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# A tale of fish in two cities: consumption patterns of low-income households in South India

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## Abstract

While much is known about fish production patterns and consumption at an aggregate level, there is little understanding of consumption behavior among low-income households in city regions. Given that fish is an important and possibly cheap source of nutrition for millions of poor people, this paper attempts to understand patterns of fish consumption among low-income households in two urban sites in South India, namely Chennai (coastal city) and Bangalore (inland city). By analyzing survey data collected in three different seasons from the same (around 250) households, we are able to infer diverse patterns of fish consumption by low-income households, including purchasing behavior, quality inferences, and trust relations with traders. Our analysis shows that Chennai's fish consumers rely more on informal markets and possess stronger preferences for certain species of fish while those in Bangalore make more use of formal market structures, displaying indifference toward the type of fish consumed. Our analysis helps to understand low-income consumer behavior while promoting fish for food and nutrition security among these populations in city regions.

**keywords** Fish consumption · Low-income households · Food and nutrition security · Transaction relations · City regions · India

## Introduction

India is now the world's second largest producer of fish. At the same time, annual fish consumption of the average Indian is only 5 kg per capita, which is one of the lowest in the world and a mere quarter of the global average (FAO 2018<sup>1</sup>). And yet, for many Indian

<sup>1</sup> <http://www.fao.org/state-of-fisheries-aquaculture/en/>, accessed on 4th April 2020.

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**Table 1** Fish consumption pattern in India across place of residence and wealth index categories based on Demographic Health Survey Data (2015–16)

	Frequency of fish consumption			
	Never (%)	Daily (%)	Weekly (%)	Occasionally (%)
<i>Type of place of residence</i>				
Urban	34.4	7.1	30.8	27.7
Rural	35.5	4.8	27.2	32.5
Total	35.1	5.6	28.4	30.9
<i>Wealth index</i>				
Poorest	25.9	2.8	27.3	44.0
Poorer	31.0	4.7	30.6	33.8
Middle	33.4	5.1	30.7	30.8
Richer	35.3	7.6	29.4	27.6
Richest	48.2	7.3	24.1	20.4
Total	35.1	5.6	28.4	30.9

Source: Authors' analysis of data from The DHS Program: Demographic and Health Surveys, <https://dhsprogram.com>, last accessed 2020/06/23

households, fish appears to be an important and relatively cheap source of nutrition. Its contribution is strikingly under-researched. While fisheries researchers have tended to focus on fish production and fisheries management, the scholarship on food and nutrition security has been tilted toward agriculture and other animal protein sources. Our ignorance of the role of fisheries for food and nutritional security poses a challenge for a country like India that ranks number one in terms of wasted and stunted children (Global Nutrition Report 2018).<sup>2</sup>

Within fisheries, the literature on consumption behavior is scanty at the disaggregate level, especially as far as it pertains to the urban poor. There are several reasons why it is important to understand the fish consumption behavior of the urban poor. First, it is generally well established in literature that fish is a prominent source of not only protein but other micronutrients essential for addressing malnutrition (Hicks et al. 2019). Second, a significant proportion of poor and malnourished people reside in and migrate to urban areas. Therefore, fish provision might, in principle, play a role in addressing urban malnutrition. Third, fish is a highly traded commodity globally as well as locally (Kawarazuka and Béné 2010) and hence is often characterized by an evolved market system. Unlike in rural areas where fish production and consumption can sometimes be intertwined to address nutritional security (for a comprehensive schematic see Table 1 in Kawarazuka and Béné 2010), urban areas more often exhibit a de-linked scenario in production and consumption. Given that it is a highly traded commodity, it is important to understand how the urban poor interact with market forces to bridge their nutritional needs. Such knowledge could provide insights into how market infrastructure could be strengthened.

There are important studies available on urban fish markets and trade in Japan (Bestor 2004), New York (Graddy 2006), Melbourne (Aljohani and Thompson 2018), Pescara and Giulianova (Giulioni and Bucciarelli 2011). While market-centric studies throw light on various dimensions of fish availability and accessibility, they may not specifically address

<sup>2</sup> <https://globalnutritionreport.org/reports/global-nutrition-report-2018/>, accessed on 4th April 2020.

the urban poor's needs. In view hereof, the objective of this paper is to understand fish consumption behavior of low-income households in two contrasting South Indian cities, one located along the shoreline and the other inland.

The paper is organized as follows. Section two highlights the theoretical underpinnings of this study. Section three contextualizes the study by presenting an overview of fish consumption patterns in India at large. Section four introduces the geographies of the cities in focus, while section five provides the methodological approach of this study. The next two sections compare the fish consumption patterns of the two cities, as well as the character of the market relations involved. Section 8 discusses these findings in light of the lead question and concludes.

## Theoretical and conceptual underpinnings

Analyzing fish consumption patterns presents a number of perspectives each having different means and goals of research inquiry. First, fish as preferred food commodity with specific characteristics, can be understood using choice framework among the possible substitutes and complimentary commodities. Second, food consumption behavior can be analyzed from an individual or a household perspective. However, there is a methodological challenge in deciding on the unit of analysis as the household (consumption through an institutional lens) or the individual (a choice lens). This is especially challenging, as food choices reveal cultural and individual meanings and preferences, in addition to relational aspects of consumption. A third challenge is viewing fish from a food and nutrition security perspective.

