Fish consumption in India: Patterns and trends

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Aquatic Foods

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Citation

This publication should be cited as: Padiyar PA, Dubey SK, Bayan B, Mohan CV, Belton B, Jena J, Susheela M, Murthy LN, Karthikeyan M and Murthy CK. 2024. Fish consumption in India: Patterns and trends. New Delhi, India: WorldFish.

Acknowledgments

This work was undertaken as part of the CGIAR Initiative on Aquatic Foods, funded by CGIAR Trust Fund donors and the ICAR-CGIAR collaboration.

Design and production

Chua Seong Lee, Thavamaler Ramanathan, Sabrina Chong and Rajita Majumdar, WorldFish.

Photo credits

Front cover, pages 11, 14,19, 32, 38, Sourabh Kumar Dubey, WorldFish; page 9, Divya Padiyar.

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CAGR	compound annual growth rate
GDP	gross domestic product
GNI	gross national income
LMICs	lower- and middle- income countries
MER	market exchange rate
NFHS	National Family Health Survey
NNI	net national income
OECD	Organization for Economic Cooperation and Development
PFCE	private final consumption expenditure

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भारत सरकार

Azadi Ka Amrit Mahotsav

भारत सरकार
कृषि अनुसंधान और शिक्षा विभाग एवं
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INTERNATIONAL YEAR OF MILLETS 2023

Foreword

I am truly delighted to announce the collaborative effort of WorldFish, the Indian Council of Agriculture Research (ICAR) under the ICAR-CGIAR research collaboration framework, and other national institutes in unveiling the monograph titled "Fish consumption in India: Patterns and trends." Driven by comprehensive data and illustrious research, this publication endeavors to explore and elucidate the dynamic landscape of fish consumption in India.

India, blessed with abundant aquatic resources and favorable climatic conditions, has long been a pivotal contributor to global fisheries. The aquatic food production sector in India, encompassing marine and inland capture fisheries and aquaculture, stands as a vibrant pillar that sustains the nation, providing nutrition and livelihoods to the teeming millions.

In India, fish stands as a beacon of nourishment, nutrition and affordability for over 70% of the population. It holds a profound cultural, religious and traditional significance within the local food ecosystem, particularly in coastal and riverine regions. Remarkably, fish consumption is surging faster than the global population growth rate, attributed to rising incomes, heightened awareness of its health benefits and the expanding urban footprint. Simultaneously, domestic demand for fish in India is on the rise, positioning the nation as the third-largest consumer of fish in the world by volume. However, per capita fish consumption in India continues to lag behind the global average.

In this context, this document delves into various facets of fish consumption behavior and establishes explicit links between fish consumption and societal and economic indicators. The monograph also projects per capita fish consumption, the demand-supply gap and other critical aspects, offering insights into the future trajectory of the fisheries sector in the country.

I am confident that this monograph will prove invaluable to students, researchers, government organizations, policymakers, fisher cooperatives, private sector players and various stakeholders, facilitating a deeper comprehension of fish consumption patterns in India. It serves as a roadmap to bolster fish consumption in tandem with fish production, fostering the well-being of our nation.

I extend my heartfelt congratulations and best wishes to all the authors for their exceptional contribution to this publication.

November 13, 2023
New Delhi

(Himanshu Pathak)

Essam Yassin Mohammed
Director General &
CGIAR Senior Director of Aquatic Food Systems

Foreword

It is my immense pleasure to announce the publication, "Fish consumption in India: Patterns and trends"—a collaborative endeavor among WorldFish, the International Food Policy Research Institute, and esteemed Government of India institutions, including the Indian Council of Agricultural Research (ICAR), the National Fisheries Development Board of Ministry of Fisheries, Animal Husbandry & Dairying, and the Marine Products Export Development Authority, as well as other leading organizations. ICAR and its affiliated institutes have long been committed partners of WorldFish, and this publication stands as a testament to the unwavering commitment and innovative spirit that define our collaborative work in the fisheries and aquaculture sector.

For centuries, fish has played a pivotal role in the Indian diet. India, a megadiverse nation blessed with an array of aquatic resources, holds the key to unlocking immense potential for transformative growth within the fisheries sector. Fish consumption in India is a nuanced tapestry influenced by geography, climate, culture, religion, and household traditions. It represents a complex interplay of factors that shape consumer choices, behaviors, and the availability and accessibility of fish.

This monograph seeks to unravel the dynamics, patterns and trends in fish consumption, recognizing the diversity across India. The findings of this study underscore the substantial room for growth in fish consumption while shedding light on regional disparities. These insights offer valuable guidance for informed policy formulation and effective intervention strategies.

I believe that this pioneering document will serve as an indispensable resource for researchers and policymakers, empowering them to design well-informed policies and interventions aimed at enhancing the fish consumption landscape in India, particularly in addressing critical challenges such as undernutrition.

As we embark on our journey forward, WorldFish and CGIAR remain steadfast in their commitment to collaboration and the pursuit of scientific innovation in partnership with ICAR under the ICAR-CGIAR research collaboration and One CGIAR global initiatives, especially the Aquatic Foods initiative. Together, we aspire to create sustainable and equitable aquatic food systems in India.

I extend my heartfelt congratulations and best wishes to all the authors for their outstanding contributions to this publication.

Executive summary

India is endowed with rich aquatic resources and favorable conditions that have long made it a significant contributor to global fisheries. The consumption of fish has deep historical roots in the country, with archaeological evidence tracing back to 2500 BCE. Beyond its role as food, fish held considerable trade value in antiquity.

Today, fish remains a cornerstone of the Indian diet, embodying the country's culinary heritage and offering a nutritious and affordable source of food for the people. Apart from being a vital protein source, fish also provides essential omega-3 fatty acids and unique bioavailable micronutrients.

This study investigates the dynamics of fish consumption in India from 2005 to 2021, using comprehensive, nationally representative surveys conducted by the Government of India. It reveals significant growth in fish consumption in India, driven by population growth, increased wealth and shifting consumption patterns. The findings suggest potential for further growth and highlight regional disparities that could inform policy and intervention strategies.

The following results stem from the timeframe under consideration for this study: 2005–2006 to 2019–2021.

Population and economy

- India's population grew 20.7%, from 1.11 billion to 1.34 billion, an increase of 230 million people.
- India's gross domestic product (GDP) doubled from India's per capita gross domestic product (GDP) doubled from INR 53,478 to INR 1,08,645, while private final consumption expenditure (PFCE) tripled, reflecting increased purchasing power.

Fish production

- Fish production in India surged 115%, reaching 14.164 million metric tons, with a compound annual growth rate (CAGR) of 5.63%.
- Domestic consumption of fish accounted for 82.36% of total production in 2005–2006, 86.2% in 2015–2016 and 83.65% in 2019–2020. The rest was used for exports to foreign countries and for non-food purposes within the country.
- Imports of fish and fishery products within India increased 543%, from 14,000 t to 76,000 t .
- Total domestic fish consumption grew 120%, from 5.428 million metric tons to 11.924 million metric tons.

Per capita fish consumption

- According to the FAOSTAT Food Balance Sheet[1] for the year 2020, India holds the global ranking of 129 out of 183 nations in terms of per capita fish food supply[2]. Additionally, in terms of per capita protein supply through fish consumption, India is positioned at 123 worldwide. Notably, India stands out as a noteworthy global contributor to total quantity of protein through fish, securing the 3rd highest position globally.
- Per capita fish consumption increased 81.43%, from 4.9 kg to 8.89 kg, with a 4.05% annual growth rate.
- Among fish-eating populations, annual per capita consumption grew 66%.
- India outperformed the World Bank's lower-middle income country group, with a 60% increase in per capita fish consumption compared to the group's 45% average. However, India's consumption remained lower (8.89 kg) than the group's average (14.94 kg) in 2020.

Fish-consuming population

- India's fish-eating population increased 32.34% (or 6.1 percentage points), from 66% to 72.1%.
- Egg consumers increased 7.35 percentage points, followed by fish (6.1 percentage points), and chicken or meat (5.45 percentage points).
- By the end of the surveys, 5.95% of the population ate fish daily, 34.8% weekly and 31.35% occasionally.
- Occasional fish consumption decreased while weekly fish consumption increased. Fish consumption increased among both genders, with a shift toward weekly consumption.
- Men (78.6%) had a higher fish consumption rate than women (65.6%).
- Urban areas (42.7%) had a higher proportion of weekly fish consumption compared to rural areas (39.8%). However, fish consumption increased more rapidly in rural areas than in urban areas, narrowing the gap.

Spatial distribution of fish consumption

- By the end of the surveys, Tripura had the highest proportion of fish consumers (99.35%) among various Indian states, while Haryana had the lowest (20.55%).
- The eastern and northeastern states, Tamil Nadu, Kerala and Goa had the highest fish-eating populations (>90%), while northern states such as Punjab, Haryana and Rajasthan had the lowest (<30%).
- Kerala (53.5%) and Goa (36.2%) had the highest percentage of daily fish consumers, while Assam (69%) and Tripura (69%) had the highest percentage of weekly consumers.
- Jammu and Kashmir experienced the highest increase (20.9 percentage points) in people eating fish. However, there was decline in fish consumers in Punjab (3.9 percentage points).
- States with lower rates of eating fish had wider consumption gaps between genders and among consumers of non-vegetarian food.

1 https://www.fao.org/faostat/en/#data/FBS
2 Fish is considered as "Fish, Seafood + (Total)"

1. Background and introduction

Fish has been an important part of the Indian diet for centuries. Archaeological evidence suggests that fish was consumed in India as early as the Indus Valley Civilization, which dates back to 2500 BCE (Reeves 2003). In ancient times, fish was not only a source of food but also an important trade commodity. In the current Anthropocene, fish is a healthy, nutritious and affordable food for people in India. It has a high degree of cultural, religious and traditional significance in the local food system, especially in coastal and riparian areas.

In 2019, aquatic foods[3] supplied about 17% of animal-sourced protein globally and constituted at least 20% of the per capita intake of animal-sourced protein for 3.3 billion people (FAO 2022). Even though terrestrial food production systems still dominate global food consumption, the significance of fish as a crucial source of nutrition and food security is increasingly being recognized (Ahern et al. 2021). Fish not only serves as a protein source but also offers essential omega-3 fatty acids and bioavailable micronutrients that are unique to aquatic foods (Ahern et al. 2021).

Worldwide, per capita fish consumption is growing faster than global population growth, reaching a record high of 20.5 kg in 2019 thanks to rising incomes, increased awareness of the health benefits of eating fish, and growing urbanization (FAO 2022). In addition to providing high quality food, fisheries and aquaculture contribute to the economy by producing, trading and marketing both wild caught and farmed fish.

India is a megadiverse country endowed with a diverse range of aquatic resources. Combined with favorable geoclimatic features, these resources provide a suitable environment for a variety of fish and other aquatic organisms, making India one of the largest contributors to global fisheries and aquaculture production. The geographic territory of India is an integral part of the Central Indian Ocean Region, encompassing three distinct marine ecosystem zones: the Arabian Sea, the Bay of Bengal and the Indian Ocean. India is blessed with vast marine water resources, including 2.37 million km^2 of exclusive economic zones with a fisheries resource potential of 7.15 million metric tons from its 8118 km long coastline (GOI 2022). India is also endowed with vast inland water resources, such as 2.45 million ha of tanks and ponds, 280,000 ha of reservoirs, 1.07 million ha of brackish water, 1.36 million ha of wetlands, oxbow lakes and derelict waters, 281,000 km of rivers and canals and 92,000 ha of other waterbodies (GOI 2022). By capitalizing and harnessing these resources, India can unlock its gigantic potential to transform its fisheries sector.

Fish food is obtained from marine and inland capture fisheries and aquaculture. The Indian fisheries sector has registered significant growth over the past few decades, with an impressive annual growth rate of 10.34%. The sector contributes 1.1% to the national GDP and 6.72% to the agricultural GDP (GOI 2022). India produced a staggering 16.248 million metric tons of fish during the 2021–2022 financial year, which included 4.127 million metric tons of fish from marine sources and 12.121 million metric tons from inland sources (GOI 2022).

Box 1. India's position in global fisheries and aquaculture (2020).

- India's contribution to global fisheries and aquaculture was impressive, with a share of 8%, making it the third-largest contributor in terms of aquatic animals and plants globally in 2020.
- For the first time since the mid-1980s, India became the world's top producer of inland capture fisheries, producing 1.8 million metric tons.
- India is also the second-largest inland aquaculture producer in the world.
- India also became the fourth-largest producer among global capture fisheries.
- In marine capture fisheries, India ranked fifth, contributing 5% to the global marine catch.
- In terms of total volume, India is the third-largest fish consumer after China and Indonesia in 2020.

Source: *FAO (2022).*

In 1991, with the introduction of economic reforms focusing on investment and trade, India embarked on a journey of economic liberalization, opening its doors for globalization and market forces. This sparked economic growth, enlarged consumer choices and reduced poverty significantly. In 2022, India became the fifth-largest economy in the world. Its nominal GDP touched INR 273.09 trillion (USD 3.5 trillion) during the 2022–2023 financial year (GOI 2023). As per the baseline projections of the Organization for Economic Cooperation and Development (OECD), India will reach USD 5, 10, 20 and 30 trillion GDP in market exchange rate (MER) terms by the 2027, 2034, 2043 and 2048 financial years, respectively. The country's population increased from 1.11 billion in 2005–2006 to 1.34 billion in 2019–2020. According to the UN population report, it is projected to reach 1.5 billion by 2030, 1.61 billion by 2040 and 1.65 billion by 2047.[4] Simultaneously, rapid urbanization is playing a crucial role in enhancing the demand for high value food items, and there is

3 FAO (2022) defines aquatic food as food for human consumption grown in or harvested from water. It includes all types of fish, crustaceans, mollusks and other aquatic animals, but excludes aquatic mammals, reptiles, seaweeds and other aquatic plants.

4 https://ourworldindata.org/population-growth

also the underlying scope of a rise in demand for fish. As the population and per capita income increase, coupled with the continuing rise in urbanization, there will be a growing demand for high value food items, including fish and other aquatic food products. It is, therefore, necessary to plan for sustainable intensification of fish production systems and put robust management practices in place to harvest the country's marine fisheries resources.

The rise in household incomes and urbanization has brought about significant changes in people's lifestyles, including their dietary habits. Increasing awareness of health and wellness has led many individuals to shift toward healthier food options, including fish. Nonetheless, the fine balance between future supply and demand for fish in India will depend on several factors, including availability, accessibility, affordability and acceptability.

Traditionally, the growth of the fisheries sector has been measured by focusing on fish production and supply, while consumer demand for fishery products has been given lower importance at the level of government programs and policy. However, with rapid shifts in the food habits and demands of consumers, it has become imperative to understand markets and consumer behavior in order to make informed decisions on strategic approaches to fish production. Therefore, a paradigm shift is necessary for our national strategy and action plan. This requires moving away from the conventional forward link of a "production to consumption" or "farm to fork" approach to adopting a more consumer-centric backward link of a "consumption to production" or "fork to farm" approach.

Traditional fish market systems existing both in rural and urban areas of India have played a significant role in influencing fish consumption. The domestic fish market is evolving to focus on freshness, product diversification, the cold chain, hygiene and food safety. In India, all market actors involved in the food supply chain are required to obtain a Food Safety and Standards Authority of India certificate to operate their businesses. Along with availability (total production), there is a need to focus on accessibility, affordability and acceptability. Accessibility concerns the distance of fish vending stalls from customers and presenting the fish in different forms and styles according to customer demand, while affordability centers on the different price ranges according to the spending power of customers, and acceptability on such factors as taste, flavor, color, shape, size, and the presence of spines. The micro picture of the fish consumption scenario in the country is incredibly complex, as it is influenced by various social, economic, environmental, religious and gender norms. Understanding the complex behavior and preferences of fish consumers throughout India would be the first step toward adopting effective fish production, marketing and policy strategies.

Empirical investigations into fish consumption and its influencing factors in India remain fragmented and primarily confined to regional analyses (Ravikanth and Kavi Kumar 2015; Barik 2017; Jyotishi et al. 2020; Paramasivam and Malaiarasan 2021). Kent (1987) previously drew attention to India's fish consumption patterns, revealing that per capita fish consumption was a mere 3 kg per year during the 1970s, a level even lower than that observed in many landlocked nations. Recent research by Paramasivam and Malaiarasan (2021) has shed light on the factors impacting fish consumption in India. Their study revealed that price increases lead to reduced demand and consequently lower consumption. Furthermore, it indicated that higher-income households tend to consume more fish than middle- and low-income households, with low-income households allocating a larger proportion of their expenditures to fish. The study also highlighted that various factors influence consumption, including education, age, household head, the number of household members with regular salaries, and the household's food practices outside the home. However, a comprehensive analysis of fish consumption patterns in India and their spatiotemporal distribution is noticeably absent from prior research efforts.

With these considerations in mind, the current study aims to bridge this longstanding research gap within the Indian context. It attempts to investigate and interpret the dynamics of fish consumption in India, as well as its spatiotemporal variations within the country's political boundaries from 2005 to 2020-2021. To investigate this dynamism, we have relied on the comprehensive and nationally representative surveys that the Government of India has periodically conducted over this timeframe.

The remainder of the document is organized as follows: First, we describe consumption trends among the part of the population that eats fish and other non-vegetarian foods, as well as apparent fish consumption behaviors by gender and age. We also investigate the explicit relationship between fish consumption and some social and wealth indicators. Next, we delve deeper into exploring the spatial variation in fish consumption across India. Subsequently, we examine the relationship between fish production and per capita fish consumption, as well as its interaction with the Indian economy and people's income. The projection estimates of per capita fish consumption, the demand-supply gap, etc., have also been incorporated to understand the future course of action in fisheries and aquaculture in the country. Finally, we put forward a variety of policy approaches and intervention areas to increase fish consumption relative to fish production in India.

2. Data source and methodology

For our analyses in this monograph, we have used a range of publicly available and nationally representative government data sources spanning 2005 to 2021. Basic descriptive statistics were drawn from these reports and used for analysis and interpretation.

