bachelor degree and about 9 per cent of farmers were illiterate. The pond size of small to marginal farmers varied from 0.5 ha to 1 ha of area. Mostly the farmers had 11-15 years of experience in fish farming.

Baflipara *et al.* (2023) studied the socio-economic profile of fish farmers in Anand district of Gujarat. The results revealed that majority of fish farmers belongs to the age group above 50 years, with low education level. Most of the fish farmers had lower size of pond holding (0.00 ha - 2.00 ha). Majority of the farmers in the study area had 11 to 20 years of experience which might be reason that majority of the farmers are of higher age group having more than 10 years of experience. Out of the total respondents, 81.25 per cent were male and 18.75 per cent were female.

Samal *et al.* (2022) analysed the marketing of freshwater fish (rohu) in Cuttack district of Odisha. The results showed that there were three marketing channels viz., Channel-I (producer to consumer), Channel-II (producer, wholesaler, retailer and consumer) and Channel-III (producer, trader, wholesaler, retailer and consumer). The marketable surplus for Rohu in the study area was found to be 20.14, 21.05 and 21.1 quintals per hectare constituting (95.36%), (94.95%) and (94.03%) to their total Rohu production. Producer's share in consumer's rupee was highest in Channel-I (97.6%) followed by Channel-II and Channel-III. While Channel-I was found to be more efficient than Channel-II (10.40%) and Channel-III (6.3%).

Das *et al.* (2023) carried out a study on the price spread and marketing efficiency of different supply chain of inland fishes in Alappuzha district of Kerala. Three different marketing channels were categorized as Channel-I (producer to consumer), Channel-II (producer, retailer and consumer) and Channel-III (producer, wholesaler, retailer and consumer). The results revealed that producer's share in consumer's rupee was highest for marketing Channel-I (100%) followed by Channel-II and Channel-III. The retailers were the key actor in both the Channel-II and Channel-III, as they were the one who incurred more marketing costs and received highest marketing margin as well. The transportation charge (25.79%) was the major cost which incurred by the wholesalers whereas for the retailers it was expenses on ice and carry boxes (21.83%). The study concluded that except direct channel, the marketing Channel-II was more efficient than the marketing Channel-III.

3. METHODOLOGY

The middle Gujarat region was selected purposively for the study as it contributes 59.87 per cent of the total inland fish production in Gujarat during the year 2020-21. Two districts namely Anand and Kheda were selected purposively due to their significant contribution to inland fish production in this region. Anand and Borsad taluka from Anand district, while Nadiad and Mahudha taluka from Kheda district were selected purposively for the study on the basis of the highest number of ponds. For the analysis of marketing cost, marketing margin and price spread, five market intermediaries each from the wholesaler, itinerant trader and retailer were selected after identifying the prevailing marketing channels in the study area. Thus, a total of 15 market functionaries were purposively selected based on their active involvement and a minimum of 2-3 years of experience in inland fish marketing to ensure relevant information for the study. A multi-stage sampling technique was employed in the study. In the first stage, the region, districts and talukas were selected purposively. In the second stage, fish-producing villages within these talukas were identified. In the final stage, a simple random sampling method was used to select 120 inland fish producers from these villages to ensure unbiased representation across different pond sizes and management practices. A pre-tested interview schedule was used to ensure clarity and reliability of the responses, as it allows necessary

modifications based on initial feedback, which can be incorporated into the final version of the interview schedule. Primary data were collected through pre-tested interview schedules from the respondents during January to March 2024.

3.1 Socio-Economic Profile

Tabular analysis: The collected data were systematically arranged, organised and finally subjected to tabular analysis to draw inferences regarding the socio-economic profile and marketing costs of inland fish producers. Simple statistical tools and techniques such as mean, percentage, ratio, *etc.,* were employed to facilitate meaningful comparisons and interpretations.

Marketing channels: Marketing channels are the routes through which inland fish move from producers to consumers. These channels were identified during the survey period based on the actual flow of produce in the study area.

The following marketing efficiency measures were used in the study to assess the efficiency of the existing fish marketing system;

Price spread: The price spread refers to the difference between the price paid by the consumer and the price received by the producer per unit of the commodity. While computing the price spread for all existing marketing channels, the actual prices of the commodity at various stages of marketing channels were ascertained and the cost incurred in the process of movement of produce from the farm to the consumer and the margins of various intermediaries were calculated by using the concurrent margin method.