Food and nutrition security is actually a burgeoning field of scholarly and practitioner activity. We take as point of departure the definition of food security that was coined in the World Food Summit of 1996: "Food Security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO 1996). The four pillars of food security were defined as availability, access, utilization and stability (FAO 1996, HLPE 2017). Availability centers on the supply of food and refers to the extent to which sources of nutrition are available locally; access refers to a household's or individual's ability to obtain the food that is available; food utilization involves the preparation and cooking of foods as well as quality dimensions of the food items in question; stability introduces a temporal dimension to food security, spanning the other three. Coates (2013) provided an improvement over these four dimensions and suggested five dimensions of food security (1) food sufficiency; (2) nutrient adequacy; (3) cultural acceptability; (4) safety; and (5) certainty and stability. HLPE in 2020 has emphasized on two additional dimensions namely agency and sustainability along with the four dimensions envisioned in HLPE (2017).

In case of urban low-income groups, nutrient adequacy gains importance as most part of the food is purchased from the market. Thus, the price of the food items and income level of the person (or household) are two important indicators of accessing food with adequate levels of nutrition. Fluctuating food prices and the choice of food made by people are identified as some of the important reasons for nutrition insecurity prevailing in LMICs (Dangour et al. 2012).

The comprehensiveness of FAO's (1996) definition mentioned above is well suited to motivate action around food security and hunger on various important aspects of modern

life. At the same time, approaches to validate food security metrics in extant literature are as varied as the conceptualizations of the measurement tools themselves. A comprehensive analysis of food security measures by Jones et al. (2013) reveals a wide range of approaches from income, wealth and socioeconomic status to dietary intake, quality, diversity and nutritional status. Even though these approaches intend to measure the same concept, the domains of food security that they measure are highly varied and do not cover the question of food choice as a determinant of food security.

We rely on economic, food choice and embeddedness theories to understand various dimensions of attitude, choice and consumption while keeping the food security dimensions in mind. This is expected to help us not only to identify challenges in bridging attitude-choice-consumption with food and nutrition security but also to indicate relational aspects that play a critical role in the consumption behavior of the poor.

In the mainstream economic model, which treats food as a commodity, the household is the main unit of analysis given its easiness of juxtaposition with the household income which acts as an important variable in utilitarian analysis. According to this model, commodities are produced by utilizing a combination of market, goods and time. Use of time is competitive where every one-hour spent on cooking would reduce it from being allocated to eating or procuring it from the market or from work (Becker 1965). Bonke (1992) used this model to understand food consumption pattern where effect of increase or decrease in income and disposable time on food consumption pattern was observed. He argues that the more time one spends on work, the less time s/he gets to spend on cooking or eating. The random utility model shows that consumers choose products (fish in our context) that have most desired attributes that they want from a product and accordingly choose among available alternatives (Hanemann 1984; Baltas and Doyle 2001).

While mainstream economic theories tend to suggest atomized behavior of household units, they ignore the relational, social, cultural and geographic dimensions that underlie the intentions, attitudes and preferences for a particular type of food, which in the end lead to food choices. The “food choice process model” (Furst et al. 1996) is an important model in this context. While explaining food choice, the model incorporates a larger set of factors making it more comprehensive than regular economic models (Sobal et al. 2006). The “food choice process model” emphasizes on the influence of life course on making food choices. Life course includes past and present eating experiences. Furst et al. (1996) aptly mention that to understand current food practices it is important to trace the lifespan of a person consisting of trajectories such as thoughts, feelings, strategies and actions. Food choices are built over time and continue long after people leave home. Such trajectories develop in situational and historical contexts, become persistent and exhibit their own momentum and continuity. However, changes do happen due to shifts in person’s life that may strengthen or change existing food choice (Seal et al. 2006, p. 4). Resources are seen as important determining factors of food preference classified as tangible (money, equipment and space) and intangible (culinary knowledge, skills and time). The values and strategies that influence food choices are sensory perceptions (Furst et al 1996), monetary considerations (Sobal et al. 2006), convenience, health/nutrition (Sun 2008), etc., bringing in the individuals choice into consumption decisions paving the way for behavioral considerations.

While probing consumption, the relational space that lies between production and consumption is an often-overlooked link. The intermediate spaces and connections that bring food (in this case fish) to the consumer are not mere transactional, as relational aspects, attitude and perceptions may prompt or restrain transactions. The concept of embeddedness proposed by Granovetter (1973) addresses this dimension. Granovetter’s ideas are extended

from Polanyi (1944) who argued that there are no pure-economic institutions in non-market societies: Economic activities like provisioning are embedded in non-economic kinship, religious and political institutions. Granovetter (1973, 1985) further developed this notion of embeddedness and argued that economic activities are not divorced from their societal surroundings—this would be true even for market economies.