These sources mainly include the following:

- **National Family Health Survey (NFHS):** India's Ministry of Health and Family Welfare initiated the NFHS, a nationally represented sample survey, in the early 1990s. The survey aims to provide periodically updated and nationally representative data on population, health and nutrition for India and its states and union territories. To achieve this, the NFHS collects data from sample households throughout the country, with the sample allocated proportionally to the size of the urban and rural population within each state. Since its inception, there have been five rounds of the survey: NFHS-1 (1992–1993), NFHS-2 (1998–1999), NFHS-3 (2005–2006), NFHS-4 (2015–2016) and NFHS-5 (2019–2021). For our purposes, we have chosen to focus on the data from NFHS-3, 4 and 5, covering the period of 2005–2006 to 2019–2021). These rounds of the survey provide information on the fish and non-vegetarian food consumption habits of people (both male and female) ages 15–49.
- **Handbook of Fisheries Statistics:** India's Ministry of Animal Husbandry, Dairying and Fisheries publishes this report every year. These reports provide a detailed compilation of India's fisheries resources, fish production, disposition, export trends, consumption, infrastructure and other related information.
- **Handbook on Fish Import Statistics:** The Indian Council of Agricultural Research and the Central Institute of Fisheries Technology publish this document. It maintains time series and compiled data on fish imports collected from the UN's Comtrade database.
- **Handbook of Statistics on Indian Economy:** Published by the Reserve Bank of India, this annual report has provided a comprehensive database of macroeconomic and financial variables since 1998. These reports cover time series data on a wide range of indicators, including national income, prices, financial markets and socioeconomic factors, at varying frequencies.

3. Findings of the study

3.1. Key findings for India from 2005 to 2021

Population and economy

1. The 20.7% increase in India's population, from 1.11 billion to 1.34 billion, is equivalent to one and a half times the population of Bangladesh.
2. The per capita GDP in constant terms doubled from INR 53,478 to 108,645. During the same period, the PFCE, which indicates the purchasing power of people, tripled from INR 18,584 to 61,594.

Fish production

1. Fish production increased 115%, from 6.577 to 14.164 million metric tons. Meaning, 7.587 million metric tons of fish were added to the Indian fish basket, with a CAGR of 5.63%.
2. Of the total fish production, India's domestic market consumed 5.415 million metric tons (82.36%) in 2005–2006, 9.277 million metric tons (86.2%) in 2015–2016 and 11.848 million metric tons (83.65%) in 2019–2020. The rest was used for non-food purposes and exports.
3. There was a rapid rise in the quantity of imported fish and fishery products from the international market for consumption within the country. These increased 543% over the timeframe, with a CAGR of 12.84%, from about 14,000 t in 2005–2006 to 52,000 t in 2015–2016 and 76,000 t in 2019–2020.
4. Considering both locally sourced and imported fish, the total quantity of fish consumed in the domestic market increased 120%, from 5.428 million metric tons to 11.924 million metric tons, for an overall addition of 6.496 million metric tons.

Per capita fish consumption

1. Annual per capita fish consumption increased from 4.9 to 8.89 kg, an increase of 3.99 kg (81.43%) with a growth rate of 4.05%.
2. Among people who eat fish, per capita annual fish consumption increased from 7.43 to 12.33 kg, an increase of 4.9 kg (66%).
3. Among the category of lower-middle income countries (LMICs) of the World Bank, India showed a relatively higher jump in per capita fish consumption (60%) when compared to the group's average (45%). However, India's per capita consumption remained far lower (7.89 kg) than the group average (14.94 kg). This shows that India has tremendous potential to catch up with other LMICs in this area.
4. The CAGR of per capita fish consumption within India was 4.05% over the 15-year timeframe. If the same rate is maintained over next 25 years, per capita fish consumption is expected to reach 19.8 kg in 2029–2030, 31.7 kg in 2039–2040 and 41.29 kg in 2047–2048, the centenary year of India's freedom. At the same time, estimated fish demand for human consumption is expected to reach 29.6 million metric tons, 51 million metric tons and 68.1 million metric tons, respectively.

Fish-consuming population

1. The proportion of people eating fish increased from 730.6 million (66%) to 966.9 million (72.1%), an increase of 236.3 million (32.34%).
2. The proportion of people eating eggs increased 7.35 percentage points, followed by fish (6.1 percentage points) and chicken or meat (5.45 percentage points).
3. In 2019–2020, 5.95% of people ate fish daily, 34.8% did so at least once in a week and 31.35% only occasionally.
4. Throughout India, there was a clear trend in people eating fish more frequently. The percentage of people eating fish occasionally dropped 4.9 percentage points, while those eating fish weekly increased 11.3 percentage points. However, there was no significant change in those eating fish daily, only a slight drop of 0.3 percentage points.
5. Men ate fish more than women did. According to NFHS-5, 78.6% of men and 65.6% of women consumed fish.
6. Overall, there was an increase in the percentage of men (9.1 percentage points) and women (3.1 percentage points) eating fish. In general, there was shift toward weekly fish consumption among both genders.
7. The proportion of the population eating fish at least once a week was higher in urban (42.7%) than rural areas (39.8%).
8. Fish lagged behind other non-vegetarian foods as the favorite food among both urban and rural populations. By the end of the timeframe for this study, the gap between those eating fish and those eating fish, chicken or meat was 12.75 percentage points higher in urban areas and 9.3 percentage points in rural areas. This could mean that there is further scope to popularize fish among the non-vegetarian population by improving the acceptability and consumption of fish.
9. The percentage of India's population who ate fish increased at a higher rate in rural than urban areas. Those eating fish at least once a week increased 11.85 percentage points in rural areas and 9.55 percentage points in urban areas.
10. The gap in fish consumption between rural and urban areas narrowed from 5.15 percentage points to 2.85 percentage points.
11. Older age groups preferred non-vegetarian foods, including fish, slightly more than younger age groups.
12. Among age categories, 42% of those ages 30–39, 41.6% ages 40–49, 40.9% ages 20–29 and 37.3% ages 15–19 ate fish at least once a week.
13. Overall, fish consumption among all age groups increased 10 to 12 percentage points.
14. As wealth increased, the percentage of the population eating non-vegetarian food at least once a week also increased. There was a linear rise in the percentage of those eating fish in the lower, middle and fourth wealth quintiles in NFHS-3 and NFHS-4. In NFHS-5, however, this trend was reversed.
15. The proportion of the population eating fish at least once a week steadily increased across all wealth categories. This increase was more significant in the lower wealth categories than the higher ones, at 20 percentage points for the lowest, 14 for the second, 8 for the middle, 8 for the fourth and just 1 for the highest quintiles.

Spatial distribution of fish consumption in India

1. By the end of the timeframe for this study, the proportion of those eating fish was highest in Tripura (99.35%) and lowest in Haryana (20.55%).
2. In general, the northeastern (>95%) and eastern states of Tamil Nadu, Kerala and Goa (>90%) had the highest percentages of people eating fish. Northern states such as Punjab (26.45%), Haryana (20.55%) and Rajasthan (22.5%) had lowest.
3. The proportion of the population who ate fish daily was highest in Kerala (53.5%), followed by Goa (36.20%), West Bengal (21.90%), Manipur (19.70%), Assam (13.10%) and Tripura (11.50%). Among those eating fish at least once a week, however, the proportion was highest in Assam and Tripura (69% each) followed by Odisha (66.8%), West Bengal (65.75%), Arunachal Pradesh (65.25%) and Tamil Nadu (58.2%).
4. There was a remarkable increase in the proportion of people eating fish in most of the states, led by Jammu and Kashmir (20.9 percentage points), with the exception of Punjab where it decreased (3.9 percentage points).
5. The gender gap between men and women was wide in states with a lower proportion of people eating fish.
6. The gap was also wide between those eating fish and all non-vegetarian consumers.


GSFP

3.2. Fish consumption patterns in India

The following results cover the timeframe of NFHS-3, 4 and 5 (from 2005 to 2021).

3.2.1. Fish vs. other non-vegetarian foods

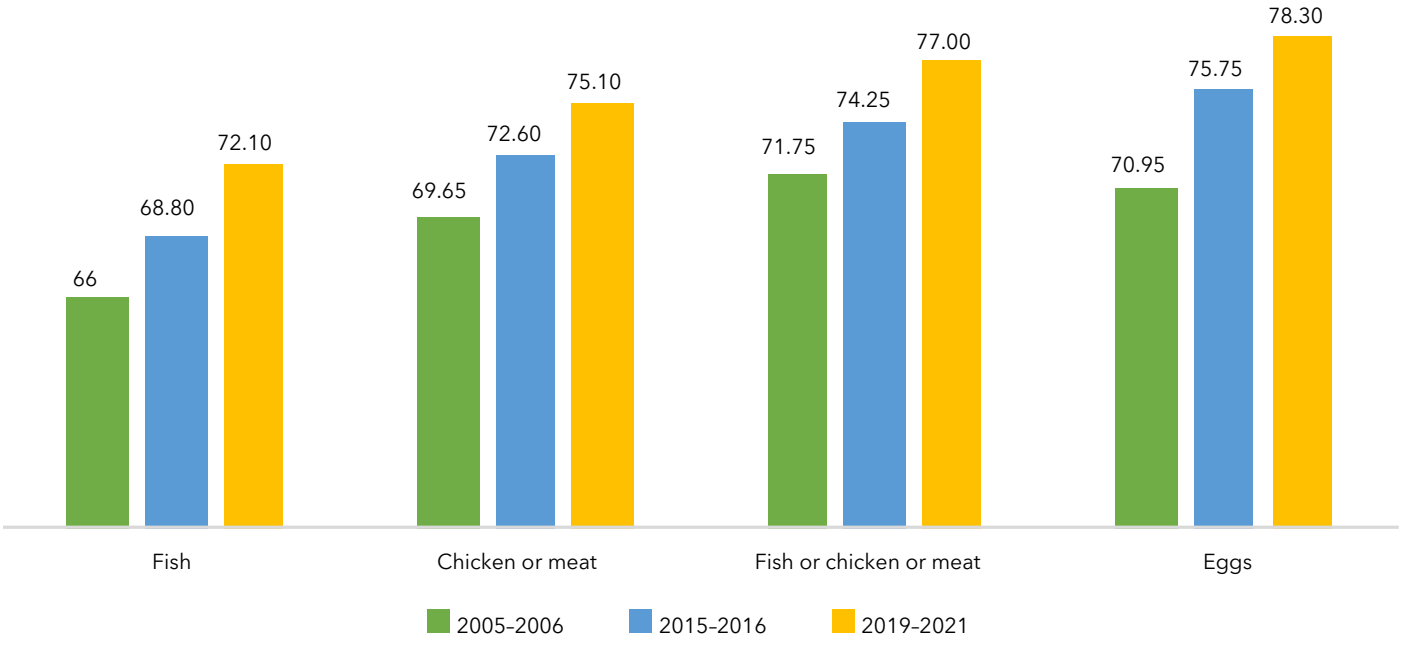
The NFHS-5 revealed that nearly three-quarters of the population ate fish (Figure 1). However, the most popular non-vegetarian food was eggs, followed by the fish or chicken or meat category, and then just chicken or meat. Over the three surveys, the percentage of people eating all kinds of non-vegetarian food increased for all four food categories.

3.2.2. Frequency of consumption

By the end of the three surveys, over one-third of the population was eating fish weekly, followed by those who ate it occasionally and then those daily (Figure 2). Overall, more people are eating fish in India, mostly those eating it weekly, while those eating fish daily or occasionally both decreased.

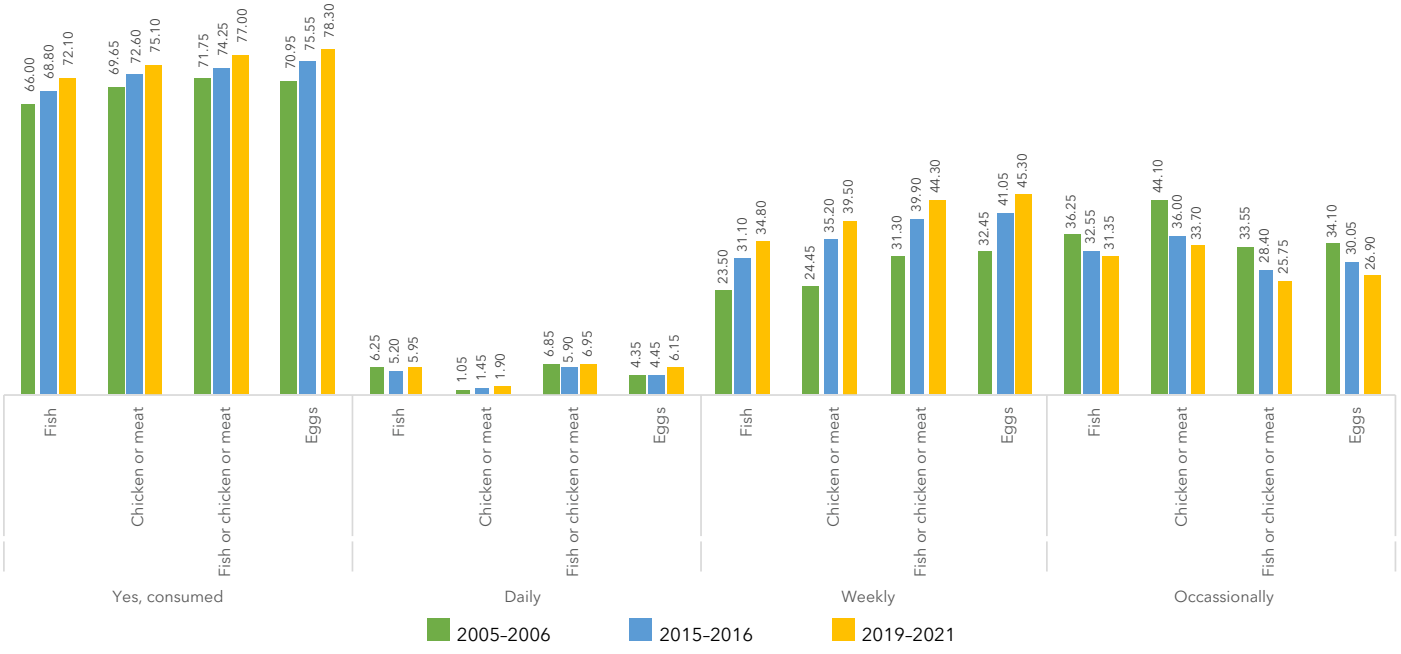
This pattern was similar in other non-vegetarian food groups, though at higher magnitudes. There was a substantial increase in the weekly category for those eating from the chicken or meat, fish or chicken or meat, and eggs categories. There was a significant drop in the occasional category among those eating chicken or meat, fish or chicken or meat, or eggs (Figure 3).

Figure 1. Non-vegetarian food consumption (% of population).



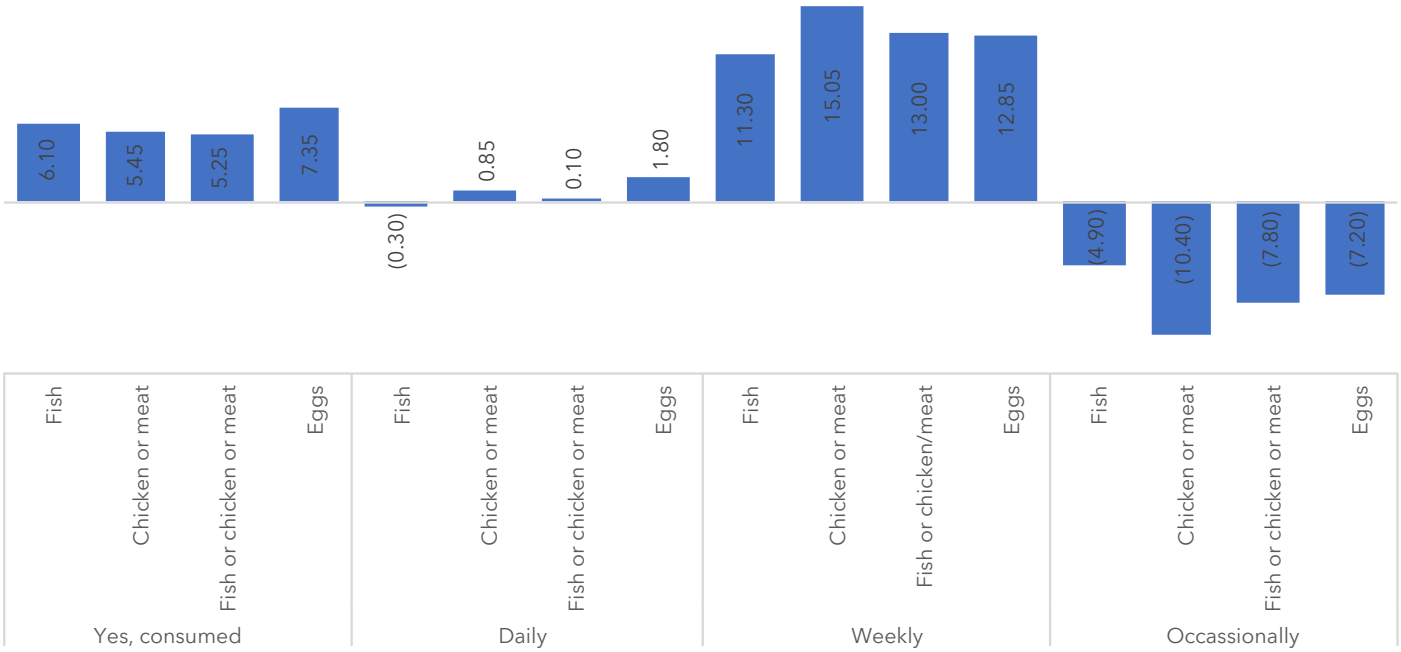
Sources: *IIPS (2007, 2017 and 2021).*

Figure 2. Frequency of non-vegetarian food consumption (% of population).



Sources: *IIPS (2007, 2017 and 2021).*

Figure 3. Frequency of non-vegetarian food consumption (percentage points) from 2005-2006 to 2019-2021.