(i) Producer's share in consumer's rupee

It is the price received by the producer expressed as a percentage of the retail price. The producer's share in various marketing channels were calculated as follows:

$$P_S = (P_F / P_R) \times 100$$

Where,

P_S = Producer's share in consumer's rupee
P_F = Price received by the producer
P_R = Price paid by the consumer

(ii) Marketing costs

The total cost incurred on marketing either in cash or in kind by the producer and various intermediaries involved in the movement of inland fish from the point of production to the ultimate consumer. It was computed as follows:

$$C = C_F + C_{m1} + C_{m2} + \ldots\ldots + C_{mi}$$

Where,

C = Total cost of marketing per quintal fishes
C_F = Cost incurred by the producer on marketing
C_{mi} = Cost incurred by the i^{th} middlemen

(iii) Marketing margins

This is the difference between the total payments (costs + purchase price) and receipts (sale price) of the middlemen. The absolute and percentage margin of middlemen involved in marketing was calculated as under:

Absolute marketing margin of i^{th} middlemen = $P_{Ri} - (P_{Pi} + C_{mi})$
Percentage margin of i^{th} middlemen = $\{[P_{Ri} - (P_{Pi} + C_{mi})] / P_{Ri}\} \times 100$

Where,

P_{Ri} = Sale price of the i^{th} middlemen
P_{Pi} = Purchase price of the i^{th} middlemen
C_{mi} = Cost incurred on marketing by the i^{th} middlemen

(iv) Modified measure of marketing efficiency

The higher the ratio, the higher the efficiency. It was computed by employing the following formula suggested by Acharya and Agrawal (2003):

MME = [RP / (MC + MM)] - 1
RP = FP + MC + MM

Where,

MME = Modified measure of marketing efficiency
RP = Prices paid by the consumer
MC = Total marketing costs
MM = Net marketing margins
FP = Prices received by the producer

4. RESULTS AND DISCUSSION

4.1 Socio-economic Condition

Family Dynamics of Respondents: Table 1, represents the family demographics of inland fish producers. On an average, each household comprised of 2 to 3 male members, 1 to 2 female

members and 2 to 3 children which totalled about 6 to 7 members per family. Among these about 1 to 2 members were income earners and 1 member was actively engaged in inland fish farming. This shows a significant portion of household members contribute to the family's income and inland fish farming activities.

Occupation of Respondents: As shown in Table 2, 77.50 per cent of inland fish producers had adopted fisheries as their primary occupation. Besides, 10.83 per cent of inland fish producers were engaged in both fisheries and farming, 6.67 per cent of inland fish producers combined fisheries with farming and animal husbandry, 4.17 per cent of inland fish producers integrated fisheries with business activities and 0.83 per cent of inland fish producers adopted fisheries along with service related occupations. The results highlight that while the majority of inland fish producers focus solely on fisheries, a notable portion diversifies their livelihoods by combining fisheries with other activities.

Educational Status of Respondents: Education is the key element for the development of an individual, society and nation as a whole. The educational status of respondents is as shown in Table 3.

From Table 3, it was noticed that the majority of the inland fish producers had completed education up to secondary level (39.17%) followed by higher secondary (25.83%), graduate and above (16.67%), primary (12.50%) and illiterate (5.83%). This implies that the majority have at least a secondary level of education, which could positively influence their adoption of improved fish farming practices, decision making capabilities and responsiveness to training and extension services.

Age of Respondents: The age of the respondents is a significant factor that could influence decision making in inland fish farming. The age distribution of inland fish producers is presented in Table 4.

Table 1. Distribution of respondents according to their family size

(n = 120)

Sr. No.	Particulars	Average size
1.	Male	2.43
2.	Female	1.87
3.	Children	2.30
4.	Total family members	6.70
5.	Income earners in family	1.53
6.	No. of family members engaged in inland fish farming	1.21

Source: Field Survey

Table 2. Distribution of respondents according to their occupation

(n = 120)

Sr. No.	Category	Frequency	Percentage
1.	Fisheries	93	77.50
2.	Fisheries + Farming	13	10.83
4.	Fisheries + Farming + Animal husbandry	8	6.67
5.	Fisheries + Business	5	4.17
6.	Fisheries + Service	1	0.83
Total		120	100.00

Source: Field Survey

Table 3. Distribution of respondents according to their educational level

(n = 120)