Granovetter's approach emphasizes that human beings act in accordance with their social relationships and social structures. Hess (2004) further divided the embeddedness of personal relations and structures framework into three sets of embeddedness namely, societal, network and territorial. Societal embeddedness includes the cultural, political and historical backgrounds that affect economic behavior. Network embeddedness highlights the process of trust building. It assesses formal and informal networks among agents where trust is the most important aspect. Territorial embeddedness is attachment or influence of the places people are anchored in.

Our study tries to understand the consumption and transactional aspects of the fish value chain in light of relational theories as mentioned above. We do not attempt to probe causality; rather our attempt is to go beyond the argument of atomized economic activities and their impact by taking the social and relational framework of food consumption into consideration. We also look at consumption while incorporating attitudes toward the pillars of food security. And while probing whether life course (food choice theory) play a role, we explore whether embeddedness is a relevant factor.

## **Fish consumption in India: patterns, gaps and reflections**

Rural to urban migration and increasing urban populations have been linked to increasing levels of food insecurity (Crush 2013). Migration-induced urban population growth (Jiang and O'Neill 2017) has resulted in food inflation often increasing faster than overall inflation rates, especially in urban areas, leading to high levels of food insecurity among low-income people (Crush and Frayne 2011).

Indian cities, including Bangalore and Chennai, correspond with the global trend and have witnessed high rates of urban expansion (Hove 2006; Saharan 2017; Taubenböck et al. 2009). With the movement of unskilled populations to urban areas, rural poverty frequently transforms to urban poverty (Datta 2007). Poverty, dependence on wage income, instability of employment and high residential densities contribute to the onset of disease and malnutrition for many urban squatter families (Basta 1977).

The literature recognizes that fish provides important nutrition not only in the form of protein but even more in the form of other essential micronutrients including vitamin A, zinc, PUFA, calcium and iron (Kumar and Dey 2006; Béné et al. 2007; Kawarazuka and Béné 2010). Particularly, low-price fishes like anchovies and sardines are identified as nutrient rich (Tacon and Metian 2009). Low-price and high nutritional value is the desirable combination to address food and nutrition security, making this category of fish species of particular relevance for the purpose of this study. However, the pathway from fish production to consumption is complex and is not free from obstacles.

FAO data suggests that India became the second largest producer of fish in the world in 2015. Subtracting the quantities of fish that are exported, we find about 5 kg of fish per person per year is available for domestic consumption (Scholtens and Jyotishi 2019); a substantial portion hereof is diverted from direct human consumption toward animal feed (Ponnusamy et al. 2012; Scholtens et al 2020). While such aggregate data may be

indicative of national level fish availability, it hides significant variations across regions and does not take into consideration the many people in India that do not eat fish. The National Sample Survey Organization's (NSSO) consumption expenditure survey provides an alternative source of consumption information. It suggests that approximately a quarter of India's households do eat fish. These fish-eating households consume on average 12 kg per year, for which they spend on an average 320INR a kilo (Anneboina and Kumar 2016).<sup>3</sup> These survey data also provide insight into how fish consumption is distributed over different population groups. Populations in coastal states thus consume much more fish than those of inland states, which is significant given the high concentration of under-nutrition in the hinterlands of India. Anneboina and Kumar (2016) did not find any significant variation between rural and urban dwellers or among various income groups. Perhaps most strikingly, they found the expenditure on fish as a proportion of the overall food basket has increased considerably, indicating that consumers spend an increasing proportion of their income on fish. On the other hand, the latest round of Demographic Health Survey (DHS) of India, 2015–2016 (also known as NFHS fourth round survey) included fish as a separate commodity in the food consumption basket. This survey provides fish consumption pattern in India. Our analysis of the data (presented in Table 1) shows about 65% of the population eat fish. Though there is not much variation in rural and urban residence, considerable variation is found across class. It shows more proportion of poor eat fish as compared to the rich though there is variation in frequency of eating. While more proportion of poor tend to eat fish, their frequency of eating is less in comparison with the rich, raising questions about accessibility and affordability.

If we look deeper in fish consumption pattern in India, some studies suggest that 50% of the population has been eating fish (NCAER 1980) which has only grown to 60% in recent years (Salim 2016). This is much higher than NSSO's finding but in line with DHS 2015–16. People from Southern India have always preferred marine fish, while people from East and North-East India have a likeness for freshwater fish (FAO 2005). Another study found that consumption of fish varies between coastal and non-coastal locations as observed in Andhra Pradesh (Madhavi and Kusuma 2015). This study found that in urban area of Nellore (a coastal city), fish consumption was very high and a variety of fish was consumed, whereas in urban areas of Tirupati (a non-coastal city) fish consumption and varieties of fish were low. Findings of the study also indicate a clearly a strong correlation between fish consumption patterns and characteristics such as religion, social status and household income. The varieties of fish consumed also appeared to depend greatly on the availability of fish locally, regionally or seasonally. Based on various studies and data sources at micro and aggregate level, we find increasing proportion of people have fish in their diet. Hence, fish consumption can be amplified by ensuring availability, affordability and accessibility to fish.