Sources: *IIPS (2007, 2017 and 2021).*

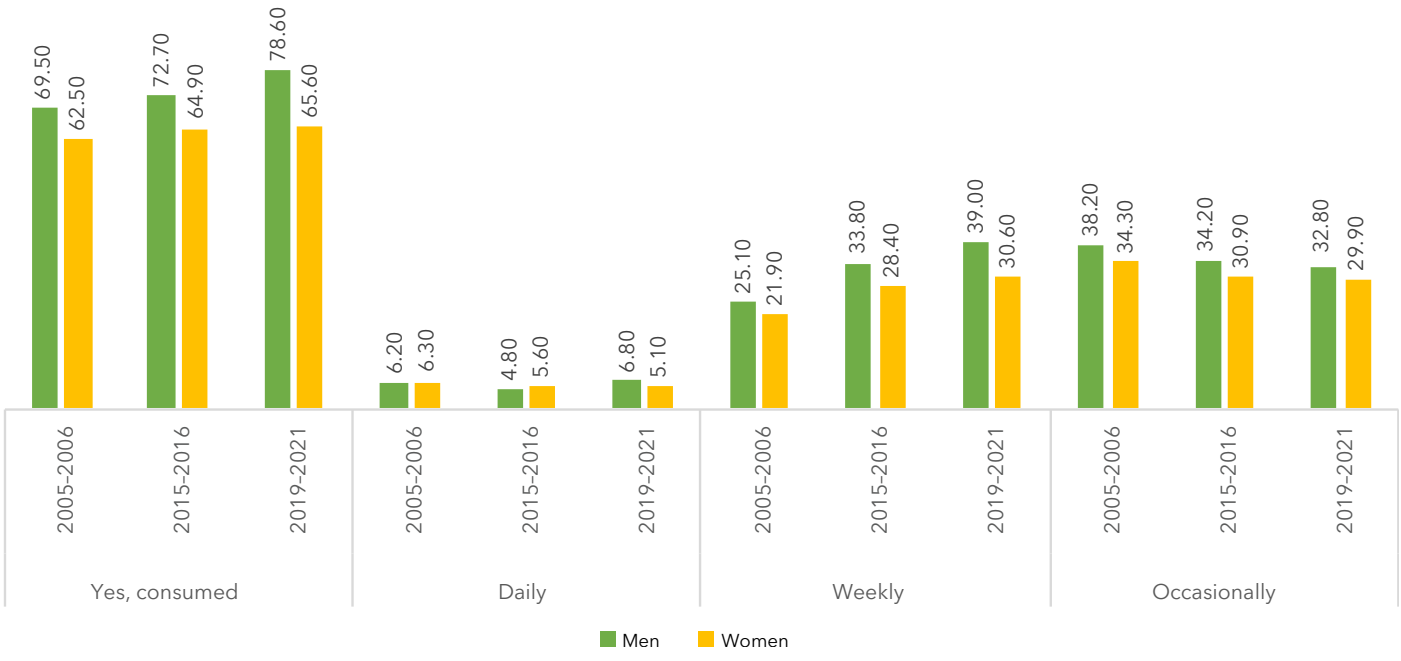
3.2.3. Fish consumption by gender

In India, fish consumption was more popular among men than women (Figures 4-5). The largest percentage of men ate fish at least once a week, while about one-third ate it occasionally. The percentages were slightly lower across all categories for women.

Over the three surveys, there was a much higher spike in men eating fish than among women. Overall, the pattern reveals a shift toward weekly fish consumption and a decline in occasional fish consumption in both genders, as fish has become a popular commodity in India. Still, there was not much change in both genders for those eating fish daily.

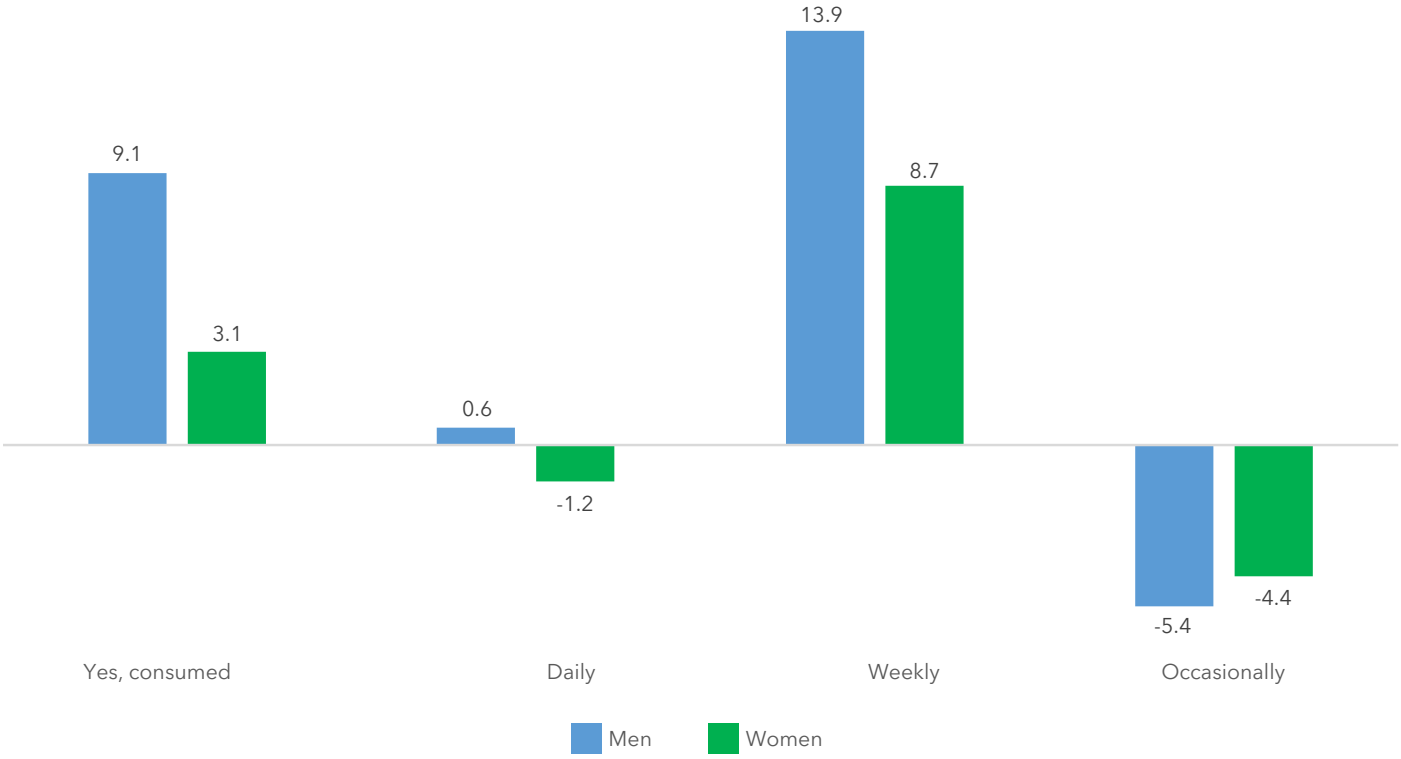
In the case of the chicken or meat category and the egg category, there was a notable rise for both men and women in daily and weekly consumption (Figures 6–7).

Figure 4. Frequency of fish consumption by gender (% of population).



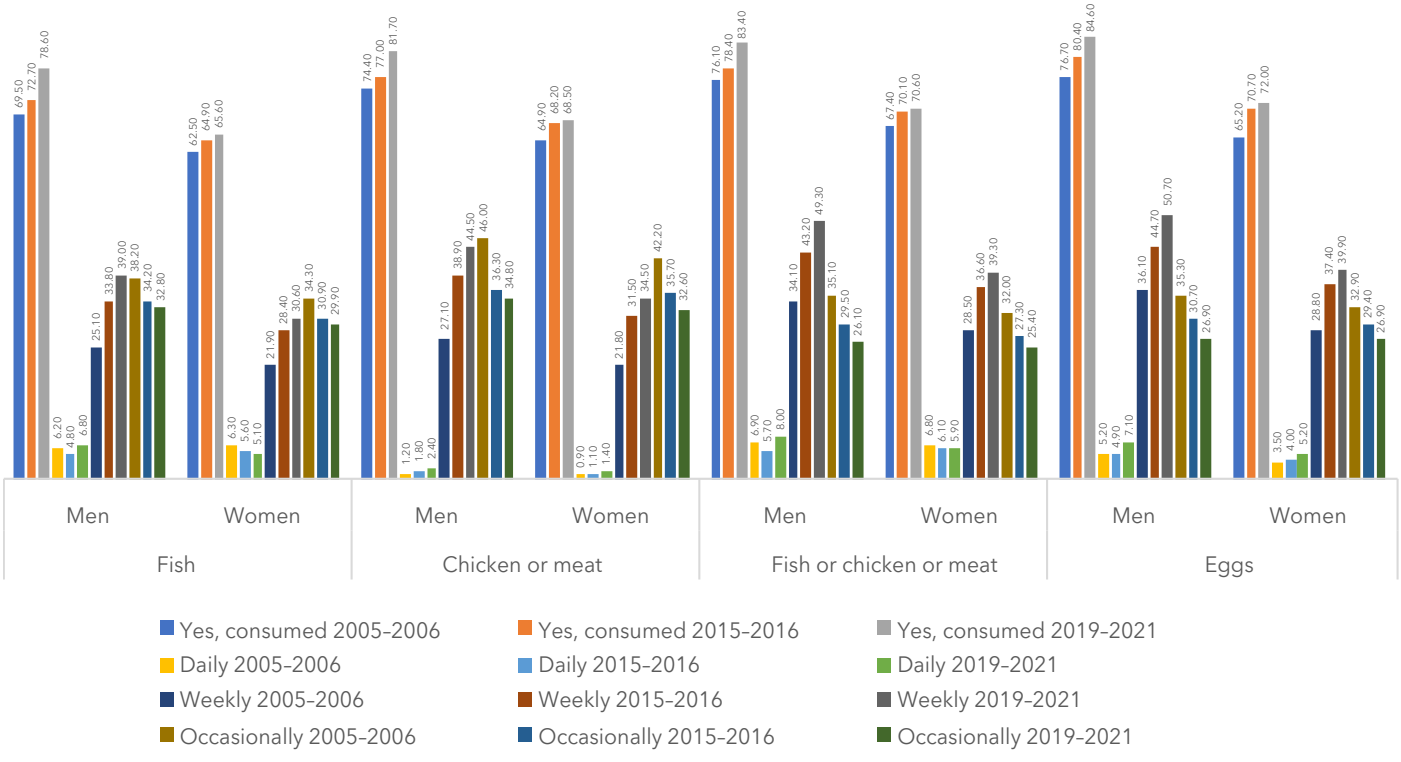
Sources: *IIPS (2007, 2017 and 2021).*

Figure 5. Frequency of fish consumption by gender (percentage points) from 2005-2006 to 2019-2021.



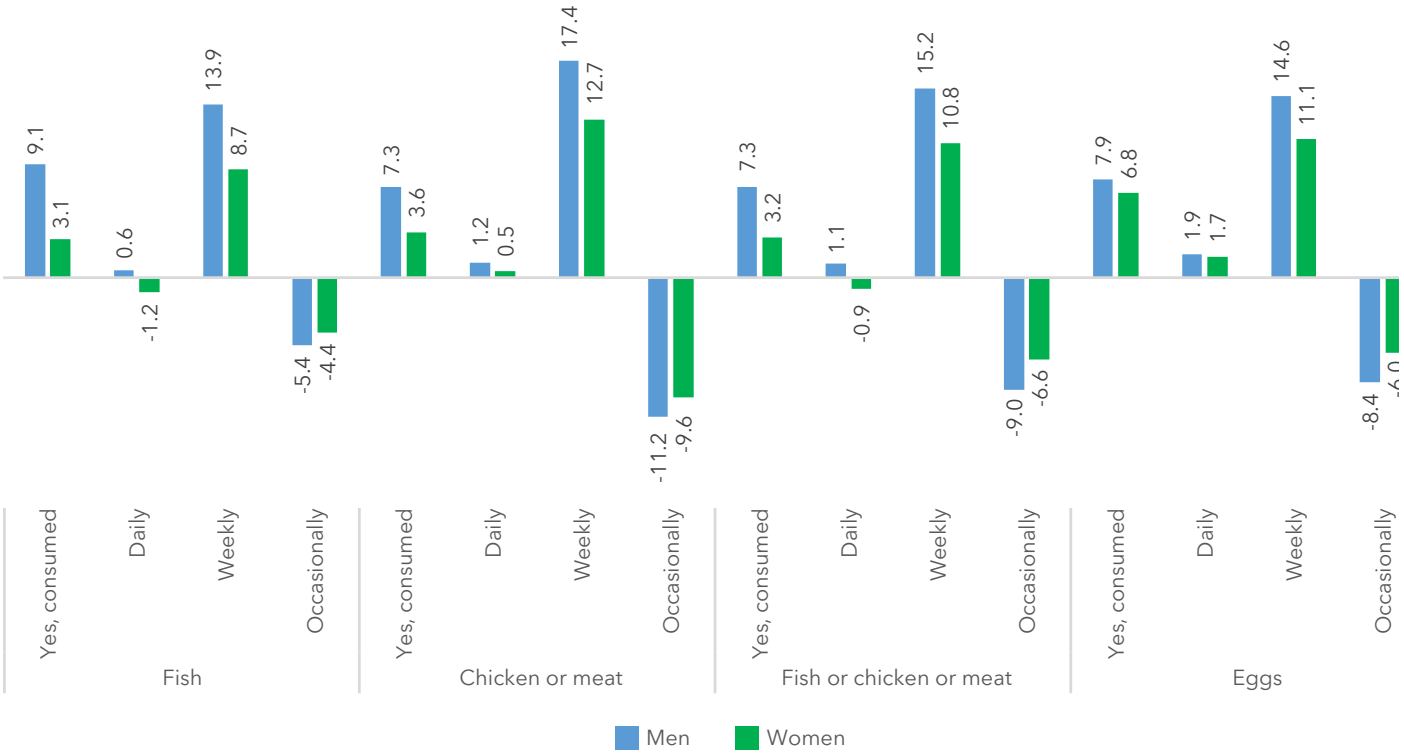
Sources: *IIPS (2007, 2017 and 2021).*

Figure 6. Frequency of non-vegetarian food consumption by gender (% of population).



Sources: *IIPS (2007, 2017 and 2021).*

Figure 7. Frequency of non-vegetarian food consumption by gender (percentage points) from 2005-2006 to 2019-2021.

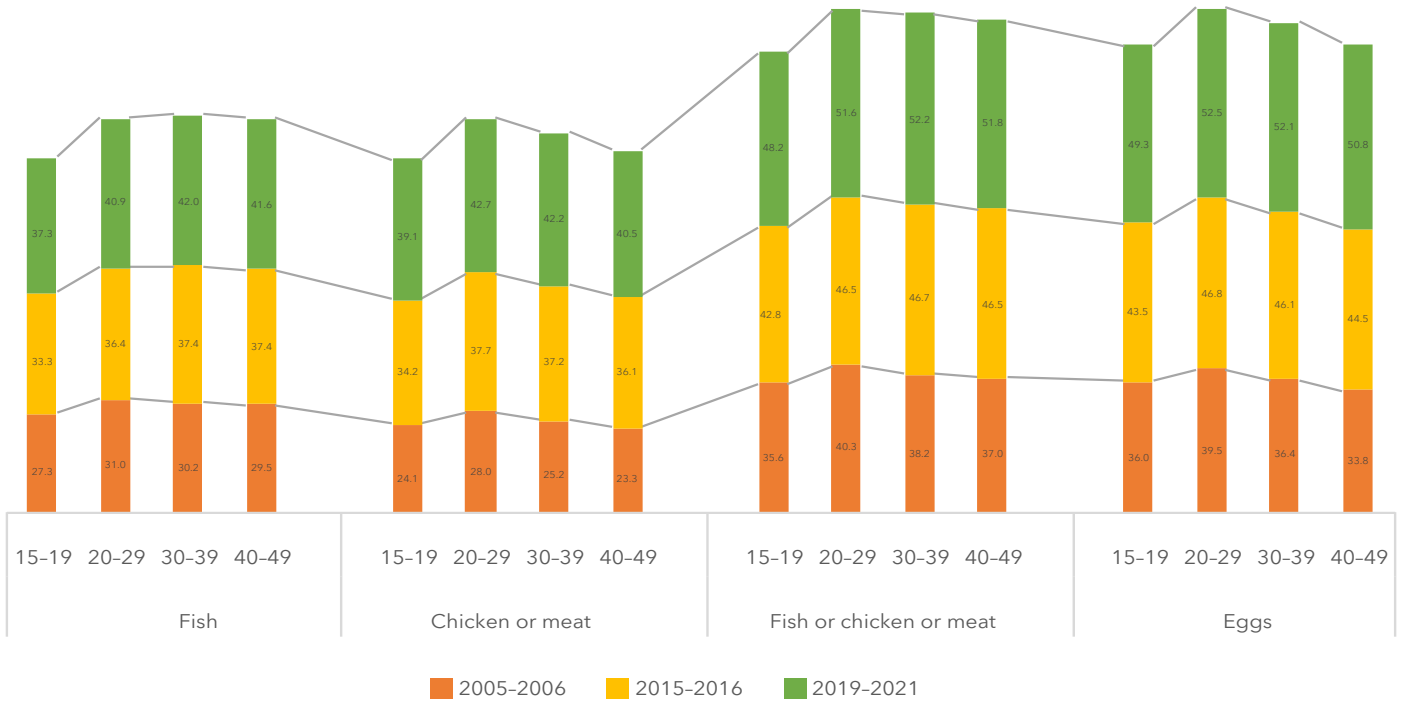


Sources: *IIPS (2007, 2017 and 2021).*

3.2.4. Pattern of fish consumption by age group

Over the three surveys, there was a considerable increase in the percentage of the population eating fish and different non-vegetarian foods at least once a week (Figure 8). Across all age groups, those eating chicken or meat increased slightly more than those eating fish. Interestingly, non-vegetarian foods were more popular in the older age groups. The reason for this could be a lower acceptance of non-vegetarian food until people reach 40 years of age. In NFHS-5, weekly fish consumption was highest in people 30–39 years old, followed by the 40–49, 20–29 and 15–19 age groups.

Figure 8. Weekly non-vegetarian food consumption by age group (% of population).