Sr. No.	Qualification	Frequency	Percentage
1.	Secondary (IX to X)	47	39.17
2.	Higher secondary (XI to XII)	31	25.83
3.	Graduate and above	20	16.67
4.	Primary (up to VIII)	15	12.50
5.	Illiterate	7	5.83
Total		120	100.00

Source: Field Survey

Table 4. Distribution of respondents according to their age

(n = 120)

Sr. No.	Age (year)	Frequency	Percentage
1.	Adult (36 - 50 years)	54	45.00
2.	Young (up to 35 years)	50	41.67
3.	Old (above 50 years)	16	13.33
Total		120	100.00

Source: Field Survey

It can be observed from the above table that the majority of respondents belonged to adult age group (45%) followed by the young age group (41.67%) and the old age group (13.33%). The results indicate that, most inland fish producers were adult, which may impact their approaches and adaptability to new techniques and innovations in inland fish farming.

Experience of Respondents: Experience in inland fish farming is a critical indicator of a producer's ability to address fundamental challenges and adopt effective practices. The respondent's experience levels were assessed and the results were presented in Table 5.

The results demonstrate that 62.50 per cent of inland fish producers had up to 10 years of inland fish farming experience followed by 19.17 per cent with 11 to 20 years, 13.33 per cent with 21 to 30 years and only 5 per cent with above 30 years of inland fish farming experience. This suggests that the majority of inland fish producers were relatively new to the industry, which may limit their ability to fully utilize advanced techniques, respond to market dynamics and implement sustainable farming practices. However, with appropriate training and extension support, this group also represents a promising segment for the successful dissemination and adoption of innovative technologies in inland fish farming.

Table 5. Distribution of respondents according to their experience

(n = 120)

Sr. No.	Experience (year)	Frequency	Percentage
1.	Up to 10 years	75	62.50
2.	11 to 20 years	23	19.17
3.	21 to 30 years	16	13.33
4.	Above 30 years	6	5.00
Total		120	100.00