## Fish trade in Chennai and Bangalore

Fishing is an ancient form of occupation that finds mention in mythology and history of Indian tradition. In India, though fish-related activities are mentioned in various historical documents, exhibition catalogues, travel diaries (like that of Francis Buchanan), a more comprehensive recognition of fisheries as an occupation and need for its regulation came with Francis Day's report, who was the Director General of Fisheries in India and led the Indian Fisheries Act of

<sup>3</sup> [http://dahd.nic.in/sites/default/files/Section%20I%20%20%2012\\_0\\_0.pdf](http://dahd.nic.in/sites/default/files/Section%20I%20%20%2012_0_0.pdf)

1897.<sup>4</sup> However, there is little knowledge in the public domain on evolution of various formal and customary institutions governing fish trade and consumption especially prior to nineteenth century. This applies to Chennai and Bangalore too, the two focal cities of our research. In modern India, fish reaches consumers through three main channels, namely local trade in fresh fish; local trade in processed fish; and domestic urban trade (Salagrama 2004). Women small-scale traders from fishing as well as non-fishing communities play important role in bringing fish to the final consumers<sup>5</sup> especially in the low-income neighborhoods in Chennai. Credit (especially short-term credit) plays an important role fish transaction in Chennai suggesting importance of trust, social-relations beyond price. With the changing demography, increase in population, availability of new technology, expansion of the city, development of new fish markets, many changes started happening in this node of the fish value chain.

Increasing scale and volumes of fish trade and connection with distance markets required mobilization of capital that paved the entry of other business actors into the value chain. The immediate settlement of bills and the faster disposal of the catch made this a lucrative option for the boat owner and thus created a channel, which was different from the traditional practices. The opening up of other retail markets inside the city, the increasing demand for fish by hotels and restaurants, in addition to increased demand from other towns and villages provided further impetus to wholesale trade. Kasimedu traditionally played an important role of fish harbor in Chennai supplying fish to the people in Chennai and other neighboring areas. However, in recent years Chennai experiences inflow of fish from various other parts of India. New markets like Vangaram play important role in fish availability in Chennai and neighboring areas.

Bangalore traditionally depended on local procurement and availability of freshwater fish in the periphery. The emphasis of fish farming in the tanks and thus generating revenue from this are documented in the “Proceedings of the Dewan to His Highness, the Maharaja of Mysore<sup>6</sup>”. However, the railway network and emergence of new markets like K. R. Market in Kalasipalya (circa 1928) and Russell Market in Shivajinagar (circa 1933) during the pre-independence period opened possibilities of marine fish trading in Bangalore especially to serve the new settlers in the cantonment areas of Bangalore. Being a land-locked city, Bangalore depends heavily on fishing ports like Chennai and Mangalore for its supply of seafood. Fish trade here was a business with little or no links to the fisher community, as fishers were locally absent. Male members of the Muslim population are seen to dominate the fish trade in Bangalore. The near absence of women in the fish trade differentiates this city from Chennai.

Post-independence, Indian cities started growing, as trade, industrial and administrative centers attracted people from various parts of the country. Urban growth accelerated after liberalization of the economy in 1991. This not only increased aggregate population levels but also led to the growth of slums and urban poverty figures.

## Materials, methods and demography of the sample

### Methods of data collection

Our study was conducted in eight low-income areas divided over Chennai and Bangalore. It took place in three identical phases between October 2017 and September 2018. The first step

<sup>4</sup> For details see <https://www.fisheries.tn.gov.in/History>

<sup>5</sup> <https://madrascourier.com/opinion/the-fish-traders-of-madras/>

<sup>6</sup> <https://archive.org/stream/modernmysore035292mbp#page/n15/mode/2up>



**Table 2** Choice and characteristics of the study areas in Chennai and Bangalore

Area	Distance from nearest fish market	Settlement type	Community diversity
<i>Chennai</i>			
Anna Nagar	Far	Old	Low
Chindadripet	Near	Old	High
Chemmencheri	Far	Resettlement	High
Saidapet	Near	New	Low
<i>Bangalore</i>			
Shivaji Nagar	Near	Old	Low
Yeshwantpur	Near	Old	Medium
K R Puram	Far	New (footloose)	High
Sarjapura	Far	Resettlement	High