Sources: *IIPS (2007, 2017 and 2021).*

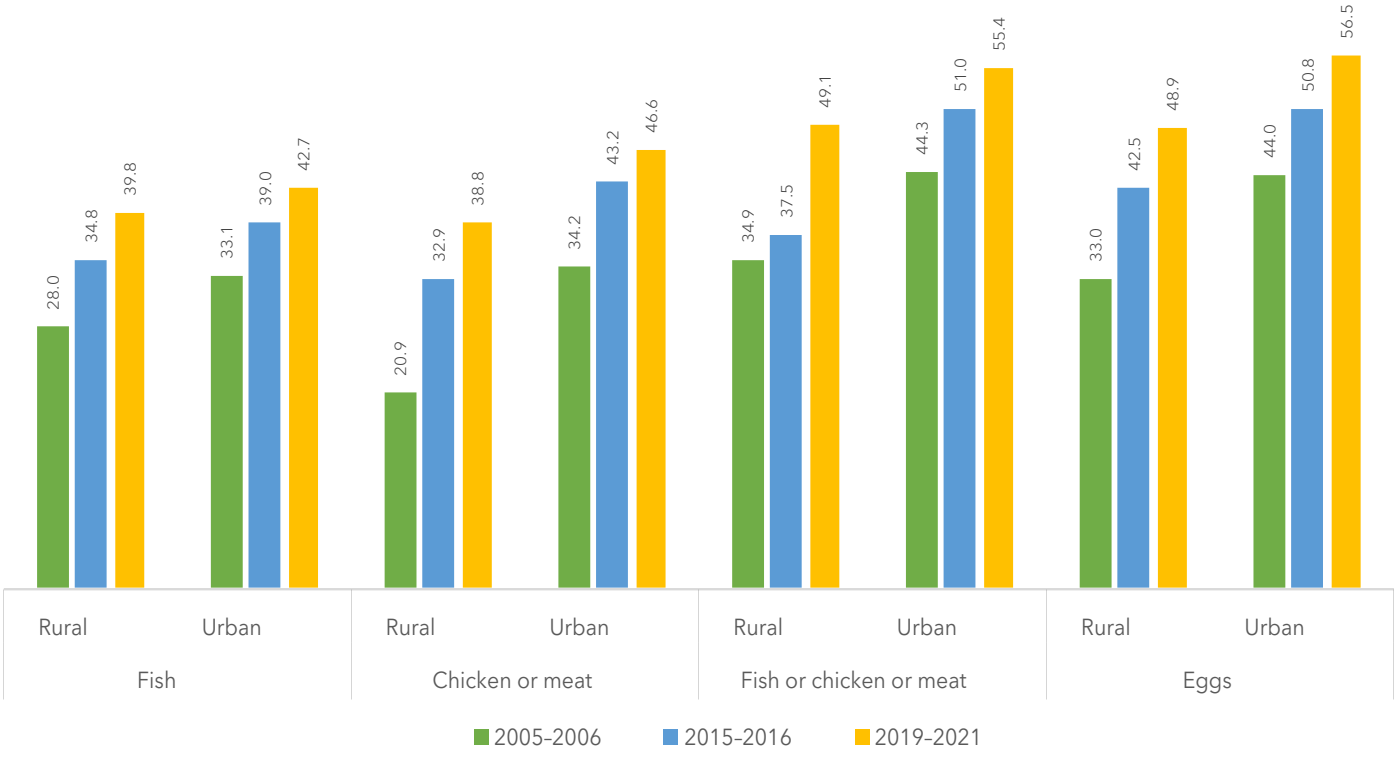
3.2.5. Pattern of fish consumption in rural and urban areas

As expected, people from urban areas eat more non-vegetarian food than their rural counterparts (Figure 9), and most of them do so at least once in a week. In NFHS-5, India's urban population consumed more of every non-vegetarian food category in the survey. In both urban and rural areas, the number of people eating fish or chicken or meat was higher than those eating only fish (Figure 10). This shows that there is scope to popularize fish in both urban and rural areas if efforts are aimed at changing the status quo by making diversified varieties of fish more available and accessible to get them onto the plates of consumers across different socioeconomic categories.

Over the three surveys, the percentage of people who ate all kinds of non-vegetarian food at least once a week significantly increased in both urban and rural areas, though the rate of increase was higher in rural areas. The proportion of people eating fish at least once a week also increased in both areas. Interestingly, the proportion of people chicken or meat increased much more than for fish, which could mean that chicken and meat are more available and accessible for people in rural areas. Urban residents, in general, prefer processed, ready-to-cook or ready-to-eat foods than do rural residents. As such, the rate of increase in non-vegetarian food is lower, leaving scope for raising demand for fish in urban areas if fish processing industries proliferate in the country.

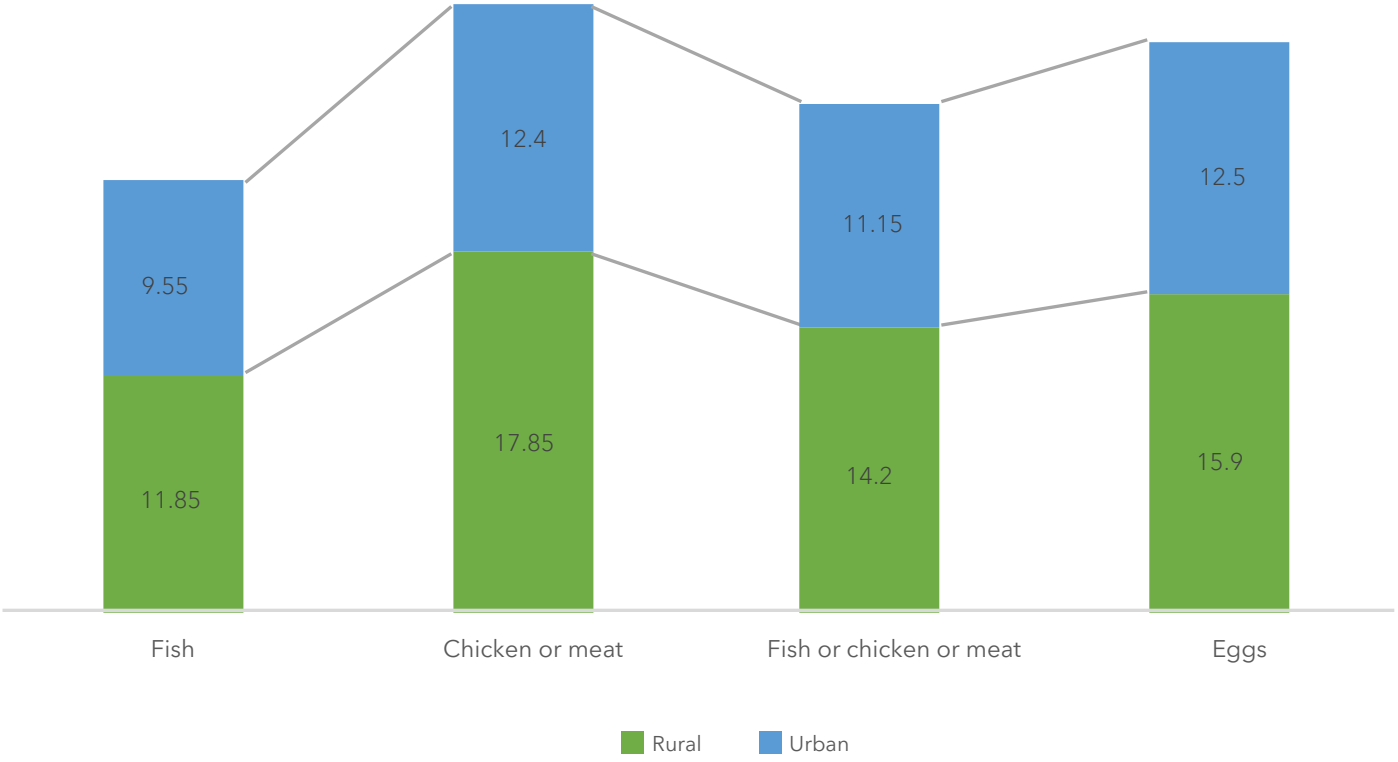
The difference in the proportion of people eating non-vegetarian food between rural and urban areas narrowed over the three surveys (Figure 11). In the case of fish consumers, it almost halved. A similar trend was also observed for consumers of chicken or meat. This reveals the "demonstration effect" that the non-vegetarian consumption habits of urban people had on those living in rural areas. Additionally, this could also be a result of the increased availability, accessibility and affordability of non-vegetarian food items in rural markets.

Figure 9. Frequency of non-vegetarian food consumption in rural and urban areas (% of population).



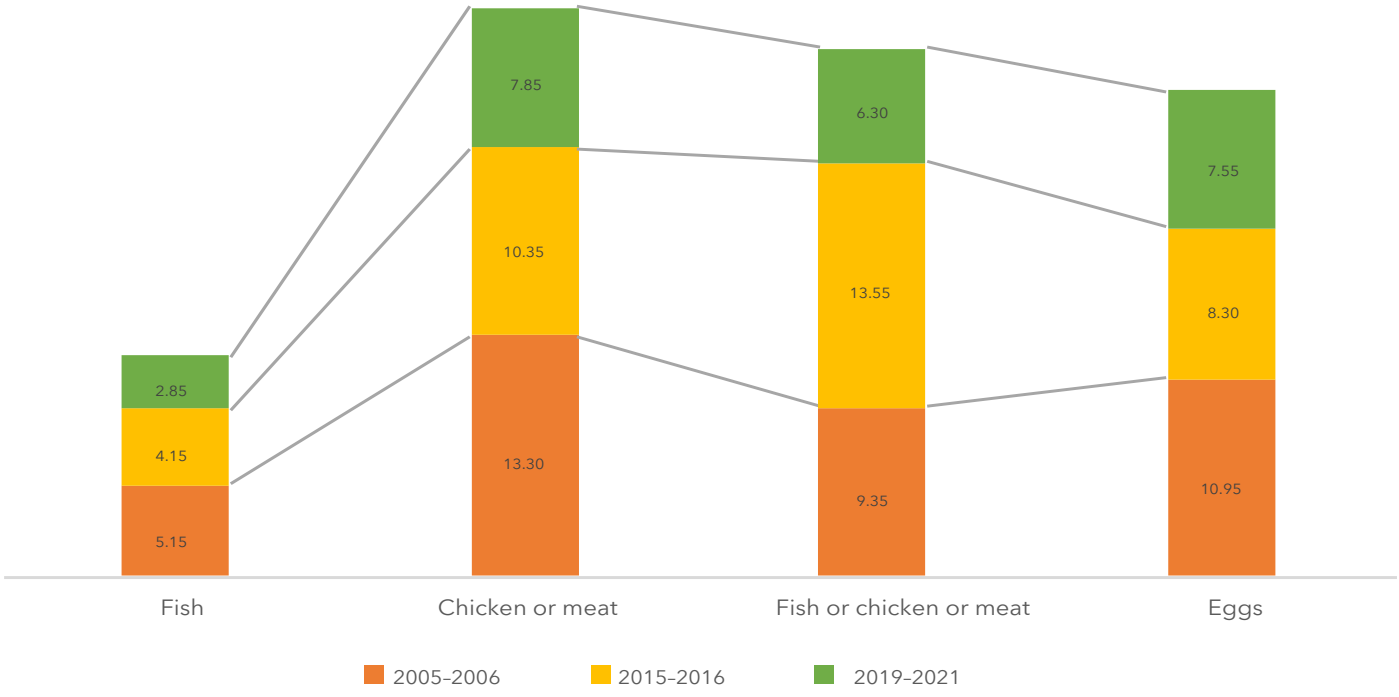
Sources: *IIPS (2007, 2017 and 2021).*

Figure 10. Change in the frequency of weekly non-vegetarian food consumption in rural and urban areas (percentage points) from 2005-2006 to 2019-2021.



Sources: *IIPS (2007, 2017 and 2021).*

Figure 11. Difference in non-vegetarian food consumption in rural and urban areas (percentage points).



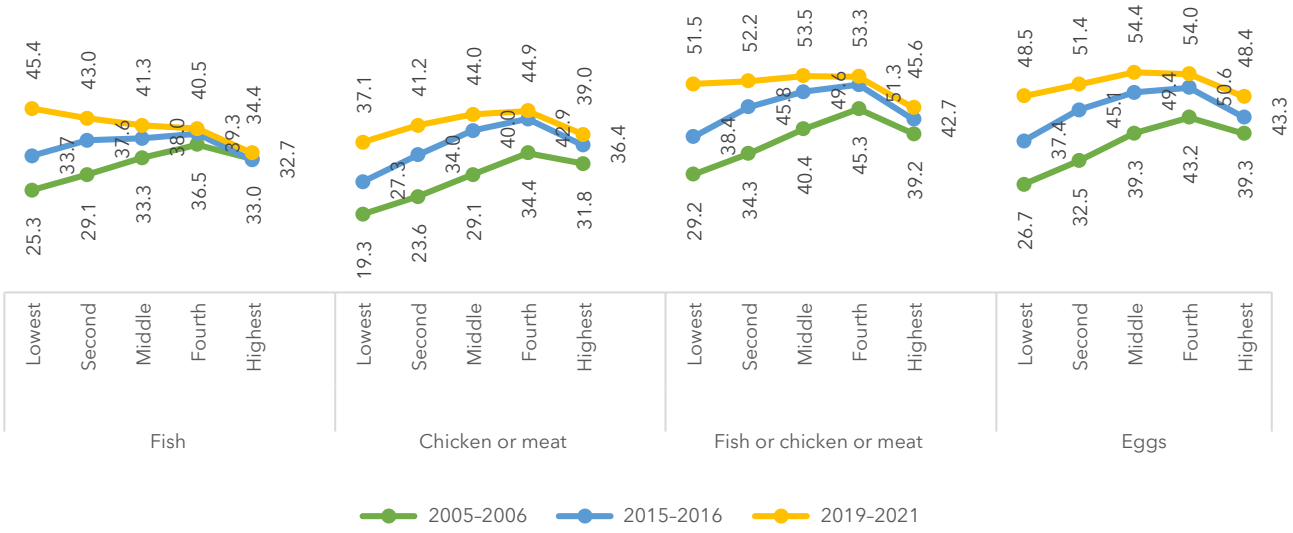
Sources: *IIPS (2007, 2017 and 2021).*

3.2.6. Pattern of fish consumption by wealth status

In India, the percentage of the population that eats fish at least once a week rose consistently across all wealth quintiles[5] (Figures 12 and 13). In the lower quintiles, the jump in the proportion of people eating fish and those eating chicken or meat was higher compared to those falling under higher wealth quintiles. However, more people chose to eat chicken or meat instead of fish at least once a week under all wealth categories.

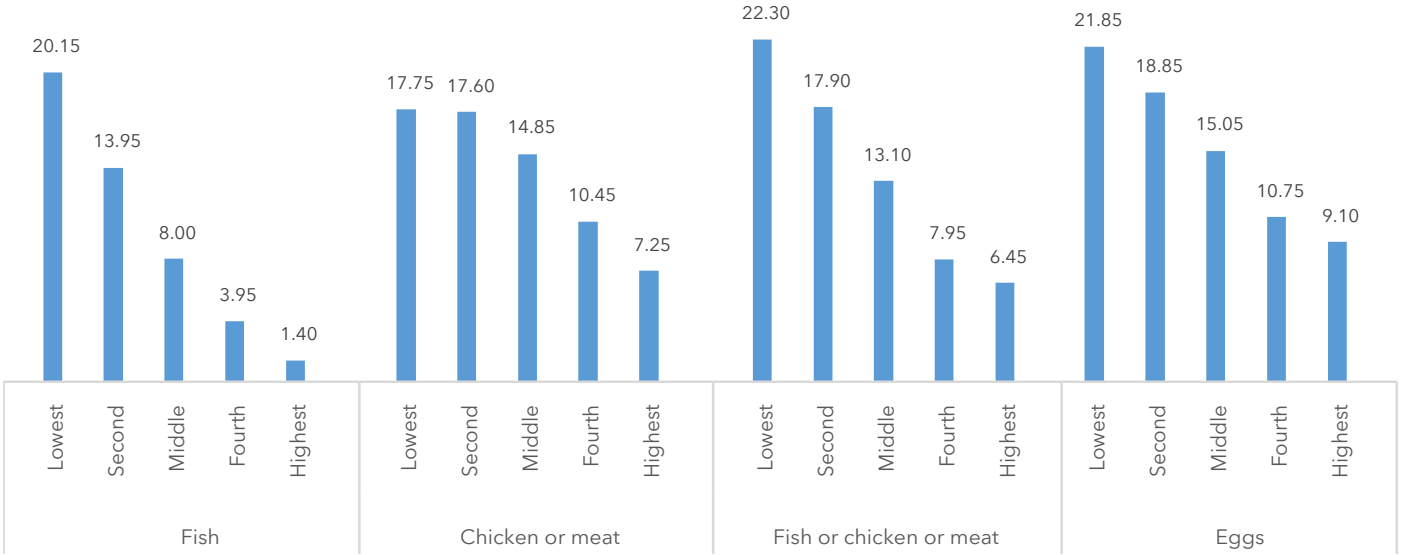
During each survey period, in general, as the wealth of people increased, the percentage of people eating non-vegetarian food at least once a week also increased. For fish, there was a linear increase in the lowest, second, middle and fourth wealth quintiles for both NFHS-3 and NFHS-4. In NFHS-5, however, the trend reversed (though this was not the case for those eating chicken or meat). One potential reason for this recent reversal in the fish-consuming population could be that wealthier people might prefer to eat different varieties of fresh fish or processed fish, such as single-bone or live fish. When these options are unavailable, they might tend to shift toward eating chicken or meat, which are freshly slaughtered and readily available.

Figure 12. Weekly non-vegetarian food consumption by wealth status (% of population).



Sources: *IIPS (2007, 2017 and 2021).*

Figure 13. Changes in non-vegetarian food consumption by wealth status (percentage points) from 2005-2006 to 2019-2021.