Source: Field Survey

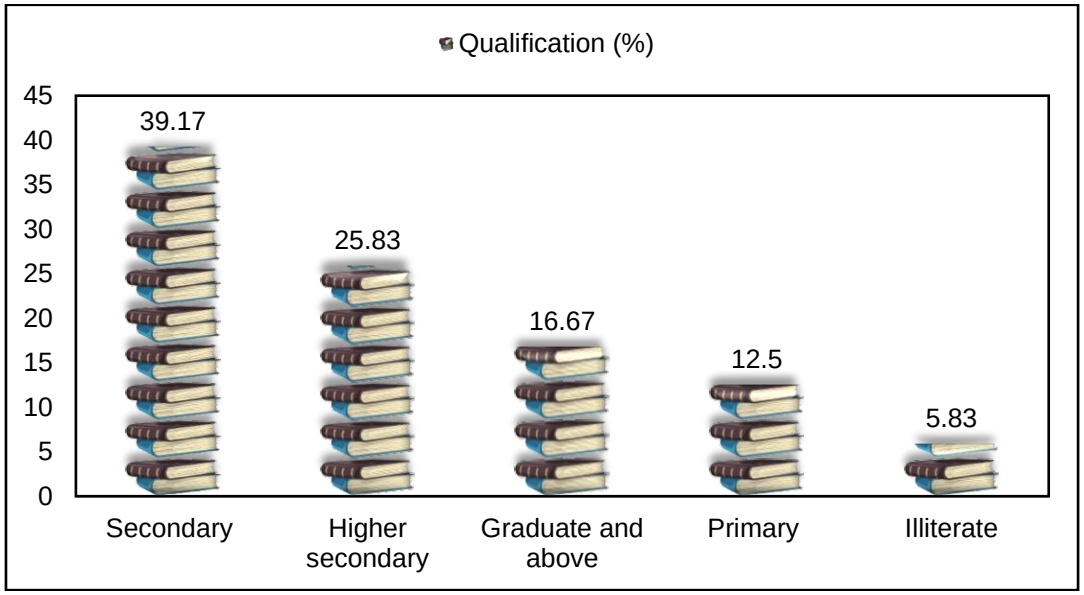

Fig. 1. Educational qualification of inland fish producers in middle Gujarat

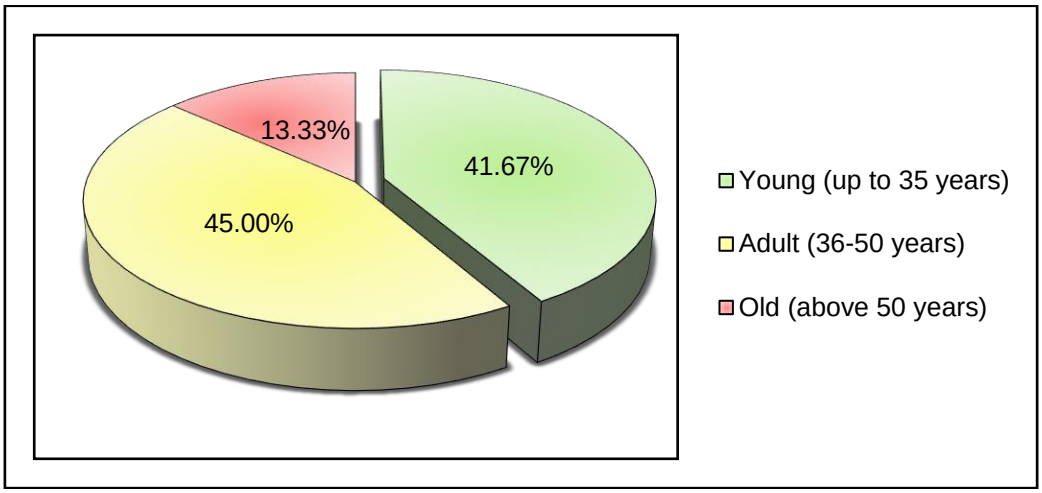

Fig. 2. Age distribution of inland fish producers in middle Gujarat

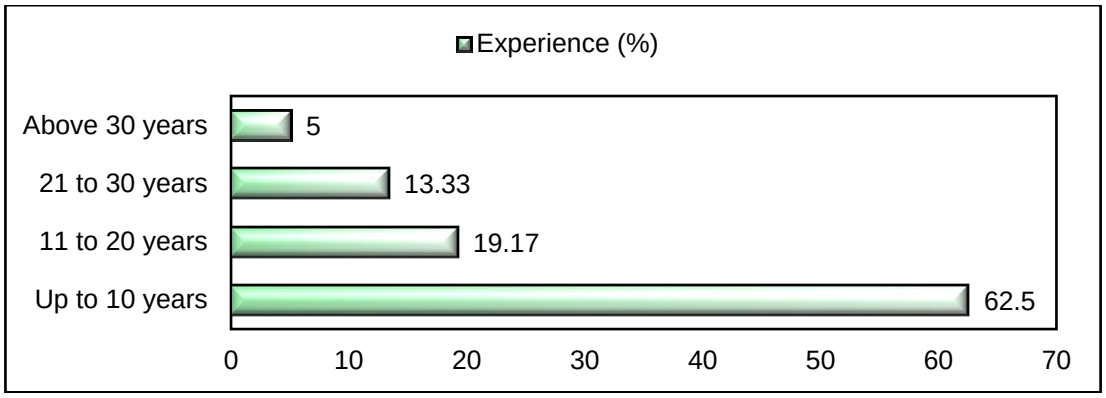

Fig. 3. Inland fish producers categorized by years of experience

Combination of Species Cultivated by Respondents: As shown in Table 6, the majority of the respondents cultivated the Rohu-Catla-Mrigal species (70.83%) followed by Rohu-Catla-Nagri species (18.33%), Rohu-Catla-Surmai species (5%), Rohu-Catla-Mrigal-Nagri species (3.34%) and Rohu-Catla-Mrigal-Surmai species (2.50%). A strong preference was observed for the Rohu-Catla-Mrigal among inland fish producers, likely due to its popularity and suitability for local conditions.

Pond Size of Respondents: From Table 7, it can be noticed that all the respondents had utilized leased ponds for inland fish farming. Among these respondents it was found that 51.67 per cent had an un-irrigated pond and 48.33 per cent had an irrigated pond. As the inland fish producers were categorized into sub-categories based on pond size, with majority of the respondents owing to marginal pond size (below 1 ha) followed by small (1 to 2 ha), semi-medium (2 to 4 ha), medium (4 to 10 ha) and large (above 10 ha).

