



How Seafood Wholesale Markets Matter for Urban Food Security: Evidence from Chennai, India

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Abstract

Urban sites gather poverty in particular locations and often require bulk food system approaches for addressing prevalent food security and nutrition needs. The food systems that service them are, however, characterized by perishability and large irregularities in supply. Seafood is currently recognized as contributing in a major way to food security and nutrition, and it is to assessing the role of wholesale markets in meeting the needs of the urban poor that this paper is directed. It zooms in on the city of Chennai, India, where an estimated 40% of the population is considered poor and marine fish plays a crucial role in diets. Building on one-and-a-half years of field research in the pre-COVID-19 period, the paper analyses the performance of one of the city's largest fish wholesale markets, Vanagaram, in relation to the four commonly recognized pillars of food security. Results demonstrate how urban food systems function as major suppliers of fish (and other food items) to thousands of low- and middle-income households. Most importantly, this case study demonstrates the crucial role that is played by wholesale markets in merging low-price fish supplies from different geographic regions and thereby ensuring food security of poorer inhabitants.

The first author—who has worked on Indian fisheries for two and a half decades—has carried out 14 months (2017–2019) of mixed method field research on low-priced fish commodity chains in Tamil Nadu, India. Vanagaram wholesale market was one of his core fieldwork locations. The second, third and fourth authors possess long-term research experience with regard to fisheries in South Asia and have contributed to conceptualization, data analysis and writing. The fourth author has studied fish traders and fish market networks (commodity chains) in India in the context of economic transformation driven by state-led development and globalization. The fifth author played an important role in conceptualization, survey design, analysis of data and critical review while drafting the paper.

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Résumé

Dans les zones urbaines, la pauvreté se concentre dans des sites spécifiques qui nécessitent souvent des systèmes alimentaires qui s'appuient sur la vente en gros pour répondre aux besoins en matière de sécurité alimentaire et d'apport nutritionnel. Les systèmes alimentaires qui les desservent sont cependant caractérisés par la périssabilité des aliments et de grandes irrégularités dans l'approvisionnement. Actuellement, il est reconnu que les produits de la mer contribuent de façon significative à la sécurité alimentaire et aux apports nutritionnels. Cet article cherche à évaluer le rôle du marché de la vente en gros dans la satisfaction des besoins des personnes en situation de pauvreté dans les villes. Il se concentre sur la ville de Chennai, en Inde, où environ 40% de la population est considérée comme étant en situation de pauvreté et où les poissons de mer jouent un rôle crucial dans l'alimentation. Cet article s'appuie sur des recherches menées sur le terrain pendant un an et demi avant la COVID-19, et analyse la performance de l'un des plus grands marchés de vente en gros de poisson de la ville, Vanagaram, par rapport aux quatre piliers communément reconnus de la sécurité alimentaire. Les résultats montrent la façon dont les systèmes alimentaires urbains fonctionnent comme d'importants fournisseurs de poisson (et d'autres produits alimentaires) pour des milliers de ménages à revenu faible ou moyen. Plus important encore, cette étude de cas démontre le rôle crucial que jouent les marchés de vente en gros pour faire fusionner l'approvisionnement en poisson à bas prix issu de différentes zones géographiques et pour garantir la sécurité alimentaire des habitant-e-s les plus pauvres.

Introduction

Concerns over human food security and nutrition are well-represented in international policy agendas, such as the Sustainable Development Goals, with special attention going to the status of the urban poor (Global Nutrition Report 2020; HLPE 2017a, b). Fish has meanwhile become recognized as a nutritious foodstuff, constituting an irreplaceable source of micronutrient contents—like omega-3 fatty acids, iodine, vitamin A and D, and minerals like iron, zinc and calcium—essential for human health (Hicks et al. 2019).

This paper presents research findings on the contribution of fish to food security and nutrition in the mega-city of Chennai, on the southeast coast of India. It focuses on the question how fish wholesale markets, which sit at the center of urban food systems in the Global South, contribute to food security and nutrition of the urban poor. Our investigation is rooted in three observations. First, fish, whether deriving from wild marine and freshwater sources or from the aquaculture industry, consists of cheaper and more expensive species, and it is especially the small pelagic species of fish, which historically have been relatively low-priced, that are relevant for nourishing poor people (Tacon and Metian 2013). In



this paper, we will therefore focus on the contribution of marine low-price fish (LPF) to urban food security and nutrition. Second, we note that the sources of marine fish are distributed unevenly—fishers in different geographical locations land different species of fish in different quantities with variations taking place by season and over the years. The consequence is that urban consumers in countries such as India must source fish from diverse geographic regions to be able to consume fish year-round. We examine how fish wholesale markets assist in matching the temporal and spatial fluctuations of supply with the demand of traders and urban consumers alike. Finally, we note that many cities in the developing world are experiencing rapid growth, and that the absolute number of poor inhabitants and poor neighborhoods too is generally increasing. To meet their increased nutritional and food security demands, urban fish market infrastructures must adapt so as to provide adequate fish supplies throughout the year.

Urban food systems evolve and change as cities grow and expand. The process of urbanization quantitatively and qualitatively affects all components of a food system (food-producing areas, marketing networks, and urban consumption centers). Understanding the ways urban food systems function is necessary if specific policy responses are to countermand undesirable nutritional, social or economic effects of urbanization (Drakakis-Smith 1990). Constituting the nexus between food producers and consumers, food marketing is clearly one of the most critical linkages in the urban food system (Baulch 2001). Yet, the way in which market institutions determine access to food and welfare, especially for the urban poor, has been neglected in policy and research circles (Aguda 2009). This study helps fill that gap.

The Vanagaram wholesale fish market (henceforth: Vanagaram) in Chennai city can be understood in relation to the above: it is a relatively new, privately owned market located on the edge of the city, readily accessible for trucks arriving from various coastal states of India and therefore well suited for mediating nation-wide supply and local demand. It is a beehive of activity and a major supplier of fish for many hundreds of retail markets in distant parts of the city, many of which are located in its poor neighborhoods, thereby indirectly serving millions of poorer consumers. The wholesale market doubles as a retail market directly serving consumers too. In this paper we analyse this wholesale market's functions in relation to the four central dimensions of food security and nutrition (HLPE 2020): availability, accessibility, quality (utilization), and stability over time.

After describing the theoretical and methodological foundations of this research (“Research Methods” and “Urbanization and Food Security Challenges in India” sections), we sketch the conditions of urban poverty and food security in India (“The Contribution of Fisheries to Indian Food Security” section), as well as the current contribution of fish in meeting food security and nutrition needs (“Positioning the Vanagaram Wholesale Fish Market in Chennai’s Food System” section). The next section then provides a description of Vanagaram; we subsequently present our findings with regard to Vanagaram’s role in contributing to conditions for food security of Chennai’s poorer inhabitants (“Vanagaram’s Contribution to Food Security for Chennai’s Poor” section). The paper concludes with a discussion on the wider relevance of the study’s findings (“Discussion” and “Conclusion” sections).