**Table 3** Survey rounds and sample size

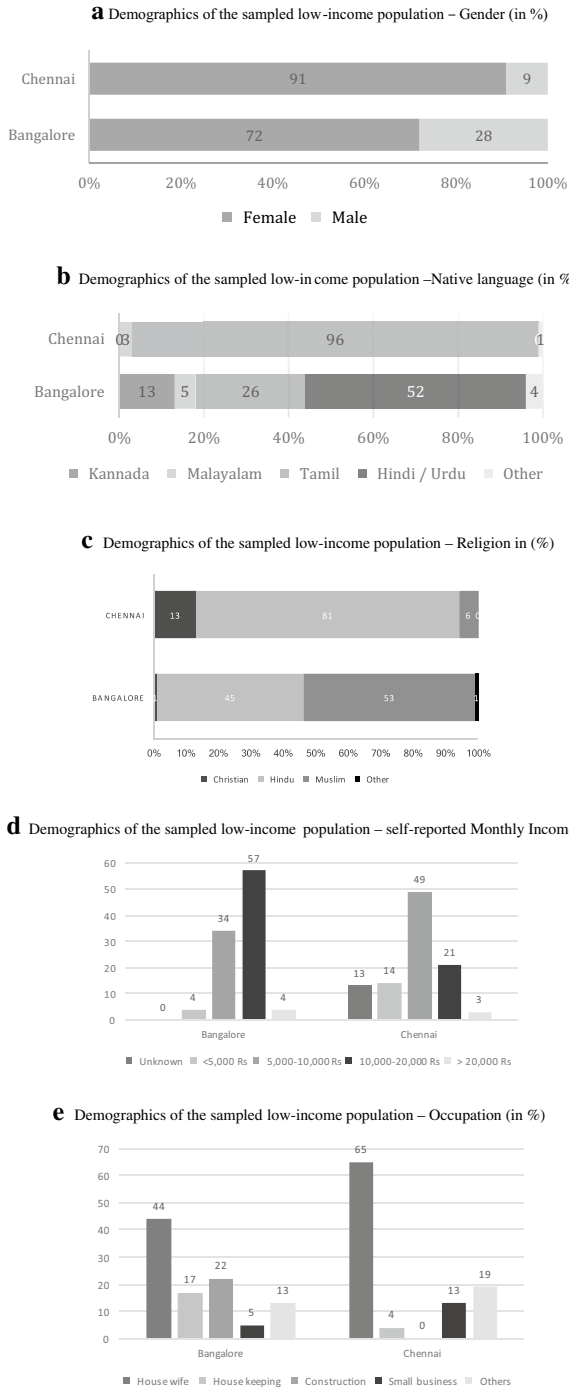
	Round 1 (Oct–Dec 2017 North-east monsoon)	Round 2 (March–April 2018 post-NE-monsoon)	Round 3 (July–Sept 2018 Pre-NE-monsoon)	Grand total
Bangalore	131	126	121	378
Chennai	125	120	109	354
Grand total	256	246	230	732

taken was to select four low-income areas in each city from the available pool. This was done through consultative workshops and an assessment of secondary literature. The criteria for identifying the neighborhoods for our study were: location within the city as a whole (whereby we aimed for a geographical spread), the settlements' type and age (old versus new and resettled areas), and distance from a fish market (which was expected to effect the accessibility of fish). Demographic diversity in terms of religion and caste was also considered while selecting the locations. A temporary settlement occupied by footloose labor was also included. Table 2 details the neighborhoods that were selected in Chennai and Bangalore based on these criteria.

We then developed an identical survey schedule, which was uploaded in ODK software for immediate data collection and processing. The schedule was piloted in a few neighborhoods in Chennai and Bangalore and further minor modifications were made before finalization. The intention was to carry out the survey among at least 30 households in each of the four neighborhoods in each city. The survey was also designed for repetition among the same households during three seasons of the year—namely the pre-northeast monsoon, monsoon and post-monsoon periods—to understand their influence on fish consumption behavior. The dropout rate turned out to be remarkably low as observed in Table 3.

### Demographic characteristics

Figure 1a–e provides a demographic overview of the sampled population. While in both cities the majority of respondents representing the households were women, Bangalore had a sizable group of men included, mainly construction workers. In Chennai, the sample



**Fig. 1** **a**: Demographics of the sampled low-income population—gender (in %). **b** Demographics of the sampled low-income population—native language (in %). **c** Demographics of the sampled low-income population—religion in (%). **d** Demographics of the sampled low-income population—self-reported monthly income (in %). **e** Demographics of the sampled low-income population—occupation (in %)

population was relatively homogeneous—being Hindu Tamils, albeit with a significant Christian minority—whereas in Bangalore it was more diverse in terms of language and religion. The majority of the respondents were women, many of whom identified themselves as housewives. Yet significant numbers of women were also involved in a variety of jobs and businesses. The Bangalore sample population on average earned a higher income, with 61% of the respondents earning more than 10,000 Rs. per month, compared to 24% in Chennai. This is partially explained by the lower numbers of “housewives” in the population.