Table 6. Distribution of respondents according to their species cultivation

(n = 120)

Sr. No.	Particulars	Frequency	Percentage
1.	Rohu-Catla-Mrigal	85	70.83
2.	Rohu-Catla-Nagri	22	18.33
3.	Rohu-Catla-Surmai	6	5.00
4.	Rohu-Catla-Mrigal-Nagri	4	3.34
5.	Rohu-Catla-Mrigal-Surmai	3	2.50
Total		120	100.00

Source: Field Survey

Table 7. Distribution of respondents based on size of pond

(n = 120)

Sr. No.	Pond Size (ha)	Leased			
		Irrigated		Un-irrigated	
		Frequency	Percentage	Frequency	Percentage
1.	Marginal (below 1 ha)	12	10.00	19	15.83
2.	Small (1 to 2 ha)	13	10.83	17	14.17
3.	Semi-medium (2 to 4 ha)	15	12.50	13	10.84
4.	Medium (4 to 10 ha)	10	08.33	12	10.00
5.	Large (above 10 ha)	08	06.67	1	00.83
Total		58	48.33	62	51.67

Source: Field Survey

For irrigated leased ponds, the majority of the respondents were associated with semi-medium pond size (12.50%) followed by small (10.83%), marginal (10%), medium (8.33%) and large (6.67%).

In case of un-irrigated leased ponds, most of the respondents belonged to marginal pond size (15.83%) followed by small (14.17%), semi-medium (10.84%), medium (10%) and large (0.83%).

4.2 Management Practices

Sizes of fish seed used by respondents: Table 8, revealed that the majority of the inland fish producers used 100 gm size of fish fingerlings, accounting for 56.67 per cent. On the other hand, 26.65 per cent of producers used 150 gm size of fish fingerling, 11.68 per cent of producers used 200 gm size of fish fingerling and 5 per cent of producers used 250 gm size of fish fingerling. The preference for smaller fingerlings among inland fish producers was due to their cost effectiveness.

Various types of fish feed used by respondents: Table 9, shows various types of fish feed used in inland fish farming. The results indicate that the majority of the inland fish producers used food waste as their fish feed accounting for 44.16 per cent, because many marginal and small fish producers had unirrigated leased ponds and they could not afford to use quality fish feed. About 37.50 per cent of fish producers used rice bran as well as ground nut oil cake as their fish feed, while 7.50 per cent fish producers used sorghum flour as their fish feed, 6.67 per cent fish producers used a combination of rice bran, groundnut oil cake and sorghum flour as their fish feed and 4.17 per cent fish producers used phytoplankton and zooplankton micro-organisms as their fish feed.

Table 8. Sizes of fish seed used by respondents

(n = 120)

Sr. No.	Particulars	Frequency	Percentage
1.	100 gm	68	56.67
2.	150 gm	32	26.65
3.	200 gm	14	11.68
4.	250 gm	6	5.00
Total		120	100.00

Source: Field Survey

Table 9. Various types of fish feed used by respondents

(n = 120)

Sr. No.	Particulars	Frequency	Percentage
1.	Food waste	53	44.16
2.	Rice bran and groundnut oil cake	45	37.50
3.	Sorghum flour	09	7.50
4.	Rice bran, groundnut oil cake and sorghum flour	8	6.67
5.	Phytoplankton and zooplankton microorganisms	5	4.17
Total		120	100.00

Source: Field Survey

Table 10. Frequency of fish feed application by respondents

(n = 120)

Sr. No.	Particulars	Frequency	Percentage
1.	Daily	71	59.17
2.	Twice in a week	32	26.66
3.	Thrice in a week	8	6.67
4.	Weekly	6	5.00
5.	Fortnightly	3	2.50
Total		120	100.00

Source: Field Survey

Frequency of fish feed application by respondents: The frequency of fish feed application is depicted in Table 10. The results revealed that 59.17 per cent inland fish producers gave fish feed on daily basis, while 26.66 per cent inland fish producers gave fish feed twice in a week, 6.67 per cent inland fish producers gave fish feed thrice in a week, 5 per cent inland fish producers gave fish feed weekly and 2.50 per cent inland fish producers gave fish feed fortnightly. The changes in feeding schedules employed by inland fish producers were likely influenced by pond size, inland fish species and production requirements.

4.3 Marketing Channels, Marketing Cost and Margin

The selection of appropriate marketing channels is crucial for producers, as the actual benefits they receive largely depend on their choice of agency and distribution channel for their produce. The channels selected by them should minimize marketing costs and ensure a higher share of the consumer's rupee.

In the study area, the following four channels were identified in the marketing of inland fish.