Sources: *IIPS (2007, 2017 and 2021).*

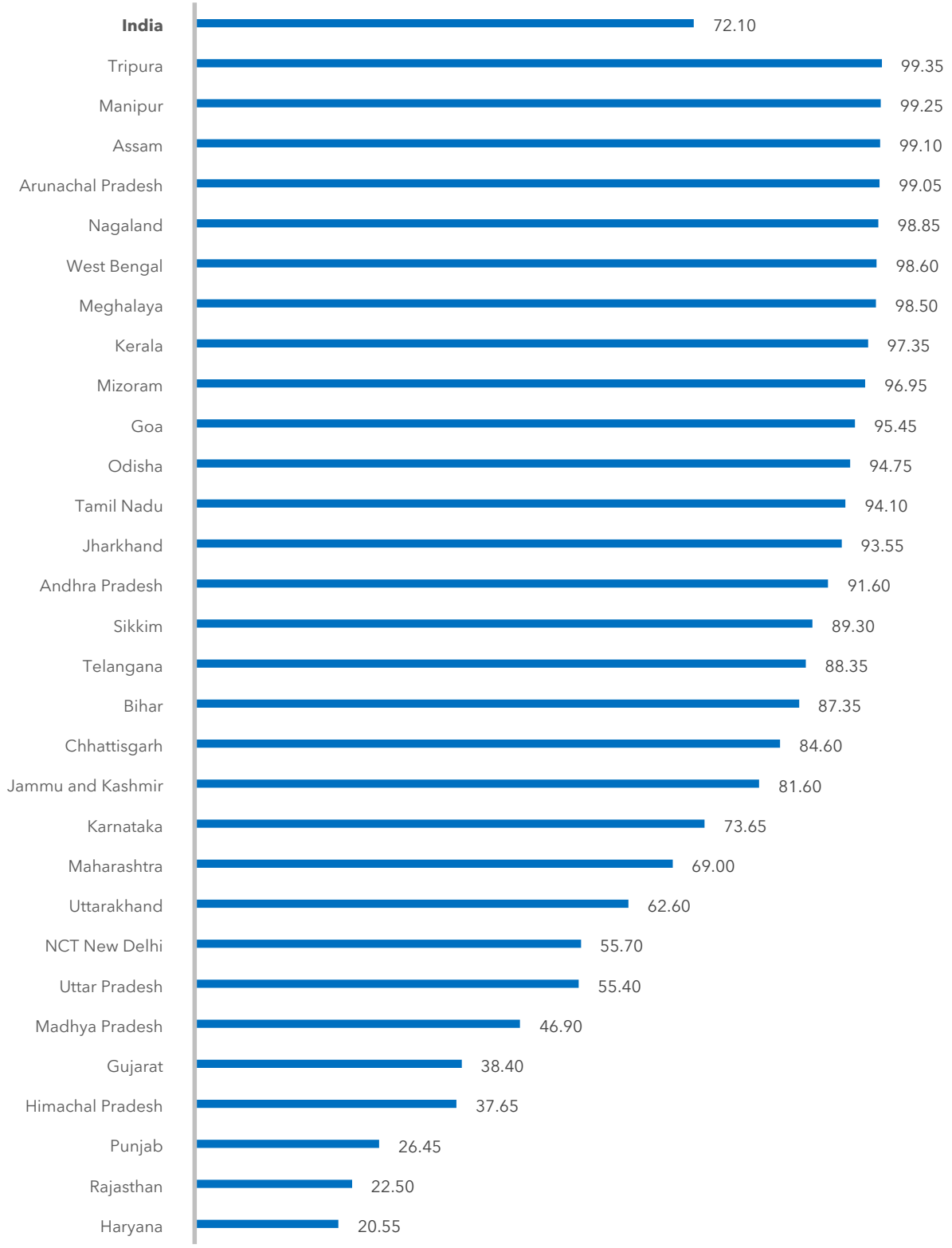
5 The NFHS calculates the wealth index based on household assets ranging from a television to a bicycle or car, and housing characteristics such as source of drinking water, toilet facilities and flooring materials. The wealth quintiles are derived through a principal component analysis, and each household is assigned a score. The score has been divided into five equal categories, each with 20%. The qualitative ranges are highest, fourth, middle, second and lowest.

3.3. Pattern of fish consumption by state

In NFHS-5, Tripura had the highest proportion of people eating fish among Indian states, while Haryana had the lowest (Figures 14 and 15). In general, the proportion of people eating fish was highest in India's northeastern states, followed by its eastern states, and Tamil Nadu, Kerala and Goa. It was lowest in Punjab, Haryana and Rajasthan.[6] States with more than 10 million people (West Bengal, Kerala, Odisha, Tamil Nadu, Jharkhand, Andhra Pradesh, Telangana, Bihar, Chhattisgarh and Jammu and Kashmir) also had higher percentages of people of eating fish.

Kerala had the highest proportion of people eating fish on a daily basis, followed by Goa, West Bengal, Manipur, Assam and Tripura, while those eating fish weekly was highest in Assam and Tripura, followed by Odisha, West Bengal, Arunachal Pradesh and Tamil Nadu.

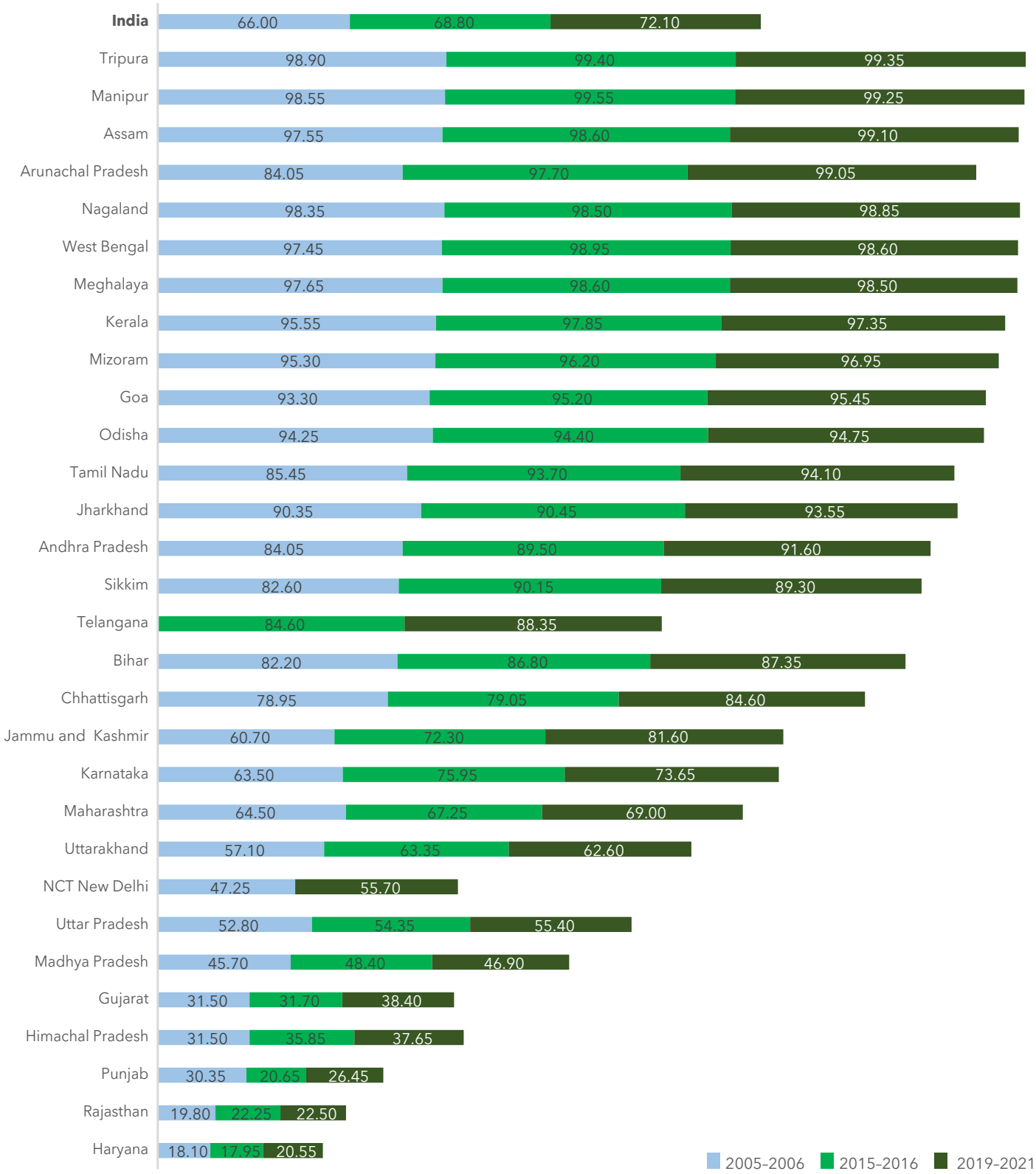
Figure 14. Fish consumption by state during 2019–2021 (% of population).



Source: *IIPS (2021).*

6 State-wise reports of NFHS-5 are not available for five Union Territories, so we were unable to include those in this report.

Figure 15. Fish consumption by state from 2005 to 2021 (% of population).



Sources: *IIPS (2007, 2017 and 2021).*

3.3.1. Variation in fish consumption by state

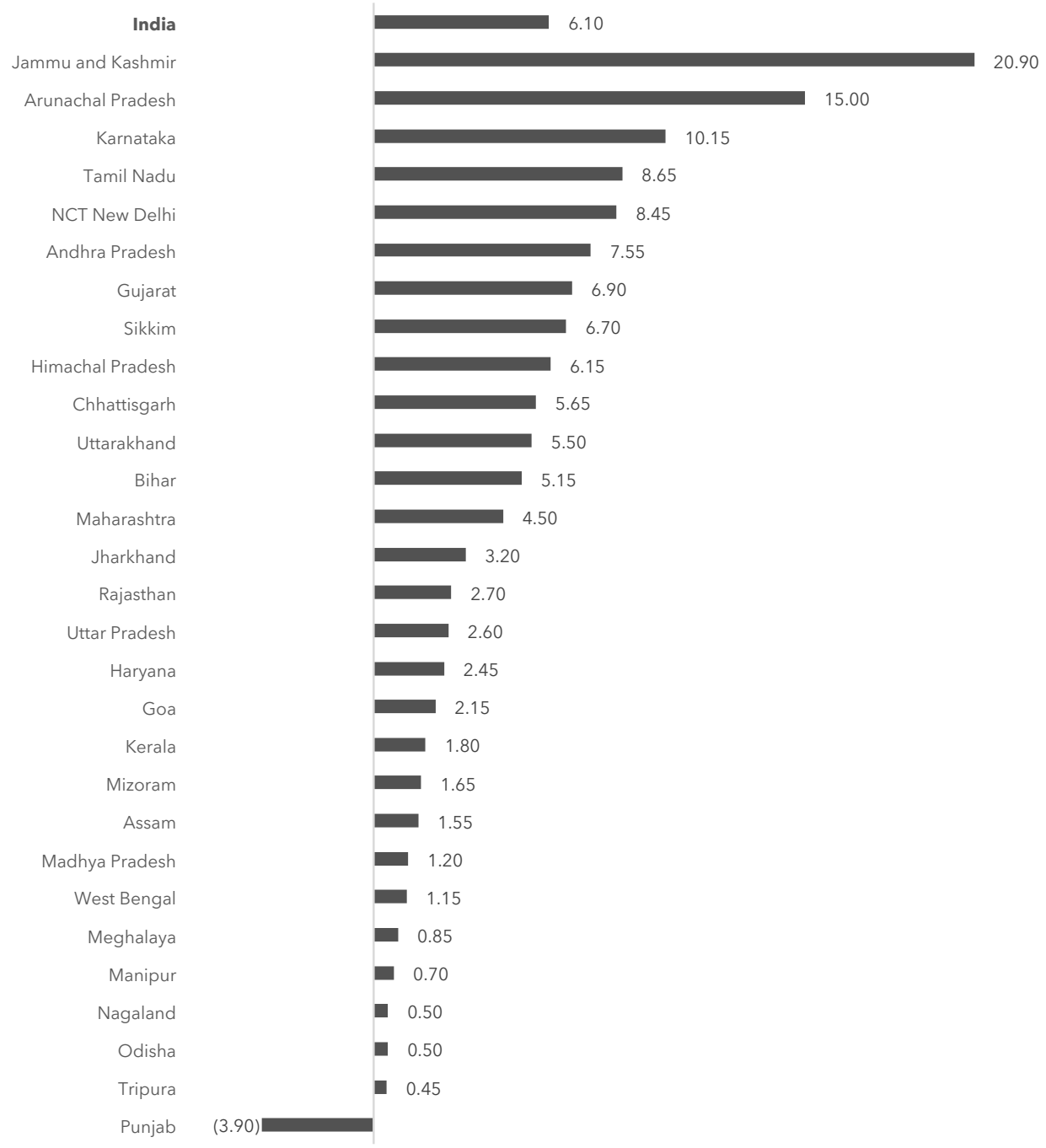
Led by Jammu and Kashmir, there was a remarkable increase in the proportion of people eating fish in every state over the three surveys (Figure 16). The only exception was Punjab, where there was a decline in consumption.

3.3.2. Frequency of fish consumption by state

Fish consumption varied across the states (Figure 17). In the northern and central regions of India, where the percentage of people eating fish is lower than the national average of 72%, less than a quarter of the people ate fish at least once a week. However, in the northeastern and eastern regions of the country, as well as in the coastal states of Goa, Andhra Pradesh, Tamil Nadu and Kerala, where the percentage of fish consumers is greater than 90%, the proportion of people who ate fish at least once a week was more than 40%.

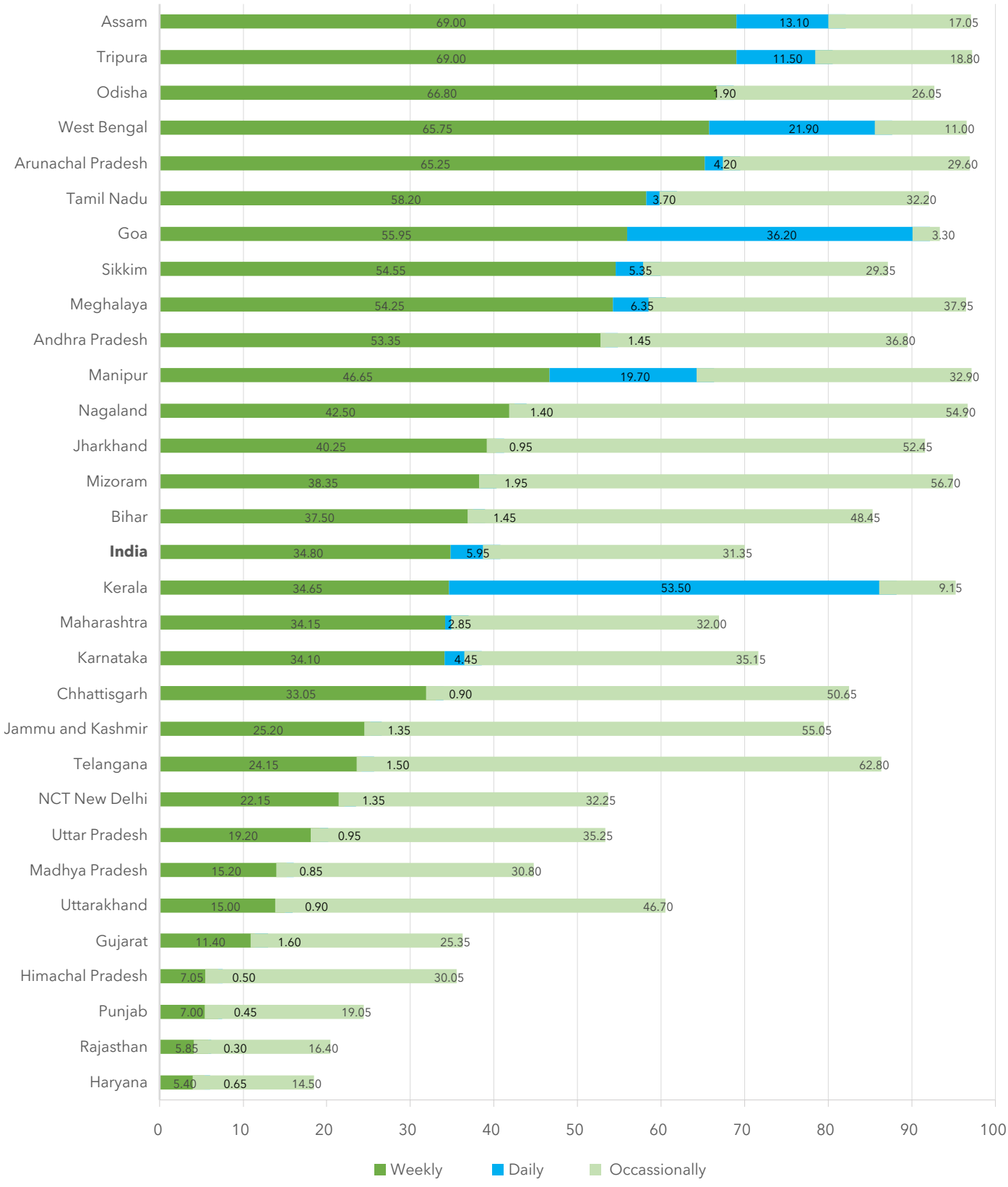
It is worth noting that only a few states had a considerable proportion of their population who ate fish daily, such as Kerala, Goa, West Bengal, Manipur, Assam and Tripura.

Figure 16. Change in fish consumption by state (percentage points) from 2005-2006 to 2019-2021.



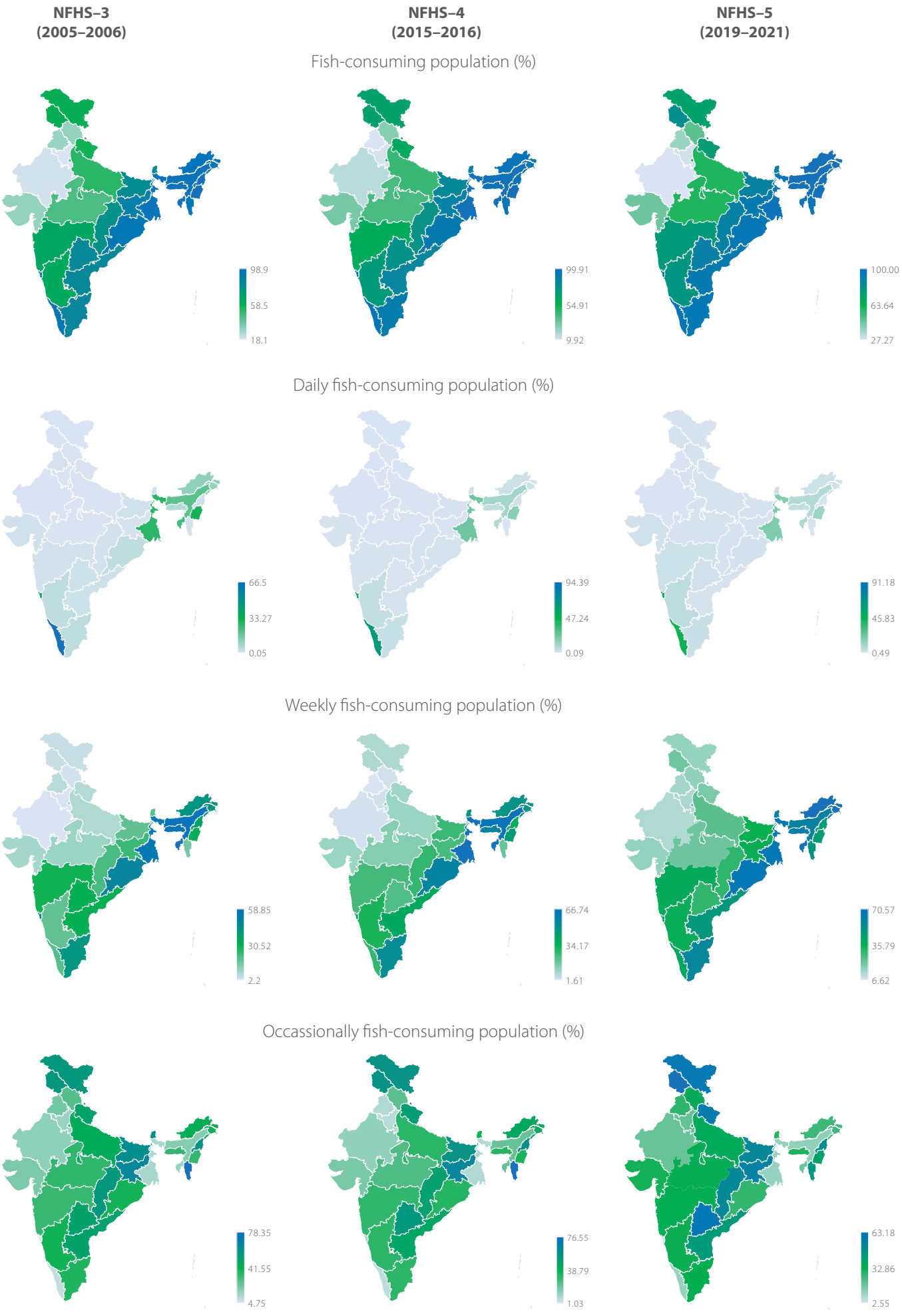
Sources: *IIPS (2007, 2017 and 2021).*

Figure 17. Frequency of fish consumption by state (% of population).



