



Catch Composition, Trade Practices and Market Structure Dynamics: In-Depth Analysis of Fish Markets in Punjab

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Abstract: A comprehensive fish market survey spanning a year, from September 2021 to August 2022, was conducted in five pivotal markets Amritsar, Jalandhar, Ludhiana, Mohali, and Bathinda in Punjab. The primary objectives of this survey were to collect data concerning Punjab's existing domestic fish markets. The survey was conducted covering uniformly the four seasons i.e. post-monsoon, winter, pre-monsoon, and monsoon. Total 54 fish species were recorded during this survey. The family Cyprinidae emerged as a significant contributor, accounting for 48.86% of the market share by weight. An overwhelming 75.41% of the market share was attributed to fish originating from inland culture and capture fisheries within the state, underscoring the local significance of this sector. Furthermore, approximately 16.71% of the fish available in Punjab markets were sourced from other states, predominantly consisting of freshwater species. Ludhiana exhibited the most diverse range of fish species, boasting a total of 45 fish species, followed by Amritsar with 22 fish species. However, despite the promising market dynamics, several challenges loom large for fish vendors in Punjab. Resolution of these pressing issues is imperative to facilitate further progress and development within the fisheries sector in Punjab.

Keywords: Fish markets, Catch composition, Cyprinidae, Market channels, Constrains

In India and other developing nations, millions of individuals grapple with two pressing challenges: malnutrition and starvation. Fish, renowned for its exceptional attributes as a source of high-quality animal protein and a wealth of essential minerals such as calcium, phosphorus, iron, magnesium, iodine, zinc, and potassium, emerges as a pivotal solution. Notably, fish stands as a nutritious food option, boasting ample digestible protein, polyunsaturated fatty acids (PUFA), and vital vitamins like vitamin D and B2. The fisheries and aquaculture sector possess immense potential to address food and nutritional security, spur entrepreneurship and livelihood opportunities, and is poised for further growth due to heightened public awareness of its health benefits (Ghosh et al 2020). In fact, fish protein already accounts for approximately 31% of animal protein consumption in Asian countries (Sreenivasa 2017). India, with its vast and diverse fisheries resources encompassing fresh, brackish, and marine water species, represents a significant player on the global stage. These resources contribute to over 10% of the world's fish and shellfish species diversity. Presently, India ranks as the world's third-largest fish producer and aquaculture provider, contributing around 16% of the global inland fish production and 5% of marine fish production. In the 2021-22 fiscal year, India achieved a total fish production of approximately

162.48 lakh tonnes, with inland and marine sectors contributing 121.21 lakh tonnes and 41.27 lakh tonnes, respectively (Government of India 2023).

The prosperity of the fishery sector fundamentally hinges on the evolution and modernization of fish marketing systems. Regrettably, India's domestic fish marketing system is plagued by inefficiency and antiquation, heavily reliant on individual dealers and intermediaries (Jha et al 2010). This ecosystem encompasses wholesale markets, retail markets, and retail outlets, where the prevailing norm often involves the sale of fish with insufficient regard for desired quality and hygiene standards, especially in roadside establishments (Deshmukh and Jawale 2014). Due to the landlocked geographical location of Punjab, fish production is limited solely to inland water sources. Freshwater fish, which are raised in both individual and community ponds, as well as obtained from natural sources such as rivers (Sutlej, Beas, Ravi, and Ghaggar), canals, and tiny reservoirs/wetlands, are delivered to market shelves in an unspoiled condition. Moreover, there is a significant demand for frozen freshwater and marine fish originating from remote regions such as Andhra Pradesh, West Bengal, Gujarat, Maharashtra, and Karnataka (Datta et al 2017). The current investigation of the fish market aims to describe the wide range of species present and the prevailing market dynamics, including

distribution techniques and the notable obstacles faced by fish dealers.