Theoretical Positioning

We follow an urban food system (Chase and Grubinger 2014; HLPE 2017a, b, 2020; Rousseau et al. 2020) and commodity chain approach (Bair 2009), in which attention is given to the flow of fish species as they proceed from dispersed aquatic ecologies, through harvesting, processing, distribution and other trade activities, to consumers within and outside a country setting. A food systems framework recognizes the complexity of relations between constituent parts and the role of drivers and supporting systems in its functioning. Being specifically interested in the food security and nutrition of low-income urban consumers, our study focuses on the flow of marine low-priced fish through local, regional, and national supply chains, and highlights the role of wholesale markets in facilitating the supply and distribution of fish to urban consumers, especially the urban poor. Although the composition of the ‘basket’ of low-priced fish varies over time—as prized seafood, which typically goes for high prices, is sometimes sold at a lower rate, and vice versa—some species, like sardines, anchovies and mackerel, are commonly low-in-price. Such species belong to what marine biologists refer to as small pelagics, as they tend to migrate over large distances in schools.¹

The perspective of markets as composed of ‘commodity chains’—also known as supply chain, value chain or *filière*—originated in the 1970s and has become an important field of study. Agro-food chains constitute a separate branch hereof with unique characteristics, namely (1) unpredictable supplies; (2) quality variation between different producers and food products; and (3) perishability of products (Trienekens 1999). Fish chains fit neatly into the agro-food chain category. Whereas much attention in recent years has gone to global chains (Gereffi and Fernandez-Stark 2016), our study is largely concerned with domestic chains that extend over local, regional and national scale. Wholesale markets constitute specific, relatively understudied nodes in the operations of such chains (Ahmadi-Esfahani and Locke 1998; Giulioni and Bucciarelli 2011; Aljohani and Thompson 2018). In the Indian context, while much of the attention in literature has gone to the aggregate production and household consumption of food (Kumar and Dey 2007; Kaicker et al 2011; Gupta 2012), literature is scant on the intermediate institutions in food systems and even rarer on fish commodity chains. We bridge this gap by paying attention to movement in the Vanagaram wholesale fish market. The critical position of this mid-segment can be understood from the fact that 30–40% of the cost of food is added here (Reardon 2015).

Previous studies of food wholesale markets have focused on the role of local authorities (Rousseau et al. 2020), freight movements and logistics (Aljohani and Thompson 2018), information management (Giulioni and Bucciarelli 2011; Galle-gatti et al. 2011), evolutionary structure (Ahmadi-Esfahani and Locke 1998; Yagi 2012), market interdependencies (Engelseth 2016) and variations in institutional architecture (Sapio et al. 2011). We differ from the above by our interest in the role

¹ See “[Vanagaram’s Contribution to Food Security for Chennai’s Poor](#)” section (footnote 8) for a discussion of categorization in terms of price.



wholesale markets play in facilitating, or obstructing, the food security and nutrition of the poor.

The World Food Summit (1996) formulated the following definition of food security: “Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.” In continuation of this definition, FAO (2006) distinguished four dimensions of food security and nutrition—availability, access, quality (utilization), and stability—to which agency and sustainability have recently been added (HLPE 2020). We will adhere to the original—and still relevant—set of four dimensions in assessing the relevance of Vanagaram wholesale market for food security and nutrition in Chennai and its periphery.

Research Methods

The paper derives from a 4-year research project with the acronym Fish4Food funded by the Netherlands Organization of Scientific Research (NWO-WOTRO 08.250.303), which aimed to understand the contribution of low-priced fish to urban food security in comparative perspective. Besides obtaining an in-depth, ethnographic understanding of market operations, the Vanagaram study strove to estimate the quantities of fish passing through the market, as well as their species composition and pricing. Such figures are not available from secondary sources. The research team therefore designed two surveys aimed at mapping the geography and volume of inflow as well as outflow of fish to and from Vanagaram. The inflow survey defined three 7-day time slots, positioned at 4-month intervals and in different seasons of the year, when weather conditions and fish harvest patterns in Tamil Nadu change:

- 28 April 2018 to 4 May 2018 for the post-monsoon season (February–May).
- 25 to 31 August 2018 for the pre-monsoon season (June–September);
- 29 December 2018 to 4 January 2019 for the monsoon season (October–January).

For the duration of these three 7-day time slots, the fish inflow into Vanagaram was exhaustively monitored through counting the number of boxes held in all incoming vehicles (disaggregated by species, geographic origin and price levels) with crucial support being obtained from market employees as well as research assistants. The outflow to local retail markets was subsequently assessed through a 1-day survey in November 2019 among traders procuring fish from Vanagaram wholesale market and then dispersing to various retail markets and city neighborhoods. While the quantities mapped in this outflow survey cannot be interpreted as representative for the full year, given the one-time snapshot methodology, we are confident that it provides a solid indication of the distributional patterns of low-priced fish leaving Vanagaram as the trader population in Vanagaram is relatively stable and tends to supply the same retail markets over time. The outflow survey included 459 retail traders selected through a stratified sample design out of an estimated population



of 3000 traders. In addition to these two surveys, during 2017/2018 the team carried out a survey of fish consumption patterns in four low-income neighborhoods of Chennai ($N=120$ households, surveyed each at three instances spread across the year), which is extensively described in Jyotishi et al. (2021). This survey is not discussed in detail in this paper but provides important background information, which we make use of. By connecting these various sub-studies, a comprehensive understanding on the role of Vanagaram wholesale market in supplying fish to the urban poor is constructed.

Urbanization and Food Security Challenges in India

According to the multidimensional poverty index (UNDP 2019), 19.3% of India's population is vulnerable to multidimensional poverty, defining it as one of the poorest regions of the world. With an urbanization rate of 34% (World Bank 2019), poverty in India has also urbanized. In line with its poverty status, India scores badly on the Global Hunger Index, where it occupies the 101st position (out of 116 countries).² Malnourishment among children and adults is severe, while nutritional and health challenges are expected to worsen in coming decades (Ritchie et al. 2018). While Tamil Nadu, where our research is situated, is performing relatively well, still an estimated 11% of people are living below the poverty line.³ Added to this, 23.5% children in the state are underweight, nearly 20% children are stunted and about 45% women in the age group of 15–49 are anemic.

Chennai (previously Madras) is India's fourth largest city; its metropolitan area counts almost 9 million inhabitants, of whom approximately 29% live in over 2173 slum areas distributed throughout the city.⁴ The city has expanded greatly in the past decades by means of natural growth, immigration as well as administrative reorganization. The Chennai Metropolitan Area currently covers 1189 km².

The development of infrastructure such as a ring road, which is linked to a grid of national highways, has come about with the expansion of the city. Chennai is also well-connected to other parts of India by rail. As we shall see below, road and rail transport are of great importance for the functioning of fish wholesale markets and the provision of low-priced fish in the city.

² See <https://www.globalhungerindex.org/ranking.html> (accessed 9–11-2021).

³ https://www.niti.gov.in/writereaddata/files/SDG_3.0_Final_04.03.2021_Web_Spreads.pdf (accessed 9–11-2021).