Source: *IIPS (2021).*

Figure 18. Fish consumption landscape in India.

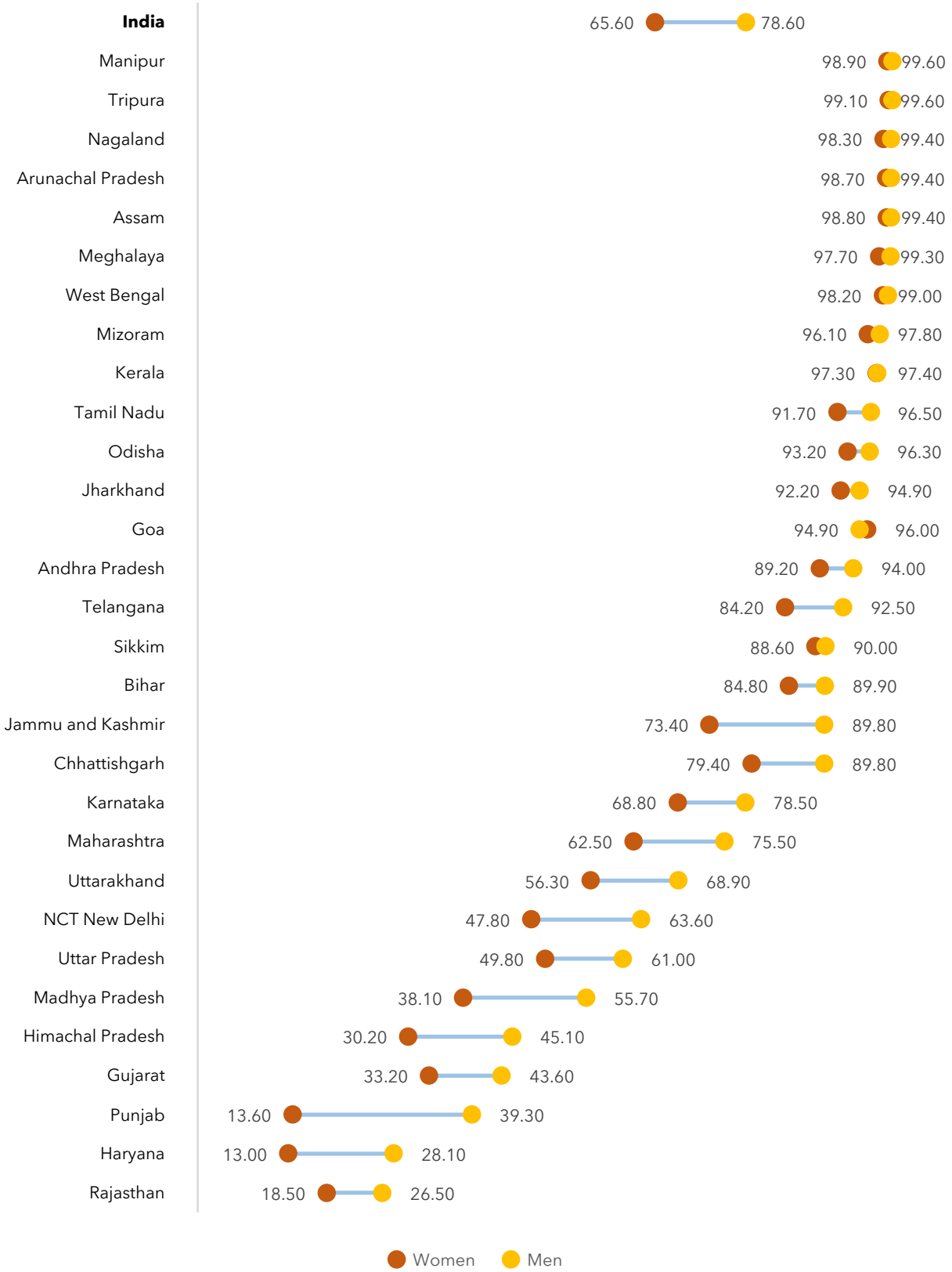


3.3.3. Gendered differences in fish consumption by state

As the proportion of people eating fish increased overall in India, the country's gender gap for fish consumption closed. In states where 90% of the population ate fish, the gap between male and female fish consumers was lower (Figures 19 and 20).

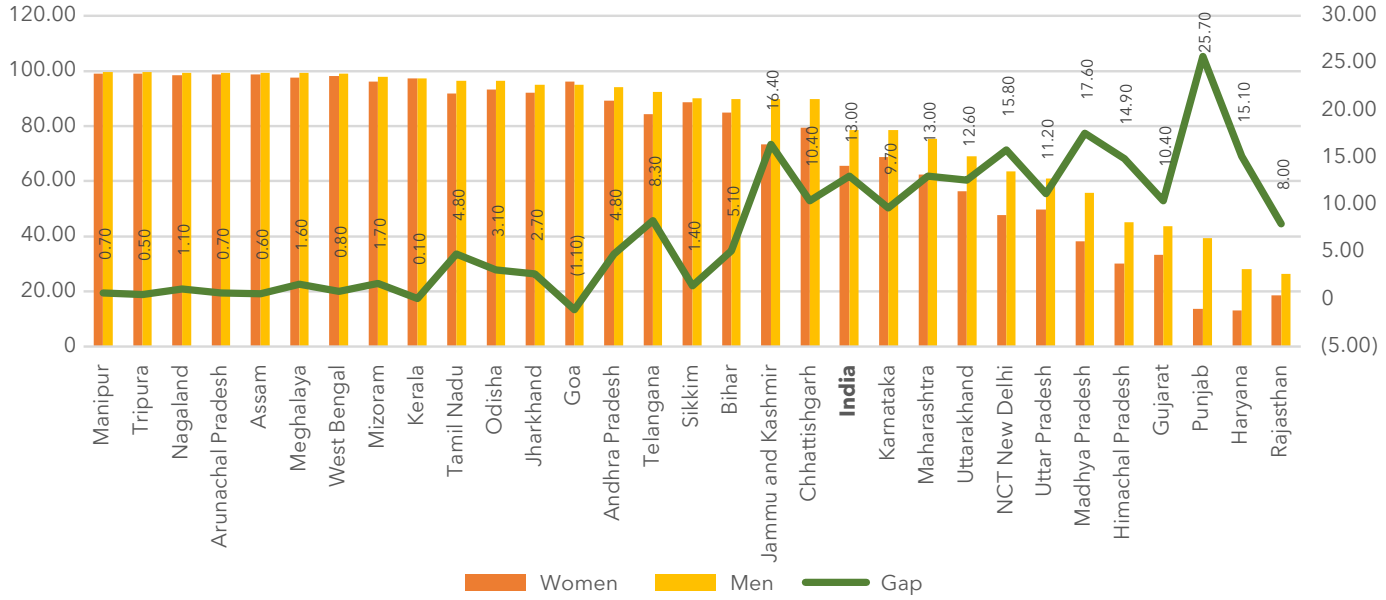
This trend was particularly acute in the northeastern states and in states like West Bengal, Jharkhand, Odisha, Tamil Nadu, Kerala, Andhra Pradesh and Goa. In states where less than 90% of the population ate fish, the gender gap was higher. This pattern was specifically seen in Bihar, Telangana, Karnataka, Maharashtra and Gujarat, as well as the northern and central states.

Figure 19. Gender gap in fish consumption by state (%).



Source: *IIPS (2021).*

Figure 20. Gender difference in fish consumption by state (percentage points).

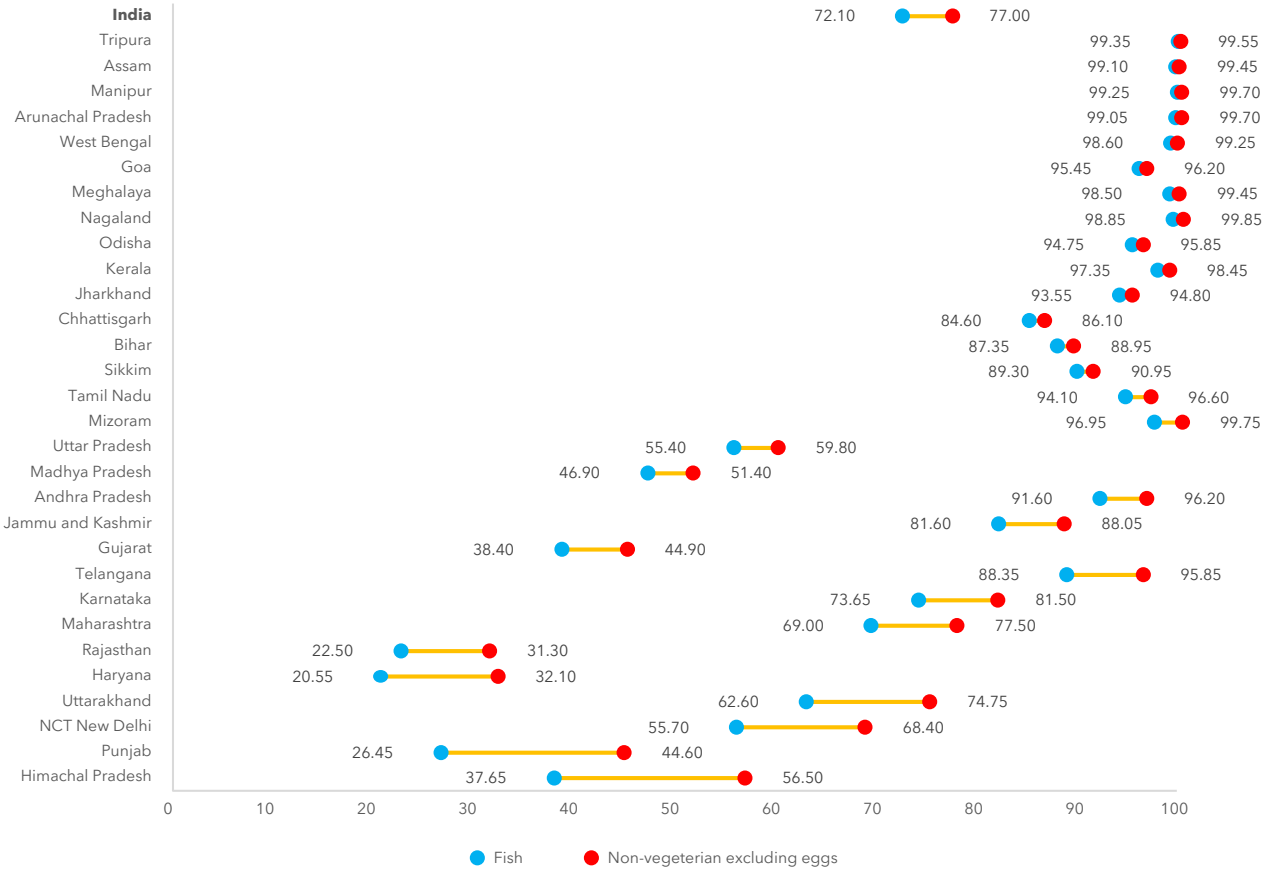


Source: *IIPS (2021).*

3.3.4. Gap in consumption of fish vs. other non-vegetarian foods[7]

The gap in the percentage of people eating fish compared to other non-vegetarian food was smaller in states where the proportion of the population consuming fish was higher than 80% (Figure 21). This gap was less than 2 percentage points in the northeastern and eastern states, as well as Goa and Kerala (Figure 22). In Jammu and Kashmir, Andhra Pradesh and Telangana, however, the gap ranged from 5 to 7 percentage points. The gap was even higher among the rest of the states, in northern, central and western India, including Karnataka, where the proportion of people eating fish was lower and so the gap between the two groups of consumers was larger.

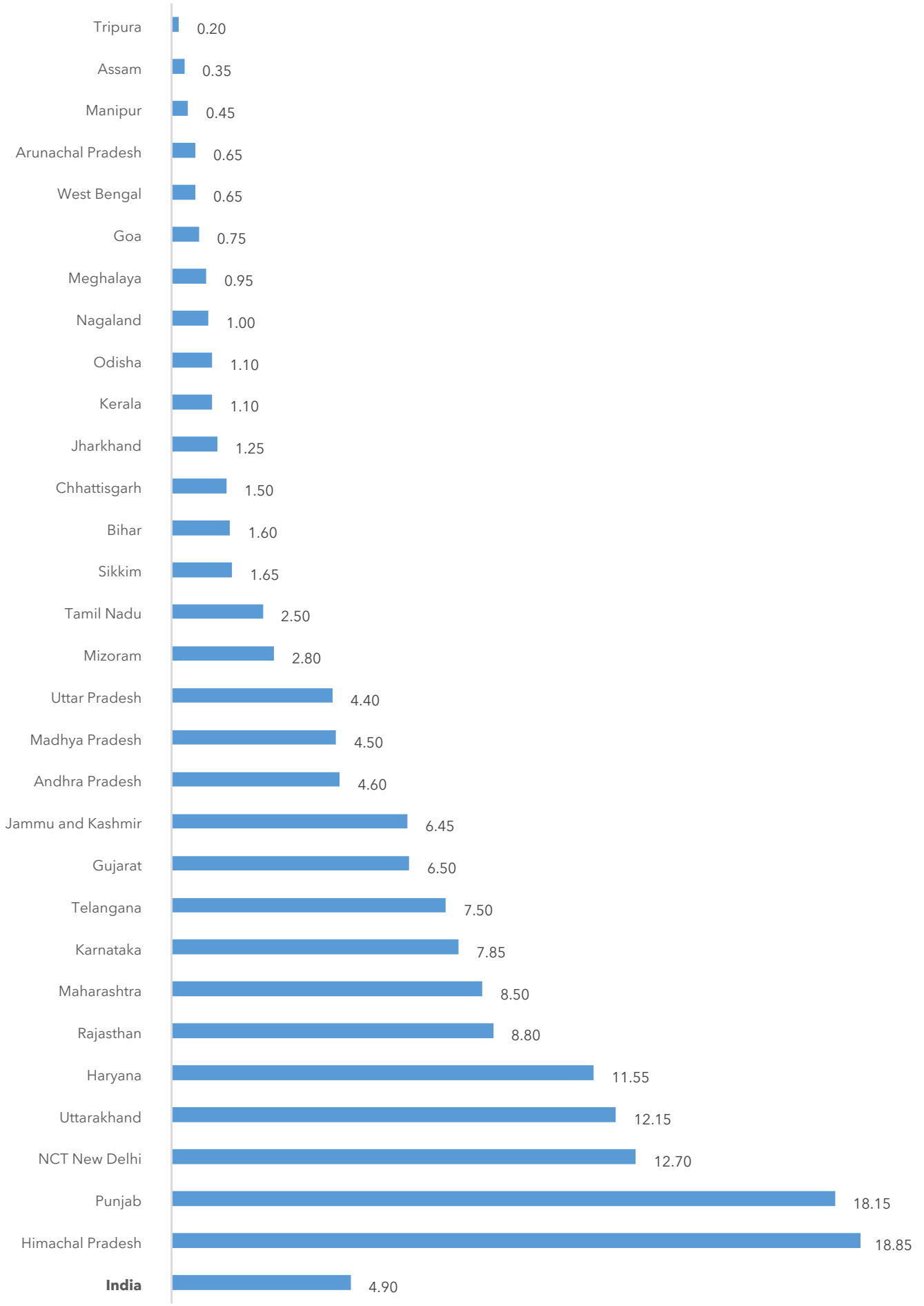
Figure 21. Gap in consumption of fish and non-vegetarian foods, excluding eggs (% of population).



Source: *IIPS (2021).*

7 The analysis excluded "egg" consumption.

Figure 22. Gap between non-vegetarian and fish consumers (percentage points).



Source: *IIPS (2021).*

The finding of this analysis suggests that lower levels of fish consumption among non-vegetarian populations could be a result of lower availability, accessibility and preference for fish.

3.4. Fish production and per capita fish consumption in India

3.4.1. Domestic fish disposition

During the three surveys under consideration, fish production in India experienced a remarkable surge of 115% (5.63% CAGR), from 6.577 million metric tons to 14.164 million metric tons (Table 1). This implies that an additional 7.587 million metric tons of fish were added to the Indian fish basket over that period. Of total fish production, most of it was used for domestic consumption, and the rest for non-food purposes and exports, which saw a slight increase.

Regarding imports, there was a significant increase for every survey in the quantity of imported fish and fishery products from the international market for consumption. Fish imports into India registered a CAGR of 12.84%. Over the three surveys, the volume of imported unprocessed whole round fish and fishery products rose from approximately 14,000 t, to 52,000 and finally to 76,000 t.

Overall, there was a massive 120% jump in fish consumption by India's population. This increased consumption is attributable to both domestic production and imports. Specifically, the amount of fish consumed in the domestic market increased from 5.428 million metric tons to 11.924 million metric tons, registering a CAGR of 5.78%, with an additional 6.496 million metric tons of fish consumption in NFHS-5.

3.4.2. Per capita fish consumption in India

Annual per capita fish consumption rose from 4.9 kg in 2005 to 8.89 kg in 2020 (Figure 23). Over the three surveys, the population of India increased by 23 billion people, at a CAGR of 1.29%, from 1.11 billion to 1.34 billion (RBI 2022). Over that time, annual per capita fish consumption increased 81.43%, revealing the growing demand for fish in the country, including among those who were already eating fish (Table 2). When considering the fish-consuming population alone, per capita annual fish consumption increased from 7.43 kg in 2005–2006 to 12.33 kg in 2019–2021 with a CAGR of 3.43% (Table 3).