Channel-I : Produce → Wholesaler → Retailer → Consumer
Channel-II : Producer → Itinerant Trader → Retailer → Consumer
Channel-III : Producer → Retailer → Consumer
Channel-IV : Producer → Consumer

The study focused on major fish markets in Anand and Nadiad. Various marketing aspects such as the identification of channels and detailed analysis of costs and margins involved in inland fish marketing in the study area were examined and illustrated as follows:

4.3.1 Fish marketed through different marketing channels

Due to the highly perishable nature of fish, it cannot remain fresh for an extended period under normal conditions. So, there is no significant difference between the marketable and marketed surplus. Fish prices are subject to frequent fluctuation based on market demand and supply. Therefore, an efficient channel for the immediate marketing of fish produce is essential.

According to Table 11, the total fish production was 2,441.80 kg per ha. Out of the total produce, 71.67 per cent of fish quantity was marketed through Channel-I (Producer → Wholesaler → Retailer → Consumer) making it the primary distribution channel. Channel-II (Producer → Itinerant Trader → Retailer → Consumer) accounted 9.16 per cent of the sales, while Channel-III (Producer → Retailer → Consumer) was utilized for 13.34 per cent of the fish sold. Only 5.83 per cent of producers sold their produce directly to consumers through Channel-IV (Producer → Consumer). Similar results were seen in the study carried out by Panigrahy *et al.* (2017).

Table 11. Fish marketed through different marketing channels

(kg/ha)

Sr. No.	Marketing Channel	Particulars	Quantity (kg)	Percentage (%)
1.	Channel-I	Producer → Wholesaler → Retailer → Consumer	1750.05	71.67
2.	Channel-II	Producer → Itinerant Trader → Retailer → Consumer	223.67	9.16
3.	Channel-III	Producer → Retailer → Consumer	325.74	13.34
4.	Channel-IV	Producer → Consumer	142.34	5.83
Total			2441.80	100.00

Source: Field Survey

4.3.2 Marketing cost, margin and price spread in channel-I

As shown in Table 12, in Channel-I (Producer → Wholesaler → Retailer → Consumer) the producer did not incur any marketing costs. However, the wholesaler and retailer incurred marketing costs of ₹ 4.98 per kg and ₹ 8.79 per kg, respectively.

At wholesaler level, the highest proportion of total costs was for storing and icing (0.80%) followed by transportation (0.73%), container (0.71%), loading-unloading (0.69%), miscellaneous (0.52%) and weighing (0.22%), respectively. For the retailer, the highest costs incurred among total costs were of storing and icing (1.28%) followed by damage/spoilage (1.22%), miscellaneous (1.21%), cleaning and cutting (1.17%), grading and sorting (0.65%) and weighing (0.58%), respectively.

The marketing margin was ₹ 6 per kg for the wholesaler and ₹ 14 per kg for the retailer. As a result, the total marketing costs incurred in this channel was ₹ 13.77 per kg and the total marketing margin was ₹ 20 per kg, which accounted for 13.91 per cent of the consumer's price. The price spread amounted to ₹ 33.77 per kg with the producer's share in the consumer's rupees being 76.51 per cent in this channel.

4.3.3 Marketing cost, margin and price spread in channel-II

As shown in Table 13, in Channel-II (Producer → Itinerant Trader → Retailer → Consumer) the producer did not incur any marketing costs. However, the marketing costs were incurred by the intermediaries; ₹ 7.40 per kg by the retailer and ₹ 5.02 per kg by the itinerant trader.

At the itinerant trader level, the highest percentage share of total costs incurred was of storing and icing (0.96%) followed by transportation (0.86%), loading-unloading (0.93%), weighing (0.86%) and container (0.82%), respectively. For the retailer, the highest costs incurred among total costs were of miscellaneous (1.58%) followed by cleaning and cutting (1.28%), damage/spoilage (1.16%), storing and icing (1.02%), weighing (0.31%) and grading and sorting (0.24%), respectively. The marketing margin was ₹ 6 per kg for the itinerant