⁴ The percentage of slum dwellers derives from the Census 2011, which refers not to Chennai Metropolitan Area but to Chennai city. More recent figures are not yet available. For more information on Chennai's slums see Saharan et al. 2018.



The Contribution of Fisheries to Indian Food Security

India's coastline is approximately 6000 km in length and counts more than 3000 fishing settlements, one for every two kilometres of strand (CMFRI 2010). As its east and west coast have differing environmental circumstances and fishing seasons, the geographical pattern of fish landings—to which we return below—is varied. Production has increased, and India is now the second largest fish producing nation in the world (FAO 2019), passing the 10 million tonnes/year threshold in 2015. The country is therefore capable—besides exporting large volumes—of largely meeting its own domestic demand, as fish imports constituted a mere 0.5% of total production in 2012. The average inhabitant of India consumes approximately 5.1 kg per capita per year. This relatively low figure hides the fact that there are major geographical and cultural differences with regard to fish consumption in the country. Fish eating households consume on average 12 kg per capita per year (Scholtens and Jyotishi 2019) with considerable variation across states as well as rural and urban areas (Anneboina and Kumar, 2016). Chennai—and Tamil Nadu in general—are counted among the regions where fish consumption is relatively frequent and common. A study on fish consumption in Chennai's poorer neighborhoods demonstrates that more than 90% of the households consumes fish at least two times a week (Jyotishi et al., 2021). Whereas freshwater species constitute a large part of India's fish consumption, in Chennai marine fish dominates the plate, and nearly 80% of the sampled low-income households indicate never consuming freshwater fish (Jyotishi et al. 2021).

Positioning the Vanagaram Wholesale Fish Market in Chennai's Food System

Chennai, situated along the Bay of Bengal, is an important fish production, distribution and consumption hub. Supply derives from the local fishing harbor, known as Kasimedu, as well as from the string of fishing villages that line the coast. In addition, large quantities of fish are brought into Chennai from other states situated on the west and east coasts of India. Fish in Chennai are distributed to consumers through an estimated 467 markets (see Table 1) spread throughout the Chennai Metropolitan Area as well as the districts that belong to the so-called Urban Agglomeration Area. These markets can be categorized as wholesale, retail and street markets based on their primary function.⁵ While the wholesale markets play an important supply function for retail as well as street markets, the latter also receive fish directly from nearby landing centers. To complicate the picture, the wholesale markets

⁵ Wholesale markets play a key role in the debulking process (see Hapke 2001), in which fish is sold to an intermediary before it reaches the consumer. Retail markets serve consumers directly. Street markets also function as retail markets but are distinguished from retail markets by their informal status. Whereas retail markets occupy officially designated space, street markets are informal clusters of vendors congregated on the street side.



Table 1 Operationalization of the four pillars of food and nutrition security for analyzing fish commodity chains

Four pillars of food and nutrition security	Operationalization for fish commodity chains analysis
Availability of sufficient quantities of food of appropriate quality, supplied through domestic production, imports or aid	Quantities of fish available in a particular locality
Accessibility: People’s ability to acquire adequate amounts of food by way of self- production or purchasing of foods	The extent to which fish is financially affordable and physically accessible
Utilization: ability to utilize accessible foods in terms of bioavailability, nutrition security, sanitation, and food safety	The quality of the available fish products, in terms of micronutrient content and absence of contaminants
Stability: available food and access to food at all times, despite economic or environmental crisis and seasonal food insecurity	The extent to which fish is consistently available and accessible throughout the seasons. The resource sustainability dimension is beyond the scope of this paper

Source [FAO \(2006\)](#) and authors

Table 2 Fish markets in the Chennai Metropolitan Area (2018)

Type of market	North	Central	South	Total
Wholesale markets	2	3	1	6
Retail markets (formal)	16	9	36	61
Street market (informal) ^a	100	120	180	400
Total	118	132	192	467

^aThe figures on the number of informal street markets are estimates, based on the conservative assumption that each of the 200 municipal wards in Chennai contains at least two informal street markets
Source authors’ fieldwork

include significant numbers of vendors selling directly to consumers, while retail markets sometimes also have a wholesale function. In addition, there are numerous vendors who sell from door-to-door and would not necessarily appear in the market places identified in [Table 1](#).

It should be noted that of the six wholesale markets, only two (including Vanagaram) specialize exclusively in fish, whereas the others also handle other agricultural commodities. All six wholesale markets are managed privately, although the land on which the markets are located is leased from different owners. The two specialized fish markets deal only in fresh fish, whereas the other markets also include the sale of dried fish ([Table 2](#)).

The Origins of Vanagaram Wholesale Fish Market

Until 1991, the Chennai city region was served by a handful of fish wholesale markets situated in the heart of the old colonial city, such as Chintadripet and Saidapet,



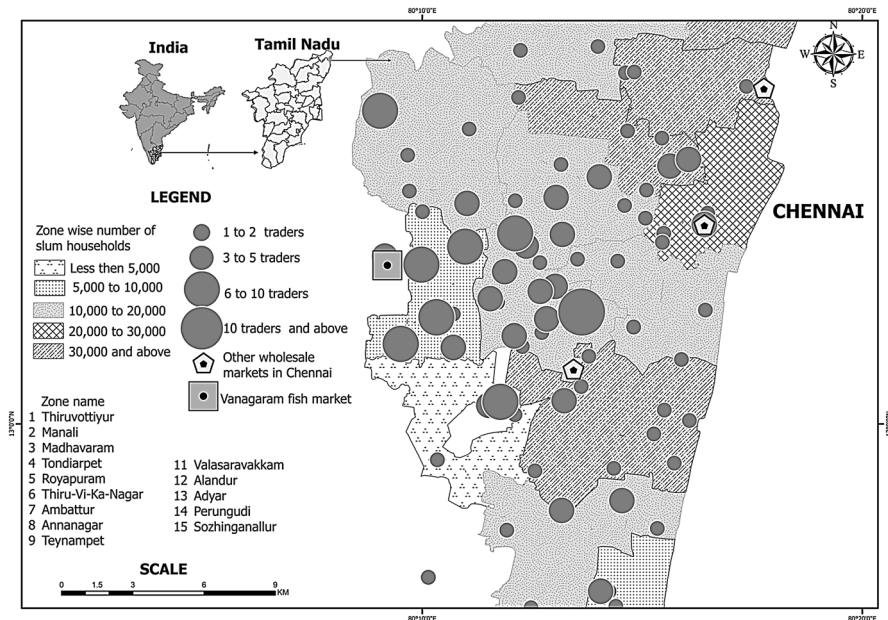


Fig. 1 Outflow of fish from Vanagaram to retail fish markets and zonal slum populations (absolute number of households) in Chennai Metropolitan Area. Source for fish distribution: authors' outflow survey and other fieldwork data. Source for slum populations according to administrative zones: TNSCB 2014: 71. Credits for map: Shivakumar Nayaka.G