## Methods of analysis

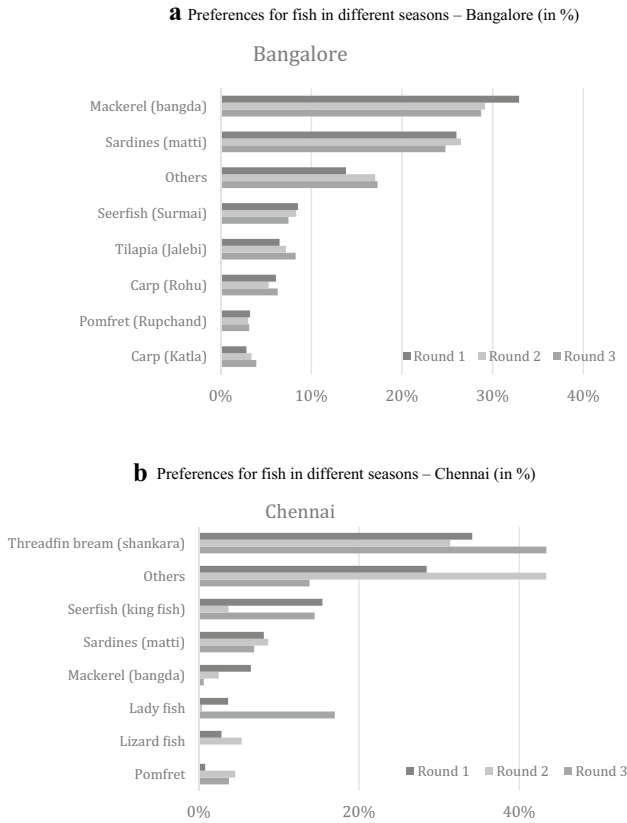
Basic statistical methods were used to understand statistical difference between the two cities. The parameters were checked for statistical significance in their relationship with the independent variable “city” (Bangalore and Chennai), using Pearson’s chi-squared tests, given the variables to be analyzed are categorical in nature. Stats iQ, a statistical analytical tool, was used to perform this test. “Effect size” as denoted by Cramer’s  $V$  alongside the  $p$ -values was observed to identify meaningful statistically significant difference between the two cities. We provide details on statistical significance in the following presentation of fish consumption patterns.

## Fish consumption patterns in Chennai and Bangalore: patterns and perceptions

This section summarizes our conclusions on fish consumption patterns in the two cities along the lines of price, health, taste and religious considerations. Our first observations concern prevailing attitudes toward fish species that originate in freshwater environments versus salt water environments. Both types of fish are available to consumers in both cities. However, while Bangalore is located in the interior of the subcontinent, in relative proximity to freshwater sources (including aquaculture), Chennai is a coastal city that hosts a large marine fishing harbor and a series of fishing villages within its very boundaries. It is then no wonder that low-income consumers in Bangalore are more familiar with freshwater species than consumers in Chennai are. Figure 2a, b presents the preferences of low-income consumers in the two cities for various species of fish according to three seasons of the year.

Our results on this topic indicate that while low-income households in Chennai exhibit a strong preference for marine fish species and substitute between them, low-income households in Bangalore switch easily between marine and freshwater fish species. The fish most low-income households in Chennai prefer is threadfin bream. However, the availability of this species declines drastically during the monsoon season (corresponding with our round 2 survey and the annual fishing ban on the east coast) prompting households to switch to other species of marine fish. Bangalore’s low-income households clearly prefer the marine species mackerel and sardines. These fish species derive sometimes from the east and sometimes from the west coast. It seems that urban consumers substitute any shortfall in supply of these species with freshwater species whose consumption increased markedly in survey rounds 2 and 3.

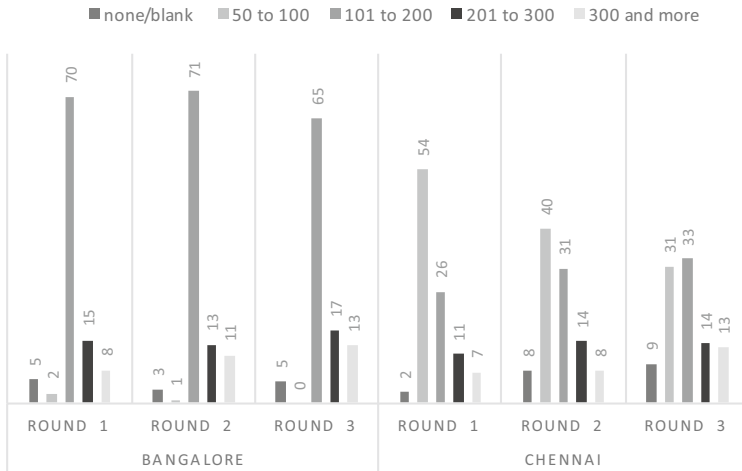
Table 4 shows a difference between Chennai and Bangalore regarding the frequency of fish consumption. Thus, low-income consumers in Chennai tend to eat fish several



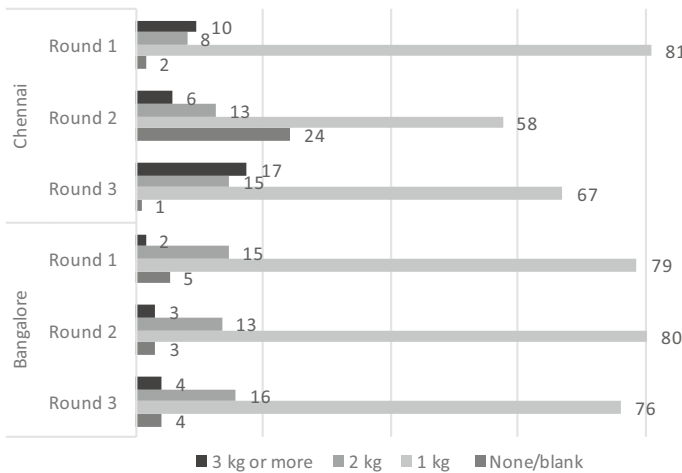
**Fig. 2** a: Preferences for fish in different seasons—Bangalore (in %). b Preferences for fish in different seasons—Chennai (in %) (common local names in brackets)

**Table 4** Frequency of fish consumption across the two cities (in %)

	Bangalore			Chennai		
	Marine fish	Freshwater fish	Dry fish	Marine fish	Freshwater fish	Dry fish
5–7 times per week	8	4	5	3	0	3
2–4 times per week	10	12	3	88	8	35
2–4 times per month	50	43	20	7	3	10
less than once a month	30	39	64	3	9	22
Never	2	3	9	0	79	30
Total	100%	100%	100%	100%	100%	100%



**Fig. 3** Amount of money (INR) spent on fish in the week previous to survey (in %)



**Fig. 4** Quantity of fish purchased last week

times every week, while consumers in Bangalore display a substantially lesser frequency of consumption.