Table 12. Marketing cost, margin and price spread in Channel-I

Sr. No.	Particulars	Cost (₹/kg)	Percentage share in Consumer's Rupees
1.	Net price received by producer	110.00	76.51
2.	Marketing cost incurred by producer	-	-
3.	Purchase price of wholesaler	110.00	76.51
4.	Total marketing cost incurred by wholesaler	4.98	3.46
	(i) Storing and icing	1.15	0.80
	(ii) Loading-unloading	0.69	0.48
	(iii) Transportation	1.05	0.73
	(iv) Weighing	0.32	0.22
	(v) Container	1.02	0.71
	(vi) Miscellaneous	0.75	0.52
5.	Marketing margin of wholesaler	6.00	4.17
6.	Purchase price of retailer	120.98	84.15
7.	Total marketing cost incurred by retailer	8.79	6.11
	(i) Cleaning and cutting	1.68	1.17
	(ii) Grading and sorting	0.95	0.65
	(iii) Damage/spoilage	1.76	1.22
	(iv) Storing and icing	1.82	1.28
	(v) Weighing	0.83	0.58
	(vi) Miscellaneous	1.75	1.21
8.	Marketing margin of retailer	14.00	9.74
9.	Total marketing cost (4+7)	13.77	9.58
10.	Total marketing margin (5+8)	20.00	13.91
11.	Price spread (cost + margin)	33.77	23.49
12.	Retailer's sale price/ Consumer's purchase price	143.77	100.00

Source: Field Survey

Table 13. Marketing cost, margin and price spread in Channel-II

Sr. No.	Particulars	Cost (₹/kg)	Percentage share in Consumer's Rupees
1.	Net price received by producer	100.00	75.52
2.	Marketing cost incurred by producer	-	-
3.	Purchase price of itinerant trader	100.00	75.52
4.	Total marketing cost incurred by itinerant trader	5.02	3.79
	(i) Storing and icing	1.27	0.96
	(ii) Loading-unloading	0.93	0.70
	(iii) Transportation	1.14	0.86
	(iv) Weighing	0.86	0.75
	(v) Container	0.82	0.52
5.	Marketing margin of itinerant trader	6.00	4.53
6.	Purchase price of retailer	111.02	83.84
7.	Total marketing cost incurred by retailer	7.40	5.59
	(i) Cleaning and cutting	1.70	1.28
	(ii) Grading and sorting	0.98	0.24
	(iii) Damage/spoilage	1.53	1.16
	(iv) Storing and icing	1.62	1.02
	(v) Weighing	0.41	0.31
	(vi) Miscellaneous	1.16	1.58
8.	Marketing margin of retailer	14.00	10.57
9.	Total marketing cost (4+7)	12.42	9.38
10.	Total marketing margin (5+8)	20.00	15.10
11.	Price spread (cost + margin)	32.42	24.48
12.	Retailer's sale price/ Consumer's purchase price	132.42	100.00

Source: Field Survey

trader and ₹ 14 per kg for the retailer. This resulted in a total marketing cost of ₹ 12.42 per kg and a total marketing margin of ₹ 20 per kg, which constituted 15.10 per cent of the consumer's price. The price spread was ₹ 32.42 per kg with the producer's share in the consumer's rupees being 75.52 per cent in this channel.

4.3.4 Marketing cost, margin and price spread in channel-III

As shown in Table 14, in Channel-III (Producer → Retailer → Consumer) the producer did not incur any marketing costs, while the retailer incurred a marketing cost of ₹ 10.16 per kg.

Among the total costs incurred at the retailer level, the highest percentage was contributed by damage/spoilage (1.69%) followed by storing and icing (1.53%), cleaning and cutting (1.40%), grading and sorting (1%) and weighing (0.94%), respectively. The retailer earned a marketing margin of ₹ 16 per kg, resulting in a price spread of ₹ 26.16 per kg. The producer's share in the consumer's rupees in this channel was 82.10 per cent.

Table 14. Marketing cost, margin and price spread in Channel-III

Sr. No.	Particulars	Cost (₹/kg)	Percentage share in Consumer's Rupees
1.	Net price received by producer	120.00	82.10
2.	Marketing cost incurred by producer	-	-
3.	Purchase price of retailer	120.00	82.10
4.	Marketing cost incurred by retailer	10.16	6.95
	(i) Cleaning and cutting	2.05	1.40
	(ii) Grading and sorting	1.46	1.00
	(iii) Damage/spoilage	2.47	1.69
	(iv) Storing and icing	2.24	1.53
	(v) Weighing	1.37	0.94

Sr. No.	Particulars	Cost (₹/kg)	Percentage share in Consumer's Rupees
	(vi) Miscellaneous	0.57	0.39
5.	Marketing margin of retailer	16.00	10.95
6.	Total marketing cost (4)	10.16	6.95
7.	Total marketing margin (5)	16.00	10.95
8.	Price spread (cost + margin)	26.16	17.90
9.	Retailer's sale price/ Consumer's purchase price	146.16	100.00