(see Fig. 1). In addition to these wholesale markets, vendors brought fish directly from landing centers in or around the city to the various retail markets or, via mobile vending, directly to consumer households. With the growth of the city and waxing urban demand, more fish came to be shipped into Chennai from other parts of India, largely by rail. The Chintadripet and Saidapet markets, which are located in congested parts of the city, were unable to handle this influx, as a result of which the Chennai Municipal Corporation, making use of the Town Planning and Country Planning Act 1971 and Madras Metropolitan Plan 1971–1991, began to consider other possible sites. In the meantime, informal distribution centers for fish from other states began to emerge around Wall Tax Road, conveniently located next to Central Station, as well as in adjacent sites at Nehru Stadium and Moore Market. Bavinck (2001) documents how the fisher and trader associations of Kasimedu fishing harbor protested against the latter development, which was viewed as unwanted competition. It was only after the tsunami of 2004, however, that sufficient political momentum arose for a new, private wholesale market in the neighborhood called Maduravoyal. This location was considered suitable as a larger proportion of the fish brought into the city from other states was now arriving by road in comparison to rail. Maduravoyal is located close to National Highway 45 and the ring road, and therefore, considered appropriate for the role of wholesale distribution. But soon after, when the Maduravoyal river required dredging, this wholesale market shifted to its present location in Vanagaram.



Individual entrepreneurs have played an important role in the expansion of wholesale markets in Chennai. The key figure with regard to Vanagaram fish market was a one-time liquor merchant,⁶ who also participated in the Maduravoyal venture. This entrepreneur leased a 1.5-acre plot (approx. 6000 m²) from a local landowner, obtained permission from the municipal authorities, and created a basic market infrastructure, which was inaugurated on April 8th, 2006. He continues to be the very-much-hands-on director of the Vanagaram market, which he has dubbed in English 'The Chennai Fish'. This title adorns the single-entry gate as well as its vehicles.

At the time of fieldwork, Vanagaram was by far the largest of six wholesale markets serving the Chennai Metropolitan Area (for the location of these markets, see Fig. 1). Three quarters of its sales stock arrived from other states by truck, the remainder from other parts of Tamil Nadu, including Kasimedu, while its customer base—retail vendors as well as individual consumers—originated from the wider vicinity of Chennai.

Vanagaram market has a single-entry gate and is enclosed by a high compound wall to discourage unwanted transgressions. Besides parking spaces, where much of the wholesale trade takes place, it includes a large building with 55 numbered retail stalls and 2 more at the entrance. The manager calculates that 65 wholesalers make use of his facilities, with almost all of them also operating a retail stall on the Vanagaram market premises. A third of this number make up the market elite in the sense that they dominate market transactions.

Market operations commence at 1 a.m. when the first trucks arrive and continue well into the day. Employment figures provide an impression of the magnitude of operations: on an average day Vanagaram provides direct employment to market cleaners (50), parking attendants (20), a box management team (30), tax collectors (5) and managers (2). In addition to those directly employed, indirect employment is provided to approximately 3000 small-scale traders who purchase fish in Vanagaram market for sale elsewhere in the city, as well as to approximately 750 fish cutters and carriers. Male traders transport fish to their destinations by bicycle, motorcycle, three-wheeler, mini-truck or mini-van. Women traders generally arrive by means of collectively rented vehicles or, occasionally, on foot.

Vanagaram fish market is busiest on Saturdays, Sundays, and Wednesdays, when consumers in Tamil Nadu prefer to buy and consume fish. Its pulse changes according to the pattern of Hindu ritual days and monsoon seasons, which depress or encourage fish consumption. The volume and intensity of trade activities therefore varies almost on a daily basis. According to our respondents—both vendors as well as low-income consumers—the weekly consumption pattern in Chennai is as follows: 2–3 days fresh fish, 2–3 days vegetables, 1 day other animal protein (egg, chicken, beef etc.). This pattern is validated by instructions commonly posted in Hindu temples as well as by texts added to wall calendars.

⁶ The owner originally worked in partnership with another businessman, from whom he soon split. This former partner went on to open another fish wholesale market in Pallavaram.



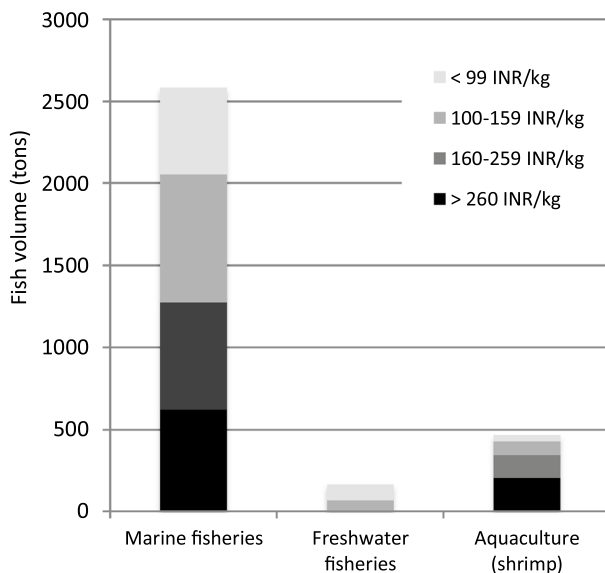


Fig. 2 Volume of fish (3 sample weeks) handled in Vanagaram fish market by sub-sector. Source: Authors' inflow survey, total of three one-week time slots

Borrowing from practice in other marketplaces of India, the owner of Vanagaram market has established his own excise system and system of control. Wholesale traders bringing fish into the market pay a tax (2018 rate: Rs 10) for each box, irrespective of the species it contains. They also pay monthly rent for their stalls. Small-scale traders purchasing fish in Vanagaram market pay a small parking fee for their vehicles. From the amassed revenue, the owner pays rent for the land, the cost of facilities, as well as salaries for his staff. The rates wholesale traders charge per box of different kinds of fish vary from day to day and are set by the market owner in consultation of the largest wholesale traders. While profit maximization is of course an important objective, the owner is also concerned to maintain the market's attractiveness to small-scale traders such as through keeping prices relatively low.

Vanagaram's Contribution to Food Security for Chennai's Poor

Having sketched the contours of wholesale market activity in Vanagaram, we now consider the contribution of this market to availability, accessibility, stability and quality of fish for poorer urban populations.

Availability

The variety of fish brought into Vanagaram is large, reflecting both seasonality of landings as well as the preferences of consumers in Chennai metropolitan area.



Vanagaram fish market thus receives fish from different sectoral sources: marine capture fisheries, freshwater capture fisheries (inland rivers and lakes), and aquaculture industries from various parts of India. Figure 2 presents the inflow from these three sources, defining four price categories: expensive fish (> 259 INR/kg); medium priced fish (160–259 INR/kg), low-priced (< 100 –159 INR/kg) and very low-priced (< 99 INR/kg) fish.⁷ During the three sample weeks, the total inflow of fish into Vanagaram amounted to 3213 metric tonnes, averaging approximately 150 tonnes per day. Extrapolating this figure to the full year suggests a total annual through-flow of approximately 55,000 tonnes. Given Chennai's population of approximately 9 million, Vanagaram would then supply the average inhabitant with an impressive 6.1 kg of fish per year. As Chennai hosts a significant vegetarian population, the average figure per fish-eater is probably even higher.