The quantity of fish purchased at a time show a similar pattern. Most households in the two cities prefer to buy a kilogram of fish at a time as shown in Fig. 4. However, the price paid by households in Bangalore is higher than in Chennai (see Fig. 3). This suggests that fish is cheaper in the coastal city as compared to the inland city. While fish prices are generally lower in Chennai, this does not necessarily mean that fish is more affordable there. After all, affordability is contingent on income. As we have seen earlier, average household income levels are higher in Bangalore than in Chennai. The other striking difference that emerges from Fig. 4 is the decline in fish consumption in Chennai during the fisheries ban period implemented along the east coast (corresponding to round 2 survey).

**Table 5** Perceptions on fish availability, accessibility, quality and stability of fish provisions (in %)

	Availability		Affordability		Quality		Stability	
	Bangalore	Chennai	Bangalore	Chennai	Bangalore	Chennai	Bangalore	Chennai
Fully agree	4	82	0	45	1	61	2	49
Agree	79	11	66	29	72	24	59	19
Neutral	16	3	32	16	26	11	37	24
Disagree	1	2	1	5	1	2	2	6
Fully disagree	0	1	0	4	0	2	0	2
No answer	1	0	1	0	1	0	1	0
Grand total	100%	100%	100%	100%	100%	100%	100%	100%

Questions (rated on a 5 point Likert scale—1 = strongly agree; 2 = agree; 3 = neutral; 4 = disagree; 5 = strongly disagree):

**Table 6** Results of analysis of variance for perceptions

Perception tested	Question used	<i>p</i> -value*	Effect size, (Cramér's V**)	Strength of statistical significance
Availability	I get fish supplied to me when I need it	<0.00001	0.817	Very strong
Affordability	I believe the prices are affordable	<0.00001	0.601	Strong
Quality	Good quality fish is available for me to purchase	<0.00001	0.679	Strong
Stability	I get the type of fish I need' all throughout the year	<0.00001	0.602	Strong

\**p*-values from chi-squared test suggest if the variance is statistically significant if they are below 0.05, at 5% confidence interval

\*\*Cramer's V (between 0 and 1) is the measure the strength of the relationship, with values above 0.35 indicating strong relationship

Aside from consumption behavior, we have also investigated consumer attitudes with regard to the four pillars of food security, namely availability, accessibility (measured as affordability), quality and stability along with other aspects of cultural and social preferences toward fish. These attitudes were captured through the questions posed on a 5-point Likert scale format. The results are tabulated in Table 5. The questions on which the response figures are based, can be found in Table 6 (column 2).

All response parameters were checked for statistical significance in their relationship with the independent variable “city” (Bangalore and Chennai), using Pearson's chi-squared tests. The results are given in Table 6.

The results of Tables 5 and 6 put together suggest that low-income households in both cities are positive about the availability, accessibility, quality and stability of fish in their locality. However, there are variations in the degree to which these attitudes are statistically different. On availability and quality parameters, Chennai's low-income consumers are more positive than in Bangalore. On the other hand, Bangalore low-income consumers are more positive than those in Chennai on the parameters of accessibility (affordability) and stability.

## Market, transaction relations and trust

Not only do fish consumption characteristics differ across both cities—the relations between consumers and traders too vary significantly from one another. Factors such as the identity of the trader or the nature of shop establishment and trust factors associated with the transaction appear to play an important role in building consumer attitudes toward the quality of fish. These factors are therefore important to understand and analyze not only for the purpose of understanding consumer behavior but also for the future planning of market infrastructure. The locations of fish purchase are presented in Table 7.

Mobile vendors along with local markets appear to provide important links between wholesale markets and low-income consumers in both cities. While in Chennai consumers predominantly prefer mobile vendors (mostly women traders), in Bangalore it is the local markets that serve this category of consumers most.

The data also provide other insights, such as on the role of credit in the relationship between consumers and traders. Table 8 demonstrates that approximately 30% of low-income consumers in Chennai are able to purchase fish on credit, while this is significantly rare in Bangalore. The difference here seems to be caused by the prevalence of mobile traders in Chennai. Mobile vendors who visit low-income areas are normally the only trader group that provide credit to low-income households. This aspect assumes importance as 79% of low-income consumers in Chennai depend on mobile vendors for their supply of fish, whereas the corresponding figure in Bangalore is only 32%.