Table 1. Fish production and exports in India (million metric tons).

		2005-2006				2015-2016				2019-2020			
Purpose	**Use**	**Inland**	**Marine**	**Total**	**%**	**Inland**	**Marine**	**Total**	**%**	**Inland**	**Marine**	**Total**	**%**
Domestic	Food	3.541	1.874	5.415	82.36	6.665	2.612	9.277	86.20	9.680	2.168	11.848	83.65
	Non-food	-	0.445	4.45	6.77	-	0.211	0.211	1.96	-	0.190	0.190	1.34
	Sub-total	3.541	2.319	5.860	89.13	6.665	2.823	9.488	88.16	9.680	2.357	12.038	84.99
Export	Food	0.186	0.433	0.619	9.42	0.497	0.625	1.122	10.43	0.757	1.179	1.936	13.67
	Non-food	-	0.095	0.095	1.45	-	0.152	0.152	1.41	-	0.190	0.190	1.34
	Sub-total	0.186	0.528	0.714	10.87	0.497	0.777	1.274	11.84	0.757	1.370	2.126	15.01
TOTAL		**3.727**	**2.847**	**6.574**		**7.162**	**3.600**	**10.762**		**10.437**	**3.727**	**14.164**	

Sources: *GOI (2009, 2019 and 2020b).*

Note: *The authors analyzed the raw data from these sources to derive the pre-processing weight of various processed items based on certain presumptions.*

Table 2. Per capita fish consumption in India.

Year	Total population* (billion)	Total fish production** (million metric tons)	Domestic fish consumption from domestic production (million metric tons)	Domestic fish consumption from imports, at pre-processing weight (t)	Total fish consumed (million metric tons)	Annual per capita fish consumption (kg)
2005-2006	1.107	6.577	5.415	14,000	5.428	4.9
2015-2016	1.283	10.762	9.277	52,000	9.328	7.27
2019-2020	1.341	14.164	11.848	76,000	11.924	8.89

Sources: *RBI (2023)*; GOI (2009, 2019 and 2020b)***

Note: *The authors analyzed the raw data from these sources to derive the pre-processing weight of various processed items based on certain presumptions.*

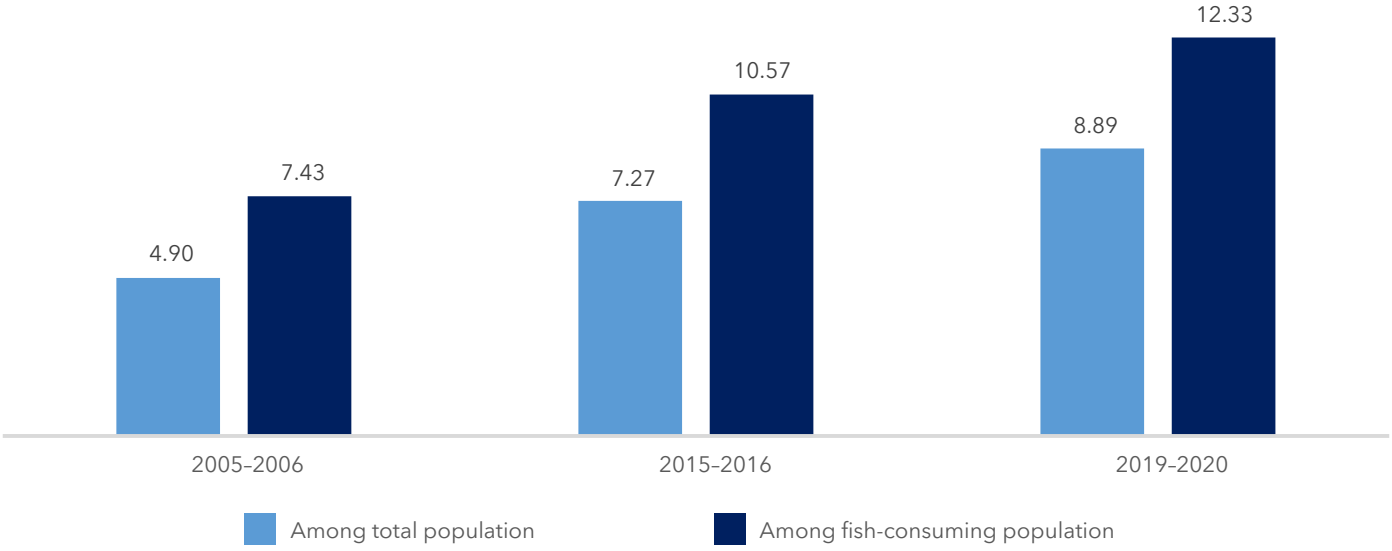
Table 3. Per capita fish consumption among people eating fish in India.

Year	Total population* (billion)	Fish-consuming population (%)**	Fish-consuming population (million)	Total fish consumed in domestic market (million metric tons)***	Annual per capita fish consumption among fish-consuming population (kg)
2005-2006	1.107	66%	730.6	5.428	7.43
2015-2016	1.283	68.8%	882.7	9.328	10.57
2019-2020	1.341	72.1%	966.9	11.924	12.33

Sources: *RBI (2023)*; IIPS (2007, 2017 and 2021)**; GOI (2009, 2019 and 2020b)****

Note: *The authors analyzed the raw data from these sources to derive the pre-processing weight of various processed items based on certain presumptions.*

Figure 23. Annual per capita fish consumption in India (kg).



Box 2. The Indian economy at a glance.

Over the three surveys, India's per capita GDP (at constant prices) doubled from INR 53,478 to INR 108,645, and its PFCE tripled from INR 18,584 to INR 61,594 (Table 4).

According to the Economic Survey 2022-23 published by the Ministry of Finance, India's nominal GDP touched INR 273.09 trillion (USD 3.5 trillion) in the 2022-2023 financial year. As per the OECD's baseline projections, India will reach USD 5, 10, 20 and 30 trillion GDP in MER terms by the 2027, 2034, 2043 and 2048 financial years, respectively. In the context of fish being an income-elastic commodity, growth in the GDP means more disposable income in the hands of people, giving rise to the growing demand for high value food commodities like fish. As such, it can be inferred that the future growth potential of the fisheries sector in India is tremendous.

Table 4. Indian population and economy.

Financial year	Total population (billion)	At constant 2011-2012 prices (INR)			At current prices (INR)		
		GDP per capita	NNI* per capita	PFCE	GDP per capita	NNI per capita	PFCE
2005-2006	1.107	53,478	48,387	18,584	32,841	29,169	15,422
2015-2016	1.283	88,617	77,659	49,738	107,341	94,797	63,065
2019-2020	1.341	108,645	94,566	61,594	149,701	132,115	91,254

Source: *RBI (2023).*
**NNI = Net national income*

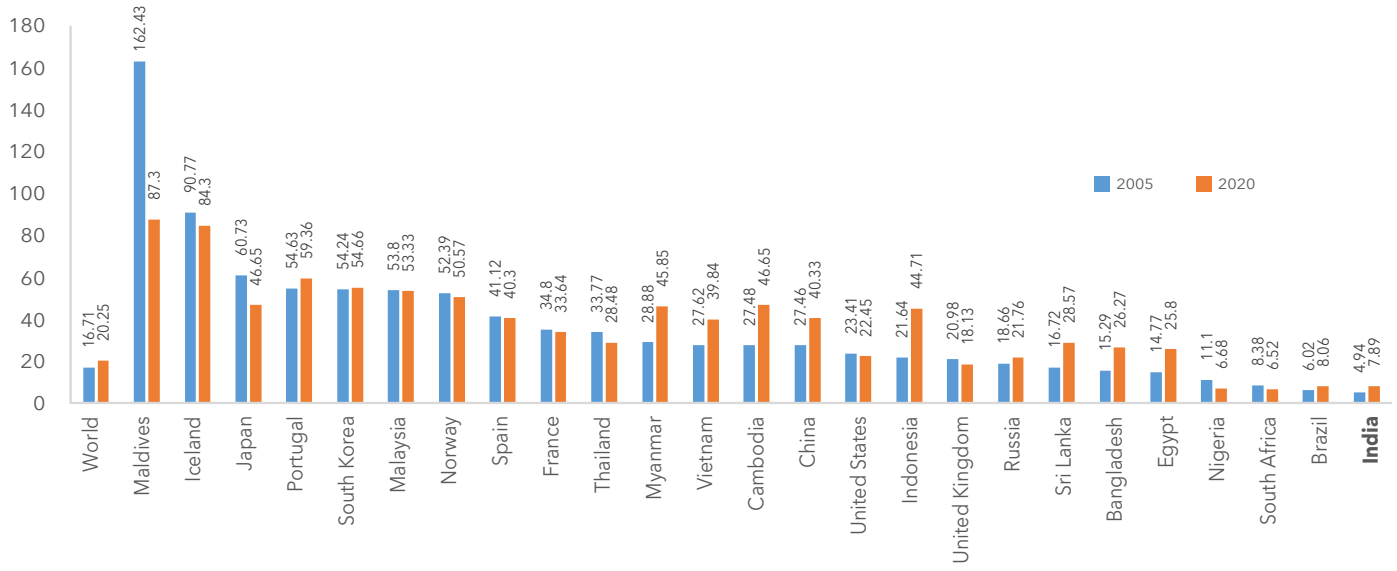
3.5. Fish consumption in India vs. other countries

As per data from the Food and Agriculture Organization, global per capita fish consumption from 2005 to 2020 increased 3.54 kg or 21% (FAO 2022) (Figures 24 and 25). In India, although per capita consumption increased 60%, the CAGR was 4.05%, which was significantly higher than all Asian countries, except Indonesia. Interestingly, per capita fish consumption marginally decreased 1% in Malaysia and 16% in Thailand during the same period. As these countries are predominantly non-vegetarian, including fish and fishery products, it is possible that the frequency of fish consumption and quantity of fish consumed per meal is higher than for India's population.

According to the FAOSTAT Food Balance Sheet for the year 2020, the per capita fish food supply in India stood at 8.04 kg/capita/ year, earning the country a global ranking of 129 among 183 nations. In the same year, India provided a daily protein intake of 2.44 g per capita through fish consumption, securing the 123th position worldwide in terms of per capita protein supply.

Remarkably, India emerged as a significant global contributor to protein through fish, supplying a substantial 1,241,327.09 tons in 2020. This impressive figure positioned India as the 3rd highest contributor globally, highlighting the country's substantial role in meeting global protein demands through its fish production.

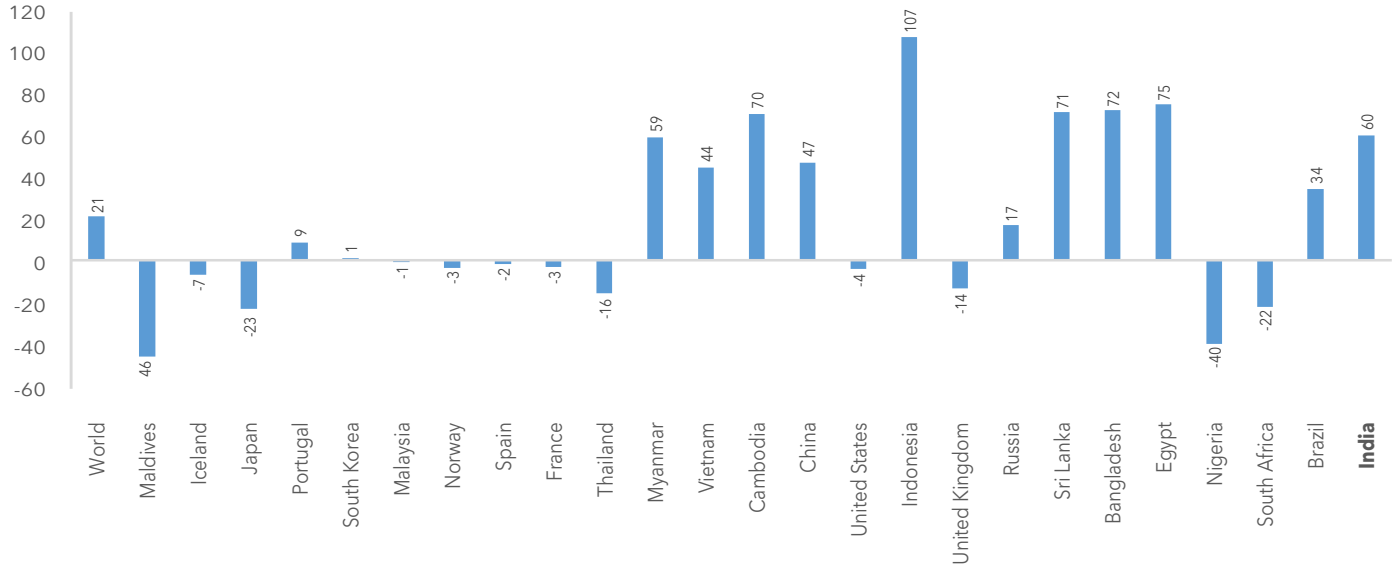
Figure 24. Per capita fish consumption around the world (kg/year).



Note: *Data is inclusive of all fish species and major seafood commodities, including crustaceans, cephalopods and other mollusks. Data is based on per capita food supply at the consumer level but does not account for food waste at consumer level.*

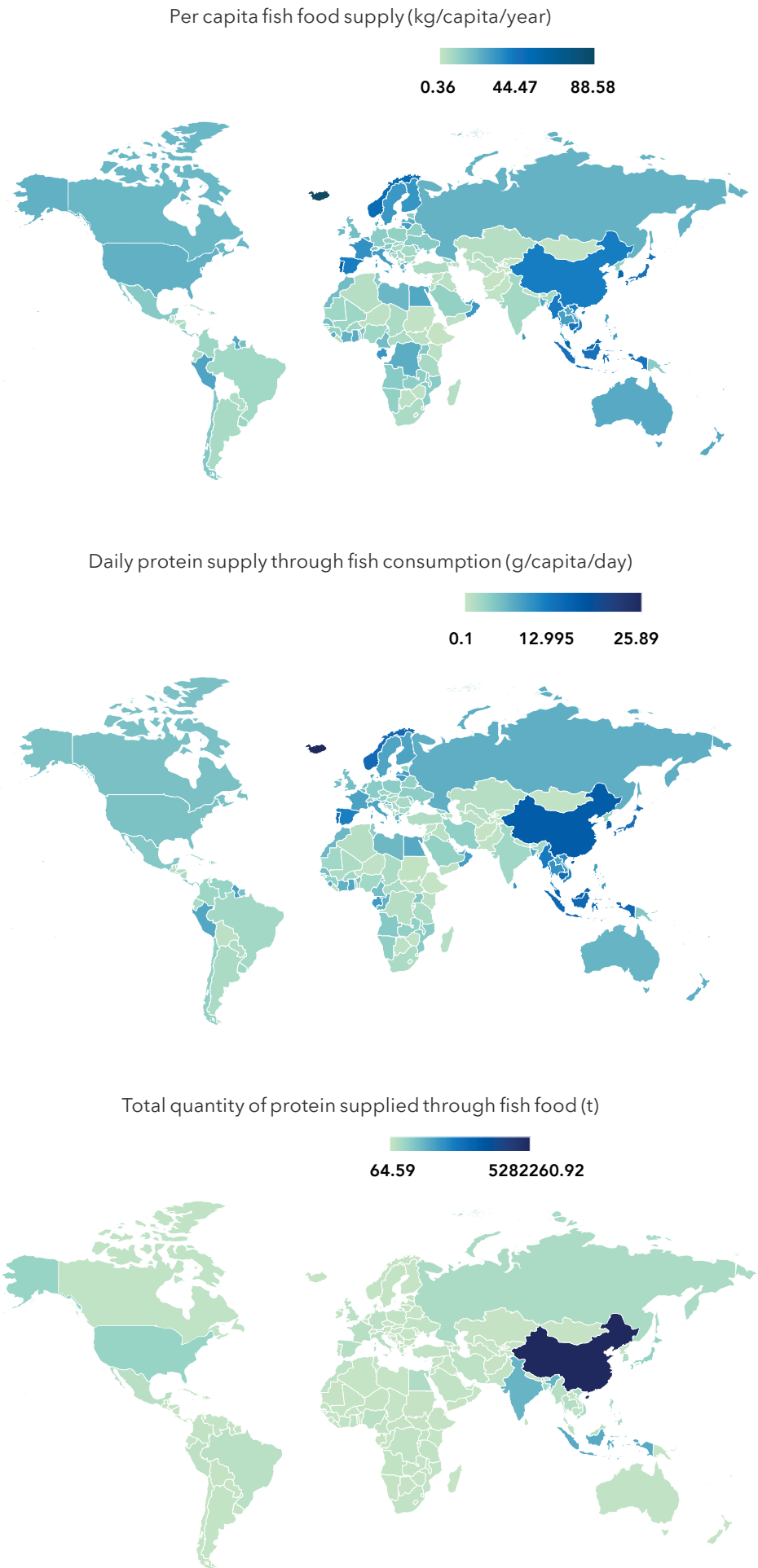
Source: *FAO.*

Figure 25. Change in frequency of per capita fish consumption around the world (percentage) from 2005 to 2020.



Source: *FAO (2022).*

Figure 26. Per capita fish food and protein supply: Global scenario in 2020.