Figure 2 demonstrates that the lion share of fish arriving in Vanagaram market derives from marine sources, with aquaculture (mostly prawns from Andhra Pradesh) forming the next important source and freshwater fish closing the ranks. Figure 3 provides a breakdown of the inflow of fish according to species. We have grouped the total of 64 different species being offered for sale in the market into eighteen categories, each of which represents a significant segment of total volume (the category of 'other marine' aggregates a variety of species that had a total inflow below 50 tonnes during the three timeslots of study). The figure points out that certain species are very well represented in Vanagaram: aside from prawn (sp. *Vannamei*) from aquaculture in Andhra Pradesh, we find particularly large quantities of Indian mackerel, sardines, and red snapper passing through this market. A major part of the latter fits into the two lowest price categories.

Accessibility

Our discussion of the accessibility of fish distributed from Vanagaram to the urban poor of Chennai has three dimensions. The first is the physical accessibility of Vanagaram market both for heavy inter-state transport vehicles, as well as for retail vendors and urban consumers. The second concerns the affordability of fish for people with low incomes. Finally, we look into the distribution of fish from Vanagaram to

⁷ We established the fish price categorization as follows. A fish consumption survey ($N=323$) among poor households in Chennai (Jyotishi et al. 2021) demonstrates that the majority of households (73%) purchased 1 kg of fish per week, for which their median expenditure was 100 INR (average 146INR). One kg indeed is a typical quantity required to prepare a meal for a household feeding 4 or 5 members. These findings resonate with India's food security and nutrition report (MSPI and WFP 2019), which suggests that the poorest 30% of India's urban population spends 9% of their income of 950 INR/month on animal protein, implying that poor households (with 5 members) have approximately 100 Rs/week available for purchasing animal protein. Such expenditure is assumed to be dominated by fish, since other sources like chicken are more expensive (160 INR/kg during fieldwork period). We therefore derive that fish priced below 100 INR/kg is generally affordable to poor households. Fish between 100 and 160 INR/kg is still relatively low in price, with 160 INR/kg being also the median fish price in the Vanagaram market. Fish above 160 INR/kg can be considered relatively expensive and is also more substitutable with other animal protein sources.



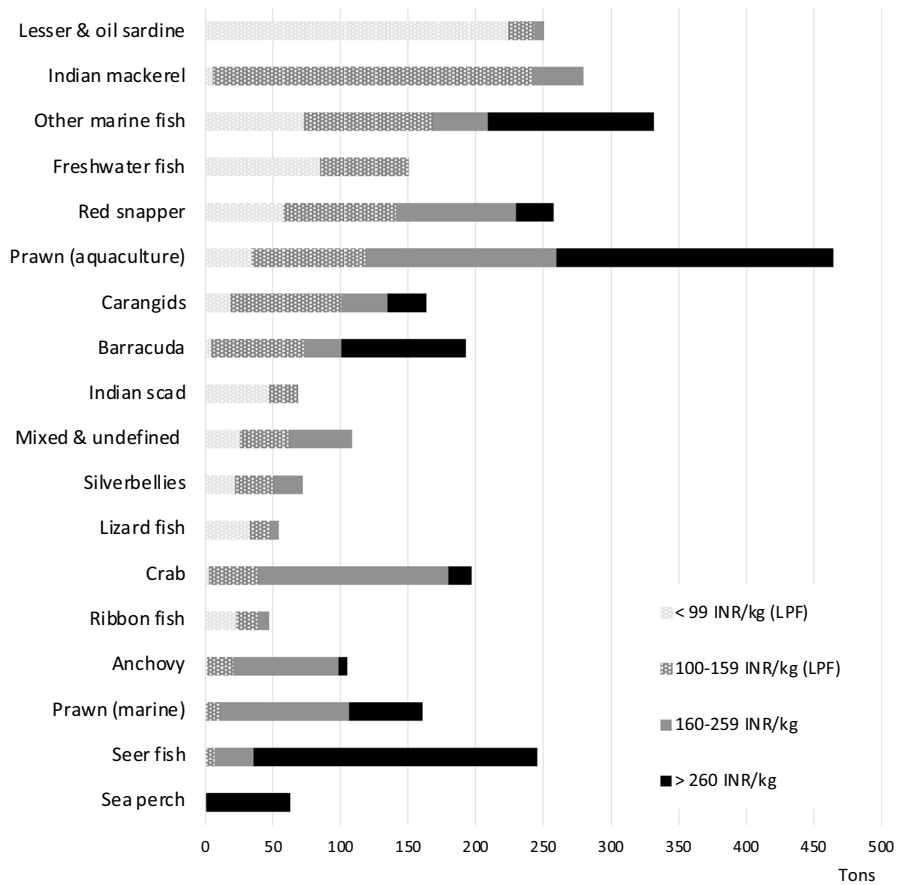


Fig. 3 Volume of fish handled in Vanagaram wholesale fish market by species and price. Species are ranked by the total volume of the two lower price segments in descending order (i.e. sardines ranks on top in terms of total volume of low-priced fish). Source: Authors’ fish inflow survey, total of three weeks over three seasons

different neighborhoods and retail markets of Chennai, thereby addressing the question whether retail traders are actually reaching poor consumers.

Vanagaram has rapidly gained popularity among wholesale traders importing fish into Chennai, as well as among retailers and consumers. It is easily accessible for trucks coming from all over India and provides retailers and local consumers with reliable supplies and cheap products. These advantages gain particular relevance in comparison to other wholesale markets in Chennai, which are known for their physical inaccessibility. The fact that fish in Vanagaram is known to be relatively cheap compared to other wholesale markets, is related to the above. Figures 2 and 3 demonstrate that what we have defined as low-priced fish (<160 INR/kg) constitutes almost 50% of the annual inflow into Vanagaram. Figure 6 and 7, moreover, which we discuss below, present evidence that a number of coastal states supply a large