Source: Field Survey

Table 15. Marketing cost, margin and price spread in Channel-IV

Sr. No.	Particulars	Cost (₹/kg)	Percentage share in Consumer's Rupees
1.	Net price received by producer	120.00	95.68
2.	Marketing cost incurred by producer	5.42	4.32
3.	Retailer's sale price/ Consumer's purchase price	125.42	100.00

Source: Field Survey

Table 16. Marketing efficiency of inland fisheries in different marketing channels

Sr. No.	Particulars	Channel-I	Channel-II	Channel-III	Channel-IV
1.	Consumer's price (₹/kg)	143.77	132.42	146.16	125.42
2.	Net price received by producer (₹/kg)	110.00	100.00	120.00	120.00
3.	Marketing cost (₹/kg)	13.77	12.42	10.16	5.42
4.	Marketing margin (₹/kg)	20.00	20.00	16.00	-
5.	Price spread (₹/kg)	33.77	32.42	26.16	5.42
6.	Producer's share in consumer's rupee (%)	76.51	75.52	82.10	95.68
7.	Marketing efficiency	3.26	3.08	4.59	22.99

Source: Field Survey

4.3.5 Marketing cost, margin and price spread in channel-IV

As shown in Table 15, in Channel-IV (Producer → Consumer) the producer incurred marketing costs of ₹ 5.42 per kg. In this channel, the producer's share in the consumer's rupees was 95.68 per cent, indicating a highly favourable return of the produce.

Marketing Efficiency of Inland Fisheries in Different Marketing Channels: The marketing efficiency of highly perishable commodities, such as fish, is generally evaluated by the price paid by the consumer. This was further computed by using a modified measure of marketing efficiency suggested by Acharya and Agarwal (2003). Table 16 represents the marketing efficiency of inland fisheries across different marketing channels.

Table 16, indicates that the highest price spread was observed in Channel-I (₹ 33.77/kg) followed by Channel-II (₹ 32.42/kg), Channel-III (₹ 26.16/kg) and Channel-IV (₹ 5.42/kg), respectively. The study highlights that a higher price spread correlates with lower marketing efficiency.

Among the four channels, Channel-IV achieved the highest marketing efficiency (22.99) followed by Channel-III (4.59), Channel-I (3.26) and Channel-II (3.08). Thus, Channel-IV emerged as the most efficient marketing channel among the four channels. The lower marketing efficiency in the other channels was attributed to higher margins taken by intermediaries. Thus, it was deduced from the fish marketing pattern that reducing the number of intermediaries in the distribution channels and enabling direct contact between fish producers and the consumers can increase the producer's share. The findings were consistent with Singh and Singh (2021) and Panigrahy *et al.* (2017).

5. CONCLUSIONS

The study reveals that inland fish production in middle Gujarat, particularly in Anand and Kheda districts, was driven by significant family involvement in income generation and farming activities, with a focus on fisheries. Most

producers were young with basic education, which contributed to their adaptability to new techniques. However, their limited experience in inland fish farming affected the full-scale adoption of best practices and efficient marketing approaches. Producers showed a clear preference for specific fish species, particularly the Rohu-Catla-Mrigal combination, used small fingerlings and often fed them food waste due to their cost constraints. Feeding schedules were adjusted according to pond size and species cultivated. Marketing analysis highlighted that most producers relied on conventional, multi-tiered channels like Channel-I, which accounted for over 71.67 per cent of fish sold. However, these channels involved multiple intermediaries, resulting in higher marketing costs, wider price spreads and reduced producer share. On the other hand, Channel-IV (Producer → Consumer), though used by only 5.83 per cent of producers, demonstrated the highest marketing efficiency (22.99) and producer share (95.68%). Despite its benefits, adoption of Channel-IV remained low due to barriers such as weak consumer networks, limited market access, labour intensive nature of direct sales and risk of post-harvest losses from unsold fish. The results underscore the importance of shortening the marketing chain, promoting direct-to-consumer sales and developing post-harvest infrastructure. Enhanced access to cold storage, transport and advisory services can significantly increase returns for fish producers and strengthen the inland fish marketing system in Gujarat.

6. SUGGESTIONS

Public-Private investment in infrastructure like cold storage, transportation and processing units is essential to extend the shelf life of fish and increase the market reach, which ultimately leads to more competitive market positioning. Extension services should be strengthened to provide continuous advisory support on technical, financial and marketing aspects.

CONSENT

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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