Source: *FAOSTAT Food Balance Sheet 2020 https://www.fao.org/faostat/en/#data/FBS*

3.6. Fish consumption by income group

The World Bank classifies nations into four income groups based on their gross national income (GNI) per capita for the fiscal year 2020[8]:

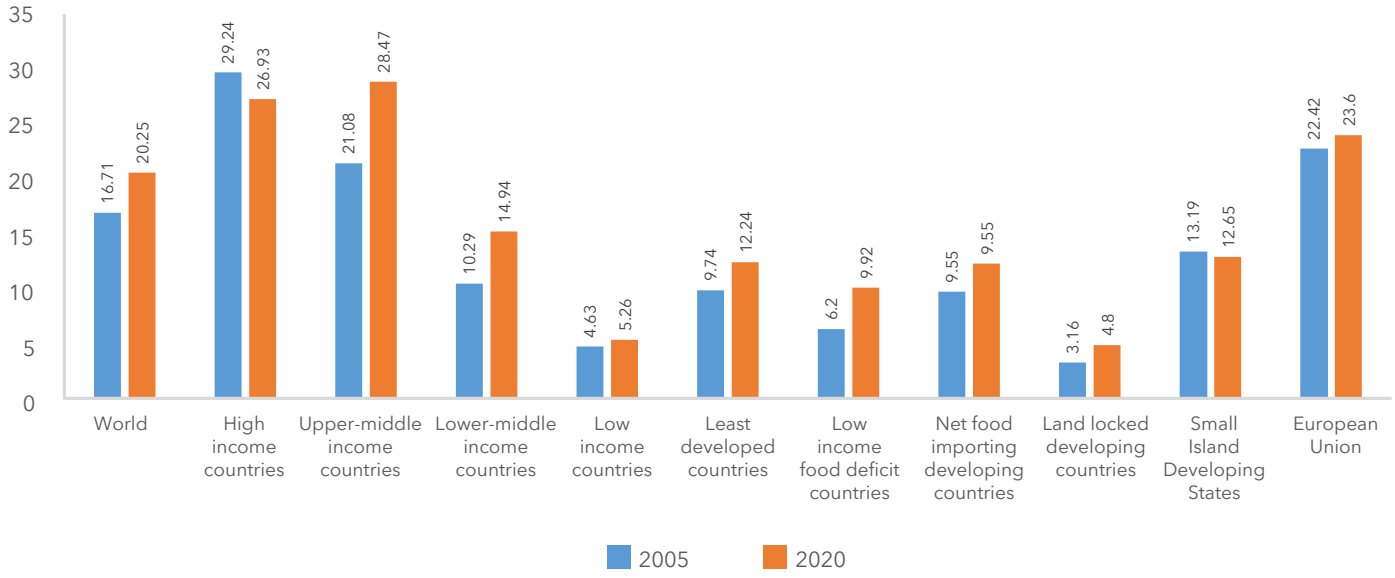
1. low income: USD 1035 or less
2. lower-middle income: USD 1036 to 4045
3. upper-middle income: USD 4046 to 12,535
4. high income: USD 12,536 or more.

As of July 2020, India fell into the lower-middle income category, with a GNI per capita of USD 1890.

Remarkably, average per capita fish consumption exceeded the global average of 20.25 kg for only the higher income (26.93 kg) and upper-middle income (28.47 kg) countries (Figure 27). Intriguingly, per capita fish consumption declined 8% in high-income countries, but increased in the other income categories, with a 35% rise in upper-middle income countries, a 45% surge in lower-middle income countries, and a 14% growth in low-income countries (Figure 28).

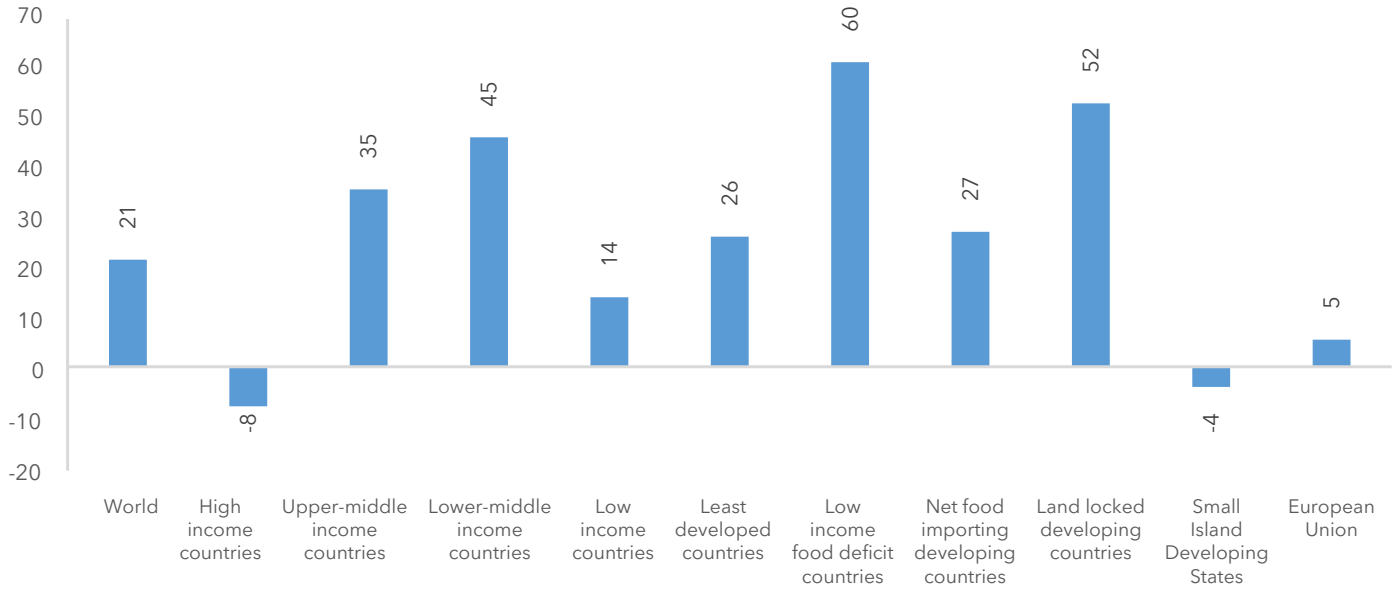
India outperformed many lower-middle income countries when it came to changes in per capita fish consumption over that time, experiencing a substantial 60% increase compared

Figure 27. Per capita fish consumption by income group (kg/year).



Source: *FAO (2022).*

Figure 28. Change in frequency of per capita fish consumption by income group (percentage) from 2005 to 2020.



Source: *FAO (2022).*

8 https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2021-2022

to the average 45% increase for that income category. Nevertheless, India's per capita fish consumption in 2020 stood at 7.89 kg (GOI 2022), nearly half that of low income countries (14.94 kg). This highlights India's significant potential to bridge the gap and catch up with other low income countries in terms of per capita fish consumption.

3.7. Future of fish consumption and fish demand in India

Over the three surveys under consideration for this study, the growth rate of per capita fish consumption within India increased. Based on the average arithmetic growth rate achieved and maintaining the same rate over next 25 years, both fish consumption and per capita fish consumption in India are expected to continue to increase right up to 2048, the centenary year of the country's independence (Table 5). This means an additional 5 million metric tons will be needed to meet the domestic fish demand by 2029–2030, 10.5 million metric tons by 2039–2040 and 14.6 million metric tons by 2047–2048 (Figure 29). This rate of growth and these production targets are, however, not satisfiable for India to excel in production and consumption. In this regard, a better consumption and production target is the most pressing need, complemented with required policy changes and support interventions. Some countries are expected to achieve a much higher growth rate during the same time period. India should benchmark those countries to enhance its growth rate so that the per capita consumption and production situations improve.

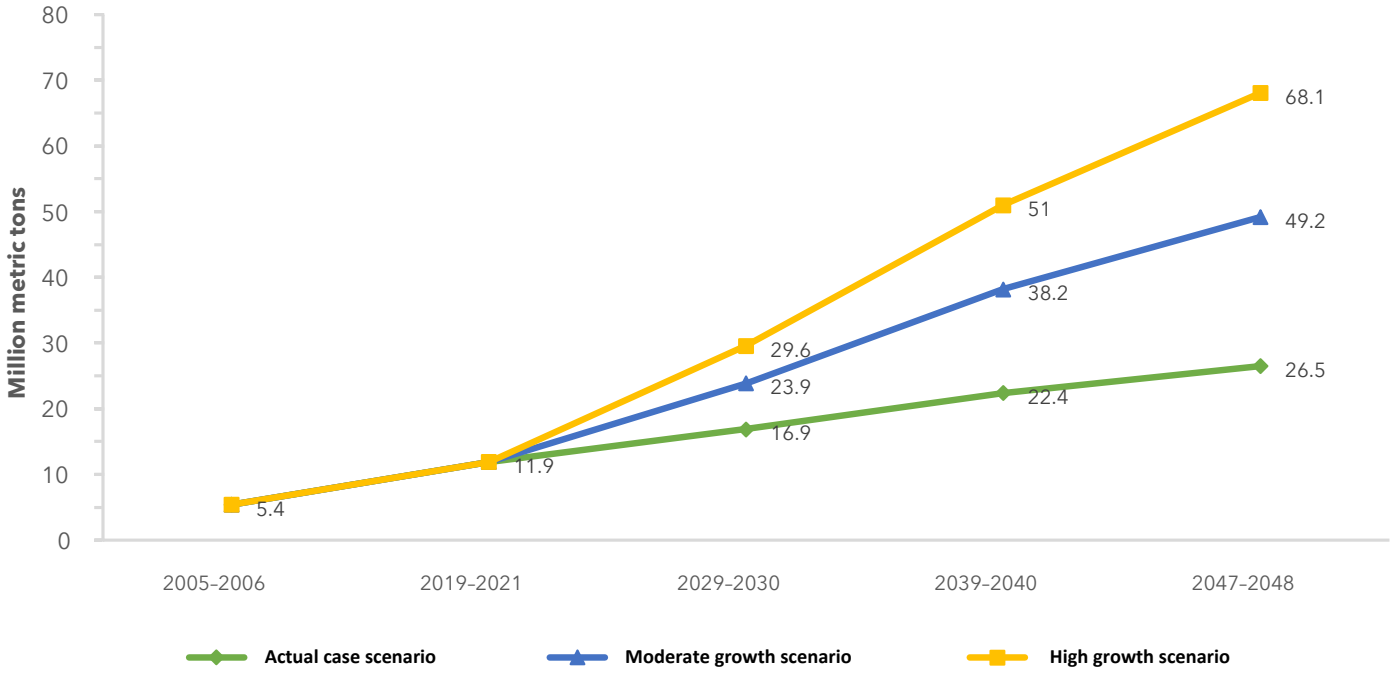
In this case, we postulated two case scenarios: an 11.68% average growth rate for Bangladesh, Egypt, Sri Lanka and China, and an 18.07% average growth rate for Cambodia and Myanmar. If India is able to maintain the growth rate of the countries in the first scenario, along with its future growth of population as projected by the UN, the country will reach per capita consumption levels of 15.91 kg by 2029–2030, 23.71 kg by 2039–2040 and 29.95 kg by 2047–2048 (Figure 30). This will further make the country surmount a production of 23.9, 38.2 and 49.2 million metric tons, respectively, during those three projection periods. In the second scenario, if India champions to change its policy and is able to achieve the same pace of growth as Cambodia and Myanmar, it will reach a per capita consumption level of 19.73 kg in 2029–2030 compared to 8.89 kg during the same period if it maintains the current growth level. Although this is a lofty target, the concerned countries have demonstrated their ability to achieve such milestones. This also indicates that India is left with enough scope for intervention in the fisheries subsector and support for its population partly in achieving nutritional security in the coming years by augmenting production and consumption (Table 5). Additionally, this kind of rapid increase in demand for fish in the domestic market will not only see a spike in aquaculture production in India but would also fuel a considerable growth in fish imports from international markets in the near future.

Table 5. Link between the projected Indian population and future fish demand in three per capita fish consumption growth rate scenarios.

Year	Population (billion)	Estimates for the actual case scenario (considering the constant arithmetic growth rate in India from 2005 to 2020)			Estimates for the average case scenario pegged at a yearly growth of 780 g of per capita fish consumption considering the average growth in Bangladesh, Sri Lanka, China and Egypt from 2005 to 2020			Estimates for the case scenario pegged at a yearly growth of 1.2 kg of per capita fish consumption considering the average growth in Cambodia and Myanmar from 2005 to 2020		
		Estimated annual per capita fish consumption (kg) as per the annual per capita growth rate of 1.53 kg observed over the three surveys	Estimated fish consumption (million metric tons) as per the annual growth rate of 4.33 million metric tons observed over the three surveys	Additional fish required for domestic consumption from 2019-2021 (million metric tons)	Estimated annual per capita fish consumption (kg)	Estimated fish consumption in the domestic market (million metric tons)	Additional fish required for domestic consumption from 2019-2021 (million metric tons)	Estimated annual per capita fish consumption (kg)	Estimated fish consumption in the domestic market (million metric tons)	Additional fish required for domestic consumption from 2019-2021 (million metric tons)
2005–2006	1.11	4.9	5.4	-	4.9	5.4	-	4.9	5.4	-
2019–2021	1.34	8.89	11.9	Base year	8.89	11.9	Base year	8.89	11.9	Base year
2029–2030	1.5*	11.28	16.9	5	15.91	23.9	12	19.73	29.6	17.7
2039–2040	1.61*	13.94	22.4	10.5	23.71	38.2	26.3	31.69	51	39.1
2047–2048	1.65*	16.07	26.5	14.6	29.95	49.2	37.5	41.29	68.1	56.2

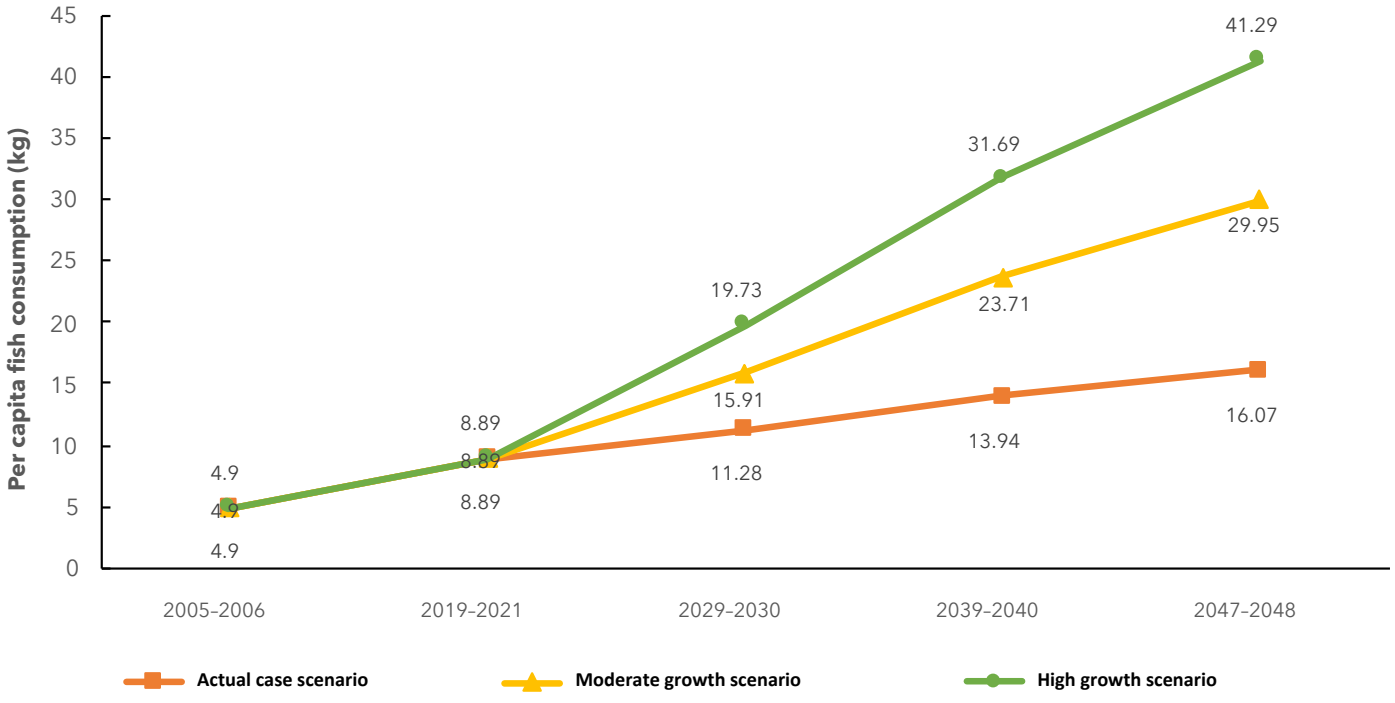
Estimates from the UN Population Division Data Portal. Our own projected estimates are based on an arithmetic average growth formula (Pt=P0+Kt**), where **dP/dt=Constant=k** arrived from the rate of change from 2005 to 2020.*

Figure 29. Estimated fish demand in the domestic market for human consumption in different growth scenarios.



Note: *The forecasting of domestic fish consumption growth is computed based on the average growth rate of per capita fish consumption in India from 2005-2006 to 2019-2021 and the corresponding projected population for India by the UN.*

Figure 30. Estimated annual per capita fish consumption (kg) in different growth scenarios.



Conclusion

India, a megadiverse nation that spans the towering Himalayas to lush coastal plains, the vast Peninsular Plateau to the arid Thar Desert, displays a multifaceted fish consumption pattern with a varying degree of heterogeneity. This pattern, influenced by geography, climate, culture, religion and household customs, presents a complex interplay of factors shaping consumer choices, behaviors, and the availability and accessibility of fish.

In this monograph, we have provided an encompassing overview of the dynamics of fish consumption in India and its spatiotemporal variations within the country's political boundaries. The study unveils significant growth in fish consumption in India, propelled by population expansion, rising affluence and evolving dietary preferences. Despite the impressive contributions to global fisheries and aquaculture, per capita fish consumption in India tends to be lower when compared to other countries in the lower-middle income bracket. These findings underscore the potential for further growth in fish consumption and illuminate regional disparities, offering valuable insights for crafting informed policy and intervention strategies. Notably, there exists an opportunity to promote fish consumption among non-vegetarians, as fish currently lags behind other non-vegetarian food choices in popularity.

The data collection associated with fisheries and aquatic foods often reveals a disconcerting degree of fragmentation and disjointedness. Notably, discrepancies emerge between the data gathered by Indian government agencies and the information presented by global organizations. This disjointedness and fragmentation introduce anomalies, hindering precise calculations and a nuanced comprehension of per capita fish consumption and daily protein intake from aquatic foods.

It is crucial to address these gaps by prioritizing Indian nationally representative surveys that encompass aspects such as human foods, livelihoods, economy, and health. Considering that 72% of India's population partakes in fish consumption, adopting a holistic approach during disaggregated data collection is imperative. Providing paramount importance to fish and other aquatic food sources within such surveys can substantially aid scientists and policymakers in refining strategies and crafting more effective policies.

Recognizing the existing data gaps and fragmented information within India's aquatic food value chain, more meticulous research is required to comprehensively understand the relationship between fish consumption and various sociodemographic and economic indicators at the household level. This research will be instrumental in developing well-informed policies and fostering a more robust understanding of this pivotal facet of India's dietary landscape.

In light of the persistent challenge of undernutrition in India, it is important to acknowledge the pivotal role that fish plays as a highly nutritious food. Consequently, public health and nutrition policies in India should, where applicable, integrate fish consumption as a strategic component to combat undernutrition. Addressing these multifaceted and interconnected issues necessitates the implementation of holistic and adaptable approaches to upgrade the value chains, ensuring the social, economic and environmental sustainability of aquatic food systems while simultaneously securing positive nutritional outcomes. Such endeavors should actively engage both public and private stakeholders, including consumers and market players.

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