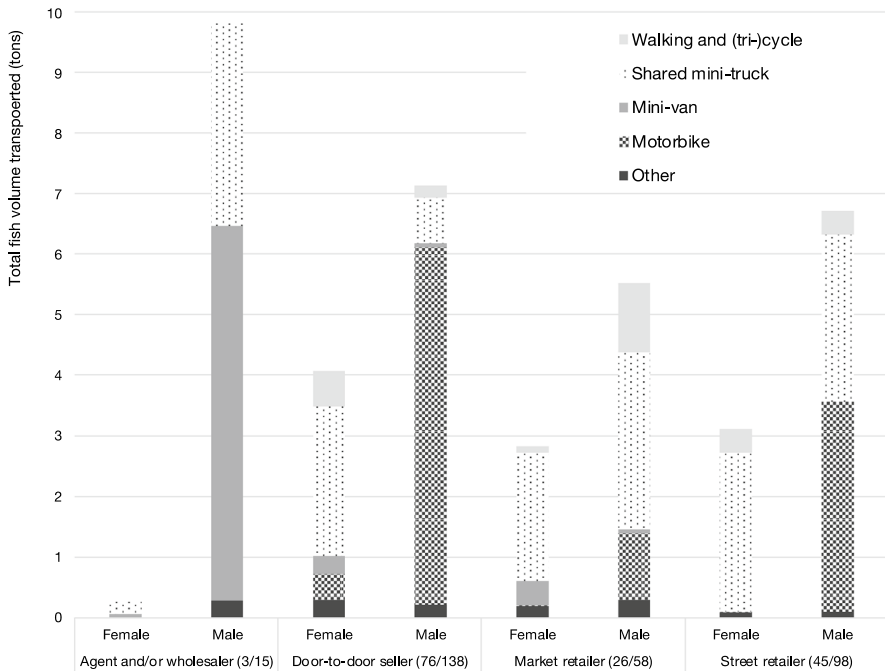


Fig. 4 How and by whom is Vanagaram's fish distributed? ($N=459$). Source: Authors' outflow survey. Note: The figures within parentheses of the X-axis represent the number of female and male traders respectively in the given category

variety of low-priced fish species to Chennai, and that wholesale traders actually view such trade as lucrative and worthwhile.

The figures further demonstrate that the majority of low-priced fish is marine (82%), the remainder coming from freshwater (10%) and aquaculture (8%) sources. Slightly more than half (51%) of marine fish belongs to the cheaper two categories, compared to only 22% of fish from aquaculture. It is thus particularly the marine fish that makes a potentially important contribution to the accessibility of seafood for the lower income urban population. We have noted that some species are generally low in price (e.g. sardine and mackerel), and some species are generally high in price (e.g. seer fish and perch); for many species significant price fluctuations do occur, resulting from seasonality, daily supply, size and freshness. This means that one cannot conclude that certain species are by disposition fixed in a certain price category. From another study (Jyotishi et al. 2021) among the low-income consumers in Chennai and elsewhere, we have identified the species preferred by these consumers and the amount of money they usually spend in procuring fish. Connecting price and preferred species, one can identify the importance of marine small pelagic fishes, especially sardine and mackerel, for the food and nutrition requirements of the poor consumers.

In “Positioning the Vanagaram Wholesale Fish Market in Chennai's Food System” section above we have pointed out the large number of retail traders who



procure their supplies from Vanagaram for distribution and sale in various parts of Chennai. Making use of the results of our 1-day outflow survey in November 2019, Fig. 4 provides insights into the roles of different kinds of traders who frequent Vanagaram market. It suggests, first of all, that the wholesalers and agents procuring fish in Vanagaram for resale to retail vendors almost wholly consist of men.⁸ While men also play a strong role in the retail sector in Chennai, women are well-represented among retail market and street vendors. Note that a significant number of traders still arrive by foot or bicycle.

Figure 1 provided an indication of the geographic distribution of fish from Vanagaram market. It demonstrates firstly that the traders procuring fish for resale serve consumers in a wide range of locations within Chennai Metropolitan Area. Not only do they cover most parts of the city, they also venture beyond its boundaries into the peri-urban area. The overlay map (see Fig. 1) points out that slum populations are found in all administrative zones frequented by the traders. The fact that Royapuram zone, which has the highest slum population in the city, is barely covered by traders from Vanagaram, is probably caused by the proximity of Chintadripet wholesale market Kasimedu fishing harbor and the trader groups that serve adjacent slums from these locations.

Now let us return to the question of whether the low- and very low-priced fish, such as distributed from Vanagaram market, is accessible to the urban poor. Our survey staff asked traders how frequently, if at all, they sold their produce to various proxy-categories of poor urban people. Quite impressively, responses point out that 74% of the traders suggest they regularly or often sell fish to either migrants, people qualified as scheduled castes, or slum residents—three unambiguous proxies of Chennai's urban poor. An even higher percentage (89%) of traders sell their fish frequently or regularly to people 'living in small houses'. These figures did not differ significantly between types of trader, or their gender. While we do not possess data on the prevalence of each of these proxy-categories in Chennai as a whole, these data do suggest that fish traders from Vanagaram market disproportionately supply poor households in Chennai.

Quality

We have pointed out the nutritional value of fish in “[Theoretical Positioning](#)” section above, noting that small pelagic species of fish, which tend to be cheaper, often possess additional nutritional advantages. Such advantages, however, may be offset by factors that impose negatively on the quality of produce sold. Lacking scientific information on the nutritional properties and hazards of fish procured in Vanagaram, we cannot, however, draw unequivocal conclusions on the quality of fish sold and purchased there. Instead we provide circumstantial evidence on the topic.

⁸ This is consistent with other studies of fish market systems in India in which it is observed that men tend to dominate the upper echelons of market systems even when women traders are more numerous. Men also tend to dominate in large wholesale markets while women traders frequent smaller wholesale markets or beach landing sites to procure fish (see for example, Hapke 2001).



Fish landing sites and markets in India do not have a particularly high reputation in terms of hygiene (Ganesh et al. 2008),⁹ and a lack of hygiene is known to affect the nutritional quality of fish products and introduce health risks too. Transportation over long distances may induce spoilage. Chemical adulteration too produces health risks. Thus a scandal over fish treated with formalin¹⁰ erupted in India in July 2018, disrupting fish markets all over the country including those of Chennai.¹¹ At the time, customers in Vanagaram market expressed concern to the researchers about adulteration that might have taken place at the landing site or *en route* to the market.

Compared to fish originating from nearby coastal waters, Vanagaram fish also does not have a particularly impressive reputation in Chennai. Locals tend to contrast what they call the ‘ice fish’ available in Vanagaram with the ‘fresh fish’ from local landing sites, suggesting that the former is lower in quality. Long term residents of the city therefore tend to have a preference for locally landed fish, which, however, is often more expensive than the fish sold in Vanagaram. The small-scale traders consulted in our outflow survey, however, point out that while fish sold in Vanagaram may be less fresh than locally caught fish, the quality remains sufficient.

Stability

We have noted above that, other than in aquaculture, where production levels can to a large extent be controlled, marine capture fisheries are susceptible to seasonal vagaries. These have implications for the regular availability of fish in Vanagaram market and thus for the stability of fish supply. Seasonality follows from various natural as well as human conditions. Thus, wild fish species have migration patterns that influence the possibility of their capture. The seasonal variations in wind, rain and current too play a role, such as through preventing or facilitating the ability of fishers to leave the harbor. The monsoon system, which plays out in different months along the east and the west coasts of India,¹² is an important marker of such seasonal variation. Industrial waste and pollution too constitute disturbances in fish availability.