MATERIAL AND METHODS

Selection of the site for conducting the present study and sample collection: The present study focused on the selection of fish markets in five districts of Punjab, namely Amritsar (31°37' 50.969"N, 74°52' 30.93"E), Jalandhar (31°20' 2.605"N, 75°34' 13.205"E), Ludhiana (30°55' 17.501"N, 75°54' 5.642"E), Mohali (30°43' 49.67"N, 76°42' 2.46"E), and Bathinda (30°12' 29.399"N, 74° 57' 56.785"E). The data collection spanned a period of one year, from September 2021 to August 2022, with sampling conducted at regular intervals corresponding to different seasons, including post-monsoon, winter, pre-monsoon, and monsoon. The selection process took into consideration the marketing of fish obtained from both culture and capture fisheries in Punjab, as well as fish imported from other states. Data on species assemblage, catch composition, demand and supply, market structure, and market chain were collected at fish markets. The identification of the fish was done using a widely accepted taxonomic key, enabling classification of the fish to the species level. The study emphasized on multiple facets encompassing the diversity of fish species accessible, the composition of fish captures, the structural arrangement of fish markets, waste management systems, marketing channels, and the obstacles faced by fish sellers in the trade.

RESULTS AND DISCUSSION

Marketing trend of fish from capture and culture fisheries: The fish species available in these markets originated primarily from capture fisheries within the state. Cyprinidae family holds a substantial market presence, 48.86% of the total weight of fish species, encompassing 16 species (Fig. 1). During various seasons, shellfish species primarily *Macrobrachium rosenbergii*, *Scylla serrata*, and *Penaeus monodon* were imported into different fish markets from coastal states like West Bengal; whereas *Litopenaeus vannamei* was marketed after harvesting from Punjab and neighboring states (Table 1).

Marketing trend of fish exclusive from capture fisheries: Capture fisheries predominantly sourced catch from key locations such as Harike wetland (31°13'N and 75°12'E), Nangal (31°23' N and 76°22' E), and Pong dams (31°97' N and 75°94' E), accounting for approximately 70-75% of the supply. The remaining 25-30% of the capture fisheries was typically harvested from rivers. *C. catla*, *L. rohita*, *C. mrigala* and *C. carpio* of the Cyprinidae family and *Wallago attu* of the Siluridae family were found throughout the year. Fish species

under family Siluridae (10.49 %) (*W. attu* and *Ompok pabda*), followed by Bagridae (4.92 %), Channidae (4.04 %) and Notopteridae (3.01 %) contributed significantly in culture fisheries sector (Fig. 2).

Low-value fish species: Seven fish species have been identified within various marketplaces, characterized by low consumer demand and consequently, diminished market value (*Puntius sarana*, *P. ticto*, *P. sophore*, *Salmostoma phulo*, *Xenentodon cancila*, *A. mola* and *Osteobrama cotio*). These species are typically introduced to the market as by-catches of other targeted species from the state's capture and culture fishery. Datta et al (2017) recorded low-value

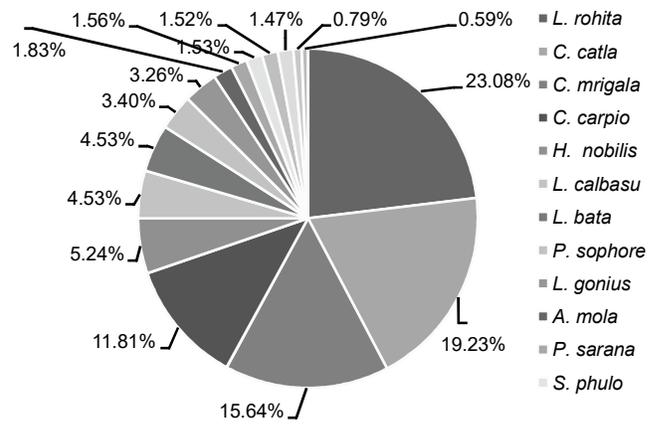


Fig. 1. Share of different fish species under family Cyprinidae (% weight basis) from both capture and culture sector in fish markets of Punjab