**Table 7** Source of fish—comparison across cities (in %)

	Bangalore	Chennai
Domestic market outside own neighborhood	3	4
Mobile vendor	32	79
Nearby local market	57	17
Nearby sedentary retailer	7	0
Other and no response	1	1
Grand total	100%	100%

Question: Where do you get these fish products from?

**Table 8** I buy from the regular vendor because I get credit\* (in %)

	Bangalore	Chennai
Fully agree	0	26
Agree	13	6
Neutral	40	12
Disagree	47	26
Fully disagree	0	30
Grand total	100%	100%

(\*statistically significant difference between the cities, with  $p$ -value  $< 0.00001$ , and effect size, denoted by Cramer's  $V = 0.638$ )

Question: "I buy from the regular vendor because I get credit" rated on a 5-point Likert scale

**Table 9** Perception of the consumers on where they get the best quality and worst quality fish (in %)

	Where do you get the best quality fish?*		Where do you get the worst quality fish?*	
	Bangalore	Chennai	Bangalore	Chennai
Market outside own area	5	4	8	8
Mobile vendor	16	66	35	87
Nearby local market	50	30	16	5
Nearby sedentary retailer	1	0	33	1
Supermarket	27	0	9	0

\*statistically significant difference between Bangalore and Chennai, with  $p$ -value < 0.00001, and effect size, denoted by Cramer's  $V=0.56$  for best quality and 0.49 for worst quality fish

Question: "Score the following vendors on the quality of fish sold" (Scale of 1–5, with 1 = very fresh, 5 = not at all fresh)

In spite of their services, mobile vendors have a mixed reputation in both cities as regards to the quality of fish (see Table 9). For the Chennai consumers, the mobile vendor in the neighborhoods represent both extremes of best and worst quality fish. Opinions in Bangalore are less stark. Another striking observation that emerges from our data is the trust low-income consumers in Bangalore have in supermarkets. Though they are not the usual customers in the supermarkets, such revelations suggest their aspiration and imagination.

## Discussion and conclusion

We have reached several conclusions on the character of fish consumption of low-income populations in Bangalore and Chennai. Some point toward differences, while in other aspects the two cities are remarkably similar. First, fish is generally perceived to be cheaper in Chennai than in Bangalore. However, this condition does not necessarily describe affordability, as the average income level among the households in Bangalore is higher. Second, consumers in Chennai display a strong preference for marine fish whereas consumers in Bangalore alternate easily between freshwater and marine fish. Third, in Bangalore, consumers generally prefer to purchase mackerel or sardine, which are available throughout the year. Consumers in Chennai on the other hand, have a preference for threadfin bream. Fourth, as the availability of this particular species declines during one season of the year, consumers then either choose to purchase other marine fish or reduce their consumption of fish altogether. In other words, consumers in Chennai show seasonal variation in consumption whereas consumers in Bangalore show relatively stable consumption of fish throughout the year. This behavior points toward a fifth feature of fish consumption patterns among low-income households in both cities.

Low-income consumers in Chennai appear to rely on more localized sources of fish than those in Bangalore, who are more integrated into the national fish market. This is to say that consumers in Chennai rely not only on more proximate sources of fish supply along the east coast, but also depend to a greater extent on informal market mechanisms, such as represented by mobile vendors. On the other hand, cheaper fish species



in Bangalore derive from a greater variety of sources along east and west coasts, as well as from freshwater bodies (including aquaculture). In addition, low-income households in the latter city rely less on informal channels, such as mobile vendors, than on formalized market institutions.

Conspicuous in our account are the positive attitudes of low-income households toward the various dimensions of food security in both locations. Not only do they believe that fish is normally available in the marketplace, but it is apparently affordable from one season to the next. These results speak positively to the nutritional relevance of fish in the context of urban poverty in India. Follow-up studies will establish whether this condition holds true for other coastal and inland cities on the subcontinent.

Ensuring quality of fish products, however, constitutes the weak side of fish market infrastructure in India. While low-income consumers in both cities point out that the fish that is offered for purchase is sometimes of good quality, they also note the availability of very bad-quality fish. Our conclusion in this respect confirms the findings of Sathiadhas et al. (2011) on the variable quality of seafood available in India.

Our findings also defy an atomized economic understanding of consumer attitude and choices and point at influence of various other socio-cultural and other dimensions on preference and choice of food items. Within this, while consumers in Bangalore show proximity to formal economic behavior, consumers in Chennai suggest the influence of socio-cultural, historical and other aspects including their relation with fish in the place of origin, cooking methods, etc., dominating over the formal economic behavior. These aspects will, however, require additional study.

Chennai exhibits several relational dimensions with the traders, which may be typical of coastal cities where fish has a more direct presence in various food habits. Our analysis shows that transactional relations in terms of credit and a greater preference to purchase from local vendors prevail among low-income consumers in Chennai. In addition to quantitative results that point in this direction, our surveyors there thus found that the quality of fish is judged by array of indicators including the hygiene condition of the shop. Low-income consumers in Bangalore, on the other hand, show relative indifference to such relational dimensions and look to formal market establishments for the supply of fish. The transaction relations in Chennai point toward more socially embedded relations among low-income consumers as compared to consumers in Bangalore. In essence, the two cities tell different tales of fish consumption among the low-income groups.

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