The natural variations that occur in line with monsoons are punctuated by a government ruling that prohibits most marine fishers from operating between 15th April to 14th June (61 days) along the east coast, and a similar ruling—but implemented between 1st June to 31st of July (61 days)—along the west coast. This temporal closure of the fishery is motivated by reference to the needs of conservation. The fluctuations that result from the closed seasons influence the quantities of fish available

⁹ Also see, for instance, the statement made by the director of the Food Safety and Standards Authority of India (FSSAI) that hygiene in fish and meat markets is a “complicated issue” and “not good”, and that FSSAI will soon start hygiene rating of vending locations (Outlook India, Feb 17, 2020).

¹⁰ Formalin prevents decay and lengthens the shelf-life of fish.

¹¹ <https://www.thehindu.com/news/cities/chennai/fish-samples-in-chennai-test-positive-for-formalin/article24367321.ece>, accessed Dec 13, 2019.

¹² India’s climate is characterized by a monsoon system in which the southwest (SW) monsoon hits between June and September and the northeast (NE) monsoon dominates from October to December. The Tamil Nadu coastline is most affected by the NE monsoon.



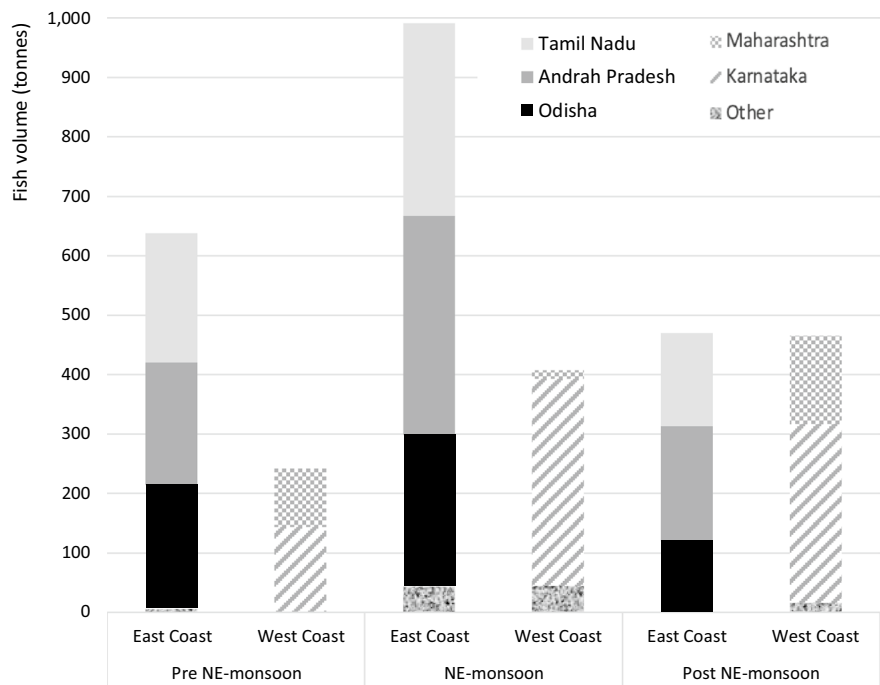


Fig. 5 State-wise origin of fish in Vanagaram wholesale fish market by season. Source: Authors’ inflow survey

in Vanagaram market but are—as we shall see below—to a large extent compensated by importing fish from other states.

Figures 5 and 6 provide an overview of the geographical origins of fish available in Vanagaram market by season and price. Note that the closed season that is implemented along the west coast of India coincides with Tamil Nadu’s pre-monsoon season; the closed season for the east coast corresponds with the post-monsoon.

Figure 5 points out that the availability of fish in Vanagaram wholesale market is highest during the northeast monsoon season and drops the post- and pre-monsoon periods. Figure 6 demonstrates that only 22% of the fish brought into Vanagaram derives from Tamil Nadu itself, the remaining 78% arriving by road and rail from landing centers and aquaculture farms as far as 1350 km north-east (Odisha) and 1250 km north-west (Maharashtra) of Chennai. Small quantities arrive from even more distant states like West Bengal and Gujarat. The inflow from other states thus greatly outranges the inflow occurring from landing and production sites in Tamil Nadu—a consequence of the specific position that Vanagaram market occupies in the overall play of local supply and demand.

Figure 6 also shows that the inflows from any one state in India vary from season to season in the year. Thus, Karnataka turns out to be a main supplier in the post-monsoon season, but its supply function reduces dramatically in the pre-monsoon season, coinciding with the west coast fishing ban. Most significantly, at the time of the east coast closed season the contribution of fish inflow from the west coast



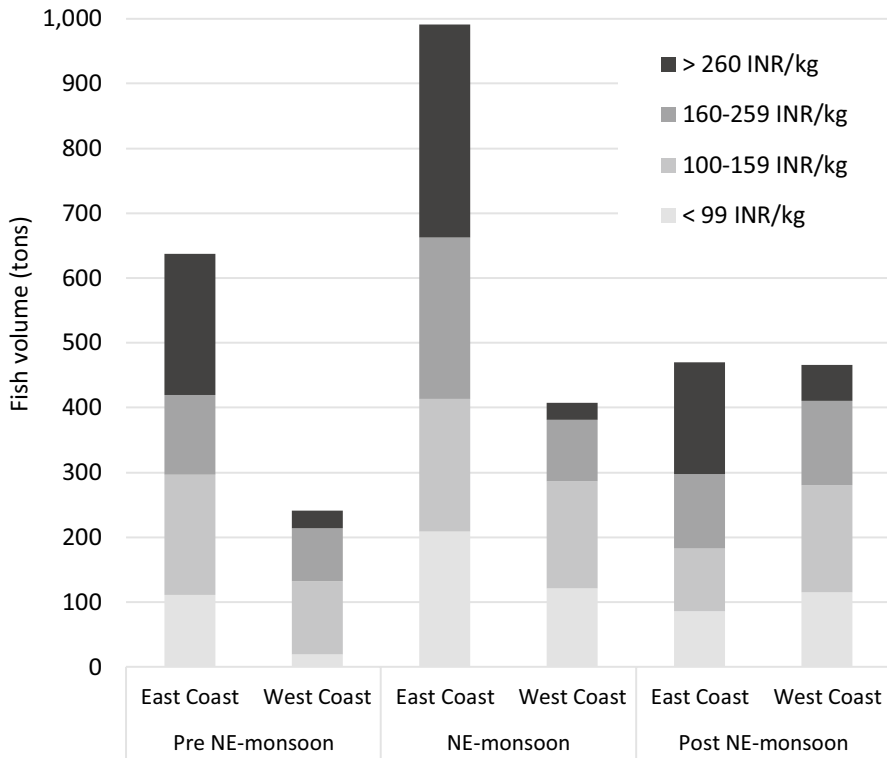


Fig. 6 Regional origins of fish in Vanagaram wholesale fish market by season and price. Source: Authors' inflow survey

increases to 50%, indicating the high level of national integration of the Indian fish market. It also shows the capacity of Vanagaram to compensate at least to some extent for local fluctuations in supply. Significantly, Fig. 6 also demonstrates that low-priced fish is apparently available in large quantities throughout the year and supplied from different states. The west coast provides 34% of the total inflow but is particularly relevant for the poor as the majority of this flow (63%) belongs to the cheaper two categories of fish (consisting largely of sardine and mackerel). During the post-monsoon season, no less than 65% of all low-priced fish is brought in from the west coast, indicating Vanagaram's vital buffering function, stabilizing the availability of affordable fish for poor households in Chennai.