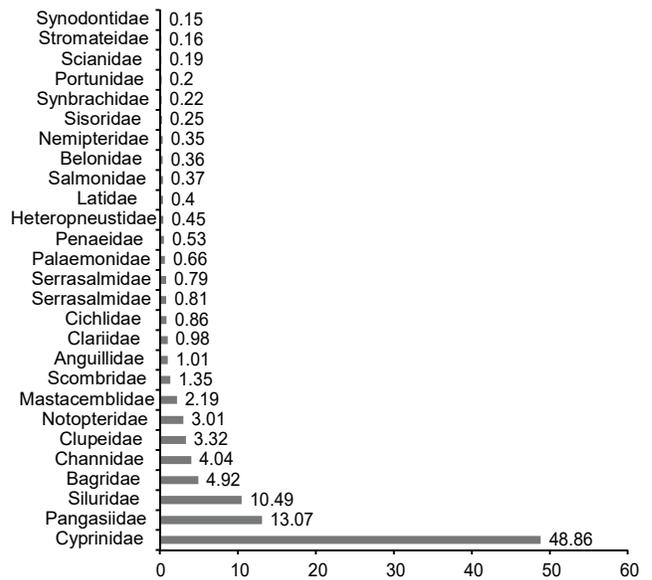


Fig. 2. Share of different families (% weight basis) in fish markets of Punjab

Table 1. Seasonal abundance of fish species from different markets of Punjab

Species name	Amritsar (Cap + Cul)				Jalandhar (Cap + Cul)				Ludhiana (Cap + Cul)				Mohali (Cap + Cul)				Bathinda (Cap + Cul)			
	PoM	W	Prm	M	PoM	W	Prm	M	PoM	W	Prm	M	PoM	W	Prm	M	PoM	W	Prm	M
Fish from culture and capture fishery within the state																				
<i>Catla</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Labeo rohita</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Labeo bata</i>	*	*	-	*	-	-	-	-	*	*	*	*	-	-	-	-	-	-	-	-
<i>Cirrhinus mrigala</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Hypophthalmichthys molitrix</i>	-	-	-	-	-	-	-	-	*	*	*	*	-	-	-	-	-	-	-	-
<i>Ctenopharyngodon idella</i>	-	-	-	-	-	-	-	-	*	*	*	*	-	-	-	-	-	-	-	-
<i>Hypophthalmichthys nobilis</i>	*	*	*	*	-	-	-	-	*	*	*	*	*	*	*	*	*	*	*	*
<i>Cyprinus carpio</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Puntius sarana</i> **	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Puntius ticto</i> **	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Salmostoma phulo</i> **	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Oreochromis niloticus</i>	-	-	-	-	*	*	*	*	-	-	-	-	-	-	-	-	*	*	*	*
<i>Clarius gariepinus</i>	-	-	-	-	-	-	-	-	*	*	*	*	-	-	-	-	-	-	-	-
<i>Clarias batrachus</i>	-	-	-	-	-	-	-	-	-	-	-	-	*	*	*	*	*	*	*	*
<i>Sperata seenghala</i>	*	*	*	*	*	*	*	*	*	*	*	*	-	-	-	-	-	-	-	-
<i>Mystus cavasius</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Mystus vittatus</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Wallago attu</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ompok pabda</i>	-	-	-	-	-	-	-	-	-	*	*	-	-	-	-	-	-	-	-	-
<i>Heteropneustes fossilis</i>	-	-	-	-	-	-	-	-	*	-	*	-	-	-	-	-	-	-	-	-
<i>Gadusia chapra</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	*	-	*
<i>Channa marulius</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Channa striata</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Channa punctate</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Xenentodon cancila</i> **	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Notopterus</i>	*	*	-	*	*	*	*	*	*	*	*	*	-	-	-	-	-	-	-	-
<i>Rita</i>	*	*	*	*	-	-	-	-	-	-	*	*	-	-	-	-	-	-	-	-
<i>Macrobrachium rosenbergii</i> #	*	*	*	*	-	-	-	-	*	*	*	*	*	*	*	*	-	-	-	-
<i>Litopenaeus vannamei</i> #	-	-	-	-	-	-	-	-	*	-	*	*	*	-	*	*	*	-	*	*
Fish from capture fishery within the state																				
<i>Puntius sophore</i> **	*	*	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Labeo gonius</i>	*	*	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Labeo calbasu</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Amblypharyngodon mola</i> **	-	-	-	-	-	-	-	-	*	*	-	*	*	*	-	*	-	-	-	-
<i>Osteobrama cotio</i> **	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-

Table 1. Seasonal abundance of fish species from different markets of Punjab

Species name	Amritsar (Cap + Cul)				Jalandhar (Cap + Cul)				Ludhiana (Cap + Cul)				Mohali (Cap + Cul)				Bathinda (Cap + Cul)			
	PoM	W	Prm	M	PoM	W	Prm	M	PoM	W	Prm	M	PoM	W	Prm	M	PoM	W	Prm	M
<i>Bagarius bagarius</i>	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-	-
<i>Mystus bleekari</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Anguilla anguilla</i>	*	*	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Macrogathus pancalus</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Monopterus cuchia</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Oncorhynchus mykiss</i>	*	*	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Scylla serrate #</i>	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-	-
Fish outside from state																				
<i>Pangasianodon hypophthalmus</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Piaractus brachypomus</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	-	-	-	-
<i>Tenualosa illisha</i>	*	*	-	*	-	-	-	-	*	*	-	*	-	-	-	-	*	*	-	*
<i>Lates calcarifer</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Nemipterus japonicus</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	*	*	-	*
<i>Johnius dussumieri</i>	-	-	-	-	*	*	*	*	*	*	-	*	-	-	-	-	-	-	-	-
<i>Pampus chinensis</i>	*	*	-	*	*	*	*	*	*	*	-	*	-	-	-	-	*	*	-	*
<i>Rastrelliger kanagurta</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<i>Auxius thazard</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	*	*	-	*
<i>Scomberomorus guttatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	*	-	*
<i>Sardinella longiceps</i>	*	*	-	*	-	-	-	-	-	-	-	-	-	-	-	-	*	*	-	*
<i>Harpodon nehereus</i>	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-
<i>Penaeus monodon #</i>	-	-	-	-	-	-	-	-	-	-	-	-	*	*	-	*	*	*	-	*

* Present, - Absent, PoM- Post-monsoon, W- Winter, PrM- Pre-monsoon and M- Monsoon, Cap- Capture fisheries, Cul- Culture fisheries, ** Low value fish, # Shellfish species

species were typically by-catch of other targeted fish species from both commercial fishing and aquaculture. *Boleophthalmus pectinirostris*, *Esomus danricus*, *P. sarana*, *P. ticto*, *Oreochromis mossambicus*, *Chanda nama*, *Xenentodon cancila* and *Colisa fasciatus* were the species with poor customer demand in fish markets.

Fish procured from outside state: Thirteen species have higher consumer demand in Punjab specially those people who are migrated from other coastal states. Among these *P. hypophthalmus* has the highest demand (Table 2).

Sector wise contribution in fish market (Weight basis): The inland culture and capture fisheries within the state contributed 75.41% of the market share. A total of 16.71 % of the fish transported to Punjab from other states were freshwater species, while 7.88% contributed from marine fisheries resources. Datta et al (2017) observed that the

culture and capture fisheries in Punjab accounted around 90 % of total catch while rest was contributed by fish imported from other states. A total of 2 to 3% of the fish marketed in Punjab were contributed by the marine sector (Table 2). The analysis of the fish marketing structure in Ludhiana, Amritsar, and Jalandhar markets in Punjab reveals several notable trends. Firstly, there has been an increase in the variety of fish species available in these markets compared to the previous study conducted by Datta et al (2017), indicating a potentially widening consumer preference. Secondly, there is a significant rise in total daily fish sales across all markets, suggesting a growing demand for fish in the region. Despite these positive trends, the presence of banned fish species in the markets raises concerns about regulatory oversight, highlighting the need for stricter measures to ensure food safety and ecosystem protection. Overall, these trends