Discussion

This paper has striven for a better understanding of the role fish wholesale markets play in meeting the food security and nutrition needs of poor, urban populations in the Global South. It has done so through a case study of one particular wholesale



market in Chennai, South India. This choice was justified through reference to the locus of poverty and malnutrition in South Asian cities and the contribution that fish makes to food and nutrition security. We have taken a food system approach, highlighting the role of intermediate institutions such as wholesale markets. Wholesale markets have received remarkably little attention in the scholarly debate on food security and nutrition.

Our study demonstrates that wholesale markets like Vanagaram constitute a significant node in urban fish market systems, ensuring conditions for food security and nutrition for a city's poorer inhabitants. Through such markets, supplies of fish from all over India reach urban consumers. This particular market, as do many fish wholesale markets in the region,¹³ serves a cross-section of the city's population, thereby including the poor: a very large proportion of the fish passing through Vanagaram is actually destined for this market segment. A mass of local vendors subsequently conveys the fish to the city's retail markets, where it is transferred to local buyers.

The success of Vanagaram does not mean that there is no unevenness in its supply function. Although the flow of fish is continuous and there is scarcely a day that business is low, variations in climate and available produce inevitably reflect in market operations. This is most obvious at a seasonal level. Although overall quantities may then be less, price levels generally remain affordable. The main problem with wholesale markets like Vanagaram therefore seems to be the third dimension of food security, namely the assurance of fish quality and hygiene, with important effects particularly on poorer consumers. After all, lower quality fish generally fetches lower prices, with deteriorating or adulterated fish ending up more frequently than not on the plates of poor people.

Our conclusions must, however, be qualified for two reasons. The first is that, while Vanagaram is the largest fish wholesale market of the city, it is not the only source of fish supply. With other sources of supply available, we have therefore not been able to construct a complete picture of the relation between the supply of low-priced fish and the impoverished local consumer in Chennai. Secondly, while we have made a thorough investigation of the operations of Vanagaram market and have also obtained a good impression of the extent to which poorer inhabitants of the city procure fish, our understanding of how low-priced fish moves from the wholesale market, through multiple retail markets, to poor households and the diets of its various members remains inconclusive. Additional research on such links is therefore essential.

A final point of attention is the relationship between Vanagaram wholesale market and governmental food policy. We noted the relationship between the growth of the city and the need for new wholesale market structures. We also pointed out that in this particular situation, private entrepreneurs have played a crucial role in the realization of the new wholesale market. They could do so, however, only

¹³ The literature on this aspect is too scant to assert this strongly. However, the authors' own observations in various coastal and inland wholesale markets including Mangalore, Bangalore, Thiruvanthapuram, Kochi, etc., and their interactions with other researchers and practitioners in these and other markets including Mumbai, Goa, reaffirms the statement.



with cooperation of the municipal authorities, whose role in the process remains unclear. As Aljohani and Thompson (2018) point out: “[l]ocal authorities in many urban areas have implemented policies to relocate various facilities and services [like wholesale markets] away from dense and crowded inner areas” (ibid.: 279). Rousseau et al. (2020) add to this by noting that urban food policies are sometimes contradictory, resulting in controversial reforms of the wholesale markets. These authors therefore plead for: “a detailed analysis of the roles of the different actors involved at different scales of government” (ibid.:8). In line with this recommendation, a consideration of how fish wholesale markets fit into Indian food policy would be worthwhile.

Conclusion

Food security and nutrition are crucial matters for poor people in developing countries. It is for this reason that HLPE (2017a, b) looks into expressions of extreme food and nutrition insecurity, as represented by malnutrition in all its forms, and Sustainable Development Goal 2, which refers to the objective of ‘zero hunger’. Fish, and other food from the ocean, are argued to have the potential for a much more significant food provisioning role, also because of seafood’s nutritious properties. ‘Small and low-price fish’, being the variety the poor rely on most, are actually proven to be one of the most nutritious. It is for these reasons that further investigations on the way in which fish currently serves the poor is of great importance.

Urban sites gather poverty in particular locations and often require bulk food system approaches for addressing prevalent food security and nutrition needs. The food systems that service them are characterized by perishability and large irregularities in supply. The improvement of transportation networks in many developing countries has, however, provided for new solutions. On the basis of an in-depth study of the functioning of one seafood wholesale market in a coastal city of the Global South, we suggest that such markets play important intermediate roles in the food system, ensuring that low-price seafood is made available to low-income populations throughout the year. While further studies will have to prove whether our findings are generalizable to other urban settings, the increasing integration of national fish markets are visible across the major fish landing sites suggesting fish from various landing sites cater to numerous wholesale markets in the city regions.¹⁴ City region wholesale markets in particular are favored due to economies of scale. The diversity of fish species, seasonality of availability, preferences also play an important role in making fish available from dispersed locations. While middle and high-income consumers can have more choices of procuring fish including rapidly growing online retailing, these wholesale markets coupled with small-scale traders serve a large segment of poor consumers.

¹⁴ http://eprints.cmfri.org.in/8796/1/Marine_Fish_Marketing_in_India.pdf (accessed 9–11-2021).



Epilogue

Following completion of this paper, the COVID-19 pandemic struck India and a nation-wide lockdown was announced on March 22nd, 2020. In the months thereafter, new lockdowns have been implemented, paralyzing many agro-food markets in Chennai city. While Vanagaram closed down for a whole week at the very beginning of the lockdown period, it has, however, continued to function since. Until April 21st, inflows of fish were limited and prices doubled, also for low-price fish such as sardines, mackerel and anchovies. But in following months the flow of fish from neighbouring states into Vanagaram has recommenced and prices have come down to more normal levels. Our sources contend that Vanagaram has been the only wholesale market in Chennai that has been open at all, albeit in a slightly modified form. First, it is able to function only through informal cooperation of the authorities, such as for allowing inter-state trade. Second, it has been strictly limiting itself to wholesale business, with all retail activities having come to an end. This has created major hardship for small-scale traders, many of whom are women. A new category of motorized traders, originating in places that were previously serviced by other markets, have now entered the field. Many open spaces in the city are now being used for consumer sales of fish. Third, market timings have largely reduced to night-time hours (10 pm to 2 pm), with Sunday trade prohibited. Physical distancing and the wearing of masks on market premises have apparently become a rule.

In September 2021 Vanagaram wholesale market shifted to new premises located within a few hundred meters of the old site. The move was triggered by changes in road infrastructure. There are no reasons to expect that the new wholesale market will be functioning differently than it was before.

How the COVID-19 crisis is affecting the food security and nutrition status of low-income consumers in Chennai cannot be assessed now. With Vanagaram wholesale market having demonstrated resilience during the first phase of the pandemic, the situation in Chennai may be better than originally expected. However, the second wave of pandemic disrupting various supply chain is yet to be assessed.

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Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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