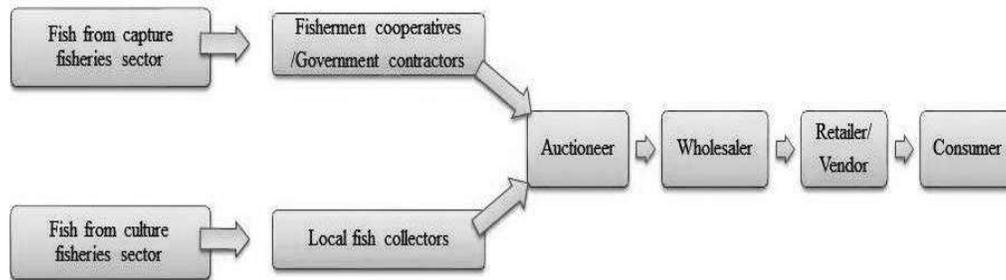


Fig. 3. Fish marketing channels in Punjab

Table 2. Demand and supply of fish species from different areas in Punjab during the study period

Parameters	Ludhiana	Amritsar	Mohali	Jalandhar	Bathinda
Total fish sale (ton/day)	2.0 -12.0	0.5- 4.5	1.0-5.5	2.5-5.5	0.75- 5.0
Fish from capture fisheries sector (%)	35-40	40-45	30-35	30-35	25-30
Fish from culture fisheries sector (%)	20-30	25-30	30-35	35-40	30-35
Fish imported from other States (%)	10-20	15-20	15-25	20-25	30-35
Low value/ non- economic fish mainly from capture fisheries sector (%)	5-10	0-5	0-5	0	0
Banned species (%)	5-7*	2-5**	2-5*	2-5**	2-5**
Total spp marketed (Nos)	35	22	12	13	19
Dominant species/groups (Maximum demand in consumer levels)	Carp	Carp	Carp	Pangas	Carp

* All three banned species Big head, Pacu and Thai Magur, ** Two banned species Big head and Pacu

indicate a dynamic and evolving fish market in Punjab, emphasizing the importance of continuous monitoring and adaptation to meet consumer demand while ensuring sustainability and regulatory compliance.

Marketing channels: Various fish marketplaces, fishermen/producers, commission agents, wholesalers, retailers, and consumers were mostly involved with the marketing channel (Fig. 3). Fish are purchased in live condition from fish farms by fish vendors or fish auctioneers in the early morning and then carried to fish markets (especially in Ludhiana).

CONCLUSIONS

Ludhiana fish market recorded the highest fish sale as compared to other fish markets and highest percentage of imported fish was marketed at Bathinda fish market. Locally produced Rohu (*L. rohita*) and imported Pangas catfish (*P. hypophthalmus*) from Andhra Pradesh have the highest demand among consumers. Marketing routes can be made simple so that fish grown in farms or caught in the wild can be delivered straight to consumers without the involvement of numerous middlemen. Unregulated fish supply in the markets, lack of proper storage and waste disposal facilities are the major constraints in fish markets of Punjab. Special emphasis should be given to Bathinda fish markets to

improve its basic facilities like electricity, toilets, waste disposals etc.

AUTHORS CONTRIBUTION

Pargi Narendrakumar Arjunsinh conducted sampling and analysed the data and wrote the manuscript. Surjya Narayan Datta conceptualized the theme, helped in sampling, interpreted the results and wrote the manuscript. Prabjeet Singh and Grishma Tewari helped in sampling.

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